Hyland Facility Associates

***6653 Herdman Road***
***Angelica, New York 14709***

***Phone: (585) 466-7271***
***Fax: (585) 466-3206***

February 22, 2011

Ms. Mary E. Hohmann
Division of Environmental Permits
NYSDEC – Region 9
182 E. Union, Suite 3
Allegany, New York 14706-1328

RE: Title V Permit Modification – Hyland Facility Associates
Permit ID: 9-0232-00003/00012

Dear Ms. Hohmann:

Hyland Facility Associates (Hyland) is submitting the enclosed three copies of a Title V permit modification application, prepared by McMahon & Mann Consulting Engineers, P.C., requesting approval to increase the annual solid waste disposal tonnage at the Hyland Landfill from 312,000 tons per year to 465,000 tons per year (i.e., approximately 49 percent increase). The design capacity of the Hyland Landfill will remain the same at 14,169,300 cubic yards.

Hyland is not requesting a change in the amount of beneficial use determination (BUD) material accepted at the landfill. BUD material will remain the same at:

- BUD for alternate daily cover (ADC) not to exceed 20 percent of the annual incoming solid waste tonnage, and
- BUD for roadways on the landfill not to exceed 10 percent of the annual incoming solid waste tonnage.

If there is any further information that you require or if you have any questions, please contact me at (585) 466-7271.

Sincerely,

HYLAND FACILITY ASSOCIATES

Joseph R. Boyles
General Manager

McMahon & Mann
Consulting Engineers, P.C.

2495 Main Street, Suite 432, Buffalo, NY 14214

*Donald R. McMahon, P.E.*
*Michael J. Mann, P.E.*
*Kenneth L. Fishman, PhD., P.E.*
*John A. Minichiello, CPESC, CPSWQ*
*James Bojarski, P.E.*
*Shawn W. Logan, P.E.*
*Andrew J. Nichols, P.E.*
*Todd Swackhamer, P.E.*

February 22, 2011
File: 93-002

Mr. Joseph Boyles
Hyland Facility Associates
6653 Herdman Road
Angelica, New York 14709

RE: Hyland Facility Associates,
Title V Permit Modification Application
49 Percent Tonnage Increase

Dear Mr. Boyles;

McMahon & Mann Consulting Engineers, P.C. has prepared the attached Title V permit modification application requesting approval from the New York State Department of Environmental Conservation to allow a 49 percent increase in the annual waste tonnage for the Hyland Landfill. The LandGEM model shows that the annual waste tonnage increase will result in an increase in landfill gas generation. However, emissions estimates based on the increase in landfill gas generation show the Hyland Landfill will continue to be a minor facility for air emissions. Therefore, the annual tonnage increase request will result in a minor modification to the Title V permit.

Please contact our office (716-834-8932) should you have any questions regarding this submittal.

Sincerely yours,

**McMAHON & MANN CONSULTING ENGINEERS, P.C.**

John A. Minichiello, CPESC, CPSWQ

Michael J. Mann, P.E.

Enclosure

**HYLAND FACILITY ASSOCIATES**

**TITLE V PERMIT MODIFICATION APPLICATION**
**PROPOSED 49 PERCENT ANNUAL ACCEPTANCE RATE INCREASE**

Prepared for:

**Hyland Facility Associates**
6653 Herdman Road
Angelica, New York 14709

Prepared by:

**McMahon & Mann Consulting Engineers, P.C.**
2495 Main Street, Suite 432
Buffalo, New York 14214


**Michael J. Mann, P.E.**
**NYS PE License No. 59917**

**FEBRUARY 2011**

## Table of Contents



**APPENDICES**

## 1.0 INTRODUCTION

Hyland Facility Associates (Hyland) owns and operates the Hyland Landfill in Angelica, New York. Hyland is requesting authorization to increase the incoming solid waste tonnage from 312,000 tons per year (t/yr) to 465,000 t/yr (i.e., 49 percent increase). Currently Hyland is allowed to receive beneficial use determination (BUD) materials in addition to the annual solid waste tonnage, at the following rates:

- BUD for alternate daily cover (ADC) not to exceed 20 percent of the annual incoming solid waste tonnage, and
- BUD for roadways on the landfill not to exceed 10 percent of the annual incoming solid waste tonnage.

The facility, operating under Title V Permit ID # 9-0232-00003, is currently a minor source under the NYSDEC Prevention of Significant Deterioration (PSD) regulations and will continue to be a minor source, because its potential emissions (PTE) with the 49 percent tonnage increase are less than the major threshold status levels, as shown in the summary table in Section 4.0. Further, the facility is subject to the New Source Performance Standards (NSPS) 40 CFR 60 Subpart WWW because the facility design capacity of 8,682,194 megagrams (Mg) of solid waste is greater than the NSPS threshold of 2.5 million Mg.

Hyland currently operates an active landfill gas (LFG) collection and control system in accordance with the Title V permit. Collected LFG can be directed to a 3-engine landfill gas to energy (LFGTE) plant or a 3,000 cubic feet per minute ($ft^3/min$) open flare.

Because the requested 49 percent annual tonnage increase exceeds the 374,400 t/yr (i.e., 312,000 t/yr of solid waste plus 62,400 t/yr BUD-ADC) under the Title V permit, a modification to the Title V permit is required. The permit modification requires estimating the PTE from the landfill, the LFGTE plant and the open flare resulting from the increased annual tonnage. A copy of the Title V permit modification application is included in Appendix A.

## 2.0 LANDGEM MODEL

PTE estimates for emissions from the LFGTE plant and the open flare require estimating the amount of LFG generated in the peak year of landfill operation (i.e., 2025) using the USEPA LandGEM v3.02 (LandGEM) model (see Appendix B). The LandGEM model requires the input of annual solid waste tonnage from the year the landfill opens until the year it closes. In order to calculate a closure year, the LandGEM model also requires the input of the maximum amount of solid waste that will be disposed in the landfill. Based on condition 25.2.6 of the Title V permit, Sanborn Head used a design capacity of 8,682,194 Mg in the November 3, 2003 State Facility Application for the Hyland Landfill expansion project.

For this Title V permit modification, the 8,682,194 Mg was converted to t/yr using the conversion factor 1.102 t/Mg. This conversion results in a design capacity of 9,567,778 tons, which was input into LandGEM[1].

Hyland provided the tons of solid waste disposed in the landfill from 1998 through 2010. The number of tons of various waste types disposed at Hyland are summarized in Table 3 in Appendix C. The NYSDEC agreed to allow the removal of BUD and drill cutting material that was less likely to produce landfill gas.

To model the landfill gas generation rate for the 49 percent increase, we used the actual tons of solid waste disposed through 2010. Non-C&D BUD and drill cuttings were not included. Future tonnage in LandGEM was assumed to be all municipal solid waste (MSW) at 465,000 t/yr without BUD or drill cuttings up to the design capacity of 9,567,778 tons. At the peak year of LFG generation (i.e., 2025), it is estimated that 3,511 $ft^3$/min of LFG will be generated. Assuming 75% collection efficiency of the gas collection system, 2,633 $ft^3$/min of LFG will be collected. This gas will be directed to the LFGTE plant first (three engines at 531 cfm each, equivalent to 1,593 $ft^3$/min capacity), and the remaining 1040 $ft^3$/min of LFG will be combusted by the 3,000 $ft^3$/min open flare.

## 3.0 FACILITY EMISSIONS

The combustion of collected LFG results in emissions of carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide ($SO_2$), particulate matter (PM), and non-methane organic compounds (NMOCs), which include some volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). There is the potential for fugitive LFG emissions from the landfill surface. Fugitive LFG emissions include NMOCs, VOCs and HAPs. In addition, there is the potential for fugitive PM emissions from vehicles traveling along paved and unpaved roads at the Hyland Landfill facility.

Table 1 provides future potential emissions from the landfill, with the LFG being combusted by the internal combustion engines and the flare. Future potential emissions are calculated for the facility based on a 24-hour per day, 365-day per year operating schedule. A description of the emission sources at the facility is presented below.

### 3.1 Landfill Gas to Energy Plant

Emissions for the LFG generator set engines were estimated based on emission factors of 0.6 grams per brake horsepower-hour (g/bhp-hr) for NOx and 3.0 g/bhp-hr for $SO_2$ in condition 30 of the Title V permit and AP-42 emission data for internal combustion engines. Future potential emissions of CO, NOx, PM, and NMOC were calculated for the proposed three engines running 24 hours a day, 365 days per year and are presented in Table 4 of Appendix C. The HAPs and $SO_2$ emissions are also presented in Table 4.

### 3.2 3,000 cfm Open Flare

Emissions for the open flare were calculated based on manufacturer emission data. Future potential combustion emissions CO, NOx, PM, and NMOC were estimated for the

[1] LandGEM estimated 8,697,980 Mg instead of 8,682,194 Mg when using the 9,567,778 tons. This was likely due to the fact that LandGEM uses 0.909 Mg/t, which is slightly greater than 0.907 Mg/t (1 Mg/1.102 t) used by MMCE to convert the 8,682,194 Mg to 9,567,778 tons.

flare and are presented in Table 4 of Appendix C. The emissions were estimated for the peak amount of excess LFG that will be combusted by the flare (1040 $ft^3$/min), assuming that the flare is running 24 hours a day, 365 days per year. The HAPs and $SO_2$ emission estimates resulting from combustion of the LFG are presented in Table 4.

### 3.3 Fugitive Landfill Emissions

Fugitive landfill emissions were estimated assuming 75% collection efficiency of the LFG collection system, resulting in a potential 25% of the LFG generated within the landfill to be emitted as fugitive emissions from the landfill surface. Fugitive emissions consist of NMOC, which include some VOCs, some of which are considered HAPs. These emissions are presented in Tables 5, 6 and 7 of Appendix C.

## 4.0 EMISSION SUMMARY

Estimated emissions are presented in Tables 4, 5, 6, 7 and 8 of Appendix C. The following is a summary of potential emissions for the entire facility.

**PTE Summary Table[1]**

| Parameter | LFGTE[2] (t/yr) | LNDFL-FLR[2] (t/yr) | LNDFL-FUG (t/yr) | Total PTE (t/yr) | Major Source Status Threshold (TPY) | Major Source Status |
|---|---|---|---|---|---|---|
| $NO_X$ | 38.8 | 8.5 | | 47.3 | 100 | Minor |
| CO | 194.1 | 46.1 | | 240.2 | 250 | Minor |
| $SO_2$ | 19.52 | 12.73 | | 32.25 | 250 | Minor |
| $H_2S$ | 0.20 | 0.13 | 5.61 | 5.94 | NA | |
| VOC | 0.15 | 0.1 | 9.15 | 9.4 | 50 | Minor |
| NMOC | 0.39 | 0.25 | 10.69 | 11.33 | NA | |
| PM | 10.1 | 2.3 | 84 | 96.4 | 250 | Minor |
| HAPs | | | 6.2 | 6.2 | 10 tpy for single HAP or 25 tpy in aggregate | Minor |

1. Emission estimates for the emission from the landfill gas to energy plant (1LFTGE), landfill fugitive emissions (1LNDFL-FUG) and the 3,000 $ft^3$/min open flare 1LNDFL-FLR are presented in Appendix C.
2. VOCs are approximately 39 percent of the NMOCs per AP-42 Section 2.4.

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# APPENDIX A
# Title V Permit Modification Application

# New York State Department of Environmental Conservation
# Air Permit Application

| DEC ID |
|---|
| 9 - 0 2 3 2 - 0 0 0 0 3 |

| APPLICATION ID | OFFICE USE ONLY |
|---|---|
| - - / | // |

## Section I - Certification

**Title V Certification**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information [required pursuant to 6 NYCRR 201-6.3(d)] I believe the information is, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

| | |
|---|---|
| Responsible Official: Larry Shilling | Title: Regional Vice President |
| Signature | Date |

**State Facility Certification**

I certify that this facility will be operated in conformance with all provisions of existing regulations.

| | |
|---|---|
| Responsible Official | Title |
| Signature | Date / / |

## Section II - Identification Information

**Title V Facility Permit**
❑ New ❑ Significant Modification ❑ Administrative Amendment
❑ Renewal ☒ Minor Modification General Permit Title:

**State Facility Permit**
❑ New ❑ Modification
General Permit Title:

❑ Application involves construction of new facility ❑ Application involves construction of new emission unit(s)

**Owner/Firm**

| | |
|---|---|
| Name | Hyland Facility Associates |
| Street Address | 25 Green Hills Lane |
| City | Rutland |
| State | Vermont |
| Country | USA |
| Zip | 05702 |

Owner Classification: ❑ Federal ❑ State ❑ Municipal ☒ Corporation/Partnership ❑ Individual

Taxpayer ID:

**Facility** ❑ Confidential

| | |
|---|---|
| Name | Hyland Landfill |
| Location Address | 6653 Herdman Road |
| ❑ City / ☒ Town / ❑ Village | Angelica, New York |
| Zip | 14709 |

**Project Description** ☒ Continuation Sheet(s)

Hyland Facility Associates is requesting a 49 percent increase in the annual MSW acceptance rate at the Hyland Landfill from the currently approved disposal rate of 312,000 tons per year to 465,000 tons per year.

**Owner/Firm Contact Mailing Address**

| | |
|---|---|
| Name (Last, First, Middle Initial) | Shilling, Larry |
| Phone No. | (585) 466-7271 |
| Affiliation | Hyland Facility Associates – Hyland Landfill |
| Title | Regional Vice President |
| Fax No. | |
| Street Address | 6653 Herdman Road |
| City | Angelica |
| State | NY |
| Country | USA |
| Zip | 14709 |

**Facility Contact Mailing Address**

| | |
|---|---|
| Name (Last, First, Middle Initial) | Boyles, Joseph, R. |
| Phone No. | (585) 466-7271 |
| Affiliation | Hyland Facility Associates – Hyland Landfill |
| Title | General Manager |
| Fax No. | |
| Street Address | 6653 Herdman Road |
| City | Angelica |
| State | NY |
| Country | USA |
| Zip | 14709 |

# New York State Department of Environmental Conservation
# Air Permit Application

| DEC ID | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
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## Section III - Facility Information

**Classification**

☐ Hospital ☐ Residential ☐ Educational/Institutional ☐ Commercial ☒ Industrial ☐ Utility

**Affected States (Title V Only)**

☐ Vermont ☐ Massachusetts ☐ Rhode Island ☐ Pennsylvania Tribal Land:
☐ New Hampshire ☐ Connecticut ☐ New Jersey ☐ Ohio Tribal Land:

**SIC Codes**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4953 | 3519 | 4911 | | | | | | | | | | |

**Facility Description** ☐ Continuation Sheet(s)

Landfill gas is collected and combusted in a 3,000 CFM open flare and 3 Caterpillar G3520 internal combustion engines. Landfill gas that escapes the collection system is accounted for in fugitive emissions.

**Compliance Statements (Title V Only)**

I certify that as of the date of this application the facility is in compliance with all applicable requirements: ☒ YES ☐ NO

If one or more emission units at the facility are not in compliance with all applicable requirements at the time of signing this application (the 'NO' box must be checked), the noncomplying units must be identified in the "Compliance Plan" block on page 8 of this form along with the compliance plan information required. For all emission units at this facility that are operating in compliance with all applicable requirements complete the following:

- ☐ This facility will continue to be operated and maintained in such a manner as to assure compliance for the duration of the permit, except those units referenced in the compliance plan portion of Section IV of this application.
- ☐ For all emission units, subject to any applicable requirements that will become effective during the term of the permit, this facility will meet all such requirements on a timely basis.
- ☒ Compliance certification reports will be submitted at least once a year. Each report will certify compliance status with respect to each requirement, and the method used to determine the status.

**Facility Applicable Federal Requirements** ☐ Continuation Sheet(s)

| Title | Type | Part | Sub Part | Section | Sub Division | Paragraph | Sub Paragraph | Clause | Sub Clause |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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**Facility State Only Requirements** ☐ Continuation Sheet(s)

| Title | Type | Part | Sub Part | Section | Sub Division | Paragraph | Sub Paragraph | Clause | Sub Clause |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

# New York State Department of Environmental Conservation
# Air Permit Application

| DEC ID | | | | | | | | | | | |
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## Section III - Facility Information (continued)

Facility Compliance Certification ☐ Continuation Sheet(s)

Rule Citation

| Title | Type | Part | Sub Part | Section | Sub Division | Paragraph | Sub Paragraph | Clause | Sub Clause |
|---|---|---|---|---|---|---|---|---|---|
| 40 | CFR | 60 | WWW | 754 | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| ☒ Applicable Federal Requirement<br>☐ State Only Requirement | ☐ Capping | CAS No. | Contaminant Name |
|---|---|---|---|
| | | 0NY988- 20 - 0 | NMOC – Landfill Use only |

Monitoring Information

☐ Ambient Air Monitoring ☐ Work Practice Involving Specific Operations ☒ Record Keeping/Maintenance Procedures

Description

Hyland Facility Associates is proposing to increase the annual solid waste acceptance rate at the Hyland Landfill from 312,000 tons to 465,000. In addition the Hyland Landfill is also allowed under its Part 360 permit to operate to accept two classes of beneficial use determination materials (BUD); BUD for alternate daily cover at the rate of no more than 20 percent of the annual MSW tonnage accepted and BUD for roadway construction at the rate of no more than 10 percent of the annual MSW tonnage accepted. Total MSW and BUD will not exceed 604,500 tons/year.

| Work Practice Type | Process Material Code | Process Material Description | Reference Test Method |
|---|---|---|---|
| | | | |

| Parameter Code | Parameter Description | Manufacturer Name/Model No. |
|---|---|---|
| | | |

| Limit Upper | Limit Lower | Limit Units Code | Limit Units Description |
|---|---|---|---|
| | | | |

| Averaging Method Code | Averaging Method Description | Monitoring Frequency Code | Monitoring Frequency Description | Reporting Requirements Code | Reporting Requirements Description |
|---|---|---|---|---|---|
| | | 11 | Per Delivery | 14 | Semi-annual |

Facility Emissions Summary ☐ Continuation Sheet(s)

| CAS No. | Contaminant Name | PTE (lbs/yr) | PTE Range Code | Actual (lbs/yr) |
|---|---|---|---|---|
| NY075 - 00 - 5 | PM-10 | | F | |
| NY075 - 00 - 0 | PM-2.5 | | B | |
| 7446 - 09 - 5 | SULFUR DIOXIDE | | D | |
| NY210 - 00 - 0 | OXIDES OF NITROGEN | | E | |
| 630 - 08 - 0 | CARBON MONOXIDE | | G | |
| 0NY998 - 20 - 0 | NMOC-LANDFILL USE ONLY | | C | |
| NY998 - 00 - 0 | VOC | | B | |
| NY100 - 00 - 0 | HAP | | B | |
| 7783 - 06 - 4 | HYDROGEN SULFIDE | | B | |

# New York State Department of Environmental Conservation
# Air Permit Application

| DEC ID | | | | | | | | | | | |
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## Section IV - Emission Unit Information

### Emission Unit Description ❑ Continuation Sheet(s)

| EMISSION UNIT | |
|---|---|
| | |
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| | |

### Building ❑ Continuation Sheet(s)

| Building | Building Name | Length (ft) | Width (ft) | Orientation |
|---|---|---|---|---|
| | | | | |
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### Emission Point ❑ Continuation Sheet(s)

| EMISSION PT. | | | | | | |
|---|---|---|---|---|---|---|
| Ground Elev. (ft) | Height (ft) | Height Above Structure (ft) | Inside Diameter (in) | Exit Temp. (°F) | Cross Section Length (in) | Cross Section Width (in) |
| | | | | | | |
| Exit Velocity (FPS) | Exit Flow (ACFM) | NYTM (E) (KM) | NYTM (N) (KM) | Building | Distance to Property Line (ft) | Date of Removal |
| | | | | | | |
| EMISSION PT. | | | | | | |
| Ground Elev. (ft) | Height (ft) | Height Above Structure (ft) | Inside Diameter (in) | Exit Temp. (°F) | Cross Section Length (in) | Cross Section Width (in) |
| | | | | | | |
| Exit Velocity (FPS) | Exit Flow (ACFM) | NYTM (E) (KM) | NYTM (N) (KM) | Building | Distance to Property Line (ft) | Date of Removal |
| | | | | | | |

### Emission Source/Control ☒ Continuation Sheet(s)

| Emission Source ID | Emission Source Type | Date of Construction | Date of Operation | Date of Removal | Control Type Code | Control Type Description | Manufacturer's Name/Model No. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Design Capacity | Design Capacity Units Code | Design Capacity Units Description | | | Waste Feed Code | Waste Feed Description | Waste Type Code / Description |
| | | | | | | | |
| Emission Source ID | Emission Source Type | Date of Construction | Date of Operation | Date of Removal | Control Type Code | Control Type Description | Manufacturer's Name/Model No. |
| | | | | | | | |
| Design Capacity | Design Capacity Units Code | Design Capacity Units Description | | | Waste Feed Code | Waste Feed Description | Waste Type Code / Description |
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**New York State Department of Environmental Conservation**
**Air Permit Application**

| DEC ID | | | | | | | | | | | |
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## Section IV - Emission Unit Information (continued)

### Process Information

☐ Continuation Sheet(s)

| EMISSION UNIT | | PROCESS | |
|---|---|---|---|
| Description | | | |
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| Source Classification Code (SCC) | Total Thruput | | Thruput Quantity Units | |
|---|---|---|---|---|
| | Quantity/Hr | Quantity/Yr | Code | Description |
| | | | | |

| ☐ Confidential<br>☐ Operating at Maximum Capacity<br>☐ Activity with Insignificant Emissions | Operating Schedule | | Building | Floor/Location |
|---|---|---|---|---|
| | Hrs/Day | Days/Yr | | |
| | | | | |

| Emission Source/Control Identifier(s) | | | | | | | |
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| EMISSION UNIT | | PROCESS | |
|---|---|---|---|
| Description | | | |
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| Source Classification Code (SCC) | Total Thruput | | Thruput Quantity Units | |
|---|---|---|---|---|
| | Quantity/Hr | Quantity/Yr | Code | Description |
| | | | | |

| ☐ Confidential<br>☐ Operating at Maximum Capacity<br>☐ Activity with Insignificant Emissions | Operating Schedule | | Building | Floor/Location |
|---|---|---|---|---|
| | Hrs/Day | Days/Yr | | |
| | | | | |

| Emission Source/Control Identifier(s) | | | | | | | |
|---|---|---|---|---|---|---|---|
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# New York State Department of Environmental Conservation
# Air Permit Application

| DEC ID | | | | | | | | | | | |
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## Section IV - Emission Unit Information (continued)

| Emission Unit | Emission Point | Process | Emission Source | Emission Unit Applicable Federal Requirements ☒Continuation Sheet(s) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Title | Type | Part | Sub Part | Section | Sub Division | Parag. | Sub Parag. | Clause | Sub Clause |
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| Emission Unit | Emission Point | Process | Emission Source | Emission Unit State Only Requirements ❑ Continuation Sheet(s) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Title | Type | Part | Sub Part | Section | Sub Division | Parag. | Sub Parag. | Clause | Sub Clause |
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### Emission Unit Compliance Certification ❑Continuation Sheet(s)

Rule Citation

| Title | Type | Part | Sub Part | Section | Sub Division | Paragraph | Sub Paragraph | Clause | Sub Clause |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

❑ Applicable Federal Requirement ❑ State Only Requirement ❑ Capping

| Emission Unit | Emission Point | Process | Emission Source | CAS No. | Contaminant Name |
|---|---|---|---|---|---|
| | | | | - - | |

Monitoring Information

❑ Continuous Emission Monitoring
❑ Intermittent Emission Testing
❑ Ambient Air Monitoring
❑ Monitoring of Process or Control Device Parameters as Surrogate
❑ Work Practice Involving Specific Operations
❑ Record Keeping/Maintenance Procedures

Description

| Work Practice Type | Process Material Code | Process Material Description | Reference Test Method |
|---|---|---|---|
| | | | |

| Parameter Code | Parameter Description | Manufacturer Name/Model No. |
|---|---|---|
| | | |

| Limit Upper | Limit Lower | Limit Units Code | Limit Units Description |
|---|---|---|---|
| | | | |

| Averaging Method Code | Averaging Method Description | Monitoring Frequency Code | Monitoring Frequency Description | Reporting Requirements Code | Reporting Requirements Description |
|---|---|---|---|---|---|
| | | | | | |

# New York State Department of Environmental Conservation
# Air Permit Application

| DEC ID | | | | | | | | | | | | |
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## Section IV - Emission Unit Information (continued)

### Determination of Non-Applicability (Title V Only) ❑ Continuation Sheet(s)

Rule Citation

| Title | Type | Part | Sub Part | Section | Sub Division | Paragraph | Sub Paragraph | Clause | Sub Clause |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| Emission Unit | Emission Point | Process | Emission Source | ❑ Applicable Federal Requirement<br>❑ State Only Requirement |
|---|---|---|---|---|
| - | | | | |

Description

Rule Citation

| Title | Type | Part | Sub Part | Section | Sub Division | Paragraph | Sub Paragraph | Clause | Sub Clause |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| Emission Unit | Emission Point | Process | Emission Source | ❑ Applicable Federal Requirement<br>❑ State Only Requirement |
|---|---|---|---|---|
| - | | | | |

Description

### Process Emissions Summary ❑ Continuation Sheet(s)

| EMISSION UNIT | - | PROCESS |
|---|---|---|
| | | |

| CAS No. | Contaminant Name | % Thruput | % Capture | % Control | ERP (lbs/hr) | ERP How Determined |
|---|---|---|---|---|---|---|
| - - | | | | | | |

| PTE (lbs/hr) | PTE (lbs/yr) | PTE (standard units) | Standard Units | PTE How Determined | Actual (lbs/hr) | Actual (lbs/yr) |
|---|---|---|---|---|---|---|
| | | | | | | |

| EMISSION UNIT | - | PROCESS |
|---|---|---|
| | | |

| CAS No. | Contaminant Name | % Thruput | % Capture | % Control | ERP (lbs/hr) | ERP How Determined |
|---|---|---|---|---|---|---|
| - - | | | | | | |

| PTE (lbs/hr) | PTE (lbs/yr) | PTE (standard units) | Standard Units | PTE How Determined | Actual (lbs/hr) | Actual (lbs/yr) |
|---|---|---|---|---|---|---|
| | | | | | | |

| EMISSION UNIT | - | PROCESS |
|---|---|---|
| | | |

| CAS No. | Contaminant Name | % Thruput | % Capture | % Control | ERP (lbs/hr) | ERP How Determined |
|---|---|---|---|---|---|---|
| - - | | | | | | |

| PTE (lbs/hr) | PTE (lbs/yr) | PTE (standard units) | Standard Units | PTE How Determined | Actual (lbs/hr) | Actual (lbs/yr) |
|---|---|---|---|---|---|---|
| | | | | | | |

**New York State Department of Environmental Conservation**
**Air Permit Application**

| DEC ID | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | - | 1 | 4 | 6 | 2 | - | 0 | 0 | 0 | 0 | 1 | |

## Section IV - Emission Unit Information (continued)

| EMISSION UNIT<br>- | Emission Unit Emissions Summary | | ☒Continuation Sheet(s) | |
|---|---|---|---|---|
| CAS No. | Contaminant Name | | | |
| - - | | | | |
| ERP (lbs/yr) | PTE Emissions | | Actual | |
| | (lbs/hr) | (lbs/yr) | (lbs/hr) | (lbs/yr) |
| | | | | |
| CAS No. | Contaminant Name | | | |
| - - | | | | |
| ERP (lbs/yr) | PTE Emissions | | Actual | |
| | (lbs/hr) | (lbs/yr) | (lbs/hr) | (lbs/yr) |
| | | | | |
| CAS No. | Contaminant Name | | | |
| - - | | | | |
| ERP (lbs/yr) | PTE Emissions | | Actual | |
| | (lbs/hr) | (lbs/yr) | (lbs/hr) | (lbs/yr) |
| | | | | |
| CAS No. | Contaminant Name | | | |
| - - | | | | |
| ERP (lbs/yr) | PTE Emissions | | Actual | |
| | (lbs/hr) | (lbs/yr) | (lbs/hr) | (lbs/yr) |
| | | | | |

Compliance Plan ❑ Continuation Sheet(s)

For any emission units which are not in compliance at the time of permit application, the applicant shall complete the following

| Consent Order | | | Certified progress reports are to be submitted every 6 months beginning ___/___/ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emission Unit | Process | Emission Source | Applicable Federal Requirement | | | | | | | | | |
| | | | Title | Type | Part | Sub Part | Section | Sub Division | Parag. | Sub Parag. | Clause | Sub Clause |
| - | | | | | | | | | | | | |

| Remedial Measure / Intermediate Milestones | R/I | Date Scheduled |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

## Section IV - Emission Unit Information (continued)

### Request for Emission Reduction Credits ❑ Continuation Sheet(s)

| | | | | |
|---|---|---|---|---|
| EMISSION UNIT | - | | | |
| Emission Reduction Description | | | | |
| | | | | |
| Contaminant Emission Reduction Data | | | | |
| | | | Reduction | |
| | | | Date | Method |
| Baseline Period ____/____/____ to ____/____/ | | | ___/___/ | |
| | | | ERC (lbs/yr) | |
| CAS No. | Contaminant Name | | Netting | Offset |
| - - | | | | |
| - - | | | | |
| - - | | | | |

| | | | |
|---|---|---|---|
| Facility to Use Future Reduction | | | |
| Name | | APPLICATION ID - - / | |
| Location Address | | | |
| ❑ City / ❑ Town / ❑ Village | | State | Zip |

### Use of Emission Reduction Credits ❑ Continuation Sheet(s)

| | | |
|---|---|---|
| EMISSION UNIT - | | |
| Proposed Project Description | | |
| | | |
| | | |
| Contaminant Emissions Increase Data | | |
| CAS No. | Contaminant Name | PEP (lbs/yr) |
| - - | | |

Statement of Compliance

❑ All facilities under the ownership of this "ownership/firm" are operating in compliance with all applicable requirements and state regulations including any compliance certification requirements under Section 114(a)(3) of the Clean Air Act Amendments of 1990, or are meeting the schedule of a consent order.

| | | | |
|---|---|---|---|
| Source of Emission Reduction Credit - Facility | | | |
| Name | | PERMIT ID - - / | |
| Location Address | | | |
| ❑ City / ❑ Town / ❑ Village | | State | Zip |

| Emission Unit | CAS No. | Contaminant Name | ERC (lbs/yr) Netting | Offset |
|---|---|---|---|---|
| - | - - | | | |
| - | - - | | | |
| - | - - | | | |

## Supporting Documentation

- ☒ P.E. Certification (form attached)
- ☐ List of Exempt Activities (form attached)
- ☐ Plot Plan
- ☐ Methods Used to Determine Compliance (form attached)
- ☒ Calculations
- ☐ Air Quality Model ( _____ / _____ / _____ )
- ☐ Confidentiality Justification
- ☐ Ambient Air Monitoring Plan ( _____ / _____ / _____ )
- ☐ Stack Test Protocols/Reports ( _____ / _____ / _____ )
- ☐ Continuous Emissions Monitoring Plans/QA/QC ( _____ / _____ / _____ )
- ☐ MACT Demonstration ( _____ / _____ / _____ )
- ☐ Operational Flexibility: Description of Alternative Operating Scenarios and Protocols
- ☐ Title IV: Application/Registration
- ☐ ERC Quantification (form attached)
- ☐ Use of ERC(s) (form attached)
- ☐ Baseline Period Demonstration
- ☐ Analysis of Contemporaneous Emission Increase/Decrease
- ☐ LAER Demonstration ( _____ / _____ / _____ )
- ☐ BACT Demonstration ( _____ / _____ / _____ )
- ☐ Other Document(s): ______ ( _____ / _____ / _____ )

______________________________________________ ( ____ / ____ / ____ )
______________________________________________ ( ____ / ____ / ____ )
______________________________________________ ( ____ / ____ / ____ )
______________________________________________ ( ____ / ____ / ____ )
______________________________________________ ( ____ / ____ / ____ )
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______________________________________________ ( ____ / ____ / ____ )
______________________________________________ ( ____ / ____ / ____ )
______________________________________________ ( ____ / ____ / ____ )
______________________________________________ ( ____ / ____ / ____ )

P.E Certification

I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments as they pertain to the practice of engineering. This is defined as the performance of a professional service such as consultation, investigation, evaluation, planning, design or supervision of construction or operation in connection with any utilities, structures, buildings, machines, equipment, processes, works, or projects wherein the safeguarding of life, health and property is concerned, when such service or work requires the application of engineering principals and data. Based on my inquiry of those individuals with primary responsibility for obtaining such information, I certify that the statements and information are to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.

Name of P.E.

Michael J. Mann, P.E.

Signature of P.E.

Date _____ / _____ /

NYS License No.

Phone (716) 834-8932

# APPENDIX B
# LandGEM v3.02 Report


# Summary Report

**Landfill Name or Identifier:** Hyland Landfill - 2011 Title V Modification

**Date:** Wednesday, February 09, 2011

**Description/Comments:**

**About LandGEM:**

First-Order Decomposition Rate Equation:

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

Where,

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

$M_i$ = mass of waste accepted in the $i^{th}$ 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 | **1998** | |
| Landfill Closure Year (with 80-year limit) | **2025** | |
| *Actual Closure Year (without limit)* | ***2025*** | |
| Have Model Calculate Closure Year? | **Yes** | |
| Waste Design Capacity | **9,567,778** | *short tons* |

MODEL PARAMETERS

| | | |
|---|---|---|
| Methane Generation Rate, k | **0.050** | *$year^{-1}$* |
| Potential Methane Generation Capacity, $L_o$ | **100** | *$m^3/Mg$* |
| NMOC Concentration | **211** | *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)* |
| 1998 | 112,387 | 123,626 | 0 | 0 |
| 1999 | 112,387 | 123,626 | 112,387 | 123,626 |
| 2000 | 112,387 | 123,626 | 224,774 | 247,251 |
| 2001 | 208,895 | 229,784 | 337,161 | 370,877 |
| 2002 | 204,673 | 225,140 | 546,055 | 600,661 |
| 2003 | 217,893 | 239,682 | 750,728 | 825,801 |
| 2004 | 209,612 | 230,573 | 968,621 | 1,065,483 |
| 2005 | 214,460 | 235,906 | 1,178,233 | 1,296,056 |
| 2006 | 224,391 | 246,830 | 1,392,693 | 1,531,962 |
| 2007 | 310,784 | 341,862 | 1,617,084 | 1,778,792 |
| 2008 | 277,865 | 305,652 | 1,927,867 | 2,120,654 |
| 2009 | 194,805 | 214,285 | 2,205,733 | 2,426,306 |
| 2010 | 143,926 | 158,319 | 2,400,537 | 2,640,591 |
| 2011 | 422,727 | 465,000 | 2,544,464 | 2,798,910 |
| 2012 | 422,727 | 465,000 | 2,967,191 | 3,263,910 |
| 2013 | 422,727 | 465,000 | 3,389,918 | 3,728,910 |
| 2014 | 422,727 | 465,000 | 3,812,645 | 4,193,910 |
| 2015 | 422,727 | 465,000 | 4,235,373 | 4,658,910 |
| 2016 | 422,727 | 465,000 | 4,658,100 | 5,123,910 |
| 2017 | 422,727 | 465,000 | 5,080,827 | 5,588,910 |
| 2018 | 422,727 | 465,000 | 5,503,555 | 6,053,910 |
| 2019 | 422,727 | 465,000 | 5,926,282 | 6,518,910 |
| 2020 | 422,727 | 465,000 | 6,349,009 | 6,983,910 |
| 2021 | 422,727 | 465,000 | 6,771,736 | 7,448,910 |
| 2022 | 422,727 | 465,000 | 7,194,464 | 7,913,910 |
| 2023 | 422,727 | 465,000 | 7,617,191 | 8,378,910 |
| 2024 | 422,727 | 465,000 | 8,039,918 | 8,843,910 |
| 2025 | 235,334 | 258,868 | 8,462,645 | 9,308,910 |
| 2026 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2027 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2028 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2029 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2030 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2031 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2032 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2033 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2034 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2035 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2036 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2037 | 0 | 0 | 8,697,980 | 9,567,778 |

WASTE ACCEPTANCE RATES (Continued)

| Year | Waste Accepted | | Waste-In-Place | |
|---|---|---|---|---|
| | (Mg/year) | (short tons/year) | (Mg) | (short tons) |
| 2038 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2039 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2040 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2041 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2042 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2043 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2044 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2045 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2046 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2047 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2048 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2049 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2050 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2051 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2052 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2053 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2054 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2055 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2056 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2057 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2058 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2059 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2060 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2061 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2062 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2063 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2064 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2065 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2066 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2067 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2068 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2069 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2070 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2071 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2072 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2073 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2074 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2075 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2076 | 0 | 0 | 8,697,980 | 9,567,778 |
| 2077 | 0 | 0 | 8,697,980 | 9,567,778 |

## 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)

| | Compound | Gas / Pollutant Default Parameters: Concentration (*ppmv*) | Molecular Weight | User-specified Pollutant Parameters: Concentration (*ppmv*) | Molecular Weight |
|---|---|---|---|---|---|
| Pollutants | Ethyl mercaptan (ethanethiol) - VOC | 2.3 | 62.13 | | |
| | Ethylbenzene - HAP/VOC | 4.6 | 106.16 | | |
| | Ethylene dibromide - HAP/VOC | 1.0E-03 | 187.88 | | |
| | Fluorotrichloromethane - VOC | 0.76 | 137.38 | | |
| | Hexane - HAP/VOC | 6.6 | 86.18 | | |
| | Hydrogen sulfide | 36 | 34.08 | | |
| | Mercury (total) - HAP | 2.9E-04 | 200.61 | | |
| | Methyl ethyl ketone - HAP/VOC | 7.1 | 72.11 | | |
| | Methyl isobutyl ketone - HAP/VOC | 1.9 | 100.16 | | |
| | Methyl mercaptan - VOC | 2.5 | 48.11 | | |
| | Pentane - VOC | 3.3 | 72.15 | | |
| | Perchloroethylene (tetrachloroethylene) - HAP | 3.7 | 165.83 | | |
| | Propane - VOC | 11 | 44.09 | | |
| | t-1,2-Dichloroethene - VOC | 2.8 | 96.94 | | |
| | Toluene - No or Unknown Co-disposal - HAP/VOC | 39 | 92.13 | | |
| | Toluene - Co-disposal - HAP/VOC | 170 | 92.13 | | |
| | Trichloroethylene (trichloroethene) - HAP/VOC | 2.8 | 131.40 | | |
| | Vinyl chloride - HAP/VOC | 7.3 | 62.50 | | |
| | Xylenes - HAP/VOC | 12 | 106.16 | | |
| | Hydrogen sulfide | | | 280.00 | 34.08 |
| | Reduced sulfur as sulfur dioxide | | | 285.00 | 64.07 |
| | | | | | |
| | | | | | |
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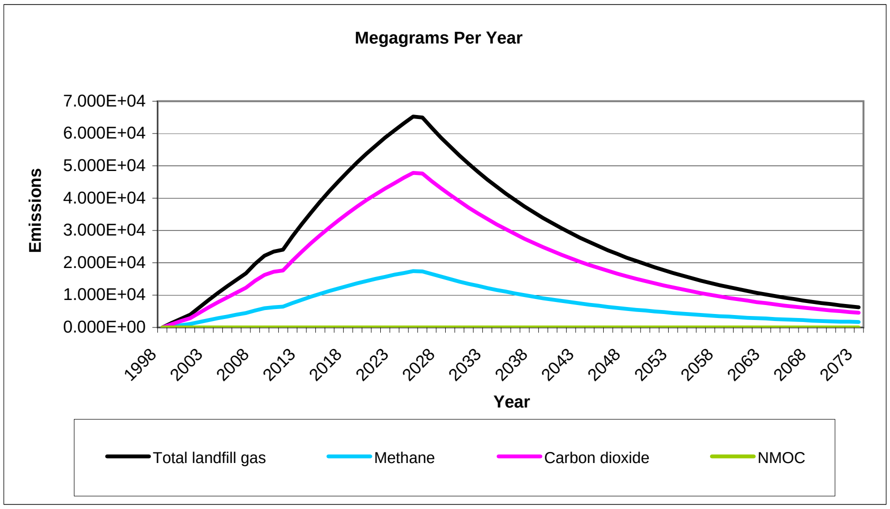
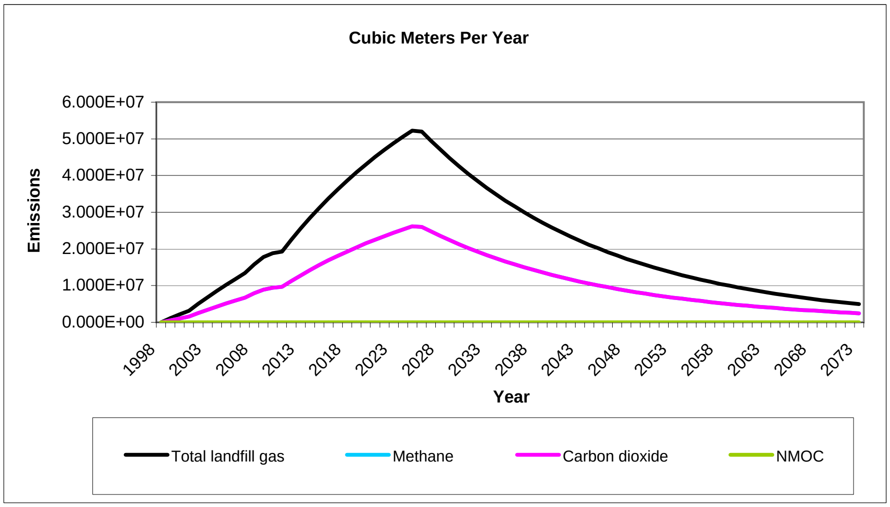
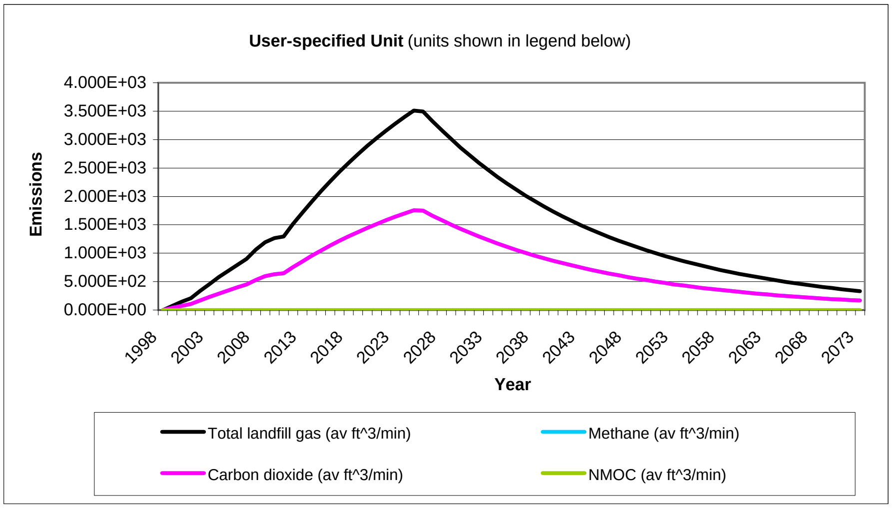
## Graphs



Megagrams Per Year
7.000E+04
6.000E+04
5.000E+04
4.000E+04
3.000E+04
2.000E+04
1.000E+04
0.000E+00
Emissions
1998
2003
2008
2013
2018
2023
2028
2033
2038
2043
2048
2053
2058
2063
2068
2073
Year
Total landfill gas
Methane
Carbon dioxide
NMOC

Cubic Meters Per Year
6.000E+07
5.000E+07
4.000E+07
3.000E+07
2.000E+07
1.000E+07
0.000E+00
Emissions
1998
2003
2008
2013
2018
2023
2028
2033
2038
2043
2048
2053
2058
2063
2068
2073
Year
Total landfill gas
Methane
Carbon dioxide
NMOC

User-specified Unit (units shown in legend below)
4.000E+03
3.500E+03
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
Emissions
1998
2003
2008
2013
2018
2023
2028
2033
2038
2043
2048
2053
2058
2063
2068
2073
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)* |
| 1998 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1.372E+03 | 1.099E+06 | 7.384E+01 | 3.666E+02 | 5.495E+05 | 3.692E+01 |
| 2000 | 2.678E+03 | 2.144E+06 | 1.441E+02 | 7.153E+02 | 1.072E+06 | 7.204E+01 |
| 2001 | 3.920E+03 | 3.139E+06 | 2.109E+02 | 1.047E+03 | 1.569E+06 | 1.054E+02 |
| 2002 | 6.280E+03 | 5.028E+06 | 3.379E+02 | 1.677E+03 | 2.514E+06 | 1.689E+02 |
| 2003 | 8.473E+03 | 6.785E+06 | 4.559E+02 | 2.263E+03 | 3.392E+06 | 2.279E+02 |
| 2004 | 1.072E+04 | 8.584E+06 | 5.768E+02 | 2.864E+03 | 4.292E+06 | 2.884E+02 |
| 2005 | 1.276E+04 | 1.022E+07 | 6.864E+02 | 3.408E+03 | 5.108E+06 | 3.432E+02 |
| 2006 | 1.475E+04 | 1.181E+07 | 7.938E+02 | 3.941E+03 | 5.907E+06 | 3.969E+02 |
| 2007 | 1.677E+04 | 1.343E+07 | 9.025E+02 | 4.481E+03 | 6.716E+06 | 4.513E+02 |
| 2008 | 1.975E+04 | 1.582E+07 | 1.063E+03 | 5.276E+03 | 7.908E+06 | 5.313E+02 |
| 2009 | 2.218E+04 | 1.776E+07 | 1.193E+03 | 5.925E+03 | 8.881E+06 | 5.967E+02 |
| 2010 | 2.348E+04 | 1.880E+07 | 1.263E+03 | 6.271E+03 | 9.400E+06 | 6.316E+02 |
| 2011 | 2.409E+04 | 1.929E+07 | 1.296E+03 | 6.435E+03 | 9.646E+06 | 6.481E+02 |
| 2012 | 2.808E+04 | 2.248E+07 | 1.511E+03 | 7.500E+03 | 1.124E+07 | 7.553E+02 |
| 2013 | 3.187E+04 | 2.552E+07 | 1.715E+03 | 8.513E+03 | 1.276E+07 | 8.574E+02 |
| 2014 | 3.548E+04 | 2.841E+07 | 1.909E+03 | 9.477E+03 | 1.420E+07 | 9.544E+02 |
| 2015 | 3.891E+04 | 3.116E+07 | 2.094E+03 | 1.039E+04 | 1.558E+07 | 1.047E+03 |
| 2016 | 4.218E+04 | 3.377E+07 | 2.269E+03 | 1.127E+04 | 1.689E+07 | 1.135E+03 |
| 2017 | 4.528E+04 | 3.626E+07 | 2.436E+03 | 1.209E+04 | 1.813E+07 | 1.218E+03 |
| 2018 | 4.823E+04 | 3.862E+07 | 2.595E+03 | 1.288E+04 | 1.931E+07 | 1.298E+03 |
| 2019 | 5.104E+04 | 4.087E+07 | 2.746E+03 | 1.363E+04 | 2.044E+07 | 1.373E+03 |
| 2020 | 5.372E+04 | 4.301E+07 | 2.890E+03 | 1.435E+04 | 2.151E+07 | 1.445E+03 |
| 2021 | 5.626E+04 | 4.505E+07 | 3.027E+03 | 1.503E+04 | 2.252E+07 | 1.513E+03 |
| 2022 | 5.868E+04 | 4.699E+07 | 3.157E+03 | 1.567E+04 | 2.349E+07 | 1.579E+03 |
| 2023 | 6.098E+04 | 4.883E+07 | 3.281E+03 | 1.629E+04 | 2.441E+07 | 1.640E+03 |
| 2024 | 6.317E+04 | 5.058E+07 | 3.399E+03 | 1.687E+04 | 2.529E+07 | 1.699E+03 |
| 2025 | 6.525E+04 | 5.225E+07 | 3.511E+03 | 1.743E+04 | 2.612E+07 | 1.755E+03 |
| 2026 | 6.494E+04 | 5.200E+07 | 3.494E+03 | 1.735E+04 | 2.600E+07 | 1.747E+03 |
| 2027 | 6.177E+04 | 4.946E+07 | 3.324E+03 | 1.650E+04 | 2.473E+07 | 1.662E+03 |
| 2028 | 5.876E+04 | 4.705E+07 | 3.161E+03 | 1.570E+04 | 2.353E+07 | 1.581E+03 |
| 2029 | 5.589E+04 | 4.476E+07 | 3.007E+03 | 1.493E+04 | 2.238E+07 | 1.504E+03 |
| 2030 | 5.317E+04 | 4.257E+07 | 2.861E+03 | 1.420E+04 | 2.129E+07 | 1.430E+03 |
| 2031 | 5.058E+04 | 4.050E+07 | 2.721E+03 | 1.351E+04 | 2.025E+07 | 1.361E+03 |
| 2032 | 4.811E+04 | 3.852E+07 | 2.588E+03 | 1.285E+04 | 1.926E+07 | 1.294E+03 |
| 2033 | 4.576E+04 | 3.664E+07 | 2.462E+03 | 1.222E+04 | 1.832E+07 | 1.231E+03 |
| 2034 | 4.353E+04 | 3.486E+07 | 2.342E+03 | 1.163E+04 | 1.743E+07 | 1.171E+03 |
| 2035 | 4.141E+04 | 3.316E+07 | 2.228E+03 | 1.106E+04 | 1.658E+07 | 1.114E+03 |
| 2036 | 3.939E+04 | 3.154E+07 | 2.119E+03 | 1.052E+04 | 1.577E+07 | 1.060E+03 |
| 2037 | 3.747E+04 | 3.000E+07 | 2.016E+03 | 1.001E+04 | 1.500E+07 | 1.008E+03 |
| 2038 | 3.564E+04 | 2.854E+07 | 1.918E+03 | 9.520E+03 | 1.427E+07 | 9.588E+02 |
| 2039 | 3.390E+04 | 2.715E+07 | 1.824E+03 | 9.055E+03 | 1.357E+07 | 9.120E+02 |
| 2040 | 3.225E+04 | 2.582E+07 | 1.735E+03 | 8.614E+03 | 1.291E+07 | 8.675E+02 |
| 2041 | 3.068E+04 | 2.456E+07 | 1.650E+03 | 8.194E+03 | 1.228E+07 | 8.252E+02 |
| 2042 | 2.918E+04 | 2.337E+07 | 1.570E+03 | 7.794E+03 | 1.168E+07 | 7.850E+02 |
| 2043 | 2.776E+04 | 2.223E+07 | 1.493E+03 | 7.414E+03 | 1.111E+07 | 7.467E+02 |
| 2044 | 2.640E+04 | 2.114E+07 | 1.421E+03 | 7.052E+03 | 1.057E+07 | 7.103E+02 |
| 2045 | 2.511E+04 | 2.011E+07 | 1.351E+03 | 6.708E+03 | 1.006E+07 | 6.756E+02 |
| 2046 | 2.389E+04 | 1.913E+07 | 1.285E+03 | 6.381E+03 | 9.565E+06 | 6.427E+02 |
| 2047 | 2.272E+04 | 1.820E+07 | 1.223E+03 | 6.070E+03 | 9.098E+06 | 6.113E+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)* |
| 2048 | 2.162E+04 | 1.731E+07 | 1.163E+03 | 5.774E+03 | 8.655E+06 | 5.815E+02 |
| 2049 | 2.056E+04 | 1.647E+07 | 1.106E+03 | 5.492E+03 | 8.233E+06 | 5.532E+02 |
| 2050 | 1.956E+04 | 1.566E+07 | 1.052E+03 | 5.225E+03 | 7.831E+06 | 5.262E+02 |
| 2051 | 1.861E+04 | 1.490E+07 | 1.001E+03 | 4.970E+03 | 7.449E+06 | 5.005E+02 |
| 2052 | 1.770E+04 | 1.417E+07 | 9.522E+02 | 4.727E+03 | 7.086E+06 | 4.761E+02 |
| 2053 | 1.683E+04 | 1.348E+07 | 9.058E+02 | 4.497E+03 | 6.740E+06 | 4.529E+02 |
| 2054 | 1.601E+04 | 1.282E+07 | 8.616E+02 | 4.277E+03 | 6.412E+06 | 4.308E+02 |
| 2055 | 1.523E+04 | 1.220E+07 | 8.196E+02 | 4.069E+03 | 6.099E+06 | 4.098E+02 |
| 2056 | 1.449E+04 | 1.160E+07 | 7.796E+02 | 3.870E+03 | 5.801E+06 | 3.898E+02 |
| 2057 | 1.378E+04 | 1.104E+07 | 7.416E+02 | 3.682E+03 | 5.519E+06 | 3.708E+02 |
| 2058 | 1.311E+04 | 1.050E+07 | 7.054E+02 | 3.502E+03 | 5.249E+06 | 3.527E+02 |
| 2059 | 1.247E+04 | 9.987E+06 | 6.710E+02 | 3.331E+03 | 4.993E+06 | 3.355E+02 |
| 2060 | 1.186E+04 | 9.500E+06 | 6.383E+02 | 3.169E+03 | 4.750E+06 | 3.191E+02 |
| 2061 | 1.128E+04 | 9.036E+06 | 6.072E+02 | 3.014E+03 | 4.518E+06 | 3.036E+02 |
| 2062 | 1.073E+04 | 8.596E+06 | 5.775E+02 | 2.867E+03 | 4.298E+06 | 2.888E+02 |
| 2063 | 1.021E+04 | 8.176E+06 | 5.494E+02 | 2.727E+03 | 4.088E+06 | 2.747E+02 |
| 2064 | 9.713E+03 | 7.778E+06 | 5.226E+02 | 2.594E+03 | 3.889E+06 | 2.613E+02 |
| 2065 | 9.239E+03 | 7.398E+06 | 4.971E+02 | 2.468E+03 | 3.699E+06 | 2.485E+02 |
| 2066 | 8.789E+03 | 7.038E+06 | 4.729E+02 | 2.348E+03 | 3.519E+06 | 2.364E+02 |
| 2067 | 8.360E+03 | 6.694E+06 | 4.498E+02 | 2.233E+03 | 3.347E+06 | 2.249E+02 |
| 2068 | 7.952E+03 | 6.368E+06 | 4.279E+02 | 2.124E+03 | 3.184E+06 | 2.139E+02 |
| 2069 | 7.564E+03 | 6.057E+06 | 4.070E+02 | 2.021E+03 | 3.029E+06 | 2.035E+02 |
| 2070 | 7.196E+03 | 5.762E+06 | 3.871E+02 | 1.922E+03 | 2.881E+06 | 1.936E+02 |
| 2071 | 6.845E+03 | 5.481E+06 | 3.683E+02 | 1.828E+03 | 2.740E+06 | 1.841E+02 |
| 2072 | 6.511E+03 | 5.214E+06 | 3.503E+02 | 1.739E+03 | 2.607E+06 | 1.751E+02 |
| 2073 | 6.193E+03 | 4.959E+06 | 3.332E+02 | 1.654E+03 | 2.480E+06 | 1.666E+02 |
| 2074 | 5.891E+03 | 4.717E+06 | 3.170E+02 | 1.574E+03 | 2.359E+06 | 1.585E+02 |
| 2075 | 5.604E+03 | 4.487E+06 | 3.015E+02 | 1.497E+03 | 2.244E+06 | 1.508E+02 |
| 2076 | 5.331E+03 | 4.268E+06 | 2.868E+02 | 1.424E+03 | 2.134E+06 | 1.434E+02 |
| 2077 | 5.071E+03 | 4.060E+06 | 2.728E+02 | 1.354E+03 | 2.030E+06 | 1.364E+02 |
| 2078 | 4.823E+03 | 3.862E+06 | 2.595E+02 | 1.288E+03 | 1.931E+06 | 1.298E+02 |
| 2079 | 4.588E+03 | 3.674E+06 | 2.468E+02 | 1.226E+03 | 1.837E+06 | 1.234E+02 |
| 2080 | 4.364E+03 | 3.495E+06 | 2.348E+02 | 1.166E+03 | 1.747E+06 | 1.174E+02 |
| 2081 | 4.151E+03 | 3.324E+06 | 2.234E+02 | 1.109E+03 | 1.662E+06 | 1.117E+02 |
| 2082 | 3.949E+03 | 3.162E+06 | 2.125E+02 | 1.055E+03 | 1.581E+06 | 1.062E+02 |
| 2083 | 3.756E+03 | 3.008E+06 | 2.021E+02 | 1.003E+03 | 1.504E+06 | 1.011E+02 |
| 2084 | 3.573E+03 | 2.861E+06 | 1.922E+02 | 9.544E+02 | 1.431E+06 | 9.612E+01 |
| 2085 | 3.399E+03 | 2.722E+06 | 1.829E+02 | 9.079E+02 | 1.361E+06 | 9.144E+01 |
| 2086 | 3.233E+03 | 2.589E+06 | 1.740E+02 | 8.636E+02 | 1.294E+06 | 8.698E+01 |
| 2087 | 3.075E+03 | 2.463E+06 | 1.655E+02 | 8.215E+02 | 1.231E+06 | 8.273E+01 |
| 2088 | 2.925E+03 | 2.343E+06 | 1.574E+02 | 7.814E+02 | 1.171E+06 | 7.870E+01 |
| 2089 | 2.783E+03 | 2.228E+06 | 1.497E+02 | 7.433E+02 | 1.114E+06 | 7.486E+01 |
| 2090 | 2.647E+03 | 2.120E+06 | 1.424E+02 | 7.071E+02 | 1.060E+06 | 7.121E+01 |
| 2091 | 2.518E+03 | 2.016E+06 | 1.355E+02 | 6.726E+02 | 1.008E+06 | 6.774E+01 |
| 2092 | 2.395E+03 | 1.918E+06 | 1.289E+02 | 6.398E+02 | 9.590E+05 | 6.443E+01 |
| 2093 | 2.278E+03 | 1.824E+06 | 1.226E+02 | 6.086E+02 | 9.122E+05 | 6.129E+01 |
| 2094 | 2.167E+03 | 1.735E+06 | 1.166E+02 | 5.789E+02 | 8.677E+05 | 5.830E+01 |
| 2095 | 2.062E+03 | 1.651E+06 | 1.109E+02 | 5.507E+02 | 8.254E+05 | 5.546E+01 |
| 2096 | 1.961E+03 | 1.570E+06 | 1.055E+02 | 5.238E+02 | 7.851E+05 | 5.275E+01 |
| 2097 | 1.865E+03 | 1.494E+06 | 1.004E+02 | 4.983E+02 | 7.468E+05 | 5.018E+01 |
| 2098 | 1.774E+03 | 1.421E+06 | 9.547E+01 | 4.740E+02 | 7.104E+05 | 4.773E+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)* |
| 2099 | 1.688E+03 | 1.352E+06 | 9.081E+01 | 4.508E+02 | 6.758E+05 | 4.541E+01 |
| 2100 | 1.606E+03 | 1.286E+06 | 8.638E+01 | 4.289E+02 | 6.428E+05 | 4.319E+01 |
| 2101 | 1.527E+03 | 1.223E+06 | 8.217E+01 | 4.079E+02 | 6.115E+05 | 4.108E+01 |
| 2102 | 1.453E+03 | 1.163E+06 | 7.816E+01 | 3.880E+02 | 5.816E+05 | 3.908E+01 |
| 2103 | 1.382E+03 | 1.107E+06 | 7.435E+01 | 3.691E+02 | 5.533E+05 | 3.717E+01 |
| 2104 | 1.315E+03 | 1.053E+06 | 7.072E+01 | 3.511E+02 | 5.263E+05 | 3.536E+01 |
| 2105 | 1.250E+03 | 1.001E+06 | 6.727E+01 | 3.340E+02 | 5.006E+05 | 3.364E+01 |
| 2106 | 1.189E+03 | 9.524E+05 | 6.399E+01 | 3.177E+02 | 4.762E+05 | 3.200E+01 |
| 2107 | 1.131E+03 | 9.060E+05 | 6.087E+01 | 3.022E+02 | 4.530E+05 | 3.044E+01 |
| 2108 | 1.076E+03 | 8.618E+05 | 5.790E+01 | 2.875E+02 | 4.309E+05 | 2.895E+01 |
| 2109 | 1.024E+03 | 8.198E+05 | 5.508E+01 | 2.735E+02 | 4.099E+05 | 2.754E+01 |
| 2110 | 9.738E+02 | 7.798E+05 | 5.239E+01 | 2.601E+02 | 3.899E+05 | 2.620E+01 |
| 2111 | 9.263E+02 | 7.417E+05 | 4.984E+01 | 2.474E+02 | 3.709E+05 | 2.492E+01 |
| 2112 | 8.811E+02 | 7.056E+05 | 4.741E+01 | 2.354E+02 | 3.528E+05 | 2.370E+01 |
| 2113 | 8.382E+02 | 6.712E+05 | 4.510E+01 | 2.239E+02 | 3.356E+05 | 2.255E+01 |
| 2114 | 7.973E+02 | 6.384E+05 | 4.290E+01 | 2.130E+02 | 3.192E+05 | 2.145E+01 |
| 2115 | 7.584E+02 | 6.073E+05 | 4.080E+01 | 2.026E+02 | 3.036E+05 | 2.040E+01 |
| 2116 | 7.214E+02 | 5.777E+05 | 3.881E+01 | 1.927E+02 | 2.888E+05 | 1.941E+01 |
| 2117 | 6.862E+02 | 5.495E+05 | 3.692E+01 | 1.833E+02 | 2.748E+05 | 1.846E+01 |
| 2118 | 6.528E+02 | 5.227E+05 | 3.512E+01 | 1.744E+02 | 2.614E+05 | 1.756E+01 |
| 2119 | 6.209E+02 | 4.972E+05 | 3.341E+01 | 1.659E+02 | 2.486E+05 | 1.670E+01 |
| 2120 | 5.906E+02 | 4.730E+05 | 3.178E+01 | 1.578E+02 | 2.365E+05 | 1.589E+01 |
| 2121 | 5.618E+02 | 4.499E+05 | 3.023E+01 | 1.501E+02 | 2.249E+05 | 1.511E+01 |
| 2122 | 5.344E+02 | 4.280E+05 | 2.875E+01 | 1.428E+02 | 2.140E+05 | 1.438E+01 |
| 2123 | 5.084E+02 | 4.071E+05 | 2.735E+01 | 1.358E+02 | 2.035E+05 | 1.368E+01 |
| 2124 | 4.836E+02 | 3.872E+05 | 2.602E+01 | 1.292E+02 | 1.936E+05 | 1.301E+01 |
| 2125 | 4.600E+02 | 3.683E+05 | 2.475E+01 | 1.229E+02 | 1.842E+05 | 1.237E+01 |
| 2126 | 4.376E+02 | 3.504E+05 | 2.354E+01 | 1.169E+02 | 1.752E+05 | 1.177E+01 |
| 2127 | 4.162E+02 | 3.333E+05 | 2.239E+01 | 1.112E+02 | 1.666E+05 | 1.120E+01 |
| 2128 | 3.959E+02 | 3.170E+05 | 2.130E+01 | 1.058E+02 | 1.585E+05 | 1.065E+01 |
| 2129 | 3.766E+02 | 3.016E+05 | 2.026E+01 | 1.006E+02 | 1.508E+05 | 1.013E+01 |
| 2130 | 3.582E+02 | 2.869E+05 | 1.927E+01 | 9.569E+01 | 1.434E+05 | 9.637E+00 |
| 2131 | 3.408E+02 | 2.729E+05 | 1.833E+01 | 9.102E+01 | 1.364E+05 | 9.167E+00 |
| 2132 | 3.242E+02 | 2.596E+05 | 1.744E+01 | 8.658E+01 | 1.298E+05 | 8.720E+00 |
| 2133 | 3.083E+02 | 2.469E+05 | 1.659E+01 | 8.236E+01 | 1.235E+05 | 8.295E+00 |
| 2134 | 2.933E+02 | 2.349E+05 | 1.578E+01 | 7.834E+01 | 1.174E+05 | 7.890E+00 |
| 2135 | 2.790E+02 | 2.234E+05 | 1.501E+01 | 7.452E+01 | 1.117E+05 | 7.505E+00 |
| 2136 | 2.654E+02 | 2.125E+05 | 1.428E+01 | 7.089E+01 | 1.063E+05 | 7.139E+00 |
| 2137 | 2.524E+02 | 2.022E+05 | 1.358E+01 | 6.743E+01 | 1.011E+05 | 6.791E+00 |
| 2138 | 2.401E+02 | 1.923E+05 | 1.292E+01 | 6.414E+01 | 9.615E+04 | 6.460E+00 |

## Results (Continued)

| Year | Carbon dioxide | | | NMOC | | |
|---|---|---|---|---|---|---|
| | *(Mg/year)* | *(m$^3$/year)* | *(av ft^3/min)* | *(Mg/year)* | *(m$^3$/year)* | *(av ft^3/min)* |
| 1998 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1999 | 1.006E+03 | 5.495E+05 | 3.692E+01 | 8.312E-01 | 2.319E+02 | 1.558E-02 |
| 2000 | 1.963E+03 | 1.072E+06 | 7.204E+01 | 1.622E+00 | 4.525E+02 | 3.040E-02 |
| 2001 | 2.873E+03 | 1.569E+06 | 1.054E+02 | 2.374E+00 | 6.623E+02 | 4.450E-02 |
| 2002 | 4.602E+03 | 2.514E+06 | 1.689E+02 | 3.803E+00 | 1.061E+03 | 7.129E-02 |
| 2003 | 6.210E+03 | 3.392E+06 | 2.279E+02 | 5.131E+00 | 1.432E+03 | 9.618E-02 |
| 2004 | 7.857E+03 | 4.292E+06 | 2.884E+02 | 6.492E+00 | 1.811E+03 | 1.217E-01 |
| 2005 | 9.350E+03 | 5.108E+06 | 3.432E+02 | 7.726E+00 | 2.155E+03 | 1.448E-01 |
| 2006 | 1.081E+04 | 5.907E+06 | 3.969E+02 | 8.935E+00 | 2.493E+03 | 1.675E-01 |
| 2007 | 1.229E+04 | 6.716E+06 | 4.513E+02 | 1.016E+01 | 2.834E+03 | 1.904E-01 |
| 2008 | 1.448E+04 | 7.908E+06 | 5.313E+02 | 1.196E+01 | 3.337E+03 | 2.242E-01 |
| 2009 | 1.626E+04 | 8.881E+06 | 5.967E+02 | 1.343E+01 | 3.748E+03 | 2.518E-01 |
| 2010 | 1.721E+04 | 9.400E+06 | 6.316E+02 | 1.422E+01 | 3.967E+03 | 2.665E-01 |
| 2011 | 1.766E+04 | 9.646E+06 | 6.481E+02 | 1.459E+01 | 4.070E+03 | 2.735E-01 |
| 2012 | 2.058E+04 | 1.124E+07 | 7.553E+02 | 1.701E+01 | 4.744E+03 | 3.188E-01 |
| 2013 | 2.336E+04 | 1.276E+07 | 8.574E+02 | 1.930E+01 | 5.385E+03 | 3.618E-01 |
| 2014 | 2.600E+04 | 1.420E+07 | 9.544E+02 | 2.149E+01 | 5.994E+03 | 4.028E-01 |
| 2015 | 2.852E+04 | 1.558E+07 | 1.047E+03 | 2.357E+01 | 6.574E+03 | 4.417E-01 |
| 2016 | 3.091E+04 | 1.689E+07 | 1.135E+03 | 2.554E+01 | 7.126E+03 | 4.788E-01 |
| 2017 | 3.319E+04 | 1.813E+07 | 1.218E+03 | 2.742E+01 | 7.651E+03 | 5.140E-01 |
| 2018 | 3.535E+04 | 1.931E+07 | 1.298E+03 | 2.921E+01 | 8.150E+03 | 5.476E-01 |
| 2019 | 3.741E+04 | 2.044E+07 | 1.373E+03 | 3.091E+01 | 8.624E+03 | 5.795E-01 |
| 2020 | 3.937E+04 | 2.151E+07 | 1.445E+03 | 3.253E+01 | 9.076E+03 | 6.098E-01 |
| 2021 | 4.123E+04 | 2.252E+07 | 1.513E+03 | 3.407E+01 | 9.506E+03 | 6.387E-01 |
| 2022 | 4.300E+04 | 2.349E+07 | 1.579E+03 | 3.554E+01 | 9.914E+03 | 6.661E-01 |
| 2023 | 4.469E+04 | 2.441E+07 | 1.640E+03 | 3.693E+01 | 1.030E+04 | 6.922E-01 |
| 2024 | 4.629E+04 | 2.529E+07 | 1.699E+03 | 3.826E+01 | 1.067E+04 | 7.171E-01 |
| 2025 | 4.782E+04 | 2.612E+07 | 1.755E+03 | 3.952E+01 | 1.102E+04 | 7.407E-01 |
| 2026 | 4.759E+04 | 2.600E+07 | 1.747E+03 | 3.933E+01 | 1.097E+04 | 7.372E-01 |
| 2027 | 4.527E+04 | 2.473E+07 | 1.662E+03 | 3.741E+01 | 1.044E+04 | 7.013E-01 |
| 2028 | 4.306E+04 | 2.353E+07 | 1.581E+03 | 3.559E+01 | 9.928E+03 | 6.671E-01 |
| 2029 | 4.096E+04 | 2.238E+07 | 1.504E+03 | 3.385E+01 | 9.444E+03 | 6.345E-01 |
| 2030 | 3.897E+04 | 2.129E+07 | 1.430E+03 | 3.220E+01 | 8.983E+03 | 6.036E-01 |
| 2031 | 3.707E+04 | 2.025E+07 | 1.361E+03 | 3.063E+01 | 8.545E+03 | 5.741E-01 |
| 2032 | 3.526E+04 | 1.926E+07 | 1.294E+03 | 2.914E+01 | 8.128E+03 | 5.461E-01 |
| 2033 | 3.354E+04 | 1.832E+07 | 1.231E+03 | 2.771E+01 | 7.732E+03 | 5.195E-01 |
| 2034 | 3.190E+04 | 1.743E+07 | 1.171E+03 | 2.636E+01 | 7.355E+03 | 4.942E-01 |
| 2035 | 3.035E+04 | 1.658E+07 | 1.114E+03 | 2.508E+01 | 6.996E+03 | 4.701E-01 |
| 2036 | 2.887E+04 | 1.577E+07 | 1.060E+03 | 2.385E+01 | 6.655E+03 | 4.471E-01 |
| 2037 | 2.746E+04 | 1.500E+07 | 1.008E+03 | 2.269E+01 | 6.330E+03 | 4.253E-01 |
| 2038 | 2.612E+04 | 1.427E+07 | 9.588E+02 | 2.158E+01 | 6.022E+03 | 4.046E-01 |
| 2039 | 2.485E+04 | 1.357E+07 | 9.120E+02 | 2.053E+01 | 5.728E+03 | 3.849E-01 |
| 2040 | 2.363E+04 | 1.291E+07 | 8.675E+02 | 1.953E+01 | 5.449E+03 | 3.661E-01 |
| 2041 | 2.248E+04 | 1.228E+07 | 8.252E+02 | 1.858E+01 | 5.183E+03 | 3.482E-01 |
| 2042 | 2.139E+04 | 1.168E+07 | 7.850E+02 | 1.767E+01 | 4.930E+03 | 3.313E-01 |
| 2043 | 2.034E+04 | 1.111E+07 | 7.467E+02 | 1.681E+01 | 4.690E+03 | 3.151E-01 |
| 2044 | 1.935E+04 | 1.057E+07 | 7.103E+02 | 1.599E+01 | 4.461E+03 | 2.997E-01 |
| 2045 | 1.841E+04 | 1.006E+07 | 6.756E+02 | 1.521E+01 | 4.243E+03 | 2.851E-01 |
| 2046 | 1.751E+04 | 9.565E+06 | 6.427E+02 | 1.447E+01 | 4.036E+03 | 2.712E-01 |
| 2047 | 1.665E+04 | 9.098E+06 | 6.113E+02 | 1.376E+01 | 3.840E+03 | 2.580E-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)* |
| 2048 | 1.584E+04 | 8.655E+06 | 5.815E+02 | 1.309E+01 | 3.652E+03 | 2.454E-01 |
| 2049 | 1.507E+04 | 8.233E+06 | 5.532E+02 | 1.245E+01 | 3.474E+03 | 2.334E-01 |
| 2050 | 1.433E+04 | 7.831E+06 | 5.262E+02 | 1.185E+01 | 3.305E+03 | 2.220E-01 |
| 2051 | 1.364E+04 | 7.449E+06 | 5.005E+02 | 1.127E+01 | 3.144E+03 | 2.112E-01 |
| 2052 | 1.297E+04 | 7.086E+06 | 4.761E+02 | 1.072E+01 | 2.990E+03 | 2.009E-01 |
| 2053 | 1.234E+04 | 6.740E+06 | 4.529E+02 | 1.020E+01 | 2.844E+03 | 1.911E-01 |
| 2054 | 1.174E+04 | 6.412E+06 | 4.308E+02 | 9.698E+00 | 2.706E+03 | 1.818E-01 |
| 2055 | 1.116E+04 | 6.099E+06 | 4.098E+02 | 9.225E+00 | 2.574E+03 | 1.729E-01 |
| 2056 | 1.062E+04 | 5.801E+06 | 3.898E+02 | 8.776E+00 | 2.448E+03 | 1.645E-01 |
| 2057 | 1.010E+04 | 5.519E+06 | 3.708E+02 | 8.348E+00 | 2.329E+03 | 1.565E-01 |
| 2058 | 9.609E+03 | 5.249E+06 | 3.527E+02 | 7.940E+00 | 2.215E+03 | 1.488E-01 |
| 2059 | 9.140E+03 | 4.993E+06 | 3.355E+02 | 7.553E+00 | 2.107E+03 | 1.416E-01 |
| 2060 | 8.695E+03 | 4.750E+06 | 3.191E+02 | 7.185E+00 | 2.004E+03 | 1.347E-01 |
| 2061 | 8.271E+03 | 4.518E+06 | 3.036E+02 | 6.834E+00 | 1.907E+03 | 1.281E-01 |
| 2062 | 7.867E+03 | 4.298E+06 | 2.888E+02 | 6.501E+00 | 1.814E+03 | 1.219E-01 |
| 2063 | 7.483E+03 | 4.088E+06 | 2.747E+02 | 6.184E+00 | 1.725E+03 | 1.159E-01 |
| 2064 | 7.119E+03 | 3.889E+06 | 2.613E+02 | 5.882E+00 | 1.641E+03 | 1.103E-01 |
| 2065 | 6.771E+03 | 3.699E+06 | 2.485E+02 | 5.596E+00 | 1.561E+03 | 1.049E-01 |
| 2066 | 6.441E+03 | 3.519E+06 | 2.364E+02 | 5.323E+00 | 1.485E+03 | 9.977E-02 |
| 2067 | 6.127E+03 | 3.347E+06 | 2.249E+02 | 5.063E+00 | 1.412E+03 | 9.491E-02 |
| 2068 | 5.828E+03 | 3.184E+06 | 2.139E+02 | 4.816E+00 | 1.344E+03 | 9.028E-02 |
| 2069 | 5.544E+03 | 3.029E+06 | 2.035E+02 | 4.581E+00 | 1.278E+03 | 8.587E-02 |
| 2070 | 5.274E+03 | 2.881E+06 | 1.936E+02 | 4.358E+00 | 1.216E+03 | 8.169E-02 |
| 2071 | 5.016E+03 | 2.740E+06 | 1.841E+02 | 4.145E+00 | 1.156E+03 | 7.770E-02 |
| 2072 | 4.772E+03 | 2.607E+06 | 1.751E+02 | 3.943E+00 | 1.100E+03 | 7.391E-02 |
| 2073 | 4.539E+03 | 2.480E+06 | 1.666E+02 | 3.751E+00 | 1.046E+03 | 7.031E-02 |
| 2074 | 4.318E+03 | 2.359E+06 | 1.585E+02 | 3.568E+00 | 9.954E+02 | 6.688E-02 |
| 2075 | 4.107E+03 | 2.244E+06 | 1.508E+02 | 3.394E+00 | 9.468E+02 | 6.362E-02 |
| 2076 | 3.907E+03 | 2.134E+06 | 1.434E+02 | 3.228E+00 | 9.006E+02 | 6.051E-02 |
| 2077 | 3.716E+03 | 2.030E+06 | 1.364E+02 | 3.071E+00 | 8.567E+02 | 5.756E-02 |
| 2078 | 3.535E+03 | 1.931E+06 | 1.298E+02 | 2.921E+00 | 8.149E+02 | 5.476E-02 |
| 2079 | 3.363E+03 | 1.837E+06 | 1.234E+02 | 2.779E+00 | 7.752E+02 | 5.209E-02 |
| 2080 | 3.199E+03 | 1.747E+06 | 1.174E+02 | 2.643E+00 | 7.374E+02 | 4.955E-02 |
| 2081 | 3.043E+03 | 1.662E+06 | 1.117E+02 | 2.514E+00 | 7.014E+02 | 4.713E-02 |
| 2082 | 2.894E+03 | 1.581E+06 | 1.062E+02 | 2.392E+00 | 6.672E+02 | 4.483E-02 |
| 2083 | 2.753E+03 | 1.504E+06 | 1.011E+02 | 2.275E+00 | 6.347E+02 | 4.264E-02 |
| 2084 | 2.619E+03 | 1.431E+06 | 9.612E+01 | 2.164E+00 | 6.037E+02 | 4.056E-02 |
| 2085 | 2.491E+03 | 1.361E+06 | 9.144E+01 | 2.058E+00 | 5.743E+02 | 3.859E-02 |
| 2086 | 2.370E+03 | 1.294E+06 | 8.698E+01 | 1.958E+00 | 5.463E+02 | 3.670E-02 |
| 2087 | 2.254E+03 | 1.231E+06 | 8.273E+01 | 1.863E+00 | 5.196E+02 | 3.491E-02 |
| 2088 | 2.144E+03 | 1.171E+06 | 7.870E+01 | 1.772E+00 | 4.943E+02 | 3.321E-02 |
| 2089 | 2.039E+03 | 1.114E+06 | 7.486E+01 | 1.685E+00 | 4.702E+02 | 3.159E-02 |
| 2090 | 1.940E+03 | 1.060E+06 | 7.121E+01 | 1.603E+00 | 4.472E+02 | 3.005E-02 |
| 2091 | 1.845E+03 | 1.008E+06 | 6.774E+01 | 1.525E+00 | 4.254E+02 | 2.858E-02 |
| 2092 | 1.755E+03 | 9.590E+05 | 6.443E+01 | 1.451E+00 | 4.047E+02 | 2.719E-02 |
| 2093 | 1.670E+03 | 9.122E+05 | 6.129E+01 | 1.380E+00 | 3.850E+02 | 2.586E-02 |
| 2094 | 1.588E+03 | 8.677E+05 | 5.830E+01 | 1.313E+00 | 3.662E+02 | 2.460E-02 |
| 2095 | 1.511E+03 | 8.254E+05 | 5.546E+01 | 1.249E+00 | 3.483E+02 | 2.340E-02 |
| 2096 | 1.437E+03 | 7.851E+05 | 5.275E+01 | 1.188E+00 | 3.313E+02 | 2.226E-02 |
| 2097 | 1.367E+03 | 7.468E+05 | 5.018E+01 | 1.130E+00 | 3.152E+02 | 2.118E-02 |
| 2098 | 1.300E+03 | 7.104E+05 | 4.773E+01 | 1.075E+00 | 2.998E+02 | 2.014E-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) |
| 2099 | 1.237E+03 | 6.758E+05 | 4.541E+01 | 1.022E+00 | 2.852E+02 | 1.916E-02 |
| 2100 | 1.177E+03 | 6.428E+05 | 4.319E+01 | 9.724E-01 | 2.713E+02 | 1.823E-02 |
| 2101 | 1.119E+03 | 6.115E+05 | 4.108E+01 | 9.249E-01 | 2.580E+02 | 1.734E-02 |
| 2102 | 1.065E+03 | 5.816E+05 | 3.908E+01 | 8.798E-01 | 2.455E+02 | 1.649E-02 |
| 2103 | 1.013E+03 | 5.533E+05 | 3.717E+01 | 8.369E-01 | 2.335E+02 | 1.569E-02 |
| 2104 | 9.634E+02 | 5.263E+05 | 3.536E+01 | 7.961E-01 | 2.221E+02 | 1.492E-02 |
| 2105 | 9.164E+02 | 5.006E+05 | 3.364E+01 | 7.573E-01 | 2.113E+02 | 1.419E-02 |
| 2106 | 8.717E+02 | 4.762E+05 | 3.200E+01 | 7.203E-01 | 2.010E+02 | 1.350E-02 |
| 2107 | 8.292E+02 | 4.530E+05 | 3.044E+01 | 6.852E-01 | 1.912E+02 | 1.284E-02 |
| 2108 | 7.888E+02 | 4.309E+05 | 2.895E+01 | 6.518E-01 | 1.818E+02 | 1.222E-02 |
| 2109 | 7.503E+02 | 4.099E+05 | 2.754E+01 | 6.200E-01 | 1.730E+02 | 1.162E-02 |
| 2110 | 7.137E+02 | 3.899E+05 | 2.620E+01 | 5.898E-01 | 1.645E+02 | 1.105E-02 |
| 2111 | 6.789E+02 | 3.709E+05 | 2.492E+01 | 5.610E-01 | 1.565E+02 | 1.052E-02 |
| 2112 | 6.458E+02 | 3.528E+05 | 2.370E+01 | 5.336E-01 | 1.489E+02 | 1.000E-02 |
| 2113 | 6.143E+02 | 3.356E+05 | 2.255E+01 | 5.076E-01 | 1.416E+02 | 9.515E-03 |
| 2114 | 5.843E+02 | 3.192E+05 | 2.145E+01 | 4.829E-01 | 1.347E+02 | 9.051E-03 |
| 2115 | 5.558E+02 | 3.036E+05 | 2.040E+01 | 4.593E-01 | 1.281E+02 | 8.610E-03 |
| 2116 | 5.287E+02 | 2.888E+05 | 1.941E+01 | 4.369E-01 | 1.219E+02 | 8.190E-03 |
| 2117 | 5.029E+02 | 2.748E+05 | 1.846E+01 | 4.156E-01 | 1.159E+02 | 7.790E-03 |
| 2118 | 4.784E+02 | 2.614E+05 | 1.756E+01 | 3.953E-01 | 1.103E+02 | 7.410E-03 |
| 2119 | 4.551E+02 | 2.486E+05 | 1.670E+01 | 3.761E-01 | 1.049E+02 | 7.049E-03 |
| 2120 | 4.329E+02 | 2.365E+05 | 1.589E+01 | 3.577E-01 | 9.979E+01 | 6.705E-03 |
| 2121 | 4.118E+02 | 2.249E+05 | 1.511E+01 | 3.403E-01 | 9.493E+01 | 6.378E-03 |
| 2122 | 3.917E+02 | 2.140E+05 | 1.438E+01 | 3.237E-01 | 9.030E+01 | 6.067E-03 |
| 2123 | 3.726E+02 | 2.035E+05 | 1.368E+01 | 3.079E-01 | 8.589E+01 | 5.771E-03 |
| 2124 | 3.544E+02 | 1.936E+05 | 1.301E+01 | 2.929E-01 | 8.170E+01 | 5.490E-03 |
| 2125 | 3.371E+02 | 1.842E+05 | 1.237E+01 | 2.786E-01 | 7.772E+01 | 5.222E-03 |
| 2126 | 3.207E+02 | 1.752E+05 | 1.177E+01 | 2.650E-01 | 7.393E+01 | 4.967E-03 |
| 2127 | 3.050E+02 | 1.666E+05 | 1.120E+01 | 2.521E-01 | 7.032E+01 | 4.725E-03 |
| 2128 | 2.902E+02 | 1.585E+05 | 1.065E+01 | 2.398E-01 | 6.689E+01 | 4.495E-03 |
| 2129 | 2.760E+02 | 1.508E+05 | 1.013E+01 | 2.281E-01 | 6.363E+01 | 4.275E-03 |
| 2130 | 2.626E+02 | 1.434E+05 | 9.637E+00 | 2.170E-01 | 6.053E+01 | 4.067E-03 |
| 2131 | 2.497E+02 | 1.364E+05 | 9.167E+00 | 2.064E-01 | 5.758E+01 | 3.869E-03 |
| 2132 | 2.376E+02 | 1.298E+05 | 8.720E+00 | 1.963E-01 | 5.477E+01 | 3.680E-03 |
| 2133 | 2.260E+02 | 1.235E+05 | 8.295E+00 | 1.867E-01 | 5.210E+01 | 3.500E-03 |
| 2134 | 2.150E+02 | 1.174E+05 | 7.890E+00 | 1.776E-01 | 4.956E+01 | 3.330E-03 |
| 2135 | 2.045E+02 | 1.117E+05 | 7.505E+00 | 1.690E-01 | 4.714E+01 | 3.167E-03 |
| 2136 | 1.945E+02 | 1.063E+05 | 7.139E+00 | 1.607E-01 | 4.484E+01 | 3.013E-03 |
| 2137 | 1.850E+02 | 1.011E+05 | 6.791E+00 | 1.529E-01 | 4.265E+01 | 2.866E-03 |
| 2138 | 1.760E+02 | 9.615E+04 | 6.460E+00 | 1.454E-01 | 4.057E+01 | 2.726E-03 |

# APPENDIX C
# Air Emissions Estimates
# And
# Example Calculations

## Table 1
## Hyland Facility Associates Landfill Design Capacity

### Hyland Landfill Design Capacity

Design capacity of the Hyland Landfill: **14,169,300** $yd^3$

**Hyland Average AUF w/o BUD**

| Survey Date | Average AUF w/o BUD - tons/$yd^3$ | |
|---|---|---|
| 4/26/2001 | 0.55 | |
| 4/24/2002 | 0.59 | |
| 4/27/2003 | 0.59 | |
| 4/14/2004 | 0.6 | |
| 11/19/2005 | 0.61 | |
| 11/22/2006 | 0.62 | |
| 11/11/2007 | 0.61 | |
| 12/31/2008 | 0.62 | |
| 10/26/2009 | 0.64 | |
| 6/18/2010 | 0.65 | drill cuttings started in 2010 |
| 11/2/2010 | 0.67 | |

Use SHA 0.675 tons/$yd^3$ as AUF for all MSW

Mutliply AUF by design capacity of landfill: **9,567,778** tons

### Sanborn Head LandGEM Run Tonnage

| Year | Waste in place (Mg) | |
|---|---|---|
| 1998 | 49,814 | |
| 1999 | 157,453 | |
| 2000 | 196,395 | |
| 2001 | 233,119 | |
| 2002 | 245,011 | |
| 2003 | 252,952 | |
| 2004 | 252,998 | |
| 2005 | 339,581 | |
| 2006 | 339,581 | |
| 2007 | 339,581 | |
| 2007 | 339,581 | |
| 2009 | 339,581 | |
| 2010 | 339,581 | |
| 2011 | 339,581 | |
| 2012 | 339,581 | |
| 2013 | 339,581 | |
| 2014 | 339,581 | |
| 2015 | 339,581 | |
| 2016 | 339,581 | |
| 2017 | 339,581 | |
| 2018 | 339,581 | |
| 2019 | 339,581 | |
| 2020 | 339,581 | |
| 2021 | 339,581 | |
| 2022 | 339,581 | |
| 2023 | 339,581 | |
| 2024 | 339,581 | |
| 2025 | 339,581 | |
| 2026 | 163,251 | |
| | | |
| Total | 8,682,194 | Mg |
| | | |
| Total tons | 9,567,778 | tons |
| | | |
| Total $yd^3$ | 14,169,300 | $yd^3$ |
| | | |
| AUF | 0.675 | t/$yd^3$ |

| | | |
|---|---|---|
| 1 ton = | 2000 | lbs |
| 1Mg = | 2204 | lbs |
| Mg = | 1.102 | ton |

**Table 2**
**Waste Accepted Input Into LandGEM**

| | Waste Accepted | |
|---|---|---|
| Year | (Mg/year)[1] | (short tons/year)[2] |
| 1998 | 112,387 | 123,626 |
| 1999 | 112,387 | 123,626 |
| 2000 | 112,387 | 123,626 |
| 2001 | 208,895 | 229,784 |
| 2002 | 204,673 | 225,140 |
| 2003 | 217,893 | 239,682 |
| 2004 | 209,612 | 230,573 |
| 2005 | 214,460 | 235,906 |
| 2006 | 224,391 | 246,830 |
| 2007 | 310,784 | 341,862 |
| 2008 | 277,865 | 305,652 |
| 2009 | 194,805 | 214,285 |
| 2010 | 143,926 | 158,319 |
| 2011 | 422,727 | 465,000 |
| 2012 | 422,727 | 465,000 |
| 2013 | 422,727 | 465,000 |
| 2014 | 422,727 | 465,000 |
| 2015 | 422,727 | 465,000 |
| 2016 | 422,727 | 465,000 |
| 2017 | 422,727 | 465,000 |
| 2018 | 422,727 | 465,000 |
| 2019 | 422,727 | 465,000 |
| 2020 | 422,727 | 465,000 |
| 2021 | 422,727 | 465,000 |
| 2022 | 422,727 | 465,000 |
| 2023 | 422,727 | 465,000 |
| 2024 | 422,727 | 465,000 |
| 2025 | 235,334 | 258,868 |
| | 8,697,980 | 9,567,778 |

1. Calculated by LandGEM
2. Input into LandGEM from Table 3

## TABLE 3

### Hyland Facility Associates Landfill Waste Totals 1998-2010[1]

| | | | | | | A | | | | B | C | D | E | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | MSW (tons) | Asbestos Waste (tons) | Ash (tons) | C&D Debris (tons) | Industrial Waste w/Drill Cuttings (tons) | Industrial Waste Drill Cuttings (tons) | Petroleum Contaminated Soil (tons) | Sewage Treatment Plant Sludge (tons) | MSW/C&D Mixed (Tons) | Year(s) Total (tons) | Total BUD Materials | C&D Type BUD Materials | Years Totals w/ C&D Type BUD Minus Drill Cuttings (B+D)-A | Total Waste in Landfill (B+C) | Identify Landfill Section(s) Used |
| 1998 | 50,403 | 2,424 | 655 | 17,171 | 9,290 | 0 | 372 | 236 | 43,076 | 123,626 | 0 | 0 | 123,626 | 123,626 | Cell 1 |
| 1999 | 50,403 | 2,424 | 655 | 17,171 | 9,290 | 0 | 372 | 236 | 43,076 | 123,626 | 0 | 0 | 123,626 | 123,626 | Cell 1 |
| 2000 | 50,403 | 2,424 | 655 | 17,171 | 9,290 | 0 | 372 | 236 | 43,076 | 123,626 | 32,046 | 0 | 123,626 | 155,672 | Cell 1 |
| 2001 | 18,805 | 655 | 0 | 6,422 | 1,956 | 0 | 242 | 1,781 | 199,923 | 229,784 | 7,478 | 0 | 229,784 | 237,262 | Cell 1 |
| 2002 | 18,437 | 0 | 0 | 6,004 | 7,560 | 0 | 89 | 2,037 | 190,833 | 224,960 | 45,908 | 180 | 225,140 | 270,868 | Cell 1 |
| 2003 | 4,951 | 0 | 0 | 2,316 | 26,299 | 0 | 0 | 1,741 | 197,010 | 232,317 | 73,191 | 7,365 | 239,682 | 305,508 | Cell 1 & 2 |
| 2004* | 170,313 | 0 | 0 | 17,178 | 16,402 | 0 | 0 | 21,939 | 0 | 225,832 | 21,777 | 4,741 | 230,573 | 247,609 | Cell 1 & 2 |
| 2005 | 201,150 | 0 | 0 | 9,218 | 13,069 | 0 | 0 | 7,421 | 0 | 230,858 | 32,903 | 5,048 | 235,906 | 263,761 | Cell 1 & 2 |
| 2006 | 212,848 | 0 | 0 | 942 | 4,603 | 0 | 0 | 12,680 | 0 | 231,073 | 27,428 | 15,757 | 246,830 | 258,501 | Cell 1 & 2 |
| 2007 | 230,729 | 0 | 0 | 23,240 | 4,449 | 0 | 0 | 32,216 | 0 | 290,634 | 59,881 | 51,228 | 341,862 | 350,515 | Cell 1 & 2 |
| 2008 | 198,674 | 0 | 0 | 43,308 | 15,276 | 0 | 0 | 23,937 | 0 | 281,195 | 42,969 | 24,457 | 305,652 | 324,164 | Cell 1, 2 & 3 |
| 2009 | 145,897 | 0 | 297 | 27,178 | 7,396 | 0 | 0 | 31,427 | 0 | 212,195 | 37,941 | 2,090 | 214,285 | 250,136 | Cell 3 |
| 2010 | 101,706 | 0 | 0 | 18,536 | 163,673 | 158,686 | 0 | 19,239 | 7,859 | 311,013 | 70,568 | 5,992 | 158,319 | 381,581 | |
| **WIP Cumulative Total** | **1,454,718** | **7,926** | **2,263** | **205,854** | **288,552** | **158,686** | **1,446** | **155,125** | **724,854** | **2,840,738** | **452,090** | **116,858** | **2,798,910** | **3,292,828** | |

Notes:

1. Waste totals and waste types provided by Hyland Facility Associates.
2. Years Total = MSW+Asbestos Waste+Ash+C&D Debris+Indusrial Waste+Petro. Cont. Soil+Sewage Sludge+MSW/C&D Mixed

**TABLE 4**
**LFGTE PLANT AND FLARE PTE EMISSION ESTIMATES**

## General Information

| | | |
|---|---|---|
| LFG Generation From LandGEM | 3511 | $ft^3$/min |
| Landfill gas collected @ 75% efficiency | 2633 | $ft^3$/min |
| Landfill gas Input for 3 engines | 1594 | $ft^3$/min |
| LFG to flare | 1040 | $ft^3$/min |
| Maximum power output per engine: | 2233 | bhp |
| For three (3) engines | 6699 | bhp |
| Maximum operating hours | 8760 | hrs/yr |
| LFG low heating value from John Zink | 456 | BTU/scf |

Maximum Landfill Gas Input to CAT G3520 Engines

| | | |
|---|---|---|
| Single engine power @ 100% load* | 2233 | bhp |
| Nominal fuel consumption* | 6509 | BTU/bhp-hr |
| Calculated Nominal Heat Rate | 14,534,597 | BTU/hr |
| Calculated Maximum LFG Input per Engine | 531 | $ft^3$/min |
| Maximum LFG Input for 3 Engines | 1,594 | $ft^3$/min |

*From CAT G3520 engines specs

Other LFG Data:

| | | |
|---|---|---|
| NMOC | 211 | ppmv as hexane (site specific Tier 2 test data) |
| Total $H_2S$ | 280 | ppmv (site specific test data) |
| Total reduced sulfur | 285 | ppmv (site specific test data) |
| NMOC | 98.00% | (Destruction efficiency, per the NSPS Subpart WWW for an enclosed combuster) |
| $CH_4$ | 50% | of landfill gas per AP-42 |
| One pound | 453.5 | grams |
| One pound | 453,500 | milligrams |

### LFGTE Plant Emissions

***Engine Emission Factors:***

| | | |
|---|---|---|
| NOx | 0.60 g/bhp-hour | Title V permitted emission rate |
| CO | 3.00 g/bhp-hour | Title V permitted emission rate |

| Air Pollutant | Emission Factor (g/bhp-hour) | LFGTE Power (bhp) | Hours per Year | Conversion (g/lbs) | Conversion (lbs/t) | LFGTE Emission Estimate (t/yr) |
|---|---|---|---|---|---|---|
| NOx | 0.6 | 6699 | 8760 | 453.5 | 2000 | 38.8 |
| CO | 3.0 | 6699 | 8760 | 453.5 | 2000 | 194.1 |

| Air Pollutant | Gas Flow $ft^3$/year | Gas Flow $m^3$/year | Molecular Weight | Conversion factor[2] ppmv to $mg/m^3$ | Concentration in LFG (ppmv) | Concentration in LFG ($mg/m^3$) | Emission Rate (mg/yr) | Emission Rate (gm/yr) | Emission Rate (lbs/yr) | Destruction Efficiency %[4] | LFGTE Emission Estimate (lbs/yr) | LFGTE Emission Estimate (t/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$[5] | 837,651,774 | 23,729,512 | 64 | 2.62 | 285 | 746 | 17,702,507,130 | 17,702,507 | 39,035 | 0.0 | 39,035 | 19.52 |
| NMOC as Hexane[3] | 837,651,774 | 23,729,512 | 86 | 3.52 | 211 | 744 | 17,648,137,917 | 17,648,138 | 38,915 | 98.0 | 778 | 0.39 |
| $H_2S$[6] | 837,651,774 | 23,729,512 | 34 | 1.39 | 280 | 389 | 9,239,466,441 | 9,239,466 | 20,374 | 98.0 | 407 | 0.20 |

| Air Pollutant | Emission Rate (lbs/$10^6$ $ft^3$ of $CH_4$) | LFG Flow Rate ($10^6$ $ft^3$/year) | $CH_4$ Flow Rate @ 50% of LFG ($10^6$ $ft^3$/year) | LFGTE Emission Estimate (lbs/yr) | LFGTE Emission Estimate (t/yr) |
|---|---|---|---|---|---|
| PM[7] | 48 | 838 | 419 | 20,104 | 10.1 |

## TABLE 4
## LFGTE PLANT AND FLARE PTE EMISSION ESTIMATES

### 3000 CFM Open Flare Emissions

***John Zink Flare Emission Factors***

| | | |
|---|---|---|
| NOx | 0.068 | lbs/MMBTU |
| CO | 0.37 | lbs/MMBTU |

| Air Pollutant | Emission Factor (lbs/MMBTU) | LFG Used ($ft^3$/min) | Hours per Year | Conversion (min/hr) | LFG Usage MMft3/yr | LFG Heat Value BTU/$ft^3$ | Annual Heat Value MMBTU/yr | Flare Emission Estimate t/yr |
|---|---|---|---|---|---|---|---|---|
| NOx | 0.068 | 1040 | 8760 | 60.0 | 546.4 | 456 | 249,151 | 8.5 |
| CO | 0.37 | 1040 | 8760 | 60.0 | 546.4 | 456 | 249,151 | 46.1 |

| Air Pollutant | Gas Flow[1] $ft^3$/year | Gas Flow[1] $m^3$/year | Molecular Weight | Conversion factor[2] | ppmv[3] | Concentration in LFG ($mg/m^3$) | mg/year | gm/year | lbs/year | Destruction Efficiency % | Flare Emission Estimate (lbs/yr) | Flare Emission Estimate (t/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SO_2$[5] | 546,384,426 | 15,478,312 | 64 | 2.62 | 285 | 746 | 11,547,010,922 | 11,547,011 | 25,462 | 0.0 | 25,462 | 12.73 |
| NMOC as Hexane | 546,384,426 | 15,478,312 | 86 | 3.52 | 211 | 744 | 11,511,546,911 | 11,511,547 | 25,384 | 98.0 | 508 | 0.25 |
| $H_2S$[6] | 546,384,426 | 15,478,312 | 34 | 1.39 | 280 | 389 | 6,026,729,385 | 6,026,729 | 13,289 | 98.0 | 266 | 0.13 |

| Air Pollutant | Emission Rate (lbs/$10^6$ $ft^3$ of $CH_4$) | LFG Flow Rate ($10^6$ $ft^3$/year) | $CH_4$ Flow Rate @ 50% of LFG ($10^6$ $ft^3$/year) | LFGTE Emission Estimate (lbs/yr) | LFGTE Emission Estimate (t/yr) |
|---|---|---|---|---|---|
| PM[8] | 17 | 546 | 273 | 4,644 | 2.3 |

1. Gas flow from LandGem results @ 75% collection efficiency minus LFG to LFGTE plant.
2. AP-42 converts ppmv to mg/m3 by multiplying ppmv by M/24.45 where M = molecular weight eg. CO = 12+16 = 28, 24.45 is derived from the molar gas constant R times T ($25^0C$) in Kelvin or .08205x298.
3. NMOC concentration of 211 ppmv is obtained from 2010 Hyland Tier 2 report.
4. From AP-42 engine and flare destructive efficiency Table 2.4-3 assumed to be at least 98%.
5. SO2 is based on total reduced sulfur (including $H_2S$) of 285 ppmv in the landfill gas per the 2010 Hyland Tier 2 report.
6. $H_2S$ is based on concentration of 280 ppmv in the landfill gas per the 2010 Hyland Tier 2 report.
7. From AP-42 Table 2.4-5 engine PM emission factor 48 lbs/$10^6$ dscf $CH_4$.
8. From AP-42 Table 2.4-5 flare PM emission factor of 17 lbs/$10^6$ dscf $CH_4$.

**Sample Estimated LFGTE and Open Flare Emissions Calculations**
**Hyland Facility Associates Landfill**

## Landfill Gas Generation and Collection Rate

LandGEM v3.02 was used to estimate the the amount of LFG generated in the peak year 2025, when the Hyland Landfill is projected to be at capacity. LFG production in 2025 is projected to be 3,511 cubic feet per minute ($ft^3/min$). Assuming a 75% collection efficiency, approximately 2,633 ft3/min of LFG will be available for combustion in the LFGTE plant and the open flare.

## Maximum LFG to the LFGTE Plant

Maximum LFG input to each of the CAT 3520 engines is based on engine power at 100% load (2233 bhp) and nominal fuel consumption (6509 BTU/bhp-hr) as provided on the Caterpillar G3520 specification sheet attached to these sample calculations. Using these two values the nominal heat rate for each engine can be calculated:

2233 bhp x 6509 BTU/bhp-hr = 14,534,597 BTU/hr

Maximum LFG to each engine is calculated as follows using the LFG low heating value of 456 BTU/$ft^3$ provided on the Caterpillar specification as follows:

14,534,597 BTU/hr x 1 $ft^3$ of LFG/456 BTU x 1 hr/60 min = 531 $ft^3/min$

For three engines:

3 x 531 $ft^3/min$ = 1,594 $ft^3/min$ or 1,594 ft3/min x 60min/hrs x 8760 hrs/yr = 837,651,744 ft3/yr

## LFG to the Open Flare

Assuming 2,633 ft3/min of LFG is collected and the LFGTE plant can combust a maximum of 1,594 $ft^3/min$ then the remaining amount needs to be controlled by the flare:

2,633 $ft^3/min$ - 1,594 $ft^3/min$ = 1,040 $ft^3/min$ to the open flare

## LFGTE Plant Estimated Emissions

The LFGTE engine emission factors for NOx and CO are based on the Title V emission rates of 0.6 g/bhp-hr (NOx) and 3.0 g/bhp-hr (CO). As an example, the annual emssion rate for NOx is estimated as follows:

3.0 g/bhp-hr x 6699 bhp x 8760 hr/yr x 1 lbs/453 g x 1 t/2000 lbs = 38.8 t/yr NOx

The estimate annual CO emission rate is calculated in the same manner.

The estimated annual emission rate for $SO_2$, NMOC and $H_2S$ is based on converting the concentration of the pollutants in parts per million by volume (ppmv) to milligrams per cubic meter ($mg/m^3$) by multiplying the conentration in ppmv by M/24.45 where M is the molecular. weight of the pollutant in g-mole. The concentration of the pollutant in $mg/m^3$ is multiplied by the maximum annual volume of combusted landfill gas in $m^3/yr$. This results in an annual emission rate in units of mg/yr which is converted to t/yr.

Example calculations for annual $SO_2$ emissions, assuming 285 ppmv total reduced sulfur in the landfill gas, are as follows:

285 ppmv x 64 g-mole/24.45 = 746 mg/$m^3$

837,651,744 $ft^3$/yr x $m^3$/35.3 $ft^3$ = 23,729,512 $m^3$/yr

23,729,512 m3/yr x 746 mg/m3 = 17,702,507,130 mg/yr

Convert mg/yr to lbs/yr:

17,702,507,130 mg/yr x lbs/453,500 mg = 39,035 lbs/yr

Convert lbs/yr to t/yr:

39,035 lbs/yr x t/2000lbs = 19.52 t/yr

NMOC and $H_2S$ are estimated the same way except there is a reduction factor of 98 percent due to the fact that NMOCs and $SO_2$ are destroyed by 98 percent during combustion per AP-42 Table 2.4-3.

The estimated PM emissions are based on AP-42 Table 2.4-5 engine PM emission factor of 48 lbs/$10^6$ dry standard cubic foot (dscf) of $CH_4$. An example calculation for annual PM emissions assuming 50% methane in the LFG is as follows:

838 x $10^6$ $ft^3$ LFG/yr x .50 = 419 x $10^6$ $ft^3$ CH4/yr

48 lbs/$10^6$ $ft^3$ CH4 x 419 x $10^6$ $ft^3$ CH4/yr x t/2000 lbs = 10.1 t/yr

**Open Flare Estimated Emissions**

The open flare emissions are estimated in the same manner as the LFGTE emissions.

# G3520C

## GAS ENGINE TECHNICAL DATA

CATERPILLAR®

| | | | |
|---|---|---|---|
| ENGINE SPEED: | 1200 | FUEL: | LOW ENERGY (1.43 CH4:CO2 RATIO) |
| COMPRESSION RATIO: | 11.3:1 | FUEL SYSTEM: | CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL |
| AFTERCOOLER - STAGE 1 MAX. INLET (°F): | 218 | | |
| AFTERCOOLER - STAGE 2 MAX. INLET (°F): | 130 | FUEL PRESS. RANGE (PSIG): | 1.5 - 5.0 |
| JACKET WATER - MAX. OUTLET (°F): | 230 | MIN. METHANE NUMBER: | 135 |
| COOLING SYSTEM: | JW+1AC, OC+2AC | RATED ALTITUDE (FT): | 1378 |
| IGNITION SYSTEM: | ADEM3 | AT AIR TO TURBO. TEMP. (°F): | 77 |
| SPARK PLUG TYPE: | J-GAP | NOx EMISSION LEVEL: | 0.5 g/bhp-hr |
| EXHAUST MANIFOLD: | DRY | FUEL LHV (BTU/SCF): | 456 |
| COMBUSTION: | LOW EMISSION | APPLICATION: | GENSET |

| RATING AND EFFICIENCY | | NOTES | LOAD | 100% | 75% | 50% |
|---|---|---|---|---|---|---|
| ENGINE POWER | (WITHOUT FAN) | (1) | BHP | 2233 | 1675 | 1116 |
| GENERATOR POWER | (WITHOUT FAN) | (2) | EKW | 1600 | 1200 | 800 |
| **ENGINE EFFICIENCY** | **(ISO 3046/1)** | **(3)** | **%** | **40.1** | **38.6** | **36.1** |
| ENGINE EFFICIENCY | (NOMINAL) | (3) | % | 39.1 | 37.7 | 35.2 |
| THERMAL EFFICIENCY | (NOMINAL) | (4) | % | 40.1 | 39.3 | 40.8 |
| TOTAL EFFICIENCY | (NOMINAL) | (5) | % | 79.2 | 77.0 | 76.0 |

| ENGINE DATA | | | | | | |
|---|---|---|---|---|---|---|
| **FUEL CONSUMPTION** | **(ISO 3046/1)** | **(6)** | **BTU/bhp-hr** | **6354** | **6592** | **7047** |
| FUEL CONSUMPTION | (NOMINAL) | (6) | BTU/bhp-hr | 6509 | 6753 | 7219 |
| AIR FLOW (77 °F, 14.7 psi) | | (7) | SCFM | 4512 | 3415 | 2286 |
| AIR FLOW | | (7) | lb/hr | 20006 | 15141 | 10136 |
| COMPRESSOR OUT PRESSURE | | | in. HG (abs) | 105.8 | 80.8 | 55.5 |
| COMPRESSOR OUT TEMPERATURE | | | °F | 375 | 306 | 220 |
| AFTERCOOLER AIR OUT TEMPERATURE | | | °F | 142 | 138 | 135 |
| INLET MAN. PRESSURE | | (8) | in. HG (abs) | 94.4 | 71.5 | 48.9 |
| INLET MAN. TEMPERATURE | (MEASURED IN PLENUM) | (9) | °F | 142 | 138 | 135 |
| TIMING | | (10) | °BTDC | 27 | 27 | 27 |
| EXHAUST STACK TEMPERATURE | | (11) | °F | 898 | 943 | 984 |
| EXHAUST GAS FLOW (@ stack temp.) | | (12) | CFM | 12476 | 9780 | 6770 |
| EXHAUST MASS FLOW | | (12) | lb/hr | 22318 | 16940 | 11418 |

| EMISSIONS DATA | | | | | |
|---|---|---|---|---|---|
| NOx (as NO2) | (13) | g/bhp-hr | 0.5 | 0.5 | 0.5 |
| NTE CO | (14) | g/bhp-hr | 4.13 | 4.25 | 4.4 |
| NOMINAL CO | (15) | g/bhp-hr | 2.5 | 2.5 | 2.5 |
| THC (molecular weight of 15.84) | (14) | g/bhp-hr | 5.84 | 6.49 | 7.51 |
| NMHC (molecular weight of 15.84) | (14) | g/bhp-hr | 0.88 | 0.98 | 1.13 |
| EXHAUST O2 | (16) | % DRY | 9.0 | 8.8 | 8.6 |
| LAMBDA | (16) | | 1.71 | 1.67 | 1.57 |

| HEAT BALANCE DATA | | | | | |
|---|---|---|---|---|---|
| LHV INPUT | (17) | BTU/min | 242216 | 188451 | 134313 |
| HEAT REJECTION TO JACKET | (18) | BTU/min | 28738 | 23806 | 21929 |
| HEAT REJECTION TO ATMOSPHERE | (19) | BTU/min | 7210 | 6034 | 4857 |
| HEAT REJECTION TO LUBE OIL | (20) | BTU/min | 10108 | 9524 | 8917 |
| HEAT REJECTION TO EXHAUST (LHV to 77°F) | (21) | BTU/min | 76779 | 65253 | 45101 |
| HEAT REJECTION TO EXHAUST (LHV to 350°F) | (21) | BTU/min | 54657 | 45140 | 32710 |
| HEAT REJECTION TO A/C - STAGE 1 | (22) | BTU/min | 13823 | 5157 | 102 |
| HEAT REJECTION TO A/C - STAGE 2 | (23) | BTU/min | 8895 | 5684 | 4086 |

**CONDITIONS AND DEFINITIONS**

ENGINE RATING OBTAINED AND PRESENTED IN ACCORDANCE WITH ISO 3046/1. DATA REPRESENTS CONDITIONS OF 77°F, 29.6 IN HG BAROMETRIC PRESSURE, 30% RELATIVE HUMIDITY, 10 IN H2O AIR FILTER RESTRICTION, AND 20 IN H2O EXHAUST STACK PRESSURE. ENGINE EFFICIENCY AND FUEL CONSUMPTION SPECIFICALLY NOTED AS ISO 3046/1 ARE REPRESENTED WITH 5 IN H2O AIR FILTER RESTRICTION AND 0 IN H2O EXHAUST STACK PRESSURE. CONSULT ALTITUDE CURVES FOR APPLICATIONS ABOVE MAXIMUM RATED ALTITUDE AND/OR TEMPERATURE. NO OVERLOAD PERMITTED AT RATING SHOWN.

EMISSION LEVELS ARE BASED ON THE ENGINE OPERATING AT STEADY STATE CONDITIONS AND ADJUSTED TO THE SPECIFIED NOx LEVEL AT 100% LOAD. EMISSION TOLERANCES SPECIFIED ARE DEPENDENT UPON FUEL QUALITY. METHANE NUMBER CANNOT VARY MORE THAN ± 3. PUBLISHED PART LOAD DATA IS WITH AIR FUEL RATIO CONTROL.

ENGINE RATING IS WITH 2 ENGINE DRIVEN WATER PUMPS. PUMP POWER IS NOT INCLUDED IN HEAT BALANCE DATA.

FOR NOTES INFORMATION CONSULT PAGE THREE.

## FUEL USAGE GUIDE

| CAT METHANE NUMBER | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IGNITION TIMING | - | - | - | - | - | - | - | - | 24 | 26 | 28 | 30 |
| DERATION FACTOR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 1.00 | 1.00 | 1.00 |

## ALTITUDE DERATION FACTORS

| AIR TO TURBO (°F) | 0 | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 | 10000 | 11000 | 12000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 0.96 | 0.93 | 0.89 | 0.86 | 0.83 | 0.79 | 0.76 | 0.74 | 0.71 | 0.68 | 0.65 | 0.63 | 0.60 |
| 120 | 0.98 | 0.94 | 0.91 | 0.87 | 0.84 | 0.81 | 0.78 | 0.75 | 0.72 | 0.69 | 0.66 | 0.64 | 0.61 |
| 110 | 0.99 | 0.96 | 0.92 | 0.89 | 0.86 | 0.82 | 0.79 | 0.76 | 0.73 | 0.70 | 0.68 | 0.65 | 0.62 |
| 100 | 1.00 | 0.97 | 0.94 | 0.90 | 0.87 | 0.84 | 0.81 | 0.77 | 0.74 | 0.72 | 0.69 | 0.66 | 0.63 |
| 90 | 1.00 | 0.99 | 0.96 | 0.92 | 0.89 | 0.85 | 0.82 | 0.79 | 0.76 | 0.73 | 0.70 | 0.67 | 0.65 |
| 80 | 1.00 | 1.00 | 0.97 | 0.94 | 0.90 | 0.87 | 0.84 | 0.80 | 0.77 | 0.74 | 0.71 | 0.68 | 0.66 |
| 70 | 1.00 | 1.00 | 0.99 | 0.96 | 0.92 | 0.89 | 0.85 | 0.82 | 0.79 | 0.76 | 0.73 | 0.70 | 0.67 |
| 60 | 1.00 | 1.00 | 1.00 | 0.97 | 0.94 | 0.90 | 0.87 | 0.83 | 0.80 | 0.77 | 0.74 | 0.71 | 0.68 |
| 50 | 1.00 | 1.00 | 1.00 | 0.99 | 0.96 | 0.92 | 0.88 | 0.85 | 0.82 | 0.79 | 0.76 | 0.73 | 0.70 |

ALTITUDE (FEET ABOVE SEA LEVEL)

## AFTERCOOLER HEAT REJECTION FACTORS

| AIR TO TURBO (°F) | 0 | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 | 10000 | 11000 | 12000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 1.33 | 1.37 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 |
| 120 | 1.26 | 1.31 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 | 1.33 |
| 110 | 1.19 | 1.24 | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 | 1.26 |
| 100 | 1.13 | 1.17 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| 90 | 1.06 | 1.11 | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 |
| 80 | 1.00 | 1.04 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 | 1.06 |
| 70 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 60 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 50 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

ALTITUDE (FEET ABOVE SEA LEVEL)

**FUEL USAGE GUIDE:**

This table shows the derate factor required for a given fuel. Note that deration occurs as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar Methane Number Calculation program.

**ALTITUDE DERATION FACTORS:**

This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart to help determine actual engine power for your site.

**INLET AND EXHAUST RESTRICTION CORRECTIONS FOR ALTITUDE CAPABILITY:**

To determine the appropriate altitude derate factor to be applied to this engine for inlet or exhaust restrictions differering from the standard conditions listed on page 1, a correction to the site altitude can be made to adjust for this difference. Add 141 feet to the site altitude for each additional inch of $H_2O$ of exhaust stack pressure greater than spec sheet conditions. Add 282 feet to the site altitude for each additional inch of $H_2O$ of inlet restriction greater than spec sheet conditions. If site inlet restriction or exhaust stack pressure are less than spec sheet conditions, the same trends apply to lower the site altitude.

**ACTUAL ENGINE RATING:**

It is important to note that the Altitude/Temperature deration and the Fuel Usage Guide deration are not cumulative. They are not to be added together. The same is true for the Low Energy Fuel deration (reference the Caterpillar Methane Number Program) and the Fuel Usage Guide deration. However, the Altitude/Temperature deration and Low Energy Fuel deration are cumulative; and they must be added together in the method shown below. To determine the actual power available, take the lowest rating between 1) and 2).

1) (Altitude/Temperature Deration) + (Low Energy Fuel Deration)
2) Fuel Usage Guide Deration

Note: For NA's always add the Low Energy Fuel deration to the Altitude/Temperature deration. For TA engines only add the Low Energy Fuel deration to the Altitude/Temperature deration whenever the Altitude/Temperature deration is less than 1.0 (100%). This will give the actual rating for the engine at the conditions specified.

**AFTERCOOLER HEAT REJECTION FACTORS:**

Aftercooler heat rejection is given for standard conditions of 77°F and 500 ft altitude. To maintain a constant air inlet manifold temperature, as the air to turbo temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor to adjust for ambient and altitude conditions. Multiply this factor by the standard aftercooler heat rejection. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail. For 2 Stage Aftercoolers with separate circuits, the 1st stage will collect 90% of the additional heat.

**NOTES**

1 ENGINE RATING IS WITH 2 ENGINE DRIVEN WATER PUMPS. TOLERANCE IS ± 3% OF FULL LOAD.

2 GENERATOR POWER DETERMINED WITH AN ASSUMED GENERATOR EFFICIENCY OF 96.1% AND POWER FACTOR OF 0.8 [GENERATOR POWER = ENGINE POWER x GENERATOR EFFICIENCY].

3 ISO 3046/1 ENGINE EFFICIENCY TOLERANCE IS (+)0, (-)5% OF FULL LOAD % EFFICIENCY VALUE. NOMINAL ENGINE EFFICIENCY TOLERANCE IS ± 2.5% OF FULL LOAD % EFFICIENCY VALUE.

4 THERMAL EFFICIENCY: JACKET HEAT + STAGE 1 A/C HEAT + EXH. HEAT TO 350°F.

5 TOTAL EFFICIENCY = ENGINE EFF. + THERMAL EFF. TOLERANCE IS ± 10% OF FULL LOAD DATA.

6 ISO 3046/1 FUEL CONSUMPTION TOLERANCE IS (+)5, (-)0% OF FULL LOAD DATA. NOMINAL FUEL CONSUMPTION TOLERANCE IS ± 2.5 % OF FULL LOAD DATA.

7 UNDRIED AIR. FLOW TOLERANCE IS ± 5 %

8 INLET MANIFOLD PRESSURE TOLERANCE IS ± 5 %

9 INLET MANIFOLD TEMPERATURE TOLERANCE IS ± 9°F.

10 TIMING INDICATED IS FOR USE WITH THE MINIMUM FUEL METHANE NUMBER SPECIFIED. CONSULT THE APPROPRIATE FUEL USAGE GUIDE FOR TIMING AT OTHER METHANE NUMBERS.

11 EXHAUST STACK TEMPERATURE TOLERANCE IS (+)63°F, (-)54°F.

12 WET EXHAUST. FLOW TOLERANCE IS ± 6 %

13 NOX TOLERANCES ARE ± 18 % OF SPECIFIED VALUE.

14 NTE CO, CO2, THC, and NMHC VALUES ARE "NOT TO EXCEED".

15 NOMINAL CO IS A NOMINAL VALUE AND IS REPRESENTATIVE OF A NEW ENGINE DURING THE FIRST 100 HOURS OF ENGINE OPERATION.

16 O2% TOLERANCE IS ± 0.5; LAMBDA TOLERANCE IS ± 0.05. LAMBDA AND O2 LEVEL ARE THE RESULT OF ADJUSTING THE ENGINE TO OPERATE AT THE SPECIFIED NOX LEVEL.

17 LHV RATE TOLERANCE IS ± 2.5%.

18 TOTAL JW HEAT (based on treated water) = JACKET HEAT + STAGE 1 A/C HEAT + 0.90 x (STAGE 1 + STAGE 2) x (ACHRF-1). TOLERANCE IS ± 10 % OF FULL LOAD DATA.

19 RADIATION HEAT RATE BASED ON TREATED WATER. TOLERANCE IS ± 50% OF FULL LOAD DATA.

20 LUBE OIL HEAT RATE BASED ON TREATED WATER. TOLERANCE IS ± 20% OF FULL LOAD DATA.

21 EXHAUST HEAT RATE BASED ON TREATED WATER. TOLERANCE IS ± 10% OF FULL LOAD DATA.

22 STAGE 1 A/C HEAT (based on treated water) = STAGE 1 A/C HEAT + 0.90 x (STAGE 1 + STAGE 2) x (ACHRF-1). TOLERANCE IS ± 5 % OF FULL LOAD DATA.

23 STAGE 2 A/C HEAT (based on treated water) = (STAGE 2 A/C HEAT + (STAGE 1 + STAGE 2) x 0.10 x (ACHRF - 1)) + LUBE OIL HEAT. TOLERANCE IS ± 5 % OF FULL LOAD DATA.

## TABLE 5

**HAPS Emissions From LandGEM Run**

| HAPs | Emission Rate (short tons/year) | |
|---|---|---|
| 1,1,1-Trichloroethane (methyl chloroform) - HAP | 0.14 | |
| 1,1,2,2-Tetrachloroethane - HAP/VOC | 0.40 | |
| 1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC | 0.52 | |
| 1,1-Dichloroethene (vinylidene chloride) - HAP/VOC | 0.04 | |
| 1,2-Dichloroethane (ethylene dichloride) - HAP/VOC | 0.09 | |
| 1,2-Dichloropropane (propylene dichloride) - HAP/VOC | 0.04 | |
| Acrylonitrile - HAP/VOC | 0.73 | |
| Benzene - No or Unknown Co-disposal - HAP/VOC | 0.32 | |
| Benzene - Co-disposal - HAP/VOC | 1.88 | |
| Carbon disulfide - HAP/VOC | 0.10 | |
| Carbon tetrachloride - HAP/VOC | 0.00 | |
| Carbonyl sulfide - HAP/VOC | 0.06 | |
| Chlorobenzene - HAP/VOC | 0.06 | |
| Chloroethane (ethyl chloride) - HAP/VOC | 0.18 | |
| Chloroform - HAP/VOC | 0.01 | |
| Dichlorobenzene - (HAP for para isomer/VOC) | 0.07 | |
| Dichloromethane (methylene chloride) - HAP | 2.60 | |
| Ethylbenzene - HAP/VOC | 1.07 | |
| Ethylene dibromide - HAP/VOC | 0.00 | |
| Hexane - HAP/VOC | 1.24 | |
| Mercury (total) - HAP | 0.00 | |
| Methyl ethyl ketone - HAP/VOC | 1.12 | |
| Methyl isobutyl ketone - HAP/VOC | 0.42 | |
| Perchloroethylene (tetrachloroethylene) - HAP | 1.34 | |
| Toluene - No or Unknown Co-disposal - HAP/VOC | 7.85 | |
| Trichloroethylene (trichloroethene) - HAP/VOC | 0.80 | |
| Vinyl chloride - HAP/VOC | 1.00 | |
| Xylenes - HAP/VOC | 2.78 | |
| Total HAPs | 24.88 | tons/yr |
| HAPS to control devices @ 75% collection efficiency | 18.66 | tons/yr |
| Assume 98.0% destruction efficiency from controls | 0.37 | tons/yr |
| Fugitive HAPs from landfill | 6.22 | tons/yr |

## TABLE 6

**VOC Emissions From LandGEM Run**

| VOCs | Emission Rate (short tons/year) | |
|---|---|---|
| 1,1,2,2-Tetrachloroethane - HAP/VOC | 0.40 | |
| 1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC | 0.52 | |
| 1,1-Dichloroethene (vinylidene chloride) - HAP/VOC | 0.04 | |
| 1,2-Dichloroethane (ethylene dichloride) - HAP/VOC | 0.09 | |
| 1,2-Dichloropropane (propylene dichloride) - HAP/VOC | 0.04 | |
| 2-Propanol (isopropyl alcohol) - VOC | 6.57 | |
| Acrylonitrile - HAP/VOC | 0.73 | |
| Benzene - No or Unknown Co-disposal - HAP/VOC | 0.32 | |
| Benzene - Co-disposal - HAP/VOC | 1.88 | |
| Bromodichloromethane - VOC | 1.11 | |
| Butane - VOC | 0.64 | |
| Carbon disulfide - HAP/VOC | 0.10 | |
| Carbon tetrachloride - HAP/VOC | 0.00 | |
| Carbonyl sulfide - HAP/VOC | 0.06 | |
| Chlorobenzene - HAP/VOC | 0.06 | |
| Chloroethane (ethyl chloride) - HAP/VOC | 0.18 | |
| Chloroform - HAP/VOC | 0.01 | |
| Chloromethane - VOC | 0.13 | |
| Dichlorobenzene - (HAP for para isomer/VOC) | 0.07 | |
| Dichlorofluoromethane - VOC | 0.58 | |
| Dimethyl sulfide (methyl sulfide) - VOC | 1.06 | |
| Ethanol - VOC | 2.72 | |
| Ethyl mercaptan (ethanethiol) - VOC | 0.31 | |
| Ethylbenzene - HAP/VOC | 1.07 | |
| Ethylene dibromide - HAP/VOC | 0.00 | |
| Fluorotrichloromethane - VOC | 0.23 | |
| Hexane - HAP/VOC | 1.24 | |
| Methyl ethyl ketone - HAP/VOC | 1.12 | |
| Methyl isobutyl ketone - HAP/VOC | 0.42 | |
| Methyl mercaptan - VOC | 0.26 | |
| Pentane - VOC | 0.52 | |
| Propane - VOC | 1.06 | |
| t-1,2-Dichloroethene - VOC | 0.59 | |
| Toluene - No or Unknown Co-disposal - HAP/VOC | 7.85 | |
| Trichloroethylene (trichloroethene) - HAP/VOC | 0.80 | |
| Vinyl chloride - HAP/VOC | 1.00 | |
| Xylenes - HAP/VOC | 2.78 | |
| Total VOCs | 36.59 | tons/yr |
| VOCs to control devices @ 75% collection efficiency | 27.44 | tons/yr |
| Assume 98.0% destruction efficiency from controls | 0.55 | tons/yr |
| Fugitive VOCs from landfill | 9.15 | tons/yr |

**TABLE 7**

**Estimated Fugitive $H_2S$ and NMOC Emissions from the Hyland Facility Associates Landfill**

| | | |
|---|---|---|
| LFG Generation From LandGEM | 3511 | $ft^3$/min |
| Landfill gas collected @ 75% efficiency | 2633 | $ft^3$/min |
| Estimated Fugitive LFG | 878 | $ft^3$/min |

| Landfill Fugitive Air Pollutant | LFG Flow ft3/year | LFG Flow m3/year | Molecular Weight | Conversion Factor[2] ppmv to mg/m3 | Concentration in LFG (ppmv) | Concentration in LFG (mg/m3) | Emission Rate (mg/yr) | Emission Rate (gm/yr) | Landfill Emission Estimate (lbs/yr) | Landfill Emission Estimate (t/yr) |
|---|---|---|---|---|---|---|---|---|---|---|
| NMOC as Hexane[1] | 461,345,400 | 13,069,275 | 86 | 3.52 | 211 | 742 | 9,699,593,468 | 9,699,593 | 21,388 | 10.69 |
| $H_2S$[3] | 461,345,400 | 13,069,275 | 34 | 1.39 | 280 | 389 | 5,088,731,942 | 5,088,732 | 11,221 | 5.61 |

1. NMOC concentration of 211 ppmv is obtained from 2010 Hyland Tier 2 report.
2. AP-42 converts ppmv to mg/m3 by multiplying ppmv by M/24.45 where M = molecular weight eg. CO = 12+16 = 28, 24.45 is derived from molar gas constant R times T ($25^0$C) in Kelvin or .08205x298.
3. $H_2S$ concentration of 280 ppmv is obtained from 2010 Hyland Tier 2 report.

# Table 8
# Vehicle PM Emissions Estimate
# Hyland Facility Associates Landfill

**AP-42 Paved Roads**

$E = k(sL)^{0.91} \times (W)^{1.02} + C$

E = particle size specific emission factor (lbs/VMT)
PM10 k = 0.0022 lb/VMT (vehicle miles traveled) AP-42, Table 13.2.1-1 particle size multiplier
PM2.5 k = 0.00054 lb/VMT (vehicle miles traveled) AP-42, Table 13.2.1-1 particle size multiplier
sL = 7.4 g/m2 mean value for MSW landfill silt loading AP-42, Table 13.2.1-3
W = average weight (tons) of vehicles traveling the road (see Vehicle Data worksheet)
PM10 C = 0.00047 lbs/VMT exhaust, brake wear and tire wear emission factor AP-42, Table 13.2.2-4
PM2.5 C = 0.00036 lbs/VMT exhaust, brake wear and tire wear emission factor AP-42, Table 13.2.2-4

**AP-42 Unpaved Roads**

$E = k(s/12)^{a} \times (W/3)^{b} + C$

E = particle size specific emission factor (lbs/VMT)
PM10 k = 1.5 lb/VMT (vehicle miles traveled) particle size multiplier
PM2.5 k = 0.15 lb/VMT (vehicle miles traveled) particle size multiplier
s = 6.4 % surface silt content for MSW landfill AP-42, Table 13.2.2-1
PM10 a = 0.9 empirical constant
PM2.5 a = 0.9 empirical constant
W = average weight (tons) of vehicles traveling the road (see Vehicle Data worksheet)
PM10 b = 0.45 empirical constant
PM2.5 b = 0.45 empirical constant
PM10 C = 0.00047 lbs/VMT exhaust, brake wear and tire wear emission factor AP-42, Table 13.2.2-4
PM2.5 C = 0.00036 lbs/VMT exhaust, brake wear and tire wear emission factor AP-42, Table 13.2.2-4

| Particulate Matter | Particle Size Multiplier for Paved Road Equation (lb/VMT) | Particle Size Multiplier for Unpaved Road Equation (lb/VMT) | Brake, Exhaust and Tire Wear Factor (lbs/VMT) | Surface Silt Loading for Paved Road ($g/m^2$) | Surface Silt Content for Unpaved Road (%) | Average Vehicle Weight[1] (tons) | Empirical Constant (a) | Empirical Constant (b) | Paved Road Emission Factor E (lb/VMT) | Unpaved Road Emission Factor E (lb/VMT) | Paved Road VMT[1] (miles/year) | Unpaved Road VMT[1] (miles/year) | Paved Road Emissions (lbs/year) | Unpaved Road Emissions (lbs/year) | Total Estimated Road Use PM Emissions[5] (lbs/yr) | (tons/yr) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM10 | 0.0022 | 1.50 | 0.00047 | 7.40 | 6.40 | 19.4 | 0.90 | 0.45 | 0.280 | 1.97 | 42,067 | 71,038 | 11,779 | 140,139 | 151,919 | 76 |
| PM2.5 | 0.00054 | 0.15 | 0.00036 | 7.40 | 6.40 | 19.4 | 0.90 | 0.45 | 0.069 | 0.20 | 42,067 | 71,038 | 2,902 | 14,036 | 16,938 | 8 |

1. See Table 9 for paved and unpaved road vehicle miles traveled and for average vehicle weight computations.

## PM Emissions Estimates for Vehicles Traveling on Paved and Unpaved Roads
## Hyland Facility Associates Landfill

The NYSDEC requires that the fugitive PM10 and PM2.5 emissions caused by vehicles traveling on paved and unpaved roads be estimated. Methods for estimating these emissions can be found in AP-42 Sections 13.2.1 (paved roads) and 13.2.2 (unpaved roads). The latest versions of sections 13.2.1 (2011) and 13.2.2 (2006) contain different equations and empirical factors than the ones used by SHA to estimate fugitve PM road emissions in 2004. The revised equations result in a PM emission that only includes resuspended soil PM emissions and not PM emissions from vehicle exhaust, brake wear and tire wear. PM emission factors from vehicle exhaust, brake wear and tire wear have to be added. In this case, emission factors for 1980's vehicle fleet in Table 13.2.2-4 of AP-42 are used to estimate PM emissions from vehicle exhaust, brake wear and tire wear.

The following equations and input factors were obtained from AP-42, sections 13.2.1 and 13.2.2:

**AP-42 Paved Roads**

$$E = k(sL)^{0.91} \times (W)^{1.02} + C$$

| | | | |
|---|---|---|---|
| | **E = particle size specific emission factor (lbs/VMT)** | | |
| **PM10** | **k =** | **0.0022** | **lb/VMT (vehicle miles traveled) AP-42, Table 13.2.1-1 particle size multiplier** |
| **PM2.5** | **k =** | **0.00054** | **lb/VMT (vehicle miles traveled) AP-42, Table 13.2.1-1 particle size multiplier** |
| | **sL =** | **7.4** | **g/m2 mean value for MSW landfill silt loading AP-42, Table 13.2.1-3** |
| | **W = average weight (tons) of vehicles traveling the road (see Vehicle Data worksheet, Table 9)** | | |
| **PM10** | **C =** | **0.00047** | **lbs/VMT exhaust, brake wear and tire wear emission factor AP-42, Table 13.2.2-4** |
| **PM2.5** | **C =** | **0.00036** | **lbs/VMT exhaust, brake wear and tire wear emission factor AP-42, Table 13.2.2-4** |

**AP-42 Unpaved Roads**

$$E = k(s/12)^{a} \times (W/3)^{b} + C$$

| | | | |
|---|---|---|---|
| | **E = particle size specific emission factor (lbs/VMT)** | | |
| **PM10** | **k =** | **1.5** | **lb/VMT (vehicle miles traveled) particle size multiplier** |
| **PM2.5** | **k =** | **0.15** | **lb/VMT (vehicle miles traveled) particle size multiplier** |
| | **s =** | **6.4** | **% surface silt content for MSW landfill AP-42, Table 13.2.2-1** |
| **PM10** | **a =** | **0.9** | **empirical constant** |
| **PM2.5** | **a =** | **0.9** | **empirical constant** |
| | **W = average weight (tons) of vehicles traveling the road (see Vehicle Data worksheet, Table 9)** | | |
| **PM10** | **b =** | **0.45** | **empirical constant** |
| **PM2.5** | **b =** | **0.45** | **empirical constant** |
| **PM10** | **C =** | **0.00047** | **lbs/VMT exhaust, brake wear and tire wear emission factor AP-42, Table 13.2.2-4** |
| **PM2.5** | **C =** | **0.00036** | **lbs/VMT exhaust, brake wear and tire wear emission factor AP-42, Table 13.2.2-4** |

**Paved and Unpaved Road Emission Factor Equation**

The particle size (i.e, PM10 and PM2.5) specific emission factors for paved and unpaved roads are estimated by entering the various factors (i.e., k, sL, s, a, W, b and C) into the respective equation and completing the operations as indicated by each equation. The average vehicle weight (W) is obtained from the Vehicle Data (Table 9) worksheet.

The PM10 and PM2.5 estimated emission factors (E) for paved and unpaved roads are then multiplied by vehicle miles traveled per year from the Vehicle Data (Table 9) worksheet. This results in PM10 and PM2.5 emissions in lbs/yr, which can be converted to tons/yr by dividing by 2000 lbs/ton.

# Table 9
# Vehicle Data
# Hyland Facility Associates Landfill

| Section of On-Site Roads Used | Vehicle Type | Approximate Vehicle Weight (lbs) | Vehicles per Day at 1000 Tons per Day[1] | Vehicles per Day at 49% Tonnage Increase | One-Way Trips for Each Vehicle Per Day | Distance Traveled on Paved Roads per Day (ft/day) | Distance Traveled on Paved Roads per Year (mi/yr) | Distance Traveled on Unpaved Roads per Day (ft/day) | Distance Traveled on Unpaved Roads per Year (mi/yr) | Number of Days per Year Used | Fraction of Each Vehicle Type Based on Total Vehicles per Day | Representative Weight Based on Fraction of Total Vehicles (lbs) | Representative Weight Based on Fraction of Total Vehicles (Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1, 2, 3, 4 | Tractor Trailers | 50000 | 48 | 72 | 2 | 453,600 | 26,804 | 579,600 | 34,249 | 312 | 0.54 | **26,866** | **13.43** |
| 1, 2, 3, 4 | Local Haul Vehicles | 35,000 | 8 | 12 | 2 | 75,600 | 4,467 | 96,600 | 5,708 | 312 | 0.09 | **3,134** | **1.57** |
| 1, 6 | Leachate Trucks | 30,000 | 9 | 13 | 2 | 72,800 | 4,302 | 145,600 | 8,604 | 312 | 0.10 | **2,910** | **1.46** |
| 1 | Employees Vehicles | 7,500 | 15 | 15 | 2 | 84,000 | 4,964 | | | 312 | 0.11 | **840** | **0.42** |
| 2 ,3 ,4 | Pickup Trucks (Operators) | 7,500 | 2 | 2 | 4 | 2,800 | 165 | 32,200 | 1,903 | 312 | 0.01 | **112** | **0.06** |
| 7 | Pickup Trucks (Laborers) | 7,500 | 2 | 2 | 1 | | | 17,780 | 1,051 | 312 | 0.01 | **112** | **0.06** |
| 1 | Pickup Truck (Parts Run) | 7,500 | 1 | 1 | 2 | 5,600 | 331 | | | 312 | 0.01 | **56** | **0.03** |
| 1, 2, 4, 5, 7 | International 4900 Plow | 20,000 | 1 | 1 | 2 | 6,300 | 93 | 25,480 | 376 | 78 | 0.01 | **149** | **0.07** |
| 1, 2, 4, 5, 7 | GMC TopKick (Water Truck) | 19,000 | 1 | 1 | 4 | 12,600 | 372 | 50,960 | 1,506 | 156 | 0.01 | **142** | **0.07** |
| 4, 5 | Vovlo A25C Dump | 39,000 | 1 | 1 | 8 | | | 30,800 | 1,820 | 312 | 0.01 | **291** | **0.15** |
| 2,3,4,5 | Caterpillar 950F Loader | 36,000 | 1 | 1 | 8 | 2,800 | 165 | 60,200 | 3,557 | 312 | 0.01 | **269** | **0.13** |
| 2,4,5,7 | John Deere 772BH Grader | 35,000 | 1 | 1 | 1 | 350 | 3 | 12,740 | 125 | 52 | 0.01 | **261** | **0.13** |
| 1, 2, 3, 4 | Ford L9000 Fuel Truck | 27,000 | 1 | 1 | 2 | 6,300 | 372 | 8,050 | 476 | 312 | 0.01 | **201** | **0.10** |
| 1 | Johnston 4000 Sweeper | 25,000 | 1 | 1 | 1 | 2,800 | 28 | | | 52 | 0.01 | **187** | **0.09** |
| 4, 5 | John Deere 350D Dump | 39,000 | 1 | 1 | 8 | | | 30,800 | 1,820 | 312 | 0.01 | **291** | **0.15** |
| **Non-Hyland Owned Heavy Equipment** | | | | | | | | | | | | | |
| 4, 5 | 10-Wheel On-road Dump | 35,000 | 6 | 6 | 20 | | | 462,000 | 6,563 | 75 | 0.04 | **1,567** | **0.78** |
| 4, 5 | Cat 350DTE Dump | 61,000 | 3 | 3 | 20 | | | 231,000 | 3,281 | 75 | 0.02 | **1,366** | **0.68** |
| **Totals** | | | **102** | **134** | | | **42,067** | | **71,038** | | | | **19.4** Tons - Average Vehicle Weight |

| Road Sections | Description | | Distance (ft) |
|---|---|---|---|
| **1** | Herdman Rd to Scale (paved) | | 2,800 |
| **2** | Scale to Tire Wash (paved) | | 350 |
| **3** | Tire Wash to Working Face Access Road (unpaved) | | 3,675 |
| **4** | Access Road to Working Face (upaved) | | 350 |
| **5** | Access Road from Soil Borrow Area to Working Face (unpaved) | | 3,500 |
| **6** | Scale to Leachate Holding Ponds (unpaved) | | 2,800 |
| **7** | Permimeter Road Around Landfill (unpaved) | | 8,890 |

1. Information from SHA 2004 calculations for vehicle road use and Hyland Facility Associates

**Sample Calculations for Vehicle Miles Traveled**
**and Average Vehicle Weight**
**Hyland Facility Associates Landfill**

Hyland Facility Associates (Hyland) is requesting a 49 percent increase in the annual tonnage into the Hyland Landfill. The increased tonnage means the number of waste hauling vehicles will increase. The NYSDEC requires that the vehicle emissions be estimated to assess fugitive particulate emissions from the vehicles traveling on paved and unpaved roads. This requires estimating an average weight of all vehicles accessing the Hyland Landfill and the total vehicle miles travelled on paved and unpaved roads. This information is used in equations found in AP-42 sections 13.2.1 and 13.2.2 for estimating emissions from vehicles traveling on paved and unpaved roads. Vehicles that stay at the working face during the operating day are not included in the the list of vehicles.

Hyland Landfill operates a maximum of 312 days per year.

**<u>I. Distance Traveled by Vehicles</u>:**

The roads traveled at Hyland Landfill are divided into numbered sections with an estimated section length in feet, as follows:

| Road Sections | Description | Distance (ft) |
|---|---|---|
| 1 | Herdman Rd to Scale (paved) | 2800 |
| 2 | Scale to Tire Wash (paved) | 350 |
| 3 | Tire Wash to Working Face Access Road (unpaved) | 3675 |
| 4 | Access Road to Working Face (unpaved) | 350 |
| 5 | Access Road from Soil Borrow Area to Working Face (unpaved) | 3500 |
| 6 | Scale to Leachate Holding Ponds (unpaved) | 2800 |
| 7 | Perimeter Road Around Landfill (unpaved) | 8890 |

Each vehicle at the Hyland Landfill travels on certain road sections depending on the vehicle type. For example, a tractor trailer hauling solid waste into the landfill would travel on sections 1, 2, 3 and 4 to get to the working face to tip its load and to exit the landfill.

<u>Vehicle Information</u>

The number of vehicles per day on the site is based in part on information provided in Sanborn Head Associates (SHA) air emission estimates for a 745 ton/day to 1000 ton/day tonnage increase request in 2004 for the Hyland Landfill. The number of waste hauling vehicles (i.e., tractor trailers, local haul vehicles and leachate trucks) in the SHA estimates was multiplied by 1.49 to represent the number of vehicles per day due to the 49 percent tonnage increase.

It is assumed that each waste truck makes two one way trips per day (i.e., one in and one out). The number of vehicles is multiplied by the number of trips per day to estimate the total vehicle type trips per day. For example, using the tractor trailers as an example:

**72 tractor trailers x 2 trips/day = 144 tractor trailer trips/day**

<u>Road Use Distance Traveled</u>

To estimate the distanced traveled by each vehicle, the vehicle trips per day is multiplied by the trip distance. Using the tractor trailers, the 72 tractor trailers make a total of 144 one way trips per day on road segments 1, 2, 3 and 4. As indicated in the road segment table above, segments 1 and 2 are paved and segments 3 and 4 are unpaved. The distance traveled by the tractor trailers on the paved and unpaved segments is estimated by multiplying the number of trips per day by the distance of the paved or unpaved segments traveled. Using the tractor trailers:

**<u>Paved Road:</u>**

**144 trips/day x (2,800 ft/trip for segment 1 + 350 ft/trip for segment 2) = 453,600 ft/day**

Converting the ft/day to miles per year (mi/yr):

**(453,600 ft/day x 312 days/yr)/ 5,280 ft/mi = 26,804 mi/yr (on paved road)**

**Sample Calculations for Vehicle Miles Traveled**
**and Average Vehicle Weight**
**Hyland Facility Associates Landfill**

**Unpaved Road:**

**144 trips/day x (3,675 ft/trip for segment 3 + 350 ft/trip for segment 4) = 579,600 ft/day**

Converting the ft/day to miles per year (mi/yr):

**(579,600 ft/day x 312 days/yr)/ 5,280 ft/mi = 34,249 mi/yr (on unpaved road)**

After estimating the vehicle miles traveled (VMT) for each vehicle type, the vehicle miles traveled is summed for the paved and unpaved roads. The VMT for paved and unpaved roads is used for estimating the fugitive PM air emissions from resuspended soil particles as the vehicles travel on paved and unpaved roads.

## II. Average Vehicle Weight

Vehicle weights are based on weights provided in the SHA 2004 emissions estimates and vehicle specification sheets obtained on the internet. A representative weight was calculated for each vehicle type based on the total number of vehicles. For example, tractor trailers made up approximately 54 percent of the total number of vehicles (e.g., 72 tractor trailers/134 total vehicles = 0.54) the fraction of tractor trailers is multiplied by the weight of the tractor trailer:

**50,000 lbs x 0.54 = 26,866 lbs**

The representative weights for each of the vehicles is estimated in the same manner and converted to tons by dividing by 2000 lbs/ton. To obtain the average weight of all vehicles, the individual representative weights are summed to obtain 19.4 tons.