Section 111(d) Plan
for
Municipal Solid Waste Landfills

to

U.S. Environmental Protection Agency
Region VIII

from

ND Department of Environmental Quality
Division of Air Quality
918 E Divide Avenue, 2nd Floor
Bismarck, ND 58501-1947

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MUNICIPAL SOLID WASTE LANDFILLS
111(d) PLAN

I. Demonstration of Legal Authority

This plan is applicable to all areas of North Dakota except those areas considered "Indian country". The term "Indian country" is defined in 18 U.S.C. § 1151 and 40 C.F.R. § 171.3 as:

> a. *all land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation;*
> b. *all dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a state; and*
> c. *all Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same.*
>
> *Consistent with the statutory definition of Indian country, as well as federal case law interpreting this statutory language, lands held by the federal government in trust for Indian tribes that exist outside of formal reservations are informal reservations and, thus, are Indian country.*

(https://www.epa.gov/pesticide-applicator-certification-indian-country/definition-indian-country)

The North Dakota Department of Environmental Quality (formerly the Department of Health's Environmental Health Section - the "Department") has previously demonstrated its authority to adopt and implement the regulations under 40 CFR 60. This has been done many times when the Department has adopted the numerous New Source Performance Standards. Adequate legal authority has also been demonstrated with the Title V program and numerous State Implementation Plan revisions. A copy of the North Dakota Air Pollution Control Law (North Dakota Century Code Chapter 23.1-06) is included in Section IX of this plan.

The Department has the legal authority to implement the plan as required by 40 CFR 60.26a as follows:

60.26a(a)(1) - Adopt standards of performance and compliance schedules applicable to designated facilities.

The Department has the authority to adopt standards of performance and compliance schedules under NDCC 23.1-06-04.1.f, h. and l. which state:

The department shall develop and coordinate a statewide program of air pollution control. To accomplish this, the department shall:

f. Provide rules relating to the construction of any new direct or indirect air contaminant source or modification of any existing direct or indirect air contaminant source which the *department determines will prevent the attainment or maintenance of any ambient air quality standard, and require that before commencing construction or modification of any such source, the owner or operator shall submit the information necessary to permit the department to make this determination.*

h. Formulate and adopt emission control requirements for the prevention, abatement, and control of air pollution in this state including achievement of ambient air quality standards.

I. Provide by rules any procedures necessary and appropriate to develop, implement, and enforce any air pollution prevention and control program established by the federal Clean Air Act [42 U.S.C. 7401 et seq.], as amended, the authorities and responsibilities of which are delegatable to the state by the United States environmental protection agency. The rules may include enforceable ambient standards, emission limitations, and other control measures, means, techniques, or economic incentives, including fees, marketable permits, and auctions of emissions rights, as provided by the Act. The department shall develop and implement the federal programs if the department determines that doing so benefits the state.

60.26a(a)(2) - Enforce applicable laws, regulations, standards, and compliance schedules, and seek injunctive relief.

The Department has this authority under NDCC 23.1-06-14, Enforcement -Penalties-Injunctions, which states:

1. A person that willfully violates this chapter, or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, is subject to a fine of not more than ten thousand dollars per day per violation, or by imprisonment for not more than one year, or both. If the conviction is for a violation committed after a first conviction of the person under this subsection, punishment must be a fine of not more than twenty thousand dollars per day per violation, or by imprisonment for not more than two years, or both.

2. A person that violates this chapter, or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, with criminal negligence, is subject to a fine of not more than ten thousand dollars per day per violation, or by imprisonment for not more than six months, or both.

3. A person that knowingly makes any false statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this chapter or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, or that falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this chapter or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, upon conviction, is subject to a fine of not more than ten thousand dollars per day per violation, or by imprisonment for not more than six months, or both.

4. A person that violates this chapter, or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, is subject to a civil penalty not to exceed ten thousand dollars per day per violation.

5. Without prior revocation of any pertinent permits, the department, in accordance with the laws of this state governing injunction or other process, may maintain an action in the name of the state against any person to enjoin a threatened or continuing violation of any provision of this chapter or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter.

In addition NDCC 23.1-06-04.1.e states:

The department shall develop and coordinate a statewide program of air pollution control. To accomplish this, the department shall:

e. Issue orders necessary to effectuate the purposes of this chapter and enforce the orders by all appropriate administrative and judicial procedures.

Further, NDAC 33.1-15-01-17, Enforcement states:

1. Enforcement action will be consistent with procedures as approved by the United States environmental protection agency.

2. Notwithstanding any other provision in this article, any credible evidence may be used for the purpose of establishing whether a person has violated or is in violation of this article.

a. Information from the use of the following methods is presumptively credible evidence of whether a violation has occurred at a source:

(1) A compliance assurance monitoring protocol approved for the source pursuant to subsection 10 of section 33.1-15-14-06.

(2) A monitoring method approved for the source pursuant to paragraph 3 of subdivision a of subsection 5 of section 33.1-15-14-06 and incorporated in a federally enforceable title V permit to operate.

(3) Compliance test methods specified in this article.

b. The following testing, monitoring, and information-gathering methods are presumptively credible testing, monitoring, or information-gathering methods:

(1) Any federally enforceable monitoring or testing methods, including those under title 40 Code of Federal Regulations parts 50, 51, 60, 61, 63, and 75.

(2) Other testing, monitoring, or information-gathering methods that produce information comparable to that produced by any method in paragraph 1 or in subdivision a.

3. a. No person may knowingly make a false statement, representation, or certification in any application, record, report, plan, or other document filed or required under this article.

b. No person may knowingly falsify, tamper with, or provide inaccurate information regarding a monitoring device or method required under this article.

60.26a(a)(3) - Obtain information necessary to determine whether designated facilities are in compliance with applicable laws, regulations, standards, and compliance schedules, including authority to require recordkeeping and to make inspections and conduct tests of designated facilities.

The Department has this authority under several sections of the NDCC and NDAC. NDCC 23.1-06-04.1.j states:

The department shall develop and coordinate a statewide program of air pollution control. To accomplish this, the department shall:

j. Require the owner or operator of a regulated air contaminant source to establish and maintain records; make reports; install, use, and maintain monitoring equipment or methods; sample emissions in accordance with those methods at designated locations and intervals, and using designated procedures; and provide other information as may be required.

NDCC 23.1-06-08.2 states:

2. A person operating or responsible for the operation of air contaminant sources of any class for which reporting is required shall make reports containing information the department deems relevant to air pollution.

NDCC 23.1-06-11, Right of Onsite Inspections, provides the Department the authority to conduct inspections as follows:

1. Any duly authorized officer, employee, or agent of the department may enter and inspect any property, premise, or place on or at which an air contaminant source is located or is being constructed, installed, or established at any reasonable time for the purpose of ascertaining the state of compliance with this chapter and related rules. If requested, the owner or operator of the premises must receive a report setting forth all facts found which relate to compliance status.

2. The department may conduct tests and take samples of air contaminants, fuel, process material, and other materials that may affect emission of air contaminants from any source, and may have access to and copy any records required by department rules to be maintained, and may inspect monitoring equipment located on the premises. Upon request of the department, the person responsible for the source to be tested shall provide necessary holes in stacks or ducts and other safe and proper sampling, and testing facilities exclusive of instruments and sensing devices necessary for proper determination of the emission of air contaminants. If an authorized representative of the department, during the course of an inspection, obtains a sample of air contaminant, fuel, process material, or other material, the representative shall issue a receipt for the sample obtained to the owner or operator of, or person responsible for, the source tested.

3. To ascertain the state of compliance with this chapter and any applicable rules, a duly authorized officer, employee, or agent of the department may enter and inspect, at any reasonable time, any property, premises, or place on or at which a lead-based paint remediation activity is ongoing. If requested, the department shall provide to the owner *or operator of the premises a report that sets forth all facts found which relate to compliance status.*

NDAC 33.1-01-12, Measurement of emissions of air contaminants, states:

1. Sampling and testing. The department may reasonably require any person responsible for emission of air contaminants to make or have made tests, at a reasonable time or interval, to determine the emission of air contaminants from any source, for the purpose of determining whether the person is in violation of any standard under this article or to satisfy other requirements under the North Dakota Century Code chapter 23.1-06. All tests shall be made and the results calculated in accordance with test procedures approved or specified by the department. All tests shall be conducted by reputable, qualified personnel. The department shall be given a copy of the test results in writing and signed by the person responsible for the tests. The owner or operator of a source shall notify the department using forms supplied by the department, or its equivalent, at least thirty calendar days in advance of any tests of emissions of air contaminants required by the department. Advanced notification for all other testing will be consistent with the requirements of the appropriate regulations but in no case will be less than thirty calendar days. If the owner or operator of a source is unable to conduct the performance test on the scheduled date, the owner or operator of a source shall notify the department as soon as practicable when conditions warrant and shall coordinate a new test date with the department. Failure to give the proper notification may prevent the department from observing the test. If the department is unable to observe the test because of improper notification, the test results may be rejected.

2. The department may make tests. The department may conduct tests of emissions of air contaminants from any source. Upon request of the department, the person responsible for the source to be tested shall provide necessary holes in stacks or ducts and such other safe and proper sampling and testing facilities, exclusive of instruments and sensing devices as may be necessary for proper determination of the emission of air contaminants.

60.26a(a)(4) - Require owners or operators of designated facilities to install, maintain, and use emission monitoring devices and to make periodic reports to the State on the nature and amounts of emissions from such facilities; also authority for the State to make such data available to the public as reported and as correlated with applicable standards of performance.

The Department has this authority under NDCC 23.1-06-04.1.j which states:

The department shall develop and coordinate a statewide program of air pollution control. To accomplish this, the department shall:

j. Require the owner or operator of a regulated air contaminant source to establish and maintain records; make reports; install, use, and maintain monitoring equipment or methods; sample emissions in accordance with those methods at designated locations and intervals, and using designated procedures; and provide other information as may be required.

The authority to make data available to the public is contained in NDCC 23.1-06-12, Confidentiality of Records which states:

1. Any record, report, or information obtained under this chapter must be available to the public. However, upon a showing satisfactory to the department that disclosure to the public of a part of the record, report, or information, other than emission data, to which the department has access under this chapter, would divulge trade secrets, the department shall consider that part of the record, report, or information confidential.

2. This section may not prevent disclosure of any report, or record of information to federal, state, or local agencies when necessary for purposes of administration of any federal, state, or local air pollution control laws, or when relevant in any proceeding under this chapter.

In addition, NDAC 33.1-15-01-16.1 states:

1. Public inspection. Any record, report, or information obtained or submitted pursuant to this article will be available to the public for inspection and copying during normal working hours unless the department certifies that the information is confidential. Anyone requesting department assistance in collecting, copying, certifying, or mailing public information must tender, in advance, the reasonable cost of those services

The Department will implement the emission guidelines under 40 CFR 60, Subpart Cf, for existing Municipal Solid Waste Landfills through rules. The emissions guidelines have been adopted by reference into Chapter 33.1-15-12 of the North Dakota Administrative Code (NDAC). A copy of NDAC 33.1-15-12 is included in Section IX of this plan. No other agency has been designated to carry out any portion of this plan.

The laws and rules cited in this section are current as of the data of submittal of this plan. The laws can be found in the North Dakota Century Code at https://www.legis.nd.gov/general-information/north-dakota-century-code and the rules in the North Dakota Administrative Code at https://www.legis.nd.gov/information/acdata/pdf/33.1-15-12.pdf.

II. Standards of Performance

The Department will use state rules adopted by reference (with slight changes) into NDAC 33.1-15-12 as the mechanism for implementing the emission guidelines (copy included in Section IX). North Dakota Century Code 23.1-06-14 gives the Department the authority to enforce any properly adopted rule (see Section l., Demonstration of Legal Authority).

III. Source Inventory

The following sources appear to have a design capacity equal to or greater than 2.5 x 10^6 megagrams:

Big Dipper Enterprises – Dakota MSW Landfill
Jahner Sanitation, Inc. – Jahner Sanitary Landfill
City of Grand Forks Municipal Landfill
City of Fargo Municipal Landfill

City of Minot Municipal Landfill
City of Williston Municipal Landfill
City of Dickinson Municipal Landfill
City of Jamestown Municipal Landfill

These sources will be subject to any applicable requirements of NDAC 33.1-15-12-02, Subpart Cf. In general, sources found to meet the conditions of 60.33f(a)(1 -4) must install and operate a collection and control system for MSW landfill emissions. Design of the collection system and control system is found in 60.33f(b) and (c). Operational standards for the collection and control systems are found in 60.34f.

The following sources appear to have a design capacity of less than 2.5 x 10^6 megagrams:

City of Bismarck Municipal Landfill
McDaniel Landfill
Mercer County Regional Landfill
Noonan Landfill, LLC
McKenzie County Landfill

These sources will be subject to only the reporting requirements in 60.33f(d) and 60.38f and recordkeeping requirements under 60.39f. This includes an initial design capacity report and records of site-specific density for owners and operators who convert design capacity from volume to mass (or vice versa) to demonstrate that the landfill capacity is less than 2.5 million megagrams or 2.5 million cubic meters.

Any source that is not listed above, or any source with a design capacity different from that listed above, will be still be subject to the applicable requirements of Subpart Cf despite the above listing.

IV. **Emission Inventory**

A. Estimated Emissions (2018)

Landfill	NMOC (tons)
Big Dipper Enterprises	16.0
Jahner Sanitation, Inc.	4.7
City of Grand Forks	56.7
City of Minot	22.0
City of Fargo	1.5
City of Bismarck	17.5
City of Dickinson	5.4
City of Jamestown	3.3
McDaniel Landfill, Inc.	8.1
McKenzie County	7.7
Mercer County	1.3
Noonan	1.8
City of Williston	8.8

B. Emission Estimation Methods

For landfills with a design capacity greater than 2.5 x 10^6 Mg, emissions were estimated based on calculations or actual emissions testing required by Subpart Cc. For the other landfills, emissions were estimated using the Land Gem Model using the defaults and parameters listed in 40 CFR 60.35f with the following exceptions:

- The k value for the equation was established at 0.02 per year since precipitation in North Dakota is less than 25 inches per year at all locations.
- A NMOC concentration of 297 parts per million (ppm) was derived from site specific testing data acquired at the Fargo, Minot and Jahner MSW landfills.
- The NMOC concentrations from the testing were corrected for air infiltration in accordance with equation 2 of AP-42, Section 2.4.

C. Emission Summary Reports

A copy of the Annual Emissions Inventory Reports for sources with a design capacity equal to or greater than 2.5 million megagrams are included in Section IX. The results of the LandGEM Air Emission Estimation Model for sources with a design capacity less than 2.5 million megagrams are also included in Section X.

D. Annual Emissions Reporting

The Department will submit an annual update of the emission inventory for sources that ceased operation or sources that were not in operation at the time of development of this plan and commenced operation during the reporting period. Emissions data for landfills subject to Title V permitting requirements will be reported to the Emissions Inventory System (EIS) as required by 40 CFR 60, Appendix D.

V. Emission Limitations

Since 40 CFR 60, Subpart Cf is incorporated by reference into NDAC 33.1-15-12, the rules are as protective as the Emission Guidelines.

VI. Testing, Monitoring, Recordkeeping and Reporting

The requirements under 40 CFR 60, Subpart Cf are incorporated by reference into NDAC 33.1-15-12, and are thus as stringent as the Emission Guidelines.

Test methods and procedures for sources equal to or above 2.5 million megagrams (or cubic meters) are specified in 60.35f. There are no testing requirements for sources with a design capacity less than 2.5 million megagrams (or cubic meters).

Monitoring requirements for landfills with a design capacity equal to greater than 2.5 million megagrams (or cubic meters) that use collection and control systems are specified in 60.37f. For landfills which do meet the criteria of 60.33f(a)(1-4), there are no monitoring requirements under 40.37f.

Recordkeeping requirements are specified in 60.39f. For landfills with a design capacity of less than 2.5 million megagrams (or cubic meters), records of site-specific density of the waste must be kept onsite in accordance with 60.39f(f) if the owner or operator used the site-specific density to demonstrate the landfill design capacity is less than 2.5 million megagrams (or cubic meters).

Reporting requirements are specified in 60.38f. For landfills with a design capacity less than 2.5 million megagrams (or cubic meters), only an initial design capacity report and amended design capacity report is required by 60.38f(a) and (b).

Review of any site-specific design plans for a gas collection and control system will be made by the Department of Environmental Quality, Division of Air Quality. Plans will be reviewed for compliance with 60.38f(d)(1-2). Approval of the system with be made either through issuance of a Permit to Construct under NDAC 33.1-15-14-02 or through an approval letter. EPA will be notified of any approval.

VII. **Compliance Schedules**

Under the rules in NDAC 33.1-15-12, Subpart Cf, sources must meet the compliance terms specified in 40 CFR 60.32f and other requirements in Subpart Cf. No extension of the compliance times is provided in this plan.

VII. **Progress Reports**

The Department will submit, annually, to EPA the compliance status, enforcement actions, identification of sources that have ceased operation or started operation, emission inventory information for sources that have started operation, updated emission inventory and compliance information. Technical reports on all performance testing and monitoring for MSW landfills subject to the emission guidelines shall be submitted in accordance with 40 CFR 60.38f. The first progress report will be submitted one year after EPA approval of this plan.

IX. **Public Hearing Record**

The following items are included to demonstrate adequate public participation in the development of this plan:

A. Notice of Public Hearing with affidavit of publication.

B. Public Hearing Transcript with a list of witnesses and any written testimony submitted.

C. Notice of the hearing sent to the EPA Regional Administrator and neighboring states.

D. Certification that the public hearing was held in accordance with Subpart B and state procedures (Legal Opinion).

E. Response to public comments.

X. **Attachments**

NDCC 23.1-06, Air Pollution Control

NDAC 33.1-15-12, Standards op Performance for New Stationary Sources

Big Dipper Enterprises Annual Emissions Inventory Report

Jahner Sanitation, Inc. Annual Emissions Inventory Report

City of Grand Forks Municipal Landfill Annual Emissions Inventory Report

City of Fargo Municipal Landfill Annual Emissions Inventory Report

City of Minot Municipal Landfill Annual Emissions Inventory Report

City of Williston Municipal Landfill LandGEM Emissions Estimate Report

City of Dickinson Municipal Landfill LandGEM Emissions Estimate Report

City of Jamestown Municipal Landfill LandGEM Emissions Estimate Report

City of Bismarck Municipal Landfill LandGEM Emissions Estimate Report

McDaniel Landfill LandGEM Emissions Estimate Report

Mercer County Regional Landfill LandGEM Emissions Estimate Report

Noonan Landfill, LLC LandGEM Emissions Estimate Report

McKenzie County Landfill LandGEM Emissions Estimate Report

CHAPTER 23.1-06
AIR POLLUTION CONTROL

23.1-06-01. Definitions.

For purposes of this chapter:

1. "Air contaminant" means any solid, liquid, gas, or odorous substance, or any combination of solid, liquid, gas, or odorous substance.
2. "Air pollution" means the presence in the outdoor atmosphere of one or more air contaminants in such quantities and duration as may be injurious to human health, welfare, or property, animal or plant life, or which unreasonably interferes with the enjoyment of life or property.
3. "Air quality standard" means an established concentration, exposure time, or frequency of occurrence of a contaminant or multiple contaminants in the ambient air which may not be exceeded.
4. "Ambient air" means the surrounding outside air.
5. "Asbestos abatement" means any demolition, renovation, salvage, repair, or construction activity which involves the repair, enclosure, encapsulation, removal, handling, or disposal of more than three square feet [0.28 square meter] or three linear feet [0.91 meter] of friable asbestos material. Asbestos abatement also means any inspections, preparation of management plans, and abatement project design for both friable and nonfriable asbestos material.
6. "Asbestos contractor" means any person that contracts to perform asbestos abatement for another.
7. "Asbestos worker" means any individual engaged in the abatement of more than three square feet [0.28 square meter] or three linear feet [0.91 meter] of friable asbestos material, except for individuals engaged in abatement at their private residence.
8. "Department" means the department of environmental quality.
9. "Emission" means a release of air contaminants into the ambient air.
10. "Emission standard" means a limitation on the release of any air contaminant into the ambient air.
11. "Friable asbestos material" means any material containing more than one percent asbestos that hand pressure or mechanical forces expected to act on the material can crumble, pulverize, or reduce to powder when dry.
12. "Indirect air contaminant source" means any facility, building, structure, or installation, or any combination that can reasonably be expected to cause or induce emissions of air contaminants.
13. "Lead-based paint" means paint or other surface coatings that contain lead equal to or in excess of one milligram per square centimeter or more than one-half percent by weight.

23.1-06-02. Declaration of public policy and legislative intent.

It is the public policy of this state and the legislative intent of this chapter to achieve and maintain the best air quality possible, consistent with the best available control technology, to protect human health, welfare, and property, to prevent injury to plant and animal life, to promote the economic and social development of this state, to foster the comfort and convenience of the people, and to facilitate the enjoyment of the natural attractions of this state.

23.1-06-03. Environmental review advisory council - Public hearing and rule recommendations.

Repealed by S.L. 2019, ch. 216, § 5.

23.1-06-04. Power and duties of the department.

1. The department shall develop and coordinate a statewide program of air pollution control. To accomplish this, the department shall:

a. Encourage the voluntary cooperation of persons to achieve the purposes of this chapter.
b. Determine by scientifically oriented field studies and sampling the degree of air pollution in the state and the several parts thereof.
c. Encourage and conduct studies, investigations, and research relating to air pollution and its causes, effects, prevention, abatement, and control.
d. Advise, consult, and cooperate with other public agencies and with affected groups and industries.
e. Issue orders necessary to effectuate the purposes of this chapter and enforce the orders by all appropriate administrative and judicial procedures.
f. Provide rules relating to the construction of any new direct or indirect air contaminant source or modification of any existing direct or indirect air contaminant source which the department determines will prevent the attainment or maintenance of any ambient air quality standard, and require that before commencing construction or modification of any such source, the owner or operator shall submit the information necessary to permit the department to make this determination.
g. Establish ambient air quality standards for the state which may vary according to appropriate areas.
h. Formulate and adopt emission control requirements for the prevention, abatement, and control of air pollution in this state including achievement of ambient air quality standards.
i. Hold hearings relating to the administration of this chapter, and compel the attendance of witnesses and the production of evidence.
j. Require the owner or operator of a regulated air contaminant source to establish and maintain records; make reports; install, use, and maintain monitoring equipment or methods; sample emissions in accordance with those methods at designated locations and intervals, and using designated procedures; and provide other information as may be required.
k. Provide by rules a procedure for handling applications for a variance for any person that owns or is in control of any plant, establishment, process, or equipment. The granting of a variance is not a right of the applicant but must be in the discretion of the department.
l. Provide by rules any procedures necessary and appropriate to develop, implement, and enforce any air pollution prevention and control program established by the federal Clean Air Act [42 U.S.C. 7401 et seq.], as amended, the authorities and responsibilities of which are delegatable to the state by the United States environmental protection agency. The rules may include enforceable ambient standards, emission limitations, and other control measures, means, techniques, or economic incentives, including fees, marketable permits, and auctions of emissions rights, as provided by the Act. The department shall develop and implement the federal programs if the department determines that doing so benefits the state.
m. Provide by rules a program for implementing lead-based paint remediation training, certification, and performance requirements in accordance with title 40, Code of Federal Regulations, part 745, sections 220, 223, 225, 226, 227, and 233.

2. After consultation with the advisory council, the department may adopt, amend, and repeal rules under this chapter.

23.1-06-05. Licensing of asbestos and lead-based paint contractors and certification of asbestos and lead-based paint workers.

1. The department shall administer and enforce a licensing program for asbestos contractors and lead-based paint contractors and a certification program for asbestos workers and lead-based paint workers. To do so, the department shall:

a. Require training of, and to examine, asbestos workers and lead-based paint workers.
b. Establish standards and procedures for the licensing of contractors, and the certification of asbestos workers engaging in the abatement of friable asbestos materials or nonfriable asbestos materials that become friable during abatement, and establish performance standards for asbestos abatement. The performance standards will be as stringent as those standards adopted by the United States environmental protection agency pursuant to section 112 of the federal Clean Air Act [42 U.S.C. 7401 et seq.], as amended.
c. Establish standards and procedures for licensing contractors and certifying lead-based paint workers engaging in the abatement of lead-based paint, and establish performance standards for lead-based paint abatement in accordance with title 40, Code of Federal Regulations, part 745, sections 220, 223, 225, 226, 227, and 233.
d. Issue certificates to all applicants who satisfy the requirements for certification under this section and any rules under this section, renew certificates, and suspend or revoke certificates for cause after notice and opportunity for hearing.
e. Establish an annual fee and renewal fees for licensing asbestos contractors and lead-based paint contractors and certifying asbestos and lead-based paint workers, and establish examination fees for asbestos and lead-based paint workers under section 23.1-06-10. The annual, renewal, and examination fees for lead-based contractors and workers may not exceed those charged to asbestos contractors and workers.
f. Establish indoor environmental nonoccupational air quality standards for asbestos.
g. Adopt and enforce rules as necessary for the implementation of this section.

2. For nonpublic employees performing asbestos abatement in facilities or on facility components owned or leased by their employer, only the provisions of rules adopted in accordance with the federal Asbestos Hazard Emergency Response Act of 1986 [Pub. L. 99-519; 100 Stat. 2970; 15 U.S.C. 2641 et seq.], as amended, or the federal Clean Air Act [Pub. L. 95-95; 91 Stat. 685; 42 U.S.C. 7401 et seq.], as amended, apply to this section. This does not include ownership that was acquired solely to effect a demolition or renovation.

23.1-06-06. Sulfur dioxide ambient air quality standards more strict than federal standards prohibited.

The department may not adopt ambient air quality rules or standards for sulfur dioxide that affect coal conversion facilities or petroleum refineries that are more strict than federal rules or standards under the federal Clean Air Act [42 U.S.C. 7401 et seq.], nor may the department adopt ambient air quality rules or standards for sulfur dioxide that affect these facilities and refineries when there are no corresponding federal rules or standards. Any ambient air quality standards that have been adopted by the department for sulfur dioxide that are more strict than federal rules or standards under the federal Clean Air Act, or for which there are no corresponding federal rules or standards, are void as to coal conversion facilities and petroleum refineries. However, the department may adopt rules for dealing with exposures of less than one hour to sulfur dioxide emissions on a source-by-source basis pursuant to any regulatory program for dealing with short-term exposures to sulfur dioxide that may be established under the federal Clean Air Act. Any intervention levels or standards set forth in the rules may not be more strict than federal levels or standards recommended or adopted under the federal program. In adopting the rules, the department shall follow all other provisions of state law governing the department's adoption of ambient air quality rules when there are no mandatory corresponding federal rules or standards.

23.1-06-07. Requirements for adoption of air quality rules more strict than federal standards.

1. Notwithstanding any other provisions of this title, the department may not adopt air quality rules or standards affecting coal conversion and associated facilities, petroleum refineries, or oil and gas production and processing facilities which are more strict than federal rules or standards under the federal Clean Air Act [42 U.S.C. 7401 et seq.], nor may the department adopt air quality rules or standards affecting such facilities when there are no corresponding federal rules or standards, unless the more strict or additional rules or standards are based on a risk assessment that demonstrates a substantial probability of significant impacts to public health or property, a cost-benefit analysis that affirmatively demonstrates that the benefits of the more stringent or additional state rules and standards will exceed the anticipated costs, and the independent peer reviews required by this section.
2. The department shall hold a hearing on any rules or standards proposed for adoption under this section on not less than ninety days' notice. The notice of hearing must specify all studies, opinions, and data that have been relied upon by the department and must state that the studies, risk assessment, and cost-benefit analysis that support the proposed rules or standards are available at the department for inspection and copying. If the department intends to rely upon any studies, opinions, risk assessments, cost-benefit analyses, or other information not available from the department when it gave its notice of hearing, the department shall give a new notice of hearing not less than ninety days before the hearing which clearly identifies the additional or amended studies, analyses, opinions, data, or information upon which the department intends to rely and conduct an additional hearing if the first hearing has already been held.
3. In this section:
    a. "Cost-benefit analysis" means both the analysis and the written document that contains:
        (1) A description and comparison of the benefits and costs of the rule and of the reasonable alternatives to the rule. The analysis must include a quantification or numerical estimate of the quantifiable benefits and costs. The quantification or numerical estimate must use comparable assumptions, including time periods, specify the ranges of predictions, and explain the margins of error involved in the quantification methods and estimates being used. The costs that must be considered include the social, environmental, and economic costs that are expected to result directly or indirectly from implementation or compliance with the proposed rule.
        (2) A reasonable determination whether as a whole the benefits of the rule justify the costs of the rule and that the rule will achieve the rulemaking objectives in a more cost-effective manner than other reasonable alternatives, including the alternative of no government action. In evaluating and comparing the costs and benefits, the department may not rely on cost, benefit, or risk assessment information that is not accompanied by data, analysis, or supporting materials that would enable the department and other persons interested in the rulemaking to assess the accuracy, reliability, and uncertainty factors applicable to the information.
    b. "Risk assessment" means both the process used by the department to identify and quantify the degree of toxicity, exposure, or other risk posed for the exposed individuals, populations, or resources, and the written document containing an explanation of how the assessment process has been applied to an individual substance, activity, or condition. The risk assessment must include a discussion that characterizes the risks being assessed. The risk characterization must include the following elements:
        (1) A description of the exposure scenarios used, the natural resources or subpopulations being exposed, and the likelihood of these exposure scenarios expressed in terms of probability.

(2) A hazard identification that demonstrates whether exposure to the substance, activity, or condition identified is causally linked to an adverse effect.
(3) The major sources of uncertainties in the hazard identification, dose-response, and exposure assessment portions of the risk assessment.
(4) When a risk assessment involves a choice of any significant assumption, inference, or model, the department, in preparing the risk assessment, shall:
(a) Rely only upon environmental protection agency-approved air dispersion models.
(b) Identify the assumptions, inferences, and models that materially affect the outcome.
(c) Explain the basis for any choices.
(d) Identify any policy decisions or assumptions.
(e) Indicate the extent to which any model has been validated by, or conflicts with, empirical data.
(f) Describe the impact of alternative choices of assumptions, inferences, or mathematical models.
(5) The range and distribution of exposures and risks derived from the risk assessment.

c. The risk assessment and cost-benefit analysis performed by the department must be independently peer reviewed by qualified experts selected by the environmental review advisory council.

4. This section applies to any petition submitted to the department under section 23.1-01-04 which identifies air quality rules or standards affecting coal conversion facilities or petroleum refineries that are more strict than federal rules or standards under the federal Clean Air Act [42 U.S.C. 7401 et seq.] or for which there are no corresponding federal rules or standards, regardless of whether the department has previously adopted the more strict or additional rules or standards pursuant to section 23.1-01-04. This section also applies to any petitions filed under section 23.1-01-04 affecting coal conversion facilities or petroleum refineries that are pending on the effective date of this section for which new rules or standards have not been adopted, and the department shall have a reasonable amount of additional time to comply with the more stringent requirements of this section. To the extent section 23.1-01-04.1 conflicts with this section, the provisions of this section govern. This section does not apply to existing rules that set air quality standards for odor, hydrogen sulfide, visible and fugitive emissions, or emission standards for particulate matter and sulfur dioxide, but does apply to new rules governing those standards.

23.1-06-08. Classification and reporting of air pollution sources.

1. After consultation with the environmental review advisory council the department, by rule, may classify air contaminant sources according to levels and types of emissions and other criteria that relate to air pollution, and may require reporting for any class. Classifications made under this subsection may apply to the state as a whole or to any designated area of the state, and must be made with special reference to effects on health, economic, and social factors and physical effects on property.
2. A person operating or responsible for the operation of air contaminant sources of any class for which reporting is required shall make reports containing information the department deems relevant to air pollution.

23.1-06-09. Permits or registration.

1. A person may not construct, install, modify, use, or operate an air contaminant source designated by regulation, capable of causing or contributing to air pollution, either directly or indirectly, without a permit from the department or in violation of any conditions imposed by the permit.
2. The department shall provide for the issuance, suspension, revocation, and renewal of permits that it requires under this section.

3. The department may require applications for permits to be accompanied by plans, specifications, and other information it deems necessary.
4. Possession of an approved permit or registration certificate does not relieve any person of the responsibility to comply with applicable emission limitations or with any other law or rule, and does not relieve any person from the requirement to possess a valid contractor's license issued under chapter 43-07.
5. The department by rule may provide for registration and registration renewal of certain air contaminant sources in lieu of a permit.
6. The department may exempt by rule certain air contaminant sources from the permit or registration requirements in this section when the department makes a finding the exemption will not be contrary to section 23.1-06-02.

23.1-06-10. Fees - Deposit in operating fund.

The department by rule may prescribe and provide for the payment and collection of reasonable fees for permits and registration certificates. The fees must be based on the anticipated cost of filing and processing the application, taking action on the requested permit or registration certificate, and conducting an inspection program to determine compliance or noncompliance with the permit or registration certificate. Any moneys collected for permit or registration fees must be deposited in the department operating fund in the state treasury and must be spent subject to appropriation by the legislative assembly.

23.1-06-11. Right of onsite inspection.

1. Any duly authorized officer, employee, or agent of the department may enter and inspect any property, premise, or place on or at which an air contaminant source is located or is being constructed, installed, or established at any reasonable time for the purpose of ascertaining the state of compliance with this chapter and related rules. If requested, the owner or operator of the premises must receive a report setting forth all facts found which relate to compliance status.
2. The department may conduct tests and take samples of air contaminants, fuel, process material, and other materials that may affect emission of air contaminants from any source, and may have access to and copy any records required by department rules to be maintained, and may inspect monitoring equipment located on the premises. Upon request of the department, the person responsible for the source to be tested shall provide necessary holes in stacks or ducts and other safe and proper sampling, and testing facilities exclusive of instruments and sensing devices necessary for proper determination of the emission of air contaminants. If an authorized representative of the department, during the course of an inspection, obtains a sample of air contaminant, fuel, process material, or other material, the representative shall issue a receipt for the sample obtained to the owner or operator of, or person responsible for, the source tested.
3. To ascertain the state of compliance with this chapter and any applicable rules, a duly authorized officer, employee, or agent of the department may enter and inspect, at any reasonable time, any property, premises, or place on or at which a lead-based paint remediation activity is ongoing. If requested, the department shall provide to the owner or operator of the premises a report that sets forth all facts found which relate to compliance status.

23.1-06-12. Confidentiality of records.

1. Any record, report, or information obtained under this chapter must be available to the public. However, upon a showing satisfactory to the department that disclosure to the public of a part of the record, report, or information, other than emission data, to which the department has access under this chapter, would divulge trade secrets, the department shall consider that part of the record, report, or information confidential.
2. This section may not prevent disclosure of any report, or record of information to federal, state, or local agencies when necessary for purposes of administration of any

federal, state, or local air pollution control laws, or when relevant in any proceeding under this chapter.

23.1-06-13. Administrative procedure and judicial review.

Any proceeding under this chapter for the issuance or modification of rules and regulations, including emergency orders relating to control of air pollution, or determining compliance with rules and regulations of the department, must be conducted in accordance with chapter 28-32. Appeals from the proceeding may be taken under chapter 28-32. When an emergency exists requiring immediate action to protect the public health and safety, the department may, without notice or hearing, issue an order reciting the existence of the emergency and requiring action be taken as necessary to meet the emergency. Notwithstanding any provision of this chapter, the order must be effective immediately, but on application to the department an interested person must be afforded a hearing before the environmental review advisory council within ten days. On the basis of the hearing, the emergency order must be continued, modified, or revoked within thirty days after the hearing. Except as provided for in this section, notice of any hearing held under this chapter must be issued at least thirty days before the date specified for the hearing.

23.1-06-14. Enforcement - Penalties - Injunctions.

1. A person that willfully violates this chapter, or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, is subject to a fine of not more than ten thousand dollars per day per violation, or by imprisonment for not more than one year, or both. If the conviction is for a violation committed after a first conviction of the person under this subsection, punishment must be a fine of not more than twenty thousand dollars per day per violation, or by imprisonment for not more than two years, or both.
2. A person that violates this chapter, or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, with criminal negligence, is subject to a fine of not more than ten thousand dollars per day per violation, or by imprisonment for not more than six months, or both.
3. A person that knowingly makes any false statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this chapter or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, or that falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this chapter or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, upon conviction, is subject to a fine of not more than ten thousand dollars per day per violation, or by imprisonment for not more than six months, or both.
4. A person that violates this chapter, or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter, is subject to a civil penalty not to exceed ten thousand dollars per day per violation.
5. Without prior revocation of any pertinent permits, the department, in accordance with the laws of this state governing injunction or other process, may maintain an action in the name of the state against any person to enjoin a threatened or continuing violation of any provision of this chapter or any permit condition, rule, order, limitation, or other applicable requirement implementing this chapter.

23.1-06-15. Regulation of odors - Rules.

1. In areas located within a city or the area over which a city has exercised extraterritorial zoning as defined in section 40-47-01.1, a person may not discharge into the ambient air any objectionable odorous air contaminant that measures seven odor concentration units or higher outside the property boundary where the discharge is occurring. If an agricultural operation as defined by section 42-04-01 has been in operation for more than one year, as provided by section 42-04-02, and the person making the odor

complaint was built or established after the agricultural operation was established, the measurement for compliance with the seven odor concentration units standard must be taken within one hundred feet [30.48 meters] of the subsequently established residence, church, school, business, or public building making the complaint rather than at the property boundary of the agricultural operation. The measurement may not be taken within five hundred feet [.15 kilometer] of the property boundary of the agricultural operation.

2. In areas located outside a city or outside the area over which a city has exercised extraterritorial zoning as defined in section 40-47-01.1, a person may not discharge into the ambient air any objectionable odorous air contaminant that causes odors that measure seven odor concentration units or higher as measured at any of the following locations:
   a. Within one hundred feet [30.48 meters] of any residence, church, school, business, or public building, or within a campground or public park. An odor measurement may not be taken at the residence of the owner or operator of the source of the odor, or at any residence, church, school, business, or public building, or within a campground or public park, that is built or established within one-half mile [.80 kilometer] of the source of the odor after the source of the odor has been built or established;
   b. At any point located beyond one-half mile [.80 kilometer] from the source of the odor, except for property owned by the owner or operator of the source of the odor, or over which the owner or operator of the source of the odor has purchased an odor easement; or
   c. If a county or township has zoned or established a setback distance for an animal feeding operation which is greater than one-half mile [.80 kilometer] under either section 11-33-02.1 or 58-03-11.1, or if the setback distance under subsection 7 is greater than one-half mile [.80 kilometer], measurements for compliance with the seven odor concentration units standard must be taken at the setback distance rather than one-half mile [.80 kilometer] from the facility under subdivision b, except for any residence, church, school, business, public building, park, or campground within the setback distance which was built or established before the animal feeding operation was established, unless the animal feeding operation has obtained an odor easement from the pre-existing facility.
3. An odor measurement may be taken only with a properly maintained scentometer, by an odor panel, or by another instrument or method approved by the department of environmental quality, and only by inspectors certified by the department who have successfully completed a department-sponsored odor certification course and demonstrated the ability to distinguish various odor samples and concentrations. If a certified inspector measures a violation of this section, the department may send a certified letter of apparent noncompliance to the person causing the apparent violation and may negotiate with the owner or operator for the establishment of an odor management plan and best management practices to address the apparent violation. The department shall give the owner or operator at least fifteen days to implement the odor management plan. If the odor problem persists, the department may proceed with an enforcement action provided at least two certified inspectors at the same time each measure a violation and then confirm the violation by a second odor measurement taken by each certified inspector, at least fifteen minutes, but no more than two hours, after the first measurement.
4. A person is exempt from this section while spreading or applying animal manure or other recycled agricultural material to land in accordance with a nutrient management plan approved by the department of environmental quality. A person is exempt from this section while spreading or applying animal manure or other recycled agricultural material to land owned or leased by that person in accordance with rules adopted by the department. An owner or operator of a lagoon or waste storage pond permitted by the department is exempt from this section in the spring from the time when the cover of the permitted lagoon or pond begins to melt until fourteen days after all the ice cover

on the lagoon or pond has completely melted. Notwithstanding these exemptions, all persons shall manage their property and systems to minimize the impact of odors on their neighbors.

5. This section does not apply to chemical compounds that can be individually measured by instruments, other than a scentometer, that have been designed and proven to measure the individual chemical or chemical compound, such as hydrogen sulfide, to a reasonable degree of scientific certainty, and for which the department of environmental quality has established a specific limitation by rule.
6. For purposes of this section:
   a. "Business" means a commercial building used primarily to carry on a for-profit or nonprofit business which is not residential and not used primarily to manufacture or produce raw materials, products, or agricultural commodities;
   b. "Campground" means a public or private area of land used exclusively for camping and open to the public for a fee on a regular or seasonal basis;
   c. "Church" means a building owned by a religious organization and used primarily for religious purposes;
   d. "Park" means a park established by the federal government, the state, or a political subdivision of the state in the manner prescribed by law;
   e. "Public building" means a building owned by a county, city, township, school district, park district, or other unit of local government; the state; or an agency, industry, institution, board, or department of the state; and
   f. "School" means a public school or nonprofit, private school approved by the superintendent of public instruction.
7. a. In a county or township that does not regulate the nature, scope, or location of an animal feeding operation under section 11-33-02.1 or section 58-03-11.1, the department shall require that any new animal feeding operation permitted under chapter 61-28 be set back from any existing residence, church, school, business, public building, park, or campground.
      (1) If there are fewer than three hundred animal units, there is no minimum setback requirement.
      (2) If there are at least three hundred animal units but no more than one thousand animal units, the setback for any animal operation is one-half mile [.80 kilometer].
      (3) If there are at least one thousand one animal units but no more than two thousand animal units, the setback for a hog operation is three-fourths mile [1.20 kilometers], and the setback for any other animal operation is one-half mile [.80 kilometer].
      (4) If there are at least two thousand one animal units but no more than five thousand animal units, the setback for a hog operation is one mile [1.60 kilometers], and the setback for any other animal operation is three-fourths mile [1.20 kilometers].
      (5) If there are five thousand one or more animal units, the setback for a hog operation is one and one-half miles [2.40 kilometers], and the setback for any other animal operation is one mile [1.60 kilometers].
   b. The setbacks set forth in subdivision a do not apply if the owner or operator applying for the permit obtains an odor easement from the pre-existing use that is closer.
   c. For purposes of this section:
      (1) One mature dairy cow, whether milking or dry, equals 1.33 animal units;
      (2) One dairy cow, heifer or bull, other than an animal described in paragraph 1 equals 1.0 animal unit;
      (3) One weaned beef animal, whether a calf, heifer, steer, or bull, equals 0.75 animal unit;
      (4) One cow-calf pair equals 1.0 animal unit;
      (5) One swine weighing fifty-five pounds [24.948 kilograms] or more equals 0.4 animal unit;

(6) One weaned swine weighing less than fifty-five pounds [24.948 kilograms] equals 0.1 animal unit;
(7) One horse equals 2.0 animal units;
(8) One sheep or weaned lamb equals 0.1 animal unit;
(9) One turkey equals 0.0182 animal unit;
(10) One chicken equals 0.01 animal unit;
(11) One duck or goose equals 0.2 animal unit; and
(12) Any weaned livestock not listed in paragraphs 1 through 11 equals 1.0 animal unit per each one thousand pounds [453.59 kilograms], whether single or combined animal weight.

d. In a county or township that regulates the nature, scope, or location of an animal feeding operation under section 11-33-02.1 or 58-03-11.1, an applicant for an animal feeding operation permit shall submit to the department with the permit application the zoning determination made by the county or township under subsection 9 of section 11-33-02.1 or subsection 9 of section 58-03-11.1, unless the animal feeding operation is in existence by January 1, 2019, and there is no change in animals or animal units which would result in an increase in the setbacks provided for in this section. The department may not impose additional odor setback requirements.

e. An animal feeding operation is not subject to zoning regulations adopted by a county or township after the date an application for the animal feeding operation is submitted to the department, provided construction of the animal feeding operation commences within three years from the date the application is submitted. Unless there is a change to the location of the proposed animal feeding operation, this exemption remains in effect if the department requires the applicant to submit a revised application.

8. A permitted animal feeding operation may expand its permitted capacity by twenty-five percent on one occasion without triggering a higher setback distance.

9. A county or township may not regulate or impose restrictions or requirements on animal feeding operations or other agricultural operations except as permitted under sections 11-33-02.1 and 58-03-11.1.

CHAPTER 33.1-15-12
STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

33.1-15-12-01. [Reserved].

33.1-15-12-01.1. Scope.

Except as noted below the title of the subpart, the subparts and appendices of title 40, Code of Federal Regulations, part 60, as they exist on July 1, ~~2015~~ 2019, which are listed under section 33.1-15-12-02 are incorporated into this chapter by reference. Any changes to the standards of performance are listed below the title of the standard. Reference to part 60 within the subparts means this chapter.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-12-02. Standards of performance.

Subpart A - General provisions.

*60.2. The definition of administrator is deleted and replaced with the following:

Administrator means the department except for those duties that cannot be delegated by the United States environmental protection agency. For those duties that cannot be delegated, administrator means the administrator of the United States environmental protection agency or the administrator’s authorized representative.

Subpart C - Emission guidelines and compliance times.

Subpart Cc - Emissions guidelines and compliance times for municipal solid waste landfills.

Designated facilities to which this subpart applies shall comply with the requirements for state plan approval in 40 CFR parts 60.33c, 60.34c, and 60.35c, except that quarterly surface monitoring for methane under part 60.34c shall only be required during the second, third, and fourth quarters of the calendar year.

Designated facilities under this subpart shall:

1. Submit a final control plan for department review and approval within twelve months of the date of the United States environmental protection agency's approval of this rule, or within twelve months of becoming subject to this rule, whichever occurs later.

2. Award contracts for control systems/process modification within twenty-four months of the date of the United States environmental protection agency's approval of this rule, or within twenty-four months of becoming subject to the rule, whichever occurs later.

3. Initiate onsite construction or installation of the air pollution control device or process changes within twenty-seven months of the date of the United States environmental protection agency's approval of this rule, or within twenty-seven months of becoming subject to the rule, whichever occurs later.

4. Complete onsite construction or installation of the air pollution control device or devices or

process changes within twenty-nine months of the United States environmental protection agency's approval of this rule, or within twenty-nine months of becoming subject to the rule, whichever is later.

5. Conduct the initial performance test within one hundred eighty days of the installation of the collection and control equipment. A notice of intent to conduct the performance test must be submitted to the department at least thirty days prior to the test.

6. Be in final compliance within thirty months of the United States environmental protection agency's approval of this rule, or within thirty months of becoming subject to the rule, whichever is later.

~~Subpart Ce - Emission guidelines and compliance times for hospital/medical/infectious waste incinerators.~~

~~Except as noted below, designated facilities to which this rule applies shall comply with the minimum requirements for state plan approval listed in subpart Ce.~~

~~*60.39e(a) is deleted in its entirety.~~

~~*60.39e(b) is deleted in its entirety and replaced with the following:~~

~~(b) Except as provided in paragraphs c and d of this section, designated facilities shall comply with all requirements of this subpart within one year of the United States environmental protection agency's approval of the state plan for hospital/medical/infectious waste incinerators regardless of whether a designated facility is identified in the state plan. Owners or operators of designated facilities who will cease operation of their incinerator to comply with this rule shall notify the department of their intention within six months of state plan approval.~~

~~*60.39e(c) is deleted in its entirety and replaced with the following:~~

~~(c) Owners or operators of designated facilities planning to install the necessary air pollution control equipment to comply with the applicable requirements may petition the department for an extension of the compliance time of up to three years after the United States environmental protection agency's approval of the state plan, but not later than September 16, 2002, for the emission guidelines promulgated on September 15, 1997, and not later than October 6, 2014, for the emission guidelines promulgated on October 6, 2009, provided the facility owner or operator complies with the following:~~

~~1. Submits a petition to the department for site specific operating parameters under 40 CFR 60.56c(i) of subpart Ec within thirty months of approval of the state plan and sixty days prior to the performance test.~~

~~2. Provides proof to the department of a contract for obtaining services of an architectural or engineering firm or architectural and engineering firm regarding the air pollution control device within nine months of state plan approval.~~

~~3. Submits design drawings to the department of the air pollution control device within twelve months of state plan approval.~~

~~4. Submits to the department a copy of the purchase order or other documentation indicating an order has been placed for the major components of the air pollution control device within sixteen months after state plan approval.~~

~~5. Submits to the department the schedule for delivery of the major components of the air pollution control device within twenty months after state plan approval.~~

~~6. Begins initiation of site preparation for installation of the air pollution control device within~~

~~twenty-two months after state plan approval.~~

7. ~~Begins initiation of installation of the air pollution control device within twenty-five months after state plan approval.~~

8. ~~Starts up the air pollution control device within twenty-eight months after state plan approval.~~

9. ~~Notifies the department of the performance test thirty days prior to the test.~~

10. ~~Conducts the performance test within one hundred eighty days of the installation of the air pollution control device.~~

11. ~~Submits a performance test report which demonstrates compliance within thirty-six months of state plan approval.~~

~~*60.39e(d) is deleted in its entirety and replaced with the following:~~

1. ~~Designated facilities petitioning for an extension of the compliance time in paragraph b of this section shall, within six months after the United States environmental protection agency's approval of the state plan, submit:~~

   i. ~~Documentation of the analyses undertaken to support the need for more than one year to comply, including an explanation of why up to three years after United States environmental protection agency approval of the state plan is sufficient to comply with this subpart while one year is not. The documentation shall also include an evaluation of the option to transport the waste offsite to a commercial medical waste treatment and disposal facility on a temporary or permanent basis; and~~

   ii. ~~Documentation of measurable and enforceable incremental steps of progress to be taken toward compliance with this subpart.~~

2. ~~The department shall review any petitions for the extension of compliance times within thirty days of receipt of a complete petition and make a decision regarding approval or denial. The department shall notify the petitioner in writing of its decision within forty-five days of the receipt of the petition. All extension approvals must include incremental steps of progress. For those sources planning on installing air pollution control equipment to comply with this subpart, the incremental steps of progress included in 40 CFR 60.39e(c) shall be included as conditions of approval of the extension.~~

3. ~~Owners or operators of facilities which received an extension to the compliance time in this subpart shall be in compliance with the applicable requirements on or before the date three years after United States environmental protection agency approval of the state plan but not later than September 16, 2002, for the emission guidelines promulgated on September 15, 1997. For the amended emission guidelines published on October 6, 2009, compliance with the applicable requirements shall be attained on or before the date three years after United States environmental protection agency approval of the amended state plan but not later than October 6, 2014.~~

~~*60.39e(f) is deleted in its entirety.~~

~~After the compliance dates specified in this subpart, an owner or operator of a facility to which this subpart applies shall not operate any such unit in violation of this subpart.~~

<u>Subpart Cf – Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills</u>

For purposes of this subpart, a state plan implementing subpart Cc of this part means the North Dakota section 111(d) plan for municipal solid waste landfills that implements the requirements of subpart Cc of this chapter.

*60.30f(a) is deleted.

*60.30f(b) is deleted.

*60.30f(c) – The first sentence is deleted and replaced with the following:

The following authorities will be retained by the United States environmental protection agency.

60.31f(c) is deleted and replaced with the following:

(c) For purposes of obtaining a title V permit to operate, the owner or operator of a municipal solid waste landfill subject to this subpart with a design capacity less than 2.5 million megagrams or 2.5 million cubic meters is not subject to the requirements to obtain a title V permit to operate under section 33.1-15-14-06 unless the landfill is otherwise subject to section 33.1-15-14-06. For submitting a timely application for a title V permit to operate, the owner or operator of a municipal solid waste landfill subject to this subpart with a design capacity greater than 2.5 million megagrams and 2.5 million cubic meters on the effective date of the U.S. environmental protection agency's approval of North Dakota's plan under section 111(d) of the federal clean air act, and not otherwise subject to the requirements of section 33.1-15-14-06, becomes subject to the requirements of subparagraph 33.1-15-14-06.4.a(1)(a) ninety days after the effective date of such section111(d) approval, even if the design capacity report is submitted earlier.

60.31f(d) – The first sentence is deleted and replaced with the following:

(d) When a municipal solid waste landfill subject to this subpart is closed as defined in this subpart, the owner or operator is no longer subject to the requirement to maintain a title v permit to operate under section 33.1-15-14-06 for the landfill if the landfill is not otherwise subject to the requirements of section 33.1-15-14-06 and either of the following are met:

*60.33f(a) – The first sentence is deleted and replaced with the following:

Each owner or operator of a municipal solid waste landfill subject to the provisions of this subpart and having a design capacity greater than or equal to 2.5 million megagrams by mass and 2.5 million cubic meters by volume shall collect and control municipal solid waste landfill emissions at each municipal solid waste landfill that meets the following conditions:

*60.33f(b) – The first sentence is deleted and replaced by the following:

Each owner or operator of a municipal solid waste landfill shall install a gas collection and control system which meets the requirements in paragraph(b)(1) through (3) and (c) of this section at each municipal solid waste landfill meeting the conditions in paragraph (a) of this section.

*60.33f(c) – The first sentence is deleted and replace with the following:

Each owner or operator of a municipal solid waste landfill subject to the provisions for the control of the gas collected from within the landfill through the use of control devices shall comply with the following requirements, except as provided in section 60.24.

*60.33f(d) – The first sentence is deleted and replaced with the following:

Each owner or operator of a municipal solid waste landfill having a design capacity less than 2.5 million megagrams by mass or 2.5 million cubic meters by volume shall submit an initial design capacity report to the department as provided in section 60.38f(a).

*60.33f(e) – The first sentence is deleted and replaced with the following:

Each owner or operator of a municipal solid waste landfill having a design capacity equal to or greater than 2.5 million megagrams and 2.5 million cubic meters shall either install a collection and control system as provided in paragraphs (b) and (c) of this section or calculate an initial nonmethane organic compounds emission rate for the landfill using the procedures specified in section 60.35f(a).

*60.34f – The first sentence is deleted and replaced with the following:

Each owner or operator of a municipal solid waste landfill subject to provisions of this subpart shall comply with the applicable provisions of the operational standards in this section for a municipal solid waste landfill with a gas collection and control system used to comply with the provisions of section 60.33f(b) and (c).

*60.35f – The first sentence is deleted and replaced with the following:

Each owner or operator of a municipal solid waste landfill subject to the provisions of this subpart shall comply with the applicable provisions in this section to calculate the landfill nonmethane organic compounds emission rate or to conduct a surface emission monitoring demonstration.

Other methods for determining the NMOC concentration or site-specific methane generation constant must be approved by the EPA administrator.

*60.36f – The first sentence is deleted and replaced with the following:

Each owner or operator of a municipal solid waste landfill that is subject to the provisions of this subpart shall comply with the applicable compliance provisions in this section.

*60.37f – The first sentence is deleted and replaced with the following:

Each owner or operator of a municipal solid waste landfill that is subject to the provisions of this subpart shall comply with the applicable monitoring provisions in this section, except as provided in 60.38f(d)(2).

*60.38f – The first sentence is deleted and replaced with the following:

Each owner or operator of a municipal solid waste landfill that is subject to the provisions of this subpart shall comply with the reporting provisions listed in this section, as applicable, except as provided by section 60.24 and 60.38f(d)(2).

*60.38f(a)(2) – In this subparagraph, administrator means the administrator of the United States environmental protection agency or the administrator's authorized representative.

*60.38f(d) – The first sentence is deleted and replaced with the following:

The department shall review and approve the site-specific design plan for each gas collection and control system as outlined in the 111(d) plan for municipal solid waste landfills subject to the provisions of this subpart.

*60.39f – The first sentence is deleted and replaced with the following:

Each owner or operator of a municipal solid waste landfill that is subject to the provisions of this subpart shall comply with the applicable recordkeeping provisions in this section.

*60.40f – The first sentence is deleted and replace by the following:

Each owner or operator of a municipal solid waste landfill that is subject to the provisions of this subpart and required to install an active collection system shall comply with the applicable specifications for active collection systems in this section.

*60.41f – The definition of administrator is deleted and replaced with the following:

Administrator means the department except for those duties that cannot be delegated by the United States environmental protection agency. For those duties that cannot be delegated, the administrator means the administrator of the United States environmental protection agency or the administrator's authorized representative.

Subpart D - Standards of performance for fossil-fuel fired steam generators for which construction is commenced after August 17, 1971.

Subpart Da - Standards of performance for electric utility steam generating units for which construction is commenced after September 18, 1978.

*The limits and other requirements for mercury are deleted.

Subpart Db - Standards of performance for industrial-commercial-institutional steam generating units.

Subpart Dc - Standards of performance for small industrial-commercial-institutional steam generating units.

Subpart E - Standards of performance for incinerators.

Subpart Ea - Standards of performance for municipal waste combustors for which construction is commenced after December 20, 1989, and on or before September 20, 1994.

Subpart Ec - Standards of performance for hospital/medical/infectious waste incinerators for which construction is commenced after June 20, 1996.

Subpart F - Standards of performance for portland cement plants.

Subpart G - Standards of performance for nitric acid plants. Subpart H

- Standards of performance for sulfuric acid plants. Subpart I -

Standards of performance for hot mix asphalt facilities. Subpart J -

Standards of performance for petroleum refineries.

Subpart Ja - Standards of performance for petroleum refineries for which construction, reconstruction, or modification commenced after May 14, 2007.

Those portions of the subpart that have been stayed are not adopted.

Subpart K - Standards of performance for storage vessels for petroleum liquids for which construction, reconstruction, or modification commenced after June 11, 1973, and prior to May 19, 1978.

*60.110(c) is deleted in its entirety and replaced with the following:

(c) Any facility under part 60.110(a) that commenced construction, reconstruction, or modification after July 1, 1970, and prior to May 19, 1978, is subject to the requirements of this subpart.

Subpart Ka - Standards of performance for storage vessels for petroleum liquids for which construction, reconstruction, or modification commenced after May 18, 1978, and prior to July 23, 1984.

Subpart Kb - Standards of performance for volatile organic liquid storage vessels (including petroleum liquid storage vessels) for which construction, reconstruction, or modification commenced after July 23, 1984.

Subpart O - Standards of performance for sewage treatment plants.

Subpart T - Standards of performance for the phosphate fertilizer industry: wet-process phosphoric acid plants.

Subpart U - Standards of performance for the phosphate fertilizer industry: superphosphoric acid plants.

Subpart V - Standards of performance for the phosphate fertilizer industry: diammonium phosphate plants.

Subpart W - Standards of performance for the phosphate fertilizer industry: triple superphosphate plants.

Subpart X - Standards of performance for the phosphate fertilizer industry: granular triple superphosphate storage facilities.

Subpart Y - Standards of performance for coal preparation plants. Subpart Z

- Standards of performance for ferroalloy production facilities.

Subpart AA - Standards of performance for steel plants: electric arc furnaces: constructed after October 21, 1974, and before August 17, 1983.

Subpart AAa - Standards of performance for steel plants: electric arc furnaces and argon-oxygen decarburization vessels constructed after August 17, 1983.

Subpart CC - Standards of performance for glass manufacturing plants.

Subpart DD - Standards of performance for grain elevators.

Subpart EE - Standards of performance for surface coatings of metal furniture.

Subpart FF - [Reserved]

Subpart GG - Standards of performance for stationary gas turbines.

Subpart HH - Standards of performance for lime manufacturing plants.

Subpart KK - Standards of performance for lead-acid battery manufacturing plants.

Subpart LL - Standards of performance for metallic mineral processing plants.

Subpart MM - Standards of performance for automobile and light-duty truck surface coating operations.

Subpart NN - Standards of performance for phosphate rock plants.

Subpart PP - Standards of performance for ammonium sulfate manufacture.

Subpart QQ - Standards of performance for the graphic arts industry: publication rotogravure printing.

Subpart RR - Standards of performance for pressure-sensitive tape and label surface coating operations.

Subpart SS - Standards of performance for industrial surface coating: large appliances.

Subpart TT - Standards of performance for metal coil surface coating.

Subpart UU - Standards of performance for asphalt processing and asphalt roofing manufacture.

Subpart VV - Standards of performance for equipment leaks of volatile organic compound (VOC) emissions in the synthetic organic chemicals manufacturing industry.

Subpart VVa - Standards of performance for equipment leaks of VOC in the synthetic organic chemicals manufacturing industry for which construction, reconstruction, or modification commenced after November 7, 2006.

Subpart WW - Standards of performance for the beverage can surface coating industry.

Subpart XX - Standards of performance for bulk gasoline terminals.

Subpart AAA - Standards of performance for new residential wood heaters.

Subpart BBB - Standards of performance for the rubber tire manufacturing industry.

Subpart CCC - [Reserved]

Subpart DDD - Standards of performance for volatile organic compound (VOC) emissions for the polymer manufacturing industry.

Subpart EEE - [Reserved]

Subpart FFF - Standards of performance for flexible vinyl and urethane coating and printing.

Subpart GGG - Standards of performance for equipment leaks of volatile organic compound (VOC) emissions in petroleum refineries.

Subpart GGGa - Standards of performance for equipment leaks of VOC in petroleum refineries for which construction, reconstruction, or modification commenced after November 7, 2006.

Those portions of the subpart that are stayed are not adopted.

Subpart HHH - Standards of performance for synthetic fiber production facilities.

Subpart III - Standards of performance for volatile organic compound (VOC) emissions from the synthetic organic chemical manufacturing industry (SOCMI) air oxidation unit processes.

Subpart JJJ - Standards of performance for petroleum drycleaners.

Subpart KKK - Standards of performance for equipment leaks of volatile organic compound (VOC) emissions from onshore natural gas processing plants.

Subpart LLL - Standards of performance for onshore natural gas processing; SO_2 emissions.

Subpart MMM - [Reserved]

Subpart NNN - Standards of performance for volatile organic compound (VOC) emissions from synthetic organic chemical manufacturing industry (SOCMI) distillation operations.

Subpart OOO - Standards of performance for nonmetallic mineral processing plants.

Subpart PPP - Standards of performance for wool fiberglass insulation manufacturing plants. Subpart

QQQ - Standards of performance for volatile organic compound (VOC) emissions from petroleum refinery wastewater systems.

Subpart RRR - Standards of performance for volatile organic compound (VOC) emissions from synthetic organic chemical manufacturing industry (SOCMI) reactor processes.

Subpart SSS - Standards of performance for magnetic tape coating facilities.

Subpart TTT - Standards of performance for industrial surface coating: surface coating of plastic parts for business machines.

Subpart UUU - Standards of performance for calciners and dryers in mineral industries.

Subpart VVV - Standards of performance for polymetric coating of supporting substrates facilities.

Subpart WWW - Standards of performance for municipal solid waste landfills.

Subpart XXX – Standards of performance for municipal solid waste landfills that commenced construction, reconstruction or modification after July 17, 2014.

Subpart AAAA - Standards of performance for small municipal waste combustion units for which construction is commenced after August 30, 1999, or for which modification or reconstruction is commenced after June 6, 2001.

Subpart CCCC - Standards of performance for commercial and industrial solid waste incineration units.

Subpart DDDD - Emission guidelines and compliance times for commercial and industrial solid waste incineration units.

Except as provided below, designated facilities to which this rule applies shall comply with 40 CFR 60.2575 through 60.2875, including tables 1 through 9.

In the rule, you means the owner or operator of a commercial or industrial solid waste incineration unit.

Table 1 of the rule is deleted and replaced with the following:

Table 1 to Subpart DDDD - Model Rule Increments of Progress and Compliance Schedules	
CISWI Units That Commenced Construction on or Before November 30, 1999	
Comply with these increments of progress	By these dates
~~Increment 1 - Submit final control plan~~	~~One year after EPA approval of the state plan or December 1, 2004, whichever comes first.~~
~~Increment 2 -~~ Final compliance	Three years after EPA approval of the state plan or December 1, 2005, whichever comes first.

Incinerator CISWI units that commenced construction after November 30, 1999, but no later than June 4, 2010, or commenced modification or reconstruction after June 1, 2001, but no later than August 7, 2013. CISWI units other than incinerator units that commenced construction on or before June 4, 2010, or commenced modification or reconstruction after June 4, 2010, but no later than August 7, 2013.	
Comply with these increments of progress	By these dates
~~Increment 1 - Submit final control plan~~	~~One year after EPA approval of the state plan or February 7, 2017, whichever comes first.~~
~~Increment 2 -~~ Final compliance	Three years after EPA approval of the state plan or February 7, 2018, whichever comes first.

Subpart GGGG - [Reserved]

Subpart IIII - Standards of performance for stationary compression ignition internal combustion engines.

Subpart JJJJ - Standards of performance for stationary sparks ignition internal combustion engines.

Subpart KKKK - Standards of performance for stationary combustion turbines.

Subpart OOOO – Standards of performance for crude oil and natural gas production, transmission and distribution for which construction, modification or reconstruction commenced after August 23, 2011, and on or before September 18, 2015.

Subpart OOOOa – Standards of performance for crude oil and natural gas facilities for which construction, modification or reconstruction commenced after September 18, 2015.

Subpart TTTT – Standards of performance for greenhouse gas emissions for electric generating units.

Appendix A - Test methods.

Appendix B - Performance specifications.

Appendix C - Determination of emission rate changes.

Appendix D - Required emission inventory information.

Appendix E - [Reserved]

Appendix F - Quality assurance procedures. Appendix I

Appendis I - Removable label and owner's manual.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

ARTICLE 33.1-15
AIR POLLUTION CONTROL

Chapter

CHAPTER 33.1-15-01
GENERAL PROVISIONS

Section

33.1-15-01-01. Purpose.

It is the purpose of these air quality standards and emission regulations to state such requirements as shall be required to achieve and maintain the best air quality possible, consistent with the best available control technology, to protect human health, welfare, and property to prevent injury to plant and animal life, to promote the economic and social development of this state, to foster the comfort and convenience for the people, and to facilitate the enjoyment of the natural attractions of this state.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-02; S.L. 2017, ch. 199, § 21

33.1-15-01-02. Scope.

These air quality standards and emission regulations apply to any source or emission existing partially or wholly within North Dakota.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-01-03. Authority.

The department of environmental quality has been authorized to provide and administer this article under the provisions of North Dakota Century Code chapter 23.1-06.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-01-04. Definitions.

As used in this article, except as otherwise specifically provided or when the context indicates otherwise, the following words shall have the meanings ascribed to them in this section:

1. "Act" means North Dakota Century Code chapter 23.1-06.

2. "Air contaminant" means any solid, liquid, gas, or odorous substance or any combination thereof emitted to the ambient air.

3. "Air pollution" means the presence in the outdoor atmosphere of one or more air contaminants in such quantities and duration as is or may be injurious to human health, welfare, or property or animal or plant life, or which unreasonably interferes with the enjoyment of life or property.

4. "Ambient air" means the surrounding outside air.

5. "ASME" means the American society of mechanical engineers.

6. "Coal conversion facility" means any of the following:

   a. An electrical generating plant, and all additions thereto, which processes or converts coal from its natural form into electrical power and which has at least one single electrical energy generation unit with a generator nameplate capacity of twenty-five megawatts or more.

   b. A plant, and all additions thereto, which processes or converts coal from its natural form into a form substantially different in chemical or physical properties, including coal gasification, coal liquefaction, and the manufacture of fertilizer and other products and which uses or is designed to use over five hundred thousand tons of coal per year.

c. A coal beneficiation plant, and all additions thereto, which improve the physical, environmental, or combustion qualities of coal and are built in conjunction with a facility defined in subdivision a or b.

7. "Control equipment" means any device or contrivance which prevents or reduces emissions.

8. "Department" means the department of environmental quality.

9. "Emission" means a release of air contaminants into the ambient air.

10. "Excess emissions" means the release of an air contaminant into the ambient air in excess of an applicable emission limit or emission standard specified in this article or a permit issued pursuant to this article.

11. "Existing" means equipment, machines, devices, articles, contrivances, or installations which are in being on or before July 1, 1970, unless specifically designated within this article; except that any existing equipment, machine, device, contrivance, or installation which is altered, repaired, or rebuilt after July 1, 1970, must be reclassified as "new" if such alteration, rebuilding, or repair results in the emission of an additional or greater amount of air contaminants.

12. "Federally enforceable" means all limitations and conditions which are enforceable by the administrator of the United States environmental protection agency, including those requirements developed pursuant to title 40 Code of Federal Regulations parts 60 and 61, requirements within any applicable state implementation plan, any permit requirements established pursuant to title 40 Code of Federal Regulations 52.21 or under regulations approved pursuant to title 40 Code of Federal Regulations part 51, subpart I, including operating permits issued under a United States environmental protection agency-approved program that is incorporated into the state implementation plan and expressly requires adherence to any permit issued under such program.

13. "Fuel burning equipment" means any furnace, boiler apparatus, stack, or appurtenances thereto used in the process of burning fuel or other combustible material for the primary purpose of producing heat or power by indirect heat transfer.

14. "Fugitive emissions" means solid airborne particulate matter, fumes, gases, mist, smoke, odorous matter, vapors, or any combination thereof generated incidental to an operation process procedure or emitted from any source other than through a well-defined stack or chimney.

15. "Garbage" means putrescible animal and vegetable wastes resulting from the handling, preparation, cooking, and consumption of food, including wastes from markets, storage facilities, handling, and sale of produce and other food products.

16. "Hazardous waste" has the same meaning as given by chapter 33.1-24-02.

17. "Heat input" means the aggregate heat content of all fuels whose products of combustion pass through a stack or stacks. The heat input value to be used shall be the equipment manufacturer's or designer's guaranteed maximum input, whichever is greater.

18. "Incinerator" means any article, machine, equipment, device, contrivance, structure, or part of a structure used for the destruction of garbage, rubbish, or other wastes by burning or to process salvageable material by burning.

19. "Industrial waste" means solid waste that is not a hazardous waste regulated under North Dakota Century Code chapter 23.1-04, generated from the combustion or gasification of municipal waste and from industrial and manufacturing processes. The term does not include municipal waste or special waste.

20. "Inhalable particulate matter" means particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers.

21. "Installation" means any property, real or personal, including processing equipment, manufacturing equipment, fuel burning equipment, incinerators, or any other equipment, or construction, capable of creating or causing emissions.

22. "Multiple chamber incinerator" means any article, machine, equipment, contrivance, structure, or part of a structure used to burn combustible refuse, consisting of two or more refractory lined combustion furnaces in series physically separated by refractory walls, interconnected by gas passage ports or ducts and employing adequate parameters necessary for maximum combustion of the material to be burned.

23. "Municipal waste" means solid waste that includes garbage, refuse, and trash generated by households, motels, hotels, and recreation facilities, by public and private facilities, and by commercial, wholesale, and private and retail businesses. The term does not include special waste or industrial waste.

24. "New" means equipment, machines, devices, articles, contrivances, or installations built or installed on or after July 1, 1970, unless specifically designated within this article, and installations existing at said stated time which are later altered, repaired, or rebuilt and result in the emission of an additional or greater amount of air contaminants.

25. "Opacity" means the degree to which emissions reduce the transmission of light and obscure the view of an object in the background.

26. "Open burning" means the burning of any matter in such a manner that the products of combustion resulting from the burning are emitted directly into the ambient air without passing through an adequate stack, duct, or chimney.

27. "Particulate matter" means any airborne finely divided solid or liquid material with an aerodynamic diameter smaller than one hundred micrometers.

28. "Particulate matter emissions" means all finely divided solid or liquid material, other than uncombined water, emitted to the ambient air.

29. "Person" means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, agency, political subdivision of this state, any other state or political subdivision or agency thereof and any legal successor, representative agent, or agency of the foregoing.

30. "Pesticide" includes:

    a. Any agent, substance, or mixture of substances intended to prevent, destroy, control, or mitigate any insect, rodent, nematode, predatory animal, snail, slug, bacterium, weed, and any other form of plant or animal life, fungus, or virus, that may infect or be detrimental to persons, vegetation, crops, animals, structures, or households or be present in any environment or which the department may declare to be a pest, except those bacteria, fungi, protozoa, or viruses on or in living man or other animals;

    b. Any agent, substance, or mixture of substances intended to be used as a plant regulator, defoliant, or desiccant; and

c. Any other similar substance so designated by the department, including herbicides, insecticides, fungicides, nematocides, molluscacides, rodenticides, lampreycides, plant regulators, gametocides, post-harvest decay preventatives, and antioxidants.

31. "Petroleum refinery" means an installation that is engaged in producing gasoline, kerosene, distillate fuel oils, residual fuel oils, lubricants, or other products through distillation of petroleum, or through the redistillation, cracking, or reforming of unfinished petroleum derivatives.

32. "$PM_{2.5}$" means particulate matter with an aerodynamic diameter less than or equal to a nominal two and five-tenths micrometers.

33. "PM_{10}" means particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers.

34. "PM_{10} emissions" means finely divided solid or liquid material with an aerodynamic diameter less than or equal to a nominal ten micrometers emitted to the ambient air.

35. "Pipeline quality natural gas" means natural gas that contains two grains, or less, of sulfur per one hundred standard cubic feet [2.83 cubic meters].

36. "Premises" means any property, piece of land or real estate, or building.

37. "Process weight" means the total weight of all materials introduced into any specific process which may cause emissions. Solid fuels charged will be considered as part of the process weight, but liquid and gaseous fuels and combustion air will not.

38. "Process weight rate" means the rate established as follows:

    a. For continuous or longrun steady state operations, the total process weight for the entire period of continuous operation or for a typical portion thereof, divided by the number of hours of such period or portion thereof.

    b. For cyclical or batch operations, the total process weight for a period that covers a complete operation or an integral number of cycles, divided by the hours of actual process operation during such a period. If the nature of any process or operation or the design of any equipment is such as to permit more than one interpretation of this definition, the interpretation that results in the minimum value for allowable emission shall apply.

39. "Radioactive waste" means solid waste containing radioactive material and subject to the requirements of article 33.1-10.

40. "Refuse" means any municipal waste, trade waste, rubbish, or garbage, exclusive of industrial waste, special waste, radioactive waste, hazardous waste, and infectious waste.

41. "Rubbish" means nonputrescible solid wastes consisting of both combustible and noncombustible wastes. Combustible rubbish includes paper, rags, cartons, wood, furniture, rubber, plastics, yard trimmings, leaves, and similar materials. Noncombustible rubbish includes glass, crockery, cans, dust, metal furniture, and like materials which will not burn at ordinary incinerator temperatures (one thousand six hundred to one thousand eight hundred degrees Fahrenheit [1,144 degrees Kelvin to 1,255 degrees Kelvin]).

42. "Salvage operation" means any operation conducted in whole or in part for the salvaging or reclaiming of any product or material.

43. "Smoke" means small gasborne particles resulting from incomplete combustion, consisting predominantly, but not exclusively, of carbon, ash, and other combustible material, that form a visible plume in the air.

44. "Source" means any property, real or personal, or person contributing to air pollution.

45. "Source operation" means the last operation preceding emission which operation:

    a. Results in the separation of the air contaminant from the process materials or in the conversion of the process materials into air contaminants, as in the case of combustion fuel; and

    b. Is not an air pollution abatement operation.

46. "Special waste" means solid waste that is not a hazardous waste regulated under North Dakota Century Code chapter 23.1-04 and includes waste generated from energy conversion facilities; waste from crude oil and natural gas exploration and production; waste from mineral and or mining, beneficiation, and extraction; and waste generated by surface coal mining operations. The term does not include municipal waste or industrial waste.

47. "Stack or chimney" means any flue, conduit, or duct arranged to conduct emissions.

48. "Standard conditions" means a dry gas temperature of sixty-eight degrees Fahrenheit [293 degrees Kelvin] and a gas pressure of fourteen and seven-tenths pounds per square inch absolute [101.3 kilopascals].

49. "Submerged fill pipe" means any fill pipe the discharge opening of which is entirely submerged when the liquid level is six inches [15.24 centimeters] above the bottom of the tank; or when applied to a tank which is loaded from the side, means any fill pipe the discharge opening of which is entirely submerged when the liquid level is one and one-half times the fill pipe diameter in inches [centimeters] above the bottom of the tank.

50. "Trade waste" means solid, liquid, or gaseous waste material resulting from construction or the conduct of any business, trade, or industry, or any demolition operation, including wood, wood containing preservatives, plastics, cartons, grease, oil, chemicals, and cinders.

51. "Trash" means refuse commonly generated by food warehouses, wholesalers, and retailers which is comprised only of nonrecyclable paper, paper products, cartons, cardboard, wood, wood scraps, and floor sweepings and other similar materials. Trash may not contain more than five percent by volume of each of the following: plastics, animal and vegetable materials, or rubber and rubber scraps. Trash must be free of grease, oil, pesticides, yard waste, scrap tires, infectious waste, and similar substances.

52. "Volatile organic compounds" means the definition of volatile organic compounds in 40 Code of Federal Regulations 51.100(s) as it exists on July 1, 2015, which is incorporated by reference.

53. "Waste classification" means the seven classifications of waste as defined by the incinerator institute of America and American society of mechanical engineers.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-01-05. Abbreviations.

The abbreviations used in this article have the following meanings:

A	-	ampere
A.S.T.M.	-	American Society for Testing and Materials
Btu	-	British thermal unit
°C	-	degree Celsius (centigrade)
cal	-	calorie
CdS	-	cadmium sulfide
cfm	-	cubic feet per minute
CFR	-	Code of Federal Regulations
cu ft	-	cubic feet
CO	-	carbon monoxide
CO_2	-	carbon dioxide
dcf	-	dry cubic feet
dcm	-	dry cubic meter
dscf	-	dry cubic feet at standard conditions
dscm	-	dry cubic meter at standard conditions
eq	-	equivalents
°F	-	degree Fahrenheit
ft	-	feet
g	-	gram
gal	-	gallon
g eq	-	gram equivalents
gr	-	grain
hr	-	hour
HCl	-	hydrochloric acid
Hg	-	mercury
H_2O	-	water
H_2S	-	hydrogen sulfide
H_2SO_4	-	sulfuric acid
Hz	-	hertz
in.	-	inch
j	-	joule
°K	-	degree Kelvin
k	-	1,000
kg	-	kilogram
l	-	liter
lpm	-	liter per minute
lb	-	pound

m	-	meter
m^3	-	cubic meter
meq	-	milliequivalent
min	-	minute
mg	-	milligram - 10^{-3} gram
Mg	-	megagram - 10^6 gram
ml	-	milliliter - 10^{-3} liter
mm	-	millimeter - 10^{-3} meter
mol	-	mole
mol.wt.	-	molecular weight
mV	-	millivolt
N_2	-	nitrogen
N	-	newton
ng	-	nanogram - 10^{-9} gram
nm	-	nanometer - 10^{-9} meter
NO	-	nitric oxide
NO_2	-	nitrogen dioxide
NO_x	-	nitrogen oxides
O_2	-	oxygen
Pa	-	pascal
PM	-	particulate matter
$PM_{2.5}$	-	particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers
PM_{10}	-	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
ppb	-	parts per billion
ppm	-	parts per million
psia	-	pounds per square inch absolute
psig	-	pounds per square inch gauge
°R	-	degree Rankine
s-sec	-	second
scf	-	cubic feet at standard conditions
scfh	-	cubic feet per hour at standard conditions
scm	-	cubic meters at standard conditions
scmh	-	cubic meters per hour at standard conditions
SO_2	-	sulfur dioxide
SO_3	-	sulfur trioxide
SO_x	-	sulfur oxides

sq ft	-	square feet
std	-	at standard conditions
TSP	-	total suspended particulate
μg	-	microgram - 10^{-6} gram
V	-	volt
W	-	watt
Ω	-	ohm

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-01-06. Entry onto premises - Authority.

Entry onto premises and onsite inspection shall be made pursuant to North Dakota Century Code section 23.1-06-11.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-11; S.L. 2017, ch. 199, § 21

33.1-15-01-07. Variances.

1. Where upon written application of the responsible person or persons the department finds that by reason of exceptional circumstances strict conformity with any provisions of this article would cause undue hardship, would be unreasonable, impractical, or not feasible under the circumstances, the department may permit a variance from this article upon such conditions and within such time limitations as it may prescribe for prevention, control, or abatement of air pollution in harmony with the intent of the state and any applicable federal laws.

2. No variance may permit or authorize the creation or continuation of a public nuisance, or a danger to public health or safety.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-01-08. Circumvention.

No person shall cause or permit the installation or use of any device or any means which conceals or dilutes an emission of air contaminant which would otherwise violate this article.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-01-09. Severability.

If any provision of this article or the application thereof to any person or circumstances is held to be invalid, such invalidity shall not affect other provisions or application of any other part of this article which can be given effect without the invalid provision or application, and to this end the provisions of this article and the various applications thereof are declared to be severable.

History: Effective January 1, 2019.

General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-01-10. Land use plans and zoning regulations.

1. **Planning agency land use plans.**

   a. The department will provide to planning agencies, for use in preparing land use plans, information concerning:

      (1) Air quality.

      (2) Air pollutant emissions.

      (3) Air pollutant meteorology.

      (4) Air quality goals.

      (5) Air pollution effects.

   b. The department will review all land use plans and prepare recommendations for consideration in the plan adoption process.

2. **Zoning agency regulations.**

   a. The department will provide to zoning control agencies, for use in preparing regulations, information concerning:

      (1) Air quality.

      (2) Air pollutant emissions.

      (3) Air pollution meteorology.

      (4) Air quality goals.

      (5) Air pollution effects.

   b. The department will review all zoning regulations and prepare recommendations for consideration in the regulation adoption process.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-01-11. [Reserved].

33.1-15-01-12. Measurement of emissions of air contaminants.

1. **Sampling and testing.** The department may reasonably require any person responsible for emission of air contaminants to make or have made tests, at a reasonable time or interval, to determine the emission of air contaminants from any source, for the purpose of determining whether the person is in violation of any standard under this article or to satisfy other requirements under the North Dakota Century Code chapter 23.1-06. All tests shall be made and the results calculated in accordance with test procedures approved or specified by the department. All tests shall be conducted by reputable, qualified personnel. The department shall be given a copy of the test results in writing and signed by the person responsible for the tests.

The owner or operator of a source shall notify the department using forms supplied by the department, or its equivalent, at least thirty calendar days in advance of any tests of emissions of air contaminants required by the department. Advanced notification for all other testing will be consistent with the requirements of the appropriate regulations but in no case will be less than thirty calendar days. If the owner or operator of a source is unable to conduct the performance test on the scheduled date, the owner or operator of a source shall notify the department as soon as practicable when conditions warrant and shall coordinate a new test date with the department.

Failure to give the proper notification may prevent the department from observing the test. If the department is unable to observe the test because of improper notification, the test results may be rejected.

2. **The department may make tests.** The department may conduct tests of emissions of air contaminants from any source. Upon request of the department, the person responsible for the source to be tested shall provide necessary holes in stacks or ducts and such other safe and proper sampling and testing facilities, exclusive of instruments and sensing devices as may be necessary for proper determination of the emission of air contaminants.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04, 23.1-06-08; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04, 23.1-06-08; S.L. 2017, ch. 199, § 21

33.1-15-01-13. Shutdown and malfunction of an installation - Requirement for notification.

1. **Maintenance shutdowns.** In the case of shutdown of air pollution control equipment for necessary scheduled maintenance, the intent to shut down such equipment shall be reported to the department at least twenty-four hours prior to the planned shutdown provided that the air contaminating source will be operated while the control equipment is not in service. Such prior notice shall include the following:

   a. Identification of the specific facility to be taken out of service as well as its location and permit number.

   b. The expected length of time that the air pollution control equipment will be out of service.

   c. The nature and estimated quantity of emissions of air pollutants likely to be emitted during the shutdown period.

   d. Measures such as the use of off-shift labor and equipment that will be taken to minimize the length of the shutdown period.

   e. The reasons that it would be impossible or impractical to shut down the source operation during the maintenance period.

   f. Nothing in this subsection shall in any manner be construed as authorizing or legalizing the emission of air contaminants in excess of the rate allowed by this article or a permit issued pursuant to this article.

2. **Malfunctions.**

   a. When a malfunction in any installation occurs that can be expected to last longer than twenty-four hours and cause the emission of air contaminants in violation of this article or other applicable rules and regulations, the person responsible for such installation shall notify the department of such malfunction as soon as possible during normal working hours. The notification must contain a statement giving all pertinent facts, including the estimated duration of the breakdown. The department shall be notified when the condition causing the malfunction has been corrected.

b. Immediate notification to the department is required for any malfunction that would threaten health or welfare, or pose an imminent danger. During normal working hours the department can be contacted at 701-328-5188. After hours the department can be contacted through the twenty-four-hour state radio emergency number 1-800-472-2121. If calling from out of state, the twenty-four-hour number is 701-328-9921.

c. Unavoidable malfunction. The owner or operator of a source who believes any excess emissions resulted from an unavoidable malfunction shall submit a written report to the department which includes evidence that:

(1) The excess emissions were caused by a sudden, unavoidable breakdown of technology that was beyond the reasonable control of the owner or operator.

(2) The excess emissions could not have been avoided by better operation and maintenance, did not stem from an activity or event that could have been foreseen and avoided or planned for.

(3) To the extent practicable, the source maintained and operated the air pollution control equipment and process equipment in a manner consistent with good practice for minimizing emissions, including minimizing any bypass emissions.

(4) Any necessary repairs were made as quickly as practicable, using off-shift labor and overtime as needed and possible.

(5) All practicable steps were taken to minimize the potential impact of the excess emissions on ambient air quality.

(6) The excess emissions are not part of a recurring pattern that may have been caused by inadequate operation or maintenance or inadequate design of the malfunctioning equipment.

The report shall be submitted within thirty days of the end of the calendar quarter in which the malfunction occurred or within thirty days of a written request by the department, whichever is sooner.

The burden of proof is on the owner or operator of the source to provide sufficient information to demonstrate that an unavoidable equipment malfunction occurred. The department may elect not to pursue enforcement action after considering whether excess emissions resulted from an unavoidable equipment malfunction. The department will evaluate, on a case-by-case basis, the information submitted by the owner or operator to determine whether to pursue enforcement action.

3. **Continuous emission monitoring system failures.** When a failure of a continuous emission monitoring system occurs, an alternative method for measuring or estimating emissions must be undertaken as soon as possible. The owner or operator of a source that uses an alternative method shall have the burden of demonstrating that the method is accurate. Timely repair of the emission monitoring system must be made. The provisions of this subsection do not apply to sources that are subject to monitoring requirements in chapter 33.1-15-21.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04, 23.1-06-08; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04, 23.1-06-08; S.L. 2017, ch. 199, § 21

33.1-15-01-14. Time schedule for compliance.

Except as otherwise specified, compliance with the provisions of this article shall be according to the following time schedule:

1. **New installations.** Every new installation shall comply as of going into continuous routine operation for its intended purpose.

2. **Existing installations.** Every existing installation shall be in compliance as of July 1, 1970, unless the owner or person responsible for the operation of the installation shall have submitted to the department in a form and manner satisfactory to it, a program and schedule for achieving compliance, such program and schedule to contain a date on or before which full compliance will be attained, and such other information as the department may require. If approved by the department, such date will be the date on which the person shall comply. The department may require persons submitting such program to submit subsequent periodic reports on progress in achieving compliance.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04, 23.1-06-09; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04, 23.1-06-09; S.L. 2017, ch. 199, § 21

33.1-15-01-15. Prohibition of air pollution.

1. No person shall permit or cause air pollution, as defined in section 33.1-15-01-04.

2. Nothing in any other part of this article concerning emission of air contaminants or any other regulation relating to air pollution shall in any manner be construed as authorizing or legalizing the creation or maintenance of air pollution.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04, 23.1-06-09; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04, 23.1-06-09; S.L. 2017, ch. 199, § 21

33.1-15-01-16. Confidentiality of records.

1. **Public inspection.** Any record, report, or information obtained or submitted pursuant to this article will be available to the public for inspection and copying during normal working hours unless the department certifies that the information is confidential. Anyone requesting department assistance in collecting, copying, certifying, or mailing public information must tender, in advance, the reasonable cost of those services.

2. **Information submitted as trade secrets.** The department may certify records, reports, or information, or particular part thereof, other than emission data, as confidential upon a showing that the information would, if made public, divulge methods or processes entitled to protection as trade secrets. Any person submitting trade secret information must present the information to the department in a sealed envelope marked "CONFIDENTIAL". Each page of any document claimed confidential must be clearly marked with the word "CONFIDENTIAL". The submission must contain two parts:

   a. The material claimed to contain trade secret information; and

   b. A request for confidential treatment including:

      (1) All information for which no claim is being made;

      (2) An affidavit stating how and why the information fulfills the conditions of confidentiality under this subsection; and

(3) An index to and summary of the information submitted which is suitable for release to the public.

3. **Accepted trade secret claims.** All information which meets the test of subsection 2 must be marked by the department as "ACCEPTED" and protected as confidential information.

4. **Rejected trade secret claims.** If the department determines that information submitted pursuant to subsection 2 does not meet the criteria of that subsection for confidential treatment, the department shall promptly notify the person submitting the information of that determination. The department shall in that event give that person at least twenty days in which to:

   a. Accept the determination of the department;

   b. Request that the information be returned to the person;

   c. Further justify the contention that the information deserves protection as a trade secret; or

   d. Further limit the scope of information for which a claim of confidentiality is made.

   If the person who submitted the information fails within the time period allowed by the department to demonstrate satisfactorily to the department that the information in the form presented qualifies for confidential treatment, the department shall promptly notify that person of that determination. If the person submitting the information did not request that it be returned, the department shall mark the information "REJECTED" and treat it as public information. The department's action on a reconsideration constitutes final agency action for purposes of judicial review. Appeal of this action must be to an appropriate district court.

5. **Appeal of nondisclosure claims.** Any person who identifies and tenders the reasonable cost of collecting, copying, certifying, and mailing particular information held by the department under subsection 2 may file with the department a petition for reconsideration stating how and why the public's interest would be better served by the release of the requested information than by its retention as confidential by the department. The department shall then reconsider the confidential status of the information. The department action on a petition for reconsideration constitutes final agency action for purposes of judicial review. Appeal of the department's action must be to an appropriate district court.

6. **Retention of confidential information.** All information which is accepted by the department as confidential must be stored in locked filing cabinets. Only those personnel of the department specifically designated by the department shall have access to the information contained therein. The department may not designate any person to have access to confidential information unless that person requires such access in order to carry out that person's responsibilities and duties. No person may disclose any confidential information except in accordance with the provisions of this section. No copies may be made except as strictly necessary for internal department use or as specified in subsection 8.

7. **Maintenance of log.** Persons designated by the department to maintain confidential files as herein provided shall maintain a log showing the persons who have had access to the confidential files and the date of such access.

8. **Transmittals of confidential information.** As necessary, confidential information acquired by the department under the provisions of the act, or this article, may be transmitted to such federal, state, or local agencies, when necessary for purposes of administration of any federal, state, or local air pollution control laws, which make an adequate showing of need to the department, provided that such transmittal is made under a continuing assurance of confidentiality.

9. **Relationship to issuance of permits.** The department may not process any application for a permit to construct or operate pursuant to chapter 33.1-15-14 or 33.1-15-15 until final agency action on confidential trade secret claims has been completed.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04, 23.1-06-09; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04, 23.1-06-12; S.L. 2017, ch. 199, § 21

33.1-15-01-17. Enforcement.

1. Enforcement action will be consistent with procedures as approved by the United States environmental protection agency.

2. Notwithstanding any other provision in this article, any credible evidence may be used for the purpose of establishing whether a person has violated or is in violation of this article.

   a. Information from the use of the following methods is presumptively credible evidence of whether a violation has occurred at a source:

      (1) A compliance assurance monitoring protocol approved for the source pursuant to subsection 10 of section 33.1-15-14-06.

      (2) A monitoring method approved for the source pursuant to paragraph 3 of subdivision a of subsection 5 of section 33.1-15-14-06 and incorporated in a federally enforceable title V permit to operate.

      (3) Compliance test methods specified in this article.

   b. The following testing, monitoring, and information-gathering methods are presumptively credible testing, monitoring, or information-gathering methods:

      (1) Any federally enforceable monitoring or testing methods, including those under title 40 Code of Federal Regulations parts 50, 51, 60, 61, 63, and 75.

      (2) Other testing, monitoring, or information-gathering methods that produce information comparable to that produced by any method in paragraph 1 or in subdivision a.

3. a. No person may knowingly make a false statement, representation, or certification in any application, record, report, plan, or other document filed or required under this article.

   b. No person may knowingly falsify, tamper with, or provide inaccurate information regarding a monitoring device or method required under this article.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

33.1-15-01-18. Compliance certifications.

Notwithstanding any other provision in this article, for the purpose of submission of compliance certifications the owner or operator is not prohibited from using the following in addition to any specified compliance methods:

1. A compliance assurance monitoring protocol approved for the source pursuant to subsection 10 of section 33.1-15-14-06.

2. Any other monitoring method approved for the source under paragraph 3 of subdivision a of subsection 5 of section 33.1-15-14-06 and incorporated into a federally enforceable title V permit to operate.

History: Effective January 1, 2019.
General Authority: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 1
Law Implemented: NDCC 23.1-06-04; S.L. 2017, ch. 199, § 21

ND Dept. of Health Emission Inventory Summary Year: **2018**

Company:	Big Dipper Enterprises, Inc.	AIRS/AFS Source Code:	38 081 00002
PTO Number:	T5O03002	Annual Permit Fee Billing:	**YES**
Unit or Station	Dakota MSW Landfill	Reviewed By:	ET

Individual Emission Sources

EU	Source Unit	SCC	CPM	PM10	SO2	NOX	CO	VOC
1	Municipal Waste Landfill	50100402						9.41
Total Facility Emissions (Less HAPS)								9.41

Hazardous Air Pollutants (Tons)			
Pollutant/Chemical Name	Boiler	Dryer	Total
Plant Totals			

Fuel Combusted & Process/Production Qty	
Coal (Tons)	
Natural Gas (MMScf)	
LPG/Propane (Gal)	
Bio-gas (MMScf)	
Low Sulfur Diesel (Gal)	
Distillate Oil (Gal)	
Residual Oil (Gal)	
Other Fuel	
Hot Mix Asphalt (Tons)	
Ethanol (Gal)	
Beets Sliced (Tons)	
Vegetable Oil (Gals)	

Action	Date	Initial
Scanned		
Checked	2/27/2019	ET
Checked (Gary)	6/20/2019	GK

Calendar Year Waste Collected	
Tons	**Megagrams**
73,460.06	66,641.85

Variable	**Estimated Waste Acceptance Rate**	**Known Waste Acceptance Rate**				
		1994	**1995...**	**2016**	**2017**	**2018**
CNMOC (ppm as Hexane)	354.00	354.00	354.00	354.00	354.00	354.00
Lo (cubic meters/Mg) - AP 42	100.00	100.00	100.00	100.00	100.00	100.00
Lo (cubic meters/Mg) - NSPS	170.00	170.00	170.00	170.00	170.00	170.00
K (1/year)	0.02	0.02	0.02	0.02	0.02	0.02
T (years)	43.00	24.00	23.00	2.00	1.00	0.00
R (Mg)	5,242.90	32,469.96	33,504.15	67,707.86	65,908.19	66,641.85
C (years)	0.00	-	-	-	-	-
e(Euler number)	2.72	2.72	2.72	2.72	2.72	2.72
Convesion factor	3.6×10^{-9}	3.6×10^{-9}	3.6×10^{-9}	3.6×10^{-9}	3.6×10^{-9}	3.6×10^{-9}
NMOC emission rate (Mg/yr)	0.77	0.10	0.11	0.33	0.33	0.34
NMOC emission rate (Mg/yr)	1.31	0.17	0.18	0.56	0.56	0.58

Total NMOC emissions	8.54	Mg/year (AP 42)
	9.41	ton/year (AP 42)
	14.52	Mg/year (NSPS)
	16.00	ton/year (NSPS)

WASTE MANAGEMENT

Scanned: ✓
Added to AQDB: ✓

WASTE MANAGEMENT
6207 Hempton Lake Road
Whitelaw, WI 54247
(920) 732-4473
(920) 732-3758 Fax

Received
Air Quality
2019

February 11, 2019

North Dakota Department of Health
Division of Air Quality
918 East Divide, 2nd Floor
Bismarck, ND 58501-1947

SUBJECT: DAKOTA MUNICIPAL SOLID WASTE LANDFILL 2018 ANNUAL EMISSIONS INVENTORY REPORT, NMOC EMISSION RATE REPORT, ANNUAL COMPLIANCE CERTIFICATION

Dear Department Air Quality Personnel:

Pursuant to the Title V Operating Permit for Dakota Municipal Solid Waste Landfill (Permit No. T5-O03002) enclosed are the

- 2018 Annual Emissions Inventory Report,
- the NMOC Emission Rate Report and
- the annual compliance certification.

The NMOC calculation is based on the tier 2 sampling conducted in 2015. The testing report dated September 3, 2015 is hereby incorporated by reference.

The enclosed NMOC calculations were performed per new source performance standards and emission guideline regulations. Those calculations utilize a regulatory default value of 170 for L_o. The emission inventory utilized the same formulas with the exception of using the latest AP42 value (100 m^3/Mg) for L_o. This approach is consistent with instructions in the Department's January 2, 2018 letter to utilize the latest AP42 emission factor. This is the reason the NMOC value is different for the two separate reporting requirements.

If you have any questions, please do not hesitate to contact me at (920) 796-6007.

Sincerely,

Raymond Seegers
Environmental Engineer (Wisconsin P.E.)

Certification
I certify that these reports are true, accurate and complete.

________________________, Derek Bohnenkamp, District Manager

cc: Derek Bohnenkamp, WM-District Manager
Dakota file
Jeffery Krall

Air & Toxics Technical Enforcement Program (8ENF-AT)
Office of Enforcement, Compliance & Environmental Justice
U.S. EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

MANUFACTURING OR PROCESSING EQUIPMENT
ANNUAL EMISSION INVENTORY REPORT

NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY
SFN 8537 (06-14)

GENERAL

Name of Firm or Organization	Permit to Operate Number	Year of Emissions	
Big Dipper Enterprises, Inc.	T5-O03002	2018	
Mailing Address	**City**	**State**	**ZIP Code**
7972 129th Avenue SE, PO Box 218	Gwinner	ND	58040

Facility Name	Facility Location	Actual Hours of Operation
Dakota Municipal Solid Waste Landfill	7972 129th Avenue SE, Gwinner, ND	7:00 - 4:00 M-F

Source Unit Description	Emission Unit Number
Municipal Solid Waste Landfill	1

RAW MATERIAL INFORMATION

Raw Materials Introduced into Process	Quantity (Specify Units)
Solid Waste from 1/1/18 through 12/31/18	73,460.06 tons

FUELS USED

	Primary Fuel	Auxiliary Fuel
Type (ex. lignite, natural gas, LPG No. 2 fuel oil, No. 6 fuel oil. etc.)		
Quantity of Fuel per Year (Specify Units: ex. ton, gal, cu.ft., etc.)		
Percent Sulfur Maximum Average		
Btu per Unit (Specify Unit in lb, ton, gal, etc.) Average		

STACK EMISSIONS

Air Contaminant *	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM (Filterable)			
Particulate - PM_{10} (Filterable)			
Particulate - $PM_{2.5}$ (Filterable)			
Particulate – CPM (Condensable)			
Sulfur Dioxide			
Nitrogen Oxides			
Carbon Monoxide			
Total Organic Compounds: Nonmethane	Lo = 100 cubic meters/Mg	AP-42 (section 2.4.4.1) 40 CFR 60.754 formula. 2015 NMOC test result of 354 ppm.	9.24

* Submit SFN 19839 for Hazardous Air Pollutants if applicable.

8.54 Mg

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report

Print Name of Person Submitting Report	Title	Telephone Number
Derek Bohnenkamp	District Manager	(701)-678-2306
Signature	**Email Address**	**Date**
[signature]	dbohnenk@wm.com	2/11/19

Return completed form to:
North Dakota Department of Health
Division of Air Quality
918 E Divide, 2nd Floor
Bismarck, ND 58501-1947
Telephone:(701)328-5188

40 CFR 60.754(a) provides two equations for determining NMOC emission rates; one for sites with known solid waste acceptance rates and another for sites with unknown waste acceptance rates. For sites that include time periods with both known and unknown acceptance rates, the Regulation indicates that both equations should be used. Dakota Landfill is such a facility. Accordingly, this Emission Rate Report applies both equations for calculating the facility NMOC emission rate.

NMOC Emission Rate Calculations for Years with Known Waste Acceptance Rates

The site has known waste acceptance rates since 1994. Therefore, the equation found in 40 CFR 60.754(a)(1)(I) was used to determine NMOC emission rates for this time period. The equation is provided below:

M_{NMOC} = Summation of $[2kL_oM_i(e^{-kt_i})(C_{NMOC})(3.6 \times 10^{-9})]$ for each year with a known waste acceptance rate

M_{NMOC}	=	Mass emission rate of NMOC, Mg/yr		
k	=	Methane generation rate constant, 1/yr	=	0.02 [1]
L_o	=	Refuse methane generation potential, m^3/Mg	=	170.00 [2]
M_i	=	Mass of solid waste received for given year, Mg	=	Varies per year (see table below)
t_i	=	Age of the i^{th} section, Years	=	current year minus year of waste placement
C_{NMOC}	=	Concentration of NMOC, ppm as hexane	=	354.00 [3]
		Conversion factor	=	3.6×10^{-9}

NMOC Emission Rate Calculation Summary (for years with known waste acceptance rates)

Year	Tons Received	M_i	t_i	M_{NMOC}
1994	35,792	32,470	25	0.17
1995	36,932	33,504	24	0.18
1996	37,448	33,973	23	0.19
1997	60,605	54,980	22	0.31
1998	52,708	47,816	21	0.27
1999	100,082	90,794	20	0.53
2000	116,282	105,490	19	0.63
2001	60,217	54,629	18	0.33
2002	23,979	21,754	17	0.13
2003	121,610	110,324	16	0.69
2004	113,419	102,893	15	0.66
2005	106,543	96,655	14	0.63
2006	124,520	112,964	13	0.75
2007	112,107	101,703	12	0.69
2008	95,241	86,402	11	0.60
2009	97,618	88,558	10	0.63
2010	105,814	95,994	9	0.69
2011	102,097	92,622	8	0.68
2012	89,756	81,426	7	0.61
2013	95,252	86,412	6	0.66
2014	90,041	81,685	5	0.64
2015	80,396	72,935	4	0.58
2016	74,635	67,709	3	0.55
2017	72,651	65,909	2	0.55
2018	73,460	66,643	1	0.57
Totals	1,688,022	1,531,363		12.95 Mg/yr

Conversions Used:

[1] For landfills in areas with a thirty year annual average precipitation of less than 25 inches, a k value of 0.02 is to be used. According to NOAA weather data, annual precipitation in the area of Dakota Landfill is less than 19 inches, therefore a k value of 0.02 has been used in the NMOC emission rate calculation.

[2] Per 40 CFR 60.754 the EPA default value for L_o must be used to calculate Tier 1 NMOC unless a site-specific value is obtained.

[3] C_{NMOC} value determined by Tier 2 testing in 2015. See Cornerstone report dated September 3, 2015.

NOTE: These calculations are made for NSPS purposes only. EPA has specifically stated as follows: "It is recommended that these default values not be used for estimating landfill emissions for purposes other than NSPS and EG" (61 FR 9905, 9912, March 12, 1996). Consequently, these emission calculations may not accurately reflect actual emissions and reviewers of this document are specifically cautioned against improper and irresponsible uses of these calculations.

NMOC Emission Rate Calculations for Years with Unknown Waste Acceptance Rates

Prior to 1994 complete historical tonnage records are not available; therefore, the volume of waste accepted is estimated between the opening date (estimated to be November 3, 1976) through 1993. Accordingly, the equation found in 40 CFR 60.754(a)(1)(ii) was used to determine NMOC emission rates for this time period. The equation is provided below:

$$M_{NMOC}=2LoR(e^{-kc}-e^{-kt})(C_{NMOC})(3.6 \times 10^{-9})$$

NMOC Emission Rate Calculation Summary (for years with estimated waste acceptance rates)[1]

M_{NMOC}	=	Mass emission rate of NMOC, Mg/yr		
L_o	=	Refuse methane generation potential, m^3/Mg	=	170.00 [1]
R	=	Average annual acceptance rate, Mg/yr	=	5242.90 [2]
k	=	Methane generation rate constant, 1/yr	=	0.02 [3]
c	=	Years since closure (0 for active and/or new landfills)	=	0.00 [4]
t	=	Age of landfill, yrs	=	43
C_{NMOC}	=	Concentration of NMOC, ppm as hexane	=	354.00 [5]

$M_{NMOC}=2(170)(5242.9)(e^{-(0.02)(0)}-e^{-(0.02)(35)})(343)(3.6 \times 10^{-9})$ = **1.31 Mg/yr**

[1] Per 40 CFR 60.754 the EPA default value for L_o must be used to calculate NMOC unless a site-specific value is obtained.

[2] Information used to determine average annual acceptance rate
The average annual acceptance rate (R) was determined by taking the total waste received between the assumed opening date of November 3, 1976 and December 31, 1993 divided by the number of years covering this time period (17.2 years).

Air space consumption summary from 11/03/76 through 12/31/93:
(from 09/11/02 Modified Design Capacity Report)

tons of refuse received from 11/03/76 to 12/31/93		Mg of refuse received from 11/03/76 to 12/31/93
99,403		90,178

Airspace (in Mg) consumed divided by 17.2 years = 5,242.90 Mg/yr (= Average annual acceptance rate)

Conversion Used: tons to Mg - - divide tons by 1.1023

[3] For landfills in areas with a thirty year annual average precipitation of less than 25 inches, a k value of 0.02 is to be used. According to NOAA weather data, annual precipitation in the area of Dakota Landfill is less than 19 inches, therefore a k value of 0.02 has been used in the NMOC emission rate calculation.

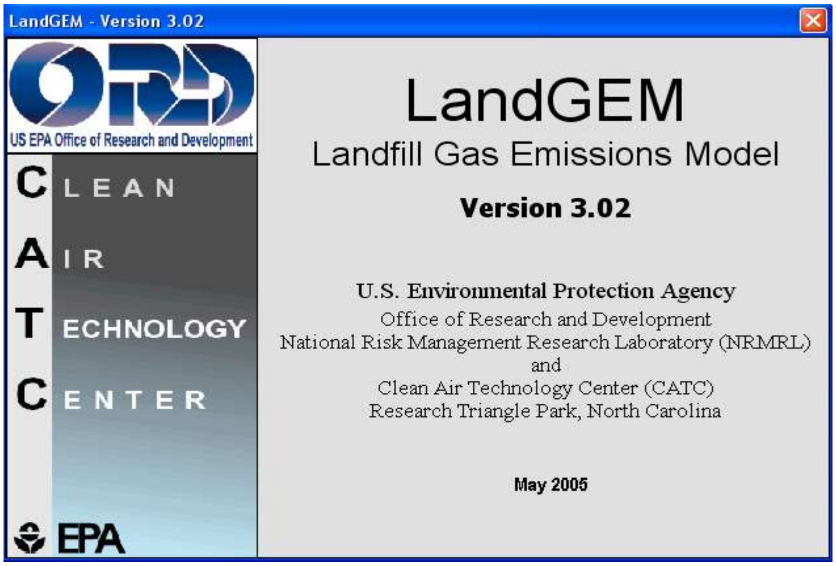
[4] Gas generation from waste accepted 1994 and after is calculated with "Known Waste Acceptance Rate" NSPS equation.

[5] C_{NMOC} value determined by Tier 2 testing in 2015. See September 3, 2015 Cornerstone report (incorporated by reference).

Total waste in place through 2018 = 1,621,541 Mg

TOTAL NMOC EMISSION RATE:	NMOC rate for years with known waste acceptance rates:	12.95
	NMOC rate for years with estimated waste acceptance rates:	1.31
	Combined NMOC Emission Rate:	**14.26 Mg/yr**
		15.71 Tons/yr

NOTE: These calculations are made for NSPS purposes only. EPA has specifically stated as follows: "It is recommended that these default values not be used for estimating landfill emissions for purposes other than NSPS and EG" (61 FR 9905, 9912, March 12, 1996). Consequently, these emission calculations may not accurately reflect actual emissions and reviewers of this document are specifically cautioned against improper and irresponsible uses of these calculations.



Summary Report

Landfill Name or Identifier: Bismarck

Date: Monday, July 15, 2019

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

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

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	**1964**	
Landfill Closure Year (with 80-year limit)	**2025**	
Actual Closure Year (without limit)	***2025***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**4,000,000**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*year^{-1}*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**297**	*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)*
1964	0	0	0	0
1965	38,831	42,714	0	0
1966	39,706	43,677	38,831	42,714
1967	40,582	44,640	78,537	86,391
1968	41,457	45,603	119,119	131,031
1969	42,333	46,566	160,576	176,634
1970	43,208	47,529	202,909	223,200
1971	44,426	48,869	246,117	270,729
1972	45,645	50,209	290,544	319,598
1973	46,863	51,549	336,188	369,807
1974	48,081	52,889	383,051	421,356
1975	49,299	54,229	431,132	474,245
1976	50,517	55,569	480,431	528,474
1977	51,735	56,909	530,948	584,043
1978	52,954	58,249	582,684	640,952
1979	54,172	59,589	635,637	699,201
1980	55,387	60,926	689,809	758,790
1981	55,981	61,579	745,196	819,716
1982	56,575	62,232	801,177	881,295
1983	57,168	62,885	857,752	943,527
1984	57,762	63,538	914,920	1,006,412
1985	58,355	64,191	972,682	1,069,950
1986	58,949	64,844	1,031,037	1,134,141
1987	59,543	65,497	1,089,986	1,198,985
1988	60,136	66,150	1,149,529	1,264,482
1989	60,730	66,803	1,209,665	1,330,632
1990	61,327	67,460	1,270,395	1,397,435
1991	62,104	68,314	1,331,723	1,464,895
1992	62,880	69,168	1,393,826	1,533,209
1993	63,656	70,022	1,456,706	1,602,377
1994	64,433	70,876	1,520,363	1,672,399
1995	65,209	71,730	1,584,795	1,743,275
1996	65,985	72,584	1,650,005	1,815,005
1997	66,762	73,438	1,715,990	1,887,589
1998	67,538	74,292	1,782,752	1,961,027
1999	68,315	75,146	1,850,290	2,035,319
2000	69,091	76,000	1,918,605	2,110,465
2001	69,847	76,832	1,987,695	2,186,465
2002	70,604	77,664	2,057,543	2,263,297
2003	71,360	78,496	2,128,146	2,340,961

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2004	72,116	79,328	2,199,506	2,419,457
2005	72,873	80,160	2,271,623	2,498,785
2006	73,629	80,992	2,344,495	2,578,945
2007	74,385	81,824	2,418,125	2,659,937
2008	75,142	82,656	2,492,510	2,741,761
2009	75,898	83,488	2,567,652	2,824,417
2010	76,650	84,315	2,643,550	2,907,905
2011	78,398	86,238	2,720,200	2,992,220
2012	80,845	88,929	2,798,598	3,078,458
2013	86,526	95,179	2,879,443	3,167,387
2014	90,357	99,393	2,965,969	3,262,566
2015	92,934	102,227	3,056,326	3,361,959
2016	91,872	101,059	3,149,260	3,464,186
2017	92,727	102,000	3,241,132	3,565,245
2018	92,727	102,000	3,333,859	3,667,245
2019	92,727	102,000	3,426,586	3,769,245
2020	92,727	102,000	3,519,314	3,871,245
2021	92,727	102,000	3,612,041	3,973,245
2022	92,727	102,000	3,704,768	4,075,245
2023	92,727	102,000	3,797,495	4,177,245
2024	92,727	102,000	3,890,223	4,279,245
2025	17,050	18,755	3,982,950	4,381,245
2026	0	0	4,000,000	4,400,000
2027	0	0	4,000,000	4,400,000
2028	0	0	4,000,000	4,400,000
2029	0	0	4,000,000	4,400,000
2030	0	0	4,000,000	4,400,000
2031	0	0	4,000,000	4,400,000
2032	0	0	4,000,000	4,400,000
2033	0	0	4,000,000	4,400,000
2034	0	0	4,000,000	4,400,000
2035	0	0	4,000,000	4,400,000
2036	0	0	4,000,000	4,400,000
2037	0	0	4,000,000	4,400,000
2038	0	0	4,000,000	4,400,000
2039	0	0	4,000,000	4,400,000
2040	0	0	4,000,000	4,400,000
2041	0	0	4,000,000	4,400,000
2042	0	0	4,000,000	4,400,000
2043	0	0	4,000,000	4,400,000

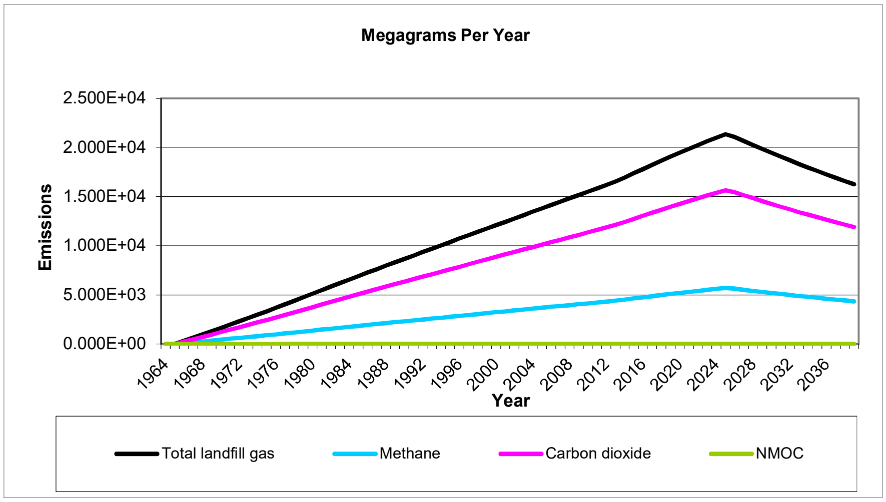
Pollutant Parameters

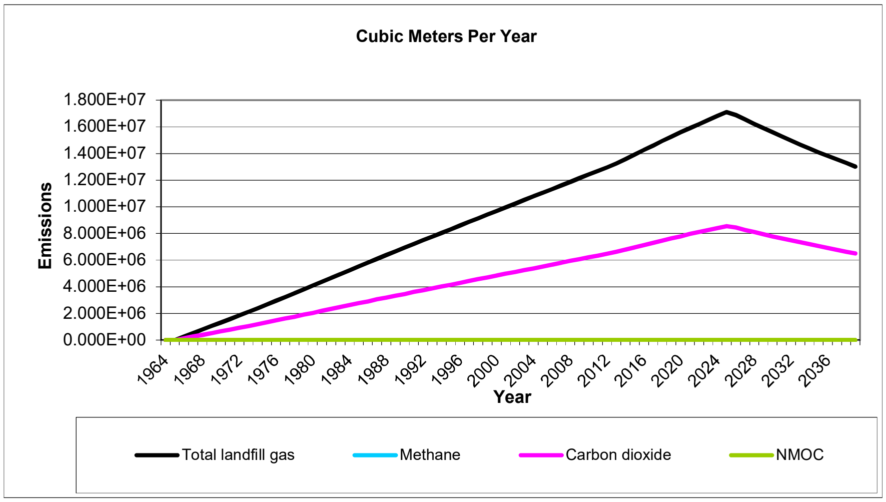
	Compound	Gas / Pollutant Default Parameters: Concentration (*ppmv*)	Molecular Weight	User-specified Pollutant Parameters: Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform)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

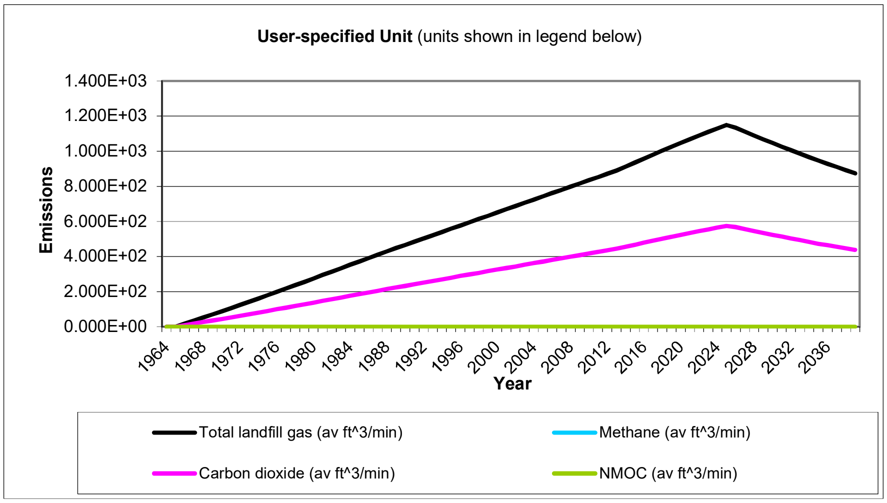
Pollutant Parameters (Continued)

	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
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
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)*
1964	0	0	0	0	0	0
1965	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1966	3.268E+02	2.617E+05	1.758E+01	8.729E+01	1.308E+05	8.791E+00
1967	6.545E+02	5.241E+05	3.521E+01	1.748E+02	2.620E+05	1.761E+01
1968	9.831E+02	7.872E+05	5.289E+01	2.626E+02	3.936E+05	2.645E+01
1969	1.313E+03	1.051E+06	7.062E+01	3.506E+02	5.255E+05	3.531E+01
1970	1.643E+03	1.315E+06	8.839E+01	4.388E+02	6.577E+05	4.419E+01
1971	1.974E+03	1.581E+06	1.062E+02	5.273E+02	7.903E+05	5.310E+01
1972	2.309E+03	1.849E+06	1.242E+02	6.167E+02	9.244E+05	6.211E+01
1973	2.647E+03	2.120E+06	1.424E+02	7.071E+02	1.060E+06	7.121E+01
1974	2.989E+03	2.394E+06	1.608E+02	7.984E+02	1.197E+06	8.041E+01
1975	3.335E+03	2.670E+06	1.794E+02	8.907E+02	1.335E+06	8.971E+01
1976	3.683E+03	2.950E+06	1.982E+02	9.839E+02	1.475E+06	9.909E+01
1977	4.036E+03	3.232E+06	2.171E+02	1.078E+03	1.616E+06	1.086E+02
1978	4.391E+03	3.516E+06	2.363E+02	1.173E+03	1.758E+06	1.181E+02
1979	4.750E+03	3.804E+06	2.556E+02	1.269E+03	1.902E+06	1.278E+02
1980	5.112E+03	4.093E+06	2.750E+02	1.365E+03	2.047E+06	1.375E+02
1981	5.477E+03	4.385E+06	2.947E+02	1.463E+03	2.193E+06	1.473E+02
1982	5.839E+03	4.676E+06	3.142E+02	1.560E+03	2.338E+06	1.571E+02
1983	6.200E+03	4.965E+06	3.336E+02	1.656E+03	2.482E+06	1.668E+02
1984	6.558E+03	5.252E+06	3.529E+02	1.752E+03	2.626E+06	1.764E+02
1985	6.915E+03	5.537E+06	3.720E+02	1.847E+03	2.768E+06	1.860E+02
1986	7.269E+03	5.820E+06	3.911E+02	1.942E+03	2.910E+06	1.955E+02
1987	7.621E+03	6.102E+06	4.100E+02	2.036E+03	3.051E+06	2.050E+02
1988	7.971E+03	6.383E+06	4.289E+02	2.129E+03	3.191E+06	2.144E+02
1989	8.319E+03	6.662E+06	4.476E+02	2.222E+03	3.331E+06	2.238E+02
1990	8.666E+03	6.939E+06	4.662E+02	2.315E+03	3.470E+06	2.331E+02
1991	9.010E+03	7.215E+06	4.848E+02	2.407E+03	3.608E+06	2.424E+02
1992	9.355E+03	7.491E+06	5.033E+02	2.499E+03	3.745E+06	2.516E+02
1993	9.699E+03	7.766E+06	5.218E+02	2.591E+03	3.883E+06	2.609E+02
1994	1.004E+04	8.041E+06	5.403E+02	2.682E+03	4.021E+06	2.701E+02
1995	1.039E+04	8.316E+06	5.588E+02	2.774E+03	4.158E+06	2.794E+02
1996	1.073E+04	8.591E+06	5.772E+02	2.866E+03	4.296E+06	2.886E+02
1997	1.107E+04	8.866E+06	5.957E+02	2.957E+03	4.433E+06	2.978E+02
1998	1.141E+04	9.140E+06	6.141E+02	3.049E+03	4.570E+06	3.071E+02
1999	1.176E+04	9.414E+06	6.325E+02	3.140E+03	4.707E+06	3.163E+02
2000	1.210E+04	9.688E+06	6.509E+02	3.232E+03	4.844E+06	3.255E+02
2001	1.244E+04	9.962E+06	6.693E+02	3.323E+03	4.981E+06	3.347E+02
2002	1.278E+04	1.024E+07	6.877E+02	3.414E+03	5.118E+06	3.439E+02
2003	1.312E+04	1.051E+07	7.061E+02	3.505E+03	5.254E+06	3.530E+02
2004	1.346E+04	1.078E+07	7.244E+02	3.596E+03	5.391E+06	3.622E+02
2005	1.380E+04	1.105E+07	7.427E+02	3.687E+03	5.527E+06	3.714E+02
2006	1.414E+04	1.133E+07	7.610E+02	3.778E+03	5.663E+06	3.805E+02
2007	1.448E+04	1.160E+07	7.793E+02	3.869E+03	5.799E+06	3.896E+02
2008	1.482E+04	1.187E+07	7.975E+02	3.959E+03	5.935E+06	3.988E+02
2009	1.516E+04	1.214E+07	8.158E+02	4.050E+03	6.071E+06	4.079E+02
2010	1.550E+04	1.241E+07	8.340E+02	4.140E+03	6.206E+06	4.170E+02
2011	1.584E+04	1.268E+07	8.522E+02	4.231E+03	6.341E+06	4.261E+02
2012	1.618E+04	1.296E+07	8.708E+02	4.323E+03	6.480E+06	4.354E+02
2013	1.654E+04	1.325E+07	8.902E+02	4.419E+03	6.624E+06	4.451E+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)
2014	1.695E+04	1.357E+07	9.117E+02	4.526E+03	6.785E+06	4.559E+02
2015	1.737E+04	1.391E+07	9.346E+02	4.640E+03	6.955E+06	4.673E+02
2016	1.781E+04	1.426E+07	9.581E+02	4.757E+03	7.130E+06	4.791E+02
2017	1.823E+04	1.460E+07	9.808E+02	4.869E+03	7.298E+06	4.904E+02
2018	1.865E+04	1.493E+07	1.003E+03	4.981E+03	7.466E+06	5.017E+02
2019	1.906E+04	1.526E+07	1.025E+03	5.091E+03	7.631E+06	5.127E+02
2020	1.946E+04	1.558E+07	1.047E+03	5.199E+03	7.792E+06	5.236E+02
2021	1.986E+04	1.590E+07	1.068E+03	5.304E+03	7.951E+06	5.342E+02
2022	2.024E+04	1.621E+07	1.089E+03	5.408E+03	8.106E+06	5.446E+02
2023	2.062E+04	1.652E+07	1.110E+03	5.509E+03	8.258E+06	5.548E+02
2024	2.100E+04	1.681E+07	1.130E+03	5.608E+03	8.406E+06	5.648E+02
2025	2.136E+04	1.710E+07	1.149E+03	5.706E+03	8.552E+06	5.746E+02
2026	2.108E+04	1.688E+07	1.134E+03	5.631E+03	8.441E+06	5.671E+02
2027	2.066E+04	1.655E+07	1.112E+03	5.520E+03	8.273E+06	5.559E+02
2028	2.025E+04	1.622E+07	1.090E+03	5.410E+03	8.110E+06	5.449E+02
2029	1.985E+04	1.590E+07	1.068E+03	5.303E+03	7.949E+06	5.341E+02
2030	1.946E+04	1.558E+07	1.047E+03	5.198E+03	7.792E+06	5.235E+02
2031	1.908E+04	1.527E+07	1.026E+03	5.095E+03	7.637E+06	5.132E+02
2032	1.870E+04	1.497E+07	1.006E+03	4.994E+03	7.486E+06	5.030E+02
2033	1.833E+04	1.468E+07	9.861E+02	4.895E+03	7.338E+06	4.930E+02
2034	1.796E+04	1.439E+07	9.665E+02	4.799E+03	7.193E+06	4.833E+02
2035	1.761E+04	1.410E+07	9.474E+02	4.703E+03	7.050E+06	4.737E+02
2036	1.726E+04	1.382E+07	9.286E+02	4.610E+03	6.911E+06	4.643E+02
2037	1.692E+04	1.355E+07	9.102E+02	4.519E+03	6.774E+06	4.551E+02
2038	1.658E+04	1.328E+07	8.922E+02	4.430E+03	6.640E+06	4.461E+02
2039	1.625E+04	1.302E+07	8.746E+02	4.342E+03	6.508E+06	4.373E+02
2040	1.593E+04	1.276E+07	8.572E+02	4.256E+03	6.379E+06	4.286E+02
2041	1.562E+04	1.251E+07	8.403E+02	4.172E+03	6.253E+06	4.201E+02
2042	1.531E+04	1.226E+07	8.236E+02	4.089E+03	6.129E+06	4.118E+02
2043	1.501E+04	1.202E+07	8.073E+02	4.008E+03	6.008E+06	4.037E+02
2044	1.471E+04	1.178E+07	7.913E+02	3.929E+03	5.889E+06	3.957E+02
2045	1.442E+04	1.154E+07	7.757E+02	3.851E+03	5.772E+06	3.878E+02
2046	1.413E+04	1.132E+07	7.603E+02	3.775E+03	5.658E+06	3.802E+02
2047	1.385E+04	1.109E+07	7.452E+02	3.700E+03	5.546E+06	3.726E+02
2048	1.358E+04	1.087E+07	7.305E+02	3.627E+03	5.436E+06	3.652E+02
2049	1.331E+04	1.066E+07	7.160E+02	3.555E+03	5.328E+06	3.580E+02
2050	1.304E+04	1.045E+07	7.018E+02	3.484E+03	5.223E+06	3.509E+02
2051	1.279E+04	1.024E+07	6.880E+02	3.415E+03	5.119E+06	3.440E+02
2052	1.253E+04	1.004E+07	6.743E+02	3.348E+03	5.018E+06	3.372E+02
2053	1.229E+04	9.837E+06	6.610E+02	3.282E+03	4.919E+06	3.305E+02
2054	1.204E+04	9.643E+06	6.479E+02	3.217E+03	4.821E+06	3.239E+02
2055	1.180E+04	9.452E+06	6.351E+02	3.153E+03	4.726E+06	3.175E+02
2056	1.157E+04	9.265E+06	6.225E+02	3.090E+03	4.632E+06	3.112E+02
2057	1.134E+04	9.081E+06	6.102E+02	3.029E+03	4.541E+06	3.051E+02
2058	1.112E+04	8.901E+06	5.981E+02	2.969E+03	4.451E+06	2.990E+02
2059	1.090E+04	8.725E+06	5.862E+02	2.910E+03	4.363E+06	2.931E+02
2060	1.068E+04	8.552E+06	5.746E+02	2.853E+03	4.276E+06	2.873E+02
2061	1.047E+04	8.383E+06	5.632E+02	2.796E+03	4.191E+06	2.816E+02
2062	1.026E+04	8.217E+06	5.521E+02	2.741E+03	4.108E+06	2.760E+02
2063	1.006E+04	8.054E+06	5.412E+02	2.687E+03	4.027E+06	2.706E+02
2064	9.859E+03	7.895E+06	5.304E+02	2.633E+03	3.947E+06	2.652E+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)*
2065	9.664E+03	7.738E+06	5.199E+02	2.581E+03	3.869E+06	2.600E+02
2066	9.473E+03	7.585E+06	5.096E+02	2.530E+03	3.793E+06	2.548E+02
2067	9.285E+03	7.435E+06	4.996E+02	2.480E+03	3.717E+06	2.498E+02
2068	9.101E+03	7.288E+06	4.897E+02	2.431E+03	3.644E+06	2.448E+02
2069	8.921E+03	7.143E+06	4.800E+02	2.383E+03	3.572E+06	2.400E+02
2070	8.744E+03	7.002E+06	4.705E+02	2.336E+03	3.501E+06	2.352E+02
2071	8.571E+03	6.863E+06	4.611E+02	2.289E+03	3.432E+06	2.306E+02
2072	8.401E+03	6.727E+06	4.520E+02	2.244E+03	3.364E+06	2.260E+02
2073	8.235E+03	6.594E+06	4.431E+02	2.200E+03	3.297E+06	2.215E+02
2074	8.072E+03	6.464E+06	4.343E+02	2.156E+03	3.232E+06	2.171E+02
2075	7.912E+03	6.336E+06	4.257E+02	2.113E+03	3.168E+06	2.128E+02
2076	7.755E+03	6.210E+06	4.173E+02	2.072E+03	3.105E+06	2.086E+02
2077	7.602E+03	6.087E+06	4.090E+02	2.031E+03	3.044E+06	2.045E+02
2078	7.451E+03	5.967E+06	4.009E+02	1.990E+03	2.983E+06	2.005E+02
2079	7.304E+03	5.849E+06	3.930E+02	1.951E+03	2.924E+06	1.965E+02
2080	7.159E+03	5.733E+06	3.852E+02	1.912E+03	2.866E+06	1.926E+02
2081	7.017E+03	5.619E+06	3.776E+02	1.874E+03	2.810E+06	1.888E+02
2082	6.878E+03	5.508E+06	3.701E+02	1.837E+03	2.754E+06	1.850E+02
2083	6.742E+03	5.399E+06	3.628E+02	1.801E+03	2.699E+06	1.814E+02
2084	6.609E+03	5.292E+06	3.556E+02	1.765E+03	2.646E+06	1.778E+02
2085	6.478E+03	5.187E+06	3.485E+02	1.730E+03	2.594E+06	1.743E+02
2086	6.350E+03	5.084E+06	3.416E+02	1.696E+03	2.542E+06	1.708E+02
2087	6.224E+03	4.984E+06	3.349E+02	1.662E+03	2.492E+06	1.674E+02
2088	6.101E+03	4.885E+06	3.282E+02	1.630E+03	2.443E+06	1.641E+02
2089	5.980E+03	4.788E+06	3.217E+02	1.597E+03	2.394E+06	1.609E+02
2090	5.861E+03	4.694E+06	3.154E+02	1.566E+03	2.347E+06	1.577E+02
2091	5.745E+03	4.601E+06	3.091E+02	1.535E+03	2.300E+06	1.546E+02
2092	5.632E+03	4.510E+06	3.030E+02	1.504E+03	2.255E+06	1.515E+02
2093	5.520E+03	4.420E+06	2.970E+02	1.474E+03	2.210E+06	1.485E+02
2094	5.411E+03	4.333E+06	2.911E+02	1.445E+03	2.166E+06	1.456E+02
2095	5.304E+03	4.247E+06	2.854E+02	1.417E+03	2.123E+06	1.427E+02
2096	5.199E+03	4.163E+06	2.797E+02	1.389E+03	2.081E+06	1.399E+02
2097	5.096E+03	4.080E+06	2.742E+02	1.361E+03	2.040E+06	1.371E+02
2098	4.995E+03	4.000E+06	2.687E+02	1.334E+03	2.000E+06	1.344E+02
2099	4.896E+03	3.920E+06	2.634E+02	1.308E+03	1.960E+06	1.317E+02
2100	4.799E+03	3.843E+06	2.582E+02	1.282E+03	1.921E+06	1.291E+02
2101	4.704E+03	3.767E+06	2.531E+02	1.256E+03	1.883E+06	1.265E+02
2102	4.611E+03	3.692E+06	2.481E+02	1.232E+03	1.846E+06	1.240E+02
2103	4.519E+03	3.619E+06	2.432E+02	1.207E+03	1.809E+06	1.216E+02
2104	4.430E+03	3.547E+06	2.383E+02	1.183E+03	1.774E+06	1.192E+02

Results (Continued)

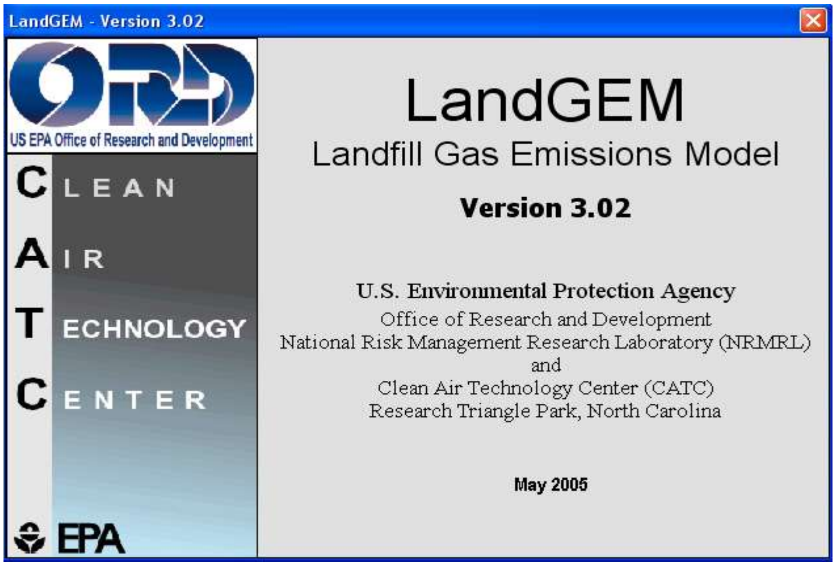
Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1964	0	0	0	0	0	0
1965	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1966	2.395E+02	1.308E+05	8.791E+00	2.786E-01	7.772E+01	5.222E-03
1967	4.797E+02	2.620E+05	1.761E+01	5.579E-01	1.557E+02	1.046E-02
1968	7.205E+02	3.936E+05	2.645E+01	8.380E-01	2.338E+02	1.571E-02
1969	9.619E+02	5.255E+05	3.531E+01	1.119E+00	3.121E+02	2.097E-02
1970	1.204E+03	6.577E+05	4.419E+01	1.400E+00	3.907E+02	2.625E-02
1971	1.447E+03	7.903E+05	5.310E+01	1.683E+00	4.694E+02	3.154E-02
1972	1.692E+03	9.244E+05	6.211E+01	1.968E+00	5.491E+02	3.689E-02
1973	1.940E+03	1.060E+06	7.121E+01	2.257E+00	6.296E+02	4.230E-02
1974	2.191E+03	1.197E+06	8.041E+01	2.548E+00	7.109E+02	4.776E-02
1975	2.444E+03	1.335E+06	8.971E+01	2.843E+00	7.930E+02	5.328E-02
1976	2.700E+03	1.475E+06	9.909E+01	3.140E+00	8.760E+02	5.886E-02
1977	2.958E+03	1.616E+06	1.086E+02	3.440E+00	9.598E+02	6.449E-02
1978	3.218E+03	1.758E+06	1.181E+02	3.743E+00	1.044E+03	7.017E-02
1979	3.481E+03	1.902E+06	1.278E+02	4.049E+00	1.130E+03	7.590E-02
1980	3.746E+03	2.047E+06	1.375E+02	4.358E+00	1.216E+03	8.168E-02
1981	4.014E+03	2.193E+06	1.473E+02	4.669E+00	1.302E+03	8.751E-02
1982	4.280E+03	2.338E+06	1.571E+02	4.978E+00	1.389E+03	9.331E-02
1983	4.544E+03	2.482E+06	1.668E+02	5.285E+00	1.474E+03	9.907E-02
1984	4.806E+03	2.626E+06	1.764E+02	5.591E+00	1.560E+03	1.048E-01
1985	5.068E+03	2.768E+06	1.860E+02	5.894E+00	1.644E+03	1.105E-01
1986	5.327E+03	2.910E+06	1.955E+02	6.196E+00	1.729E+03	1.161E-01
1987	5.585E+03	3.051E+06	2.050E+02	6.497E+00	1.812E+03	1.218E-01
1988	5.842E+03	3.191E+06	2.144E+02	6.795E+00	1.896E+03	1.274E-01
1989	6.097E+03	3.331E+06	2.238E+02	7.092E+00	1.979E+03	1.329E-01
1990	6.351E+03	3.470E+06	2.331E+02	7.387E+00	2.061E+03	1.385E-01
1991	6.604E+03	3.608E+06	2.424E+02	7.681E+00	2.143E+03	1.440E-01
1992	6.856E+03	3.745E+06	2.516E+02	7.974E+00	2.225E+03	1.495E-01
1993	7.108E+03	3.883E+06	2.609E+02	8.268E+00	2.307E+03	1.550E-01
1994	7.360E+03	4.021E+06	2.701E+02	8.561E+00	2.388E+03	1.605E-01
1995	7.612E+03	4.158E+06	2.794E+02	8.853E+00	2.470E+03	1.660E-01
1996	7.863E+03	4.296E+06	2.886E+02	9.146E+00	2.552E+03	1.714E-01
1997	8.114E+03	4.433E+06	2.978E+02	9.438E+00	2.633E+03	1.769E-01
1998	8.365E+03	4.570E+06	3.071E+02	9.730E+00	2.715E+03	1.824E-01
1999	8.616E+03	4.707E+06	3.163E+02	1.002E+01	2.796E+03	1.879E-01
2000	8.867E+03	4.844E+06	3.255E+02	1.031E+01	2.877E+03	1.933E-01
2001	9.118E+03	4.981E+06	3.347E+02	1.061E+01	2.959E+03	1.988E-01
2002	9.368E+03	5.118E+06	3.439E+02	1.090E+01	3.040E+03	2.043E-01
2003	9.618E+03	5.254E+06	3.530E+02	1.119E+01	3.121E+03	2.097E-01
2004	9.868E+03	5.391E+06	3.622E+02	1.148E+01	3.202E+03	2.151E-01
2005	1.012E+04	5.527E+06	3.714E+02	1.177E+01	3.283E+03	2.206E-01
2006	1.037E+04	5.663E+06	3.805E+02	1.206E+01	3.364E+03	2.260E-01
2007	1.062E+04	5.799E+06	3.896E+02	1.235E+01	3.445E+03	2.314E-01
2008	1.086E+04	5.935E+06	3.988E+02	1.264E+01	3.525E+03	2.369E-01
2009	1.111E+04	6.071E+06	4.079E+02	1.293E+01	3.606E+03	2.423E-01
2010	1.136E+04	6.206E+06	4.170E+02	1.321E+01	3.686E+03	2.477E-01
2011	1.161E+04	6.341E+06	4.261E+02	1.350E+01	3.767E+03	2.531E-01
2012	1.186E+04	6.480E+06	4.354E+02	1.380E+01	3.849E+03	2.586E-01
2013	1.213E+04	6.624E+06	4.451E+02	1.410E+01	3.935E+03	2.644E-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)
2014	1.242E+04	6.785E+06	4.559E+02	1.445E+01	4.030E+03	2.708E-01
2015	1.273E+04	6.955E+06	4.673E+02	1.481E+01	4.131E+03	2.776E-01
2016	1.305E+04	7.130E+06	4.791E+02	1.518E+01	4.235E+03	2.846E-01
2017	1.336E+04	7.298E+06	4.904E+02	1.554E+01	4.335E+03	2.913E-01
2018	1.367E+04	7.466E+06	5.017E+02	1.590E+01	4.435E+03	2.980E-01
2019	1.397E+04	7.631E+06	5.127E+02	1.625E+01	4.533E+03	3.046E-01
2020	1.426E+04	7.792E+06	5.236E+02	1.659E+01	4.629E+03	3.110E-01
2021	1.455E+04	7.951E+06	5.342E+02	1.693E+01	4.723E+03	3.173E-01
2022	1.484E+04	8.106E+06	5.446E+02	1.726E+01	4.815E+03	3.235E-01
2023	1.512E+04	8.258E+06	5.548E+02	1.758E+01	4.905E+03	3.296E-01
2024	1.539E+04	8.406E+06	5.648E+02	1.790E+01	4.993E+03	3.355E-01
2025	1.566E+04	8.552E+06	5.746E+02	1.821E+01	5.080E+03	3.413E-01
2026	1.545E+04	8.441E+06	5.671E+02	1.797E+01	5.014E+03	3.369E-01
2027	1.514E+04	8.273E+06	5.559E+02	1.762E+01	4.914E+03	3.302E-01
2028	1.484E+04	8.110E+06	5.449E+02	1.727E+01	4.817E+03	3.237E-01
2029	1.455E+04	7.949E+06	5.341E+02	1.692E+01	4.722E+03	3.173E-01
2030	1.426E+04	7.792E+06	5.235E+02	1.659E+01	4.628E+03	3.110E-01
2031	1.398E+04	7.637E+06	5.132E+02	1.626E+01	4.537E+03	3.048E-01
2032	1.370E+04	7.486E+06	5.030E+02	1.594E+01	4.447E+03	2.988E-01
2033	1.343E+04	7.338E+06	4.930E+02	1.562E+01	4.359E+03	2.929E-01
2034	1.317E+04	7.193E+06	4.833E+02	1.531E+01	4.272E+03	2.871E-01
2035	1.291E+04	7.050E+06	4.737E+02	1.501E+01	4.188E+03	2.814E-01
2036	1.265E+04	6.911E+06	4.643E+02	1.471E+01	4.105E+03	2.758E-01
2037	1.240E+04	6.774E+06	4.551E+02	1.442E+01	4.024E+03	2.703E-01
2038	1.215E+04	6.640E+06	4.461E+02	1.414E+01	3.944E+03	2.650E-01
2039	1.191E+04	6.508E+06	4.373E+02	1.386E+01	3.866E+03	2.597E-01
2040	1.168E+04	6.379E+06	4.286E+02	1.358E+01	3.789E+03	2.546E-01
2041	1.145E+04	6.253E+06	4.201E+02	1.331E+01	3.714E+03	2.496E-01
2042	1.122E+04	6.129E+06	4.118E+02	1.305E+01	3.641E+03	2.446E-01
2043	1.100E+04	6.008E+06	4.037E+02	1.279E+01	3.569E+03	2.398E-01
2044	1.078E+04	5.889E+06	3.957E+02	1.254E+01	3.498E+03	2.350E-01
2045	1.057E+04	5.772E+06	3.878E+02	1.229E+01	3.429E+03	2.304E-01
2046	1.036E+04	5.658E+06	3.802E+02	1.205E+01	3.361E+03	2.258E-01
2047	1.015E+04	5.546E+06	3.726E+02	1.181E+01	3.294E+03	2.213E-01
2048	9.951E+03	5.436E+06	3.652E+02	1.157E+01	3.229E+03	2.170E-01
2049	9.754E+03	5.328E+06	3.580E+02	1.135E+01	3.165E+03	2.127E-01
2050	9.560E+03	5.223E+06	3.509E+02	1.112E+01	3.102E+03	2.084E-01
2051	9.371E+03	5.119E+06	3.440E+02	1.090E+01	3.041E+03	2.043E-01
2052	9.186E+03	5.018E+06	3.372E+02	1.068E+01	2.981E+03	2.003E-01
2053	9.004E+03	4.919E+06	3.305E+02	1.047E+01	2.922E+03	1.963E-01
2054	8.825E+03	4.821E+06	3.239E+02	1.027E+01	2.864E+03	1.924E-01
2055	8.651E+03	4.726E+06	3.175E+02	1.006E+01	2.807E+03	1.886E-01
2056	8.479E+03	4.632E+06	3.112E+02	9.863E+00	2.752E+03	1.849E-01
2057	8.311E+03	4.541E+06	3.051E+02	9.668E+00	2.697E+03	1.812E-01
2058	8.147E+03	4.451E+06	2.990E+02	9.476E+00	2.644E+03	1.776E-01
2059	7.986E+03	4.363E+06	2.931E+02	9.289E+00	2.591E+03	1.741E-01
2060	7.827E+03	4.276E+06	2.873E+02	9.105E+00	2.540E+03	1.707E-01
2061	7.672E+03	4.191E+06	2.816E+02	8.924E+00	2.490E+03	1.673E-01
2062	7.521E+03	4.108E+06	2.760E+02	8.748E+00	2.440E+03	1.640E-01
2063	7.372E+03	4.027E+06	2.706E+02	8.574E+00	2.392E+03	1.607E-01
2064	7.226E+03	3.947E+06	2.652E+02	8.405E+00	2.345E+03	1.575E-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)*
2065	7.083E+03	3.869E+06	2.600E+02	8.238E+00	2.298E+03	1.544E-01
2066	6.942E+03	3.793E+06	2.548E+02	8.075E+00	2.253E+03	1.514E-01
2067	6.805E+03	3.717E+06	2.498E+02	7.915E+00	2.208E+03	1.484E-01
2068	6.670E+03	3.644E+06	2.448E+02	7.758E+00	2.164E+03	1.454E-01
2069	6.538E+03	3.572E+06	2.400E+02	7.605E+00	2.122E+03	1.426E-01
2070	6.409E+03	3.501E+06	2.352E+02	7.454E+00	2.080E+03	1.397E-01
2071	6.282E+03	3.432E+06	2.306E+02	7.307E+00	2.038E+03	1.370E-01
2072	6.157E+03	3.364E+06	2.260E+02	7.162E+00	1.998E+03	1.342E-01
2073	6.035E+03	3.297E+06	2.215E+02	7.020E+00	1.958E+03	1.316E-01
2074	5.916E+03	3.232E+06	2.171E+02	6.881E+00	1.920E+03	1.290E-01
2075	5.799E+03	3.168E+06	2.128E+02	6.745E+00	1.882E+03	1.264E-01
2076	5.684E+03	3.105E+06	2.086E+02	6.611E+00	1.844E+03	1.239E-01
2077	5.571E+03	3.044E+06	2.045E+02	6.480E+00	1.808E+03	1.215E-01
2078	5.461E+03	2.983E+06	2.005E+02	6.352E+00	1.772E+03	1.191E-01
2079	5.353E+03	2.924E+06	1.965E+02	6.226E+00	1.737E+03	1.167E-01
2080	5.247E+03	2.866E+06	1.926E+02	6.103E+00	1.703E+03	1.144E-01
2081	5.143E+03	2.810E+06	1.888E+02	5.982E+00	1.669E+03	1.121E-01
2082	5.041E+03	2.754E+06	1.850E+02	5.864E+00	1.636E+03	1.099E-01
2083	4.941E+03	2.699E+06	1.814E+02	5.748E+00	1.603E+03	1.077E-01
2084	4.843E+03	2.646E+06	1.778E+02	5.634E+00	1.572E+03	1.056E-01
2085	4.748E+03	2.594E+06	1.743E+02	5.522E+00	1.541E+03	1.035E-01
2086	4.654E+03	2.542E+06	1.708E+02	5.413E+00	1.510E+03	1.015E-01
2087	4.561E+03	2.492E+06	1.674E+02	5.306E+00	1.480E+03	9.945E-02
2088	4.471E+03	2.443E+06	1.641E+02	5.201E+00	1.451E+03	9.748E-02
2089	4.383E+03	2.394E+06	1.609E+02	5.098E+00	1.422E+03	9.555E-02
2090	4.296E+03	2.347E+06	1.577E+02	4.997E+00	1.394E+03	9.366E-02
2091	4.211E+03	2.300E+06	1.546E+02	4.898E+00	1.366E+03	9.181E-02
2092	4.127E+03	2.255E+06	1.515E+02	4.801E+00	1.339E+03	8.999E-02
2093	4.046E+03	2.210E+06	1.485E+02	4.706E+00	1.313E+03	8.821E-02
2094	3.966E+03	2.166E+06	1.456E+02	4.613E+00	1.287E+03	8.646E-02
2095	3.887E+03	2.123E+06	1.427E+02	4.521E+00	1.261E+03	8.475E-02
2096	3.810E+03	2.081E+06	1.399E+02	4.432E+00	1.236E+03	8.307E-02
2097	3.735E+03	2.040E+06	1.371E+02	4.344E+00	1.212E+03	8.143E-02
2098	3.661E+03	2.000E+06	1.344E+02	4.258E+00	1.188E+03	7.981E-02
2099	3.588E+03	1.960E+06	1.317E+02	4.174E+00	1.164E+03	7.823E-02
2100	3.517E+03	1.921E+06	1.291E+02	4.091E+00	1.141E+03	7.668E-02
2101	3.447E+03	1.883E+06	1.265E+02	4.010E+00	1.119E+03	7.517E-02
2102	3.379E+03	1.846E+06	1.240E+02	3.931E+00	1.097E+03	7.368E-02
2103	3.312E+03	1.809E+06	1.216E+02	3.853E+00	1.075E+03	7.222E-02
2104	3.247E+03	1.774E+06	1.192E+02	3.776E+00	1.054E+03	7.079E-02



Summary Report

Landfill Name or Identifier: Dickinson

Date: Wednesday, July 24, 2019

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	**1990**	
Landfill Closure Year (with 80-year limit)	**2065**	
Actual Closure Year (without limit)	***2065***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**2,813,544**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**297**	*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)*
1990	28,797	31,677	0	0
1991	28,797	31,677	28,797	31,677
1992	28,797	31,677	57,595	63,354
1993	28,797	31,677	86,392	95,031
1994	28,797	31,677	115,189	126,708
1995	28,797	31,677	143,986	158,385
1996	28,797	31,677	172,784	190,062
1997	28,797	31,677	201,581	221,739
1998	28,797	31,677	230,378	253,416
1999	28,797	31,677	259,175	285,093
2000	28,797	31,677	287,973	316,770
2001	28,797	31,677	316,770	348,447
2002	28,797	31,677	345,567	380,124
2003	28,797	31,677	374,365	411,801
2004	28,797	31,677	403,162	443,478
2005	28,797	31,677	431,959	475,155
2006	28,797	31,677	460,756	506,832
2007	28,797	31,677	489,554	538,509
2008	28,797	31,677	518,351	570,186
2009	28,797	31,677	547,148	601,863
2010	28,797	31,677	575,945	633,540
2011	28,797	31,677	604,743	665,217
2012	28,797	31,677	633,540	696,894
2013	40,318	44,350	662,337	728,571
2014	44,655	49,121	702,655	772,921
2015	45,220	49,742	747,311	822,042
2016	37,135	40,848	792,531	871,784
2017	40,909	45,000	829,665	912,632
2018	40,909	45,000	870,575	957,632
2019	40,909	45,000	911,484	1,002,632
2020	40,909	45,000	952,393	1,047,632
2021	40,909	45,000	993,302	1,092,632
2022	40,909	45,000	1,034,211	1,137,632
2023	40,909	45,000	1,075,120	1,182,632
2024	40,909	45,000	1,116,029	1,227,632
2025	40,909	45,000	1,156,938	1,272,632
2026	40,909	45,000	1,197,847	1,317,632
2027	40,909	45,000	1,238,756	1,362,632
2028	40,909	45,000	1,279,665	1,407,632
2029	40,909	45,000	1,320,575	1,452,632

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2030	40,909	45,000	1,361,484	1,497,632
2031	40,909	45,000	1,402,393	1,542,632
2032	40,909	45,000	1,443,302	1,587,632
2033	40,909	45,000	1,484,211	1,632,632
2034	40,909	45,000	1,525,120	1,677,632
2035	40,909	45,000	1,566,029	1,722,632
2036	40,909	45,000	1,606,938	1,767,632
2037	40,909	45,000	1,647,847	1,812,632
2038	40,909	45,000	1,688,756	1,857,632
2039	40,909	45,000	1,729,665	1,902,632
2040	40,909	45,000	1,770,575	1,947,632
2041	40,909	45,000	1,811,484	1,992,632
2042	40,909	45,000	1,852,393	2,037,632
2043	40,909	45,000	1,893,302	2,082,632
2044	40,909	45,000	1,934,211	2,127,632
2045	40,909	45,000	1,975,120	2,172,632
2046	40,909	45,000	2,016,029	2,217,632
2047	40,909	45,000	2,056,938	2,262,632
2048	40,909	45,000	2,097,847	2,307,632
2049	40,909	45,000	2,138,756	2,352,632
2050	40,909	45,000	2,179,665	2,397,632
2051	40,909	45,000	2,220,575	2,442,632
2052	40,909	45,000	2,261,484	2,487,632
2053	40,909	45,000	2,302,393	2,532,632
2054	40,909	45,000	2,343,302	2,577,632
2055	40,909	45,000	2,384,211	2,622,632
2056	40,909	45,000	2,425,120	2,667,632
2057	40,909	45,000	2,466,029	2,712,632
2058	40,909	45,000	2,506,938	2,757,632
2059	40,909	45,000	2,547,847	2,802,632
2060	40,909	45,000	2,588,756	2,847,632
2061	40,909	45,000	2,629,665	2,892,632
2062	40,909	45,000	2,670,575	2,937,632
2063	40,909	45,000	2,711,484	2,982,632
2064	40,909	45,000	2,752,393	3,027,632
2065	20,242	22,266	2,793,302	3,072,632
2066	0	0	2,813,544	3,094,898
2067	0	0	2,813,544	3,094,898
2068	0	0	2,813,544	3,094,898
2069	0	0	2,813,544	3,094,898

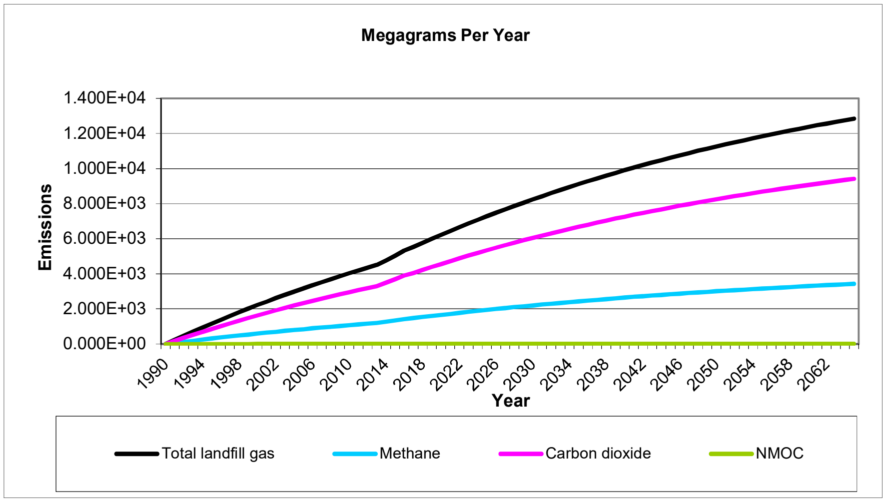
Pollutant Parameters

	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
Emissions
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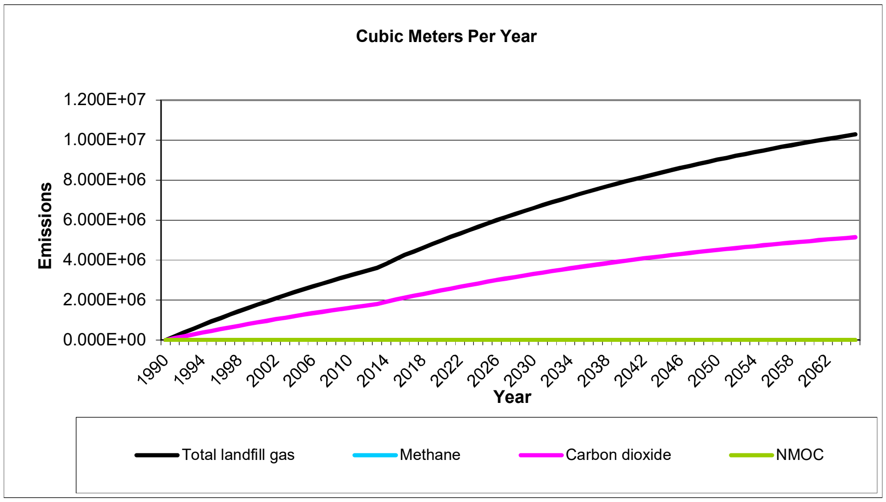
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
1990 1994 1998 2002 2006 2010 2014 2018 2022 2026 2030 2034 2038 2042 2046 2050 2054 2058 2062
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
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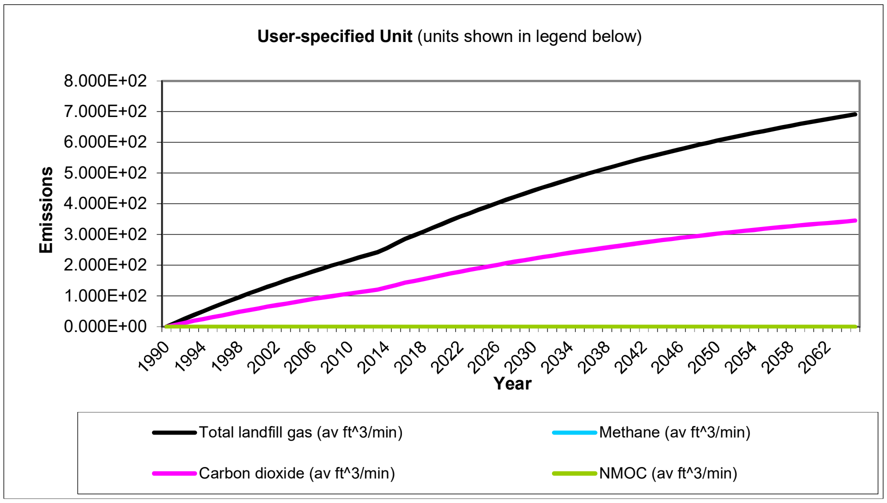
1.000E+07
8.000E+06
6.000E+06
4.000E+06
2.000E+06
0.000E+00
1990 1994 1998 2002 2006 2010 2014 2018 2022 2026 2030 2034 2038 2042 2046 2050 2054 2058 2062
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
8.000E+02
7.000E+02
6.000E+02
5.000E+02
4.000E+02
3.000E+02
2.000E+02
1.000E+02
0.000E+00
1990 1994 1998 2002 2006 2010 2014 2018 2022 2026 2030 2034 2038 2042 2046 2050 2054 2058 2062
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)
1990	0	0	0	0	0	0
1991	2.424E+02	1.941E+05	1.304E+01	6.474E+01	9.704E+04	6.520E+00
1992	4.799E+02	3.843E+05	2.582E+01	1.282E+02	1.921E+05	1.291E+01
1993	7.128E+02	5.708E+05	3.835E+01	1.904E+02	2.854E+05	1.917E+01
1994	9.410E+02	7.535E+05	5.063E+01	2.514E+02	3.768E+05	2.531E+01
1995	1.165E+03	9.327E+05	6.267E+01	3.111E+02	4.663E+05	3.133E+01
1996	1.384E+03	1.108E+06	7.447E+01	3.697E+02	5.541E+05	3.723E+01
1997	1.599E+03	1.280E+06	8.603E+01	4.271E+02	6.402E+05	4.302E+01
1998	1.810E+03	1.449E+06	9.737E+01	4.834E+02	7.246E+05	4.868E+01
1999	2.016E+03	1.614E+06	1.085E+02	5.386E+02	8.072E+05	5.424E+01
2000	2.219E+03	1.777E+06	1.194E+02	5.926E+02	8.883E+05	5.968E+01
2001	2.417E+03	1.935E+06	1.300E+02	6.456E+02	9.677E+05	6.502E+01
2002	2.612E+03	2.091E+06	1.405E+02	6.976E+02	1.046E+06	7.025E+01
2003	2.802E+03	2.244E+06	1.508E+02	7.485E+02	1.122E+06	7.538E+01
2004	2.989E+03	2.394E+06	1.608E+02	7.984E+02	1.197E+06	8.041E+01
2005	3.172E+03	2.540E+06	1.707E+02	8.473E+02	1.270E+06	8.534E+01
2006	3.352E+03	2.684E+06	1.803E+02	8.953E+02	1.342E+06	9.017E+01
2007	3.528E+03	2.825E+06	1.898E+02	9.423E+02	1.412E+06	9.490E+01
2008	3.700E+03	2.963E+06	1.991E+02	9.884E+02	1.482E+06	9.954E+01
2009	3.869E+03	3.098E+06	2.082E+02	1.034E+03	1.549E+06	1.041E+02
2010	4.035E+03	3.231E+06	2.171E+02	1.078E+03	1.616E+06	1.086E+02
2011	4.198E+03	3.361E+06	2.258E+02	1.121E+03	1.681E+06	1.129E+02
2012	4.357E+03	3.489E+06	2.344E+02	1.164E+03	1.744E+06	1.172E+02
2013	4.513E+03	3.614E+06	2.428E+02	1.205E+03	1.807E+06	1.214E+02
2014	4.763E+03	3.814E+06	2.563E+02	1.272E+03	1.907E+06	1.281E+02
2015	5.044E+03	4.039E+06	2.714E+02	1.347E+03	2.020E+06	1.357E+02
2016	5.325E+03	4.264E+06	2.865E+02	1.422E+03	2.132E+06	1.433E+02
2017	5.532E+03	4.430E+06	2.976E+02	1.478E+03	2.215E+06	1.488E+02
2018	5.767E+03	4.618E+06	3.103E+02	1.540E+03	2.309E+06	1.551E+02
2019	5.997E+03	4.802E+06	3.227E+02	1.602E+03	2.401E+06	1.613E+02
2020	6.223E+03	4.983E+06	3.348E+02	1.662E+03	2.491E+06	1.674E+02
2021	6.444E+03	5.160E+06	3.467E+02	1.721E+03	2.580E+06	1.733E+02
2022	6.660E+03	5.333E+06	3.583E+02	1.779E+03	2.667E+06	1.792E+02
2023	6.873E+03	5.503E+06	3.698E+02	1.836E+03	2.752E+06	1.849E+02
2024	7.081E+03	5.670E+06	3.810E+02	1.891E+03	2.835E+06	1.905E+02
2025	7.285E+03	5.834E+06	3.920E+02	1.946E+03	2.917E+06	1.960E+02
2026	7.485E+03	5.994E+06	4.027E+02	1.999E+03	2.997E+06	2.014E+02
2027	7.681E+03	6.151E+06	4.133E+02	2.052E+03	3.075E+06	2.066E+02
2028	7.873E+03	6.305E+06	4.236E+02	2.103E+03	3.152E+06	2.118E+02
2029	8.062E+03	6.455E+06	4.337E+02	2.153E+03	3.228E+06	2.169E+02
2030	8.246E+03	6.603E+06	4.437E+02	2.203E+03	3.302E+06	2.218E+02
2031	8.427E+03	6.748E+06	4.534E+02	2.251E+03	3.374E+06	2.267E+02
2032	8.605E+03	6.890E+06	4.630E+02	2.298E+03	3.445E+06	2.315E+02
2033	8.779E+03	7.030E+06	4.723E+02	2.345E+03	3.515E+06	2.362E+02
2034	8.949E+03	7.166E+06	4.815E+02	2.390E+03	3.583E+06	2.407E+02
2035	9.116E+03	7.300E+06	4.905E+02	2.435E+03	3.650E+06	2.452E+02
2036	9.280E+03	7.431E+06	4.993E+02	2.479E+03	3.716E+06	2.496E+02
2037	9.441E+03	7.560E+06	5.079E+02	2.522E+03	3.780E+06	2.540E+02
2038	9.598E+03	7.686E+06	5.164E+02	2.564E+03	3.843E+06	2.582E+02
2039	9.752E+03	7.809E+06	5.247E+02	2.605E+03	3.905E+06	2.623E+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)
2040	9.903E+03	7.930E+06	5.328E+02	2.645E+03	3.965E+06	2.664E+02
2041	1.005E+04	8.049E+06	5.408E+02	2.685E+03	4.024E+06	2.704E+02
2042	1.020E+04	8.165E+06	5.486E+02	2.724E+03	4.083E+06	2.743E+02
2043	1.034E+04	8.279E+06	5.563E+02	2.762E+03	4.140E+06	2.781E+02
2044	1.048E+04	8.391E+06	5.638E+02	2.799E+03	4.195E+06	2.819E+02
2045	1.062E+04	8.500E+06	5.711E+02	2.836E+03	4.250E+06	2.856E+02
2046	1.075E+04	8.608E+06	5.784E+02	2.871E+03	4.304E+06	2.892E+02
2047	1.088E+04	8.713E+06	5.854E+02	2.906E+03	4.357E+06	2.927E+02
2048	1.101E+04	8.816E+06	5.924E+02	2.941E+03	4.408E+06	2.962E+02
2049	1.114E+04	8.917E+06	5.992E+02	2.975E+03	4.459E+06	2.996E+02
2050	1.126E+04	9.016E+06	6.058E+02	3.008E+03	4.508E+06	3.029E+02
2051	1.138E+04	9.114E+06	6.123E+02	3.040E+03	4.557E+06	3.062E+02
2052	1.150E+04	9.209E+06	6.187E+02	3.072E+03	4.604E+06	3.094E+02
2053	1.162E+04	9.302E+06	6.250E+02	3.103E+03	4.651E+06	3.125E+02
2054	1.173E+04	9.394E+06	6.312E+02	3.134E+03	4.697E+06	3.156E+02
2055	1.184E+04	9.483E+06	6.372E+02	3.163E+03	4.742E+06	3.186E+02
2056	1.195E+04	9.571E+06	6.431E+02	3.193E+03	4.786E+06	3.215E+02
2057	1.206E+04	9.657E+06	6.489E+02	3.221E+03	4.829E+06	3.244E+02
2058	1.217E+04	9.742E+06	6.546E+02	3.250E+03	4.871E+06	3.273E+02
2059	1.227E+04	9.825E+06	6.601E+02	3.277E+03	4.912E+06	3.301E+02
2060	1.237E+04	9.906E+06	6.656E+02	3.304E+03	4.953E+06	3.328E+02
2061	1.247E+04	9.985E+06	6.709E+02	3.331E+03	4.993E+06	3.355E+02
2062	1.257E+04	1.006E+07	6.762E+02	3.357E+03	5.032E+06	3.381E+02
2063	1.266E+04	1.014E+07	6.813E+02	3.382E+03	5.070E+06	3.406E+02
2064	1.276E+04	1.021E+07	6.863E+02	3.407E+03	5.107E+06	3.432E+02
2065	1.285E+04	1.029E+07	6.913E+02	3.432E+03	5.144E+06	3.456E+02
2066	1.276E+04	1.022E+07	6.867E+02	3.409E+03	5.110E+06	3.434E+02
2067	1.251E+04	1.002E+07	6.731E+02	3.342E+03	5.009E+06	3.366E+02
2068	1.226E+04	9.820E+06	6.598E+02	3.276E+03	4.910E+06	3.299E+02
2069	1.202E+04	9.626E+06	6.467E+02	3.211E+03	4.813E+06	3.234E+02
2070	1.178E+04	9.435E+06	6.339E+02	3.147E+03	4.718E+06	3.170E+02
2071	1.155E+04	9.248E+06	6.214E+02	3.085E+03	4.624E+06	3.107E+02
2072	1.132E+04	9.065E+06	6.091E+02	3.024E+03	4.533E+06	3.045E+02
2073	1.110E+04	8.886E+06	5.970E+02	2.964E+03	4.443E+06	2.985E+02
2074	1.088E+04	8.710E+06	5.852E+02	2.905E+03	4.355E+06	2.926E+02
2075	1.066E+04	8.537E+06	5.736E+02	2.848E+03	4.269E+06	2.868E+02
2076	1.045E+04	8.368E+06	5.623E+02	2.791E+03	4.184E+06	2.811E+02
2077	1.024E+04	8.202E+06	5.511E+02	2.736E+03	4.101E+06	2.756E+02
2078	1.004E+04	8.040E+06	5.402E+02	2.682E+03	4.020E+06	2.701E+02
2079	9.842E+03	7.881E+06	5.295E+02	2.629E+03	3.940E+06	2.648E+02
2080	9.647E+03	7.725E+06	5.190E+02	2.577E+03	3.862E+06	2.595E+02
2081	9.456E+03	7.572E+06	5.087E+02	2.526E+03	3.786E+06	2.544E+02
2082	9.269E+03	7.422E+06	4.987E+02	2.476E+03	3.711E+06	2.493E+02
2083	9.085E+03	7.275E+06	4.888E+02	2.427E+03	3.637E+06	2.444E+02
2084	8.905E+03	7.131E+06	4.791E+02	2.379E+03	3.565E+06	2.396E+02
2085	8.729E+03	6.990E+06	4.696E+02	2.332E+03	3.495E+06	2.348E+02
2086	8.556E+03	6.851E+06	4.603E+02	2.285E+03	3.426E+06	2.302E+02
2087	8.387E+03	6.716E+06	4.512E+02	2.240E+03	3.358E+06	2.256E+02
2088	8.221E+03	6.583E+06	4.423E+02	2.196E+03	3.291E+06	2.211E+02
2089	8.058E+03	6.452E+06	4.335E+02	2.152E+03	3.226E+06	2.168E+02
2090	7.898E+03	6.324E+06	4.249E+02	2.110E+03	3.162E+06	2.125E+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)*
2091	7.742E+03	6.199E+06	4.165E+02	2.068E+03	3.100E+06	2.083E+02
2092	7.588E+03	6.077E+06	4.083E+02	2.027E+03	3.038E+06	2.041E+02
2093	7.438E+03	5.956E+06	4.002E+02	1.987E+03	2.978E+06	2.001E+02
2094	7.291E+03	5.838E+06	3.923E+02	1.947E+03	2.919E+06	1.961E+02
2095	7.147E+03	5.723E+06	3.845E+02	1.909E+03	2.861E+06	1.923E+02
2096	7.005E+03	5.609E+06	3.769E+02	1.871E+03	2.805E+06	1.884E+02
2097	6.866E+03	5.498E+06	3.694E+02	1.834E+03	2.749E+06	1.847E+02
2098	6.730E+03	5.389E+06	3.621E+02	1.798E+03	2.695E+06	1.811E+02
2099	6.597E+03	5.283E+06	3.549E+02	1.762E+03	2.641E+06	1.775E+02
2100	6.466E+03	5.178E+06	3.479E+02	1.727E+03	2.589E+06	1.740E+02
2101	6.338E+03	5.076E+06	3.410E+02	1.693E+03	2.538E+06	1.705E+02
2102	6.213E+03	4.975E+06	3.343E+02	1.660E+03	2.488E+06	1.671E+02
2103	6.090E+03	4.877E+06	3.277E+02	1.627E+03	2.438E+06	1.638E+02
2104	5.969E+03	4.780E+06	3.212E+02	1.594E+03	2.390E+06	1.606E+02
2105	5.851E+03	4.685E+06	3.148E+02	1.563E+03	2.343E+06	1.574E+02
2106	5.735E+03	4.593E+06	3.086E+02	1.532E+03	2.296E+06	1.543E+02
2107	5.622E+03	4.502E+06	3.025E+02	1.502E+03	2.251E+06	1.512E+02
2108	5.510E+03	4.412E+06	2.965E+02	1.472E+03	2.206E+06	1.482E+02
2109	5.401E+03	4.325E+06	2.906E+02	1.443E+03	2.163E+06	1.453E+02
2110	5.294E+03	4.239E+06	2.848E+02	1.414E+03	2.120E+06	1.424E+02
2111	5.189E+03	4.155E+06	2.792E+02	1.386E+03	2.078E+06	1.396E+02
2112	5.087E+03	4.073E+06	2.737E+02	1.359E+03	2.037E+06	1.368E+02
2113	4.986E+03	3.993E+06	2.683E+02	1.332E+03	1.996E+06	1.341E+02
2114	4.887E+03	3.913E+06	2.629E+02	1.305E+03	1.957E+06	1.315E+02
2115	4.790E+03	3.836E+06	2.577E+02	1.280E+03	1.918E+06	1.289E+02
2116	4.696E+03	3.760E+06	2.526E+02	1.254E+03	1.880E+06	1.263E+02
2117	4.603E+03	3.686E+06	2.476E+02	1.229E+03	1.843E+06	1.238E+02
2118	4.512E+03	3.613E+06	2.427E+02	1.205E+03	1.806E+06	1.214E+02
2119	4.422E+03	3.541E+06	2.379E+02	1.181E+03	1.771E+06	1.190E+02
2120	4.335E+03	3.471E+06	2.332E+02	1.158E+03	1.735E+06	1.166E+02
2121	4.249E+03	3.402E+06	2.286E+02	1.135E+03	1.701E+06	1.143E+02
2122	4.165E+03	3.335E+06	2.241E+02	1.112E+03	1.667E+06	1.120E+02
2123	4.082E+03	3.269E+06	2.196E+02	1.090E+03	1.634E+06	1.098E+02
2124	4.001E+03	3.204E+06	2.153E+02	1.069E+03	1.602E+06	1.076E+02
2125	3.922E+03	3.141E+06	2.110E+02	1.048E+03	1.570E+06	1.055E+02
2126	3.844E+03	3.078E+06	2.068E+02	1.027E+03	1.539E+06	1.034E+02
2127	3.768E+03	3.018E+06	2.027E+02	1.007E+03	1.509E+06	1.014E+02
2128	3.694E+03	2.958E+06	1.987E+02	9.866E+02	1.479E+06	9.937E+01
2129	3.621E+03	2.899E+06	1.948E+02	9.671E+02	1.450E+06	9.740E+01
2130	3.549E+03	2.842E+06	1.909E+02	9.479E+02	1.421E+06	9.547E+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)*
1990	0	0	0	0	0	0
1991	1.776E+02	9.704E+04	6.520E+00	2.066E-01	5.764E+01	3.873E-03
1992	3.517E+02	1.921E+05	1.291E+01	4.091E-01	1.141E+02	7.669E-03
1993	5.224E+02	2.854E+05	1.917E+01	6.076E-01	1.695E+02	1.139E-02
1994	6.897E+02	3.768E+05	2.531E+01	8.022E-01	2.238E+02	1.504E-02
1995	8.536E+02	4.663E+05	3.133E+01	9.929E-01	2.770E+02	1.861E-02
1996	1.014E+03	5.541E+05	3.723E+01	1.180E+00	3.292E+02	2.212E-02
1997	1.172E+03	6.402E+05	4.302E+01	1.363E+00	3.803E+02	2.555E-02
1998	1.326E+03	7.246E+05	4.868E+01	1.543E+00	4.304E+02	2.892E-02
1999	1.478E+03	8.072E+05	5.424E+01	1.719E+00	4.795E+02	3.222E-02
2000	1.626E+03	8.883E+05	5.968E+01	1.891E+00	5.276E+02	3.545E-02
2001	1.771E+03	9.677E+05	6.502E+01	2.060E+00	5.748E+02	3.862E-02
2002	1.914E+03	1.046E+06	7.025E+01	2.226E+00	6.211E+02	4.173E-02
2003	2.054E+03	1.122E+06	7.538E+01	2.389E+00	6.664E+02	4.478E-02
2004	2.191E+03	1.197E+06	8.041E+01	2.548E+00	7.109E+02	4.776E-02
2005	2.325E+03	1.270E+06	8.534E+01	2.704E+00	7.544E+02	5.069E-02
2006	2.457E+03	1.342E+06	9.017E+01	2.857E+00	7.971E+02	5.356E-02
2007	2.585E+03	1.412E+06	9.490E+01	3.007E+00	8.390E+02	5.637E-02
2008	2.712E+03	1.482E+06	9.954E+01	3.154E+00	8.800E+02	5.913E-02
2009	2.836E+03	1.549E+06	1.041E+02	3.299E+00	9.202E+02	6.183E-02
2010	2.957E+03	1.616E+06	1.086E+02	3.440E+00	9.597E+02	6.448E-02
2011	3.076E+03	1.681E+06	1.129E+02	3.578E+00	9.983E+02	6.707E-02
2012	3.193E+03	1.744E+06	1.172E+02	3.714E+00	1.036E+03	6.962E-02
2013	3.307E+03	1.807E+06	1.214E+02	3.847E+00	1.073E+03	7.211E-02
2014	3.491E+03	1.907E+06	1.281E+02	4.060E+00	1.133E+03	7.611E-02
2015	3.697E+03	2.020E+06	1.357E+02	4.300E+00	1.200E+03	8.061E-02
2016	3.903E+03	2.132E+06	1.433E+02	4.539E+00	1.266E+03	8.509E-02
2017	4.054E+03	2.215E+06	1.488E+02	4.716E+00	1.316E+03	8.840E-02
2018	4.227E+03	2.309E+06	1.551E+02	4.916E+00	1.372E+03	9.215E-02
2019	4.395E+03	2.401E+06	1.613E+02	5.112E+00	1.426E+03	9.583E-02
2020	4.560E+03	2.491E+06	1.674E+02	5.305E+00	1.480E+03	9.943E-02
2021	4.722E+03	2.580E+06	1.733E+02	5.493E+00	1.532E+03	1.030E-01
2022	4.881E+03	2.667E+06	1.792E+02	5.678E+00	1.584E+03	1.064E-01
2023	5.037E+03	2.752E+06	1.849E+02	5.859E+00	1.635E+03	1.098E-01
2024	5.190E+03	2.835E+06	1.905E+02	6.036E+00	1.684E+03	1.131E-01
2025	5.339E+03	2.917E+06	1.960E+02	6.210E+00	1.733E+03	1.164E-01
2026	5.486E+03	2.997E+06	2.014E+02	6.381E+00	1.780E+03	1.196E-01
2027	5.629E+03	3.075E+06	2.066E+02	6.548E+00	1.827E+03	1.227E-01
2028	5.770E+03	3.152E+06	2.118E+02	6.712E+00	1.872E+03	1.258E-01
2029	5.908E+03	3.228E+06	2.169E+02	6.872E+00	1.917E+03	1.288E-01
2030	6.044E+03	3.302E+06	2.218E+02	7.030E+00	1.961E+03	1.318E-01
2031	6.176E+03	3.374E+06	2.267E+02	7.184E+00	2.004E+03	1.347E-01
2032	6.306E+03	3.445E+06	2.315E+02	7.335E+00	2.046E+03	1.375E-01
2033	6.434E+03	3.515E+06	2.362E+02	7.484E+00	2.088E+03	1.403E-01
2034	6.559E+03	3.583E+06	2.407E+02	7.629E+00	2.128E+03	1.430E-01
2035	6.681E+03	3.650E+06	2.452E+02	7.771E+00	2.168E+03	1.457E-01
2036	6.801E+03	3.716E+06	2.496E+02	7.911E+00	2.207E+03	1.483E-01
2037	6.919E+03	3.780E+06	2.540E+02	8.048E+00	2.245E+03	1.509E-01
2038	7.034E+03	3.843E+06	2.582E+02	8.182E+00	2.283E+03	1.534E-01
2039	7.147E+03	3.905E+06	2.623E+02	8.313E+00	2.319E+03	1.558E-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)
2040	7.258E+03	3.965E+06	2.664E+02	8.442E+00	2.355E+03	1.582E-01
2041	7.367E+03	4.024E+06	2.704E+02	8.569E+00	2.391E+03	1.606E-01
2042	7.473E+03	4.083E+06	2.743E+02	8.693E+00	2.425E+03	1.629E-01
2043	7.577E+03	4.140E+06	2.781E+02	8.814E+00	2.459E+03	1.652E-01
2044	7.680E+03	4.195E+06	2.819E+02	8.933E+00	2.492E+03	1.674E-01
2045	7.780E+03	4.250E+06	2.856E+02	9.049E+00	2.525E+03	1.696E-01
2046	7.878E+03	4.304E+06	2.892E+02	9.164E+00	2.557E+03	1.718E-01
2047	7.975E+03	4.357E+06	2.927E+02	9.276E+00	2.588E+03	1.739E-01
2048	8.069E+03	4.408E+06	2.962E+02	9.386E+00	2.618E+03	1.759E-01
2049	8.162E+03	4.459E+06	2.996E+02	9.493E+00	2.648E+03	1.779E-01
2050	8.252E+03	4.508E+06	3.029E+02	9.599E+00	2.678E+03	1.799E-01
2051	8.341E+03	4.557E+06	3.062E+02	9.702E+00	2.707E+03	1.819E-01
2052	8.428E+03	4.604E+06	3.094E+02	9.804E+00	2.735E+03	1.838E-01
2053	8.514E+03	4.651E+06	3.125E+02	9.903E+00	2.763E+03	1.856E-01
2054	8.598E+03	4.697E+06	3.156E+02	1.000E+01	2.790E+03	1.875E-01
2055	8.680E+03	4.742E+06	3.186E+02	1.010E+01	2.817E+03	1.892E-01
2056	8.760E+03	4.786E+06	3.215E+02	1.019E+01	2.843E+03	1.910E-01
2057	8.839E+03	4.829E+06	3.244E+02	1.028E+01	2.868E+03	1.927E-01
2058	8.916E+03	4.871E+06	3.273E+02	1.037E+01	2.893E+03	1.944E-01
2059	8.992E+03	4.912E+06	3.301E+02	1.046E+01	2.918E+03	1.961E-01
2060	9.066E+03	4.953E+06	3.328E+02	1.055E+01	2.942E+03	1.977E-01
2061	9.139E+03	4.993E+06	3.355E+02	1.063E+01	2.966E+03	1.993E-01
2062	9.211E+03	5.032E+06	3.381E+02	1.071E+01	2.989E+03	2.008E-01
2063	9.280E+03	5.070E+06	3.406E+02	1.079E+01	3.012E+03	2.023E-01
2064	9.349E+03	5.107E+06	3.432E+02	1.087E+01	3.034E+03	2.038E-01
2065	9.416E+03	5.144E+06	3.456E+02	1.095E+01	3.056E+03	2.053E-01
2066	9.355E+03	5.110E+06	3.434E+02	1.088E+01	3.036E+03	2.040E-01
2067	9.169E+03	5.009E+06	3.366E+02	1.067E+01	2.975E+03	1.999E-01
2068	8.988E+03	4.910E+06	3.299E+02	1.045E+01	2.917E+03	1.960E-01
2069	8.810E+03	4.813E+06	3.234E+02	1.025E+01	2.859E+03	1.921E-01
2070	8.635E+03	4.718E+06	3.170E+02	1.004E+01	2.802E+03	1.883E-01
2071	8.464E+03	4.624E+06	3.107E+02	9.846E+00	2.747E+03	1.846E-01
2072	8.297E+03	4.533E+06	3.045E+02	9.651E+00	2.692E+03	1.809E-01
2073	8.133E+03	4.443E+06	2.985E+02	9.459E+00	2.639E+03	1.773E-01
2074	7.971E+03	4.355E+06	2.926E+02	9.272E+00	2.587E+03	1.738E-01
2075	7.814E+03	4.269E+06	2.868E+02	9.089E+00	2.536E+03	1.704E-01
2076	7.659E+03	4.184E+06	2.811E+02	8.909E+00	2.485E+03	1.670E-01
2077	7.507E+03	4.101E+06	2.756E+02	8.732E+00	2.436E+03	1.637E-01
2078	7.359E+03	4.020E+06	2.701E+02	8.559E+00	2.388E+03	1.604E-01
2079	7.213E+03	3.940E+06	2.648E+02	8.390E+00	2.341E+03	1.573E-01
2080	7.070E+03	3.862E+06	2.595E+02	8.224E+00	2.294E+03	1.542E-01
2081	6.930E+03	3.786E+06	2.544E+02	8.061E+00	2.249E+03	1.511E-01
2082	6.793E+03	3.711E+06	2.493E+02	7.901E+00	2.204E+03	1.481E-01
2083	6.658E+03	3.637E+06	2.444E+02	7.745E+00	2.161E+03	1.452E-01
2084	6.527E+03	3.565E+06	2.396E+02	7.591E+00	2.118E+03	1.423E-01
2085	6.397E+03	3.495E+06	2.348E+02	7.441E+00	2.076E+03	1.395E-01
2086	6.271E+03	3.426E+06	2.302E+02	7.294E+00	2.035E+03	1.367E-01
2087	6.146E+03	3.358E+06	2.256E+02	7.149E+00	1.995E+03	1.340E-01
2088	6.025E+03	3.291E+06	2.211E+02	7.008E+00	1.955E+03	1.314E-01
2089	5.905E+03	3.226E+06	2.168E+02	6.869E+00	1.916E+03	1.288E-01
2090	5.788E+03	3.162E+06	2.125E+02	6.733E+00	1.878E+03	1.262E-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)
2091	5.674E+03	3.100E+06	2.083E+02	6.600E+00	1.841E+03	1.237E-01
2092	5.562E+03	3.038E+06	2.041E+02	6.469E+00	1.805E+03	1.213E-01
2093	5.451E+03	2.978E+06	2.001E+02	6.341E+00	1.769E+03	1.189E-01
2094	5.343E+03	2.919E+06	1.961E+02	6.215E+00	1.734E+03	1.165E-01
2095	5.238E+03	2.861E+06	1.923E+02	6.092E+00	1.700E+03	1.142E-01
2096	5.134E+03	2.805E+06	1.884E+02	5.972E+00	1.666E+03	1.119E-01
2097	5.032E+03	2.749E+06	1.847E+02	5.853E+00	1.633E+03	1.097E-01
2098	4.933E+03	2.695E+06	1.811E+02	5.737E+00	1.601E+03	1.075E-01
2099	4.835E+03	2.641E+06	1.775E+02	5.624E+00	1.569E+03	1.054E-01
2100	4.739E+03	2.589E+06	1.740E+02	5.512E+00	1.538E+03	1.033E-01
2101	4.645E+03	2.538E+06	1.705E+02	5.403E+00	1.507E+03	1.013E-01
2102	4.553E+03	2.488E+06	1.671E+02	5.296E+00	1.478E+03	9.928E-02
2103	4.463E+03	2.438E+06	1.638E+02	5.191E+00	1.448E+03	9.731E-02
2104	4.375E+03	2.390E+06	1.606E+02	5.089E+00	1.420E+03	9.539E-02
2105	4.288E+03	2.343E+06	1.574E+02	4.988E+00	1.392E+03	9.350E-02
2106	4.203E+03	2.296E+06	1.543E+02	4.889E+00	1.364E+03	9.165E-02
2107	4.120E+03	2.251E+06	1.512E+02	4.792E+00	1.337E+03	8.983E-02
2108	4.038E+03	2.206E+06	1.482E+02	4.697E+00	1.310E+03	8.805E-02
2109	3.959E+03	2.163E+06	1.453E+02	4.604E+00	1.285E+03	8.631E-02
2110	3.880E+03	2.120E+06	1.424E+02	4.513E+00	1.259E+03	8.460E-02
2111	3.803E+03	2.078E+06	1.396E+02	4.424E+00	1.234E+03	8.292E-02
2112	3.728E+03	2.037E+06	1.368E+02	4.336E+00	1.210E+03	8.128E-02
2113	3.654E+03	1.996E+06	1.341E+02	4.250E+00	1.186E+03	7.967E-02
2114	3.582E+03	1.957E+06	1.315E+02	4.166E+00	1.162E+03	7.810E-02
2115	3.511E+03	1.918E+06	1.289E+02	4.084E+00	1.139E+03	7.655E-02
2116	3.441E+03	1.880E+06	1.263E+02	4.003E+00	1.117E+03	7.503E-02
2117	3.373E+03	1.843E+06	1.238E+02	3.924E+00	1.095E+03	7.355E-02
2118	3.306E+03	1.806E+06	1.214E+02	3.846E+00	1.073E+03	7.209E-02
2119	3.241E+03	1.771E+06	1.190E+02	3.770E+00	1.052E+03	7.066E-02
2120	3.177E+03	1.735E+06	1.166E+02	3.695E+00	1.031E+03	6.926E-02
2121	3.114E+03	1.701E+06	1.143E+02	3.622E+00	1.010E+03	6.789E-02
2122	3.052E+03	1.667E+06	1.120E+02	3.550E+00	9.905E+02	6.655E-02
2123	2.992E+03	1.634E+06	1.098E+02	3.480E+00	9.708E+02	6.523E-02
2124	2.933E+03	1.602E+06	1.076E+02	3.411E+00	9.516E+02	6.394E-02
2125	2.874E+03	1.570E+06	1.055E+02	3.343E+00	9.328E+02	6.267E-02
2126	2.818E+03	1.539E+06	1.034E+02	3.277E+00	9.143E+02	6.143E-02
2127	2.762E+03	1.509E+06	1.014E+02	3.212E+00	8.962E+02	6.022E-02
2128	2.707E+03	1.479E+06	9.937E+01	3.149E+00	8.785E+02	5.902E-02
2129	2.653E+03	1.450E+06	9.740E+01	3.086E+00	8.611E+02	5.785E-02
2130	2.601E+03	1.421E+06	9.547E+01	3.025E+00	8.440E+02	5.671E-02

Revised 3-14-06 ND Dept. of Health Emission Inventory Summary Year: 2018

Company:	City of Fargo	AIRS/AFS Source Code:	38 017 00080
PTO Number:	T5-O98009	Annual Permit Fee Billing:	**NO**
Unit or Station	Fargo Sanitary Landfill	Reviewed By:	ET

Individual Emission Sources

EU	Source Unit	SCC	CPM	PM10	PM2.5	SO2	NOX	CO	VOC
1	Landfill gas emissions	50100402	0.0	0.0	0.0	0.0	0.0	0.0	1.5
2	Flare and off-site gas transfer	50100410	0.0	0.1	0.1	5.0	0.3	6.9	0.6
3	Tub grinder and diesel engine	30700820	0.0	1.4	1.4	0.1	1.7	0.2	0.0
4	Landfill/natural gas-fired engine and turbine	20300801	0.0	0.6	0.6	7.4	3.1	5.8	0.0
5 & 6	Landfill/natural gas-fired boilers	10300811	0.0	4.0	4.0	0.5	16.0	2.8	0.0
Total Facility Emissions (Less HAPS)			0.0	6.1	6.1	12.9	21.1	15.7	2.1

Hazardous Air Pollutants (Tons)				
Pollutant/Chemical Name	EU 1&2	EU 4	EU 5&6	Total
Xylene	0.00	0.01	0.00	0.01
Ethyl benzene	0.00	0.00	0.00	0.00
Tetrachloroethene	0.00	0.00	0.00	0.00
Toluene	0.00	0.01	0.00	0.01
Hydrogen Chloride	0.01	0.01	0.00	0.02
Methylene Chloride	0.00	0.00	0.00	0.00
Trichloroethene	0.00	0.00	0.00	0.00
Plant Totals	0.01	0.03	0.00	0.04

Fuel Combusted & Process/Production Qty	
Coal (Tons)	
Natural Gas (MMScf)	0.678
LPG/Propane (Gal)	
Landfill gas (MMScf)	2.766
Low Sulfur Diesel (Gal)	
Distillate Oil (Gal)	4,237
Residual Oil (Gal)	
Other Fuel	

Action	Date	Initial
Scanned		
Checked	6/17/2019	ET
Checked (Gary)	6/18/2019	GK
Database Entry	6/20/2019	ET

Fargo Landfill - Landfill Gas (LFG) and Natural Gas		
LFG sent off-site	236,595,158.00	ft3
Hours LFG sent off-site (Cargill)	7,412.00	hours
Hours of flare operation	966.00	hours
Hours of gas system down time	399.00	hours
Wood Grinder Operation	269.00	hr/yr
	8,070.00	tons/yr
	4,237	gallons/yr
	137,000.00	Btu/gal
Boilers LFG hours of operation	636	hours
Boilers Natural Gas hours of operation	212	hours
Total Gas Generation	42,560.74	ft3/hr
Fugitive Landfill Gas	93,208,022.31	ft3/yr
Landfill Gas controlled at flare	873,157.23	m3/yr
Methane Collection rate	17,556.31	ft3/hr
Hours of generator operation	2,803	hours
Engine LFG Capacity	16,062.38	ft3/hr
LFG Controlled at Engine	1,274,146.38	m3/yr
Boiler Quantity of LFG used	2,766,400	ft3/yr
	78,335.71	m3/yr
Boiler Max . Fuel consumption	7,700.00	ft3/hr
Boiler Quantity of Natural Gas used	678,240.72	ft3/yr
Boiler Max . Fuel consumption	7,500.00	ft3/hr
LFG Collection Rate	31,920.56	ft3/hr
	903.89	m3/hr
Total Gas Generation	42,560.74	ft3/hr
	1,205.19	m3/hr
	372,832,089.24	ft3/yr
Fug. Landfill Gas	93,208,022.31	ft3/hr
	3,016,987.27	m3/hr
Methane concentration	55.00%	
Turbine engine methane	8,834.31	ft3/hr

Fug. LFG Emissions

	Concentration (ppmv)	Mol. Weight (g/mol)	Grav. Conc.	Fug. LFG (ton/yr)	TOTAL LFG ton/yr	TOTAL LFG lb/hr
NMOCs (hexane)	127.30	86.18	448.70	1.49	1.50	0.34
VOCs	49.65	86.18	174.99	0.58	0.58	0.13
Carbon Monoxide	141.00	28.01	161.53	0.54		
Benzene	0.69	78.11	2.20	0.01	0.01	0.00
Ethyl Benzene	3.00	106.16	13.03	0.04	0.04	0.01
Methylene Choride	0.14	84.94	0.49	0.00	0.00	0.00
Styrene	0.20	104.15	0.85	0.00	0.00	0.00
Tetracholorethene	0.28	165.83	1.90	0.01	0.01	0.00
Toluene	12.00	92.13	45.22	0.15	0.15	0.03
Trichoroethene	0.11	131.4	0.59	0.00	0.00	0.00
Vinyl Chloride	0.52	62.5	1.33	0.00	0.00	0.00
Xylene	6.40	106.16	27.79	0.09	0.09	0.02

Flared LFG

	Concentration (ppmv)	Mol. Weight (g/mol)	Grav. Conc.	Control Efficiency	Fug. LFG (ton/yr)	TOTAL LFG ton/yr	TOTAL LFG lb/hr
NMOCs (hexane)	127.30	86.17	448.65	99.20%	0.003		
VOCs	49.65	86.17	174.97	99.20%	0.001		
Sulfur Dioxide	2000	64.04	5238.45	0.00%	5.042	5.042	1.151
Hydrogen Chloride	4.31	35.45	6.25	0.00%	0.006		
Benzene	0.69	78.11	2.20	99.70%	0.000		
Ethyl Benzene	3.00	106.16	13.03	99.70%	0.000		
Methylene Choride	0.14	84.94	0.49	98.00%	0.000		
Styrene	0.20	104.15	0.85	99.70%	0.000		
Tetracholorethene	0.28	165.83	1.90	98.00%	0.000		
Toluene	12.00	92.13	45.22	99.70%	0.000		
Trichoroethene	0.11	131.4	0.59	98.00%	0.000		
Vinyl Chloride	0.52	62.5	1.33	98.00%	0.000		
Xylene	6.40	106.16	27.79	99.70%	0.000		
				lb/hr	ton/yr		
PM/PM10/PM2.5				0.30	0.144155	0.144155	0.03
NOx				0.70	0.339188	0.339188	0.08
CO				13.17	6.359772	6.90	1.57
					TOTAL HAPS	0.31	0.07

Tub Grinder

				Total Grinder	
Grinding:	**Em. Fact.**				
	(lb/ton)	ton/yr	lb/hr	lb/hr	ton/yr
Total PM	0.35	1.41	10.50	10.69	1.44
PM10	0.35	1.41	10.50	10.69	1.44
PM2.5	0.35	1.41	10.50	10.69	1.44
Engine:	(lb/MMBtu)				
SO2	0.29	0.08	0.65	0.65	0.08
Engine:	(lb/hr)				
PM/PM10/PM2.5	0.19	0.03	0.19		
NOx	12.29	1.65	12.29	12.29	1.65
CO	1.14	0.15	1.14	1.14	0.15
VOC	0.24	0.03	0.24	0.24	0.03

Turbine

	Concentration (ppmv)	Mol. Weight	Grav. Conc.	Control Efficiency	ton/yr
NMOCs (hexane)	127.30	86.18	448.70	97.20%	0.02
VOCs	49.65	86.18	174.99	97.20%	0.01
Sulfur Dioxide	2000	64.04	5238.45	0.00%	7.36
Ammonia	7500	17.03	5223.93	0.00%	7.34
Hydrogen Chloride	4.31	35.45	6.25	0.00%	0.01
Benzene	0.69	78.11	2.20	86.10%	0.00
Ethyl Benzene	3.00	106.16	13.03	86.10%	0.00
Methylene Choride	0.14	84.94	0.49	93.00%	0.00
Styrene	0.20	104.15	0.85	86.10%	0.00
Tetracholorethene	0.28	165.83	1.90	93.00%	0.00
Toluene	12.00	92.13	45.22	86.10%	0.01
Trichoroethene	0.11	131.4	0.59	93.00%	0.00
Vinyl Chloride	0.52	62.5	1.33	93.00%	0.00
Xylene	6.40	106.16	27.79	86.10%	0.01

TOTAL HAPs	
lb/hr	ton/yr
0.02	0.03

	Em. Fact.		lb/hr	ton/yr
PM/PM10/PM2.5	48	lb/MMsdcf	0.42	0.59
NOx	250	lb/MMsdcf	2.21	3.10
CO	470	lb/MMsdcf	4.15	5.82

7.658 MMBtu/hr Boilers (2)

LFG	550 Btu/ft3	Max. fuel consumption	14000 ft3/hr
Nat. Gas	1020 Btu/ft3	Max. fuel consumption	7500 ft3/hr

Landfill Gas Combustion:

	Concentration (ppmv)	Mol. Weight	Grav. Conc.	Control Efficiency	Fug. LFG (ton/yr)	Fug. LFG (lb/hr)
NMOCs (hexane)	127.30	86.17	448.65	98.00%	0.00	0.02039
VOCs	49.65	86.17	174.97	98.00%	0.00	
Sulfur Dioxide	2000	64.04	5238.45	0.00%	0.45	11.9036
Ammonia	7500	17.03	5223.93	0.00%	0.45	11.87061
Hydrogen Chloride	4.31	35.45	6.25	0.00%	0.00	
Benzene	0.69	78.11	2.20	99.80%	0.00	
Ethyl Benzene	3.00	106.16	13.03	99.80%	0.00	
Methylene Choride	0.14	84.94	0.49	98.60%	0.00	
Styrene	0.20	104.15	0.85	99.80%	0.00	
Tetracholorethene	0.28	165.83	1.90	99.60%	0.00	
Toluene	12.00	92.13	45.22	99.80%	0.00	
Trichoroethene	0.11	131.4	0.59	99.60%	0.00	
Vinyl Chloride	0.52	62.5	1.33	99.60%	0.00	
Xylene	6.40	106.16	27.79	99.80%	0.00	
				lb/hr	ton/yr	
PM/PM10/PM2.5				12.48	3.97	
NOx				50.21	15.97	
CO				8.67	2.76	

Natural Gas Combustion:

	Em. Fact.		lb/hr	ton/yr	Boiler TOTAL lb/hr	Boiler TOTAL ton/yr
CPM	5.7	lb/MMscf	0.02	0.00	0.02	0.00
PM10/PM2.5	1.9	lb/MMscf	0.01	0.00	12.48	3.97
SO2	0.6	lb/MMscf	0.00	0.00	11.91	0.45
NOx	100	lb/MMscf	0.32	0.03	50.53	16.00
CO	84	lb/MMscf	0.27	0.03	8.94	2.79
VOC	5.5	lb/MMscf	0.02	0.00	0.04	0.00

CITY OF Fargo

Scanned: ✓
Added to AQDB: __

Division of Solid Waste

2301 8th Avenue North
Fargo, North Dakota 58102
Phone: 701-241-1449
Fax: 701-241-8109

Received Air Quality

March 12, 2019

Kyla Schneider
North Dakota Department of Health
Division of Air Quality
918 East Divide, 2nd Floor
Bismarck, ND 58501-1947

Re: City of Fargo Division of Solid Waste
2018 Air Emission Inventory Report
Permit to Operate Number: T5-O98009

Dear Ms. Schneider,

Enclosed is one copy of the City of Fargo Division of Solid Waste's 2018 Air Emission Inventory Report and supporting calculations. The calculations show that the emissions at the facility are below the limits established in Section 3 of the facility's Title V Permit to Operate.

If you have any questions about the emission inventory, please call me at (701) 241-1552.

Sincerely,

Terry Ludlum
Solid Waste Utility Director

Enclosures

GENERAL
INCINERATORS OR FLARES

ANNUAL EMISSION INVENTORY REPORT NORTH DAKOTA DEPARTMENT OF HEALTH DIVISION OF AIR QUALITY

SFN 11624 (06-14)

Name of Firm or Organization City of Fargo Division of Solid Waste	Permit to Operate Number T5-O98009	Year of Emissions 2018	
Mailing Address 2301 8th Avenue North	City Fargo	State ND	ZIP Code 58102
Facility Name City of Fargo MSW Landfill	Facility Location Fargo	Actual Hours of Operation ✓ 966 hrs flare; 7412 hrs off-site gas xfer, 399 hrs system down	
Equipment Manufacturer's Name LFG&E International	Maximum Rated Capacity (Specify Units) 1200 scfm	Emission Unit Number EU 1-2	

WASTE INFORMATION

Type of Wastes Burned - (see 1.1.A Waste Classification Chart)	Quantity (Specify Units)
Type 0 Trash *	
Type 1 Rubbish	
Type 2 Refuse	
Type 3 Garbage	
Type 4 Pathological - Animal Solids & Organic Wastes	
Type 5 Gaseous, Liquid or Semi-Liquid Waste*	426,175,599 cubic feet of landfill gas per year, total generation estimated; 75% collection assumed
Type 6 Semi-Solid & Solid Wastes *	
Other (Describe)*	
Other (Describe) *	

* Complete Table Below

Type	Origin	Description	Chemical Composition
Type 0 with more than 10% plastic/rubber			
Type 5	City of Fargo MSW Landfill	Landfill Gas	
Type 6			
Other (Describe)			

STACK EMISSIONS

Air Contaminant	Quantity	
	Pounds Per Hour (average)	Tons
Particulate - Total PM (Filterable)	See Notes Discussion.	
Particulate - PM_{10} (Filterable)		
Particulate - $PM_{2.5}$ (Filterable)		
Particulate – CPM (Condensable)		
Sulfur Dioxide	1.10E+00	~~4.80~~ 5.04
Nitrogen Oxides	8.85E-02	~~3.88E-01~~ 0.34
Carbon Monoxide	1.78E+00	~~7.81~~ 6.9
Total Organic Compounds: Nonmethane	3.42E-01	~~1.50~~ 0.58

SFN 11624 (06-14) Page 2

Basis for quantities listed under Stack Emissions; provide calculations:
See Attached Spreadsheet Calculations for Landfill Gas Emissions

Below is a summary of the operation.

Flare Operating Hours – 966 hours; Gas Sent Off-Site – 7,412 hours; Active Gas System Down – 399 hours

Note: Landfill gas was not exhausted directly to atmosphere while the gas collection system was down. The landfill gas pressure was allowed to build up within the system and was burned when either the flare or off-site transfers was restarted.

Particulate emissions not reported in AP-42 Table 2.4-5 in filterable or condensable fractions. Total Particulate emissions shown below.

Average Hourly Emission Rate (lb/hr)=3.39E-02 Tons Per Year: 1.49E-01 0.144 ✓

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report Terry Ludlum	Title Solid Waste Utility Director	Telephone Number 701-241-1552
Signature [signature]	Email Address Tludlum@cityoffargo.com	Date 3-12-19

Return completed form to:
North Dakota Department of Health Division of Air Quality
918 E Divide, 2nd Floor Bismarck, ND 58501-1947
Telephone: (701)328-5188

HAZARDOUS AIR POLLUTANT ANNUAL ANNUAL EMISSIONS INVENTORY REPORT
NORTH DAKOTA DEPARTMENT OF HEALTH DIVISION OF AIR QUALITY

SFN 19839 (06-14)

Name of Firm or Organization City of Fargo Division of Solid Waste	Permit to Operate Number T5-O98009	Year of Emissions 2018
Mailing Address 2301 8th Avenue North	City Fargo	State ND / ZIP Code 58102
Facility Name City of Fargo MSW Landfill	Facility Location Fargo	Emission Unit Number EU1-2
Amount of Material Processed (material used, etc.) 426,175,599 cubic feet of landfill gas per year, total generation estimated; 75% collection assumed		
Air Pollution Control Equipment Flare		Hours of Operation 7,412 hours offsite transfer, 966 hours flare, 399 hours system down

HAZARDOUS AIR POLLUTANT EMISSIONS:

CHEMICAL EMITTED TO AIR	CAS NUMBER	EMISSIONS QUANTITY	
		Emission Factor (include units)	TONS
Benzene	71-43-2	0.69 ppmv from LFG Sample (June 2017)	7.34E-03 ✓
Ethyl Benzene	100-41-4	3.00 ppmv from LFG Sample (June 2017)	4.34E-02 ✓
Methylene Chloride	75-09-2	0.14 ppmv from LFG Sample (June 2017)	1.63E-03 ✓
Styrene	100-42-5	0.20 ppmv from LFG Sample (June 2017)	2.84E-03 ✓
Tetrachloroethene	127-18-4	0.28 ppmv from LFG Sample (June 2017)	6.36E-03 ✓
Toluene	108-88-3	12.00 ppmv from LFG Sample (June 2017)	1.51E-01 ✓
Trichloroethene	79-01-6	0.11 ppmv from LFG Sample (June 2017)	1.98E-03 ✓
Vinyl Chloride	75-01-4	0.52 ppmv from LFG Sample (June 2017)	4.45E-03 ✓
Xylene	1330-20-7	6.40 ppmv from LFG Sample (June 2017)	9.25E-02 ✓
Hydrogen Chloride	7647-01-0	4.31 ppmv from LFG Sample (5/25/2012) and Equation 9 of AP-42 Section 2.4	7.28E-03 ✓

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report Terry Ludlum	Title Solid Waste Utility Director	Telephone Number 701-241-1552
Signature [signature]	Email Address Tludlum@cityoffargo.com	Date 3-12-19

Return completed form to:
North Dakota Department of Health Division of Air Quality
918 E Divide, 2nd Floor Bismarck, ND 58501-1947
Telephone: (701)328-5188

MANUFACTURING OR PROCESSING EQUIPMENT ANNUAL EMISSION INVENTORY REPORT
NORTH DAKOTA DEPARTMENT OF HEALTH DIVISION OF AIR QUALITY
SFN 8537 (06-14)

GENERAL

Name of Firm or Organization City of Fargo Division of Solid Waste	Permit to Operate Number T5-O98009	Year of Emissions 2018
Mailing Address 2301 8th Avenue North	City Fargo	State: ND / ZIP Code: 58102
Facility Name City of Fargo MSW Landfill	Facility Location Fargo	Actual Hours of Operation 269
Source Unit Description Wood Waste Grinder		Emission Unit Number 3

RAW MATERIAL INFORMATION

Raw Materials Introduced into Process	Quantity (Specify Units)
Waste Wood - Trees, Clean wood, Clean pallets	8070 (ton/yr) ✓

FUELS USED

	Primary Fuel	Auxiliary Fue
Type (ex. lignite, natural gas, LPG No. 2 fuel oil, No. 6 fuel oil. etc.)	Diesel - see Engine Form	
Quantity of Fuel per Year (Specify Units: ex. ton, gal, cu.ft., etc.)		
Percent Sulfur Maximum Average		
Btu per Unit (Specify Unit in lb, ton, gal, etc.) Average		

STACK EMISSIONS

Air Contaminant *	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM (Filterable)	0.35 lb/ton	AP-42, 4th Edition, Table 10.3-1 (2/80)	1.41 ✓
Particulate - PM_{10} (Filterable)	0.35 lb/ton	AP-42, 4th Edition, Table 10.3-1 (2/80)	1.41 ✓
Particulate - $PM_{2.5}$ (Filterable)	0.35 lb/ton	AP-42, 4th Edition, Table 10.3-1 (2/80)	1.41 ✓
Particulate – CPM (Condensable)	NA	NA	NA
Sulfur Dioxide	NA	NA	NA
Nitrogen Oxides	NA	NA	NA
Carbon Monoxide	NA	NA	NA
Total Organic Compounds: Nonmethane	NA	NA	NA

* Submit SFN 19839 for Hazardous Air Pollutants if applicable.

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report Terry Ludlum	Title Solid Waste Utility Director	Telephone Number (701) 241-1552
Signature [signature]	Email Address TLudlum@cityoffargo.com	Date 3-12-19

Return completed form to:
North Dakota Department of Health
Division of Air Quality
918 E Divide, 2nd Floor
Bismarck, ND 58501-1947
Telephone:(701)328-5188

COMPRESSOR/INDUSTRIAL ENGINES
ANNUAL EMISSIONS INVENTORY REPORT
NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY

SFN 11829 (11-15)

GENERAL

Name of Film or Organization City of Fargo Division of Solid Waste	Permit to Operate Number T5-O98009	Year of Emissions 2018	
Mailing Address 2301 8th Avenue North	City Fargo	State ND	ZIP Code 58102
Facility Name City of Fargo MSW Landfill	Facility Location Fargo	Emission Unit Number 3	

EQUIPMENT INFORMATION

☐ Stationary Gas Turbine ☐ Reciprocating Engine ☐ Dual Fuel Engine ☐ Spark Ignition
☐ 2-Stroke Lean Burn
☐ Stationary Large Bore Diesel ☐ 4-Stroke Lean Burn ☐ Other, Specify________ ■ Compression Ignition
☐ 4-Stroke Rich Burn

Manufacturer of Unit Caterpillar	Model Number 3412	Actual Hours of Operation 269 ✓
Maximum Rating 650 BHP at 2000 RPM	Design Capacity BHP at RPM	
If turbine used for electrical generation: MWe-hours generated		

FUELS USED

Natural Gas (if applicable)	Thousand Cu. Ft.	Btu/Cu. Ft.	Percent H_2S
Diesel (if applicable) #2 and/or off-road diesel	Gallons ✓ 4,237	Btu/Gal 137,000	
LP Gas (if applicable)	Gallons	Btu/Gal	
Other (Specify)	Specify	Btu/Unit	

COMPRESSOR STATION FLARE STACK EMISSIONS

Quantity Flared Thousand Cu. Ft./Yr	Average H_2S Content	SO_2 Emissions Tons/Yr

(The table below is used for single fuel combustion. Use the tables on the other side if multiple fuels are combusted and then summarize the total emissions per year in the "Tons" column below)

TOTAL STACK EMISSIONS

Air Contaminant*	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM Filterable)	0.062 (lb/MMBtu)	AP-42, Table 3.4-2 (10/96)	0.02 0.03
Particulate - PM_{10} (Filterable)	0.0496(lb/MMBtu)	AP-42, Table 3.4-2 (10/96)	0.01 0.03
Particulate - $PM_{2.5}$ (Filterable)	0.0479 (lb/MMBtu)	AP-42, Table 3.4-2 (10/96)	0.01 0.03
Particulate – CPM (Condensable)	0.0077 (lb/MMBtu)	AP-42, Table 3.4-2 (10/96)	2.23E-03
Sulfur Dioxide	0.29 (lb/MMBtu)	AP-42, Table 3.4-2 (10/96)	0.08 ✓
Nitrogen Oxides	4.41 (lb/MMBtu)	AP-42, Table 3.4-2 (10/96)	~~1.28~~ 1.65
Carbon Monoxide	0.95 (lb/MMBtu)	AP-42, Table 3.4-2 (10/96)	~~0.28~~ 0.15
Total Organic Compounds: Nonmethane	0.36 (lb/MMBtu)	AP-42, Table 3.4-2 (10/96)	~~0.10~~ 0.03

*Submit SFN 19839 for Hazardous Air Pollutants; include formaldehyde and total hazardous air pollutant emissions.

STACK EMISSIONS FUEL TYPE:

Air Contaminant*	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate - PM Total (Filterable)			
Particulate - PM_{10} (Filterable)			
Particulate - $PM_{2.5}$ (Filterable)			
Particulate - CPM (Condensable)			
Sulfur Dioxide			
Nitrogen Oxides			
Carbon Monoxide			
Total Organic Compounds: Nonmethane			

*Submit SFN 19839 for Hazardous Air Pollutants; include formaldehyde and total hazardous air pollutant emissions.

STACK EMISSIONS FUEL TYPE:

Air Contaminant*	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – PM Total (Filterable)			

Particulate - PM_{10} (Filterable)			
Particulate - $PM_{2.5}$ (Filterable)			
Particulate – CPM (Condensable)			
Sulfur Dioxide			
Nitrogen Oxides			
Carbon Monoxide			
Total Organic Compounds: Nonmethane			

*Submit SFN 19839 for Hazardous air Pollutants; include formaldehyde and total hazardous air pollutant emissions.

Provide calculations for quantities listed above. Use additional sheets if necessary. See Attached Spreadsheet Calculations

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report Terry Ludlum	Title Solid Waste Utility Director	Telephone Number (701) 241-1552
Signature Terry Ud	Email Address TLudlum@cityoffargo.com	Date 3-12-19

Return completed form to:
North Dakota Department of Health Division of Air Quality
918 E Divide, 2nd Floor Bismarck, ND 58501-1947
Telephone: (701)328-5188

HAZARDOUS AIR POLLUTANT ANNUAL ANNUAL EMISSIONS INVENTORY REPORT NORTH DAKOTA DEPARTMENT OF HEALTH DIVISION OF AIR QUALITY

SFN 19839 (06-14)

Name of Firm or Organization: City of Fargo Division of Solid Waste	Permit to Operate Number: T5-O98009	Year of Emissions: 2018	
Mailing Address: 2301 8th Avenue North	City: Fargo	State: ND	ZIP Code: 58102
Facility Name: City of Fargo MSW Landfill	Facility Location: Fargo	Emission Unit Number: Unit 3	
Amount of Material Processed (material used, etc.): 4237 Gallons diesel fuel			
Air Pollution Control Equipment: None		Hours of Operation: 269	

HAZARDOUS AIR POLLUTANT EMISSIONS:

CHEMICAL EMITTED TO AIR	CAS NUMBER	EMISSIONS QUANTITY	
		Emission Factor (include units)	TONS
Acetaldehyde	75-7-0	2.52E-05 lb/MMBtu	7.31E-06
Acrolein	107-02-8	7.88E-06 lb/MMBtu	2.29E-06
Benzene	71-43-2	7.76E-04 lb/MMBtu	2.25E-04
Formaldehyde	50-00-0	7.89E-05 lb/MMBtu	2.29E-05
PAH	NA	2.12E-04 lb/MMBtu	6.15E-05
Toluene	108-88-3	2.81E-04 lb/MMBtu	8.16E-05
Xylenes	1330-20-7	1.93E-04 lb/MMBtu	5.60E-05

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report: Terry Ludlum	Title: Solid Waste Utility Director	Telephone Number: (701) 241-1552
Signature: Terry Ludlum	Email Address: TLudlum@cityoffargo.com	Date: 3-12-19

Return completed form to:
North Dakota Department of Health Division of Air Quality
918 E Divide, 2nd Floor Bismarck, ND 58501-1947
Telephone: (701)328-5188

COMPRESSOR/INDUSTRIAL ENGINES
ANNUAL EMISSIONS INVENTORY REPORT
NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY

SFN 11829 (11-15)

GENERAL

Name of Film or Organization City of Fargo Division of Solid Waste	Permit to Operate Number T5-O98009	Year of Emissions 2018	
Mailing Address 2301 8th Avenue North	City Fargo	State ND	ZIP Code 58102
Facility Name City of Fargo MSW Landfill	Facility Location Fargo	Emission Unit Number 4	

EQUIPMENT INFORMATION

☐ Stationary Gas Turbine ☐ Reciprocating Engine ☐ Dual Fuel Engine ☐ Spark Ignition
☐ 2-Stroke Lean Burn
☐ Stationary Large Bore Diesel ☐ 4-Stroke Lean Burn ☐ Other, Specify________________ ■ Compression Ignition
☐ 4-Stroke Rich Burn

Manufacturer of Unit Caterpillar	Model Number G3516	Actual Hours of Operation 2,803 ✓
Maximum Rating 1306 BHP at 100% RPM	Design Capacity 1306 BHP at 100% RPM	
If turbine used for electrical generation: MWe-hours generated		

FUELS USED

Natural Gas (if applicable)	Thousand Cu. Ft.	Btu/Cu. Ft.	Percent H_2S
Diesel (if applicable)	Gallons	Btu/Gal	
LP Gas (if applicable)	Gallons	Btu/Gal	
Other (Specify) Landfill Gas	Specify 45,023,084.07 ft^3	Btu/Unit 550 Btu/ft^3	

COMPRESSOR STATION FLARE STACK EMISSIONS

Quantity Flared Thousand Cu. Ft./Yr	Average H_2S Content	SO_2 Emissions Tons/Yr

(The table below is used for single fuel combustion. Use the tables on the other side if multiple fuels are combusted and then summarize the total emissions per year in the "Tons" column below)

TOTAL STACK EMISSIONS

Air Contaminant*	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM Filterable)		See Note Below	0.59 ✓
Particulate - PM_{10} (Filterable)			0.59 ✓
Particulate - $PM_{2.5}$ (Filterable)			0.59 ✓
Particulate – CPM (Condensable)			
Sulfur Dioxide	4,366.24 mg/m^3	Landfill gas samples collected August - November 2012	~~6.14~~ 7.36
Nitrogen Oxides	250 $lb/10^6$ dscf	AP-42, Table 2.4-5 (11/98)	3.10 ✓
Carbon Monoxide	470 $lb/10^6$ dscf	AP-42, Table 2.4-5 (11/98)	5.82 ✓
Total Organic Compounds: Nonmethane	448.82 mg/m^3	Tier 2 Sampling (June 2017)	~~0.02~~ 0.01

*Submit SFN 19839 for Hazardous Air Pollutants; include formaldehyde and total hazardous air pollutant emissions.

STACK EMISSIONS

FUEL TYPE:

Air Contaminant*	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate - PM Total (Filterable)			
Particulate - PM_{10} (Filterable)			
Particulate - $PM_{2.5}$ (Filterable)			
Particulate - CPM (Condensable)			
Sulfur Dioxide			
Nitrogen Oxides			
Carbon Monoxide			
Total Organic Compounds: Nonmethane			

*Submit SFN 19839 for Hazardous Air Pollutants; include formaldehyde and total hazardous air pollutant emissions.

STACK EMISSIONS

FUEL TYPE:

Air Contaminant*	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – PM Total (Filterable)			

Particulate - PM_{10} (Filterable)			
Particulate - $PM_{2.5}$ (Filterable)			
Particulate – CPM (Condensable)			
Sulfur Dioxide			
Nitrogen Oxides			
Carbon Monoxide			
Total Organic Compounds: Nonmethane			

*Submit SFN 19839 for Hazardous air Pollutants; include formaldehyde and total hazardous air pollutant emissions.

Provide calculations for quantities listed above. Use additional sheets if necessary.
See Attached Spreadsheet Calculations. Particulate Emission Factors do not speciate Filterable vs. Condesable. Particulate emissions = 0.59 tons per year ✓

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report	Title	Telephone Number
Terry Ludlum	Solid Waste Utility Director	(701) 241-1552
Signature: Terry Ud	Email Address: TLudlum@cityoffargo.com	Date: 3-12-19

Return completed form to:
North Dakota Department of Health Division of Air Quality
918 E Divide, 2nd Floor Bismarck, ND 58501-1947
Telephone: (701)328-5188

HAZARDOUS AIR POLLUTANT ANNUAL ANNUAL EMISSIONS INVENTORY REPORT NORTH DAKOTA DEPARTMENT OF HEALTH DIVISION OF AIR QUALITY
SFN 19839 (06-14)

Name of Firm or Organization	Permit to Operate Number	Year of Emissions	
City of Fargo Division of Solid Waste	T5-O98009	2018	
Mailing Address: 2301 8th Avenue North	City: Fargo	State: ND	ZIP Code: 58102
Facility Name: City of Fargo MSW Landfill	Facility Location: Fargo	Emission Unit Number: Unit 4	
Amount of Material Processed (material used, etc.): 45,023,084.07 ft^3 Landfill Gas Estimated			
Air Pollution Control Equipment: None		Hours of Operation: 2,803 ✓	

HAZARDOUS AIR POLLUTANT EMISSIONS

CHEMICAL EMITTED TO AIR	CAS NUMBER	EMISSIONS QUANTITY	
		Emission Factor (include units)	TONS
Hydrogen Chloride	7647-01-0	4.31 ppmv	9.03E-03 ✓
Benzene	71-43-2	0.69 ppmv	4.31E-04 ✓
Ethyl Benzene	100-41-4	3.00 ppmv	2.54E-03 ✓
Methylene Chloride	75-09-2	0.14 ppmv	4.78E-05 ✓
Styrene	100-42-5	0.20 ppmv	1.66E-04 ✓
Tetrachloroethene	127-18-4	0.28 ppmv	1.87E-04 ✓
Toluene	108-88-3	12.00 ppmv	8.83E-03 ✓
Trichloroethene	79-01-06	0.11 ppmv	5.82E-05 ✓
Vinyl Chloride	75-01-4	0.52 ppmv	1.31E-04 ✓
Xylene	1330-20-7	6.40 ppmv	5.43E-03 ✓

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report	Title	Telephone Number
Terry Ludlum	Solid Waste Utility Director	(701) 241-1552
Signature: Terry Ul	Email Address: TLudlum@cityoffargo.com	Date: 3-12-19

Return completed form to:
North Dakota Department of Health Division of Air Quality
918 E Divide, 2nd Floor Bismarck, ND 58501-1947
Telephone: (701)328-5188

FUEL BURNING EQUIPMENT USED FOR INDIRECT HEATING
ANNUAL EMISSION INVENTORY REPORT
NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY
SFN 8536 (02-15)

GENERAL

Name of Firm or Organization		Permit to Operate Number	Year of Emissions	
City of Fargo Division of Solid Waste		T5-O98009	2018	
Mailing Address: 2301 8th Avenue North		City: Fargo	State: ND	ZIP Code: 58102
Facility Name: Fargo Sanitary Landfill	Facility Location: Fargo		Emission Unit Number: 5 and 6	

EQUIPMENT INFORMATION

Manufacturer of Unit	Model Number	Max Heat Input (Btu/hr)	Gross Electricity Generated (MWh)*
Burnham	4FW-827-45-G-GP	7.658 (each)	NA
Boiler Type: ☐ Pulverized Tangential ☐ Pulverized Wall Fired ☐ Fluidized Bed ☐ Cyclone ☐ Stoker Type: ______ ☒ Other: Specify: Gas fired		Hours of Operation: 848 hours total	Net Electricity Generated (MWh)*

*Electric utility only.

75% hours LFG, 25% nat. gas ex 636 hrs. 212hrs.

FUELS USED

Type	Primary Fuel	Standby Fuel	Other Fuel
Type (ex. Lignite coal, Subbituminous coal, RDF, Natural gas, LPG, No. 2 oil, No. 6 oil. etc.)	Natural Gas	Landfill Gas	
Quantity of Fuel per Year (Specify Units: ex. ton, gal, cu.ft., etc.)	6,918 therms 678,240.72 ft³ ex	2,766,400 cu.ft. ✓	
Percent Ash (Coal Only) Average			
Percent Sulfur Average	1,667 ppmv		
Btu per Unit (Specify lb, ton, gal, etc.) Average	1,020 Btu/cf	550 Btu/cf	
Percent Sodium in Coal Ash Average			

TOTAL STACK EMISSIONS

(The table below is used for single fuel combustion. Use the tables on the other side if multiple fuels are combusted and then summarize the total emissions per year in the "Tons" column below.)

Air Contaminant **	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM (Filterable)	See Tables Below for Landfill Gas and Natural Gas	See Tables Below for Landfill Gas and Natural Gas	~~5.03~~ 3.97 ex
Particulate – PM_{10} (Filterable)	See Tables Below for Landfill Gas and Natural Gas	See Tables Below for Landfill Gas and Natural Gas	~~5.03~~ 3.97 ex
Particulate – $PM_{2.5}$ (Filterable)	See Tables Below for Landfill Gas and Natural Gas	See Tables Below for Landfill Gas and Natural Gas	~~5.03~~ 3.97 ex
Particulate – CPM (Condensable)	See Tables Below for Landfill Gas and Natural Gas	See Tables Below for Landfill Gas and Natural Gas	1.93E-03
Sulfur Dioxide	See Tables Below for Landfill Gas and Natural Gas	See Tables Below for Landfill Gas and Natural Gas	~~3.77E-01~~ 0.45 ex
Nitrogen Oxides	See Tables Below for Landfill Gas and Natural Gas	See Tables Below for Landfill Gas and Natural Gas	~~20.30~~ 16.00 ex
Carbon Monoxide	See Tables Below for Landfill Gas and Natural Gas	See Tables Below for Landfill Gas and Natural Gas	~~3.52~~ 2.79 ex
Total Organic Compounds: Nonmethane	See Tables Below for Landfill Gas and Natural Gas	See Tables Below for Landfill Gas and Natural Gas	3.73E-03 ✓
Mercury***	See Tables Below for Landfill Gas and Natural Gas	See Tables Below for Landfill Gas and Natural Gas	2.95E-07
Ammonia***	NA	NA	NA

**Submit SFN 19839 for Hazardous Air Pollutants if applicable.
***Title V coal and oil-fired units only.

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report	Title	Telephone Number
Terry Ludlum	Solid Waste Utility Director	701-241-1552
Signature: Terry Ld	Email Address: Tludlum@cityoffargo.com	Date: 3-12-19

Return completed form to:
North Dakota Department of Health
Division of Air Quality
918 E Divide, 2nd Floor
Bismarck, ND 58501-1947
Telephone: (701)328-5188

STACK EMISSIONS	Primary Fuel (Type): Natural Gas	Quantity: 6,918.00 therms	
Air Contaminant **	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM (Filterable)	1.9 lbs/106 dscf	AP-42 Table 1.4-2 (7/98)	6.44E-04
Particulate – PM_{10} (Filterable)	1.9 lbs/106 dscf	AP-42 Table 1.4-2 (7/98)	6.44E-04
Particulate – $PM_{2.5}$ (Filterable)	1.9 lbs/106 dscf	AP-42 Table 1.4-2 (7/98)	6.44E-04
Particulate – CPM (Condensable)	5.7 lbs/106 dscf	AP-42 Table 1.4-2 (7/98)	1.93E-03
Sulfur Dioxide	0.60 lb/106 dscf	AP-42 Table 1.4-2 (7/98)	2.03E-04
Nitrogen Oxides	100 lb/106 dscf	AP-42 Table 1.4-2 (7/98)	3.39E-02
Carbon Monoxide	84 lb/106 dscf	AP-42 Table 1.4-2 (7/98)	2.85E-02
Total Organic Compounds: Nonmethane	8.7 lb/106 dscf	AP-42 Table 1.4-2 (7/98)	2.95E-03
Mercury***	2.6E-4 lb/106 dscf	AP-42 Table 1.4-2 (7/98)	8.82E-08
Ammonia***	NA	NA	NA

STACK EMISSIONS	Standby Fuel (Type): Landfill Gas	Quantity: 2,766,400.0 ft3/yr	
Air Contaminant **	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM (Filterable)	8.2 lb/10^6 dscf	AP-42, Table 2.4-5	5.03
Particulate – PM_{10} (Filterable)	8.2 lb/10^6 dscf	AP-42, Table 2.4-5	5.03
Particulate – $PM_{2.5}$ (Filterable)	8.2 lb/10^6 dscf	AP-42, Table 2.4-5	5.03
Particulate – CPM (Condensable)		No data, so assuming all PM is filterable	
Sulfur Dioxide	4,366.24 mg/m3	Landfill Gas Samples (8/12-11/12)	3.77E-01
Nitrogen Oxides	33 lb/10^6 dscf	AP-42, Table 2.4-5	20.2
Carbon Monoxide	5.7 lb/106 dscf	AP-42, Table 2.4-5	3.49
Total Organic Compounds: Nonmethane	175.04 mg/m3	Landfill Gas Sample (June 2017)	7.75E-04
Mercury***	0.0024 mg/m3	AP-42, Table 2.4-1	2.07E-07
Ammonia***	NA	NA	NA

STACK EMISSIONS	Other Fuel (Type):	Quantity:	
Air Contaminant **	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total (Filterable)			
Particulate – PM_{10} (Filterable)			
Particulate – $PM_{2.5}$ (Filterable)			
Particulate – CPM Condensable)			
Sulfur Dioxide			
Nitrogen Oxides			
Carbon Monoxide			
Total Organic Compounds: Nonmethane			
Other			

**Submit SFN 19839 for Hazardous Air Pollutants if applicable.
***Title V coal and oil-fired units only.

Use additional sheets if necessary to provide calculations for quantities listed above.

HAZARDOUS AIR POLLUTANT ANNUAL
ANNUAL EMISSIONS INVENTORY REPORT
NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY
SFN 19839 (06-14)

Name of Firm or Organization	Permit to Operate Number	Year of Emissions	
City of Fargo Division of Solid Waste	T5-O98009	2018	
Mailing Address	City	State	ZIP Code
2301 8th Avenue North	Fargo	ND	58102
Facility Name	Facility Location	Emission Unit Number	
City of Fargo MSW Landfill	Fargo	Units 5 & 6	
Amount of Material Processed (material used, etc.)			
2,766,400 scf LFG; 6,918 therms natural gas			
Air Pollution Control Equipment		Hours of Operation	
NA		848 (total hours) ✓	

HAZARDOUS AIR POLLUTANT EMISSIONS:

CHEMICAL EMITTED TO AIR	CAS NUMBER	EMISSIONS QUANTITY	
		Emission Factor (include units)	TONS
2-Methylnaphthalene	91-57-6	2.4E-05 lbs/10^6 scf	8.14E-09
3-Methylchloranthrene	56-49-5	1.8E-06 lbs/10^6 scf	6.10E-10
7,12-Dimethylbenz(a)anthracene	57-97-6	1.6E-05 lbs/10^6 scf	5.43E-09
Acenaphthene	83-82-9	1.8E-06 lbs/10^6 scf	6.10E-10
Acenaphthylene	203-96-8	1.8E-06 lbs/10^6 scf	6.10E-10
Anthracene	120-12-7	2.4E-06 lbs/10^6 scf	8.14E-10
Benz(a)anthracene	56-55-3	1.8E-06 lbs/10^6 scf	6.10E-10
Benzene	71-43-2	2.1E-03 lbs/106 scf 0.69 ppmv from LFG sample (5/25/2012)	1.09E-06
Benzo(a)pyrene	50-32-8	1.2E-06 lbs/10^6 scf	4.07E-10
Benzo(b)flouranthene	205-99-2	1.8E-06 lbs/10^6 scf	6.10E-10
Benzo(g,h,i)perylene	191-24-2	1.2E-06 lbs/10^6 scf	4.07E-10
Benzo(k)flouranthene	205-82-3	1.8E-06 lbs/10^6 scf	6.10E-10
Chrysene	208-01-9	1.8E-06 lbs/10^6 scf	6.10E-10
Dibenzo(a,h)anthracene	53-70-3	1.2E-06 lbs/10^6 scf	4.07E-10
Dichlorobenzene	25321-22-6	1.2E-03 lbs/10^6 scf	4.07E-07

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report	Title	Telephone Number
Terry Ludlum	Solid Waste Utility Director	701-241-1552
Signature Terry Ludlum	Email Address	Date
	TLudlum@cityoffargo.com	3-12-19

Return completed form to:
North Dakota Department of Health
Division of Air Quality
918 E Divide, 2nd Floor
Bismarck, ND 58501-1947
Telephone: (701)328-5188

HAZARDOUS AIR POLLUTANT ANNUAL
ANNUAL EMISSIONS INVENTORY REPORT

NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY
SFN 19839 (06-14)

Name of Firm or Organization	Permit to Operate Number	Year of Emissions	
City of Fargo Division of Solid Waste	T5-O98009	2018	
Mailing Address	**City**	**State**	**ZIP Code**
2301 8th Avenue North	Fargo	ND	58102
Facility Name	**Facility Location**	**Emission Unit Number**	
City of Fargo MSW Landfill	Fargo	Units 5 & 6	
Amount of Material Processed (material used, etc.)			
2,766,400 scf LFG; 6,918 therms natural gas			
Air Pollution Control Equipment		**Hours of Operation**	
NA		848 (total hours) ✓	

HAZARDOUS AIR POLLUTANT EMISSIONS:

CHEMICAL EMITTED TO AIR	CAS NUMBER	EMISSIONS QUANTITY	
		Emission Factor (include units)	TONS
Ethyl Benzene	100-41-4	3.00 ppmv from LFG sample (5/25/2012)	2.25E-06
Flouranthene	206-44-0	3.0E-06 lbs/10^6 scf	1.02E-09
Flourene	86-73-7	2.8E-06 lbs/10^6 scf	9.50E-10
Formaldehyde	50-00-0	7.5E-02 lbs/10^6 scf	2.54E-05
Hexane	110-54-3	1.8 lbs/10^6 scf	6.10E-04
Hydrogen Chloride	7647-01-0	4.31 ppmv from LFG sample (June 2017)	5.56E-04
Indeno(1,2,3-cd)pyrene	193-39-5	1.8E-06 lbs/10^6 scf	6.10E-10
Methylene Chloride	75-09-2	0.14 ppmv from LFG sample (5/25/2012)	1.68E-07
Naphthalene	91-20-3	6.1E-04 lbs/10^6 scf	2.07E-07
Phenanthracene	85-01-0	1.7E-05 lbs/10^6 scf	5.77E-09
Pyrene	190-00-0	5.0E-05 lbs/10^6 scf	1.70E-08
Styrene	100-42-5	0.20 ppmv from LFG sample (5/25/2012)	1.47E-07
Toluene	108-88-3	3.4E-03 lbs/10^6 scf 12.0 ppmv from LFG sample (5/25/2012)	8.96E-06
Tetrachloroethene	127-18-4	0.28 ppmv from LFG sample (5/25/2012)	6.56E-07
Trichloroethene	79-01-6	0.11 ppmv from LFG sample (5/25/2012)	2.04E-07

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report	Title	Telephone Number
Terry Ludlum	Solid Waste Utility Director	701-241-1552
Signature	**Email Address**	**Date**
Terry Ll	TLudlum@cityoffargo.com	3-12-19

Return completed form to:
North Dakota Department of Health
Division of Air Quality
918 E Divide, 2nd Floor
Bismarck, ND 58501-1947
Telephone: (701)328-5188

HAZARDOUS AIR POLLUTANT ANNUAL
ANNUAL EMISSIONS INVENTORY REPORT

NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY
SFN 19839 (06-14)

Name of Firm or Organization City of Fargo Division of Solid Waste	Permit to Operate Number T5-O98009	Year of Emissions 2018
Mailing Address 2301 8th Avenue North	City Fargo	State ND / ZIP Code 58102
Facility Name City of Fargo MSW Landfill	Facility Location Fargo	Emission Unit Number Units 5 & 6
Amount of Material Processed (material used, etc.) 2,766,400 scf LFG; 6,918 therms natural gas		
Air Pollution Control Equipment NA		Hours of Operation 848 (total hours) ✓

HAZARDOUS AIR POLLUTANT EMISSIONS:

CHEMICAL EMITTED TO AIR	CAS NUMBER	EMISSIONS QUANTITY	
		Emission Factor (include units)	TONS
Vinyl Chloride	75-01-4	0.52 ppmv from LFG sample (5/25/2012)	4.59E-07
Xylene	1330-20-7	6.40 ppmv from LFG sample (5/25/2012)	4.80E-06
Arsenic	7440-38-2	2.00E-04 lbs/10^6 scf	6.78E-08
Beryllium	7440-41-7	1.2E-05 lbs/10^6 scf	4.07E-09
Cadmium	7440-43-9	1.10E-03 lbs/10^6 scf	3.73E-07
Chromium	7440-47-3	1.40E-03 lbs/10^6 scf	4.75E-07
Cobalt	7440-48-4	8.4E-05 lbs/10^6 scf	2.85E-08
Manganese	7439-96-5	3.8E-04 lbs/10^6 scf	1.29E-07
Mercury	7439-97-6	2.6E-04 lbs/10^6 scf 2.92E-04 ppmv for LFG	2.95E-07
Nickel	7440-02-0	2.10E-03 lbs/10^6 scf	7.12E-07
Selenium	7782-49-2	2.4E-05 lbs/10^6 scf	8.14E-09

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report Terry Ludlum	Title Solid Waste Utility Director	Telephone Number 701-241-1552
Signature Terry Ul	Email Address TLudlum@cityoffargo.com	Date 3-12-19

Return completed form to:
North Dakota Department of Health
Division of Air Quality
918 E Divide, 2nd Floor
Bismarck, ND 58501-1947
Telephone: (701)328-5188

City of Fargo, Division of Solid Waste

Fargo MSW Landfill 2018 Emissions Inventory
Units 1 and 2: Landfill Gas Emission Calculations
Project No. : 0208-0150

Gas Flow Data:			**Comment**
LFG sent off-site:	236,595,158	ft^3 ✓	Supplied by City of Fargo
Total LFG Collected:	319,631,699	ft^3	
Hours LFG sent off-site (Cargill):	7,412	hours ✓	Supplied by City of Fargo
Hours of flare operation:	966	hours ✓	Supplied by City of Fargo
Hours of gas system down time[1]:	399	hours ✓	Supplied by City of Fargo

Note: Gas is not vented to atmosphere during downtime, pressure is allowed to build up in the landfill.

Parameters:

Active gas system collection efficiency: 75% AP-42, Section 2.4, 11/98

LFG Collection Rate: ~~319,631,699 ft3 x 1/8760 hr =~~ 236,595,158 ft^3 x 1/7412 = ~~36,487.64~~ 31,920.56 ft^3/hr collected ✓
~~1,033.21~~ 903.89 m^3/hr collected

Total Gas Generation: ~~319,631,699~~ 236,595,158 ft3 x ~~1/8760~~ 1/7412 hr x 1/0.75 = ~~48,650.18~~ 42,560.75 ft^3/hr generated total
= ~~1,377.62~~ 1,205.19 m^3/hr generated total
= 426,175,599.10 ft^3/yr generated total ✓

Fugitive Landfill Gas: ~~48,650.18~~ 42,560.75 ft3/hr x (1-0.75) x ~~8760~~ 7,412 hr/yr = ~~106,543,900~~ 78,865,069.75 ft^3/yr ✓
= ~~3,016,987.27~~ 2233210.08 m^3/yr

Fugitive Landfill Gas Emissions

Compound	CAS No.	Compound Concentration (ppmv)	Molecular Weight (g/mol)	Gravimetric Concentration (mg/m³)	Fugitive LFG Emissions (ton/yr)
NMOCs (as hexane)[1,4]	NA	127.33	86.18	448.82	1.49 ✓
VOCs[2]	NA	49.66	86.18	175.04	0.58 ✓
Carbon Monoxide[3]	630-08-0	141.00	28.01	161.53	0.54 ✓
Benzene[1]	71-43-2	0.69	78.11	2.20	0.0073 ✓
Ethyl Benzene[1]	100-41-4	3.00	106.16	13.03	0.0433 ✓
Methylene Chloride[1]	75-09-2	0.14	84.94	0.49	0.0016 ✓
Styrene[1]	100-42-5	0.20	104.15	0.85	0.0028 ✓
Tetrachloroethene[1]	127-18-4	0.28	165.83	1.90	0.0063 ✓
Toluene[1]	108-88-3	12.00	92.13	45.22	0.1504 ✓
Trichloroethene[1]	79-01-6	0.11	131.40	0.59	0.0020 ✓
Vinyl Chloride[1]	75-01-4	0.52	62.50	1.33	0.0044 ✓
Xylene[1]	1330-20-7	6.40	106.16	27.79	0.0924 ✓

[1] NMOC concentration obtained from samples taken in June 2017, and HAP compound concentrations obtained from landfill gas samples taken on 5/25/2012. HAPs with non-detect results are not included.

[2] VOCs are calculated as 39% of NMOC emissions, based on AP-42, Table 2.4-2, Footnote c (Nov. 1998).

[3] CO concentration obtained from AP-42, Table 2.4-1 (Nov. 1998).

[4] NMOC is measured as carbon (1 carbon) and coverted to hexane (6 carbons) (i.e. divided by a factor of 6).

<u>Sample Calculations</u>

NMOC Gravimetric Concentration:

= 127.3 L NMOC/1,000,000 L LFG x aV

NMOC Emissions:

= 448.82 mg/m³ x 3.017E+06 m³ LFG/yr x Mg/10^9 mg x 1.1023 ton/Mg = 1.493 ton NMOC/yr

Where:

24.45 L/mol = Standard volume of an ideal gas at 25°C

86.18 g/mol = Molecular weight of hexane

1.1023 ton/Mg = Coversion factor obtained from 40 CFR 60, Subpart WWW.

City of Fargo, Division of Solid Waste

Fargo MSW Landfill 2018 Emissions Inventory
Units 1 and 2: Landfill Gas Emission Calculations
Project No. : 0208-0150

LFG Controlled at the Flare: ~~1,033.21~~ 903.89 m3/hr collected x 966 hr/yr = ~~998,085.51~~ 873,157.74 m³/yr
~~35,247,057.25~~ 30,835,274 ft³/yr

Landfill Gas Emissions at the Flare

Compound	CAS No.	Compound Concentration (ppmv)	Molecular Weight (g/mol)	Gravimetric Concentration (mg/m³)	Control Efficiency[5] (%)	Flare LFG Emissions (ton/yr)	Average Emissions (lb/hr)
NMOCs (as hexane)[1]	NA	127.33	86.18	448.82	99.20%	3.95E-03	9.02E-04
VOCs[2]	NA	49.66	86.18	175.04	99.20%	1.54E-03	3.52E-04
Sulfur Dioxide[3]	7446-09-5	1,667.00	64.04	4,366.24	0.00%	4.80E+00 5.04	1.10E+00
Hydrogen Chloride[4]	7647-01-0	4.31	36.45	6.62	0.00%	7.28E-03 0.006	1.66E-03
Benzene[1]	71-43-2	0.69	78.11	2.20	99.70%	7.28E-06	1.66E-06
Ethyl Benzene[1]	100-41-4	3.00	106.16	13.03	99.70%	4.30E-05	9.82E-06
Methylene Chloride[1]	75-09-2	0.14	84.94	0.49	98.00%	1.07E-05	2.44E-06
Styrene[1]	100-42-5	0.20	104.15	0.85	99.70%	2.81E-06	6.42E-07
Tetrachloroethene[1]	127-18-4	0.28	165.83	1.90	98.00%	4.18E-05	9.54E-06
Toluene[1]	108-88-3	12.00	92.13	45.22	99.70%	1.49E-04	3.41E-05
Trichloroethene[1]	79-01-6	0.11	131.40	0.59	98.00%	1.30E-05	2.97E-06
Vinyl Chloride[1]	75-01-4	0.52	62.50	1.33	98.00%	2.92E-05	6.68E-06
Xylene[1]	1330-20-7	6.40	106.16	27.79	99.70%	9.17E-05	2.09E-05

[1] NMOC concentration obtained from samples taken in June 2017, and HAP compound concentrations obtained from landfill gas samples taken on 5/25/2012. HAPs with non-detect results are not included.

[2] VOCs are calculated as 39% of NMOC emissions, based on AP-42, Table 2.4-2, Footnote c (Nov. 1998).

[3] SO2 concentrations are conservatively assumed to be that of H2S. H2S concentration was tested in the landfill gas, and is estimated to be 1667 ppm based on landfill gas samples collected between August and November 2012.

[4] The hydrogen chloride (HCl) is formed as compounds are combusted at the flare. The HCl concentration was estimated by all compound with a Cl- ion found in the three landfill gas samples, 5/25/2012, in combinations with Equation 9 of AP-42 Section 2.4.

[5] Control efficiencies obtained from AP-42, Table 2.4-3 (Nov. 1998).

Landfill Gas Collection Rate = ~~36,488~~ 31,920.56 ft³ LFG/hr

Methane Collection Rate: ~~36,488 ft3~~ LFG/hr x 0.55 ft3 methane/ft3 LFG = ~~20,068~~ 17,556.31 ft³ methane/hr

Where 55% methane obtained from AP-42, Page 2.4-4, Nov. 1998.

Secondary Flare Emission Calculations

Pollutant	Emission Factor[1] (lb/10⁶ dscf) (methane)	Actual Emission Rate (lbs/hr)	Flare Operating Hours	Actual Emissions (tons/yr)	Average Emissions (lb/hr)	
PM/PM10/PM2.5	17	0.34	966	1.65E-01	3.76E-02	0.144 tn/yr
NO_x	40	0.80	966	3.88E-01	8.85E-02	
CO	750	15.05	966	~~7.27E+00~~	1.66E+00	6.36 tn/yr

[1] Emission factors obtained from AP-42, Table 2.4-5 (Nov. 1998)

Summary

Pollutant	CAS No.	Fugitive Landfill Gas Emissions (ton/yr)	Flare Emissions (ton/yr)	Total Landfill Gas Emissions (ton/yr)	Average Emissions Rate (lb/hr)	Maximum Hourly Emissions during Flare Operation (lb/hr)	
NMOCs (as hexane)	NA	1.49E+00	3.95E-03	1.50E+00	3.42E-01	3.49E-01	
VOCs	NA	5.82E-01	1.54E-03	5.84E-01	1.33E-01	1.36E-01	
Carbon Monoxide	630-08-0	5.37E-01	7.27E+00	~~7.81E+00~~	1.78E+00	1.52E+01	6.9 tn/yr
Nitrogen Oxides	NA	---	3.88E-01	~~3.88E-01~~	8.85E-02	8.03E-01	0.39 tn/yr
PM/PM10/PM2.5	NA	---	1.65E-01	~~1.65E-01~~	3.76E-02	3.41E-01	0.14 tn/yr
Sulfur Dioxide	7446-09-5	---	4.80E+00	~~4.80E+00~~	1.10E+00	9.95E+00	5.04 tn/yr
Hydrogen Chloride	7647-01-0	---	7.28E-03	7.28E-03	1.66E-03	1.51E-02	
Benzene	71-43-2	7.33E-03	7.28E-06	7.34E-03	1.68E-03	1.69E-03	
Ethyl Benzene	100-41-4	4.33E-02	4.30E-05	4.34E-02	9.90E-03	9.98E-03	
Methylene Chloride	75-09-2	1.62E-03	1.07E-05	1.63E-03	3.72E-04	3.91E-04	
Styrene	100-42-5	2.83E-03	2.81E-06	2.84E-03	6.47E-04	6.53E-04	
Tetrachloroethene	127-18-4	6.32E-03	4.18E-05	6.36E-03	1.45E-03	1.53E-03	
Toluene	108-88-3	1.50E-01	1.49E-04	1.51E-01	3.44E-02	3.46E-02	
Trichloroethene	79-01-6	1.97E-03	1.30E-05	1.98E-03	4.52E-04	4.76E-04	
Vinyl Chloride	75-01-4	4.42E-03	2.92E-05	4.45E-03	1.02E-03	1.07E-03	
Xylene	1330-20-7	9.24E-02	9.17E-05	9.25E-02	2.11E-02	2.13E-02	
Total HAPs				**0.3183**	**0.0727**	**0.0868**	

City of Fargo, Division of Solid Waste

Fargo MSW Landfill 2018 Emissions Inventory
Unit 3: Wood Grinder Emission Calculations
Project No. : 0208-0150

Grinder Throughput Information:

			Comment
Hours of operation:	269	hr/yr ✓	Supplied by City of Fargo
Wood ground:	8,070	ton/yr ✓	Supplied by City of Fargo
Diesel Fuel Combusted:	4,237	gal/yr ✓	Supplied by City of Fargo

Grinding Particulate Emissions:

Pollutant	Emission Factor (lb/ton)	Actual Emissions (ton/yr)	Average Hourly Emission Rate (lb/hr)
Particulate Matter (PM/PM10/PM2.5)	0.35	1.41 ✓	10.50

Emission factors obtained from AP-42 4th Edition, Table 10.3-1 for "Uncontrolled fugitive emissions factors for plywood veneer and layout operations" Feb. 1980.

Engine Parameters:

Engine type:	12-cylinder, diesel fueled
Rated capacity:	650 Horsepower
Actual Fuel Consumption rate:	15.75 gal/hr
Heat content of diesel fuel:	137,000 Btu/gal, AP-42, Page A-5, Sept. 1985.

Engine Combustion Emissions:

Pollutant	Emission Factor (lb/MMBtu)	Hourly Emission Rate (lb/hr)	Actual Emissions (ton/yr)	
Particulate Matter (PM) filt	0.062	0.13	~~0.02~~	0.03 tn/yr. ct
PM10 filterable	0.0496	0.11	~~0.01~~	0.03 tn/yr ct
PM2.5 filterable	0.0479	0.10	~~0.01~~	0.03 tn/yr ct
Condensable Particulate	0.0077	0.02	2.23E-03	
Oxides of Nitrogen (NOx)	4.41	9.52	~~1.28~~	1.65 tn/yr ct
Sulfur Dioxide (SO2)	0.29	0.63	0.08 ✓	
Carbon Monoxide (CO)	0.95	2.05	~~0.28~~	0.15 tn/yr ct
Total Org. Cmpds (TOC)	0.36	0.78	~~0.10~~	0.03 tn/yr

Emission factors taken from AP-42, Table 3.4-2 (10/96), Large Diesel fueled industrial engines.
The maximum diesel capacity listed for AP-42, Section 3.3 is to 600 hp.

Pollutant	CAS No.	Emission Factor (lb/MMBtu)	Emission Factor (lb/Gallon)	Usage (Gallons)	Emissions (tpy)
Acetaldehyde	75-7-0	2.52E-05	3.45E-06	4237	7.31E-06
Acrolein	107-02-8	7.88E-06	1.08E-06	4237	2.29E-06
Benzene	71-43-2	7.76E-04	1.06E-04	4237	2.25E-04
Formaldehyde	50-00-0	7.89E-05	1.08E-05	4237	2.29E-05
PAH	NA	2.12E-04	2.90E-05	4237	6.15E-05
Toluene	108-88-3	2.81E-04	3.85E-05	4237	8.16E-05
Xylenes	1330-20-7	1.93E-04	2.64E-05	4237	5.60E-05
Total HAPs					**4.57E-04**

Emission factors are from AP-42 Table 3.4-3. Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines.

Total Wood Grinder Emissions:

Pollutant	Hourly Emissions (lb/hr)	Actual Emissions (ton/yr)	
Particulate Matter (PM) (PM/PM10/PM2.5)	10.63	1.43 ✓	
Oxides of Nitrogen (NOx)	9.52	~~1.28~~	1.65 tn/yr ct
Sulfur Dioxide (SO_2)	0.63	0.08 ✓	
Carbon Monoxide (CO)	2.05	~~0.28~~	0.15 tn/yr ct
Total Org. Cmpds (TOC)	0.78	~~0.10~~	0.03 tn/yr ct

City of Fargo, Division of Solid Waste

Fargo MSW Landfill 2018 Emissions Inventory
Unit 4: Generator Emission Calculations
Project No. : 0208-0150

Hours of generator operation: 2,803 hours ✓ — Comment: Supplied by City of Fargo

Engine LFG Capacity: 925 kW x 1.341 bhp/kW x 7122 Btu/bhp-hr ÷550 Btu/ft^3 = 16,062.4 ft^3/hr
140,706,414.56 ft^3/yr

LFG Controlled at the Engine: 16,062.38 ft3/hr collected x 0.0283m3/ft3 x 2,803 hr/yr = 1,274,911.77 m^3/yr
45,023,084.07 ft^3/yr

Compound	CAS No.	Compound Concentration (ppmv)	Molecular Weight (g/mol)	Gravimetric Concentration (mg/m³)	Control Efficiency[5] (%)	Actual Emissions (ton/yr)
NMOCs (as hexane)[1]	NA	127.33	86.18	448.82	97.20%	1.77E-02 ✓
VOCs[2]	NA	49.66	86.18	175.04	97.20%	6.89E-03 ✓
Sulfur Dioxide[3]	7446-09-5	1,667.00	64.04	4,366.24	0.00%	~~6.14~~ 7.36 tn/yr
Hydrogen Chloride[4]	7647-01-0	4.31	36.45	6.43	0.00%	9.03E-03 ✓
Benzene[1]	71-43-2	0.69	78.11	2.20	86.10%	4.31E-04
Ethyl Benzene[1]	100-41-4	3.00	106.16	13.03	86.10%	2.54E-03
Methylene Chloride[1]	75-09-2	0.14	84.94	0.49	93.00%	4.78E-05
Styrene[1]	100-42-5	0.20	104.15	0.85	86.10%	1.66E-04
Tetrachloroethene[1]	127-18-4	0.28	165.83	1.90	93.00%	1.87E-04
Toluene[1]	108-88-3	12.00	92.13	45.22	86.10%	8.83E-03 ✓
Trichloroethene[1]	79-01-6	0.11	131.40	0.59	93.00%	5.82E-05
Vinyl Chloride[1]	75-01-4	0.52	62.50	1.33	93.00%	1.31E-04
Xylene[1]	1330-20-7	6.40	106.16	27.79	86.10%	5.43E-03 ✓

[1] Compound concentrations were directly obtained from three landfill gas samples, June 2017 and 5/25/2012.

[2] VOCs are calculated as 39% of NMOC emissions, based on AP-42, Table 2.4-2, Footnote c (Nov. 1998).

[3] SO2 concentrations are conservatively assumed to be that of H2S. H2S concentration is assumed to be 1667 ppm based on landfill gas samples collected between August and November 2012.

[4] The hydrogen chloride (HCl) is formed as compounds are combusted at the flare. The HCl concentration was estimated by all compounds with a Cl ion found in the three landfill gas samples, 5/25/2012, in combinations with Equation 9 of AP-42 Section 2.4.

[5] Control efficiencies obtained from AP-42, Table 2.4-3 (Nov. 1998).

Sample Calculations
NMOC Gravimetric Concentration:
= 127.3 L NMOC/1,000,000 L LFG x mol/24.45 L x 86.18 g NMOC/mol x 1000 mg/g x 1000 L/m³ = 448.82 mg/m
NMOC Emissions:
= 448.82 mg/m³ x 1.275E+06 m³ LFG/yr x Mg/10^9 mg x 1.1023 ton/Mg = 0.018 ton NMOC/yr

Where:
24.45 L/mol = Standard volume of an ideal gas at 25°C
86.18 g/mol = Molecular weight of hexane
1.1023 ton/Mg = Coversion factor obtained from 40 CFR 60, Subpart WWW.

Engine Capacity: 16,062 ft3 LFG/hr x 0.55 ft3 methane/ft3 LFG = 8,834 ft^3 methane/hr
Where 55% methane obtained from AP-42, Page 2.4-4, Nov. 1998.

Engine Secondary Emission Calculations:

Pollutant	Emission Factor (lb/10^6 dscf) (methane)	Hourly Emission Rate (lbs/hr)	Engine Operating Hours	Actual Emissions (tons/yr)
PM/PM10/PM2.5	48	0.42	2,803	0.59 ✓
NO_x	250	2.21	2,803	3.10 ✓
CO	470	4.15	2,803	5.82 ✓

Emission factors obtained from AP-42, Table 2.4-5 (Nov. 1998)

Total Engine Emissions:

Pollutant	CAS No.	Engine Emissions (ton/yr)	Maximum Emissions Rate (lb/hr)
NMOCs (as hexane)	NA	1.77E-02	1.26E-02
VOCs	NA	6.89E-03	4.91E-03
Carbon Monoxide	630-08-0	5.82	4.15
Nitrogen Oxides	NA	3.10	2.21
PM/PM10/PM2.5	NA	0.59	0.42
Sulfur Dioxide	7446-09-5	6.14	4.38
Hydrogen Chloride	7647-01-0	9.03E-03	6.44E-03
Benzene	71-43-2	4.31E-04	3.07E-04
Ethyl Benzene	100-41-4	2.54E-03	1.82E-03
Methylene Chloride	75-09-2	4.78E-05	3.41E-05
Styrene	100-42-5	1.66E-04	1.19E-04
Tetrachloroethene	127-18-4	1.87E-04	1.33E-04
Toluene	108-88-3	8.83E-03	6.30E-03
Trichloroethene	79-01-6	5.82E-05	4.15E-05
Vinyl Chloride	75-01-4	1.31E-04	9.33E-05
Xylene	1330-20-7	5.43E-03	3.87E-03

City of Fargo, Division of Solid Waste
Fargo MSW Landfill 2018 Emissions Inventory
Units 5 and 6: Boiler Emission Calculations - LFG
Project No. : 0208-0150

Maximum Rated Boiler Capacity: 7.7 MMBtu/hr Gas (EACH)
Boilers 5 & 6 Fuel Parameters:
Total Boiler Operating Hours: ~~805.6~~ 9448 hrs
Total Quantity of Fuel Used Per Year: 2,766,400.0 ft^3/yr ✓
78,335.72 m^3/yr

Calculations Summary - Fuel : Landfill Gas

Compound	CAS No.	Compound Concentration (ppmv)	Molecular Weight (g/mol)	Gravimetric Concentration (mg/m³)	Control Efficiency[5] (%)	Boiler LFG Emissions (ton/yr)
NMOCs (as hexane)[1]	NA	127.33	86.18	448.82	98.00%	7.75E-04 ✓
VOCs[2]	NA	49.66	86.18	175.04	98.00%	3.02E-04 ✓
Sulfur Dioxide[3]	7446-09-5	1667.00	64.04	4,366.24	0.00%	~~3.77E-01~~ 0.18 tn/yr et
Hydrogen Chloride[4]	7647-01-0	4.31	36.45	6.62	0.00%	5.71E-04
Benzene[1]	71-43-2	0.69	78.11	2.20	99.80%	3.81E-07
Ethyl Benzene[1]	100-41-4	3.00	106.16	13.03	99.80%	2.25E-06
Methylene Chloride[1]	75-09-2	0.14	84.94	0.49	99.60%	1.68E-07
Mercury[6]	7439-97-6	2.92E-04	200.61	2.40E-03	0.00%	2.07E-07
Styrene[1]	100-42-5	0.20	104.15	0.85	99.80%	1.47E-07
Tetrachloroethene[1]	127-18-4	0.28	165.83	1.90	99.60%	6.56E-07
Toluene[1]	108-88-3	12.00	92.13	45.22	99.80%	7.81E-06
Trichloroethene[1]	79-01-6	0.11	131.40	0.59	99.60%	2.04E-07
Vinyl Chloride[1]	75-01-4	0.52	62.50	1.33	99.60%	4.59E-07
Xylene[1]	1330-20-7	6.40	106.16	27.79	99.80%	4.80E-06

[1] Compound concentrations were directly obtained from three landfill gas samples, 5/25/2012.
[2] VOCs are calculated as 39% of NMOC emissions, based on AP-42, Table 2.4-2, Footnote c (Nov. 1998).
[3] SO2 concentrations are conservatively assumed to be that of H2S. H2S concentration is assumed to be 1667 ppm based on landfill gas samples collected between August and November 2012.
[4] The hydrogen chloride (HCl) is formed as compounds are combusted at the flare. The HCl concentration was estimated by all compounds with a Cl- ion found in the three landfill gas samples, 5/25/2012, in combinations with Equation 9 of AP-42 Section 2.4.
[5] Control efficiencies obtained from AP-42, Table 2.4-3 (Nov. 1998).
[6] Mercury concentrations are based on AP-42, Table 2.4-1 (Nov. 1998).

Sample Calculations
NMOC Gravimetric Concentration:
= 127.3 L NMOC/1,000,000 L LFG x mol/24.45 L x 86.18 g NMOC/mol x 1000 mg/g x 1000 L/m³ = 448.82 mg/m³
NMOC Emissions:
= 448.82 mg/m³ x 7.834E+04 m³ LFG/yr x Mg/10^9 mg x 1.1023 ton/Mg x (1-98%) = 0.001 ton NMOC/yr

Where:
24.45 L/mol = Standard volume of an ideal gas at 25 °C
86.18 g/mol = Molecular weight of hexane
1.1023 ton/Mg = Conversion factor obtained from 40 CFR 60, Subpart WWW.

Boiler LFG Use: 2,766,400.00 x10^6 cu. ft. LFG/hr x 0.55 cu. ft. methane/cu. ft. LFG = 1,521,520 ft^3 methane/hr
Where 55% methane obtained from AP-42, Page 2.4-4, Nov. 1998. 1.5215 10^6 ft^3 methane/hr

Secondary Boiler Emissions:

Pollutant	Emission Factor[4] (lb/10^6 dscf) (methane)	Maximum Hourly Emission Rate (lbs/hr)	Actual Boiler Operating Hours	Actual Emissions (tons/yr)
PM	8.2	12.48	806	~~5.03E+00~~ 3.97 tn/yr et
PM_{10} and $PM_{2.5}$	8.2	12.48	806	~~5.03E+00~~ 3.97 tn/yr et
NO_x	33	50.21	806	~~2.02E+01~~ 16.00 tn/yr et
CO	5.7	8.67	806	~~3.49E+00~~ 2.79 tn/yr et

[4] Emission factors obtained from AP-42, Table 2.4-5 (Nov. 1998)

Total Boiler Emissions for 2 Boilers - LFG:

Pollutant	CAS No.	Actual Boiler Emissions (ton/yr)	Actual Hourly Boiler Emissions (lb/hr)
NMOCs (as hexane)	NA	7.75E-04	1.92E-03
VOCs	NA	3.02E-04	7.50E-04
Carbon Monoxide	630-08-0	~~3.49E+00~~ 2.79 tn/yr et	8.67E+00
Nitrogen Oxides	NA	~~2.02E+01~~ 16.00 tn/yr et	5.02E+01
PM/PM10/PM2.5	NA	~~5.03E+00~~ 3.97 tn/yr et	1.25E+01
Sulfur Dioxide	7446-09-5	~~3.77E-01~~ 0.45 tn/yr et	9.36E-01
Hydrogen Chloride	7647-01-0	5.71E-04	1.42E-03
Benzene	71-43-2	3.81E-07	9.45E-07
Ethyl Benzene	100-41-4	2.25E-06	5.58E-06
Methylene Chloride	75-09-2	1.68E-07	4.17E-07
Mercury	7439-97-6	2.07E-07	5.14E-07
Styrene	100-42-5	1.47E-07	3.65E-07
Tetrachloroethene	127-18-4	6.56E-07	1.63E-06
Toluene	108-88-3	7.81E-06	1.94E-05
Trichloroethene	79-01-6	2.04E-07	5.07E-07
Vinyl Chloride	75-01-4	4.59E-07	1.14E-06
Xylene	1330-20-7	4.80E-06	1.19E-05

City of Fargo, Division of Solid Waste

Fargo MSW Landfill 2018 Emissions Inventory

Units 5 and 6: Boiler Emission Calculations - NG

Project No. : 0208-0150

Maximum Rated Boiler Capacity:	7.7 MMBtu/hr	Gas	**(EACH)**
Control Equipment:	NA		
Fuel Parameters:			

Total Hours of Operation	42.4
Total therms of NG used:	6,918.00
ft^3 of NG per therm	98.04
Quantity of fuel used per year:	678,235 ft^3/yr 678,240.72 ft^3/yr. ✓
Quantity of fuel used per hour:	15,996 ft^3/hr

Calculations Summary - Fuel: Natural Gas

Pollutant	Uncontrolled Emission Factor ($lbs/10^6$ scf)	Uncontrolled Emission Rate (lbs/hr)	Maximum Uncontrolled Emissions (tons/yr)	Limit	Pollution Control Efficiency (%)	Including Both Units 5 and 6: Maximum Controlled Emissions (lbs/hr)	Including Both Units 5 and 6: Maximum Controlled Emissions (tons/year)
PM/PM10/PM2.5 filterable[2]	1.9	3.04E-02	6.44E-04	NA	0.00%	3.04E-02	~~6.44E-04~~ ✓ 0.8 tn/yr est
Condensable PM	5.7	9.12E-02	1.93E-03	NA	0.00%	9.12E-02	1.93E-03 ✓
SO_x[2]	0.60	9.60E-03	2.03E-04	NA	0.00%	9.60E-03	~~2.03E-04~~ ✓ 0.18 tn/yr est
NO_x[1]	100	1.60E+00	3.39E-02	NA	0.00%	1.60E+00	~~3.39E-02~~ 0.09 tn/yr est
NMOC[3]	8.7	1.39E-01	2.95E-03	NA	0.00%	1.39E-01	2.95E-03 ✓
VOC[2]	5.5	8.80E-02	1.87E-03	NA	0.00%	8.80E-02	~~1.87E-03~~ 0.01 tn/yr est
CO[1]	84	1.34E+00	2.85E-02	NA	0.00%	1.34E+00	~~2.85E-02~~ 0.62 tn/yr est
Lead[2]	5.0E-04	8.00E-06	1.70E-07	NA	0.00%	8.00E-06	1.70E-07

[1] Emission Factors obtained from AP-42, Table 1.4-1, dated 7/98

[2] Emission Factors obtained from AP-42, Table 1.4-2, dated 7/98

[3] Emission Factors obtained from AP-42, Table 1.4-2, dated 7/98, and assumed to be (TOC - Methane) = 11 - 2.3 = 8.7

Calculations Summary: HAPs

Pollutant	CAS No.	Emission Factor[1] ($lbs/10^6$ scf)	Including Both Units 5 and 6: Emission Rate (lbs/hr)	Including Both Units 5 and 6: Maximum Emissions (tons/yr)
2-Methylnaphthalene	91-57-6	2.4E-05	3.84E-07	8.14E-09
3-Methylchloranthrene	56-49-5	1.8E-06	2.88E-08	6.10E-10
7,12-Dimethylbenz(a)anthracene	57-97-6	1.6E-05	2.56E-07	5.43E-09
Acenaphthene	83-82-9	1.8E-06	2.88E-08	6.10E-10
Acenaphthylene	203-96-8	1.8E-06	2.88E-08	6.10E-10
Anthracene	120-12-7	2.4E-06	3.84E-08	8.14E-10
Benz(a)anthracene	56-55-3	1.8E-06	2.88E-08	6.10E-10
Benzene	71-43-2	2.1E-03	3.36E-05	7.12E-07
Benzo(a)pyrene	50-32-8	1.2E-06	1.92E-08	4.07E-10
Benzo(b)flouranthene	205-99-2	1.8E-06	2.88E-08	6.10E-10
Benzo(g,h,i)perylene	191-24-2	1.2E-06	1.92E-08	4.07E-10
Benzo(k)flouranthene	205-82-3	1.8E-06	2.88E-08	6.10E-10
Chrysene	208-01-9	1.8E-06	2.88E-08	6.10E-10
Dibenzo(a,h)anthracene	53-70-3	1.2E-06	1.92E-08	4.07E-10
Dichlorobenzene	25321-22-6	1.2E-03	1.92E-05	4.07E-07
Flouranthene	206-44-0	3.0E-06	4.80E-08	1.02E-09
Flourene	86-73-7	2.8E-06	4.48E-08	9.50E-10
Formaldehyde	50-00-0	7.5E-02	1.20E-03	2.54E-05
Hexane	110-54-3	1.8	2.88E-02	6.10E-04
Indeno(1,2,3-cd)pyrene	193-39-5	1.8E-06	2.88E-08	6.10E-10
Naphthalene	91-20-3	6.1E-04	9.76E-06	2.07E-07
Phenanthracene	85-01-0	1.7E-05	2.72E-07	5.77E-09
Pyrene	190-00-0	5.0E-05	8.00E-07	1.70E-08
Toluene	108-88-3	3.4E-03	5.44E-05	1.15E-06
Metals				
Arsenic	7440-38-2	2.00E-04	3.20E-06	6.78E-08
Beryllium	7440-41-7	1.2E-05	1.92E-07	4.07E-09
Cadmium	7440-43-9	1.10E-03	1.76E-05	3.73E-07
Chromium	7440-47-3	1.40E-03	2.24E-05	4.75E-07
Cobalt	7440-48-4	8.4E-05	1.34E-06	2.85E-08
Manganese	7439-96-5	3.8E-04	6.08E-06	1.29E-07
Mercury	7439-97-6	2.6E-04	4.16E-06	8.82E-08
Nickel	7440-02-0	2.10E-03	3.36E-05	7.12E-07
Selenium	7782-49-2	2.4E-05	3.84E-07	8.14E-09

[1] Emission Factors obtained from AP-42, Table 1.4-3 and Table 1.4-4, dated 7/98

City of Fargo, Division of Solid Waste

Fargo MSW Landfill 2018 Emissions Inventory
Units 5 and 6: Boiler Emission Calculations - NG
Project No. : 0208-0150

Total Emissions generated from 2 Boilers (Using Landfill and Natural Gas)

Pollutant	CAS No.	Actual Boiler Emissions (tons/yr)	Actual Hourly Boiler Emissions (lbs/hr)
PM/PM10/PM2.5 filterabe	NA	5.03E+00	1.15E+00
Condensable PM	NA	1.93E-03	4.41E-04
SO2	7446-09-5	3.77E-01	8.61E-02
NOx	NA	2.03E+01	4.63E+00
NMOCs (as hexane)	NA	3.73E-03	8.51E-04
VOC	NA	2.17E-03	4.95E-04
CO	630-08-0	3.52E+00	8.04E-01
Lead	7439-92-1	1.70E-07	3.87E-08
2-Methylnaphthalene	91-57-6	8.14E-09	1.86E-09
3-Methylchloranthrene	56-49-5	6.10E-10	1.39E-10
7,12-Dimethylbenz(a)anthracene	57-97-6	5.43E-09	1.24E-09
Acenaphthene	83-82-9	6.10E-10	1.39E-10
Acenaphthylene	203-96-8	6.10E-10	1.39E-10
Anthracene	120-12-7	8.14E-10	1.86E-10
Benz(a)anthracene	56-55-3	6.10E-10	1.39E-10
Benzene	71-43-2	1.09E-06	2.50E-07
Benzo(a)pyrene	50-32-8	4.07E-10	9.29E-11
Benzo(b)flouranthene	205-99-2	6.10E-10	1.39E-10
Benzo(g,h,i)perylene	191-24-2	4.07E-10	9.29E-11
Benzo(k)flouranthene	205-82-3	6.10E-10	1.39E-10
Chrysene	208-01-9	6.10E-10	1.39E-10
Dibenzo(a,h)anthracene	53-70-3	4.07E-10	9.29E-11
Dichlorobenzene	25321-22-6	4.07E-07	9.29E-08
Ethyl Benzene	100-41-4	2.25E-06	5.14E-07
Flouranthene	206-44-0	1.02E-09	2.32E-10
Flourene	86-73-7	9.50E-10	2.17E-10
Formaldehyde	50-00-0	2.54E-05	5.81E-06
Hexane	110-54-3	6.10E-04	1.39E-04
Hydrogen Chloride	7647-01-0	5.71E-04	1.42E-03
Indeno (1,2,3-cd)pyrene	193-39-5	6.10E-10	1.39E-10
Methylene Chloride	75-09-2	1.68E-07	3.84E-08
Naphthalene	91-20-3	2.07E-07	4.72E-08
Phenanthracene	85-01-0	5.77E-09	1.32E-09
Pyrene	190-00-0	1.70E-08	3.87E-09
Styrene[1]	100-42-5	1.47E-07	3.36E-08
Toluene	108-88-3	8.96E-06	2.05E-06
Tetrachloroethene[1]	127-18-4	6.56E-07	1.50E-07
Trichloroethene	79-01-6	2.04E-07	4.66E-08
Vinyl Chloride[1]	75-01-4	4.59E-07	1.05E-07
Xylene	1330-20-7	4.80E-06	1.10E-06
Arsenic	7440-38-2	6.78E-08	1.55E-08
Beryllium	7440-41-7	4.07E-09	9.29E-10
Cadmium	7440-43-9	3.73E-07	8.52E-08
Chromium	7440-47-3	4.75E-07	1.08E-07
Cobalt	7440-48-4	2.85E-08	6.50E-09
Manganese	7439-96-5	1.29E-07	2.94E-08
Mercury	7439-97-6	2.95E-07	6.74E-08
Nickel	7440-02-0	7.12E-07	1.63E-07
Selenium	7782-49-2	8.14E-09	1.86E-09

ND Dept. of Health Emission Inventory Summary Year: **2018**

Company:	City of Grand Forks	AIRS/AFS Source Code:	38 035 00133
PTO Number:	T5-O10007	Annual Permit Fee Billing:	**NO**
Unit or Station	City of Grand Forks MSW Landfill	Reviewed By:	ET

Individual Emission Sources

EU	Source Unit	SCC	PM	PM10	SO2	NOX	CO	VOC
1	Municipal Solid Waste Landfill	50100402						56.7
Total Facility Emissions (Less HAPS)								56.7

Hazardous Air Pollutants (Tons)				
Pollutant/Chemical Name	Boiler	Dryer		Total
Plant Totals				

Fuel Combusted & Process/Production Qty	
Coal (Tons)	
Natural Gas (MMScf)	
LPG/Propane (Gal)	
Bio-gas (MMScf)	
Low Sulfur Diesel (Gal)	
Distillate Oil (Gal)	
Residual Oil (Gal)	
Other Fuel	
Hot Mix Asphalt (Tons)	
Ethanol (Gal)	
Beets Sliced (Tons)	
Vegetable Oil (Gals)	

Action	Date	Initial
Scanned		
Checked	2/27/2019	ET
Checked (Gary)	6/21/2019	GK
Database Entry		

City of Grand Forks Landfill

	Tons	Megagrams
Current Year Landfill Acceptance	70,477.00	63,922.64

	2009	2010...	...2017	2018	
CNMOC (ppm as Hexane)	4000.00	4000.00	4000.00	4000.00	
Lo (cubic meters/Mg)	170.00	170.00	170.00	170.00	
K (1/year)	0.02	0.02	0.02	0.02	
T (years)	9.00	8.00	1.00	0.00	Total
R (Mg)	14,083	52,273	65,302	63,923	567,501
C (years)	0.00	0.00	0.00	0.00	
e(Euler number)	2.72	2.72	2.72	2.72	
$e^{-kc}-e^{-kt}$	0.16	0.15	0.02	0.00	
NMOC (Mg/year)	1.15	4.36	6.27	6.26	
NMOC Total emission rate	51.44	mg/year			
	56.70	ton/year			

Director of Public Works
Operations Division

City of Grand Forks

724 N. 47th Street • P.O. Box 5200 • Grand Forks, ND 58206-5200

Office: (701) 738-8744
Fax: (701) 738-8749

Scanned: ✓
Added to AQDB:

Received
Air Quality
2019

February 15, 2019

Liz Trythall, Environmental Scientist
North Dakota Department of Health Division of Air Quality
918 East Divide Avenue
Bismarck, ND 58501-1947

RE: Title V Monitoring Reports
City of Grand Forks Regional Municipal Solid Waste (MSW) Landfill
Grand Forks County, Rye Township Section 13
Grand Forks, North Dakota

Dear Ms. Trythall:

Please find the standard forms for the annual Title V emissions for the City of Grand Forks (City) Regional MSW Landfill in Grand Forks County, Rye Township Section 13. MSW is currently accepted at the City's Baling Facility and transported to the MSW landfill in Section 13, T152N, R51W, Grand Forks County, ND. MSW disposal is regulated under NDDH Permit No. SW-0347 and Title V Permit to Operate No. T5-O10007. Disposal of other types of waste, such as inert waste, will continue in accordance with applicable existing disposal permit and procedures.

The City currently operates according to the EPA's 40 CFR 60 Subpart WWW with an emissions threshold of 50 Mg/year, and is planning to implement Tier II testing based on the 2018 emissions calculation of 50.42 Mg/yr. Thank you for your continued discussions and assistance working through the current and proposed regulatory thresholds. Please feel free to contact me at (701) 738-8744.

Sincerely,

LeahRae Amundson
Public Works Operations Director

Enc. SFN 8537 Annual Emission Inventory Report
SFN 52738 Title V Annual Compliance Certification Report

cc: Lisa S. Botnen, Assistant Director, City of Grand Forks Waterworks Division
Diana Trussell, P.E., ND Dept. of Health, Waste Management Division
Air & Toxics Technical Enforcement Program, USEPA Region 8
Melissa Knutson, P.E., CPS, Ltd.

MANUFACTURING OR PROCESSING EQUIPMENT
ANNUAL EMISSION INVENTORY REPORT
NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY
SFN 8537 (06-14)

GENERAL

Name of Firm or Organization		Permit to Operate Number	Year of Emissions	
City of Grand Forks, ND		T5-O10007	2018	
Mailing Address: PO Box 5200		City: Grand Forks, ND	State: ND	ZIP Code: 58206-5200
Facility Name: City of Grand Forks Municipal Solid Waste Landfill	Facility Location: Sec 13, T152N, R51W, Grand Forks County, ND		Actual Hours of Operation: 2808 hrs/yr	
Source Unit Description: MSW landfill with total capacity of approximately 9.04x106 m3 (~11.83x106 CY) of waste			Emission Unit Number: 1	

RAW MATERIAL INFORMATION

Raw Materials Introduced into Process	Quantity (Specify Units)
Municipal Solid Waste	60,100 Tons
Other Waste (Unclassified, Asbestos, Contaminated Soil, Sandblast, Creosote Treated Wood, Wastewater Treatment Plant Grit, Ag Waste)	10,377 Tons

FUELS USED

	Primary Fuel	Auxiliary Fuel
Type (ex. lignite, natural gas, LPG No. 2 fuel oil, No. 6 fuel oil. etc.)		
Quantity of Fuel per Year (Specify Units: ex. ton, gal, cu.ft., etc.)		
Percent Sulfur Maximum / Average		
Btu per Unit (Specify Unit in lb, ton, gal, etc.) Average		

STACK EMISSIONS

Air Contaminant *	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM (Filterable)			
Particulate - PM_{10} (Filterable)			
Particulate - $PM_{2.5}$ (Filterable)			
Particulate – CPM (Condensable)			
Sulfur Dioxide			
Nitrogen Oxides			
Carbon Monoxide			
Total Organic Compounds: Nonmethane		Tier 1 Calculations (see attached)	50.42 Mg/yr

* Submit SFN 19839 for Hazardous Air Pollutants if applicable.

51.44 Mg [illegible] [illegible] EK

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report	Title	Telephone Number
LeahRae Amundson	Public Works Operations Division Director	(701) 738-8744
Signature: LeahRae Amundson	Email Address: LAmundson@grandforksgov.com	Date: 2-13-18

Return completed form to:
North Dakota Department of Health
Division of Air Quality
918 E Divide, 2nd Floor
Bismarck, ND 58501-1947
Telephone:(701)328-5188

Attachment to SFN 8537 (06-14): Basis of Reporting

From City of Grand Forks Solid Waste Management Logs:

MSW Accepted in 2009: 15,527 T = 14,083 Mg
MSW Accepted in 2010: 57,633 T = 52,273 Mg
MSW & Other Applicable Waste Accepted in 2011: 57,919 T = 52,533 Mg
MSW & Other Applicable Waste Accepted in 2012: 64,014 T = 58,061 Mg
MSW & Other Applicable Waste Accepted in 2013: 66,743 T = 60,536 Mg
MSW & Other Applicable Waste Accepted in 2014: 71,294 T = 64,664 Mg
MSW & Other Applicable Waste Accepted in 2015: 78,325 T = 71,041 Mg
MSW & Other Applicable Waste Accepted in 2016: 71,759 T = 65,085 Mg
MSW & Other Applicable Waste Accepted in 2017: 71,998 T = 65,302 Mg
MSW & Other Applicable Waste Accepted in 2018: 70,478 T = 63,923 Mg

(Tons (T) to Megagrams (Mg) Conversion = 0.907 Mg/Ton)

From 40 CFR Part 60, Subpart WWW, Section 60.754(a)(1)(i),

M_{NMOC} = Mass Emission Rate of NMOC (Mg/year) = $\sum_{i}^{n} 2kL_0M_i(e^{-kt})(C_{NMOC})(3.6 \times 10^{-9})$

k = Methane Generation Rate Constant (yr^{-1}) = <u>0.02/yr</u>
L_0 = Methane Generation Potential (m^3/Mg) = <u>170 m^3/Mg</u>

M_i = Mass of Solid Waste in the i^{th} Section (Mg)

M_{2009} = 14,083 Mg
M_{2010} = 52,273 Mg
M_{2011} = 52,533 Mg
M_{2012} = 58,061 Mg
M_{2013} = 60,536 Mg
M_{2014} = 64,664 Mg
M_{2015} = 71,041 Mg
M_{2016} = 65,085 Mg
M_{2017} = 65,302 Mg
M_{2018} = 63,923 Mg

t = Age of i^{th} Section in Years

t_{2009} = 10 yr
t_{2010} = 9 yr
t_{2011} = 8 yr
t_{2012} = 7 yr
t_{2013} = 6 yr
t_{2014} = 5 yr
t_{2015} = 4 yr
t_{2016} = 3 yr
t_{2017} = 2 yr
t_{2018} = 1 yr

C_{NMOC} = Concentration of NMOC (ppmv as hexane) = <u>4000 ppmv as hexane</u>

$$
\begin{aligned}
M_{NMOC} = {} & 2(0.02)(170)(14{,}083)(e^{(-(0.02)(10))})(4000)(3.6 \times 10^{-9}) = 1.13 \text{ Mg/yr} \\
& + 2(0.02)(170)(52{,}273)(e^{(-(0.02)(9))})(4000)(3.6 \times 10^{-9}) = 4.28 \text{ Mg/yr} \\
& + 2(0.02)(170)(52{,}533)(e^{(-(0.02)(8))})(4000)(3.6 \times 10^{-9}) = 4.38 \text{ Mg/yr} \\
& + 2(0.02)(170)(58{,}061)(e^{(-(0.02)(7))})(4000)(3.6 \times 10^{-9}) = 4.94 \text{ Mg/yr} \\
& + 2(0.02)(170)(60{,}536)(e^{(-(0.02)(6))})(4000)(3.6 \times 10^{-9}) = 5.26 \text{ Mg/yr} \\
& + 2(0.02)(170)(64{,}664)(e^{(-(0.02)(5))})(4000)(3.6 \times 10^{-9}) = 5.73 \text{ Mg/yr} \\
& + 2(0.02)(170)(71{,}041)(e^{(-(0.02)(4))})(4000)(3.6 \times 10^{-9}) = 6.42 \text{ Mg/yr} \\
& + 2(0.02)(170)(65{,}085)(e^{(-(0.02)(3))})(4000)(3.6 \times 10^{-9}) = 6.00 \text{ Mg/yr} \\
& + 2(0.02)(170)(65{,}302)(e^{(-(0.02)(2))})(4000)(3.6 \times 10^{-9}) = 6.14 \text{ Mg/yr} \\
& + 2(0.02)(170)(63{,}923)(e^{(-(0.02)(1))})(4000)(3.6 \times 10^{-9}) = \underline{6.14 \text{ Mg/yr}}
\end{aligned}
$$

50.42 Mg/yr (55.59 T/year)

Permit Emission Limit (Threshold for Additional Monitoring Requirements) = 50 Mg/yr
M_{NMOC} > 50 Mg/yr

ND Dept. of Health Emission Inventory Summary Year: **2018**

Company:	Jahner Sanitation, Inc	AIRS/AFS Source Code:	38 051 00002
PTO Number:	T5-O00001	Annual Permit Fee Billing:	**YES**
Unit or Station	Jahner Sanitary (Wishek) Landfill	Reviewed By:	ET

Individual Emission Sources

EU	Source Unit	SCC	CPM	PM10	SO2	NOX	CO	VOC
1	Municipal Waste Landfill	50100402						2.79
Total Facility Emissions (Less HAPS)								2.79

Hazardous Air Pollutants (Tons)			
Pollutant/Chemical Name	Boiler	Dryer	Total
Plant Totals			

Fuel Combusted & Process/Production Qty	
Coal (Tons)	
Natural Gas (MMScf)	
LPG/Propane (Gal)	
Bio-gas (MMScf)	
Low Sulfur Diesel (Gal)	
Distillate Oil (Gal)	
Residual Oil (Gal)	
Other Fuel	
Hot Mix Asphalt (Tons)	
Ethanol (Gal)	
Beets Sliced (Tons)	
Vegetable Oil (Gals)	

Action	Date	Initial
Scanned		
Checked	2/27/2019	ET
Checked (Gary)	6/20/2019	GK
Database Entry		

Current Year Waste Collected

Tons	Megagrams
3,339.81	3,029.82

Variable	Estimated Waste	Waste Acceptan 2003...	...2016	2017	2018
CNMOC (ppm as Hexane)	204.20	204.20	204.20	204.20	204.20
Lo (cubic meters/Mg) - AP 42	100.00	100.00	100.00	100.00	100.00
Lo (cubic meters/Mg) - NSPS	170.00	170.00	170.00	170.00	170.00
K (1/year)	0.02	0.02	0.02	0.02	0.02
T (years)	30.00	15.00	2.00	1.00	0.00
R (Mg)	34326.44	1852.47	3338.74	3377.09	3029.82
C (years)	0.00	-	-	-	-
e(Euler number)	2.72	2.72	2.72	2.72	2.72
Convesion factor	3.6×10^{-9}	3.6×10^{-9}	3.6×10^{-9}	3.6×10^{-9}	3.6×10^{-9}
NMOC emission rate (Mg/yr) - AP 42	2.28	0.00	0.01	0.01	0.01
NMOC emission rate (Mg/yr) - NSPS	3.87	0.01	0.02	0.02	0.02

NMOC 2003 to current (Mg/yr) - AP 42
NMOC 2003 to current (Mg/yr) - NSPS

Total NMOC emissions		
	2.53	Mg/year (AP 42)
	2.79	ton/year (AP 42)
	4.30	Mg/year (NSPS)
	4.74	ton/year (NSPS)

Scanned: ✓
Added to AQDB: __

WM
WASTE MANAGEMENT

WASTE MANAGEMENT
6207 Hempton Lake Road
Whitelaw, WI 54247
(920) 732-4473
(920) 732-3758 Fax

February 11, 2019

Received
Air Quality
2019

North Dakota Department of Health
Division of Air Quality
918 East Divide, 2nd Floor
Bismarck, ND 58501-1947

**SUBJECT: JAHNER MUNICIPAL SOLID WASTE LANDFILL
2018 ANNUAL EMISSIONS INVENTORY REPORT,
NMOC EMISSION RATE REPORT
ANNUAL COMPLIANCE CERTIFICATION**

Dear Department Air Quality Personnel:

Pursuant to the Title V Operating Permit for Jahner Municipal Solid Waste Landfill (Permit No. T5-O00001) enclosed are the

- 2018 Annual Emissions Inventory Report,
- the annual NMOC Emission Rate Report and
- the annual compliance certification.

The NMOC calculation is based on the tier 2 sampling conducted in 2015. The testing report dated September 3, 2015 is hereby incorporated by reference.

The enclosed NMOC calculations were performed per new source performance standards and emission guideline regulations. Those calculations utilize a regulatory default value of 170 for L_o. The emission inventory utilized the same formulas with the exception of using the latest AP42 value (100 m^3/Mg) for L_o. This approach is consistent with instructions in the Department's January 2, 2018 letter to utilize the latest AP42 emission factor. This is the reason the NMOC value is different for the two separate reporting requirements.

If you have any questions, please do not hesitate to contact me at (920) 796-6007.

Sincerely,

Raymond Seegers
Environmental Engineer (Wisconsin P.E.)

cc: Derek Bohnenkamp, WM-District Manager
Jahner file
Jeffery Krall

Air & Toxics Technical Enforcement Program (8ENF-AT)
Office of Enforcement, Compliance & Environmental Justice
U.S. EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Certification
I certify that these reports are true, accurate and complete.

______________________, Derek Bohnenkamp, District Manager

MANUFACTURING OR PROCESSING EQUIPMENT
ANNUAL EMISSION INVENTORY REPORT
NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY
SFN 8537 (06-14)

GENERAL

Name of Firm or Organization	Permit to Operate Number	Year of Emissions
Jahner Sanitation, Inc.	T5-O00001	2018

Mailing Address	City	State	ZIP Code
7971 32nd Ave, SE	Wishek	ND	58495

Facility Name	Facility Location	Actual Hours of Operation
Jahner Sanitary Landfill	7971 32nd Ave, SE Wishek ND	7:00 - 3:00 Monday & Thursday

Source Unit Description	Emission Unit Number
Municipal Solid Waste Landfill	1

RAW MATERIAL INFORMATION

Raw Materials Introduced into Process	Quantity (Specify Units)
Solid Waste from 1/1/18 through 12/31/18	3339.81 tons

FUELS USED

	Primary Fuel	Auxiliary Fuel
Type (ex. lignite, natural gas, LPG No. 2 fuel oil, No. 6 fuel oil, etc.)		
Quantity of Fuel per Year (Specify Units: ex. ton, gal, cu.ft., etc.)		
Percent Sulfur Maximum Average		
Btu per Unit (Specify Unit in lb, ton, gal, etc.) Average		

STACK EMISSIONS

Air Contaminant *	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM (Filterable)			
Particulate - PM_{10} (Filterable)			
Particulate - $PM_{2.5}$ (Filterable)			
Particulate – CPM (Condensable)			
Sulfur Dioxide			
Nitrogen Oxides			
Carbon Monoxide			
Total Organic Compounds: Nonmethane	Lo = 100 cubic meters/Mg	AP-42 (section 2.4.4.1) 40 CFR 60.754 formula 7/7/15 NMOC test result of 204.2 ppm	2.78

* Submit SFN 19839 for Hazardous Air Pollutants if applicable.

2.58 [illegible]

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report	Title	Telephone Number
Derek Bohnenkamp	District Manager	(701)-678-2306
Signature	Email Address	Date
[signature]	dbohnenk@wm.com	2/11/19

Return completed form to:
North Dakota Department of Health
Division of Air Quality
918 E Divide, 2nd Floor
Bismarck, ND 58501-1947
Telephone:(701)328-5188

Prior to scale installation in November 2003, volume of waste accepted was estimated based on container size of incoming waste. Therefore, because the *actual* year-to-year solid waste acceptance rate is estimated, the equation found in 40 CFR 60.754(a)(ii) was used to determine NMOC emission rates for this time period.

$$M_{NMOC}=2LoR(e^{-kc}-e^{-kt})(C_{NMOC})(3.6 \times 10^{-9})$$

NMOC Emission Rate for Years with Estimated Waste Acceptance Rates

M_{NMOC}	=	Mass emission rate of NMOC, Mg/yr		
Lo	=	Refuse methane generation potential, m^3/Mg	=	170.00 [2]
R	=	Average annual acceptance rate, Mg/yr	=	34326.44 [1]
k	=	Methane generation rate constant, 1/yr	=	0.02 [3]
c	=	Years since closure, yrs (c = 0 for active and/or new landfills)	=	0 [4]
t	=	Age of landfill, yrs	=	30
C_{NMOC}	=	Concentration of NMOC, ppm as hexane	=	204.20 [2 (7/7/15 tier 2)]
		Conversion factor	=	3.6×10^{-9}

$$\mathbf{M_{NMOC}=2(Lo)(R)(e^{-(k)(c)}-e^{-(k)(t)})(Cnmoc)(3.6 \times 10^{-9})} = \mathbf{3.87\ Mg/yr}$$

[1] **Information used to determine annual average acceptance rate**

The average annual acceptance rate (R) is determined by taking the total waste received between the approximate opening date of August 1, 1989 and November 10, 2003 divided by the number of years for this period (14.3 years).

Tonnage received (from 08/01/89 through 11/10/03):

Total tons received as of 11/10/03	Total tons converted to Mg[5]
541083.90	490868.09

Airspace (in Mg) consumed divided by 14.3 years = 34,326.44 Mg/yr (= average annual acceptence rate)

[2] For regulatory purposes, the EPA default values for Lo and C_{NMOC} must be used to calculate Tier 1 NMOC emission rates unless actual values have been obtained during Tier 2 sampling.

[3] For landfills in areas with a thirty year annual average precipitation of less than 25 inches, a k value of 0.02 is to be used. According to NOAA weather data, annual precipitation in the area of Jahner Landfill is less than 19 inches, therefore a k value of 0.02 has been used in the NMOC emission rate calculation.

[4] Gas generation from waste accepted after November 10, 2003 is calculated with "Known Waste Acceptance Rate" NSPS equation.

[5] Conversion Used: tons to Mg divide tons by 1.1023

NOTE: These calculations are made for NSPS purposes only. EPA has specifically stated as follows: "It is recommended that these default values not be used for estimating landfill emissions for purposes other than NSPS and EG" (61 FR 9905, 9912, March 12, 1996). Consequently, these emission calculations may not accurately reflect actual emissions and reviewers of this document are specifically cautioned against improper and irresponsible uses of these calculations.

40 CFR 60.754(a) provides two equations for determining NMOC emission rates; one for sites with known solid waste acceptance rates and another for sites with unknown waste acceptance rates. For sites that include time periods with both known and unknown acceptance rates, the Regulation indicates that both equations should be used. Jahner Landfill is such a facility. Accordingly, this Emission Rate Report applies both equations for calculating the facility NMOC emission rate.

NMOC Emission Rate Calculations for Years with Known Waste Acceptance Rates

The site has known waste acceptance rates since November 10, 2003. Therefore, the equation found in 40 CFR 60.754(a)(1)(I) was used to determine NMOC emission rates for this time period. The equation is provided below:

M_{NMOC} = Summation of $[2kL_oM_i(e^{-kt_i})(C_{NMOC})(3.6 \times 10^{-9})]$ for each year with a known waste acceptance rate

M_{NMOC}	=	Mass emission rate of NMOC, Mg/yr			
k	=	Methane generation rate constant, 1/yr	=	0.02 [1]	
L_o	=	Refuse methane generation potential, m^3/Mg	=	170.00 [2]	
M_i	=	Mass of solid waste received for given year, Mg	=	Varies per year (see table below)	
t_i	=	Age of the i^{th} section, Years	=	current year minus year of waste placement	
C_{NMOC}	=	Concentration of NMOC, ppm as hexane	=	204.20 [2]	7/7/15 tier 2 result
		Conversion factor	=	3.6×10^{-9}	

NMOC Emission Rate Calculation Summary (for years with known waste acceptance rates)

Year	Tons Received	M_i	t_i	M_{NMOC}	
11/10-12/31/2003	2,042	1,852	16	0.01	
2004	14,257	12,934	15	0.05	
2005	13,740	12,465	14	0.05	
2006	12,547	11,383	13	0.04	
2007	6,042	5,481	12	0.02	
2008	4,492	4,075	11	0.02	
2009	10,221	9,272	10	0.04	
2010	9,204	8,350	9	0.03	
2011	7,474	6,781	8	0.03	
2012	5,709	5,179	7	0.02	
2013	5,755	5,221	6	0.02	
2014	4,781	4,338	5	0.02	
2015	5,617	5,095	4	0.02	
2016	3,680	3,339	3	0.02	
2017	3,723	3,377	2	0.02	
2018	3,340	3,030	1	0.01	
Totals	**109,284**	**99,142**		**0.42**	**Mg/yr**

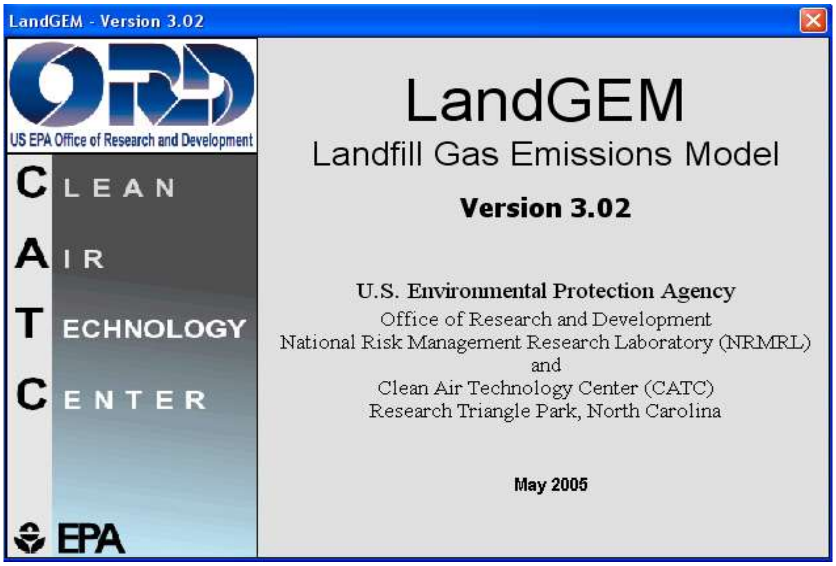
Conversion Used: tons to Mg divide tons by 1.1023

[1] For landfills in areas with a thirty year annual average precipitation of less than 25 inches, a k value of 0.02 is to be used. According to NOAA weather data, annual precipitation in the area of Jahner Landfill is less than 19 inches, therefore a k value of 0.02 has been used in the NMOC emission rate calculation.

[2] For regulatory purposes, the EPA default values for L_o and C_{NMOC} must be used to calculate Tier 1 NMOC emission rates unless actual values have been obtained during Tier 2 sampling.

NOTE: These calculations are made for NSPS purposes only. EPA has specifically stated as follows: "It is recommended that these default values not be used for estimating landfill emissions for purposes other than NSPS and EG" (61 FR 9905, 9912, March 12, 1996). Consequently, these emission calculations likely overestimate actual and potential emissions and reviewers of this document are specifically cautioned against improper and irresponsible uses of these calculations.

TOTAL NMOC EMISSION RATE:	NMOC rate for years with known waste acceptance rates:		**0.42**
	NMOC rate for years with estimated waste acceptance rates:		**3.87**
	Combined NMOC Emission Rate:	**Mg/yr**	**4.29**
		Tons/year	4.73



Summary Report

Landfill Name or Identifier: Jamestown

Date: Wednesday, July 24, 2019

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

The 80-year waste acceptance limit of the model has been exceeded before the Waste Design Capacity was reached. The model will assume the 80th year of waste acceptance as the final year to estimate emissions. See Section 2.6 of the User's Manual.

LANDFILL CHARACTERISTICS

Landfill Open Year	**1979**	
Landfill Closure Year (with 80-year limit)	**2058**	
Actual Closure Year (without limit)	***2196***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**3,758,757**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**279**	*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)*
1979	16,100	17,710	0	0
1980	16,100	17,710	16,100	17,710
1981	16,100	17,710	32,200	35,420
1982	16,100	17,710	48,300	53,130
1983	16,100	17,710	64,400	70,840
1984	16,100	17,710	80,500	88,550
1985	16,100	17,710	96,600	106,260
1986	16,100	17,710	112,700	123,970
1987	16,100	17,710	128,800	141,680
1988	16,100	17,710	144,900	159,390
1989	16,100	17,710	161,000	177,100
1990	16,100	17,710	177,100	194,810
1991	16,100	17,710	193,200	212,520
1992	16,100	17,710	209,300	230,230
1993	16,100	17,710	225,400	247,940
1994	16,100	17,710	241,500	265,650
1995	16,100	17,710	257,600	283,360
1996	16,100	17,710	273,700	301,070
1997	16,100	17,710	289,800	318,780
1998	16,100	17,710	305,900	336,490
1999	16,100	17,710	322,000	354,200
2000	16,100	17,710	338,100	371,910
2001	16,100	17,710	354,200	389,620
2002	16,100	17,710	370,300	407,330
2003	16,100	17,710	386,400	425,040
2004	16,100	17,710	402,500	442,750
2005	16,100	17,710	418,600	460,460
2006	16,100	17,710	434,700	478,170
2007	16,100	17,710	450,800	495,880
2008	16,100	17,710	466,900	513,590
2009	16,100	17,710	483,000	531,300
2010	16,100	17,710	499,100	549,010
2011	16,100	17,710	515,200	566,720
2012	16,053	17,658	531,300	584,430
2013	16,082	17,690	547,353	602,088
2014	16,816	18,498	563,435	619,779
2015	17,483	19,231	580,251	638,276
2016	17,431	19,174	597,734	657,507
2017	17,500	19,250	615,165	676,682
2018	17,500	19,250	632,665	695,932

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2019	17,500	19,250	650,165	715,182
2020	17,500	19,250	667,665	734,432
2021	17,500	19,250	685,165	753,682
2022	17,500	19,250	702,665	772,932
2023	17,500	19,250	720,165	792,182
2024	17,500	19,250	737,665	811,432
2025	17,500	19,250	755,165	830,682
2026	17,500	19,250	772,665	849,932
2027	17,500	19,250	790,165	869,182
2028	17,500	19,250	807,665	888,432
2029	17,500	19,250	825,165	907,682
2030	17,500	19,250	842,665	926,932
2031	17,500	19,250	860,165	946,182
2032	17,500	19,250	877,665	965,432
2033	17,500	19,250	895,165	984,682
2034	17,500	19,250	912,665	1,003,932
2035	17,500	19,250	930,165	1,023,182
2036	17,500	19,250	947,665	1,042,432
2037	17,500	19,250	965,165	1,061,682
2038	17,500	19,250	982,665	1,080,932
2039	17,500	19,250	1,000,165	1,100,182
2040	17,500	19,250	1,017,665	1,119,432
2041	17,500	19,250	1,035,165	1,138,682
2042	17,500	19,250	1,052,665	1,157,932
2043	17,500	19,250	1,070,165	1,177,182
2044	17,500	19,250	1,087,665	1,196,432
2045	17,500	19,250	1,105,165	1,215,682
2046	17,500	19,250	1,122,665	1,234,932
2047	17,500	19,250	1,140,165	1,254,182
2048	17,500	19,250	1,157,665	1,273,432
2049	17,500	19,250	1,175,165	1,292,682
2050	17,500	19,250	1,192,665	1,311,932
2051	17,500	19,250	1,210,165	1,331,182
2052	17,500	19,250	1,227,665	1,350,432
2053	17,500	19,250	1,245,165	1,369,682
2054	17,500	19,250	1,262,665	1,388,932
2055	17,500	19,250	1,280,165	1,408,182
2056	17,500	19,250	1,297,665	1,427,432
2057	17,500	19,250	1,315,165	1,446,682
2058	17,500	19,250	1,332,665	1,465,932

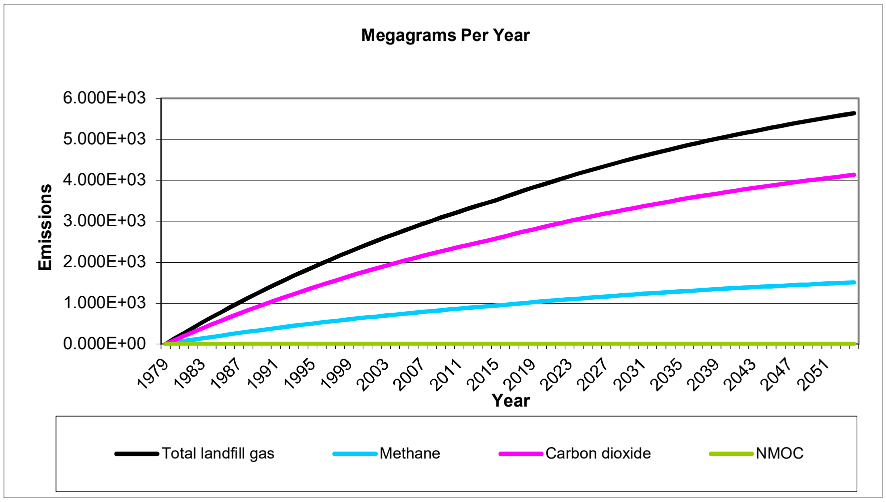
Pollutant Parameters

	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
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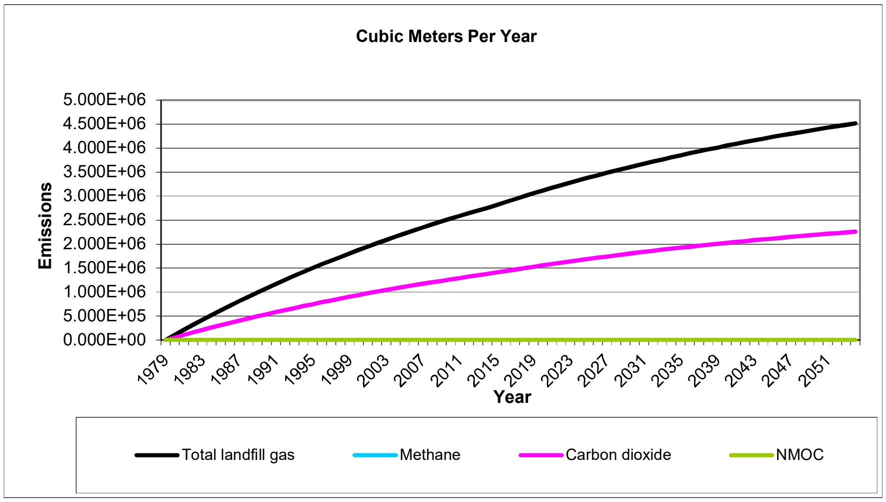
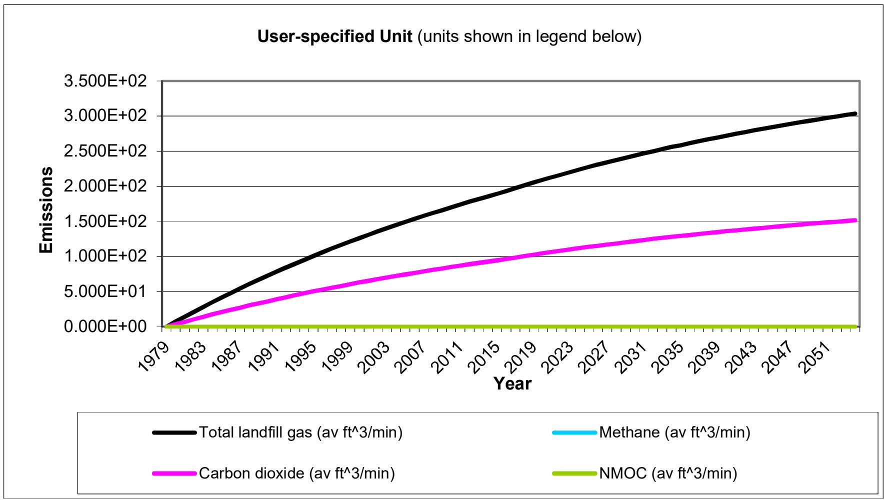
5.000E+03
4.000E+03
3.000E+03
2.000E+03
1.000E+03
0.000E+00
Emissions
1979 1983 1987 1991 1995 1999 2003 2007 2011 2015 2019 2023 2027 2031 2035 2039 2043 2047 2051
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
5.000E+06
4.500E+06
4.000E+06
3.500E+06
3.000E+06
2.500E+06
2.000E+06
1.500E+06
1.000E+06
5.000E+05
0.000E+00
Emissions
1979 1983 1987 1991 1995 1999 2003 2007 2011 2015 2019 2023 2027 2031 2035 2039 2043 2047 2051
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
3.500E+02
3.000E+02
2.500E+02
2.000E+02
1.500E+02
1.000E+02
5.000E+01
0.000E+00
Emissions
1979 1983 1987 1991 1995 1999 2003 2007 2011 2015 2019 2023 2027 2031 2035 2039 2043 2047 2051
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)
1979	0	0	0	0	0	0
1980	1.355E+02	1.085E+05	7.290E+00	3.619E+01	5.425E+04	3.645E+00
1981	2.683E+02	2.149E+05	1.444E+01	7.167E+01	1.074E+05	7.218E+00
1982	3.985E+02	3.191E+05	2.144E+01	1.064E+02	1.595E+05	1.072E+01
1983	5.261E+02	4.213E+05	2.831E+01	1.405E+02	2.106E+05	1.415E+01
1984	6.512E+02	5.214E+05	3.504E+01	1.739E+02	2.607E+05	1.752E+01
1985	7.738E+02	6.196E+05	4.163E+01	2.067E+02	3.098E+05	2.082E+01
1986	8.940E+02	7.158E+05	4.810E+01	2.388E+02	3.579E+05	2.405E+01
1987	1.012E+03	8.102E+05	5.444E+01	2.703E+02	4.051E+05	2.722E+01
1988	1.127E+03	9.026E+05	6.065E+01	3.011E+02	4.513E+05	3.032E+01
1989	1.240E+03	9.933E+05	6.674E+01	3.313E+02	4.966E+05	3.337E+01
1990	1.351E+03	1.082E+06	7.271E+01	3.610E+02	5.410E+05	3.635E+01
1991	1.460E+03	1.169E+06	7.856E+01	3.900E+02	5.846E+05	3.928E+01
1992	1.567E+03	1.255E+06	8.429E+01	4.185E+02	6.273E+05	4.215E+01
1993	1.671E+03	1.338E+06	8.991E+01	4.464E+02	6.691E+05	4.496E+01
1994	1.774E+03	1.420E+06	9.542E+01	4.737E+02	7.101E+05	4.771E+01
1995	1.874E+03	1.501E+06	1.008E+02	5.005E+02	7.503E+05	5.041E+01
1996	1.972E+03	1.579E+06	1.061E+02	5.268E+02	7.897E+05	5.306E+01
1997	2.069E+03	1.657E+06	1.113E+02	5.526E+02	8.283E+05	5.565E+01
1998	2.163E+03	1.732E+06	1.164E+02	5.778E+02	8.661E+05	5.820E+01
1999	2.256E+03	1.806E+06	1.214E+02	6.026E+02	9.032E+05	6.069E+01
2000	2.347E+03	1.879E+06	1.263E+02	6.269E+02	9.396E+05	6.313E+01
2001	2.436E+03	1.950E+06	1.311E+02	6.506E+02	9.752E+05	6.553E+01
2002	2.523E+03	2.020E+06	1.357E+02	6.739E+02	1.010E+06	6.787E+01
2003	2.609E+03	2.089E+06	1.404E+02	6.968E+02	1.044E+06	7.018E+01
2004	2.692E+03	2.156E+06	1.449E+02	7.192E+02	1.078E+06	7.243E+01
2005	2.775E+03	2.222E+06	1.493E+02	7.411E+02	1.111E+06	7.464E+01
2006	2.855E+03	2.286E+06	1.536E+02	7.627E+02	1.143E+06	7.681E+01
2007	2.934E+03	2.350E+06	1.579E+02	7.837E+02	1.175E+06	7.893E+01
2008	3.012E+03	2.412E+06	1.620E+02	8.044E+02	1.206E+06	8.102E+01
2009	3.087E+03	2.472E+06	1.661E+02	8.247E+02	1.236E+06	8.306E+01
2010	3.162E+03	2.532E+06	1.701E+02	8.446E+02	1.266E+06	8.506E+01
2011	3.235E+03	2.590E+06	1.740E+02	8.640E+02	1.295E+06	8.702E+01
2012	3.306E+03	2.647E+06	1.779E+02	8.831E+02	1.324E+06	8.894E+01
2013	3.376E+03	2.703E+06	1.816E+02	9.017E+02	1.352E+06	9.081E+01
2014	3.444E+03	2.758E+06	1.853E+02	9.200E+02	1.379E+06	9.266E+01
2015	3.518E+03	2.817E+06	1.893E+02	9.396E+02	1.408E+06	9.463E+01
2016	3.595E+03	2.879E+06	1.934E+02	9.603E+02	1.439E+06	9.671E+01
2017	3.671E+03	2.939E+06	1.975E+02	9.805E+02	1.470E+06	9.874E+01
2018	3.745E+03	2.999E+06	2.015E+02	1.000E+03	1.499E+06	1.008E+02
2019	3.818E+03	3.058E+06	2.054E+02	1.020E+03	1.529E+06	1.027E+02
2020	3.890E+03	3.115E+06	2.093E+02	1.039E+03	1.557E+06	1.046E+02
2021	3.960E+03	3.171E+06	2.131E+02	1.058E+03	1.586E+06	1.065E+02
2022	4.029E+03	3.226E+06	2.168E+02	1.076E+03	1.613E+06	1.084E+02
2023	4.097E+03	3.280E+06	2.204E+02	1.094E+03	1.640E+06	1.102E+02
2024	4.163E+03	3.333E+06	2.240E+02	1.112E+03	1.667E+06	1.120E+02
2025	4.228E+03	3.385E+06	2.275E+02	1.129E+03	1.693E+06	1.137E+02
2026	4.291E+03	3.436E+06	2.309E+02	1.146E+03	1.718E+06	1.154E+02
2027	4.353E+03	3.486E+06	2.342E+02	1.163E+03	1.743E+06	1.171E+02
2028	4.415E+03	3.535E+06	2.375E+02	1.179E+03	1.767E+06	1.188E+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)
2029	4.474E+03	3.583E+06	2.407E+02	1.195E+03	1.791E+06	1.204E+02
2030	4.533E+03	3.630E+06	2.439E+02	1.211E+03	1.815E+06	1.219E+02
2031	4.591E+03	3.676E+06	2.470E+02	1.226E+03	1.838E+06	1.235E+02
2032	4.647E+03	3.721E+06	2.500E+02	1.241E+03	1.861E+06	1.250E+02
2033	4.702E+03	3.765E+06	2.530E+02	1.256E+03	1.883E+06	1.265E+02
2034	4.756E+03	3.809E+06	2.559E+02	1.271E+03	1.904E+06	1.280E+02
2035	4.810E+03	3.851E+06	2.588E+02	1.285E+03	1.926E+06	1.294E+02
2036	4.862E+03	3.893E+06	2.616E+02	1.299E+03	1.946E+06	1.308E+02
2037	4.913E+03	3.934E+06	2.643E+02	1.312E+03	1.967E+06	1.322E+02
2038	4.963E+03	3.974E+06	2.670E+02	1.326E+03	1.987E+06	1.335E+02
2039	5.012E+03	4.013E+06	2.696E+02	1.339E+03	2.007E+06	1.348E+02
2040	5.060E+03	4.052E+06	2.722E+02	1.351E+03	2.026E+06	1.361E+02
2041	5.107E+03	4.089E+06	2.748E+02	1.364E+03	2.045E+06	1.374E+02
2042	5.153E+03	4.126E+06	2.772E+02	1.376E+03	2.063E+06	1.386E+02
2043	5.198E+03	4.162E+06	2.797E+02	1.388E+03	2.081E+06	1.398E+02
2044	5.243E+03	4.198E+06	2.821E+02	1.400E+03	2.099E+06	1.410E+02
2045	5.286E+03	4.233E+06	2.844E+02	1.412E+03	2.116E+06	1.422E+02
2046	5.329E+03	4.267E+06	2.867E+02	1.423E+03	2.133E+06	1.433E+02
2047	5.370E+03	4.300E+06	2.889E+02	1.434E+03	2.150E+06	1.445E+02
2048	5.411E+03	4.333E+06	2.911E+02	1.445E+03	2.167E+06	1.456E+02
2049	5.451E+03	4.365E+06	2.933E+02	1.456E+03	2.183E+06	1.467E+02
2050	5.491E+03	4.397E+06	2.954E+02	1.467E+03	2.198E+06	1.477E+02
2051	5.529E+03	4.428E+06	2.975E+02	1.477E+03	2.214E+06	1.487E+02
2052	5.567E+03	4.458E+06	2.995E+02	1.487E+03	2.229E+06	1.498E+02
2053	5.604E+03	4.488E+06	3.015E+02	1.497E+03	2.244E+06	1.508E+02
2054	5.640E+03	4.517E+06	3.035E+02	1.507E+03	2.258E+06	1.517E+02
2055	5.676E+03	4.545E+06	3.054E+02	1.516E+03	2.273E+06	1.527E+02
2056	5.711E+03	4.573E+06	3.073E+02	1.525E+03	2.287E+06	1.536E+02
2057	5.745E+03	4.600E+06	3.091E+02	1.535E+03	2.300E+06	1.546E+02
2058	5.779E+03	4.627E+06	3.109E+02	1.544E+03	2.314E+06	1.555E+02
2059	5.812E+03	4.654E+06	3.127E+02	1.552E+03	2.327E+06	1.563E+02
2060	5.696E+03	4.561E+06	3.065E+02	1.522E+03	2.281E+06	1.532E+02
2061	5.584E+03	4.471E+06	3.004E+02	1.491E+03	2.236E+06	1.502E+02
2062	5.473E+03	4.383E+06	2.945E+02	1.462E+03	2.191E+06	1.472E+02
2063	5.365E+03	4.296E+06	2.886E+02	1.433E+03	2.148E+06	1.443E+02
2064	5.258E+03	4.211E+06	2.829E+02	1.405E+03	2.105E+06	1.415E+02
2065	5.154E+03	4.127E+06	2.773E+02	1.377E+03	2.064E+06	1.387E+02
2066	5.052E+03	4.046E+06	2.718E+02	1.350E+03	2.023E+06	1.359E+02
2067	4.952E+03	3.966E+06	2.664E+02	1.323E+03	1.983E+06	1.332E+02
2068	4.854E+03	3.887E+06	2.612E+02	1.297E+03	1.944E+06	1.306E+02
2069	4.758E+03	3.810E+06	2.560E+02	1.271E+03	1.905E+06	1.280E+02
2070	4.664E+03	3.735E+06	2.509E+02	1.246E+03	1.867E+06	1.255E+02
2071	4.572E+03	3.661E+06	2.460E+02	1.221E+03	1.830E+06	1.230E+02
2072	4.481E+03	3.588E+06	2.411E+02	1.197E+03	1.794E+06	1.205E+02
2073	4.392E+03	3.517E+06	2.363E+02	1.173E+03	1.759E+06	1.182E+02
2074	4.305E+03	3.447E+06	2.316E+02	1.150E+03	1.724E+06	1.158E+02
2075	4.220E+03	3.379E+06	2.270E+02	1.127E+03	1.690E+06	1.135E+02
2076	4.136E+03	3.312E+06	2.226E+02	1.105E+03	1.656E+06	1.113E+02
2077	4.055E+03	3.247E+06	2.181E+02	1.083E+03	1.623E+06	1.091E+02
2078	3.974E+03	3.182E+06	2.138E+02	1.062E+03	1.591E+06	1.069E+02
2079	3.896E+03	3.119E+06	2.096E+02	1.041E+03	1.560E+06	1.048E+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)
2080	3.818E+03	3.058E+06	2.054E+02	1.020E+03	1.529E+06	1.027E+02
2081	3.743E+03	2.997E+06	2.014E+02	9.998E+02	1.499E+06	1.007E+02
2082	3.669E+03	2.938E+06	1.974E+02	9.800E+02	1.469E+06	9.869E+01
2083	3.596E+03	2.880E+06	1.935E+02	9.606E+02	1.440E+06	9.674E+01
2084	3.525E+03	2.823E+06	1.896E+02	9.415E+02	1.411E+06	9.482E+01
2085	3.455E+03	2.767E+06	1.859E+02	9.229E+02	1.383E+06	9.295E+01
2086	3.387E+03	2.712E+06	1.822E+02	9.046E+02	1.356E+06	9.111E+01
2087	3.320E+03	2.658E+06	1.786E+02	8.867E+02	1.329E+06	8.930E+01
2088	3.254E+03	2.606E+06	1.751E+02	8.691E+02	1.303E+06	8.753E+01
2089	3.189E+03	2.554E+06	1.716E+02	8.519E+02	1.277E+06	8.580E+01
2090	3.126E+03	2.503E+06	1.682E+02	8.351E+02	1.252E+06	8.410E+01
2091	3.064E+03	2.454E+06	1.649E+02	8.185E+02	1.227E+06	8.244E+01
2092	3.004E+03	2.405E+06	1.616E+02	8.023E+02	1.203E+06	8.080E+01
2093	2.944E+03	2.358E+06	1.584E+02	7.864E+02	1.179E+06	7.920E+01
2094	2.886E+03	2.311E+06	1.553E+02	7.709E+02	1.155E+06	7.763E+01
2095	2.829E+03	2.265E+06	1.522E+02	7.556E+02	1.133E+06	7.610E+01
2096	2.773E+03	2.220E+06	1.492E+02	7.406E+02	1.110E+06	7.459E+01
2097	2.718E+03	2.176E+06	1.462E+02	7.260E+02	1.088E+06	7.311E+01
2098	2.664E+03	2.133E+06	1.433E+02	7.116E+02	1.067E+06	7.167E+01
2099	2.611E+03	2.091E+06	1.405E+02	6.975E+02	1.046E+06	7.025E+01
2100	2.560E+03	2.050E+06	1.377E+02	6.837E+02	1.025E+06	6.886E+01
2101	2.509E+03	2.009E+06	1.350E+02	6.702E+02	1.005E+06	6.749E+01
2102	2.459E+03	1.969E+06	1.323E+02	6.569E+02	9.846E+05	6.616E+01
2103	2.411E+03	1.930E+06	1.297E+02	6.439E+02	9.651E+05	6.485E+01
2104	2.363E+03	1.892E+06	1.271E+02	6.311E+02	9.460E+05	6.356E+01
2105	2.316E+03	1.855E+06	1.246E+02	6.186E+02	9.273E+05	6.230E+01
2106	2.270E+03	1.818E+06	1.221E+02	6.064E+02	9.089E+05	6.107E+01
2107	2.225E+03	1.782E+06	1.197E+02	5.944E+02	8.909E+05	5.986E+01
2108	2.181E+03	1.747E+06	1.174E+02	5.826E+02	8.733E+05	5.868E+01
2109	2.138E+03	1.712E+06	1.150E+02	5.711E+02	8.560E+05	5.751E+01
2110	2.096E+03	1.678E+06	1.127E+02	5.598E+02	8.390E+05	5.637E+01
2111	2.054E+03	1.645E+06	1.105E+02	5.487E+02	8.224E+05	5.526E+01
2112	2.013E+03	1.612E+06	1.083E+02	5.378E+02	8.061E+05	5.416E+01
2113	1.974E+03	1.580E+06	1.062E+02	5.272E+02	7.902E+05	5.309E+01
2114	1.934E+03	1.549E+06	1.041E+02	5.167E+02	7.745E+05	5.204E+01
2115	1.896E+03	1.518E+06	1.020E+02	5.065E+02	7.592E+05	5.101E+01
2116	1.859E+03	1.488E+06	1.000E+02	4.965E+02	7.442E+05	5.000E+01
2117	1.822E+03	1.459E+06	9.802E+01	4.866E+02	7.294E+05	4.901E+01
2118	1.786E+03	1.430E+06	9.608E+01	4.770E+02	7.150E+05	4.804E+01
2119	1.750E+03	1.402E+06	9.418E+01	4.676E+02	7.008E+05	4.709E+01

Results (Continued)

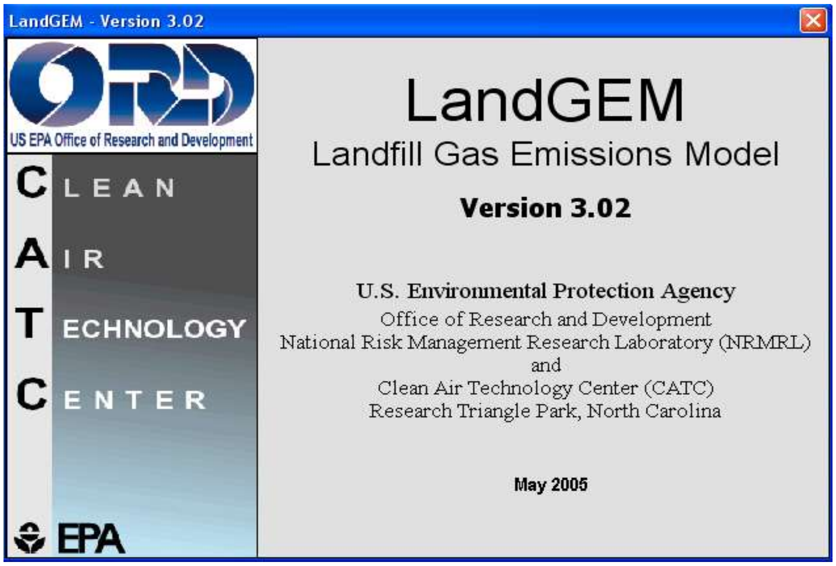
Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1979	0	0	0	0	0	0
1980	9.931E+01	5.425E+04	3.645E+00	1.085E-01	3.027E+01	2.034E-03
1981	1.966E+02	1.074E+05	7.218E+00	2.149E-01	5.994E+01	4.028E-03
1982	2.921E+02	1.595E+05	1.072E+01	3.191E-01	8.903E+01	5.982E-03
1983	3.856E+02	2.106E+05	1.415E+01	4.213E-01	1.175E+02	7.897E-03
1984	4.772E+02	2.607E+05	1.752E+01	5.215E-01	1.455E+02	9.775E-03
1985	5.671E+02	3.098E+05	2.082E+01	6.197E-01	1.729E+02	1.162E-02
1986	6.552E+02	3.579E+05	2.405E+01	7.159E-01	1.997E+02	1.342E-02
1987	7.415E+02	4.051E+05	2.722E+01	8.102E-01	2.260E+02	1.519E-02
1988	8.261E+02	4.513E+05	3.032E+01	9.027E-01	2.518E+02	1.692E-02
1989	9.091E+02	4.966E+05	3.337E+01	9.933E-01	2.771E+02	1.862E-02
1990	9.904E+02	5.410E+05	3.635E+01	1.082E+00	3.019E+02	2.028E-02
1991	1.070E+03	5.846E+05	3.928E+01	1.169E+00	3.262E+02	2.192E-02
1992	1.148E+03	6.273E+05	4.215E+01	1.255E+00	3.500E+02	2.352E-02
1993	1.225E+03	6.691E+05	4.496E+01	1.338E+00	3.734E+02	2.509E-02
1994	1.300E+03	7.101E+05	4.771E+01	1.420E+00	3.962E+02	2.662E-02
1995	1.373E+03	7.503E+05	5.041E+01	1.501E+00	4.187E+02	2.813E-02
1996	1.445E+03	7.897E+05	5.306E+01	1.579E+00	4.406E+02	2.961E-02
1997	1.516E+03	8.283E+05	5.565E+01	1.657E+00	4.622E+02	3.105E-02
1998	1.585E+03	8.661E+05	5.820E+01	1.732E+00	4.833E+02	3.247E-02
1999	1.653E+03	9.032E+05	6.069E+01	1.807E+00	5.040E+02	3.386E-02
2000	1.720E+03	9.396E+05	6.313E+01	1.879E+00	5.243E+02	3.523E-02
2001	1.785E+03	9.752E+05	6.553E+01	1.951E+00	5.442E+02	3.656E-02
2002	1.849E+03	1.010E+06	6.787E+01	2.021E+00	5.637E+02	3.787E-02
2003	1.912E+03	1.044E+06	7.018E+01	2.089E+00	5.828E+02	3.916E-02
2004	1.973E+03	1.078E+06	7.243E+01	2.156E+00	6.015E+02	4.042E-02
2005	2.034E+03	1.111E+06	7.464E+01	2.222E+00	6.199E+02	4.165E-02
2006	2.093E+03	1.143E+06	7.681E+01	2.286E+00	6.379E+02	4.286E-02
2007	2.150E+03	1.175E+06	7.893E+01	2.350E+00	6.555E+02	4.404E-02
2008	2.207E+03	1.206E+06	8.102E+01	2.412E+00	6.728E+02	4.521E-02
2009	2.263E+03	1.236E+06	8.306E+01	2.472E+00	6.898E+02	4.635E-02
2010	2.317E+03	1.266E+06	8.506E+01	2.532E+00	7.064E+02	4.746E-02
2011	2.371E+03	1.295E+06	8.702E+01	2.590E+00	7.227E+02	4.856E-02
2012	2.423E+03	1.324E+06	8.894E+01	2.648E+00	7.386E+02	4.963E-02
2013	2.474E+03	1.352E+06	9.081E+01	2.703E+00	7.542E+02	5.067E-02
2014	2.524E+03	1.379E+06	9.266E+01	2.758E+00	7.695E+02	5.170E-02
2015	2.578E+03	1.408E+06	9.463E+01	2.817E+00	7.859E+02	5.280E-02
2016	2.635E+03	1.439E+06	9.671E+01	2.879E+00	8.032E+02	5.397E-02
2017	2.690E+03	1.470E+06	9.874E+01	2.939E+00	8.200E+02	5.510E-02
2018	2.745E+03	1.499E+06	1.008E+02	2.999E+00	8.367E+02	5.622E-02
2019	2.798E+03	1.529E+06	1.027E+02	3.058E+00	8.531E+02	5.732E-02
2020	2.851E+03	1.557E+06	1.046E+02	3.115E+00	8.691E+02	5.839E-02
2021	2.902E+03	1.586E+06	1.065E+02	3.171E+00	8.848E+02	5.945E-02
2022	2.953E+03	1.613E+06	1.084E+02	3.227E+00	9.001E+02	6.048E-02
2023	3.002E+03	1.640E+06	1.102E+02	3.281E+00	9.152E+02	6.149E-02
2024	3.051E+03	1.667E+06	1.120E+02	3.334E+00	9.300E+02	6.249E-02
2025	3.098E+03	1.693E+06	1.137E+02	3.386E+00	9.445E+02	6.346E-02
2026	3.145E+03	1.718E+06	1.154E+02	3.436E+00	9.587E+02	6.441E-02
2027	3.191E+03	1.743E+06	1.171E+02	3.486E+00	9.726E+02	6.535E-02
2028	3.235E+03	1.767E+06	1.188E+02	3.535E+00	9.863E+02	6.627E-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)*
2029	3.279E+03	1.791E+06	1.204E+02	3.583E+00	9.996E+02	6.717E-02
2030	3.322E+03	1.815E+06	1.219E+02	3.630E+00	1.013E+03	6.805E-02
2031	3.364E+03	1.838E+06	1.235E+02	3.676E+00	1.026E+03	6.891E-02
2032	3.406E+03	1.861E+06	1.250E+02	3.721E+00	1.038E+03	6.976E-02
2033	3.446E+03	1.883E+06	1.265E+02	3.766E+00	1.051E+03	7.059E-02
2034	3.486E+03	1.904E+06	1.280E+02	3.809E+00	1.063E+03	7.140E-02
2035	3.525E+03	1.926E+06	1.294E+02	3.852E+00	1.075E+03	7.220E-02
2036	3.563E+03	1.946E+06	1.308E+02	3.893E+00	1.086E+03	7.298E-02
2037	3.600E+03	1.967E+06	1.322E+02	3.934E+00	1.098E+03	7.374E-02
2038	3.637E+03	1.987E+06	1.335E+02	3.974E+00	1.109E+03	7.449E-02
2039	3.673E+03	2.007E+06	1.348E+02	4.013E+00	1.120E+03	7.523E-02
2040	3.708E+03	2.026E+06	1.361E+02	4.052E+00	1.130E+03	7.595E-02
2041	3.743E+03	2.045E+06	1.374E+02	4.090E+00	1.141E+03	7.666E-02
2042	3.777E+03	2.063E+06	1.386E+02	4.126E+00	1.151E+03	7.735E-02
2043	3.810E+03	2.081E+06	1.398E+02	4.163E+00	1.161E+03	7.803E-02
2044	3.842E+03	2.099E+06	1.410E+02	4.198E+00	1.171E+03	7.870E-02
2045	3.874E+03	2.116E+06	1.422E+02	4.233E+00	1.181E+03	7.935E-02
2046	3.905E+03	2.133E+06	1.433E+02	4.267E+00	1.190E+03	7.999E-02
2047	3.936E+03	2.150E+06	1.445E+02	4.301E+00	1.200E+03	8.061E-02
2048	3.966E+03	2.167E+06	1.456E+02	4.333E+00	1.209E+03	8.123E-02
2049	3.995E+03	2.183E+06	1.467E+02	4.366E+00	1.218E+03	8.183E-02
2050	4.024E+03	2.198E+06	1.477E+02	4.397E+00	1.227E+03	8.242E-02
2051	4.052E+03	2.214E+06	1.487E+02	4.428E+00	1.235E+03	8.300E-02
2052	4.080E+03	2.229E+06	1.498E+02	4.458E+00	1.244E+03	8.357E-02
2053	4.107E+03	2.244E+06	1.508E+02	4.488E+00	1.252E+03	8.412E-02
2054	4.134E+03	2.258E+06	1.517E+02	4.517E+00	1.260E+03	8.467E-02
2055	4.160E+03	2.273E+06	1.527E+02	4.545E+00	1.268E+03	8.520E-02
2056	4.186E+03	2.287E+06	1.536E+02	4.573E+00	1.276E+03	8.573E-02
2057	4.211E+03	2.300E+06	1.546E+02	4.601E+00	1.284E+03	8.624E-02
2058	4.235E+03	2.314E+06	1.555E+02	4.628E+00	1.291E+03	8.674E-02
2059	4.259E+03	2.327E+06	1.563E+02	4.654E+00	1.298E+03	8.724E-02
2060	4.175E+03	2.281E+06	1.532E+02	4.562E+00	1.273E+03	8.551E-02
2061	4.092E+03	2.236E+06	1.502E+02	4.471E+00	1.247E+03	8.382E-02
2062	4.011E+03	2.191E+06	1.472E+02	4.383E+00	1.223E+03	8.216E-02
2063	3.932E+03	2.148E+06	1.443E+02	4.296E+00	1.199E+03	8.053E-02
2064	3.854E+03	2.105E+06	1.415E+02	4.211E+00	1.175E+03	7.893E-02
2065	3.778E+03	2.064E+06	1.387E+02	4.128E+00	1.152E+03	7.737E-02
2066	3.703E+03	2.023E+06	1.359E+02	4.046E+00	1.129E+03	7.584E-02
2067	3.629E+03	1.983E+06	1.332E+02	3.966E+00	1.106E+03	7.434E-02
2068	3.558E+03	1.944E+06	1.306E+02	3.887E+00	1.084E+03	7.287E-02
2069	3.487E+03	1.905E+06	1.280E+02	3.810E+00	1.063E+03	7.142E-02
2070	3.418E+03	1.867E+06	1.255E+02	3.735E+00	1.042E+03	7.001E-02
2071	3.350E+03	1.830E+06	1.230E+02	3.661E+00	1.021E+03	6.862E-02
2072	3.284E+03	1.794E+06	1.205E+02	3.588E+00	1.001E+03	6.726E-02
2073	3.219E+03	1.759E+06	1.182E+02	3.517E+00	9.813E+02	6.593E-02
2074	3.155E+03	1.724E+06	1.158E+02	3.448E+00	9.618E+02	6.463E-02
2075	3.093E+03	1.690E+06	1.135E+02	3.379E+00	9.428E+02	6.335E-02
2076	3.032E+03	1.656E+06	1.113E+02	3.313E+00	9.241E+02	6.209E-02
2077	2.972E+03	1.623E+06	1.091E+02	3.247E+00	9.058E+02	6.086E-02
2078	2.913E+03	1.591E+06	1.069E+02	3.183E+00	8.879E+02	5.966E-02
2079	2.855E+03	1.560E+06	1.048E+02	3.120E+00	8.703E+02	5.848E-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)
2080	2.799E+03	1.529E+06	1.027E+02	3.058E+00	8.531E+02	5.732E-02
2081	2.743E+03	1.499E+06	1.007E+02	2.997E+00	8.362E+02	5.618E-02
2082	2.689E+03	1.469E+06	9.869E+01	2.938E+00	8.196E+02	5.507E-02
2083	2.636E+03	1.440E+06	9.674E+01	2.880E+00	8.034E+02	5.398E-02
2084	2.583E+03	1.411E+06	9.482E+01	2.823E+00	7.875E+02	5.291E-02
2085	2.532E+03	1.383E+06	9.295E+01	2.767E+00	7.719E+02	5.186E-02
2086	2.482E+03	1.356E+06	9.111E+01	2.712E+00	7.566E+02	5.084E-02
2087	2.433E+03	1.329E+06	8.930E+01	2.658E+00	7.416E+02	4.983E-02
2088	2.385E+03	1.303E+06	8.753E+01	2.606E+00	7.269E+02	4.884E-02
2089	2.338E+03	1.277E+06	8.580E+01	2.554E+00	7.126E+02	4.788E-02
2090	2.291E+03	1.252E+06	8.410E+01	2.504E+00	6.984E+02	4.693E-02
2091	2.246E+03	1.227E+06	8.244E+01	2.454E+00	6.846E+02	4.600E-02
2092	2.201E+03	1.203E+06	8.080E+01	2.405E+00	6.711E+02	4.509E-02
2093	2.158E+03	1.179E+06	7.920E+01	2.358E+00	6.578E+02	4.420E-02
2094	2.115E+03	1.155E+06	7.763E+01	2.311E+00	6.447E+02	4.332E-02
2095	2.073E+03	1.133E+06	7.610E+01	2.265E+00	6.320E+02	4.246E-02
2096	2.032E+03	1.110E+06	7.459E+01	2.220E+00	6.195E+02	4.162E-02
2097	1.992E+03	1.088E+06	7.311E+01	2.176E+00	6.072E+02	4.080E-02
2098	1.952E+03	1.067E+06	7.167E+01	2.133E+00	5.952E+02	3.999E-02
2099	1.914E+03	1.046E+06	7.025E+01	2.091E+00	5.834E+02	3.920E-02
2100	1.876E+03	1.025E+06	6.886E+01	2.050E+00	5.718E+02	3.842E-02
2101	1.839E+03	1.005E+06	6.749E+01	2.009E+00	5.605E+02	3.766E-02
2102	1.802E+03	9.846E+05	6.616E+01	1.969E+00	5.494E+02	3.692E-02
2103	1.767E+03	9.651E+05	6.485E+01	1.930E+00	5.385E+02	3.618E-02
2104	1.732E+03	9.460E+05	6.356E+01	1.892E+00	5.279E+02	3.547E-02
2105	1.697E+03	9.273E+05	6.230E+01	1.855E+00	5.174E+02	3.477E-02
2106	1.664E+03	9.089E+05	6.107E+01	1.818E+00	5.072E+02	3.408E-02
2107	1.631E+03	8.909E+05	5.986E+01	1.782E+00	4.971E+02	3.340E-02
2108	1.599E+03	8.733E+05	5.868E+01	1.747E+00	4.873E+02	3.274E-02
2109	1.567E+03	8.560E+05	5.751E+01	1.712E+00	4.776E+02	3.209E-02
2110	1.536E+03	8.390E+05	5.637E+01	1.678E+00	4.682E+02	3.146E-02
2111	1.505E+03	8.224E+05	5.526E+01	1.645E+00	4.589E+02	3.083E-02
2112	1.476E+03	8.061E+05	5.416E+01	1.612E+00	4.498E+02	3.022E-02
2113	1.446E+03	7.902E+05	5.309E+01	1.580E+00	4.409E+02	2.963E-02
2114	1.418E+03	7.745E+05	5.204E+01	1.549E+00	4.322E+02	2.904E-02
2115	1.390E+03	7.592E+05	5.101E+01	1.518E+00	4.236E+02	2.846E-02
2116	1.362E+03	7.442E+05	5.000E+01	1.488E+00	4.152E+02	2.790E-02
2117	1.335E+03	7.294E+05	4.901E+01	1.459E+00	4.070E+02	2.735E-02
2118	1.309E+03	7.150E+05	4.804E+01	1.430E+00	3.990E+02	2.681E-02
2119	1.283E+03	7.008E+05	4.709E+01	1.402E+00	3.911E+02	2.628E-02



Summary Report

Landfill Name or Identifier: McDaniel

Date: Wednesday, July 24, 2019

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	**1980**	
Landfill Closure Year (with 80-year limit)	**2028**	
Actual Closure Year (without limit)	***2028***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**1,798,986**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*year^{-1}*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**297**	*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)*
1980	0	0	0	0
1981	39,000	42,900	0	0
1982	39,000	42,900	39,000	42,900
1983	39,000	42,900	78,000	85,800
1984	39,000	42,900	117,000	128,700
1985	39,000	42,900	156,000	171,600
1986	39,000	42,900	195,000	214,500
1987	39,000	42,900	234,000	257,400
1988	39,000	42,900	273,000	300,300
1989	39,000	42,900	312,000	343,200
1990	39,000	42,900	351,000	386,100
1991	39,000	42,900	390,000	429,000
1992	39,000	42,900	429,000	471,900
1993	39,000	42,900	468,000	514,800
1994	39,000	42,900	507,000	557,700
1995	39,000	42,900	546,000	600,600
1996	39,000	42,900	585,000	643,500
1997	39,000	42,900	624,000	686,400
1998	39,000	42,900	663,000	729,300
1999	39,000	42,900	702,000	772,200
2000	39,000	42,900	741,000	815,100
2001	39,000	42,900	780,000	858,000
2002	39,000	42,900	819,000	900,900
2003	39,000	42,900	858,000	943,800
2004	39,000	42,900	897,000	986,700
2005	39,000	42,900	936,000	1,029,600
2006	39,000	42,900	975,000	1,072,500
2007	39,000	42,900	1,014,000	1,115,400
2008	39,000	42,900	1,053,000	1,158,300
2009	39,000	42,900	1,092,000	1,201,200
2010	39,000	42,900	1,131,000	1,244,100
2011	39,000	42,900	1,170,000	1,287,000
2012	40,055	44,061	1,209,000	1,329,900
2013	39,936	43,930	1,249,055	1,373,961
2014	36,263	39,889	1,288,991	1,417,890
2015	38,037	41,841	1,325,254	1,457,779
2016	36,721	40,393	1,363,291	1,499,620
2017	36,000	39,600	1,400,012	1,540,013
2018	36,000	39,600	1,436,012	1,579,613
2019	36,000	39,600	1,472,012	1,619,213

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2020	36,000	39,600	1,508,012	1,658,813
2021	36,000	39,600	1,544,012	1,698,413
2022	36,000	39,600	1,580,012	1,738,013
2023	36,000	39,600	1,616,012	1,777,613
2024	36,000	39,600	1,652,012	1,817,213
2025	36,000	39,600	1,688,012	1,856,813
2026	36,000	39,600	1,724,012	1,896,413
2027	36,000	39,600	1,760,012	1,936,013
2028	2,974	3,271	1,796,012	1,975,613
2029	0	0	1,798,986	1,978,885
2030	0	0	1,798,986	1,978,885
2031	0	0	1,798,986	1,978,885
2032	0	0	1,798,986	1,978,885
2033	0	0	1,798,986	1,978,885
2034	0	0	1,798,986	1,978,885
2035	0	0	1,798,986	1,978,885
2036	0	0	1,798,986	1,978,885
2037	0	0	1,798,986	1,978,885
2038	0	0	1,798,986	1,978,885
2039	0	0	1,798,986	1,978,885
2040	0	0	1,798,986	1,978,885
2041	0	0	1,798,986	1,978,885
2042	0	0	1,798,986	1,978,885
2043	0	0	1,798,986	1,978,885
2044	0	0	1,798,986	1,978,885
2045	0	0	1,798,986	1,978,885
2046	0	0	1,798,986	1,978,885
2047	0	0	1,798,986	1,978,885
2048	0	0	1,798,986	1,978,885
2049	0	0	1,798,986	1,978,885
2050	0	0	1,798,986	1,978,885
2051	0	0	1,798,986	1,978,885
2052	0	0	1,798,986	1,978,885
2053	0	0	1,798,986	1,978,885
2054	0	0	1,798,986	1,978,885
2055	0	0	1,798,986	1,978,885
2056	0	0	1,798,986	1,978,885
2057	0	0	1,798,986	1,978,885
2058	0	0	1,798,986	1,978,885
2059	0	0	1,798,986	1,978,885

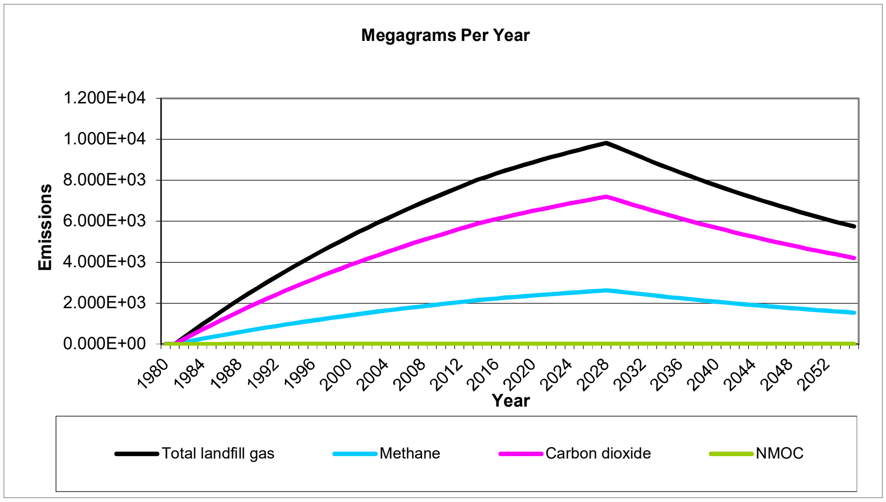
Pollutant Parameters

	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		

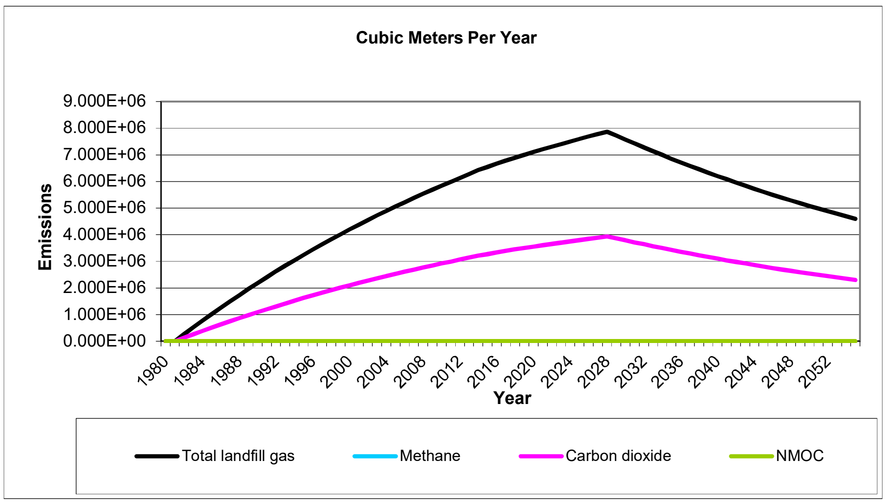
Pollutant Parameters (Continued)

	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		

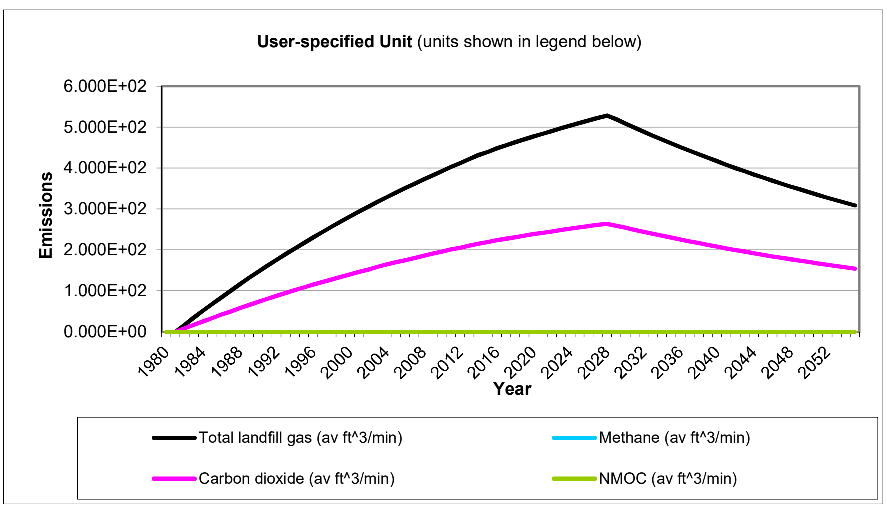
Graphs



Megagrams Per Year
Emissions
Year
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
1980 1984 1988 1992 1996 2000 2004 2008 2012 2016 2020 2024 2028 2032 2036 2040 2044 2048 2052
Total landfill gas
Methane
Carbon dioxide
NMOC



Cubic Meters Per Year
Emissions
Year
9.000E+06
8.000E+06
7.000E+06
6.000E+06
5.000E+06
4.000E+06
3.000E+06
2.000E+06
1.000E+06
0.000E+00
1980 1984 1988 1992 1996 2000 2004 2008 2012 2016 2020 2024 2028 2032 2036 2040 2044 2048 2052
Total landfill gas
Methane
Carbon dioxide
NMOC



User-specified Unit (units shown in legend below)
Emissions
Year
6.000E+02
5.000E+02
4.000E+02
3.000E+02
2.000E+02
1.000E+02
0.000E+00
1980 1984 1988 1992 1996 2000 2004 2008 2012 2016 2020 2024 2028 2032 2036 2040 2044 2048 2052
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)
1980	0	0	0	0	0	0
1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1982	3.282E+02	2.628E+05	1.766E+01	8.767E+01	1.314E+05	8.830E+00
1983	6.500E+02	5.205E+05	3.497E+01	1.736E+02	2.602E+05	1.748E+01
1984	9.653E+02	7.730E+05	5.194E+01	2.578E+02	3.865E+05	2.597E+01
1985	1.274E+03	1.020E+06	6.857E+01	3.404E+02	5.102E+05	3.428E+01
1986	1.577E+03	1.263E+06	8.487E+01	4.213E+02	6.316E+05	4.243E+01
1987	1.874E+03	1.501E+06	1.008E+02	5.007E+02	7.505E+05	5.042E+01
1988	2.166E+03	1.734E+06	1.165E+02	5.784E+02	8.670E+05	5.826E+01
1989	2.451E+03	1.963E+06	1.319E+02	6.547E+02	9.813E+05	6.593E+01
1990	2.731E+03	2.187E+06	1.469E+02	7.294E+02	1.093E+06	7.346E+01
1991	3.005E+03	2.406E+06	1.617E+02	8.026E+02	1.203E+06	8.083E+01
1992	3.273E+03	2.621E+06	1.761E+02	8.744E+02	1.311E+06	8.806E+01
1993	3.537E+03	2.832E+06	1.903E+02	9.447E+02	1.416E+06	9.515E+01
1994	3.795E+03	3.039E+06	2.042E+02	1.014E+03	1.519E+06	1.021E+02
1995	4.048E+03	3.242E+06	2.178E+02	1.081E+03	1.621E+06	1.089E+02
1996	4.296E+03	3.440E+06	2.311E+02	1.148E+03	1.720E+06	1.156E+02
1997	4.539E+03	3.635E+06	2.442E+02	1.213E+03	1.817E+06	1.221E+02
1998	4.778E+03	3.826E+06	2.571E+02	1.276E+03	1.913E+06	1.285E+02
1999	5.011E+03	4.013E+06	2.696E+02	1.339E+03	2.006E+06	1.348E+02
2000	5.240E+03	4.196E+06	2.819E+02	1.400E+03	2.098E+06	1.410E+02
2001	5.465E+03	4.376E+06	2.940E+02	1.460E+03	2.188E+06	1.470E+02
2002	5.685E+03	4.552E+06	3.059E+02	1.518E+03	2.276E+06	1.529E+02
2003	5.900E+03	4.725E+06	3.175E+02	1.576E+03	2.362E+06	1.587E+02
2004	6.112E+03	4.894E+06	3.288E+02	1.633E+03	2.447E+06	1.644E+02
2005	6.319E+03	5.060E+06	3.400E+02	1.688E+03	2.530E+06	1.700E+02
2006	6.522E+03	5.223E+06	3.509E+02	1.742E+03	2.611E+06	1.755E+02
2007	6.721E+03	5.382E+06	3.616E+02	1.795E+03	2.691E+06	1.808E+02
2008	6.916E+03	5.538E+06	3.721E+02	1.847E+03	2.769E+06	1.861E+02
2009	7.108E+03	5.691E+06	3.824E+02	1.899E+03	2.846E+06	1.912E+02
2010	7.295E+03	5.842E+06	3.925E+02	1.949E+03	2.921E+06	1.962E+02
2011	7.479E+03	5.989E+06	4.024E+02	1.998E+03	2.994E+06	2.012E+02
2012	7.659E+03	6.133E+06	4.121E+02	2.046E+03	3.066E+06	2.060E+02
2013	7.844E+03	6.281E+06	4.221E+02	2.095E+03	3.141E+06	2.110E+02
2014	8.025E+03	6.426E+06	4.318E+02	2.144E+03	3.213E+06	2.159E+02
2015	8.172E+03	6.543E+06	4.396E+02	2.183E+03	3.272E+06	2.198E+02
2016	8.330E+03	6.670E+06	4.482E+02	2.225E+03	3.335E+06	2.241E+02
2017	8.474E+03	6.786E+06	4.559E+02	2.263E+03	3.393E+06	2.280E+02
2018	8.609E+03	6.894E+06	4.632E+02	2.300E+03	3.447E+06	2.316E+02
2019	8.742E+03	7.000E+06	4.703E+02	2.335E+03	3.500E+06	2.352E+02
2020	8.872E+03	7.104E+06	4.773E+02	2.370E+03	3.552E+06	2.387E+02
2021	8.999E+03	7.206E+06	4.842E+02	2.404E+03	3.603E+06	2.421E+02
2022	9.124E+03	7.306E+06	4.909E+02	2.437E+03	3.653E+06	2.454E+02
2023	9.246E+03	7.404E+06	4.975E+02	2.470E+03	3.702E+06	2.487E+02
2024	9.366E+03	7.500E+06	5.039E+02	2.502E+03	3.750E+06	2.520E+02
2025	9.483E+03	7.594E+06	5.102E+02	2.533E+03	3.797E+06	2.551E+02
2026	9.599E+03	7.686E+06	5.164E+02	2.564E+03	3.843E+06	2.582E+02
2027	9.711E+03	7.776E+06	5.225E+02	2.594E+03	3.888E+06	2.613E+02
2028	9.822E+03	7.865E+06	5.285E+02	2.624E+03	3.933E+06	2.642E+02
2029	9.653E+03	7.729E+06	5.193E+02	2.578E+03	3.865E+06	2.597E+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)
2030	9.462E+03	7.576E+06	5.091E+02	2.527E+03	3.788E+06	2.545E+02
2031	9.274E+03	7.426E+06	4.990E+02	2.477E+03	3.713E+06	2.495E+02
2032	9.091E+03	7.279E+06	4.891E+02	2.428E+03	3.640E+06	2.445E+02
2033	8.911E+03	7.135E+06	4.794E+02	2.380E+03	3.568E+06	2.397E+02
2034	8.734E+03	6.994E+06	4.699E+02	2.333E+03	3.497E+06	2.350E+02
2035	8.561E+03	6.855E+06	4.606E+02	2.287E+03	3.428E+06	2.303E+02
2036	8.392E+03	6.720E+06	4.515E+02	2.241E+03	3.360E+06	2.257E+02
2037	8.225E+03	6.587E+06	4.426E+02	2.197E+03	3.293E+06	2.213E+02
2038	8.063E+03	6.456E+06	4.338E+02	2.154E+03	3.228E+06	2.169E+02
2039	7.903E+03	6.328E+06	4.252E+02	2.111E+03	3.164E+06	2.126E+02
2040	7.746E+03	6.203E+06	4.168E+02	2.069E+03	3.101E+06	2.084E+02
2041	7.593E+03	6.080E+06	4.085E+02	2.028E+03	3.040E+06	2.043E+02
2042	7.443E+03	5.960E+06	4.004E+02	1.988E+03	2.980E+06	2.002E+02
2043	7.295E+03	5.842E+06	3.925E+02	1.949E+03	2.921E+06	1.963E+02
2044	7.151E+03	5.726E+06	3.847E+02	1.910E+03	2.863E+06	1.924E+02
2045	7.009E+03	5.613E+06	3.771E+02	1.872E+03	2.806E+06	1.886E+02
2046	6.870E+03	5.502E+06	3.696E+02	1.835E+03	2.751E+06	1.848E+02
2047	6.734E+03	5.393E+06	3.623E+02	1.799E+03	2.696E+06	1.812E+02
2048	6.601E+03	5.286E+06	3.552E+02	1.763E+03	2.643E+06	1.776E+02
2049	6.470E+03	5.181E+06	3.481E+02	1.728E+03	2.591E+06	1.741E+02
2050	6.342E+03	5.079E+06	3.412E+02	1.694E+03	2.539E+06	1.706E+02
2051	6.217E+03	4.978E+06	3.345E+02	1.661E+03	2.489E+06	1.672E+02
2052	6.094E+03	4.879E+06	3.278E+02	1.628E+03	2.440E+06	1.639E+02
2053	5.973E+03	4.783E+06	3.214E+02	1.595E+03	2.391E+06	1.607E+02
2054	5.855E+03	4.688E+06	3.150E+02	1.564E+03	2.344E+06	1.575E+02
2055	5.739E+03	4.595E+06	3.088E+02	1.533E+03	2.298E+06	1.544E+02
2056	5.625E+03	4.504E+06	3.026E+02	1.503E+03	2.252E+06	1.513E+02
2057	5.514E+03	4.415E+06	2.967E+02	1.473E+03	2.208E+06	1.483E+02
2058	5.405E+03	4.328E+06	2.908E+02	1.444E+03	2.164E+06	1.454E+02
2059	5.297E+03	4.242E+06	2.850E+02	1.415E+03	2.121E+06	1.425E+02
2060	5.193E+03	4.158E+06	2.794E+02	1.387E+03	2.079E+06	1.397E+02
2061	5.090E+03	4.076E+06	2.738E+02	1.360E+03	2.038E+06	1.369E+02
2062	4.989E+03	3.995E+06	2.684E+02	1.333E+03	1.997E+06	1.342E+02
2063	4.890E+03	3.916E+06	2.631E+02	1.306E+03	1.958E+06	1.316E+02
2064	4.793E+03	3.838E+06	2.579E+02	1.280E+03	1.919E+06	1.289E+02
2065	4.698E+03	3.762E+06	2.528E+02	1.255E+03	1.881E+06	1.264E+02
2066	4.605E+03	3.688E+06	2.478E+02	1.230E+03	1.844E+06	1.239E+02
2067	4.514E+03	3.615E+06	2.429E+02	1.206E+03	1.807E+06	1.214E+02
2068	4.425E+03	3.543E+06	2.381E+02	1.182E+03	1.772E+06	1.190E+02
2069	4.337E+03	3.473E+06	2.334E+02	1.159E+03	1.737E+06	1.167E+02
2070	4.251E+03	3.404E+06	2.287E+02	1.136E+03	1.702E+06	1.144E+02
2071	4.167E+03	3.337E+06	2.242E+02	1.113E+03	1.668E+06	1.121E+02
2072	4.085E+03	3.271E+06	2.198E+02	1.091E+03	1.635E+06	1.099E+02
2073	4.004E+03	3.206E+06	2.154E+02	1.069E+03	1.603E+06	1.077E+02
2074	3.924E+03	3.143E+06	2.111E+02	1.048E+03	1.571E+06	1.056E+02
2075	3.847E+03	3.080E+06	2.070E+02	1.028E+03	1.540E+06	1.035E+02
2076	3.771E+03	3.019E+06	2.029E+02	1.007E+03	1.510E+06	1.014E+02
2077	3.696E+03	2.960E+06	1.989E+02	9.872E+02	1.480E+06	9.943E+01
2078	3.623E+03	2.901E+06	1.949E+02	9.677E+02	1.450E+06	9.746E+01
2079	3.551E+03	2.843E+06	1.911E+02	9.485E+02	1.422E+06	9.553E+01
2080	3.481E+03	2.787E+06	1.873E+02	9.297E+02	1.394E+06	9.364E+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)
2081	3.412E+03	2.732E+06	1.836E+02	9.113E+02	1.366E+06	9.178E+01
2082	3.344E+03	2.678E+06	1.799E+02	8.933E+02	1.339E+06	8.996E+01
2083	3.278E+03	2.625E+06	1.764E+02	8.756E+02	1.312E+06	8.818E+01
2084	3.213E+03	2.573E+06	1.729E+02	8.583E+02	1.286E+06	8.644E+01
2085	3.149E+03	2.522E+06	1.694E+02	8.413E+02	1.261E+06	8.472E+01
2086	3.087E+03	2.472E+06	1.661E+02	8.246E+02	1.236E+06	8.305E+01
2087	3.026E+03	2.423E+06	1.628E+02	8.083E+02	1.212E+06	8.140E+01
2088	2.966E+03	2.375E+06	1.596E+02	7.923E+02	1.188E+06	7.979E+01
2089	2.907E+03	2.328E+06	1.564E+02	7.766E+02	1.164E+06	7.821E+01
2090	2.850E+03	2.282E+06	1.533E+02	7.612E+02	1.141E+06	7.666E+01
2091	2.793E+03	2.237E+06	1.503E+02	7.461E+02	1.118E+06	7.514E+01
2092	2.738E+03	2.192E+06	1.473E+02	7.314E+02	1.096E+06	7.366E+01
2093	2.684E+03	2.149E+06	1.444E+02	7.169E+02	1.075E+06	7.220E+01
2094	2.631E+03	2.107E+06	1.415E+02	7.027E+02	1.053E+06	7.077E+01
2095	2.579E+03	2.065E+06	1.387E+02	6.888E+02	1.032E+06	6.937E+01
2096	2.528E+03	2.024E+06	1.360E+02	6.751E+02	1.012E+06	6.799E+01
2097	2.477E+03	1.984E+06	1.333E+02	6.618E+02	9.919E+05	6.665E+01
2098	2.428E+03	1.945E+06	1.307E+02	6.487E+02	9.723E+05	6.533E+01
2099	2.380E+03	1.906E+06	1.281E+02	6.358E+02	9.530E+05	6.403E+01
2100	2.333E+03	1.868E+06	1.255E+02	6.232E+02	9.342E+05	6.277E+01
2101	2.287E+03	1.831E+06	1.230E+02	6.109E+02	9.157E+05	6.152E+01
2102	2.242E+03	1.795E+06	1.206E+02	5.988E+02	8.975E+05	6.030E+01
2103	2.197E+03	1.760E+06	1.182E+02	5.869E+02	8.798E+05	5.911E+01
2104	2.154E+03	1.725E+06	1.159E+02	5.753E+02	8.623E+05	5.794E+01
2105	2.111E+03	1.691E+06	1.136E+02	5.639E+02	8.453E+05	5.679E+01
2106	2.069E+03	1.657E+06	1.113E+02	5.527E+02	8.285E+05	5.567E+01
2107	2.028E+03	1.624E+06	1.091E+02	5.418E+02	8.121E+05	5.457E+01
2108	1.988E+03	1.592E+06	1.070E+02	5.311E+02	7.960E+05	5.349E+01
2109	1.949E+03	1.561E+06	1.049E+02	5.206E+02	7.803E+05	5.243E+01
2110	1.910E+03	1.530E+06	1.028E+02	5.102E+02	7.648E+05	5.139E+01
2111	1.872E+03	1.499E+06	1.007E+02	5.001E+02	7.497E+05	5.037E+01
2112	1.835E+03	1.470E+06	9.875E+01	4.902E+02	7.348E+05	4.937E+01
2113	1.799E+03	1.441E+06	9.679E+01	4.805E+02	7.203E+05	4.840E+01
2114	1.763E+03	1.412E+06	9.487E+01	4.710E+02	7.060E+05	4.744E+01
2115	1.728E+03	1.384E+06	9.300E+01	4.617E+02	6.920E+05	4.650E+01
2116	1.694E+03	1.357E+06	9.115E+01	4.525E+02	6.783E+05	4.558E+01
2117	1.661E+03	1.330E+06	8.935E+01	4.436E+02	6.649E+05	4.467E+01
2118	1.628E+03	1.303E+06	8.758E+01	4.348E+02	6.517E+05	4.379E+01
2119	1.596E+03	1.278E+06	8.585E+01	4.262E+02	6.388E+05	4.292E+01
2120	1.564E+03	1.252E+06	8.415E+01	4.178E+02	6.262E+05	4.207E+01

Results (Continued)

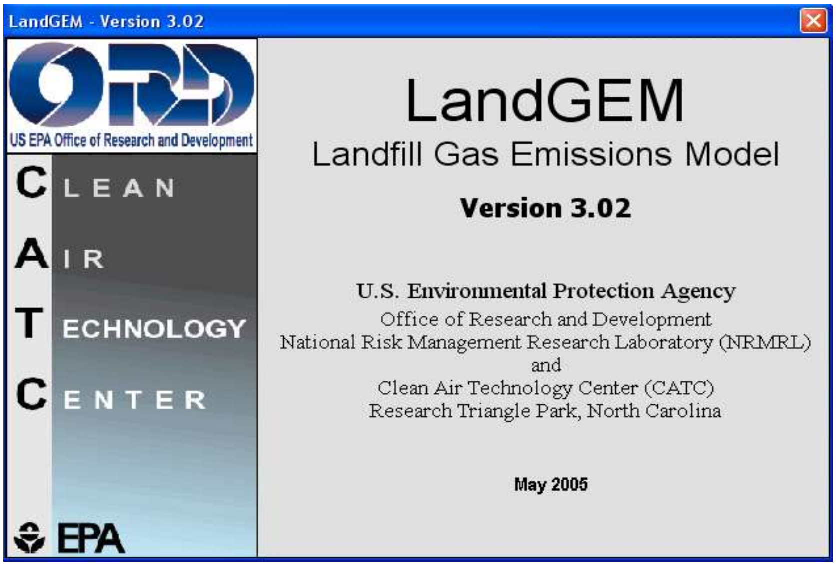
Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1980	0	0	0	0	0	0
1981	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1982	2.406E+02	1.314E+05	8.830E+00	2.798E-01	7.806E+01	5.245E-03
1983	4.763E+02	2.602E+05	1.748E+01	5.541E-01	1.546E+02	1.039E-02
1984	7.075E+02	3.865E+05	2.597E+01	8.229E-01	2.296E+02	1.543E-02
1985	9.340E+02	5.102E+05	3.428E+01	1.086E+00	3.031E+02	2.036E-02
1986	1.156E+03	6.316E+05	4.243E+01	1.345E+00	3.751E+02	2.521E-02
1987	1.374E+03	7.505E+05	5.042E+01	1.598E+00	4.458E+02	2.995E-02
1988	1.587E+03	8.670E+05	5.826E+01	1.846E+00	5.150E+02	3.460E-02
1989	1.796E+03	9.813E+05	6.593E+01	2.089E+00	5.829E+02	3.916E-02
1990	2.001E+03	1.093E+06	7.346E+01	2.328E+00	6.494E+02	4.363E-02
1991	2.202E+03	1.203E+06	8.083E+01	2.561E+00	7.146E+02	4.801E-02
1992	2.399E+03	1.311E+06	8.806E+01	2.791E+00	7.785E+02	5.231E-02
1993	2.592E+03	1.416E+06	9.515E+01	3.015E+00	8.411E+02	5.652E-02
1994	2.781E+03	1.519E+06	1.021E+02	3.235E+00	9.026E+02	6.064E-02
1995	2.967E+03	1.621E+06	1.089E+02	3.451E+00	9.627E+02	6.469E-02
1996	3.149E+03	1.720E+06	1.156E+02	3.662E+00	1.022E+03	6.865E-02
1997	3.327E+03	1.817E+06	1.221E+02	3.870E+00	1.080E+03	7.254E-02
1998	3.502E+03	1.913E+06	1.285E+02	4.073E+00	1.136E+03	7.634E-02
1999	3.673E+03	2.006E+06	1.348E+02	4.272E+00	1.192E+03	8.008E-02
2000	3.841E+03	2.098E+06	1.410E+02	4.467E+00	1.246E+03	8.374E-02
2001	4.005E+03	2.188E+06	1.470E+02	4.659E+00	1.300E+03	8.732E-02
2002	4.166E+03	2.276E+06	1.529E+02	4.846E+00	1.352E+03	9.084E-02
2003	4.324E+03	2.362E+06	1.587E+02	5.030E+00	1.403E+03	9.429E-02
2004	4.479E+03	2.447E+06	1.644E+02	5.210E+00	1.454E+03	9.766E-02
2005	4.631E+03	2.530E+06	1.700E+02	5.387E+00	1.503E+03	1.010E-01
2006	4.780E+03	2.611E+06	1.755E+02	5.560E+00	1.551E+03	1.042E-01
2007	4.926E+03	2.691E+06	1.808E+02	5.730E+00	1.598E+03	1.074E-01
2008	5.069E+03	2.769E+06	1.861E+02	5.896E+00	1.645E+03	1.105E-01
2009	5.209E+03	2.846E+06	1.912E+02	6.059E+00	1.690E+03	1.136E-01
2010	5.347E+03	2.921E+06	1.962E+02	6.219E+00	1.735E+03	1.166E-01
2011	5.481E+03	2.994E+06	2.012E+02	6.376E+00	1.779E+03	1.195E-01
2012	5.613E+03	3.066E+06	2.060E+02	6.529E+00	1.821E+03	1.224E-01
2013	5.749E+03	3.141E+06	2.110E+02	6.687E+00	1.866E+03	1.253E-01
2014	5.882E+03	3.213E+06	2.159E+02	6.841E+00	1.909E+03	1.282E-01
2015	5.989E+03	3.272E+06	2.198E+02	6.966E+00	1.943E+03	1.306E-01
2016	6.105E+03	3.335E+06	2.241E+02	7.101E+00	1.981E+03	1.331E-01
2017	6.210E+03	3.393E+06	2.280E+02	7.224E+00	2.015E+03	1.354E-01
2018	6.310E+03	3.447E+06	2.316E+02	7.339E+00	2.047E+03	1.376E-01
2019	6.407E+03	3.500E+06	2.352E+02	7.452E+00	2.079E+03	1.397E-01
2020	6.502E+03	3.552E+06	2.387E+02	7.563E+00	2.110E+03	1.418E-01
2021	6.595E+03	3.603E+06	2.421E+02	7.671E+00	2.140E+03	1.438E-01
2022	6.687E+03	3.653E+06	2.454E+02	7.778E+00	2.170E+03	1.458E-01
2023	6.776E+03	3.702E+06	2.487E+02	7.882E+00	2.199E+03	1.477E-01
2024	6.864E+03	3.750E+06	2.520E+02	7.984E+00	2.227E+03	1.497E-01
2025	6.950E+03	3.797E+06	2.551E+02	8.084E+00	2.255E+03	1.515E-01
2026	7.035E+03	3.843E+06	2.582E+02	8.182E+00	2.283E+03	1.534E-01
2027	7.117E+03	3.888E+06	2.613E+02	8.279E+00	2.310E+03	1.552E-01
2028	7.199E+03	3.933E+06	2.642E+02	8.373E+00	2.336E+03	1.570E-01
2029	7.074E+03	3.865E+06	2.597E+02	8.229E+00	2.296E+03	1.542E-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)
2030	6.934E+03	3.788E+06	2.545E+02	8.066E+00	2.250E+03	1.512E-01
2031	6.797E+03	3.713E+06	2.495E+02	7.906E+00	2.206E+03	1.482E-01
2032	6.662E+03	3.640E+06	2.445E+02	7.749E+00	2.162E+03	1.453E-01
2033	6.530E+03	3.568E+06	2.397E+02	7.596E+00	2.119E+03	1.424E-01
2034	6.401E+03	3.497E+06	2.350E+02	7.446E+00	2.077E+03	1.396E-01
2035	6.274E+03	3.428E+06	2.303E+02	7.298E+00	2.036E+03	1.368E-01
2036	6.150E+03	3.360E+06	2.257E+02	7.154E+00	1.996E+03	1.341E-01
2037	6.028E+03	3.293E+06	2.213E+02	7.012E+00	1.956E+03	1.314E-01
2038	5.909E+03	3.228E+06	2.169E+02	6.873E+00	1.917E+03	1.288E-01
2039	5.792E+03	3.164E+06	2.126E+02	6.737E+00	1.880E+03	1.263E-01
2040	5.677E+03	3.101E+06	2.084E+02	6.604E+00	1.842E+03	1.238E-01
2041	5.565E+03	3.040E+06	2.043E+02	6.473E+00	1.806E+03	1.213E-01
2042	5.455E+03	2.980E+06	2.002E+02	6.345E+00	1.770E+03	1.189E-01
2043	5.347E+03	2.921E+06	1.963E+02	6.219E+00	1.735E+03	1.166E-01
2044	5.241E+03	2.863E+06	1.924E+02	6.096E+00	1.701E+03	1.143E-01
2045	5.137E+03	2.806E+06	1.886E+02	5.975E+00	1.667E+03	1.120E-01
2046	5.035E+03	2.751E+06	1.848E+02	5.857E+00	1.634E+03	1.098E-01
2047	4.936E+03	2.696E+06	1.812E+02	5.741E+00	1.602E+03	1.076E-01
2048	4.838E+03	2.643E+06	1.776E+02	5.627E+00	1.570E+03	1.055E-01
2049	4.742E+03	2.591E+06	1.741E+02	5.516E+00	1.539E+03	1.034E-01
2050	4.648E+03	2.539E+06	1.706E+02	5.407E+00	1.508E+03	1.013E-01
2051	4.556E+03	2.489E+06	1.672E+02	5.300E+00	1.478E+03	9.934E-02
2052	4.466E+03	2.440E+06	1.639E+02	5.195E+00	1.449E+03	9.737E-02
2053	4.377E+03	2.391E+06	1.607E+02	5.092E+00	1.421E+03	9.544E-02
2054	4.291E+03	2.344E+06	1.575E+02	4.991E+00	1.392E+03	9.355E-02
2055	4.206E+03	2.298E+06	1.544E+02	4.892E+00	1.365E+03	9.170E-02
2056	4.123E+03	2.252E+06	1.513E+02	4.795E+00	1.338E+03	8.989E-02
2057	4.041E+03	2.208E+06	1.483E+02	4.700E+00	1.311E+03	8.811E-02
2058	3.961E+03	2.164E+06	1.454E+02	4.607E+00	1.285E+03	8.636E-02
2059	3.882E+03	2.121E+06	1.425E+02	4.516E+00	1.260E+03	8.465E-02
2060	3.806E+03	2.079E+06	1.397E+02	4.427E+00	1.235E+03	8.297E-02
2061	3.730E+03	2.038E+06	1.369E+02	4.339E+00	1.210E+03	8.133E-02
2062	3.656E+03	1.997E+06	1.342E+02	4.253E+00	1.187E+03	7.972E-02
2063	3.584E+03	1.958E+06	1.316E+02	4.169E+00	1.163E+03	7.814E-02
2064	3.513E+03	1.919E+06	1.289E+02	4.086E+00	1.140E+03	7.660E-02
2065	3.443E+03	1.881E+06	1.264E+02	4.005E+00	1.117E+03	7.508E-02
2066	3.375E+03	1.844E+06	1.239E+02	3.926E+00	1.095E+03	7.359E-02
2067	3.308E+03	1.807E+06	1.214E+02	3.848E+00	1.074E+03	7.213E-02
2068	3.243E+03	1.772E+06	1.190E+02	3.772E+00	1.052E+03	7.071E-02
2069	3.179E+03	1.737E+06	1.167E+02	3.697E+00	1.031E+03	6.931E-02
2070	3.116E+03	1.702E+06	1.144E+02	3.624E+00	1.011E+03	6.793E-02
2071	3.054E+03	1.668E+06	1.121E+02	3.552E+00	9.910E+02	6.659E-02
2072	2.994E+03	1.635E+06	1.099E+02	3.482E+00	9.714E+02	6.527E-02
2073	2.934E+03	1.603E+06	1.077E+02	3.413E+00	9.522E+02	6.398E-02
2074	2.876E+03	1.571E+06	1.056E+02	3.346E+00	9.333E+02	6.271E-02
2075	2.819E+03	1.540E+06	1.035E+02	3.279E+00	9.149E+02	6.147E-02
2076	2.763E+03	1.510E+06	1.014E+02	3.214E+00	8.967E+02	6.025E-02
2077	2.709E+03	1.480E+06	9.943E+01	3.151E+00	8.790E+02	5.906E-02
2078	2.655E+03	1.450E+06	9.746E+01	3.088E+00	8.616E+02	5.789E-02
2079	2.603E+03	1.422E+06	9.553E+01	3.027E+00	8.445E+02	5.674E-02
2080	2.551E+03	1.394E+06	9.364E+01	2.967E+00	8.278E+02	5.562E-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)
2081	2.500E+03	1.366E+06	9.178E+01	2.908E+00	8.114E+02	5.452E-02
2082	2.451E+03	1.339E+06	8.996E+01	2.851E+00	7.953E+02	5.344E-02
2083	2.402E+03	1.312E+06	8.818E+01	2.794E+00	7.796E+02	5.238E-02
2084	2.355E+03	1.286E+06	8.644E+01	2.739E+00	7.642E+02	5.134E-02
2085	2.308E+03	1.261E+06	8.472E+01	2.685E+00	7.490E+02	5.033E-02
2086	2.263E+03	1.236E+06	8.305E+01	2.632E+00	7.342E+02	4.933E-02
2087	2.218E+03	1.212E+06	8.140E+01	2.580E+00	7.196E+02	4.835E-02
2088	2.174E+03	1.188E+06	7.979E+01	2.528E+00	7.054E+02	4.740E-02
2089	2.131E+03	1.164E+06	7.821E+01	2.478E+00	6.914E+02	4.646E-02
2090	2.089E+03	1.141E+06	7.666E+01	2.429E+00	6.777E+02	4.554E-02
2091	2.047E+03	1.118E+06	7.514E+01	2.381E+00	6.643E+02	4.464E-02
2092	2.007E+03	1.096E+06	7.366E+01	2.334E+00	6.512E+02	4.375E-02
2093	1.967E+03	1.075E+06	7.220E+01	2.288E+00	6.383E+02	4.289E-02
2094	1.928E+03	1.053E+06	7.077E+01	2.243E+00	6.256E+02	4.204E-02
2095	1.890E+03	1.032E+06	6.937E+01	2.198E+00	6.132E+02	4.120E-02
2096	1.852E+03	1.012E+06	6.799E+01	2.155E+00	6.011E+02	4.039E-02
2097	1.816E+03	9.919E+05	6.665E+01	2.112E+00	5.892E+02	3.959E-02
2098	1.780E+03	9.723E+05	6.533E+01	2.070E+00	5.775E+02	3.880E-02
2099	1.745E+03	9.530E+05	6.403E+01	2.029E+00	5.661E+02	3.804E-02
2100	1.710E+03	9.342E+05	6.277E+01	1.989E+00	5.549E+02	3.728E-02
2101	1.676E+03	9.157E+05	6.152E+01	1.950E+00	5.439E+02	3.654E-02
2102	1.643E+03	8.975E+05	6.030E+01	1.911E+00	5.331E+02	3.582E-02
2103	1.610E+03	8.798E+05	5.911E+01	1.873E+00	5.226E+02	3.511E-02
2104	1.578E+03	8.623E+05	5.794E+01	1.836E+00	5.122E+02	3.442E-02
2105	1.547E+03	8.453E+05	5.679E+01	1.800E+00	5.021E+02	3.373E-02
2106	1.517E+03	8.285E+05	5.567E+01	1.764E+00	4.921E+02	3.307E-02
2107	1.487E+03	8.121E+05	5.457E+01	1.729E+00	4.824E+02	3.241E-02
2108	1.457E+03	7.960E+05	5.349E+01	1.695E+00	4.728E+02	3.177E-02
2109	1.428E+03	7.803E+05	5.243E+01	1.661E+00	4.635E+02	3.114E-02
2110	1.400E+03	7.648E+05	5.139E+01	1.628E+00	4.543E+02	3.052E-02
2111	1.372E+03	7.497E+05	5.037E+01	1.596E+00	4.453E+02	2.992E-02
2112	1.345E+03	7.348E+05	4.937E+01	1.565E+00	4.365E+02	2.933E-02
2113	1.318E+03	7.203E+05	4.840E+01	1.534E+00	4.278E+02	2.875E-02
2114	1.292E+03	7.060E+05	4.744E+01	1.503E+00	4.194E+02	2.818E-02
2115	1.267E+03	6.920E+05	4.650E+01	1.473E+00	4.111E+02	2.762E-02
2116	1.242E+03	6.783E+05	4.558E+01	1.444E+00	4.029E+02	2.707E-02
2117	1.217E+03	6.649E+05	4.467E+01	1.416E+00	3.950E+02	2.654E-02
2118	1.193E+03	6.517E+05	4.379E+01	1.388E+00	3.871E+02	2.601E-02
2119	1.169E+03	6.388E+05	4.292E+01	1.360E+00	3.795E+02	2.550E-02
2120	1.146E+03	6.262E+05	4.207E+01	1.333E+00	3.720E+02	2.499E-02



Summary Report

Landfill Name or Identifier: McKenzie County

Date: Wednesday, July 24, 2019

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	**1991**	
Landfill Closure Year (with 80-year limit)	**2020**	
Actual Closure Year (without limit)	***2020***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**1,320,550**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**297**	*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)*
1991	50,000	55,000	0	0
1992	50,000	55,000	50,000	55,000
1993	50,000	55,000	100,000	110,000
1994	50,000	55,000	150,000	165,000
1995	50,000	55,000	200,000	220,000
1996	50,000	55,000	250,000	275,000
1997	50,000	55,000	300,000	330,000
1998	50,000	55,000	350,000	385,000
1999	50,000	55,000	400,000	440,000
2000	50,000	55,000	450,000	495,000
2001	50,000	55,000	500,000	550,000
2002	50,000	55,000	550,000	605,000
2003	50,000	55,000	600,000	660,000
2004	50,000	55,000	650,000	715,000
2005	50,000	55,000	700,000	770,000
2006	50,000	55,000	750,000	825,000
2007	50,000	55,000	800,000	880,000
2008	50,000	55,000	850,000	935,000
2009	50,000	55,000	900,000	990,000
2010	50,000	55,000	950,000	1,045,000
2011	50,000	55,000	1,000,000	1,100,000
2012	50,000	55,000	1,050,000	1,155,000
2013	60,357	66,393	1,100,000	1,210,000
2014	35,765	39,342	1,160,357	1,276,393
2015	27,581	30,339	1,196,123	1,315,735
2016	19,932	21,925	1,223,704	1,346,074
2017	19,932	21,925	1,243,635	1,367,999
2018	19,932	21,925	1,263,567	1,389,924
2019	19,932	21,925	1,283,499	1,411,849
2020	17,119	18,831	1,303,431	1,433,774
2021	0	0	1,320,550	1,452,605
2022	0	0	1,320,550	1,452,605
2023	0	0	1,320,550	1,452,605
2024	0	0	1,320,550	1,452,605
2025	0	0	1,320,550	1,452,605
2026	0	0	1,320,550	1,452,605
2027	0	0	1,320,550	1,452,605
2028	0	0	1,320,550	1,452,605
2029	0	0	1,320,550	1,452,605
2030	0	0	1,320,550	1,452,605

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2031	0	0	1,320,550	1,452,605
2032	0	0	1,320,550	1,452,605
2033	0	0	1,320,550	1,452,605
2034	0	0	1,320,550	1,452,605
2035	0	0	1,320,550	1,452,605
2036	0	0	1,320,550	1,452,605
2037	0	0	1,320,550	1,452,605
2038	0	0	1,320,550	1,452,605
2039	0	0	1,320,550	1,452,605
2040	0	0	1,320,550	1,452,605
2041	0	0	1,320,550	1,452,605
2042	0	0	1,320,550	1,452,605
2043	0	0	1,320,550	1,452,605
2044	0	0	1,320,550	1,452,605
2045	0	0	1,320,550	1,452,605
2046	0	0	1,320,550	1,452,605
2047	0	0	1,320,550	1,452,605
2048	0	0	1,320,550	1,452,605
2049	0	0	1,320,550	1,452,605
2050	0	0	1,320,550	1,452,605
2051	0	0	1,320,550	1,452,605
2052	0	0	1,320,550	1,452,605
2053	0	0	1,320,550	1,452,605
2054	0	0	1,320,550	1,452,605
2055	0	0	1,320,550	1,452,605
2056	0	0	1,320,550	1,452,605
2057	0	0	1,320,550	1,452,605
2058	0	0	1,320,550	1,452,605
2059	0	0	1,320,550	1,452,605
2060	0	0	1,320,550	1,452,605
2061	0	0	1,320,550	1,452,605
2062	0	0	1,320,550	1,452,605
2063	0	0	1,320,550	1,452,605
2064	0	0	1,320,550	1,452,605
2065	0	0	1,320,550	1,452,605
2066	0	0	1,320,550	1,452,605
2067	0	0	1,320,550	1,452,605
2068	0	0	1,320,550	1,452,605
2069	0	0	1,320,550	1,452,605
2070	0	0	1,320,550	1,452,605

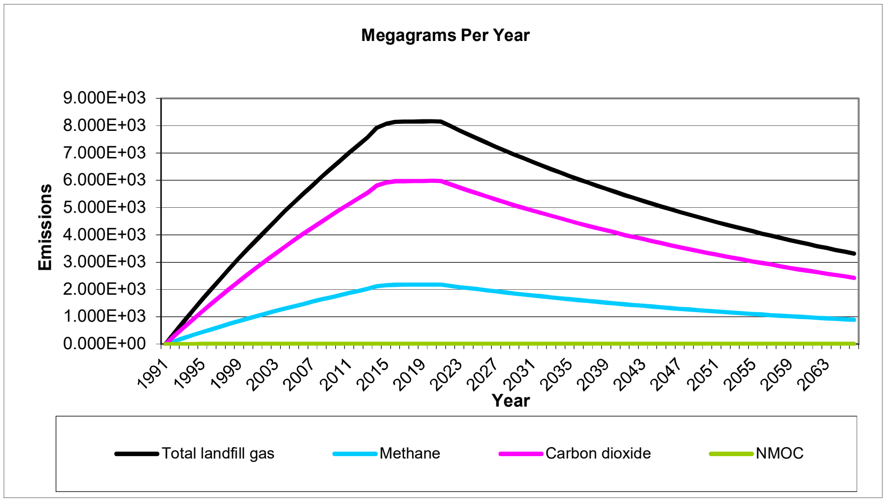
Pollutant Parameters

	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
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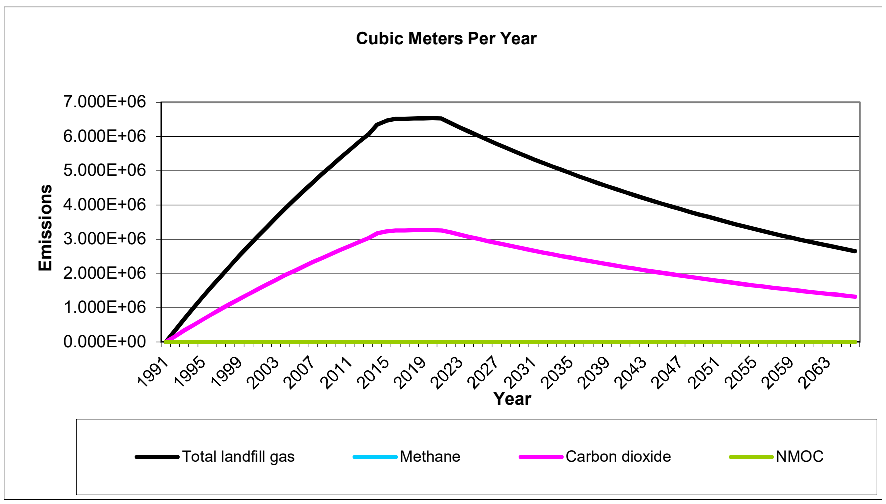
7.000E+03
6.000E+03
5.000E+03
4.000E+03
3.000E+03
2.000E+03
1.000E+03
0.000E+00
Emissions
1991 1995 1999 2003 2007 2011 2015 2019 2023 2027 2031 2035 2039 2043 2047 2051 2055 2059 2063
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
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5.000E+06
4.000E+06
3.000E+06
2.000E+06
1.000E+06
0.000E+00
Emissions
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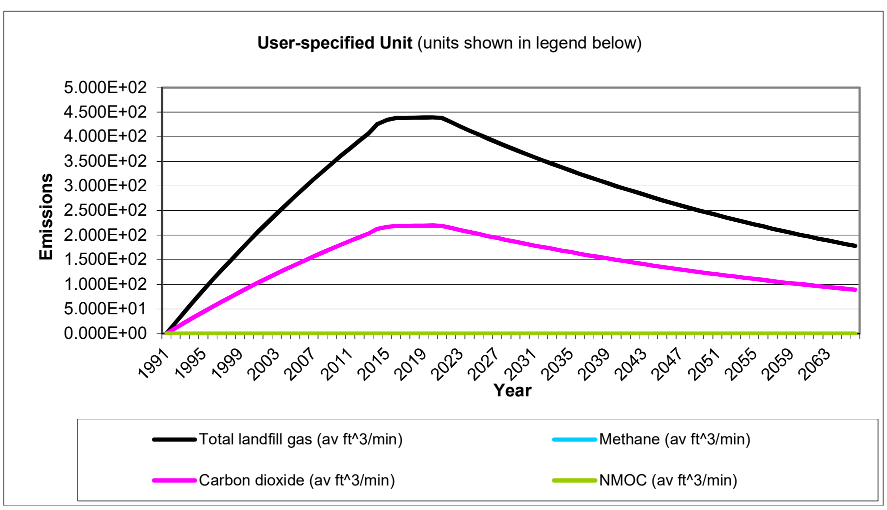
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
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4.000E+02
3.500E+02
3.000E+02
2.500E+02
2.000E+02
1.500E+02
1.000E+02
5.000E+01
0.000E+00
Emissions
1991 1995 1999 2003 2007 2011 2015 2019 2023 2027 2031 2035 2039 2043 2047 2051 2055 2059 2063
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)
1991	0	0	0	0	0	0
1992	4.208E+02	3.370E+05	2.264E+01	1.124E+02	1.685E+05	1.132E+01
1993	8.333E+02	6.672E+05	4.483E+01	2.226E+02	3.336E+05	2.242E+01
1994	1.238E+03	9.910E+05	6.658E+01	3.306E+02	4.955E+05	3.329E+01
1995	1.634E+03	1.308E+06	8.791E+01	4.364E+02	6.542E+05	4.395E+01
1996	2.022E+03	1.619E+06	1.088E+02	5.402E+02	8.097E+05	5.440E+01
1997	2.403E+03	1.924E+06	1.293E+02	6.419E+02	9.621E+05	6.465E+01
1998	2.776E+03	2.223E+06	1.494E+02	7.416E+02	1.112E+06	7.469E+01
1999	3.142E+03	2.516E+06	1.691E+02	8.393E+02	1.258E+06	8.453E+01
2000	3.501E+03	2.803E+06	1.883E+02	9.351E+02	1.402E+06	9.417E+01
2001	3.852E+03	3.085E+06	2.073E+02	1.029E+03	1.542E+06	1.036E+02
2002	4.197E+03	3.361E+06	2.258E+02	1.121E+03	1.680E+06	1.129E+02
2003	4.534E+03	3.631E+06	2.440E+02	1.211E+03	1.815E+06	1.220E+02
2004	4.865E+03	3.896E+06	2.618E+02	1.300E+03	1.948E+06	1.309E+02
2005	5.190E+03	4.156E+06	2.792E+02	1.386E+03	2.078E+06	1.396E+02
2006	5.508E+03	4.410E+06	2.963E+02	1.471E+03	2.205E+06	1.482E+02
2007	5.820E+03	4.660E+06	3.131E+02	1.554E+03	2.330E+06	1.566E+02
2008	6.125E+03	4.905E+06	3.296E+02	1.636E+03	2.452E+06	1.648E+02
2009	6.425E+03	5.145E+06	3.457E+02	1.716E+03	2.572E+06	1.728E+02
2010	6.718E+03	5.380E+06	3.615E+02	1.795E+03	2.690E+06	1.807E+02
2011	7.006E+03	5.610E+06	3.769E+02	1.871E+03	2.805E+06	1.885E+02
2012	7.288E+03	5.836E+06	3.921E+02	1.947E+03	2.918E+06	1.961E+02
2013	7.565E+03	6.057E+06	4.070E+02	2.021E+03	3.029E+06	2.035E+02
2014	7.923E+03	6.344E+06	4.263E+02	2.116E+03	3.172E+06	2.131E+02
2015	8.067E+03	6.460E+06	4.340E+02	2.155E+03	3.230E+06	2.170E+02
2016	8.139E+03	6.518E+06	4.379E+02	2.174E+03	3.259E+06	2.190E+02
2017	8.146E+03	6.523E+06	4.383E+02	2.176E+03	3.261E+06	2.191E+02
2018	8.152E+03	6.528E+06	4.386E+02	2.178E+03	3.264E+06	2.193E+02
2019	8.159E+03	6.533E+06	4.390E+02	2.179E+03	3.267E+06	2.195E+02
2020	8.165E+03	6.538E+06	4.393E+02	2.181E+03	3.269E+06	2.196E+02
2021	8.147E+03	6.524E+06	4.383E+02	2.176E+03	3.262E+06	2.192E+02
2022	7.986E+03	6.395E+06	4.297E+02	2.133E+03	3.197E+06	2.148E+02
2023	7.828E+03	6.268E+06	4.212E+02	2.091E+03	3.134E+06	2.106E+02
2024	7.673E+03	6.144E+06	4.128E+02	2.049E+03	3.072E+06	2.064E+02
2025	7.521E+03	6.022E+06	4.046E+02	2.009E+03	3.011E+06	2.023E+02
2026	7.372E+03	5.903E+06	3.966E+02	1.969E+03	2.952E+06	1.983E+02
2027	7.226E+03	5.786E+06	3.888E+02	1.930E+03	2.893E+06	1.944E+02
2028	7.083E+03	5.672E+06	3.811E+02	1.892E+03	2.836E+06	1.905E+02
2029	6.943E+03	5.559E+06	3.735E+02	1.854E+03	2.780E+06	1.868E+02
2030	6.805E+03	5.449E+06	3.661E+02	1.818E+03	2.725E+06	1.831E+02
2031	6.670E+03	5.341E+06	3.589E+02	1.782E+03	2.671E+06	1.794E+02
2032	6.538E+03	5.236E+06	3.518E+02	1.746E+03	2.618E+06	1.759E+02
2033	6.409E+03	5.132E+06	3.448E+02	1.712E+03	2.566E+06	1.724E+02
2034	6.282E+03	5.030E+06	3.380E+02	1.678E+03	2.515E+06	1.690E+02
2035	6.158E+03	4.931E+06	3.313E+02	1.645E+03	2.465E+06	1.656E+02
2036	6.036E+03	4.833E+06	3.247E+02	1.612E+03	2.417E+06	1.624E+02
2037	5.916E+03	4.737E+06	3.183E+02	1.580E+03	2.369E+06	1.592E+02
2038	5.799E+03	4.644E+06	3.120E+02	1.549E+03	2.322E+06	1.560E+02
2039	5.684E+03	4.552E+06	3.058E+02	1.518E+03	2.276E+06	1.529E+02
2040	5.572E+03	4.461E+06	2.998E+02	1.488E+03	2.231E+06	1.499E+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)
2041	5.461E+03	4.373E+06	2.938E+02	1.459E+03	2.187E+06	1.469E+02
2042	5.353E+03	4.287E+06	2.880E+02	1.430E+03	2.143E+06	1.440E+02
2043	5.247E+03	4.202E+06	2.823E+02	1.402E+03	2.101E+06	1.412E+02
2044	5.143E+03	4.118E+06	2.767E+02	1.374E+03	2.059E+06	1.384E+02
2045	5.041E+03	4.037E+06	2.712E+02	1.347E+03	2.018E+06	1.356E+02
2046	4.942E+03	3.957E+06	2.659E+02	1.320E+03	1.978E+06	1.329E+02
2047	4.844E+03	3.879E+06	2.606E+02	1.294E+03	1.939E+06	1.303E+02
2048	4.748E+03	3.802E+06	2.554E+02	1.268E+03	1.901E+06	1.277E+02
2049	4.654E+03	3.727E+06	2.504E+02	1.243E+03	1.863E+06	1.252E+02
2050	4.562E+03	3.653E+06	2.454E+02	1.218E+03	1.826E+06	1.227E+02
2051	4.471E+03	3.580E+06	2.406E+02	1.194E+03	1.790E+06	1.203E+02
2052	4.383E+03	3.510E+06	2.358E+02	1.171E+03	1.755E+06	1.179E+02
2053	4.296E+03	3.440E+06	2.311E+02	1.148E+03	1.720E+06	1.156E+02
2054	4.211E+03	3.372E+06	2.266E+02	1.125E+03	1.686E+06	1.133E+02
2055	4.128E+03	3.305E+06	2.221E+02	1.103E+03	1.653E+06	1.110E+02
2056	4.046E+03	3.240E+06	2.177E+02	1.081E+03	1.620E+06	1.088E+02
2057	3.966E+03	3.176E+06	2.134E+02	1.059E+03	1.588E+06	1.067E+02
2058	3.887E+03	3.113E+06	2.091E+02	1.038E+03	1.556E+06	1.046E+02
2059	3.810E+03	3.051E+06	2.050E+02	1.018E+03	1.526E+06	1.025E+02
2060	3.735E+03	2.991E+06	2.009E+02	9.976E+02	1.495E+06	1.005E+02
2061	3.661E+03	2.931E+06	1.970E+02	9.778E+02	1.466E+06	9.848E+01
2062	3.588E+03	2.873E+06	1.931E+02	9.585E+02	1.437E+06	9.653E+01
2063	3.517E+03	2.816E+06	1.892E+02	9.395E+02	1.408E+06	9.462E+01
2064	3.448E+03	2.761E+06	1.855E+02	9.209E+02	1.380E+06	9.275E+01
2065	3.379E+03	2.706E+06	1.818E+02	9.027E+02	1.353E+06	9.091E+01
2066	3.312E+03	2.652E+06	1.782E+02	8.848E+02	1.326E+06	8.911E+01
2067	3.247E+03	2.600E+06	1.747E+02	8.673E+02	1.300E+06	8.734E+01
2068	3.183E+03	2.548E+06	1.712E+02	8.501E+02	1.274E+06	8.561E+01
2069	3.120E+03	2.498E+06	1.678E+02	8.333E+02	1.249E+06	8.392E+01
2070	3.058E+03	2.449E+06	1.645E+02	8.168E+02	1.224E+06	8.226E+01
2071	2.997E+03	2.400E+06	1.613E+02	8.006E+02	1.200E+06	8.063E+01
2072	2.938E+03	2.353E+06	1.581E+02	7.847E+02	1.176E+06	7.903E+01
2073	2.880E+03	2.306E+06	1.549E+02	7.692E+02	1.153E+06	7.747E+01
2074	2.823E+03	2.260E+06	1.519E+02	7.540E+02	1.130E+06	7.593E+01
2075	2.767E+03	2.216E+06	1.489E+02	7.390E+02	1.108E+06	7.443E+01
2076	2.712E+03	2.172E+06	1.459E+02	7.244E+02	1.086E+06	7.296E+01
2077	2.658E+03	2.129E+06	1.430E+02	7.101E+02	1.064E+06	7.151E+01
2078	2.606E+03	2.086E+06	1.402E+02	6.960E+02	1.043E+06	7.010E+01
2079	2.554E+03	2.045E+06	1.374E+02	6.822E+02	1.023E+06	6.871E+01
2080	2.503E+03	2.005E+06	1.347E+02	6.687E+02	1.002E+06	6.735E+01
2081	2.454E+03	1.965E+06	1.320E+02	6.555E+02	9.825E+05	6.601E+01
2082	2.405E+03	1.926E+06	1.294E+02	6.425E+02	9.630E+05	6.471E+01
2083	2.358E+03	1.888E+06	1.269E+02	6.298E+02	9.440E+05	6.343E+01
2084	2.311E+03	1.851E+06	1.243E+02	6.173E+02	9.253E+05	6.217E+01
2085	2.265E+03	1.814E+06	1.219E+02	6.051E+02	9.070E+05	6.094E+01
2086	2.220E+03	1.778E+06	1.195E+02	5.931E+02	8.890E+05	5.973E+01
2087	2.176E+03	1.743E+06	1.171E+02	5.813E+02	8.714E+05	5.855E+01
2088	2.133E+03	1.708E+06	1.148E+02	5.698E+02	8.541E+05	5.739E+01
2089	2.091E+03	1.674E+06	1.125E+02	5.586E+02	8.372E+05	5.625E+01
2090	2.050E+03	1.641E+06	1.103E+02	5.475E+02	8.206E+05	5.514E+01
2091	2.009E+03	1.609E+06	1.081E+02	5.367E+02	8.044E+05	5.405E+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)
2092	1.969E+03	1.577E+06	1.060E+02	5.260E+02	7.885E+05	5.298E+01
2093	1.930E+03	1.546E+06	1.039E+02	5.156E+02	7.729E+05	5.193E+01
2094	1.892E+03	1.515E+06	1.018E+02	5.054E+02	7.576E+05	5.090E+01
2095	1.855E+03	1.485E+06	9.978E+01	4.954E+02	7.426E+05	4.989E+01
2096	1.818E+03	1.456E+06	9.781E+01	4.856E+02	7.278E+05	4.890E+01
2097	1.782E+03	1.427E+06	9.587E+01	4.760E+02	7.134E+05	4.794E+01
2098	1.747E+03	1.399E+06	9.397E+01	4.665E+02	6.993E+05	4.699E+01
2099	1.712E+03	1.371E+06	9.211E+01	4.573E+02	6.855E+05	4.606E+01
2100	1.678E+03	1.344E+06	9.029E+01	4.482E+02	6.719E+05	4.514E+01
2101	1.645E+03	1.317E+06	8.850E+01	4.394E+02	6.586E+05	4.425E+01
2102	1.612E+03	1.291E+06	8.675E+01	4.307E+02	6.455E+05	4.337E+01
2103	1.580E+03	1.266E+06	8.503E+01	4.221E+02	6.328E+05	4.252E+01
2104	1.549E+03	1.240E+06	8.335E+01	4.138E+02	6.202E+05	4.167E+01
2105	1.518E+03	1.216E+06	8.170E+01	4.056E+02	6.079E+05	4.085E+01
2106	1.488E+03	1.192E+06	8.008E+01	3.976E+02	5.959E+05	4.004E+01
2107	1.459E+03	1.168E+06	7.849E+01	3.897E+02	5.841E+05	3.925E+01
2108	1.430E+03	1.145E+06	7.694E+01	3.820E+02	5.725E+05	3.847E+01
2109	1.402E+03	1.122E+06	7.541E+01	3.744E+02	5.612E+05	3.771E+01
2110	1.374E+03	1.100E+06	7.392E+01	3.670E+02	5.501E+05	3.696E+01
2111	1.347E+03	1.078E+06	7.246E+01	3.597E+02	5.392E+05	3.623E+01
2112	1.320E+03	1.057E+06	7.102E+01	3.526E+02	5.285E+05	3.551E+01
2113	1.294E+03	1.036E+06	6.962E+01	3.456E+02	5.181E+05	3.481E+01
2114	1.268E+03	1.016E+06	6.824E+01	3.388E+02	5.078E+05	3.412E+01
2115	1.243E+03	9.955E+05	6.689E+01	3.321E+02	4.977E+05	3.344E+01
2116	1.219E+03	9.758E+05	6.556E+01	3.255E+02	4.879E+05	3.278E+01
2117	1.194E+03	9.565E+05	6.426E+01	3.191E+02	4.782E+05	3.213E+01
2118	1.171E+03	9.375E+05	6.299E+01	3.127E+02	4.688E+05	3.150E+01
2119	1.148E+03	9.190E+05	6.174E+01	3.065E+02	4.595E+05	3.087E+01
2120	1.125E+03	9.008E+05	6.052E+01	3.005E+02	4.504E+05	3.026E+01
2121	1.103E+03	8.829E+05	5.932E+01	2.945E+02	4.415E+05	2.966E+01
2122	1.081E+03	8.654E+05	5.815E+01	2.887E+02	4.327E+05	2.907E+01
2123	1.059E+03	8.483E+05	5.700E+01	2.830E+02	4.242E+05	2.850E+01
2124	1.038E+03	8.315E+05	5.587E+01	2.774E+02	4.158E+05	2.793E+01
2125	1.018E+03	8.150E+05	5.476E+01	2.719E+02	4.075E+05	2.738E+01
2126	9.977E+02	7.989E+05	5.368E+01	2.665E+02	3.995E+05	2.684E+01
2127	9.779E+02	7.831E+05	5.262E+01	2.612E+02	3.915E+05	2.631E+01
2128	9.586E+02	7.676E+05	5.157E+01	2.560E+02	3.838E+05	2.579E+01
2129	9.396E+02	7.524E+05	5.055E+01	2.510E+02	3.762E+05	2.528E+01
2130	9.210E+02	7.375E+05	4.955E+01	2.460E+02	3.687E+05	2.478E+01
2131	9.027E+02	7.229E+05	4.857E+01	2.411E+02	3.614E+05	2.429E+01

Results (Continued)

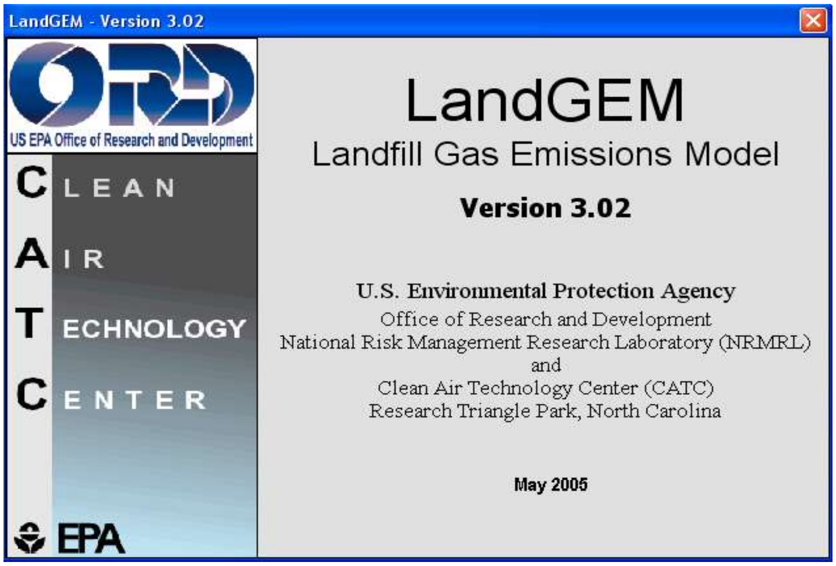
Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m³/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m³/year)*	*(av ft^3/min)*
1991	0	0	0	0	0	0
1992	3.084E+02	1.685E+05	1.132E+01	3.587E-01	1.001E+02	6.724E-03
1993	6.107E+02	3.336E+05	2.242E+01	7.103E-01	1.982E+02	1.332E-02
1994	9.070E+02	4.955E+05	3.329E+01	1.055E+00	2.943E+02	1.978E-02
1995	1.197E+03	6.542E+05	4.395E+01	1.393E+00	3.886E+02	2.611E-02
1996	1.482E+03	8.097E+05	5.440E+01	1.724E+00	4.810E+02	3.232E-02
1997	1.761E+03	9.621E+05	6.465E+01	2.049E+00	5.715E+02	3.840E-02
1998	2.035E+03	1.112E+06	7.469E+01	2.367E+00	6.603E+02	4.436E-02
1999	2.303E+03	1.258E+06	8.453E+01	2.679E+00	7.473E+02	5.021E-02
2000	2.566E+03	1.402E+06	9.417E+01	2.984E+00	8.326E+02	5.594E-02
2001	2.823E+03	1.542E+06	1.036E+02	3.284E+00	9.161E+02	6.156E-02
2002	3.076E+03	1.680E+06	1.129E+02	3.578E+00	9.981E+02	6.706E-02
2003	3.323E+03	1.815E+06	1.220E+02	3.865E+00	1.078E+03	7.246E-02
2004	3.566E+03	1.948E+06	1.309E+02	4.148E+00	1.157E+03	7.775E-02
2005	3.804E+03	2.078E+06	1.396E+02	4.424E+00	1.234E+03	8.293E-02
2006	4.037E+03	2.205E+06	1.482E+02	4.695E+00	1.310E+03	8.801E-02
2007	4.265E+03	2.330E+06	1.566E+02	4.961E+00	1.384E+03	9.299E-02
2008	4.489E+03	2.452E+06	1.648E+02	5.222E+00	1.457E+03	9.788E-02
2009	4.709E+03	2.572E+06	1.728E+02	5.477E+00	1.528E+03	1.027E-01
2010	4.924E+03	2.690E+06	1.807E+02	5.727E+00	1.598E+03	1.074E-01
2011	5.135E+03	2.805E+06	1.885E+02	5.973E+00	1.666E+03	1.120E-01
2012	5.341E+03	2.918E+06	1.961E+02	6.213E+00	1.733E+03	1.165E-01
2013	5.544E+03	3.029E+06	2.035E+02	6.449E+00	1.799E+03	1.209E-01
2014	5.807E+03	3.172E+06	2.131E+02	6.754E+00	1.884E+03	1.266E-01
2015	5.912E+03	3.230E+06	2.170E+02	6.877E+00	1.919E+03	1.289E-01
2016	5.965E+03	3.259E+06	2.190E+02	6.939E+00	1.936E+03	1.301E-01
2017	5.970E+03	3.261E+06	2.191E+02	6.944E+00	1.937E+03	1.302E-01
2018	5.975E+03	3.264E+06	2.193E+02	6.950E+00	1.939E+03	1.303E-01
2019	5.979E+03	3.267E+06	2.195E+02	6.955E+00	1.940E+03	1.304E-01
2020	5.984E+03	3.269E+06	2.196E+02	6.960E+00	1.942E+03	1.305E-01
2021	5.971E+03	3.262E+06	2.192E+02	6.945E+00	1.938E+03	1.302E-01
2022	5.853E+03	3.197E+06	2.148E+02	6.808E+00	1.899E+03	1.276E-01
2023	5.737E+03	3.134E+06	2.106E+02	6.673E+00	1.862E+03	1.251E-01
2024	5.623E+03	3.072E+06	2.064E+02	6.541E+00	1.825E+03	1.226E-01
2025	5.512E+03	3.011E+06	2.023E+02	6.411E+00	1.789E+03	1.202E-01
2026	5.403E+03	2.952E+06	1.983E+02	6.284E+00	1.753E+03	1.178E-01
2027	5.296E+03	2.893E+06	1.944E+02	6.160E+00	1.719E+03	1.155E-01
2028	5.191E+03	2.836E+06	1.905E+02	6.038E+00	1.684E+03	1.132E-01
2029	5.088E+03	2.780E+06	1.868E+02	5.918E+00	1.651E+03	1.109E-01
2030	4.987E+03	2.725E+06	1.831E+02	5.801E+00	1.618E+03	1.087E-01
2031	4.889E+03	2.671E+06	1.794E+02	5.686E+00	1.586E+03	1.066E-01
2032	4.792E+03	2.618E+06	1.759E+02	5.574E+00	1.555E+03	1.045E-01
2033	4.697E+03	2.566E+06	1.724E+02	5.463E+00	1.524E+03	1.024E-01
2034	4.604E+03	2.515E+06	1.690E+02	5.355E+00	1.494E+03	1.004E-01
2035	4.513E+03	2.465E+06	1.656E+02	5.249E+00	1.464E+03	9.839E-02
2036	4.423E+03	2.417E+06	1.624E+02	5.145E+00	1.435E+03	9.645E-02
2037	4.336E+03	2.369E+06	1.592E+02	5.043E+00	1.407E+03	9.454E-02
2038	4.250E+03	2.322E+06	1.560E+02	4.943E+00	1.379E+03	9.266E-02
2039	4.166E+03	2.276E+06	1.529E+02	4.846E+00	1.352E+03	9.083E-02
2040	4.083E+03	2.231E+06	1.499E+02	4.750E+00	1.325E+03	8.903E-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)
2041	4.003E+03	2.187E+06	1.469E+02	4.656E+00	1.299E+03	8.727E-02
2042	3.923E+03	2.143E+06	1.440E+02	4.563E+00	1.273E+03	8.554E-02
2043	3.846E+03	2.101E+06	1.412E+02	4.473E+00	1.248E+03	8.385E-02
2044	3.769E+03	2.059E+06	1.384E+02	4.384E+00	1.223E+03	8.219E-02
2045	3.695E+03	2.018E+06	1.356E+02	4.298E+00	1.199E+03	8.056E-02
2046	3.622E+03	1.978E+06	1.329E+02	4.213E+00	1.175E+03	7.896E-02
2047	3.550E+03	1.939E+06	1.303E+02	4.129E+00	1.152E+03	7.740E-02
2048	3.480E+03	1.901E+06	1.277E+02	4.047E+00	1.129E+03	7.587E-02
2049	3.411E+03	1.863E+06	1.252E+02	3.967E+00	1.107E+03	7.436E-02
2050	3.343E+03	1.826E+06	1.227E+02	3.889E+00	1.085E+03	7.289E-02
2051	3.277E+03	1.790E+06	1.203E+02	3.812E+00	1.063E+03	7.145E-02
2052	3.212E+03	1.755E+06	1.179E+02	3.736E+00	1.042E+03	7.003E-02
2053	3.148E+03	1.720E+06	1.156E+02	3.662E+00	1.022E+03	6.865E-02
2054	3.086E+03	1.686E+06	1.133E+02	3.590E+00	1.001E+03	6.729E-02
2055	3.025E+03	1.653E+06	1.110E+02	3.519E+00	9.816E+02	6.596E-02
2056	2.965E+03	1.620E+06	1.088E+02	3.449E+00	9.622E+02	6.465E-02
2057	2.906E+03	1.588E+06	1.067E+02	3.381E+00	9.431E+02	6.337E-02
2058	2.849E+03	1.556E+06	1.046E+02	3.314E+00	9.245E+02	6.211E-02
2059	2.792E+03	1.526E+06	1.025E+02	3.248E+00	9.062E+02	6.088E-02
2060	2.737E+03	1.495E+06	1.005E+02	3.184E+00	8.882E+02	5.968E-02
2061	2.683E+03	1.466E+06	9.848E+01	3.121E+00	8.706E+02	5.850E-02
2062	2.630E+03	1.437E+06	9.653E+01	3.059E+00	8.534E+02	5.734E-02
2063	2.578E+03	1.408E+06	9.462E+01	2.998E+00	8.365E+02	5.620E-02
2064	2.527E+03	1.380E+06	9.275E+01	2.939E+00	8.199E+02	5.509E-02
2065	2.477E+03	1.353E+06	9.091E+01	2.881E+00	8.037E+02	5.400E-02
2066	2.428E+03	1.326E+06	8.911E+01	2.824E+00	7.878E+02	5.293E-02
2067	2.380E+03	1.300E+06	8.734E+01	2.768E+00	7.722E+02	5.188E-02
2068	2.332E+03	1.274E+06	8.561E+01	2.713E+00	7.569E+02	5.086E-02
2069	2.286E+03	1.249E+06	8.392E+01	2.659E+00	7.419E+02	4.985E-02
2070	2.241E+03	1.224E+06	8.226E+01	2.607E+00	7.272E+02	4.886E-02
2071	2.197E+03	1.200E+06	8.063E+01	2.555E+00	7.128E+02	4.789E-02
2072	2.153E+03	1.176E+06	7.903E+01	2.504E+00	6.987E+02	4.695E-02
2073	2.110E+03	1.153E+06	7.747E+01	2.455E+00	6.849E+02	4.602E-02
2074	2.069E+03	1.130E+06	7.593E+01	2.406E+00	6.713E+02	4.510E-02
2075	2.028E+03	1.108E+06	7.443E+01	2.359E+00	6.580E+02	4.421E-02
2076	1.988E+03	1.086E+06	7.296E+01	2.312E+00	6.450E+02	4.334E-02
2077	1.948E+03	1.064E+06	7.151E+01	2.266E+00	6.322E+02	4.248E-02
2078	1.910E+03	1.043E+06	7.010E+01	2.221E+00	6.197E+02	4.164E-02
2079	1.872E+03	1.023E+06	6.871E+01	2.177E+00	6.074E+02	4.081E-02
2080	1.835E+03	1.002E+06	6.735E+01	2.134E+00	5.954E+02	4.000E-02
2081	1.798E+03	9.825E+05	6.601E+01	2.092E+00	5.836E+02	3.921E-02
2082	1.763E+03	9.630E+05	6.471E+01	2.050E+00	5.720E+02	3.844E-02
2083	1.728E+03	9.440E+05	6.343E+01	2.010E+00	5.607E+02	3.767E-02
2084	1.694E+03	9.253E+05	6.217E+01	1.970E+00	5.496E+02	3.693E-02
2085	1.660E+03	9.070E+05	6.094E+01	1.931E+00	5.387E+02	3.620E-02
2086	1.627E+03	8.890E+05	5.973E+01	1.893E+00	5.281E+02	3.548E-02
2087	1.595E+03	8.714E+05	5.855E+01	1.855E+00	5.176E+02	3.478E-02
2088	1.563E+03	8.541E+05	5.739E+01	1.819E+00	5.074E+02	3.409E-02
2089	1.533E+03	8.372E+05	5.625E+01	1.783E+00	4.973E+02	3.341E-02
2090	1.502E+03	8.206E+05	5.514E+01	1.747E+00	4.875E+02	3.275E-02
2091	1.472E+03	8.044E+05	5.405E+01	1.713E+00	4.778E+02	3.210E-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)
2092	1.443E+03	7.885E+05	5.298E+01	1.679E+00	4.683E+02	3.147E-02
2093	1.415E+03	7.729E+05	5.193E+01	1.646E+00	4.591E+02	3.085E-02
2094	1.387E+03	7.576E+05	5.090E+01	1.613E+00	4.500E+02	3.023E-02
2095	1.359E+03	7.426E+05	4.989E+01	1.581E+00	4.411E+02	2.964E-02
2096	1.332E+03	7.278E+05	4.890E+01	1.550E+00	4.323E+02	2.905E-02
2097	1.306E+03	7.134E+05	4.794E+01	1.519E+00	4.238E+02	2.847E-02
2098	1.280E+03	6.993E+05	4.699E+01	1.489E+00	4.154E+02	2.791E-02
2099	1.255E+03	6.855E+05	4.606E+01	1.459E+00	4.072E+02	2.736E-02
2100	1.230E+03	6.719E+05	4.514E+01	1.431E+00	3.991E+02	2.682E-02
2101	1.206E+03	6.586E+05	4.425E+01	1.402E+00	3.912E+02	2.628E-02
2102	1.182E+03	6.455E+05	4.337E+01	1.374E+00	3.835E+02	2.576E-02
2103	1.158E+03	6.328E+05	4.252E+01	1.347E+00	3.759E+02	2.525E-02
2104	1.135E+03	6.202E+05	4.167E+01	1.321E+00	3.684E+02	2.475E-02
2105	1.113E+03	6.079E+05	4.085E+01	1.294E+00	3.611E+02	2.426E-02
2106	1.091E+03	5.959E+05	4.004E+01	1.269E+00	3.540E+02	2.378E-02
2107	1.069E+03	5.841E+05	3.925E+01	1.244E+00	3.470E+02	2.331E-02
2108	1.048E+03	5.725E+05	3.847E+01	1.219E+00	3.401E+02	2.285E-02
2109	1.027E+03	5.612E+05	3.771E+01	1.195E+00	3.334E+02	2.240E-02
2110	1.007E+03	5.501E+05	3.696E+01	1.171E+00	3.268E+02	2.195E-02
2111	9.870E+02	5.392E+05	3.623E+01	1.148E+00	3.203E+02	2.152E-02
2112	9.675E+02	5.285E+05	3.551E+01	1.125E+00	3.139E+02	2.109E-02
2113	9.483E+02	5.181E+05	3.481E+01	1.103E+00	3.077E+02	2.068E-02
2114	9.295E+02	5.078E+05	3.412E+01	1.081E+00	3.016E+02	2.027E-02
2115	9.111E+02	4.977E+05	3.344E+01	1.060E+00	2.957E+02	1.987E-02
2116	8.931E+02	4.879E+05	3.278E+01	1.039E+00	2.898E+02	1.947E-02
2117	8.754E+02	4.782E+05	3.213E+01	1.018E+00	2.841E+02	1.909E-02
2118	8.581E+02	4.688E+05	3.150E+01	9.981E-01	2.784E+02	1.871E-02
2119	8.411E+02	4.595E+05	3.087E+01	9.783E-01	2.729E+02	1.834E-02
2120	8.244E+02	4.504E+05	3.026E+01	9.589E-01	2.675E+02	1.798E-02
2121	8.081E+02	4.415E+05	2.966E+01	9.399E-01	2.622E+02	1.762E-02
2122	7.921E+02	4.327E+05	2.907E+01	9.213E-01	2.570E+02	1.727E-02
2123	7.764E+02	4.242E+05	2.850E+01	9.031E-01	2.519E+02	1.693E-02
2124	7.610E+02	4.158E+05	2.793E+01	8.852E-01	2.470E+02	1.659E-02
2125	7.460E+02	4.075E+05	2.738E+01	8.677E-01	2.421E+02	1.626E-02
2126	7.312E+02	3.995E+05	2.684E+01	8.505E-01	2.373E+02	1.594E-02
2127	7.167E+02	3.915E+05	2.631E+01	8.337E-01	2.326E+02	1.563E-02
2128	7.025E+02	3.838E+05	2.579E+01	8.172E-01	2.280E+02	1.532E-02
2129	6.886E+02	3.762E+05	2.528E+01	8.010E-01	2.235E+02	1.501E-02
2130	6.750E+02	3.687E+05	2.478E+01	7.851E-01	2.190E+02	1.472E-02
2131	6.616E+02	3.614E+05	2.429E+01	7.696E-01	2.147E+02	1.443E-02



Summary Report

Landfill Name or Identifier: Mercer County

Date: Wednesday, July 24, 2019

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

The 80-year waste acceptance limit of the model has been exceeded before the Waste Design Capacity was reached. The model will assume the 80th year of waste acceptance as the final year to estimate emissions. See Section 2.6 of the User's Manual.

LANDFILL CHARACTERISTICS

Landfill Open Year	**1976**	
Landfill Closure Year (with 80-year limit)	**2055**	
Actual Closure Year (without limit)	***2150***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**973,177**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*year^{-1}*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**297**	*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)*
1976	5,545	6,100	0	0
1977	5,545	6,100	5,545	6,100
1978	5,545	6,100	11,091	12,200
1979	5,545	6,100	16,636	18,300
1980	5,545	6,100	22,182	24,400
1981	5,545	6,100	27,727	30,500
1982	5,545	6,100	33,273	36,600
1983	5,545	6,100	38,818	42,700
1984	5,545	6,100	44,364	48,800
1985	5,545	6,100	49,909	54,900
1986	5,545	6,100	55,455	61,000
1987	5,545	6,100	61,000	67,100
1988	5,545	6,100	66,545	73,200
1989	5,545	6,100	72,091	79,300
1990	5,545	6,100	77,636	85,400
1991	5,545	6,100	83,182	91,500
1992	5,545	6,100	88,727	97,600
1993	5,545	6,100	94,273	103,700
1994	5,545	6,100	99,818	109,800
1995	5,545	6,100	105,364	115,900
1996	5,545	6,100	110,909	122,000
1997	5,545	6,100	116,455	128,100
1998	5,545	6,100	122,000	134,200
1999	5,545	6,100	127,545	140,300
2000	5,545	6,100	133,091	146,400
2001	5,545	6,100	138,636	152,500
2002	5,545	6,100	144,182	158,600
2003	5,545	6,100	149,727	164,700
2004	5,545	6,100	155,273	170,800
2005	5,545	6,100	160,818	176,900
2006	5,545	6,100	166,364	183,000
2007	5,545	6,100	171,909	189,100
2008	5,545	6,100	177,455	195,200
2009	5,545	6,100	183,000	201,300
2010	5,545	6,100	188,545	207,400
2011	5,545	6,100	194,091	213,500
2012	5,545	6,100	199,636	219,600
2013	5,514	6,065	205,182	225,700
2014	5,563	6,119	210,695	231,765
2015	6,166	6,783	216,258	237,884

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
2016	5,567	6,124	222,425	244,667
2017	5,591	6,150	227,992	250,791
2018	5,591	6,150	233,583	256,941
2019	5,591	6,150	239,174	263,091
2020	5,591	6,150	244,765	269,241
2021	5,591	6,150	250,355	275,391
2022	5,591	6,150	255,946	281,541
2023	5,591	6,150	261,537	287,691
2024	5,591	6,150	267,128	293,841
2025	5,591	6,150	272,719	299,991
2026	5,591	6,150	278,310	306,141
2027	5,591	6,150	283,901	312,291
2028	5,591	6,150	289,492	318,441
2029	5,591	6,150	295,083	324,591
2030	5,591	6,150	300,674	330,741
2031	5,591	6,150	306,265	336,891
2032	5,591	6,150	311,855	343,041
2033	5,591	6,150	317,446	349,191
2034	5,591	6,150	323,037	355,341
2035	5,591	6,150	328,628	361,491
2036	5,591	6,150	334,219	367,641
2037	5,591	6,150	339,810	373,791
2038	5,591	6,150	345,401	379,941
2039	5,591	6,150	350,992	386,091
2040	5,591	6,150	356,583	392,241
2041	5,591	6,150	362,174	398,391
2042	5,591	6,150	367,765	404,541
2043	5,591	6,150	373,355	410,691
2044	5,591	6,150	378,946	416,841
2045	5,591	6,150	384,537	422,991
2046	5,591	6,150	390,128	429,141
2047	5,591	6,150	395,719	435,291
2048	5,591	6,150	401,310	441,441
2049	5,591	6,150	406,901	447,591
2050	5,591	6,150	412,492	453,741
2051	5,591	6,150	418,083	459,891
2052	5,591	6,150	423,674	466,041
2053	5,591	6,150	429,265	472,191
2054	5,591	6,150	434,855	478,341
2055	5,591	6,150	440,446	484,491

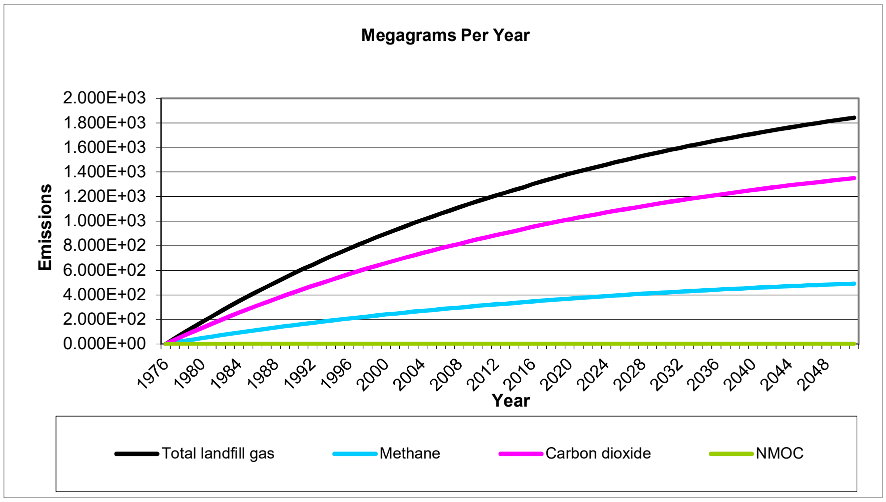
Pollutant Parameters

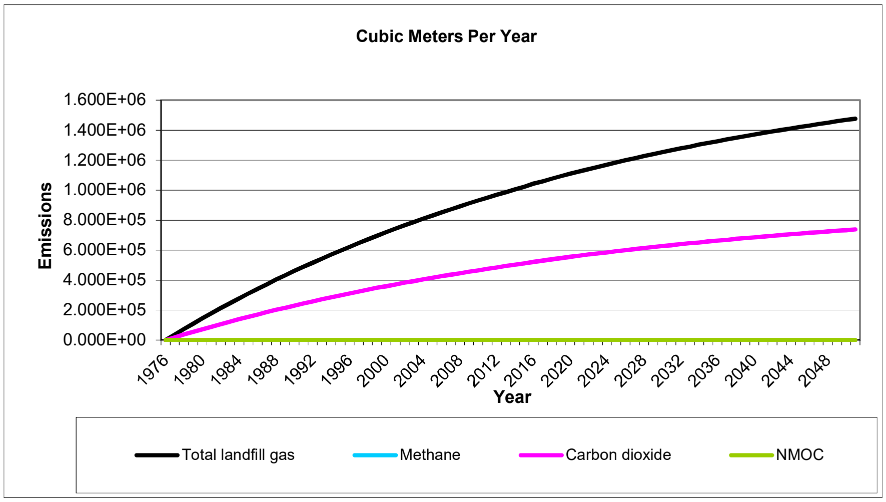
		Gas / Pollutant Default Parameters:		User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl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

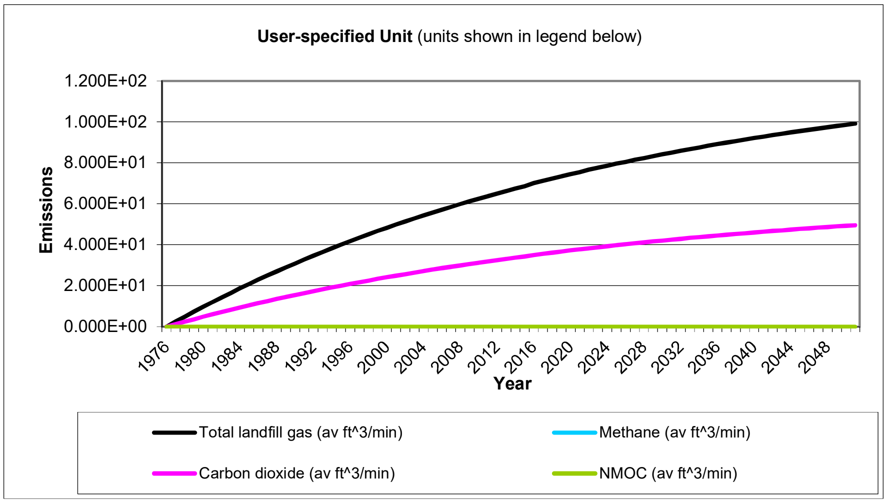
Pollutant Parameters (Continued)

	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
2.000E+03
1.800E+03
1.600E+03
1.400E+03
1.200E+03
1.000E+03
8.000E+02
6.000E+02
4.000E+02
2.000E+02
0.000E+00
Emissions
1976
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
2020
2024
2028
2032
2036
2040
2044
2048
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
1.600E+06
1.400E+06
1.200E+06
1.000E+06
8.000E+05
6.000E+05
4.000E+05
2.000E+05
0.000E+00
Emissions
1976
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
2020
2024
2028
2032
2036
2040
2044
2048
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
1.200E+02
1.000E+02
8.000E+01
6.000E+01
4.000E+01
2.000E+01
0.000E+00
Emissions
1976
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
2020
2024
2028
2032
2036
2040
2044
2048
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)
1976	0	0	0	0	0	0
1977	4.667E+01	3.737E+04	2.511E+00	1.247E+01	1.869E+04	1.256E+00
1978	9.242E+01	7.400E+04	4.972E+00	2.469E+01	3.700E+04	2.486E+00
1979	1.373E+02	1.099E+05	7.385E+00	3.666E+01	5.496E+04	3.692E+00
1980	1.812E+02	1.451E+05	9.750E+00	4.840E+01	7.255E+04	4.875E+00
1981	2.243E+02	1.796E+05	1.207E+01	5.991E+01	8.980E+04	6.034E+00
1982	2.665E+02	2.134E+05	1.434E+01	7.119E+01	1.067E+05	7.170E+00
1983	3.079E+02	2.466E+05	1.657E+01	8.225E+01	1.233E+05	8.283E+00
1984	3.485E+02	2.791E+05	1.875E+01	9.309E+01	1.395E+05	9.375E+00
1985	3.883E+02	3.109E+05	2.089E+01	1.037E+02	1.555E+05	1.044E+01
1986	4.272E+02	3.421E+05	2.299E+01	1.141E+02	1.711E+05	1.149E+01
1987	4.655E+02	3.727E+05	2.504E+01	1.243E+02	1.864E+05	1.252E+01
1988	5.029E+02	4.027E+05	2.706E+01	1.343E+02	2.014E+05	1.353E+01
1989	5.396E+02	4.321E+05	2.903E+01	1.441E+02	2.161E+05	1.452E+01
1990	5.756E+02	4.609E+05	3.097E+01	1.538E+02	2.305E+05	1.548E+01
1991	6.109E+02	4.892E+05	3.287E+01	1.632E+02	2.446E+05	1.643E+01
1992	6.455E+02	5.169E+05	3.473E+01	1.724E+02	2.584E+05	1.736E+01
1993	6.793E+02	5.440E+05	3.655E+01	1.815E+02	2.720E+05	1.828E+01
1994	7.126E+02	5.706E+05	3.834E+01	1.903E+02	2.853E+05	1.917E+01
1995	7.451E+02	5.967E+05	4.009E+01	1.990E+02	2.983E+05	2.004E+01
1996	7.770E+02	6.222E+05	4.181E+01	2.076E+02	3.111E+05	2.090E+01
1997	8.083E+02	6.473E+05	4.349E+01	2.159E+02	3.236E+05	2.174E+01
1998	8.390E+02	6.718E+05	4.514E+01	2.241E+02	3.359E+05	2.257E+01
1999	8.690E+02	6.959E+05	4.676E+01	2.321E+02	3.479E+05	2.338E+01
2000	8.985E+02	7.195E+05	4.834E+01	2.400E+02	3.597E+05	2.417E+01
2001	9.274E+02	7.426E+05	4.990E+01	2.477E+02	3.713E+05	2.495E+01
2002	9.557E+02	7.653E+05	5.142E+01	2.553E+02	3.826E+05	2.571E+01
2003	9.834E+02	7.875E+05	5.291E+01	2.627E+02	3.937E+05	2.646E+01
2004	1.011E+03	8.093E+05	5.438E+01	2.700E+02	4.046E+05	2.719E+01
2005	1.037E+03	8.306E+05	5.581E+01	2.771E+02	4.153E+05	2.790E+01
2006	1.063E+03	8.515E+05	5.722E+01	2.841E+02	4.258E+05	2.861E+01
2007	1.089E+03	8.721E+05	5.859E+01	2.909E+02	4.360E+05	2.930E+01
2008	1.114E+03	8.922E+05	5.994E+01	2.976E+02	4.461E+05	2.997E+01
2009	1.139E+03	9.119E+05	6.127E+01	3.042E+02	4.559E+05	3.063E+01
2010	1.163E+03	9.312E+05	6.257E+01	3.106E+02	4.656E+05	3.128E+01
2011	1.187E+03	9.501E+05	6.384E+01	3.169E+02	4.751E+05	3.192E+01
2012	1.210E+03	9.687E+05	6.509E+01	3.231E+02	4.843E+05	3.254E+01
2013	1.232E+03	9.869E+05	6.631E+01	3.292E+02	4.934E+05	3.315E+01
2014	1.254E+03	1.004E+06	6.749E+01	3.351E+02	5.022E+05	3.375E+01
2015	1.276E+03	1.022E+06	6.867E+01	3.409E+02	5.110E+05	3.434E+01
2016	1.303E+03	1.043E+06	7.011E+01	3.481E+02	5.217E+05	3.505E+01
2017	1.324E+03	1.060E+06	7.124E+01	3.537E+02	5.301E+05	3.562E+01
2018	1.345E+03	1.077E+06	7.236E+01	3.592E+02	5.385E+05	3.618E+01
2019	1.365E+03	1.093E+06	7.346E+01	3.647E+02	5.466E+05	3.673E+01
2020	1.385E+03	1.109E+06	7.454E+01	3.700E+02	5.547E+05	3.727E+01
2021	1.405E+03	1.125E+06	7.559E+01	3.753E+02	5.625E+05	3.780E+01
2022	1.424E+03	1.140E+06	7.663E+01	3.804E+02	5.702E+05	3.831E+01
2023	1.443E+03	1.156E+06	7.764E+01	3.855E+02	5.778E+05	3.882E+01
2024	1.462E+03	1.170E+06	7.863E+01	3.904E+02	5.852E+05	3.932E+01
2025	1.480E+03	1.185E+06	7.961E+01	3.952E+02	5.924E+05	3.980E+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)
2026	1.497E+03	1.199E+06	8.056E+01	4.000E+02	5.995E+05	4.028E+01
2027	1.515E+03	1.213E+06	8.150E+01	4.046E+02	6.065E+05	4.075E+01
2028	1.532E+03	1.227E+06	8.242E+01	4.092E+02	6.133E+05	4.121E+01
2029	1.549E+03	1.240E+06	8.332E+01	4.136E+02	6.200E+05	4.166E+01
2030	1.565E+03	1.253E+06	8.420E+01	4.180E+02	6.266E+05	4.210E+01
2031	1.581E+03	1.266E+06	8.506E+01	4.223E+02	6.330E+05	4.253E+01
2032	1.597E+03	1.279E+06	8.591E+01	4.265E+02	6.393E+05	4.296E+01
2033	1.612E+03	1.291E+06	8.674E+01	4.306E+02	6.455E+05	4.337E+01
2034	1.627E+03	1.303E+06	8.756E+01	4.347E+02	6.516E+05	4.378E+01
2035	1.642E+03	1.315E+06	8.835E+01	4.386E+02	6.575E+05	4.418E+01
2036	1.657E+03	1.327E+06	8.914E+01	4.425E+02	6.633E+05	4.457E+01
2037	1.671E+03	1.338E+06	8.990E+01	4.463E+02	6.690E+05	4.495E+01
2038	1.685E+03	1.349E+06	9.065E+01	4.501E+02	6.746E+05	4.533E+01
2039	1.699E+03	1.360E+06	9.139E+01	4.537E+02	6.801E+05	4.569E+01
2040	1.712E+03	1.371E+06	9.211E+01	4.573E+02	6.855E+05	4.606E+01
2041	1.725E+03	1.381E+06	9.282E+01	4.608E+02	6.907E+05	4.641E+01
2042	1.738E+03	1.392E+06	9.351E+01	4.643E+02	6.959E+05	4.676E+01
2043	1.751E+03	1.402E+06	9.419E+01	4.676E+02	7.009E+05	4.710E+01
2044	1.763E+03	1.412E+06	9.486E+01	4.709E+02	7.059E+05	4.743E+01
2045	1.775E+03	1.422E+06	9.551E+01	4.742E+02	7.108E+05	4.776E+01
2046	1.787E+03	1.431E+06	9.615E+01	4.774E+02	7.155E+05	4.808E+01
2047	1.799E+03	1.440E+06	9.678E+01	4.805E+02	7.202E+05	4.839E+01
2048	1.810E+03	1.450E+06	9.740E+01	4.835E+02	7.248E+05	4.870E+01
2049	1.821E+03	1.459E+06	9.800E+01	4.865E+02	7.293E+05	4.900E+01
2050	1.832E+03	1.467E+06	9.859E+01	4.895E+02	7.337E+05	4.930E+01
2051	1.843E+03	1.476E+06	9.917E+01	4.923E+02	7.380E+05	4.958E+01
2052	1.854E+03	1.484E+06	9.974E+01	4.952E+02	7.422E+05	4.987E+01
2053	1.864E+03	1.493E+06	1.003E+02	4.979E+02	7.463E+05	5.015E+01
2054	1.874E+03	1.501E+06	1.008E+02	5.006E+02	7.504E+05	5.042E+01
2055	1.884E+03	1.509E+06	1.014E+02	5.033E+02	7.544E+05	5.069E+01
2056	1.894E+03	1.517E+06	1.019E+02	5.059E+02	7.583E+05	5.095E+01
2057	1.856E+03	1.487E+06	9.988E+01	4.959E+02	7.433E+05	4.994E+01
2058	1.820E+03	1.457E+06	9.790E+01	4.861E+02	7.286E+05	4.895E+01
2059	1.784E+03	1.428E+06	9.596E+01	4.764E+02	7.141E+05	4.798E+01
2060	1.748E+03	1.400E+06	9.406E+01	4.670E+02	7.000E+05	4.703E+01
2061	1.714E+03	1.372E+06	9.220E+01	4.577E+02	6.861E+05	4.610E+01
2062	1.680E+03	1.345E+06	9.038E+01	4.487E+02	6.725E+05	4.519E+01
2063	1.647E+03	1.318E+06	8.859E+01	4.398E+02	6.592E+05	4.429E+01
2064	1.614E+03	1.292E+06	8.683E+01	4.311E+02	6.462E+05	4.342E+01
2065	1.582E+03	1.267E+06	8.511E+01	4.226E+02	6.334E+05	4.256E+01
2066	1.551E+03	1.242E+06	8.343E+01	4.142E+02	6.208E+05	4.171E+01
2067	1.520E+03	1.217E+06	8.178E+01	4.060E+02	6.085E+05	4.089E+01
2068	1.490E+03	1.193E+06	8.016E+01	3.979E+02	5.965E+05	4.008E+01
2069	1.460E+03	1.169E+06	7.857E+01	3.901E+02	5.847E+05	3.928E+01
2070	1.431E+03	1.146E+06	7.701E+01	3.823E+02	5.731E+05	3.851E+01
2071	1.403E+03	1.124E+06	7.549E+01	3.748E+02	5.618E+05	3.774E+01
2072	1.375E+03	1.101E+06	7.399E+01	3.674E+02	5.506E+05	3.700E+01
2073	1.348E+03	1.079E+06	7.253E+01	3.601E+02	5.397E+05	3.626E+01
2074	1.321E+03	1.058E+06	7.109E+01	3.529E+02	5.290E+05	3.555E+01
2075	1.295E+03	1.037E+06	6.968E+01	3.460E+02	5.186E+05	3.484E+01
2076	1.270E+03	1.017E+06	6.830E+01	3.391E+02	5.083E+05	3.415E+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)*
2077	1.244E+03	9.965E+05	6.695E+01	3.324E+02	4.982E+05	3.348E+01
2078	1.220E+03	9.767E+05	6.563E+01	3.258E+02	4.884E+05	3.281E+01
2079	1.196E+03	9.574E+05	6.433E+01	3.194E+02	4.787E+05	3.216E+01
2080	1.172E+03	9.384E+05	6.305E+01	3.130E+02	4.692E+05	3.153E+01
2081	1.149E+03	9.199E+05	6.180E+01	3.068E+02	4.599E+05	3.090E+01
2082	1.126E+03	9.016E+05	6.058E+01	3.008E+02	4.508E+05	3.029E+01
2083	1.104E+03	8.838E+05	5.938E+01	2.948E+02	4.419E+05	2.969E+01
2084	1.082E+03	8.663E+05	5.821E+01	2.890E+02	4.331E+05	2.910E+01
2085	1.060E+03	8.491E+05	5.705E+01	2.832E+02	4.246E+05	2.853E+01
2086	1.039E+03	8.323E+05	5.592E+01	2.776E+02	4.162E+05	2.796E+01
2087	1.019E+03	8.158E+05	5.482E+01	2.721E+02	4.079E+05	2.741E+01
2088	9.987E+02	7.997E+05	5.373E+01	2.668E+02	3.998E+05	2.687E+01
2089	9.789E+02	7.838E+05	5.267E+01	2.615E+02	3.919E+05	2.633E+01
2090	9.595E+02	7.683E+05	5.162E+01	2.563E+02	3.842E+05	2.581E+01
2091	9.405E+02	7.531E+05	5.060E+01	2.512E+02	3.766E+05	2.530E+01
2092	9.219E+02	7.382E+05	4.960E+01	2.462E+02	3.691E+05	2.480E+01
2093	9.036E+02	7.236E+05	4.862E+01	2.414E+02	3.618E+05	2.431E+01
2094	8.857E+02	7.093E+05	4.765E+01	2.366E+02	3.546E+05	2.383E+01
2095	8.682E+02	6.952E+05	4.671E+01	2.319E+02	3.476E+05	2.336E+01
2096	8.510E+02	6.814E+05	4.579E+01	2.273E+02	3.407E+05	2.289E+01
2097	8.342E+02	6.679E+05	4.488E+01	2.228E+02	3.340E+05	2.244E+01
2098	8.176E+02	6.547E+05	4.399E+01	2.184E+02	3.274E+05	2.200E+01
2099	8.014E+02	6.418E+05	4.312E+01	2.141E+02	3.209E+05	2.156E+01
2100	7.856E+02	6.291E+05	4.227E+01	2.098E+02	3.145E+05	2.113E+01
2101	7.700E+02	6.166E+05	4.143E+01	2.057E+02	3.083E+05	2.071E+01
2102	7.548E+02	6.044E+05	4.061E+01	2.016E+02	3.022E+05	2.030E+01
2103	7.398E+02	5.924E+05	3.980E+01	1.976E+02	2.962E+05	1.990E+01
2104	7.252E+02	5.807E+05	3.902E+01	1.937E+02	2.903E+05	1.951E+01
2105	7.108E+02	5.692E+05	3.824E+01	1.899E+02	2.846E+05	1.912E+01
2106	6.967E+02	5.579E+05	3.749E+01	1.861E+02	2.790E+05	1.874E+01
2107	6.829E+02	5.469E+05	3.674E+01	1.824E+02	2.734E+05	1.837E+01
2108	6.694E+02	5.360E+05	3.602E+01	1.788E+02	2.680E+05	1.801E+01
2109	6.562E+02	5.254E+05	3.530E+01	1.753E+02	2.627E+05	1.765E+01
2110	6.432E+02	5.150E+05	3.460E+01	1.718E+02	2.575E+05	1.730E+01
2111	6.304E+02	5.048E+05	3.392E+01	1.684E+02	2.524E+05	1.696E+01
2112	6.180E+02	4.948E+05	3.325E+01	1.651E+02	2.474E+05	1.662E+01
2113	6.057E+02	4.850E+05	3.259E+01	1.618E+02	2.425E+05	1.629E+01
2114	5.937E+02	4.754E+05	3.194E+01	1.586E+02	2.377E+05	1.597E+01
2115	5.820E+02	4.660E+05	3.131E+01	1.554E+02	2.330E+05	1.566E+01
2116	5.704E+02	4.568E+05	3.069E+01	1.524E+02	2.284E+05	1.535E+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)*
1976	0	0	0	0	0	0
1977	3.420E+01	1.869E+04	1.256E+00	3.979E-02	1.110E+01	7.458E-04
1978	6.773E+01	3.700E+04	2.486E+00	7.878E-02	2.198E+01	1.477E-03
1979	1.006E+02	5.496E+04	3.692E+00	1.170E-01	3.264E+01	2.193E-03
1980	1.328E+02	7.255E+04	4.875E+00	1.545E-01	4.310E+01	2.896E-03
1981	1.644E+02	8.980E+04	6.034E+00	1.912E-01	5.334E+01	3.584E-03
1982	1.953E+02	1.067E+05	7.170E+00	2.272E-01	6.339E+01	4.259E-03
1983	2.257E+02	1.233E+05	8.283E+00	2.625E-01	7.323E+01	4.920E-03
1984	2.554E+02	1.395E+05	9.375E+00	2.971E-01	8.288E+01	5.569E-03
1985	2.846E+02	1.555E+05	1.044E+01	3.310E-01	9.234E+01	6.204E-03
1986	3.131E+02	1.711E+05	1.149E+01	3.642E-01	1.016E+02	6.827E-03
1987	3.411E+02	1.864E+05	1.252E+01	3.968E-01	1.107E+02	7.438E-03
1988	3.686E+02	2.014E+05	1.353E+01	4.287E-01	1.196E+02	8.036E-03
1989	3.955E+02	2.161E+05	1.452E+01	4.600E-01	1.283E+02	8.623E-03
1990	4.219E+02	2.305E+05	1.548E+01	4.907E-01	1.369E+02	9.198E-03
1991	4.477E+02	2.446E+05	1.643E+01	5.208E-01	1.453E+02	9.761E-03
1992	4.730E+02	2.584E+05	1.736E+01	5.502E-01	1.535E+02	1.031E-02
1993	4.979E+02	2.720E+05	1.828E+01	5.791E-01	1.616E+02	1.086E-02
1994	5.222E+02	2.853E+05	1.917E+01	6.074E-01	1.695E+02	1.139E-02
1995	5.461E+02	2.983E+05	2.004E+01	6.352E-01	1.772E+02	1.191E-02
1996	5.695E+02	3.111E+05	2.090E+01	6.624E-01	1.848E+02	1.242E-02
1997	5.924E+02	3.236E+05	2.174E+01	6.891E-01	1.922E+02	1.292E-02
1998	6.149E+02	3.359E+05	2.257E+01	7.152E-01	1.995E+02	1.341E-02
1999	6.369E+02	3.479E+05	2.338E+01	7.408E-01	2.067E+02	1.389E-02
2000	6.585E+02	3.597E+05	2.417E+01	7.660E-01	2.137E+02	1.436E-02
2001	6.797E+02	3.713E+05	2.495E+01	7.906E-01	2.206E+02	1.482E-02
2002	7.004E+02	3.826E+05	2.571E+01	8.147E-01	2.273E+02	1.527E-02
2003	7.208E+02	3.937E+05	2.646E+01	8.384E-01	2.339E+02	1.571E-02
2004	7.407E+02	4.046E+05	2.719E+01	8.615E-01	2.404E+02	1.615E-02
2005	7.602E+02	4.153E+05	2.790E+01	8.843E-01	2.467E+02	1.658E-02
2006	7.794E+02	4.258E+05	2.861E+01	9.065E-01	2.529E+02	1.699E-02
2007	7.981E+02	4.360E+05	2.930E+01	9.284E-01	2.590E+02	1.740E-02
2008	8.165E+02	4.461E+05	2.997E+01	9.498E-01	2.650E+02	1.780E-02
2009	8.346E+02	4.559E+05	3.063E+01	9.708E-01	2.708E+02	1.820E-02
2010	8.523E+02	4.656E+05	3.128E+01	9.913E-01	2.766E+02	1.858E-02
2011	8.696E+02	4.751E+05	3.192E+01	1.011E+00	2.822E+02	1.896E-02
2012	8.866E+02	4.843E+05	3.254E+01	1.031E+00	2.877E+02	1.933E-02
2013	9.032E+02	4.934E+05	3.315E+01	1.051E+00	2.931E+02	1.969E-02
2014	9.194E+02	5.022E+05	3.375E+01	1.069E+00	2.983E+02	2.004E-02
2015	9.355E+02	5.110E+05	3.434E+01	1.088E+00	3.036E+02	2.040E-02
2016	9.550E+02	5.217E+05	3.505E+01	1.111E+00	3.099E+02	2.082E-02
2017	9.704E+02	5.301E+05	3.562E+01	1.129E+00	3.149E+02	2.116E-02
2018	9.857E+02	5.385E+05	3.618E+01	1.146E+00	3.199E+02	2.149E-02
2019	1.001E+03	5.466E+05	3.673E+01	1.164E+00	3.247E+02	2.182E-02
2020	1.015E+03	5.547E+05	3.727E+01	1.181E+00	3.295E+02	2.214E-02
2021	1.030E+03	5.625E+05	3.780E+01	1.198E+00	3.341E+02	2.245E-02
2022	1.044E+03	5.702E+05	3.831E+01	1.214E+00	3.387E+02	2.276E-02
2023	1.058E+03	5.778E+05	3.882E+01	1.230E+00	3.432E+02	2.306E-02
2024	1.071E+03	5.852E+05	3.932E+01	1.246E+00	3.476E+02	2.335E-02
2025	1.084E+03	5.924E+05	3.980E+01	1.261E+00	3.519E+02	2.364E-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)
2026	1.097E+03	5.995E+05	4.028E+01	1.276E+00	3.561E+02	2.393E-02
2027	1.110E+03	6.065E+05	4.075E+01	1.291E+00	3.603E+02	2.421E-02
2028	1.123E+03	6.133E+05	4.121E+01	1.306E+00	3.643E+02	2.448E-02
2029	1.135E+03	6.200E+05	4.166E+01	1.320E+00	3.683E+02	2.475E-02
2030	1.147E+03	6.266E+05	4.210E+01	1.334E+00	3.722E+02	2.501E-02
2031	1.159E+03	6.330E+05	4.253E+01	1.348E+00	3.760E+02	2.526E-02
2032	1.170E+03	6.393E+05	4.296E+01	1.361E+00	3.798E+02	2.552E-02
2033	1.182E+03	6.455E+05	4.337E+01	1.374E+00	3.834E+02	2.576E-02
2034	1.193E+03	6.516E+05	4.378E+01	1.387E+00	3.870E+02	2.600E-02
2035	1.204E+03	6.575E+05	4.418E+01	1.400E+00	3.905E+02	2.624E-02
2036	1.214E+03	6.633E+05	4.457E+01	1.412E+00	3.940E+02	2.647E-02
2037	1.225E+03	6.690E+05	4.495E+01	1.424E+00	3.974E+02	2.670E-02
2038	1.235E+03	6.746E+05	4.533E+01	1.436E+00	4.007E+02	2.692E-02
2039	1.245E+03	6.801E+05	4.569E+01	1.448E+00	4.040E+02	2.714E-02
2040	1.255E+03	6.855E+05	4.606E+01	1.459E+00	4.072E+02	2.736E-02
2041	1.264E+03	6.907E+05	4.641E+01	1.471E+00	4.103E+02	2.757E-02
2042	1.274E+03	6.959E+05	4.676E+01	1.482E+00	4.134E+02	2.777E-02
2043	1.283E+03	7.009E+05	4.710E+01	1.492E+00	4.164E+02	2.798E-02
2044	1.292E+03	7.059E+05	4.743E+01	1.503E+00	4.193E+02	2.817E-02
2045	1.301E+03	7.108E+05	4.776E+01	1.513E+00	4.222E+02	2.837E-02
2046	1.310E+03	7.155E+05	4.808E+01	1.523E+00	4.250E+02	2.856E-02
2047	1.318E+03	7.202E+05	4.839E+01	1.533E+00	4.278E+02	2.874E-02
2048	1.327E+03	7.248E+05	4.870E+01	1.543E+00	4.305E+02	2.893E-02
2049	1.335E+03	7.293E+05	4.900E+01	1.553E+00	4.332E+02	2.911E-02
2050	1.343E+03	7.337E+05	4.930E+01	1.562E+00	4.358E+02	2.928E-02
2051	1.351E+03	7.380E+05	4.958E+01	1.571E+00	4.384E+02	2.945E-02
2052	1.359E+03	7.422E+05	4.987E+01	1.580E+00	4.409E+02	2.962E-02
2053	1.366E+03	7.463E+05	5.015E+01	1.589E+00	4.433E+02	2.979E-02
2054	1.374E+03	7.504E+05	5.042E+01	1.598E+00	4.457E+02	2.995E-02
2055	1.381E+03	7.544E+05	5.069E+01	1.606E+00	4.481E+02	3.011E-02
2056	1.388E+03	7.583E+05	5.095E+01	1.615E+00	4.504E+02	3.026E-02
2057	1.361E+03	7.433E+05	4.994E+01	1.583E+00	4.415E+02	2.966E-02
2058	1.334E+03	7.286E+05	4.895E+01	1.551E+00	4.328E+02	2.908E-02
2059	1.307E+03	7.141E+05	4.798E+01	1.521E+00	4.242E+02	2.850E-02
2060	1.281E+03	7.000E+05	4.703E+01	1.490E+00	4.158E+02	2.794E-02
2061	1.256E+03	6.861E+05	4.610E+01	1.461E+00	4.076E+02	2.738E-02
2062	1.231E+03	6.725E+05	4.519E+01	1.432E+00	3.995E+02	2.684E-02
2063	1.207E+03	6.592E+05	4.429E+01	1.404E+00	3.916E+02	2.631E-02
2064	1.183E+03	6.462E+05	4.342E+01	1.376E+00	3.838E+02	2.579E-02
2065	1.159E+03	6.334E+05	4.256E+01	1.349E+00	3.762E+02	2.528E-02
2066	1.136E+03	6.208E+05	4.171E+01	1.322E+00	3.688E+02	2.478E-02
2067	1.114E+03	6.085E+05	4.089E+01	1.296E+00	3.615E+02	2.429E-02
2068	1.092E+03	5.965E+05	4.008E+01	1.270E+00	3.543E+02	2.381E-02
2069	1.070E+03	5.847E+05	3.928E+01	1.245E+00	3.473E+02	2.334E-02
2070	1.049E+03	5.731E+05	3.851E+01	1.220E+00	3.404E+02	2.287E-02
2071	1.028E+03	5.618E+05	3.774E+01	1.196E+00	3.337E+02	2.242E-02
2072	1.008E+03	5.506E+05	3.700E+01	1.172E+00	3.271E+02	2.198E-02
2073	9.880E+02	5.397E+05	3.626E+01	1.149E+00	3.206E+02	2.154E-02
2074	9.684E+02	5.290E+05	3.555E+01	1.126E+00	3.142E+02	2.111E-02
2075	9.492E+02	5.186E+05	3.484E+01	1.104E+00	3.080E+02	2.070E-02
2076	9.304E+02	5.083E+05	3.415E+01	1.082E+00	3.019E+02	2.029E-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)*
2077	9.120E+02	4.982E+05	3.348E+01	1.061E+00	2.959E+02	1.988E-02
2078	8.940E+02	4.884E+05	3.281E+01	1.040E+00	2.901E+02	1.949E-02
2079	8.763E+02	4.787E+05	3.216E+01	1.019E+00	2.843E+02	1.911E-02
2080	8.589E+02	4.692E+05	3.153E+01	9.990E-01	2.787E+02	1.873E-02
2081	8.419E+02	4.599E+05	3.090E+01	9.793E-01	2.732E+02	1.836E-02
2082	8.252E+02	4.508E+05	3.029E+01	9.599E-01	2.678E+02	1.799E-02
2083	8.089E+02	4.419E+05	2.969E+01	9.409E-01	2.625E+02	1.764E-02
2084	7.929E+02	4.331E+05	2.910E+01	9.222E-01	2.573E+02	1.729E-02
2085	7.772E+02	4.246E+05	2.853E+01	9.040E-01	2.522E+02	1.694E-02
2086	7.618E+02	4.162E+05	2.796E+01	8.861E-01	2.472E+02	1.661E-02
2087	7.467E+02	4.079E+05	2.741E+01	8.685E-01	2.423E+02	1.628E-02
2088	7.319E+02	3.998E+05	2.687E+01	8.513E-01	2.375E+02	1.596E-02
2089	7.174E+02	3.919E+05	2.633E+01	8.345E-01	2.328E+02	1.564E-02
2090	7.032E+02	3.842E+05	2.581E+01	8.179E-01	2.282E+02	1.533E-02
2091	6.893E+02	3.766E+05	2.530E+01	8.018E-01	2.237E+02	1.503E-02
2092	6.756E+02	3.691E+05	2.480E+01	7.859E-01	2.192E+02	1.473E-02
2093	6.623E+02	3.618E+05	2.431E+01	7.703E-01	2.149E+02	1.444E-02
2094	6.491E+02	3.546E+05	2.383E+01	7.551E-01	2.106E+02	1.415E-02
2095	6.363E+02	3.476E+05	2.336E+01	7.401E-01	2.065E+02	1.387E-02
2096	6.237E+02	3.407E+05	2.289E+01	7.255E-01	2.024E+02	1.360E-02
2097	6.113E+02	3.340E+05	2.244E+01	7.111E-01	1.984E+02	1.333E-02
2098	5.992E+02	3.274E+05	2.200E+01	6.970E-01	1.945E+02	1.307E-02
2099	5.874E+02	3.209E+05	2.156E+01	6.832E-01	1.906E+02	1.281E-02
2100	5.757E+02	3.145E+05	2.113E+01	6.697E-01	1.868E+02	1.255E-02
2101	5.643E+02	3.083E+05	2.071E+01	6.564E-01	1.831E+02	1.230E-02
2102	5.532E+02	3.022E+05	2.030E+01	6.434E-01	1.795E+02	1.206E-02
2103	5.422E+02	2.962E+05	1.990E+01	6.307E-01	1.759E+02	1.182E-02
2104	5.315E+02	2.903E+05	1.951E+01	6.182E-01	1.725E+02	1.159E-02
2105	5.209E+02	2.846E+05	1.912E+01	6.060E-01	1.690E+02	1.136E-02
2106	5.106E+02	2.790E+05	1.874E+01	5.940E-01	1.657E+02	1.113E-02
2107	5.005E+02	2.734E+05	1.837E+01	5.822E-01	1.624E+02	1.091E-02
2108	4.906E+02	2.680E+05	1.801E+01	5.707E-01	1.592E+02	1.070E-02
2109	4.809E+02	2.627E+05	1.765E+01	5.594E-01	1.561E+02	1.049E-02
2110	4.714E+02	2.575E+05	1.730E+01	5.483E-01	1.530E+02	1.028E-02
2111	4.620E+02	2.524E+05	1.696E+01	5.374E-01	1.499E+02	1.007E-02
2112	4.529E+02	2.474E+05	1.662E+01	5.268E-01	1.470E+02	9.875E-03
2113	4.439E+02	2.425E+05	1.629E+01	5.164E-01	1.441E+02	9.679E-03
2114	4.351E+02	2.377E+05	1.597E+01	5.061E-01	1.412E+02	9.487E-03
2115	4.265E+02	2.330E+05	1.566E+01	4.961E-01	1.384E+02	9.299E-03
2116	4.181E+02	2.284E+05	1.535E+01	4.863E-01	1.357E+02	9.115E-03

ND Dept. of Health Emission Inventory Summary Year: **2018**

Company:	City of Minot	AIRS/AFS Source Code:	38 101 00043
PTO Number:	T5-O98001	Annual Permit Fee Billing:	**NO**
Unit or Station	City of Minot Landfill	Reviewed By:	ET

Individual Emission Sources

EU	Source Unit	SCC	CPM	PM10	SO2	NOX	CO	VOC
1	Municipal Solid Waste Landfill	50100402						22.0
Total Facility Emissions (Less HAPS)								22.0

Hazardous Air Pollutants (Tons)				
Pollutant/Chemical Name	Boiler	Dryer		Total
Plant Totals				

Fuel Combusted & Process/Production Qty	
Coal (Tons)	
Natural Gas (MMScf)	
LPG/Propane (Gal)	
Bio-gas (MMScf)	
Low Sulfur Diesel (Gal)	
Distillate Oil (Gal)	
Residual Oil (Gal)	
Other Fuel	
Hot Mix Asphalt (Tons)	
Ethanol (Gal)	
Beets Sliced (Tons)	
Vegetable Oil (Gals)	

Action	Date	Initial
Scanned		
Checked	6/1/2019	ET
Checked (Gary)	6/20/2019	GK
Database Entry		

	Tons	Megagrams
Current Year Landfill Acceptance	68,944.00	62,532.21

	Old Landfill	**New Landfill**				
Variables	**1980-Oct. 1993**	**10-12/1993**	**1994...**	**...2016**	**2017**	**2018**
CNMOC (ppm as Hexane)	485.00	463.8	463.8	463.8	463.8	463.8
Lo (cubic meters/Mg)	170.00	170.00	170.00	170.00	170.00	170.00
K (1/year)	0.02	0.02	0.02	0.02	0.02	0.02
T (years)	39.00	25.25	24.25	2.25	1.25	0.25
R (Mg)	79828.00	7400	31,073	67,861	65,413.75	62,532.21
C (years)	22.25	0	0	0	0	0
e(Euler number)	2.72	2.72	2.72	2.72	2.72	2.72
$e^{-kc}-e^{-kt}$	0.18	0.40	0.38	0.04	0.02	0.00
NMOC (Mg/year)	8.64	0.05	0.22	0.74	0.72	0.71
NMOC Total emission rate	19.92	mg/year				
	21.96	ton/year				

City of Minot

Public Works Department

Scanned: ✓
Added to AQDB: __

BK

January 29, 2019

NDDH – Division of Air Quality
918 East Divide Avenue
Bismarck, ND 58501-1947

2019
Received
Air Quality

RE: City of Minot Landfill
Minot, North Dakota
Annual NMOC Emission Inventory Report

To whom it may concern:

Enclosed please find the City of Minot's Annual NMOC Emission Rate Estimate & Report for the City landfill. Periodic reporting is required under 40 CFR 60.75(b)(1). This report provides general information and the calculation of NMOC emissions using updated data. Attached to this report are the calculations for the current emissions and the Annual Emissions Inventory Report. The Annual Emissions Data for PM2.5 and Mercury are shown as no value because we were informed that these figures did not apply to landfills.

The updated NMOC emission rate for 2018 is 17.14 Mg/yr. This value is substantially less than the 50 Mg/yr allowed by current regulations. The City of Minot will continue to submit periodic reporting as required. If you have any further questions or comments please contact me at (701) 857-4140.

Respectfully,

Ben H Cofell

Ben Cofell
Project Civil Engineer
City of Minot

The Magic City

PO Box 5006 • Minot, North Dakota 58702-5006 • (701) 857-4140 • Fax (701) 857-4130

City of Minot

Landfill

ANNUAL NMOC EMISSION RATE REPORT

Prepared By: Ben Cofell

Project #3880

Prepared For:
North Dakota Department of Health
Division of Air Quality
Bismarck, ND

2018

GENERAL INFORMATION & NMOC EMISSION RATE ESTIMATE

For background data, Tier II sampling data and other general information see the previous reports that are on file with the NDDH Air Quality Division.

The emission rate for the old landfill and new landfill are as follows for the year 2018.

Waste stream data for the old landfill was estimated at 1,143,940 tons for the time period January 1, 1980 to October 13, 1993. Waste stream data used in the analysis has been tabulated in the following table.

LANDFILL	DATES	TONS/YR	MG/YR
Old Landfill	1980 - Oct 1993	1,143,940	1,037,765
New Landfill	Oct 1993 - Dec 1993	8,157	7,400
New Landfill	1994	34,252	31,073
New Landfill	1995	31,022	28,143
New Landfill	1996	25,946	23,538
New Landfill	1997	24,809	22,506
New Landfill	1998	28,022	25,421
New Landfill	1999	39,435	35,775
New Landfill	2000	41,872	37,986
New Landfill	2001	43,448	39,415
New Landfill	2002	41,788	37,909
New Landfill	2003	43,430	39,399
New Landfill	2004	39,324	35,674
New Landfill	2005	40,441	36,687
New Landfill	2006	42,714	38,749
New Landfill	2007	46,731	42,393
New Landfill	2008	53,654	48,673
New Landfill	2009	59,244	53,745
New Landfill	2010	60,287	54,691
New Landfill	2011	70,924	64,340
New Landfill	2012	83,986	76,190
New Landfill	2013	81,908	74,305
New Landfill	2014	83,395	75,654
New Landfill	2015	82,260	74,624
New Landfill	2016	74,819	67,874
New Landfill	2017	72,121	65,426
New Landfill	2018	68,944	62,544

The following data was used to calculate the mass NMOC emission rate. The average annual waste acceptance rate was derived by dividing the sum of accumulated waste in MG/year by the number of years the landfill has been in operation.

Variable	Old Landfill	New Landfill
CNMOC (ppm as Hexane)	485.0	463.8
Lo (Cubic Meters/Mg)	170	170
K (1/yr)	.02	.02
T (years)	~~38~~ 29	25.25
R (Mg)	79,828	47,530
C (years)	25.25	0
e (Euler number)	2.71828	2.71828

The following equation was used to calculate the mass NMOC emission rate.

$$M_{NMOC} = \Sigma 2 L_o R(e^{-kc} - e^{-kt})(C_{NMOC})(3.6X10^{-9})$$

Where, M_{NMOC} = mass emission rate of NMOC, Mg/yr;

L_o = methane generation potential;
R = average annual waste acceptance rate, Mg/yr;
k = methane generation rate constant, $year^{-1}$ (0.02 per year);
c = time since closure;
t = age of landfill in years;
C_{NMOC} = concentration of NMOC, ppmv as hexane.
e = 2.71828 (Euler number)

Applying these variables into the mass NMOC emission equation results in a NMOC emission rate of 18.89Tons/year or 17.14 Mg/yr. This value is less than the 50 Mg/year allowed by current regulations. Therefore, the City of Minot is not required to install a gas collection and control system. The total mass NMOC emission rate was calculated by adding both NMOC emission rates to each other. The result of this equation is the total NMOC emission rate for the entire landfill. This equation automatically accounts for variability in NMOC emission rates for refuse in landfill sections with different ages. No reduction of the waste acceptance rate was used for non-degradable waste.

CONCLUSION

Periodic reporting and re-testing is required under 40 CFR 60.75(b)(1). This includes annual estimates of the NMOC emission rate using updated waste acceptance rates. In addition, every five years Tier II sampling is required to update the site-specific data. Tier II sampling was performed in 2018. The Cnmoc (ppm as Hexane) has been updated to reflect the latest Tier II sampling results.

MANUFACTURING OR PROCESSING EQUIPMENT
ANNUAL EMISSION INVENTORY REPORT
NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF AIR QUALITY
SFN 8537 (06-14)

GENERAL

Name of Firm or Organization: City of Minot		Permit to Operate Number: T5-098001	Year of Emissions: 2018
Mailing Address: P.O.Box 5006		City: Minot	State: ND / ZIP Code: 58702-5006
Facility Name: City of Minot Landfill	Facility Location: NW1/4,Sec 33-155-83 Ward Cty		Actual Hours of Operation: N/A
Source Unit Description:			Emission Unit Number:

RAW MATERIAL INFORMATION

Raw Materials Introduced into Process	Quantity (Specify Units)
Municipal Solid Waste	68,944 Tons/YR

FUELS USED

	Primary Fuel	Auxiliary Fuel
Type (ex. lignite, natural gas, LPG No. 2 fuel oil, No. 6 fuel oil. etc.)		
Quantity of Fuel per Year (Specify Units: ex. ton, gal, cu.ft., etc.)		
Percent Sulfur — Maximum / Average		
Btu per Unit (Specify Unit in lb, ton, gal, etc.) Average		

STACK EMISSIONS

Air Contaminant *	Emission Factor (Include Units)	Emission Factor Source (Include Test Date if Applicable)	Tons
Particulate – Total PM (Filterable)			
Particulate - PM_{10} (Filterable)			
Particulate - $PM_{2.5}$ (Filterable)			
Particulate – CPM (Condensable)			
Sulfur Dioxide			
Nitrogen Oxides			
Carbon Monoxide			
Total Organic Compounds: Nonmethane		485.1 Old Landfill 463.8 New Landfill See Tier II Report- 2018 Sampling	18.89

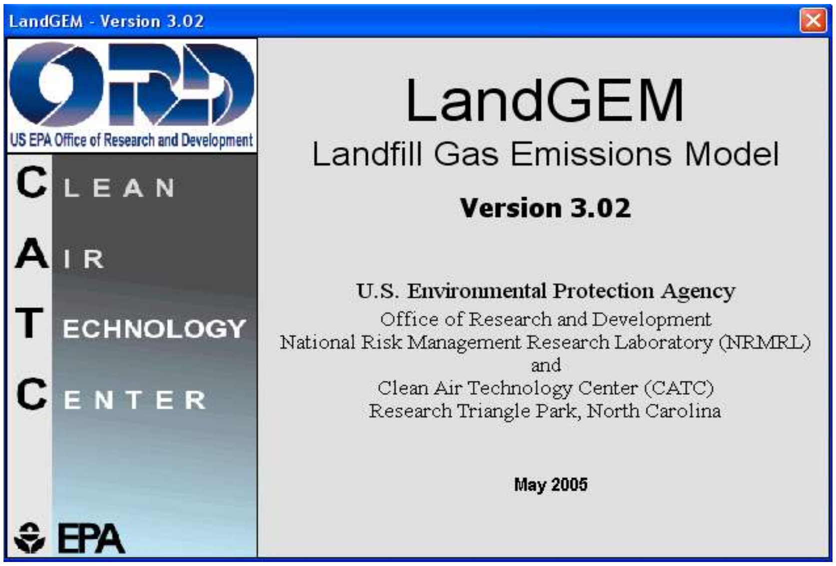
* Submit SFN 19839 for Hazardous Air Pollutants if applicable.

24
~~[illegible]~~ 19.92 Mg/yr

I declare under the penalties of perjury that this report has been examined by me and to the best of my knowledge is a true, correct and complete report.

Print Name of Person Submitting Report: Ben Cofell	Title: Project Civil Engineer	Telephone Number: (701)-857-4140
Signature: [signature]	Email Address: ben.cofell@minotnd.org	Date: 1/29/2019

Return completed form to:
North Dakota Department of Health
Division of Air Quality
918 E Divide, 2nd Floor
Bismarck, ND 58501-1947
Telephone:(701)328-5188



Summary Report

Landfill Name or Identifier: Noonan

Date: Wednesday, July 24, 2019

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

The 80-year waste acceptance limit of the model has been exceeded before the Waste Design Capacity was reached. The model will assume the 80th year of waste acceptance as the final year to estimate emissions. See Section 2.6 of the User's Manual.

LANDFILL CHARACTERISTICS

Landfill Open Year	**1965**	
Landfill Closure Year (with 80-year limit)	**2044**	
Actual Closure Year (without limit)	***2068***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**975,438**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*year* $^{-1}$
Potential Methane Generation Capacity, L_o	**170**	*m* ^{3} */Mg*
NMOC Concentration	**297**	*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)*
1965	6,364	7,000	0	0
1966	6,364	7,000	6,364	7,000
1967	6,364	7,000	12,727	14,000
1968	6,364	7,000	19,091	21,000
1969	6,364	7,000	25,455	28,000
1970	6,364	7,000	31,818	35,000
1971	6,364	7,000	38,182	42,000
1972	6,364	7,000	44,545	49,000
1973	6,364	7,000	50,909	56,000
1974	6,364	7,000	57,273	63,000
1975	6,364	7,000	63,636	70,000
1976	6,364	7,000	70,000	77,000
1977	6,364	7,000	76,364	84,000
1978	6,364	7,000	82,727	91,000
1979	6,364	7,000	89,091	98,000
1980	6,364	7,000	95,455	105,000
1981	6,364	7,000	101,818	112,000
1982	6,364	7,000	108,182	119,000
1983	6,364	7,000	114,545	126,000
1984	6,364	7,000	120,909	133,000
1985	6,364	7,000	127,273	140,000
1986	6,364	7,000	133,636	147,000
1987	6,364	7,000	140,000	154,000
1988	6,364	7,000	146,364	161,000
1989	6,364	7,000	152,727	168,000
1990	6,364	7,000	159,091	175,000
1991	6,364	7,000	165,455	182,000
1992	6,364	7,000	171,818	189,000
1993	6,364	7,000	178,182	196,000
1994	6,364	7,000	184,545	203,000
1995	6,364	7,000	190,909	210,000
1996	6,364	7,000	197,273	217,000
1997	6,364	7,000	203,636	224,000
1998	6,364	7,000	210,000	231,000
1999	6,364	7,000	216,364	238,000
2000	6,364	7,000	222,727	245,000
2001	6,364	7,000	229,091	252,000
2002	6,364	7,000	235,455	259,000
2003	6,364	7,000	241,818	266,000
2004	6,364	7,000	248,182	273,000

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
2005	6,364	7,000	254,545	280,000
2006	6,364	7,000	260,909	287,000
2007	6,364	7,000	267,273	294,000
2008	6,364	7,000	273,636	301,000
2009	6,364	7,000	280,000	308,000
2010	6,364	7,000	286,364	315,000
2011	6,364	7,000	292,727	322,000
2012	6,471	7,118	299,091	329,000
2013	6,537	7,191	305,562	336,118
2014	10,455	11,500	312,099	343,309
2015	12,565	13,822	322,554	354,809
2016	12,103	13,313	335,119	368,631
2017	12,273	13,500	347,222	381,944
2018	12,273	13,500	359,495	395,444
2019	12,273	13,500	371,767	408,944
2020	12,273	13,500	384,040	422,444
2021	12,273	13,500	396,313	435,944
2022	12,273	13,500	408,585	449,444
2023	12,273	13,500	420,858	462,944
2024	12,273	13,500	433,131	476,444
2025	12,273	13,500	445,404	489,944
2026	12,273	13,500	457,676	503,444
2027	12,273	13,500	469,949	516,944
2028	12,273	13,500	482,222	530,444
2029	12,273	13,500	494,495	543,944
2030	12,273	13,500	506,767	557,444
2031	12,273	13,500	519,040	570,944
2032	12,273	13,500	531,313	584,444
2033	12,273	13,500	543,585	597,944
2034	12,273	13,500	555,858	611,444
2035	12,273	13,500	568,131	624,944
2036	12,273	13,500	580,404	638,444
2037	12,273	13,500	592,676	651,944
2038	12,273	13,500	604,949	665,444
2039	12,273	13,500	617,222	678,944
2040	12,273	13,500	629,495	692,444
2041	12,273	13,500	641,767	705,944
2042	12,273	13,500	654,040	719,444
2043	12,273	13,500	666,313	732,944
2044	12,273	13,500	678,585	746,444

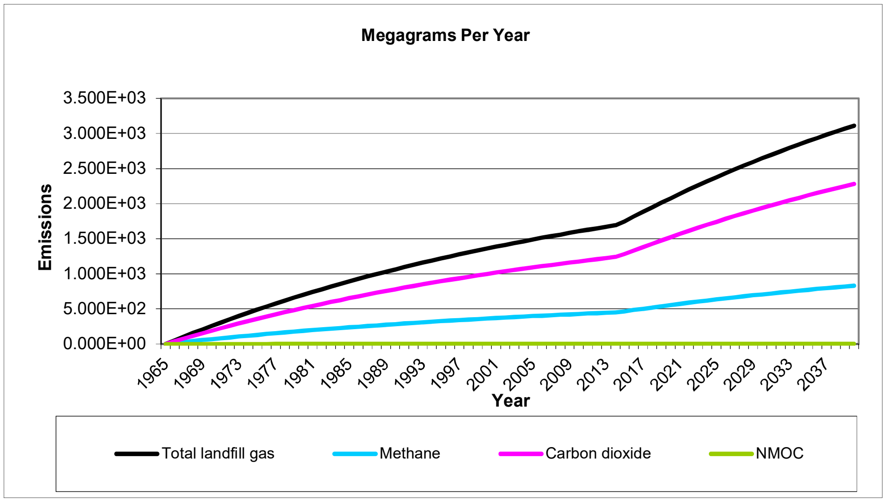
Pollutant Parameters

	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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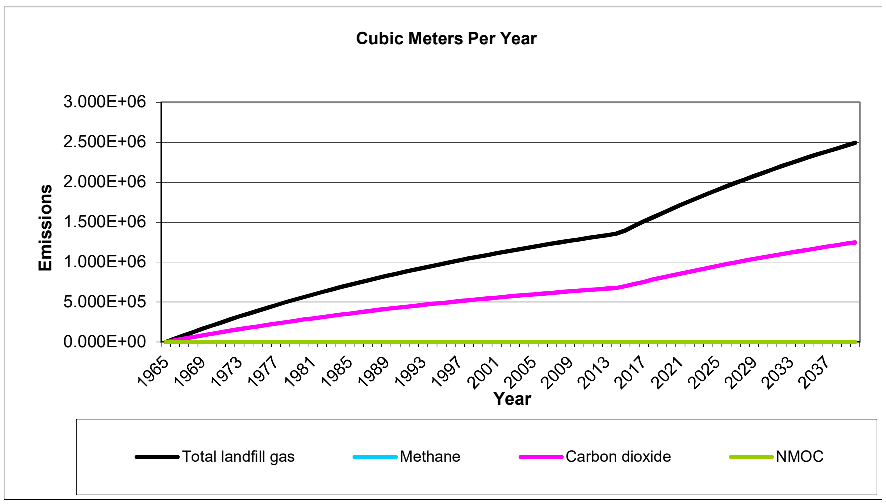
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
Emissions
1965 1969 1973 1977 1981 1985 1989 1993 1997 2001 2005 2009 2013 2017 2021 2025 2029 2033 2037
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
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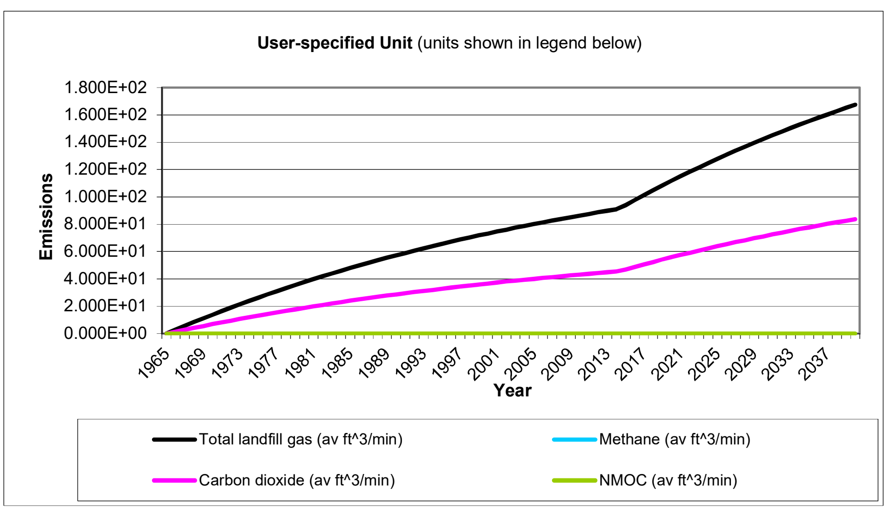
2.500E+06
2.000E+06
1.500E+06
1.000E+06
5.000E+05
0.000E+00
Emissions
1965 1969 1973 1977 1981 1985 1989 1993 1997 2001 2005 2009 2013 2017 2021 2025 2029 2033 2037
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
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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
1965 1969 1973 1977 1981 1985 1989 1993 1997 2001 2005 2009 2013 2017 2021 2025 2029 2033 2037
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)
1965	0	0	0	0	0	0
1966	5.356E+01	4.289E+04	2.881E+00	1.431E+01	2.144E+04	1.441E+00
1967	1.061E+02	8.492E+04	5.706E+00	2.833E+01	4.246E+04	2.853E+00
1968	1.575E+02	1.261E+05	8.474E+00	4.207E+01	6.306E+04	4.237E+00
1969	2.079E+02	1.665E+05	1.119E+01	5.554E+01	8.326E+04	5.594E+00
1970	2.574E+02	2.061E+05	1.385E+01	6.875E+01	1.031E+05	6.924E+00
1971	3.058E+02	2.449E+05	1.646E+01	8.169E+01	1.225E+05	8.228E+00
1972	3.533E+02	2.829E+05	1.901E+01	9.438E+01	1.415E+05	9.505E+00
1973	3.999E+02	3.202E+05	2.152E+01	1.068E+02	1.601E+05	1.076E+01
1974	4.455E+02	3.568E+05	2.397E+01	1.190E+02	1.784E+05	1.199E+01
1975	4.903E+02	3.926E+05	2.638E+01	1.310E+02	1.963E+05	1.319E+01
1976	5.341E+02	4.277E+05	2.874E+01	1.427E+02	2.139E+05	1.437E+01
1977	5.771E+02	4.621E+05	3.105E+01	1.542E+02	2.311E+05	1.552E+01
1978	6.192E+02	4.959E+05	3.332E+01	1.654E+02	2.479E+05	1.666E+01
1979	6.605E+02	5.289E+05	3.554E+01	1.764E+02	2.645E+05	1.777E+01
1980	7.010E+02	5.613E+05	3.772E+01	1.872E+02	2.807E+05	1.886E+01
1981	7.407E+02	5.931E+05	3.985E+01	1.978E+02	2.966E+05	1.993E+01
1982	7.796E+02	6.242E+05	4.194E+01	2.082E+02	3.121E+05	2.097E+01
1983	8.177E+02	6.548E+05	4.399E+01	2.184E+02	3.274E+05	2.200E+01
1984	8.551E+02	6.847E+05	4.600E+01	2.284E+02	3.423E+05	2.300E+01
1985	8.917E+02	7.140E+05	4.797E+01	2.382E+02	3.570E+05	2.399E+01
1986	9.276E+02	7.428E+05	4.991E+01	2.478E+02	3.714E+05	2.495E+01
1987	9.628E+02	7.709E+05	5.180E+01	2.572E+02	3.855E+05	2.590E+01
1988	9.973E+02	7.986E+05	5.366E+01	2.664E+02	3.993E+05	2.683E+01
1989	1.031E+03	8.256E+05	5.547E+01	2.754E+02	4.128E+05	2.774E+01
1990	1.064E+03	8.522E+05	5.726E+01	2.843E+02	4.261E+05	2.863E+01
1991	1.097E+03	8.782E+05	5.901E+01	2.929E+02	4.391E+05	2.950E+01
1992	1.129E+03	9.037E+05	6.072E+01	3.014E+02	4.518E+05	3.036E+01
1993	1.160E+03	9.287E+05	6.240E+01	3.098E+02	4.643E+05	3.120E+01
1994	1.190E+03	9.532E+05	6.404E+01	3.180E+02	4.766E+05	3.202E+01
1995	1.220E+03	9.772E+05	6.566E+01	3.260E+02	4.886E+05	3.283E+01
1996	1.250E+03	1.001E+06	6.724E+01	3.338E+02	5.004E+05	3.362E+01
1997	1.279E+03	1.024E+06	6.879E+01	3.415E+02	5.119E+05	3.439E+01
1998	1.307E+03	1.046E+06	7.031E+01	3.491E+02	5.232E+05	3.515E+01
1999	1.334E+03	1.069E+06	7.180E+01	3.564E+02	5.343E+05	3.590E+01
2000	1.362E+03	1.090E+06	7.326E+01	3.637E+02	5.451E+05	3.663E+01
2001	1.388E+03	1.112E+06	7.469E+01	3.708E+02	5.558E+05	3.734E+01
2002	1.414E+03	1.132E+06	7.609E+01	3.778E+02	5.662E+05	3.805E+01
2003	1.440E+03	1.153E+06	7.747E+01	3.846E+02	5.765E+05	3.873E+01
2004	1.465E+03	1.173E+06	7.881E+01	3.913E+02	5.865E+05	3.941E+01
2005	1.489E+03	1.193E+06	8.013E+01	3.978E+02	5.963E+05	4.007E+01
2006	1.513E+03	1.212E+06	8.143E+01	4.043E+02	6.060E+05	4.071E+01
2007	1.537E+03	1.231E+06	8.270E+01	4.106E+02	6.154E+05	4.135E+01
2008	1.560E+03	1.249E+06	8.394E+01	4.167E+02	6.247E+05	4.197E+01
2009	1.583E+03	1.267E+06	8.516E+01	4.228E+02	6.337E+05	4.258E+01
2010	1.605E+03	1.285E+06	8.636E+01	4.287E+02	6.426E+05	4.318E+01
2011	1.627E+03	1.303E+06	8.753E+01	4.345E+02	6.513E+05	4.376E+01
2012	1.648E+03	1.320E+06	8.868E+01	4.402E+02	6.599E+05	4.434E+01
2013	1.670E+03	1.337E+06	8.985E+01	4.461E+02	6.686E+05	4.492E+01
2014	1.692E+03	1.355E+06	9.103E+01	4.519E+02	6.774E+05	4.552E+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)
2015	1.746E+03	1.398E+06	9.396E+01	4.665E+02	6.992E+05	4.698E+01
2016	1.818E+03	1.455E+06	9.779E+01	4.855E+02	7.277E+05	4.890E+01
2017	1.883E+03	1.508E+06	1.013E+02	5.031E+02	7.541E+05	5.067E+01
2018	1.949E+03	1.561E+06	1.049E+02	5.207E+02	7.805E+05	5.244E+01
2019	2.014E+03	1.613E+06	1.084E+02	5.380E+02	8.064E+05	5.418E+01
2020	2.078E+03	1.664E+06	1.118E+02	5.549E+02	8.318E+05	5.589E+01
2021	2.140E+03	1.713E+06	1.151E+02	5.715E+02	8.567E+05	5.756E+01
2022	2.201E+03	1.762E+06	1.184E+02	5.878E+02	8.811E+05	5.920E+01
2023	2.260E+03	1.810E+06	1.216E+02	6.038E+02	9.050E+05	6.081E+01
2024	2.319E+03	1.857E+06	1.248E+02	6.194E+02	9.284E+05	6.238E+01
2025	2.376E+03	1.903E+06	1.278E+02	6.347E+02	9.514E+05	6.392E+01
2026	2.432E+03	1.948E+06	1.309E+02	6.497E+02	9.739E+05	6.544E+01
2027	2.488E+03	1.992E+06	1.338E+02	6.645E+02	9.960E+05	6.692E+01
2028	2.542E+03	2.035E+06	1.367E+02	6.789E+02	1.018E+06	6.837E+01
2029	2.595E+03	2.078E+06	1.396E+02	6.930E+02	1.039E+06	6.980E+01
2030	2.646E+03	2.119E+06	1.424E+02	7.069E+02	1.060E+06	7.119E+01
2031	2.697E+03	2.160E+06	1.451E+02	7.205E+02	1.080E+06	7.256E+01
2032	2.747E+03	2.200E+06	1.478E+02	7.338E+02	1.100E+06	7.390E+01
2033	2.796E+03	2.239E+06	1.504E+02	7.469E+02	1.120E+06	7.522E+01
2034	2.844E+03	2.277E+06	1.530E+02	7.597E+02	1.139E+06	7.651E+01
2035	2.891E+03	2.315E+06	1.555E+02	7.722E+02	1.158E+06	7.777E+01
2036	2.937E+03	2.352E+06	1.580E+02	7.845E+02	1.176E+06	7.901E+01
2037	2.982E+03	2.388E+06	1.605E+02	7.966E+02	1.194E+06	8.023E+01
2038	3.026E+03	2.423E+06	1.628E+02	8.084E+02	1.212E+06	8.142E+01
2039	3.070E+03	2.458E+06	1.652E+02	8.200E+02	1.229E+06	8.258E+01
2040	3.112E+03	2.492E+06	1.674E+02	8.313E+02	1.246E+06	8.372E+01
2041	3.154E+03	2.526E+06	1.697E+02	8.425E+02	1.263E+06	8.485E+01
2042	3.195E+03	2.558E+06	1.719E+02	8.534E+02	1.279E+06	8.594E+01
2043	3.235E+03	2.590E+06	1.740E+02	8.641E+02	1.295E+06	8.702E+01
2044	3.274E+03	2.622E+06	1.762E+02	8.745E+02	1.311E+06	8.808E+01
2045	3.313E+03	2.653E+06	1.782E+02	8.848E+02	1.326E+06	8.911E+01
2046	3.247E+03	2.600E+06	1.747E+02	8.673E+02	1.300E+06	8.735E+01
2047	3.183E+03	2.549E+06	1.712E+02	8.501E+02	1.274E+06	8.562E+01
2048	3.120E+03	2.498E+06	1.678E+02	8.333E+02	1.249E+06	8.392E+01
2049	3.058E+03	2.449E+06	1.645E+02	8.168E+02	1.224E+06	8.226E+01
2050	2.997E+03	2.400E+06	1.613E+02	8.006E+02	1.200E+06	8.063E+01
2051	2.938E+03	2.353E+06	1.581E+02	7.848E+02	1.176E+06	7.903E+01
2052	2.880E+03	2.306E+06	1.549E+02	7.692E+02	1.153E+06	7.747E+01
2053	2.823E+03	2.260E+06	1.519E+02	7.540E+02	1.130E+06	7.594E+01
2054	2.767E+03	2.216E+06	1.489E+02	7.391E+02	1.108E+06	7.443E+01
2055	2.712E+03	2.172E+06	1.459E+02	7.244E+02	1.086E+06	7.296E+01
2056	2.658E+03	2.129E+06	1.430E+02	7.101E+02	1.064E+06	7.151E+01
2057	2.606E+03	2.087E+06	1.402E+02	6.960E+02	1.043E+06	7.010E+01
2058	2.554E+03	2.045E+06	1.374E+02	6.822E+02	1.023E+06	6.871E+01
2059	2.504E+03	2.005E+06	1.347E+02	6.687E+02	1.002E+06	6.735E+01
2060	2.454E+03	1.965E+06	1.320E+02	6.555E+02	9.825E+05	6.601E+01
2061	2.405E+03	1.926E+06	1.294E+02	6.425E+02	9.631E+05	6.471E+01
2062	2.358E+03	1.888E+06	1.269E+02	6.298E+02	9.440E+05	6.343E+01
2063	2.311E+03	1.851E+06	1.243E+02	6.173E+02	9.253E+05	6.217E+01
2064	2.265E+03	1.814E+06	1.219E+02	6.051E+02	9.070E+05	6.094E+01
2065	2.220E+03	1.778E+06	1.195E+02	5.931E+02	8.890E+05	5.973E+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)*
2066	2.176E+03	1.743E+06	1.171E+02	5.814E+02	8.714E+05	5.855E+01
2067	2.133E+03	1.708E+06	1.148E+02	5.698E+02	8.542E+05	5.739E+01
2068	2.091E+03	1.674E+06	1.125E+02	5.586E+02	8.372E+05	5.625E+01
2069	2.050E+03	1.641E+06	1.103E+02	5.475E+02	8.207E+05	5.514E+01
2070	2.009E+03	1.609E+06	1.081E+02	5.367E+02	8.044E+05	5.405E+01
2071	1.969E+03	1.577E+06	1.060E+02	5.260E+02	7.885E+05	5.298E+01
2072	1.930E+03	1.546E+06	1.039E+02	5.156E+02	7.729E+05	5.193E+01
2073	1.892E+03	1.515E+06	1.018E+02	5.054E+02	7.576E+05	5.090E+01
2074	1.855E+03	1.485E+06	9.979E+01	4.954E+02	7.426E+05	4.989E+01
2075	1.818E+03	1.456E+06	9.781E+01	4.856E+02	7.279E+05	4.891E+01
2076	1.782E+03	1.427E+06	9.587E+01	4.760E+02	7.135E+05	4.794E+01
2077	1.747E+03	1.399E+06	9.398E+01	4.666E+02	6.993E+05	4.699E+01
2078	1.712E+03	1.371E+06	9.211E+01	4.573E+02	6.855E+05	4.606E+01
2079	1.678E+03	1.344E+06	9.029E+01	4.483E+02	6.719E+05	4.515E+01
2080	1.645E+03	1.317E+06	8.850E+01	4.394E+02	6.586E+05	4.425E+01
2081	1.612E+03	1.291E+06	8.675E+01	4.307E+02	6.456E+05	4.337E+01
2082	1.580E+03	1.266E+06	8.503E+01	4.222E+02	6.328E+05	4.252E+01
2083	1.549E+03	1.240E+06	8.335E+01	4.138E+02	6.202E+05	4.167E+01
2084	1.518E+03	1.216E+06	8.170E+01	4.056E+02	6.080E+05	4.085E+01
2085	1.488E+03	1.192E+06	8.008E+01	3.976E+02	5.959E+05	4.004E+01
2086	1.459E+03	1.168E+06	7.849E+01	3.897E+02	5.841E+05	3.925E+01
2087	1.430E+03	1.145E+06	7.694E+01	3.820E+02	5.726E+05	3.847E+01
2088	1.402E+03	1.122E+06	7.542E+01	3.744E+02	5.612E+05	3.771E+01
2089	1.374E+03	1.100E+06	7.392E+01	3.670E+02	5.501E+05	3.696E+01
2090	1.347E+03	1.078E+06	7.246E+01	3.597E+02	5.392E+05	3.623E+01
2091	1.320E+03	1.057E+06	7.102E+01	3.526E+02	5.285E+05	3.551E+01
2092	1.294E+03	1.036E+06	6.962E+01	3.456E+02	5.181E+05	3.481E+01
2093	1.268E+03	1.016E+06	6.824E+01	3.388E+02	5.078E+05	3.412E+01
2094	1.243E+03	9.955E+05	6.689E+01	3.321E+02	4.978E+05	3.344E+01
2095	1.219E+03	9.758E+05	6.556E+01	3.255E+02	4.879E+05	3.278E+01
2096	1.194E+03	9.565E+05	6.427E+01	3.191E+02	4.782E+05	3.213E+01
2097	1.171E+03	9.375E+05	6.299E+01	3.127E+02	4.688E+05	3.150E+01
2098	1.148E+03	9.190E+05	6.175E+01	3.065E+02	4.595E+05	3.087E+01
2099	1.125E+03	9.008E+05	6.052E+01	3.005E+02	4.504E+05	3.026E+01
2100	1.103E+03	8.829E+05	5.932E+01	2.945E+02	4.415E+05	2.966E+01
2101	1.081E+03	8.655E+05	5.815E+01	2.887E+02	4.327E+05	2.908E+01
2102	1.059E+03	8.483E+05	5.700E+01	2.830E+02	4.242E+05	2.850E+01
2103	1.038E+03	8.315E+05	5.587E+01	2.774E+02	4.158E+05	2.794E+01
2104	1.018E+03	8.151E+05	5.476E+01	2.719E+02	4.075E+05	2.738E+01
2105	9.977E+02	7.989E+05	5.368E+01	2.665E+02	3.995E+05	2.684E+01

Results (Continued)

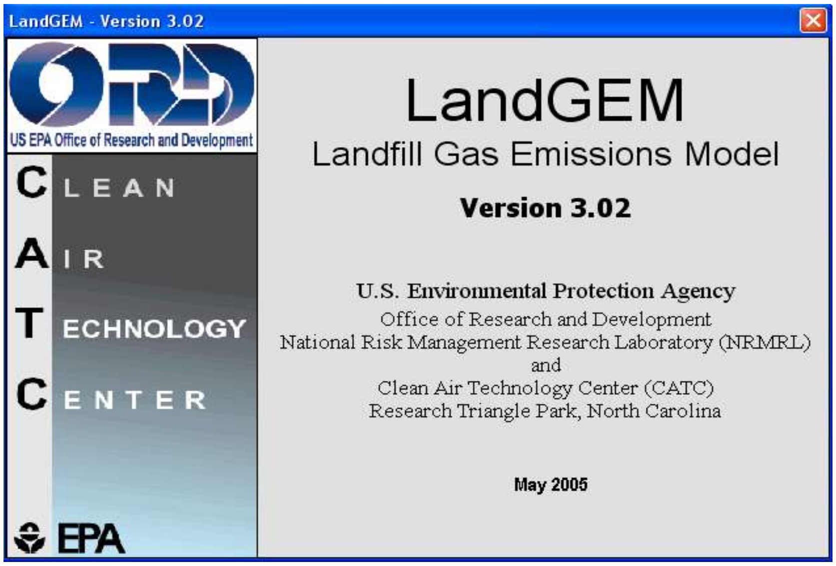
Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1965	0	0	0	0	0	0
1966	3.925E+01	2.144E+04	1.441E+00	4.566E-02	1.274E+01	8.558E-04
1967	7.773E+01	4.246E+04	2.853E+00	9.041E-02	2.522E+01	1.695E-03
1968	1.154E+02	6.306E+04	4.237E+00	1.343E-01	3.746E+01	2.517E-03
1969	1.524E+02	8.326E+04	5.594E+00	1.773E-01	4.945E+01	3.323E-03
1970	1.886E+02	1.031E+05	6.924E+00	2.194E-01	6.121E+01	4.113E-03
1971	2.242E+02	1.225E+05	8.228E+00	2.607E-01	7.274E+01	4.887E-03
1972	2.590E+02	1.415E+05	9.505E+00	3.012E-01	8.403E+01	5.646E-03
1973	2.931E+02	1.601E+05	1.076E+01	3.409E-01	9.511E+01	6.390E-03
1974	3.265E+02	1.784E+05	1.199E+01	3.798E-01	1.060E+02	7.120E-03
1975	3.593E+02	1.963E+05	1.319E+01	4.179E-01	1.166E+02	7.834E-03
1976	3.915E+02	2.139E+05	1.437E+01	4.553E-01	1.270E+02	8.535E-03
1977	4.230E+02	2.311E+05	1.552E+01	4.920E-01	1.373E+02	9.222E-03
1978	4.538E+02	2.479E+05	1.666E+01	5.279E-01	1.473E+02	9.895E-03
1979	4.841E+02	2.645E+05	1.777E+01	5.631E-01	1.571E+02	1.055E-02
1980	5.138E+02	2.807E+05	1.886E+01	5.976E-01	1.667E+02	1.120E-02
1981	5.428E+02	2.966E+05	1.993E+01	6.314E-01	1.762E+02	1.184E-02
1982	5.713E+02	3.121E+05	2.097E+01	6.646E-01	1.854E+02	1.246E-02
1983	5.993E+02	3.274E+05	2.200E+01	6.971E-01	1.945E+02	1.307E-02
1984	6.267E+02	3.423E+05	2.300E+01	7.289E-01	2.034E+02	1.366E-02
1985	6.535E+02	3.570E+05	2.399E+01	7.601E-01	2.121E+02	1.425E-02
1986	6.798E+02	3.714E+05	2.495E+01	7.907E-01	2.206E+02	1.482E-02
1987	7.056E+02	3.855E+05	2.590E+01	8.207E-01	2.290E+02	1.538E-02
1988	7.309E+02	3.993E+05	2.683E+01	8.501E-01	2.372E+02	1.594E-02
1989	7.557E+02	4.128E+05	2.774E+01	8.790E-01	2.452E+02	1.648E-02
1990	7.800E+02	4.261E+05	2.863E+01	9.072E-01	2.531E+02	1.701E-02
1991	8.038E+02	4.391E+05	2.950E+01	9.349E-01	2.608E+02	1.752E-02
1992	8.271E+02	4.518E+05	3.036E+01	9.621E-01	2.684E+02	1.803E-02
1993	8.500E+02	4.643E+05	3.120E+01	9.887E-01	2.758E+02	1.853E-02
1994	8.724E+02	4.766E+05	3.202E+01	1.015E+00	2.831E+02	1.902E-02
1995	8.944E+02	4.886E+05	3.283E+01	1.040E+00	2.902E+02	1.950E-02
1996	9.159E+02	5.004E+05	3.362E+01	1.065E+00	2.972E+02	1.997E-02
1997	9.370E+02	5.119E+05	3.439E+01	1.090E+00	3.041E+02	2.043E-02
1998	9.577E+02	5.232E+05	3.515E+01	1.114E+00	3.108E+02	2.088E-02
1999	9.780E+02	5.343E+05	3.590E+01	1.138E+00	3.174E+02	2.132E-02
2000	9.979E+02	5.451E+05	3.663E+01	1.161E+00	3.238E+02	2.176E-02
2001	1.017E+03	5.558E+05	3.734E+01	1.183E+00	3.301E+02	2.218E-02
2002	1.036E+03	5.662E+05	3.805E+01	1.206E+00	3.363E+02	2.260E-02
2003	1.055E+03	5.765E+05	3.873E+01	1.227E+00	3.424E+02	2.301E-02
2004	1.074E+03	5.865E+05	3.941E+01	1.249E+00	3.484E+02	2.341E-02
2005	1.092E+03	5.963E+05	4.007E+01	1.270E+00	3.542E+02	2.380E-02
2006	1.109E+03	6.060E+05	4.071E+01	1.290E+00	3.599E+02	2.418E-02
2007	1.126E+03	6.154E+05	4.135E+01	1.310E+00	3.655E+02	2.456E-02
2008	1.143E+03	6.247E+05	4.197E+01	1.330E+00	3.710E+02	2.493E-02
2009	1.160E+03	6.337E+05	4.258E+01	1.349E+00	3.764E+02	2.529E-02
2010	1.176E+03	6.426E+05	4.318E+01	1.368E+00	3.817E+02	2.565E-02
2011	1.192E+03	6.513E+05	4.376E+01	1.387E+00	3.869E+02	2.600E-02
2012	1.208E+03	6.599E+05	4.434E+01	1.405E+00	3.920E+02	2.634E-02
2013	1.224E+03	6.686E+05	4.492E+01	1.424E+00	3.972E+02	2.669E-02
2014	1.240E+03	6.774E+05	4.552E+01	1.442E+00	4.024E+02	2.704E-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)*
2015	1.280E+03	6.992E+05	4.698E+01	1.489E+00	4.153E+02	2.791E-02
2016	1.332E+03	7.277E+05	4.890E+01	1.549E+00	4.323E+02	2.904E-02
2017	1.380E+03	7.541E+05	5.067E+01	1.606E+00	4.479E+02	3.010E-02
2018	1.429E+03	7.805E+05	5.244E+01	1.662E+00	4.636E+02	3.115E-02
2019	1.476E+03	8.064E+05	5.418E+01	1.717E+00	4.790E+02	3.218E-02
2020	1.523E+03	8.318E+05	5.589E+01	1.771E+00	4.941E+02	3.320E-02
2021	1.568E+03	8.567E+05	5.756E+01	1.824E+00	5.089E+02	3.419E-02
2022	1.613E+03	8.811E+05	5.920E+01	1.876E+00	5.234E+02	3.516E-02
2023	1.657E+03	9.050E+05	6.081E+01	1.927E+00	5.376E+02	3.612E-02
2024	1.699E+03	9.284E+05	6.238E+01	1.977E+00	5.515E+02	3.705E-02
2025	1.742E+03	9.514E+05	6.392E+01	2.026E+00	5.651E+02	3.797E-02
2026	1.783E+03	9.739E+05	6.544E+01	2.074E+00	5.785E+02	3.887E-02
2027	1.823E+03	9.960E+05	6.692E+01	2.121E+00	5.916E+02	3.975E-02
2028	1.863E+03	1.018E+06	6.837E+01	2.167E+00	6.045E+02	4.061E-02
2029	1.902E+03	1.039E+06	6.980E+01	2.212E+00	6.171E+02	4.146E-02
2030	1.940E+03	1.060E+06	7.119E+01	2.256E+00	6.294E+02	4.229E-02
2031	1.977E+03	1.080E+06	7.256E+01	2.299E+00	6.415E+02	4.310E-02
2032	2.013E+03	1.100E+06	7.390E+01	2.342E+00	6.534E+02	4.390E-02
2033	2.049E+03	1.120E+06	7.522E+01	2.384E+00	6.650E+02	4.468E-02
2034	2.084E+03	1.139E+06	7.651E+01	2.424E+00	6.764E+02	4.545E-02
2035	2.119E+03	1.158E+06	7.777E+01	2.465E+00	6.876E+02	4.620E-02
2036	2.153E+03	1.176E+06	7.901E+01	2.504E+00	6.985E+02	4.693E-02
2037	2.186E+03	1.194E+06	8.023E+01	2.542E+00	7.092E+02	4.765E-02
2038	2.218E+03	1.212E+06	8.142E+01	2.580E+00	7.198E+02	4.836E-02
2039	2.250E+03	1.229E+06	8.258E+01	2.617E+00	7.301E+02	4.905E-02
2040	2.281E+03	1.246E+06	8.372E+01	2.653E+00	7.402E+02	4.973E-02
2041	2.312E+03	1.263E+06	8.485E+01	2.689E+00	7.501E+02	5.040E-02
2042	2.341E+03	1.279E+06	8.594E+01	2.723E+00	7.598E+02	5.105E-02
2043	2.371E+03	1.295E+06	8.702E+01	2.758E+00	7.693E+02	5.169E-02
2044	2.400E+03	1.311E+06	8.808E+01	2.791E+00	7.786E+02	5.232E-02
2045	2.428E+03	1.326E+06	8.911E+01	2.824E+00	7.878E+02	5.293E-02
2046	2.380E+03	1.300E+06	8.735E+01	2.768E+00	7.722E+02	5.188E-02
2047	2.333E+03	1.274E+06	8.562E+01	2.713E+00	7.569E+02	5.086E-02
2048	2.286E+03	1.249E+06	8.392E+01	2.659E+00	7.419E+02	4.985E-02
2049	2.241E+03	1.224E+06	8.226E+01	2.607E+00	7.272E+02	4.886E-02
2050	2.197E+03	1.200E+06	8.063E+01	2.555E+00	7.128E+02	4.789E-02
2051	2.153E+03	1.176E+06	7.903E+01	2.505E+00	6.987E+02	4.695E-02
2052	2.111E+03	1.153E+06	7.747E+01	2.455E+00	6.849E+02	4.602E-02
2053	2.069E+03	1.130E+06	7.594E+01	2.406E+00	6.713E+02	4.511E-02
2054	2.028E+03	1.108E+06	7.443E+01	2.359E+00	6.580E+02	4.421E-02
2055	1.988E+03	1.086E+06	7.296E+01	2.312E+00	6.450E+02	4.334E-02
2056	1.948E+03	1.064E+06	7.151E+01	2.266E+00	6.322E+02	4.248E-02
2057	1.910E+03	1.043E+06	7.010E+01	2.221E+00	6.197E+02	4.164E-02
2058	1.872E+03	1.023E+06	6.871E+01	2.177E+00	6.074E+02	4.081E-02
2059	1.835E+03	1.002E+06	6.735E+01	2.134E+00	5.954E+02	4.001E-02
2060	1.798E+03	9.825E+05	6.601E+01	2.092E+00	5.836E+02	3.921E-02
2061	1.763E+03	9.631E+05	6.471E+01	2.051E+00	5.721E+02	3.844E-02
2062	1.728E+03	9.440E+05	6.343E+01	2.010E+00	5.607E+02	3.768E-02
2063	1.694E+03	9.253E+05	6.217E+01	1.970E+00	5.496E+02	3.693E-02
2064	1.660E+03	9.070E+05	6.094E+01	1.931E+00	5.387E+02	3.620E-02
2065	1.627E+03	8.890E+05	5.973E+01	1.893E+00	5.281E+02	3.548E-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)
2066	1.595E+03	8.714E+05	5.855E+01	1.855E+00	5.176E+02	3.478E-02
2067	1.564E+03	8.542E+05	5.739E+01	1.819E+00	5.074E+02	3.409E-02
2068	1.533E+03	8.372E+05	5.625E+01	1.783E+00	4.973E+02	3.342E-02
2069	1.502E+03	8.207E+05	5.514E+01	1.747E+00	4.875E+02	3.275E-02
2070	1.472E+03	8.044E+05	5.405E+01	1.713E+00	4.778E+02	3.210E-02
2071	1.443E+03	7.885E+05	5.298E+01	1.679E+00	4.684E+02	3.147E-02
2072	1.415E+03	7.729E+05	5.193E+01	1.646E+00	4.591E+02	3.085E-02
2073	1.387E+03	7.576E+05	5.090E+01	1.613E+00	4.500E+02	3.024E-02
2074	1.359E+03	7.426E+05	4.989E+01	1.581E+00	4.411E+02	2.964E-02
2075	1.332E+03	7.279E+05	4.891E+01	1.550E+00	4.324E+02	2.905E-02
2076	1.306E+03	7.135E+05	4.794E+01	1.519E+00	4.238E+02	2.847E-02
2077	1.280E+03	6.993E+05	4.699E+01	1.489E+00	4.154E+02	2.791E-02
2078	1.255E+03	6.855E+05	4.606E+01	1.459E+00	4.072E+02	2.736E-02
2079	1.230E+03	6.719E+05	4.515E+01	1.431E+00	3.991E+02	2.682E-02
2080	1.206E+03	6.586E+05	4.425E+01	1.402E+00	3.912E+02	2.629E-02
2081	1.182E+03	6.456E+05	4.337E+01	1.375E+00	3.835E+02	2.576E-02
2082	1.158E+03	6.328E+05	4.252E+01	1.347E+00	3.759E+02	2.525E-02
2083	1.135E+03	6.202E+05	4.167E+01	1.321E+00	3.684E+02	2.475E-02
2084	1.113E+03	6.080E+05	4.085E+01	1.294E+00	3.611E+02	2.426E-02
2085	1.091E+03	5.959E+05	4.004E+01	1.269E+00	3.540E+02	2.378E-02
2086	1.069E+03	5.841E+05	3.925E+01	1.244E+00	3.470E+02	2.331E-02
2087	1.048E+03	5.726E+05	3.847E+01	1.219E+00	3.401E+02	2.285E-02
2088	1.027E+03	5.612E+05	3.771E+01	1.195E+00	3.334E+02	2.240E-02
2089	1.007E+03	5.501E+05	3.696E+01	1.171E+00	3.268E+02	2.196E-02
2090	9.870E+02	5.392E+05	3.623E+01	1.148E+00	3.203E+02	2.152E-02
2091	9.675E+02	5.285E+05	3.551E+01	1.125E+00	3.140E+02	2.109E-02
2092	9.483E+02	5.181E+05	3.481E+01	1.103E+00	3.077E+02	2.068E-02
2093	9.296E+02	5.078E+05	3.412E+01	1.081E+00	3.016E+02	2.027E-02
2094	9.111E+02	4.978E+05	3.344E+01	1.060E+00	2.957E+02	1.987E-02
2095	8.931E+02	4.879E+05	3.278E+01	1.039E+00	2.898E+02	1.947E-02
2096	8.754E+02	4.782E+05	3.213E+01	1.018E+00	2.841E+02	1.909E-02
2097	8.581E+02	4.688E+05	3.150E+01	9.981E-01	2.784E+02	1.871E-02
2098	8.411E+02	4.595E+05	3.087E+01	9.783E-01	2.729E+02	1.834E-02
2099	8.244E+02	4.504E+05	3.026E+01	9.590E-01	2.675E+02	1.798E-02
2100	8.081E+02	4.415E+05	2.966E+01	9.400E-01	2.622E+02	1.762E-02
2101	7.921E+02	4.327E+05	2.908E+01	9.214E-01	2.570E+02	1.727E-02
2102	7.764E+02	4.242E+05	2.850E+01	9.031E-01	2.520E+02	1.693E-02
2103	7.611E+02	4.158E+05	2.794E+01	8.852E-01	2.470E+02	1.659E-02
2104	7.460E+02	4.075E+05	2.738E+01	8.677E-01	2.421E+02	1.626E-02
2105	7.312E+02	3.995E+05	2.684E+01	8.505E-01	2.373E+02	1.594E-02



Summary Report

Landfill Name or Identifier: Williston

Date: Wednesday, July 24, 2019

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

The 80-year waste acceptance limit of the model has been exceeded before the Waste Design Capacity was reached. The model will assume the 80th year of waste acceptance as the final year to estimate emissions. See Section 2.6 of the User's Manual.

LANDFILL CHARACTERISTICS

Landfill Open Year	**1987**	
Landfill Closure Year (with 80-year limit)	**2066**	
Actual Closure Year (without limit)	***2166***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**7,819,053**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**297**	*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)*
1987	40,909	45,000	0	0
1988	40,909	45,000	40,909	45,000
1989	40,909	45,000	81,818	90,000
1990	40,909	45,000	122,727	135,000
1991	40,909	45,000	163,636	180,000
1992	40,909	45,000	204,545	225,000
1993	40,909	45,000	245,455	270,000
1994	40,909	45,000	286,364	315,000
1995	40,909	45,000	327,273	360,000
1996	40,909	45,000	368,182	405,000
1997	40,909	45,000	409,091	450,000
1998	40,909	45,000	450,000	495,000
1999	40,909	45,000	490,909	540,000
2000	38,464	42,310	531,818	585,000
2001	39,545	43,500	570,282	627,310
2002	40,658	44,724	609,827	670,810
2003	41,755	45,931	650,485	715,534
2004	42,853	47,138	692,241	761,465
2005	43,950	48,345	735,094	808,603
2006	45,047	49,552	779,044	856,948
2007	46,145	50,759	824,091	906,500
2008	47,242	51,966	870,235	957,259
2009	48,339	53,173	917,477	1,009,225
2010	49,435	54,378	965,816	1,062,398
2011	53,455	58,800	1,015,251	1,116,776
2012	59,779	65,757	1,068,705	1,175,576
2013	66,423	73,065	1,128,485	1,241,333
2014	68,637	75,501	1,194,907	1,314,398
2015	85,152	93,667	1,263,545	1,389,899
2016	43,100	47,410	1,348,696	1,483,566
2017	43,100	47,410	1,391,796	1,530,976
2018	43,100	47,410	1,434,896	1,578,386
2019	43,100	47,410	1,477,996	1,625,796
2020	43,100	47,410	1,521,096	1,673,206
2021	43,100	47,410	1,564,196	1,720,616
2022	43,100	47,410	1,607,296	1,768,026
2023	43,100	47,410	1,650,396	1,815,436
2024	43,100	47,410	1,693,496	1,862,846
2025	43,100	47,410	1,736,596	1,910,256
2026	43,100	47,410	1,779,696	1,957,666

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2027	43,100	47,410	1,822,796	2,005,076
2028	43,100	47,410	1,865,896	2,052,486
2029	43,100	47,410	1,908,996	2,099,896
2030	43,100	47,410	1,952,096	2,147,306
2031	43,100	47,410	1,995,196	2,194,716
2032	43,100	47,410	2,038,296	2,242,126
2033	43,100	47,410	2,081,396	2,289,536
2034	43,100	47,410	2,124,496	2,336,946
2035	43,100	47,410	2,167,596	2,384,356
2036	43,100	47,410	2,210,696	2,431,766
2037	43,100	47,410	2,253,796	2,479,176
2038	43,100	47,410	2,296,896	2,526,586
2039	43,100	47,410	2,339,996	2,573,996
2040	43,100	47,410	2,383,096	2,621,406
2041	43,100	47,410	2,426,196	2,668,816
2042	43,100	47,410	2,469,296	2,716,226
2043	43,100	47,410	2,512,396	2,763,636
2044	43,100	47,410	2,555,496	2,811,046
2045	43,100	47,410	2,598,596	2,858,456
2046	43,100	47,410	2,641,696	2,905,866
2047	43,100	47,410	2,684,796	2,953,276
2048	43,100	47,410	2,727,896	3,000,686
2049	43,100	47,410	2,770,996	3,048,096
2050	43,100	47,410	2,814,096	3,095,506
2051	43,100	47,410	2,857,196	3,142,916
2052	43,100	47,410	2,900,296	3,190,326
2053	43,100	47,410	2,943,396	3,237,736
2054	43,100	47,410	2,986,496	3,285,146
2055	43,100	47,410	3,029,596	3,332,556
2056	43,100	47,410	3,072,696	3,379,966
2057	43,100	47,410	3,115,796	3,427,376
2058	43,100	47,410	3,158,896	3,474,786
2059	43,100	47,410	3,201,996	3,522,196
2060	43,100	47,410	3,245,096	3,569,606
2061	43,100	47,410	3,288,196	3,617,016
2062	43,100	47,410	3,331,296	3,664,426
2063	43,100	47,410	3,374,396	3,711,836
2064	43,100	47,410	3,417,496	3,759,246
2065	43,100	47,410	3,460,596	3,806,656
2066	43,100	47,410	3,503,696	3,854,066

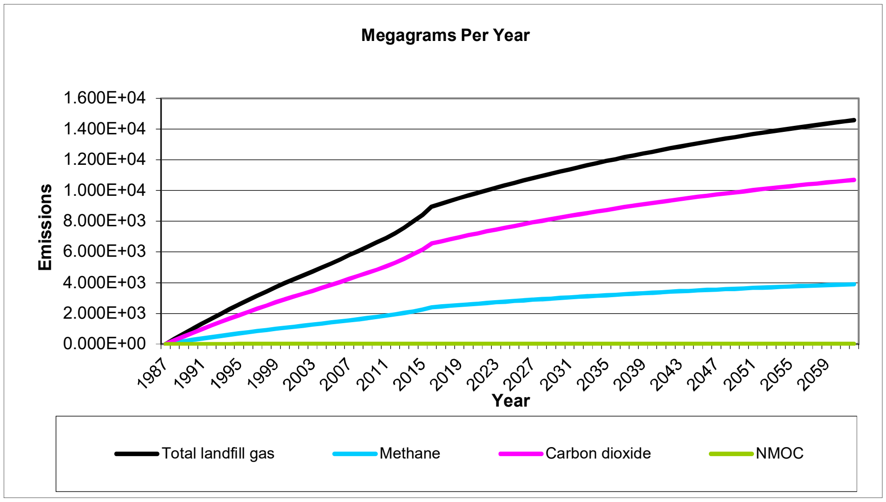
Pollutant Parameters

	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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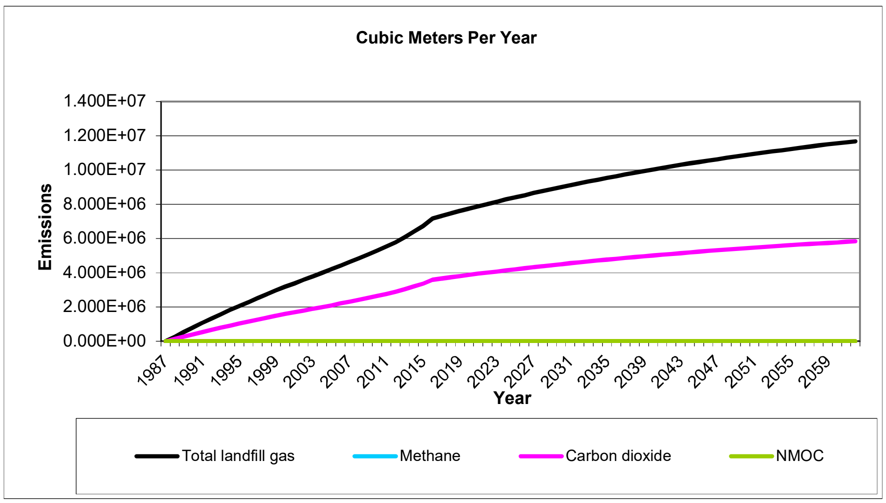
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
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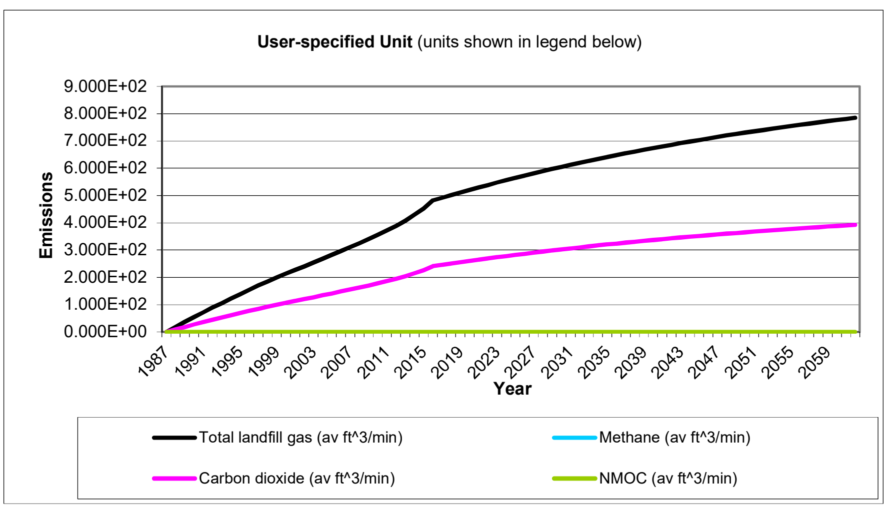
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
9.000E+02
8.000E+02
7.000E+02
6.000E+02
5.000E+02
4.000E+02
3.000E+02
2.000E+02
1.000E+02
0.000E+00
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)	*(m³/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m³/year)*	*(av ft^3/min)*
1987	0	0	0	0	0	0
1988	3.443E+02	2.757E+05	1.852E+01	9.196E+01	1.378E+05	9.262E+00
1989	6.818E+02	5.459E+05	3.668E+01	1.821E+02	2.730E+05	1.834E+01
1990	1.013E+03	8.108E+05	5.448E+01	2.705E+02	4.054E+05	2.724E+01
1991	1.337E+03	1.070E+06	7.192E+01	3.571E+02	5.352E+05	3.596E+01
1992	1.655E+03	1.325E+06	8.902E+01	4.420E+02	6.625E+05	4.451E+01
1993	1.966E+03	1.574E+06	1.058E+02	5.252E+02	7.872E+05	5.289E+01
1994	2.272E+03	1.819E+06	1.222E+02	6.067E+02	9.095E+05	6.111E+01
1995	2.571E+03	2.059E+06	1.383E+02	6.867E+02	1.029E+06	6.916E+01
1996	2.864E+03	2.294E+06	1.541E+02	7.651E+02	1.147E+06	7.705E+01
1997	3.152E+03	2.524E+06	1.696E+02	8.419E+02	1.262E+06	8.479E+01
1998	3.434E+03	2.750E+06	1.847E+02	9.172E+02	1.375E+06	9.237E+01
1999	3.710E+03	2.971E+06	1.996E+02	9.910E+02	1.485E+06	9.980E+01
2000	3.981E+03	3.188E+06	2.142E+02	1.063E+03	1.594E+06	1.071E+02
2001	4.226E+03	3.384E+06	2.274E+02	1.129E+03	1.692E+06	1.137E+02
2002	4.475E+03	3.583E+06	2.408E+02	1.195E+03	1.792E+06	1.204E+02
2003	4.728E+03	3.786E+06	2.544E+02	1.263E+03	1.893E+06	1.272E+02
2004	4.986E+03	3.993E+06	2.683E+02	1.332E+03	1.996E+06	1.341E+02
2005	5.248E+03	4.202E+06	2.824E+02	1.402E+03	2.101E+06	1.412E+02
2006	5.514E+03	4.415E+06	2.967E+02	1.473E+03	2.208E+06	1.483E+02
2007	5.784E+03	4.632E+06	3.112E+02	1.545E+03	2.316E+06	1.556E+02
2008	6.058E+03	4.851E+06	3.259E+02	1.618E+03	2.425E+06	1.630E+02
2009	6.335E+03	5.073E+06	3.409E+02	1.692E+03	2.537E+06	1.704E+02
2010	6.617E+03	5.298E+06	3.560E+02	1.767E+03	2.649E+06	1.780E+02
2011	6.902E+03	5.527E+06	3.713E+02	1.844E+03	2.763E+06	1.857E+02
2012	7.215E+03	5.778E+06	3.882E+02	1.927E+03	2.889E+06	1.941E+02
2013	7.575E+03	6.066E+06	4.076E+02	2.023E+03	3.033E+06	2.038E+02
2014	7.984E+03	6.393E+06	4.296E+02	2.133E+03	3.197E+06	2.148E+02
2015	8.404E+03	6.729E+06	4.522E+02	2.245E+03	3.365E+06	2.261E+02
2016	8.954E+03	7.170E+06	4.818E+02	2.392E+03	3.585E+06	2.409E+02
2017	9.140E+03	7.319E+06	4.917E+02	2.441E+03	3.659E+06	2.459E+02
2018	9.321E+03	7.464E+06	5.015E+02	2.490E+03	3.732E+06	2.508E+02
2019	9.499E+03	7.607E+06	5.111E+02	2.537E+03	3.803E+06	2.555E+02
2020	9.674E+03	7.747E+06	5.205E+02	2.584E+03	3.873E+06	2.602E+02
2021	9.845E+03	7.884E+06	5.297E+02	2.630E+03	3.942E+06	2.649E+02
2022	1.001E+04	8.018E+06	5.387E+02	2.675E+03	4.009E+06	2.694E+02
2023	1.018E+04	8.150E+06	5.476E+02	2.719E+03	4.075E+06	2.738E+02
2024	1.034E+04	8.279E+06	5.562E+02	2.762E+03	4.139E+06	2.781E+02
2025	1.050E+04	8.405E+06	5.648E+02	2.804E+03	4.203E+06	2.824E+02
2026	1.065E+04	8.529E+06	5.731E+02	2.845E+03	4.265E+06	2.865E+02
2027	1.080E+04	8.651E+06	5.813E+02	2.886E+03	4.325E+06	2.906E+02
2028	1.095E+04	8.770E+06	5.893E+02	2.925E+03	4.385E+06	2.946E+02
2029	1.110E+04	8.887E+06	5.971E+02	2.964E+03	4.443E+06	2.986E+02
2030	1.124E+04	9.001E+06	6.048E+02	3.003E+03	4.501E+06	3.024E+02
2031	1.138E+04	9.114E+06	6.123E+02	3.040E+03	4.557E+06	3.062E+02
2032	1.152E+04	9.224E+06	6.197E+02	3.077E+03	4.612E+06	3.099E+02
2033	1.165E+04	9.331E+06	6.270E+02	3.113E+03	4.666E+06	3.135E+02
2034	1.179E+04	9.437E+06	6.341E+02	3.148E+03	4.719E+06	3.170E+02
2035	1.191E+04	9.541E+06	6.410E+02	3.183E+03	4.770E+06	3.205E+02
2036	1.204E+04	9.642E+06	6.479E+02	3.216E+03	4.821E+06	3.239E+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)
2037	1.217E+04	9.742E+06	6.545E+02	3.250E+03	4.871E+06	3.273E+02
2038	1.229E+04	9.839E+06	6.611E+02	3.282E+03	4.920E+06	3.306E+02
2039	1.241E+04	9.935E+06	6.675E+02	3.314E+03	4.967E+06	3.338E+02
2040	1.252E+04	1.003E+07	6.738E+02	3.345E+03	5.014E+06	3.369E+02
2041	1.264E+04	1.012E+07	6.800E+02	3.376E+03	5.060E+06	3.400E+02
2042	1.275E+04	1.021E+07	6.860E+02	3.406E+03	5.105E+06	3.430E+02
2043	1.286E+04	1.030E+07	6.920E+02	3.435E+03	5.149E+06	3.460E+02
2044	1.297E+04	1.039E+07	6.978E+02	3.464E+03	5.193E+06	3.489E+02
2045	1.308E+04	1.047E+07	7.035E+02	3.493E+03	5.235E+06	3.517E+02
2046	1.318E+04	1.055E+07	7.091E+02	3.520E+03	5.277E+06	3.545E+02
2047	1.328E+04	1.063E+07	7.146E+02	3.548E+03	5.317E+06	3.573E+02
2048	1.338E+04	1.071E+07	7.199E+02	3.574E+03	5.357E+06	3.600E+02
2049	1.348E+04	1.079E+07	7.252E+02	3.600E+03	5.396E+06	3.626E+02
2050	1.357E+04	1.087E+07	7.303E+02	3.626E+03	5.435E+06	3.652E+02
2051	1.367E+04	1.094E+07	7.354E+02	3.651E+03	5.472E+06	3.677E+02
2052	1.376E+04	1.102E+07	7.403E+02	3.676E+03	5.509E+06	3.702E+02
2053	1.385E+04	1.109E+07	7.452E+02	3.700E+03	5.545E+06	3.726E+02
2054	1.394E+04	1.116E+07	7.500E+02	3.723E+03	5.581E+06	3.750E+02
2055	1.403E+04	1.123E+07	7.546E+02	3.746E+03	5.616E+06	3.773E+02
2056	1.411E+04	1.130E+07	7.592E+02	3.769E+03	5.650E+06	3.796E+02
2057	1.419E+04	1.137E+07	7.637E+02	3.791E+03	5.683E+06	3.818E+02
2058	1.428E+04	1.143E+07	7.681E+02	3.813E+03	5.716E+06	3.840E+02
2059	1.436E+04	1.150E+07	7.724E+02	3.835E+03	5.748E+06	3.862E+02
2060	1.443E+04	1.156E+07	7.766E+02	3.856E+03	5.779E+06	3.883E+02
2061	1.451E+04	1.162E+07	7.807E+02	3.876E+03	5.810E+06	3.904E+02
2062	1.459E+04	1.168E+07	7.848E+02	3.896E+03	5.840E+06	3.924E+02
2063	1.466E+04	1.174E+07	7.888E+02	3.916E+03	5.870E+06	3.944E+02
2064	1.473E+04	1.180E+07	7.927E+02	3.935E+03	5.899E+06	3.963E+02
2065	1.480E+04	1.185E+07	7.965E+02	3.954E+03	5.927E+06	3.982E+02
2066	1.487E+04	1.191E+07	8.002E+02	3.973E+03	5.955E+06	4.001E+02
2067	1.494E+04	1.196E+07	8.039E+02	3.991E+03	5.982E+06	4.020E+02
2068	1.465E+04	1.173E+07	7.880E+02	3.912E+03	5.864E+06	3.940E+02
2069	1.436E+04	1.150E+07	7.724E+02	3.835E+03	5.748E+06	3.862E+02
2070	1.407E+04	1.127E+07	7.571E+02	3.759E+03	5.634E+06	3.785E+02
2071	1.379E+04	1.104E+07	7.421E+02	3.684E+03	5.522E+06	3.710E+02
2072	1.352E+04	1.083E+07	7.274E+02	3.611E+03	5.413E+06	3.637E+02
2073	1.325E+04	1.061E+07	7.130E+02	3.540E+03	5.306E+06	3.565E+02
2074	1.299E+04	1.040E+07	6.989E+02	3.470E+03	5.201E+06	3.494E+02
2075	1.273E+04	1.020E+07	6.850E+02	3.401E+03	5.098E+06	3.425E+02
2076	1.248E+04	9.994E+06	6.715E+02	3.334E+03	4.997E+06	3.357E+02
2077	1.223E+04	9.796E+06	6.582E+02	3.268E+03	4.898E+06	3.291E+02
2078	1.199E+04	9.602E+06	6.452E+02	3.203E+03	4.801E+06	3.226E+02
2079	1.175E+04	9.412E+06	6.324E+02	3.140E+03	4.706E+06	3.162E+02
2080	1.152E+04	9.225E+06	6.199E+02	3.077E+03	4.613E+06	3.099E+02
2081	1.129E+04	9.043E+06	6.076E+02	3.016E+03	4.521E+06	3.038E+02
2082	1.107E+04	8.864E+06	5.955E+02	2.957E+03	4.432E+06	2.978E+02
2083	1.085E+04	8.688E+06	5.838E+02	2.898E+03	4.344E+06	2.919E+02
2084	1.064E+04	8.516E+06	5.722E+02	2.841E+03	4.258E+06	2.861E+02
2085	1.042E+04	8.347E+06	5.609E+02	2.785E+03	4.174E+06	2.804E+02
2086	1.022E+04	8.182E+06	5.498E+02	2.729E+03	4.091E+06	2.749E+02
2087	1.002E+04	8.020E+06	5.389E+02	2.675E+03	4.010E+06	2.694E+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)
2088	9.817E+03	7.861E+06	5.282E+02	2.622E+03	3.931E+06	2.641E+02
2089	9.623E+03	7.706E+06	5.177E+02	2.570E+03	3.853E+06	2.589E+02
2090	9.433E+03	7.553E+06	5.075E+02	2.520E+03	3.777E+06	2.537E+02
2091	9.246E+03	7.404E+06	4.974E+02	2.470E+03	3.702E+06	2.487E+02
2092	9.063E+03	7.257E+06	4.876E+02	2.421E+03	3.628E+06	2.438E+02
2093	8.883E+03	7.113E+06	4.779E+02	2.373E+03	3.557E+06	2.390E+02
2094	8.707E+03	6.972E+06	4.685E+02	2.326E+03	3.486E+06	2.342E+02
2095	8.535E+03	6.834E+06	4.592E+02	2.280E+03	3.417E+06	2.296E+02
2096	8.366E+03	6.699E+06	4.501E+02	2.235E+03	3.350E+06	2.251E+02
2097	8.200E+03	6.566E+06	4.412E+02	2.190E+03	3.283E+06	2.206E+02
2098	8.038E+03	6.436E+06	4.325E+02	2.147E+03	3.218E+06	2.162E+02
2099	7.879E+03	6.309E+06	4.239E+02	2.104E+03	3.154E+06	2.119E+02
2100	7.723E+03	6.184E+06	4.155E+02	2.063E+03	3.092E+06	2.078E+02
2101	7.570E+03	6.062E+06	4.073E+02	2.022E+03	3.031E+06	2.036E+02
2102	7.420E+03	5.941E+06	3.992E+02	1.982E+03	2.971E+06	1.996E+02
2103	7.273E+03	5.824E+06	3.913E+02	1.943E+03	2.912E+06	1.957E+02
2104	7.129E+03	5.709E+06	3.836E+02	1.904E+03	2.854E+06	1.918E+02
2105	6.988E+03	5.595E+06	3.760E+02	1.867E+03	2.798E+06	1.880E+02
2106	6.849E+03	5.485E+06	3.685E+02	1.830E+03	2.742E+06	1.843E+02
2107	6.714E+03	5.376E+06	3.612E+02	1.793E+03	2.688E+06	1.806E+02
2108	6.581E+03	5.270E+06	3.541E+02	1.758E+03	2.635E+06	1.770E+02
2109	6.451E+03	5.165E+06	3.471E+02	1.723E+03	2.583E+06	1.735E+02
2110	6.323E+03	5.063E+06	3.402E+02	1.689E+03	2.532E+06	1.701E+02
2111	6.198E+03	4.963E+06	3.334E+02	1.655E+03	2.481E+06	1.667E+02
2112	6.075E+03	4.864E+06	3.268E+02	1.623E+03	2.432E+06	1.634E+02
2113	5.955E+03	4.768E+06	3.204E+02	1.591E+03	2.384E+06	1.602E+02
2114	5.837E+03	4.674E+06	3.140E+02	1.559E+03	2.337E+06	1.570E+02
2115	5.721E+03	4.581E+06	3.078E+02	1.528E+03	2.291E+06	1.539E+02
2116	5.608E+03	4.490E+06	3.017E+02	1.498E+03	2.245E+06	1.509E+02
2117	5.497E+03	4.402E+06	2.957E+02	1.468E+03	2.201E+06	1.479E+02
2118	5.388E+03	4.314E+06	2.899E+02	1.439E+03	2.157E+06	1.449E+02
2119	5.281E+03	4.229E+06	2.841E+02	1.411E+03	2.114E+06	1.421E+02
2120	5.177E+03	4.145E+06	2.785E+02	1.383E+03	2.073E+06	1.393E+02
2121	5.074E+03	4.063E+06	2.730E+02	1.355E+03	2.032E+06	1.365E+02
2122	4.974E+03	3.983E+06	2.676E+02	1.329E+03	1.991E+06	1.338E+02
2123	4.875E+03	3.904E+06	2.623E+02	1.302E+03	1.952E+06	1.311E+02
2124	4.779E+03	3.827E+06	2.571E+02	1.276E+03	1.913E+06	1.286E+02
2125	4.684E+03	3.751E+06	2.520E+02	1.251E+03	1.875E+06	1.260E+02
2126	4.591E+03	3.676E+06	2.470E+02	1.226E+03	1.838E+06	1.235E+02
2127	4.500E+03	3.604E+06	2.421E+02	1.202E+03	1.802E+06	1.211E+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)*
1987	0	0	0	0	0	0
1988	2.523E+02	1.378E+05	9.262E+00	2.935E-01	8.188E+01	5.502E-03
1989	4.997E+02	2.730E+05	1.834E+01	5.812E-01	1.621E+02	1.089E-02
1990	7.421E+02	4.054E+05	2.724E+01	8.632E-01	2.408E+02	1.618E-02
1991	9.797E+02	5.352E+05	3.596E+01	1.140E+00	3.179E+02	2.136E-02
1992	1.213E+03	6.625E+05	4.451E+01	1.411E+00	3.935E+02	2.644E-02
1993	1.441E+03	7.872E+05	5.289E+01	1.676E+00	4.676E+02	3.142E-02
1994	1.665E+03	9.095E+05	6.111E+01	1.936E+00	5.402E+02	3.630E-02
1995	1.884E+03	1.029E+06	6.916E+01	2.192E+00	6.114E+02	4.108E-02
1996	2.099E+03	1.147E+06	7.705E+01	2.442E+00	6.812E+02	4.577E-02
1997	2.310E+03	1.262E+06	8.479E+01	2.687E+00	7.496E+02	5.036E-02
1998	2.517E+03	1.375E+06	9.237E+01	2.927E+00	8.166E+02	5.487E-02
1999	2.719E+03	1.485E+06	9.980E+01	3.163E+00	8.823E+02	5.928E-02
2000	2.917E+03	1.594E+06	1.071E+02	3.394E+00	9.467E+02	6.361E-02
2001	3.097E+03	1.692E+06	1.137E+02	3.602E+00	1.005E+03	6.752E-02
2002	3.280E+03	1.792E+06	1.204E+02	3.815E+00	1.064E+03	7.151E-02
2003	3.465E+03	1.893E+06	1.272E+02	4.031E+00	1.125E+03	7.556E-02
2004	3.654E+03	1.996E+06	1.341E+02	4.251E+00	1.186E+03	7.968E-02
2005	3.846E+03	2.101E+06	1.412E+02	4.474E+00	1.248E+03	8.386E-02
2006	4.041E+03	2.208E+06	1.483E+02	4.701E+00	1.311E+03	8.811E-02
2007	4.239E+03	2.316E+06	1.556E+02	4.931E+00	1.376E+03	9.242E-02
2008	4.440E+03	2.425E+06	1.630E+02	5.164E+00	1.441E+03	9.680E-02
2009	4.643E+03	2.537E+06	1.704E+02	5.401E+00	1.507E+03	1.012E-01
2010	4.849E+03	2.649E+06	1.780E+02	5.641E+00	1.574E+03	1.057E-01
2011	5.058E+03	2.763E+06	1.857E+02	5.884E+00	1.641E+03	1.103E-01
2012	5.288E+03	2.889E+06	1.941E+02	6.151E+00	1.716E+03	1.153E-01
2013	5.552E+03	3.033E+06	2.038E+02	6.458E+00	1.802E+03	1.210E-01
2014	5.852E+03	3.197E+06	2.148E+02	6.806E+00	1.899E+03	1.276E-01
2015	6.159E+03	3.365E+06	2.261E+02	7.164E+00	1.999E+03	1.343E-01
2016	6.562E+03	3.585E+06	2.409E+02	7.633E+00	2.130E+03	1.431E-01
2017	6.698E+03	3.659E+06	2.459E+02	7.791E+00	2.174E+03	1.460E-01
2018	6.831E+03	3.732E+06	2.508E+02	7.946E+00	2.217E+03	1.489E-01
2019	6.962E+03	3.803E+06	2.555E+02	8.098E+00	2.259E+03	1.518E-01
2020	7.090E+03	3.873E+06	2.602E+02	8.247E+00	2.301E+03	1.546E-01
2021	7.215E+03	3.942E+06	2.649E+02	8.393E+00	2.341E+03	1.573E-01
2022	7.338E+03	4.009E+06	2.694E+02	8.536E+00	2.381E+03	1.600E-01
2023	7.459E+03	4.075E+06	2.738E+02	8.676E+00	2.420E+03	1.626E-01
2024	7.577E+03	4.139E+06	2.781E+02	8.813E+00	2.459E+03	1.652E-01
2025	7.693E+03	4.203E+06	2.824E+02	8.948E+00	2.496E+03	1.677E-01
2026	7.806E+03	4.265E+06	2.865E+02	9.080E+00	2.533E+03	1.702E-01
2027	7.918E+03	4.325E+06	2.906E+02	9.210E+00	2.569E+03	1.726E-01
2028	8.027E+03	4.385E+06	2.946E+02	9.336E+00	2.605E+03	1.750E-01
2029	8.134E+03	4.443E+06	2.986E+02	9.461E+00	2.639E+03	1.773E-01
2030	8.238E+03	4.501E+06	3.024E+02	9.583E+00	2.673E+03	1.796E-01
2031	8.341E+03	4.557E+06	3.062E+02	9.702E+00	2.707E+03	1.819E-01
2032	8.442E+03	4.612E+06	3.099E+02	9.819E+00	2.739E+03	1.841E-01
2033	8.541E+03	4.666E+06	3.135E+02	9.934E+00	2.771E+03	1.862E-01
2034	8.637E+03	4.719E+06	3.170E+02	1.005E+01	2.803E+03	1.883E-01
2035	8.732E+03	4.770E+06	3.205E+02	1.016E+01	2.834E+03	1.904E-01
2036	8.825E+03	4.821E+06	3.239E+02	1.026E+01	2.864E+03	1.924E-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)
2037	8.916E+03	4.871E+06	3.273E+02	1.037E+01	2.893E+03	1.944E-01
2038	9.005E+03	4.920E+06	3.306E+02	1.047E+01	2.922E+03	1.963E-01
2039	9.093E+03	4.967E+06	3.338E+02	1.058E+01	2.951E+03	1.983E-01
2040	9.179E+03	5.014E+06	3.369E+02	1.068E+01	2.979E+03	2.001E-01
2041	9.263E+03	5.060E+06	3.400E+02	1.077E+01	3.006E+03	2.020E-01
2042	9.345E+03	5.105E+06	3.430E+02	1.087E+01	3.033E+03	2.038E-01
2043	9.426E+03	5.149E+06	3.460E+02	1.096E+01	3.059E+03	2.055E-01
2044	9.505E+03	5.193E+06	3.489E+02	1.106E+01	3.084E+03	2.072E-01
2045	9.583E+03	5.235E+06	3.517E+02	1.115E+01	3.110E+03	2.089E-01
2046	9.659E+03	5.277E+06	3.545E+02	1.123E+01	3.134E+03	2.106E-01
2047	9.734E+03	5.317E+06	3.573E+02	1.132E+01	3.159E+03	2.122E-01
2048	9.807E+03	5.357E+06	3.600E+02	1.141E+01	3.182E+03	2.138E-01
2049	9.878E+03	5.396E+06	3.626E+02	1.149E+01	3.206E+03	2.154E-01
2050	9.949E+03	5.435E+06	3.652E+02	1.157E+01	3.228E+03	2.169E-01
2051	1.002E+04	5.472E+06	3.677E+02	1.165E+01	3.251E+03	2.184E-01
2052	1.008E+04	5.509E+06	3.702E+02	1.173E+01	3.273E+03	2.199E-01
2053	1.015E+04	5.545E+06	3.726E+02	1.181E+01	3.294E+03	2.213E-01
2054	1.022E+04	5.581E+06	3.750E+02	1.188E+01	3.315E+03	2.227E-01
2055	1.028E+04	5.616E+06	3.773E+02	1.196E+01	3.336E+03	2.241E-01
2056	1.034E+04	5.650E+06	3.796E+02	1.203E+01	3.356E+03	2.255E-01
2057	1.040E+04	5.683E+06	3.818E+02	1.210E+01	3.376E+03	2.268E-01
2058	1.046E+04	5.716E+06	3.840E+02	1.217E+01	3.395E+03	2.281E-01
2059	1.052E+04	5.748E+06	3.862E+02	1.224E+01	3.414E+03	2.294E-01
2060	1.058E+04	5.779E+06	3.883E+02	1.230E+01	3.433E+03	2.307E-01
2061	1.064E+04	5.810E+06	3.904E+02	1.237E+01	3.451E+03	2.319E-01
2062	1.069E+04	5.840E+06	3.924E+02	1.243E+01	3.469E+03	2.331E-01
2063	1.074E+04	5.870E+06	3.944E+02	1.250E+01	3.487E+03	2.343E-01
2064	1.080E+04	5.899E+06	3.963E+02	1.256E+01	3.504E+03	2.354E-01
2065	1.085E+04	5.927E+06	3.982E+02	1.262E+01	3.521E+03	2.366E-01
2066	1.090E+04	5.955E+06	4.001E+02	1.268E+01	3.537E+03	2.377E-01
2067	1.095E+04	5.982E+06	4.020E+02	1.274E+01	3.554E+03	2.388E-01
2068	1.073E+04	5.864E+06	3.940E+02	1.249E+01	3.483E+03	2.340E-01
2069	1.052E+04	5.748E+06	3.862E+02	1.224E+01	3.414E+03	2.294E-01
2070	1.031E+04	5.634E+06	3.785E+02	1.200E+01	3.347E+03	2.249E-01
2071	1.011E+04	5.522E+06	3.710E+02	1.176E+01	3.280E+03	2.204E-01
2072	9.909E+03	5.413E+06	3.637E+02	1.153E+01	3.215E+03	2.160E-01
2073	9.712E+03	5.306E+06	3.565E+02	1.130E+01	3.152E+03	2.118E-01
2074	9.520E+03	5.201E+06	3.494E+02	1.107E+01	3.089E+03	2.076E-01
2075	9.332E+03	5.098E+06	3.425E+02	1.085E+01	3.028E+03	2.035E-01
2076	9.147E+03	4.997E+06	3.357E+02	1.064E+01	2.968E+03	1.994E-01
2077	8.966E+03	4.898E+06	3.291E+02	1.043E+01	2.909E+03	1.955E-01
2078	8.788E+03	4.801E+06	3.226E+02	1.022E+01	2.852E+03	1.916E-01
2079	8.614E+03	4.706E+06	3.162E+02	1.002E+01	2.795E+03	1.878E-01
2080	8.444E+03	4.613E+06	3.099E+02	9.821E+00	2.740E+03	1.841E-01
2081	8.276E+03	4.521E+06	3.038E+02	9.627E+00	2.686E+03	1.805E-01
2082	8.112E+03	4.432E+06	2.978E+02	9.436E+00	2.633E+03	1.769E-01
2083	7.952E+03	4.344E+06	2.919E+02	9.249E+00	2.580E+03	1.734E-01
2084	7.794E+03	4.258E+06	2.861E+02	9.066E+00	2.529E+03	1.699E-01
2085	7.640E+03	4.174E+06	2.804E+02	8.887E+00	2.479E+03	1.666E-01
2086	7.489E+03	4.091E+06	2.749E+02	8.711E+00	2.430E+03	1.633E-01
2087	7.340E+03	4.010E+06	2.694E+02	8.538E+00	2.382E+03	1.600E-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)
2088	7.195E+03	3.931E+06	2.641E+02	8.369E+00	2.335E+03	1.569E-01
2089	7.053E+03	3.853E+06	2.589E+02	8.203E+00	2.289E+03	1.538E-01
2090	6.913E+03	3.777E+06	2.537E+02	8.041E+00	2.243E+03	1.507E-01
2091	6.776E+03	3.702E+06	2.487E+02	7.882E+00	2.199E+03	1.477E-01
2092	6.642E+03	3.628E+06	2.438E+02	7.726E+00	2.155E+03	1.448E-01
2093	6.510E+03	3.557E+06	2.390E+02	7.573E+00	2.113E+03	1.419E-01
2094	6.381E+03	3.486E+06	2.342E+02	7.423E+00	2.071E+03	1.391E-01
2095	6.255E+03	3.417E+06	2.296E+02	7.276E+00	2.030E+03	1.364E-01
2096	6.131E+03	3.350E+06	2.251E+02	7.132E+00	1.990E+03	1.337E-01
2097	6.010E+03	3.283E+06	2.206E+02	6.990E+00	1.950E+03	1.310E-01
2098	5.891E+03	3.218E+06	2.162E+02	6.852E+00	1.912E+03	1.284E-01
2099	5.774E+03	3.154E+06	2.119E+02	6.716E+00	1.874E+03	1.259E-01
2100	5.660E+03	3.092E+06	2.078E+02	6.583E+00	1.837E+03	1.234E-01
2101	5.548E+03	3.031E+06	2.036E+02	6.453E+00	1.800E+03	1.210E-01
2102	5.438E+03	2.971E+06	1.996E+02	6.325E+00	1.765E+03	1.186E-01
2103	5.330E+03	2.912E+06	1.957E+02	6.200E+00	1.730E+03	1.162E-01
2104	5.225E+03	2.854E+06	1.918E+02	6.077E+00	1.695E+03	1.139E-01
2105	5.121E+03	2.798E+06	1.880E+02	5.957E+00	1.662E+03	1.117E-01
2106	5.020E+03	2.742E+06	1.843E+02	5.839E+00	1.629E+03	1.094E-01
2107	4.920E+03	2.688E+06	1.806E+02	5.723E+00	1.597E+03	1.073E-01
2108	4.823E+03	2.635E+06	1.770E+02	5.610E+00	1.565E+03	1.052E-01
2109	4.728E+03	2.583E+06	1.735E+02	5.499E+00	1.534E+03	1.031E-01
2110	4.634E+03	2.532E+06	1.701E+02	5.390E+00	1.504E+03	1.010E-01
2111	4.542E+03	2.481E+06	1.667E+02	5.283E+00	1.474E+03	9.903E-02
2112	4.452E+03	2.432E+06	1.634E+02	5.179E+00	1.445E+03	9.707E-02
2113	4.364E+03	2.384E+06	1.602E+02	5.076E+00	1.416E+03	9.515E-02
2114	4.278E+03	2.337E+06	1.570E+02	4.976E+00	1.388E+03	9.327E-02
2115	4.193E+03	2.291E+06	1.539E+02	4.877E+00	1.361E+03	9.142E-02
2116	4.110E+03	2.245E+06	1.509E+02	4.781E+00	1.334E+03	8.961E-02
2117	4.029E+03	2.201E+06	1.479E+02	4.686E+00	1.307E+03	8.783E-02
2118	3.949E+03	2.157E+06	1.449E+02	4.593E+00	1.281E+03	8.610E-02
2119	3.871E+03	2.114E+06	1.421E+02	4.502E+00	1.256E+03	8.439E-02
2120	3.794E+03	2.073E+06	1.393E+02	4.413E+00	1.231E+03	8.272E-02
2121	3.719E+03	2.032E+06	1.365E+02	4.326E+00	1.207E+03	8.108E-02
2122	3.645E+03	1.991E+06	1.338E+02	4.240E+00	1.183E+03	7.948E-02
2123	3.573E+03	1.952E+06	1.311E+02	4.156E+00	1.159E+03	7.790E-02
2124	3.502E+03	1.913E+06	1.286E+02	4.074E+00	1.136E+03	7.636E-02
2125	3.433E+03	1.875E+06	1.260E+02	3.993E+00	1.114E+03	7.485E-02
2126	3.365E+03	1.838E+06	1.235E+02	3.914E+00	1.092E+03	7.337E-02
2127	3.298E+03	1.802E+06	1.211E+02	3.836E+00	1.070E+03	7.191E-02