City of Roswell
Roswell Municipal Landfill

Title V Renewal Application

February 15, 2021

Prepared for:

City of Roswell
3006 West Brasher Road
Roswell, NM 88203

Prepared by:

Alliant Environmental, LLC
7804 Pan American Fwy. NE, Suite 5
Albuquerque, NM 87109

Mail Application To:		**For Department use only:**
New Mexico Environment Department Air Quality Bureau Permits Section 525 Camino de los Marquez, Suite 1 Santa Fe, New Mexico, 87505 Phone: (505) 476-4300 Fax: (505) 476-4375 www.env.nm.gov/aqb		AIRS No.:

Universal Air Quality Permit Application

Use this application for NOI, NSR, or Title V sources.

Use this application for: the initial application, modifications, technical revisions, and renewals. For technical revisions, complete Sections, 1-A, 1-B, 2-E, 3, 9 and any other sections that are relevant to the requested action; coordination with the Air Quality Bureau permit staff prior to submittal is encouraged to clarify submittal requirements and to determine if more or less than these sections of the application are needed. Use this application for streamline permits as well. See Section 1-I for submittal instructions for other permits.

This application is submitted as (check all that apply): ☐ Request for a No Permit Required Determination (no fee)
☐ **Updating** an application currently under NMED review. Include this page and all pages that are being updated (no fee required).
Construction Status: ☐ Not Constructed ☑ Existing Permitted (or NOI) Facility ☐ Existing Non-permitted (or NOI) Facility
Minor Source: ☐ a NOI 20.2.73 NMAC ☐ 20.2.72 NMAC application or revision ☐ 20.2.72.300 NMAC Streamline application
Title V Source: ☐ Title V (new) ☑ Title V renewal ☑ TV minor mod. ☐ TV significant mod. TV Acid Rain: ☐ New ☐ Renewal
PSD Major Source: ☐ PSD major source (new) ☐ minor modification to a PSD source ☐ a PSD major modification

Acknowledgements:
☑ I acknowledge that a pre-application meeting is available to me upon request. ☑ Title V Operating, Title IV Acid Rain, and NPR applications have no fees.
☐ $500 NSR application Filing Fee enclosed OR ☐ The full permit fee associated with 10 fee points (required w/ streamline applications).
☐ Check No.: in the amount of
☑ I acknowledge the required submittal format for the hard copy application is printed double sided 'head-to-toe', 2-hole punched (except the Sect. 2 landscape tables is printed 'head-to-head'), numbered tab separators. Incl. a copy of the check on a separate page.
☐ This facility qualifies to receive assistance from the Small Business Environmental Assistance program (SBEAP) and qualifies for 50% of the normal application and permit fees. Enclosed is a check for 50% of the normal application fee which will be verified with the Small Business Certification Form for your company.
☐ This facility qualifies to receive assistance from the Small Business Environmental Assistance Program (SBEAP) but does not qualify for 50% of the normal application and permit fees. To see if you qualify for SBEAP assistance and for the small business certification form go to https://www.env.nm.gov/aqb/sbap/small_business_criteria.html).

Citation: Please provide the **low level citation** under which this application is being submitted: **20.2.70.300.B.2 NMAC**
(e.g. application for a new minor source would be 20.2.72.200.A NMAC, one example for a Technical Permit Revision is 20.2.72.219.B.1.b NMAC, a Title V acid rain application would be: 20.2.70.200.C NMAC)

Section 1 – Facility Information

Section 1-A: Company Information

		AI # if known (see 1st 3 to 5 #s of permit IDEA ID No.): **61**	Updating Permit/NOI #: **P187L**
1	Facility Name: **Roswell Municipal Landfill**	Plant primary SIC Code (4 digits): **4953**	
		Plant NAIC code (6 digits): **562212**	
a	Facility Street Address (If no facility street address, provide directions from a prominent landmark): **3006 West Brasher Road, Roswell, NM 88203**		
2	Plant Operator Company Name: **City of Roswell**	Phone/Fax: **(575) 624-6746**	
a	Plant Operator Address: **425 N. Richardson, Roswell, NM 88201**		
b	Plant Operator's New Mexico Corporate ID or Tax ID: **N/A**		

3	Plant Owner(s) name(s): **City of Roswell**	Phone/Fax: **(575) 624-6746**
a	Plant Owner(s) Mailing Address(s): **425 N. Richardson, Roswell, NM 88201**	
4	Bill To (Company): **City of Roswell**	Phone/Fax: **(575) 624-6746**
a	Mailing Address: **425 N. Richardson, Roswell, NM 88201**	E-mail: **N/A**
5	☑ Preparer: **Martin R. Schluep, Alliant Environmental, LLC** ☑ Consultant: **Scott McKitrick, Souder, Miller & Associates**	Phone/Fax: **(505) 299-0942**
a	Mailing Address: **5454 Venice Ave. NE, Ste. D** **Albuquerque, NM 87113**	E-mail: **mschluep@alliantenv.com** **scott.mckitrick@soudermiller.com**
6	Plant Operator Contact: **Fernando Valdez**	Phone/Fax: **(575) 624-6746/(575) 624-6954**
a	Address: **3006 West Brasher Road, Roswell, NM 88203**	E-mail: **f.valdez@roswell-nm.gov**
7	Air Permit Contact: **Scott McKitrick**	Title: **Senior Geoscientist/Environmental Services Manager**
a	E-mail: **scott.mckitrick@soudermiller.com**	Phone/Fax: **(505) 299-0942**
b	Mailing Address: **5454 Venice Ave. NE, Ste. D, Albuquerque, NM 87113**	
c	The designated Air permit Contact will receive all official correspondence (i.e. letters, permits) from the Air Quality Bureau.	

Section 1-B: Current Facility Status

1.a	Has this facility already been constructed? ☑ Yes ☐ No	1.b If yes to question 1.a, is it currently operating in New Mexico? ☑ Yes ☐ No
2	If yes to question 1.a, was the existing facility subject to a Notice of Intent (NOI) (20.2.73 NMAC) before submittal of this application? ☐ Yes ☑ No	If yes to question 1.a, was the existing facility subject to a construction permit (20.2.72 NMAC) before submittal of this application? ☐ Yes ☑ No
3	Is the facility currently shut down? ☐ Yes ☑ No	If yes, give month and year of shut down (MM/YY): **N/A**
4	Was this facility constructed before 8/31/1972 and continuously operated since 1972? ☐ Yes ☑ No	
5	If Yes to question 3, has this facility been modified (see 20.2.72.7.P NMAC) or the capacity increased since 8/31/1972? ☐ Yes ☐ No ☑ N/A	
6	Does this facility have a Title V operating permit (20.2.70 NMAC)? ☑ Yes ☐ No	If yes, the permit No. is: **P-187L-R1**
7	Has this facility been issued a No Permit Required (NPR)? ☐ Yes ☑ No	If yes, the NPR No. is: **N/A**
8	Has this facility been issued a Notice of Intent (NOI)? ☐ Yes ☑ No	If yes, the NOI No. is: **N/A**
9	Does this facility have a construction permit (20.2.72/20.2.74 NMAC)? ☐ Yes ☑ No	If yes, the permit No. is: **N/A**
10	Is this facility registered under a General permit (GCP-1, GCP-2, etc.)? ☐ Yes ☑ No	If yes, the register No. is: **N/A**

Section 1-C: Facility Input Capacity & Production Rate

1	What is the facility's maximum input capacity, specify units (reference here and list capacities in Section 20, if more room is required)			
a	Current	Hourly: **36.52 tons**	Daily: **310.45 tons**	Annually: **95,000 tons**
b	Proposed	Hourly: **36.52 ton**	Daily: **310.45 tons**	Annually: **95,000 tons**
2	What is the facility's maximum production rate, specify units (reference here and list capacities in Section 20, if more room is required)			
a	Current	Hourly: **36.52 ton**	Daily: **310.45 tons**	Annually: **95,000 tons**
b	Proposed	Hourly: **36.52 ton**	Daily: **310.45 tons**	Annually: **95,000 tons**

Section 1-D: Facility Location Information

1	Section: **24**	Range: **23E**	Township: **11S**	County: **Chaves**	Elevation (ft): **3,681**
2	UTM Zone: ☐ 12 or ☑ 13			Datum: ☐ NAD 27 ☐ NAD 83 ☑ WGS 84	
a	UTM E (in meters, to nearest 10 meters): **540,420**			UTM N (in meters, to nearest 10 meters): **3,689,550**	
b	**AND** Latitude (deg., min., sec.): **33° 20' 39.76" N**			Longitude (deg., min., sec.): **104° 33' 56.22" E**	
3	Name and zip code of nearest New Mexico town: **Roswell, NM**				
4	Detailed Driving Instructions from nearest NM town (attach a road map if necessary): **The facility is in Roswell, NM at 3006 West Brasher Road**				
5	The facility is in Roswell, NM at 3006 West Brasher Road.				
6	Status of land at facility (check one): ☐ Private ☐ Indian/Pueblo ☐ Federal BLM ☐ Federal Forest Service ☑ Other (specify): **Government**				
7	List all municipalities, Indian tribes, and counties within a ten (10) mile radius (20.2.72.203.B.2 NMAC) of the property on which the facility is proposed to be constructed or operated: **City of Roswell, Chaves County**				
8	**20.2.72** NMAC applications **only**: Will the property on which the facility is proposed to be constructed or operated be closer than 50 km (31 miles) to other states, Bernalillo County, or a Class I area (see www.env.nm.gov/aqb/modeling/class1areas.html)? ☐ Yes ☐ No (20.2.72.206.A.7 NMAC) If yes, list all with corresponding distances in kilometers: **N/A**				
9	Name nearest Class I area: **Salt Creek Wilderness**				
10	Shortest distance (in km) from facility boundary to the boundary of the nearest Class I area (to the nearest 10 meters): **27.10 km**				
11	Distance (meters) from the perimeter of the Area of Operations (AO is defined as the plant site inclusive of all disturbed lands, including mining overburden removal areas) to nearest residence, school or occupied structure: **902.3 meters**				
12	Method(s) used to delineate the Restricted Area: **Continuous fencing** "**Restricted Area**" is an area to which public entry is effectively precluded. Effective barriers include continuous fencing, continuous walls, or other continuous barriers approved by the Department, such as rugged physical terrain with steep grade that would require special equipment to traverse. If a large property is completely enclosed by fencing, a restricted area within the property may be identified with signage only. Public roads cannot be part of a Restricted Area.				
13	Does the owner/operator intend to operate this source as a portable stationary source as defined in 20.2.72.7.X NMAC? ☐ Yes ☑ No A portable stationary source is not a mobile source, such as an automobile, but a source that can be installed permanently at one location or that can be re-installed at various locations, such as a hot mix asphalt plant that is moved to different job sites.				
14	Will this facility operate in conjunction with other air regulated parties on the same property? ☒ No ☐ Yes If yes, what is the name and permit number (if known) of the other facility?				

Section 1-E: Proposed Operating Schedule (The 1-E.1 & 1-E.2 operating schedules may become conditions in the permit.)

1	Facility **maximum** operating ($\frac{\text{hours}}{\text{day}}$): **12**	($\frac{\text{days}}{\text{week}}$): **6**		($\frac{\text{weeks}}{\text{year}}$): **52**	($\frac{\text{hours}}{\text{year}}$): **3,744**	
2	Facility's maximum daily operating schedule (if less than 24 $\frac{\text{hours}}{\text{day}}$)?	Start: **6:00**	☑AM ☐PM		End: **6:00**	☐AM ☑PM
3	Month and year of anticipated start of construction: **Landfill units 1, 2, 3A, 3B, and 4 have been constructed**					
4	Month and year of anticipated construction completion: **Landfill units 5, 6, and 7 will be constructed within the next 17 years. Landfill unit 4 is the next unit planned for operation.**					
5	Month and year of anticipated startup of new or modified facility: **Site is already operating**					
6	Will this facility operate at this site for more than one year? ☑ Yes ☐ No					

Section 1-F: Other Facility Information

1	Are there any current Notice of Violations (NOV), compliance orders, or any other compliance or enforcement issues related to this facility? ☐ Yes ☑ No If yes, specify: **N/A**			
a	If yes, NOV date or description of issue: **N/A**			NOV Tracking No: **N/A**
b	Is this application in response to any issue listed in 1-F, 1 or 1a above? ☐ Yes ☑ No If Yes, provide the 1c & 1d info below:			
c	Document Title: **N/A**	Date: **N/A**	Requirement # (or page # and paragraph #): **N/A**	
d	Provide the required text to be inserted in this permit: **N/A**			
2	Is air quality dispersion modeling or modeling waiver being submitted with this application? ☐ Yes ☑ No			
3	Does this facility require an "Air Toxics" permit under 20.2.72.400 NMAC & 20.2.72.502, Tables A and/or B? ☐ Yes ☑ No			
4	Will this facility be a source of federal Hazardous Air Pollutants (HAP)? ☑ Yes ☐ No			
a	If Yes, what type of source? ☐ **Major** (☐ ≥10 tpy of any single HAP **OR** ☐ ≥25 tpy of any combination of HAPS) **OR** ☑ **Minor** (☑ <10 tpy of any single HAP **AND** ☑ <25 tpy of any combination of HAPS)			
5	Is any unit exempt under 20.2.72.202.B.3 NMAC? ☐ Yes ☑ No			
a	If yes, include the name of company providing commercial electric power to the facility: N/A Commercial power is purchased from a commercial utility company, which specifically does not include power generated on site for the sole purpose of the user.			

Section 1-G: Streamline Application **(This section applies to 20.2.72.300 NMAC Streamline applications only)**

1	☐ I have filled out Section 18, "Addendum for Streamline Applications."	☑ N/A (This is not a Streamline application.)

Section 1-H: Current Title V Information - Required for all applications from TV Sources

(Title V-source required information for all applications submitted pursuant to 20.2.72 NMAC (Minor Construction Permits), or 20.2.74/20.2.79 NMAC (Major PSD/NNSR applications), and/or 20.2.70 NMAC (Title V))

1	Responsible Official (R.O.) (20.2.70.300.D.2 NMAC): **Joe Neeb**		Phone: **(575) 637-6269**
a	R.O. Title: **City Manager**	R.O. e-mail: **j.neeb@roswell-nm.gov**	
b	R. O. Address: **PO Drawer 1838, Roswell, NM 88202-1838**		
2	Alternate Responsible Official (20.2.70.300.D.2 NMAC): **Fernando Valdez**		Phone: **(575) 624-6746**
a	A. R.O. Title: **Landfill Operator/Supervisor**	A. R.O. e-mail: **f.valdez@roswell-nm.gov**	
b	A. R. O. Address: **3006 West Brasher Road, Roswell, NM 88203**		
3	Company's Corporate or Partnership Relationship to any other Air Quality Permittee (List the names of any companies that have operating (20.2.70 NMAC) permits and with whom the applicant for this permit has a corporate or partnership relationship): **None**		
4	Name of Parent Company ("Parent Company" means the primary name of the organization that owns the company to be permitted wholly or in part.): **N/A**		
a	Address of Parent Company: **N/A**		
5	Names of Subsidiary Companies ("Subsidiary Companies" means organizations, branches, divisions or subsidiaries, which are owned, wholly or in part, by the company to be permitted.): **None**		
6	Telephone numbers & names of the owners' agents and site contacts familiar with plant operations: **N/A**		
7	Affected Programs to include Other States, local air pollution control programs (i.e. Bernalillo) and Indian tribes: Will the property on which the facility is proposed to be constructed or operated be closer than 80 km (50 miles) from other states, local pollution control programs, and Indian tribes and pueblos (20.2.70.402.A.2 and 20.2.70.7.B)? If yes, state which ones and provide the distances in kilometers: **No**		

Section 1-I – Submittal Requirements

Each 20.2.73 NMAC (**NOI**), a 20.2.70 NMAC (**Title V**), a 20.2.72 NMAC (**NSR** minor source), or 20.2.74 NMAC (**PSD**) application package shall consist of the following:

Hard Copy Submittal Requirements:

1) One hard copy **original signed and notarized application package** **printed double sided** **'head-to-toe'** **2-hole punched** as we bind the document on top, not on the side; except Section 2 (landscape tables), which should be head-to-head. Please use **numbered tab separators** in the hard copy submittal(s) as this facilitates the review process. For NOI submittals only, hard copies of UA1, Tables 2A, 2D & 2F, Section 3 and the signed Certification Page are required. Please include a copy of the check on a separate page.

2) If the application is for a minor NSR, PSD, NNSR, or Title V application, include one working hard **copy** for Department use. This copy should be printed in book form, 3-hole punched, and **must be double sided**. Note that this is in addition to the head-to-to 2-hole punched copy required in 1) above. Minor NSR Technical Permit revisions (20.2.72.219.B NMAC) only need to fill out Sections 1-A, 1-B, 3, and should fill out those portions of other Section(s) relevant to the technical permit revision. TV Minor Modifications need only fill out Sections 1-A, 1-B, 1-H, 3, and those portions of other Section(s) relevant to the minor modification. NMED may require additional portions of the application to be submitted, as needed.

3) The entire NOI or Permit application package, including the full modeling study, should be submitted electronically. Electronic files for applications for NOIs, any type of General Construction Permit (GCP), or technical revisions to NSRs must be submitted with compact disk (CD) or digital versatile disc (DVD). For these permit application submittals, **two** CD copies are required (in sleeves, not crystal cases, please), with additional CD copies as specified below. NOI applications require only a single CD submittal. Electronic files for other New Source Review (construction) permits/permit modifications or Title V permits/permit modifications can be submitted on CD/DVD or sent through AQB's secure file transfer service.

Electronic files sent by (check one):

☑ CD/DVD attached to paper application

☐ secure electronic transfer. Air Permit Contact Name____________________________

Email______________________________

Phone number _______________________

a. If the file transfer service is chosen by the applicant, after receipt of the application, the Bureau will email the applicant with instructions for submitting the electronic files through a secure file transfer service. Submission of the electronic files through the file transfer service needs to be completed within 3 business days after the invitation is received, so the applicant should ensure that the files are ready when sending the hard copy of the application. The applicant will not need a password to complete the transfer. **Do not use the file transfer service for NOIs, any type of GCP, or technical revisions to NSR permits.**

4) Optionally, the applicant may submit the files with the application on compact disk (CD) or digital versatile disc (DVD) following the instructions above and the instructions in 5 for applications subject to PSD review.

5) If **air dispersion modeling** is required by the application type, include the **NMED Modeling Waiver** and/or electronic air dispersion modeling report, input, and output files. The dispersion modeling ***summary report only*** should be submitted as hard copy(ies) unless otherwise indicated by the Bureau.

6) If the applicant submits the electronic files on CD and the application is subject to PSD review under 20.2.74 NMAC (PSD) or NNSR under 20.2.79 NMC include,
   a. one additional CD copy for US EPA,
   b. one additional CD copy for each federal land manager affected (NPS, USFS, FWS, USDI) and,
   c. one additional CD copy for each affected regulatory agency other than the Air Quality Bureau.

   If the application is submitted electronically through the secure file transfer service, these extra CDs do not need to be submitted.

Electronic Submittal Requirements [in addition to the required hard copy(ies)]:

1) All required electronic documents shall be submitted as 2 separate CDs or submitted through the AQB secure file transfer service. Submit a single PDF document of the entire application as submitted and the individual documents comprising the application.

2) The documents should also be submitted in Microsoft Office compatible file format (Word, Excel, etc.) allowing us to access the text and formulas in the documents (copy & paste). Any documents that cannot be submitted in a Microsoft Office compatible

format shall be saved as a PDF file from within the electronic document that created the file. If you are unable to provide Microsoft office compatible electronic files or internally generated PDF files of files (items that were not created electronically: i.e. brochures, maps, graphics, etc,), submit these items in hard copy format. We must be able to review the formulas and inputs that calculated the emissions.

3) It is preferred that this application form be submitted as 4 electronic files (3 MSWord docs: Universal Application section 1 [UA1], Universal Application section 3-19 [UA3], and Universal Application 4, the modeling report [UA4]) and 1 Excel file of the tables (Universal Application section 2 [UA2]). Please include as many of the 3-19 Sections as practical in a single MS Word electronic document. Create separate electronic file(s) if a single file becomes too large or if portions must be saved in a file format other than MS Word.

4) The electronic file names shall be a maximum of 25 characters long (including spaces, if any). The format of the electronic Universal Application shall be in the format: "A-3423-FacilityName". The "A" distinguishes the file as an application submittal, as opposed to other documents the Department itself puts into the database. Thus, all electronic application submittals should begin with "A-". Modifications to existing facilities should use the core permit number (i.e. '3423') the Department assigned to the facility as the next 4 digits. Use 'XXXX' for new facility applications. The format of any separate electronic submittals (additional submittals such as non-Word attachments, re-submittals, application updates) and Section document shall be in the format: "A-3423-9-description", where "9" stands for the section # (in this case Section 9-Public Notice). Please refrain, as much as possible, from submitting any scanned documents as this file format is extremely large, which uses up too much storage capacity in our database. Please take the time to fill out the header information throughout all submittals as this will identify any loose pages, including the Application Date (date submitted) & Revision number (0 for original, 1, 2, etc.; which will help keep track of subsequent partial update(s) to the original submittal. Do not use special symbols (#, @, etc.) in file names. The footer information should not be modified by the applicant.

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Table 2-A: Regulated Emission Sources

Unit and stack numbering must correspond throughout the application package. If applying for a NOI under 20.2.73 NMAC, equipment exemptions under 2.72.202 NMAC do not apply.

Unit Number[1]	Source Description	Make	Model #	Serial #	Manufact-urer's Rated Capacity[3] (Specify Units)	Requested Permitted Capacity[3] (Specify Units)	Date of Manufacture[2] Date of Construction/ Reconstruction[2]	Controlled by Unit # Emissions vented to Stack #	Source Classi-fication Code (SCC)	For Each Piece of Equipment, Check One	RICE Ignition Type (CI, SI, 4SLB, 4SRB, 2SLB)[4]	Replacing Unit No.
LF-OP	Landfill Operations	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	50100403	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
LG-1	Landfill Gas Emissions	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	50100406	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
Tank-1	Gasoline Tank	N/A	N/A	N/A	1,000 gal	1,000 gal	N/A 1999	N/A N/A	40301008	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
HAUL-1	Unpaved Haul Roads	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	50100401	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
HAUL-2	Paved Haul Roads	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A N/A	50100401	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
PSV 1-20	Passive Vents 1-20	N/A	N/A	N/A	N/A	N/A	N/A N/A	N/A PSV 1-20	50100406	☐ Existing (unchanged) ☐ To be Removed ☑ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced	N/A	N/A
										☐ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced		
										☐ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced		
										☐ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced		
										☐ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced		

[1] Unit numbers must correspond to unit numbers in the previous permit unless a complete cross reference table of all units in both permits is provided.
[2] Specify dates required to determine regulatory applicability.
[3] To properly account for power conversion efficiencies, generator set rated capacity shall be reported as the rated capacity of the engine in horsepower, not the kilowatt capacity of the generator set.
[4] "4SLB" means four stroke lean burn engine, "4SRB" means four stroke rich burn engine, "2SLB" means two stroke lean burn engine, "CI" means compression ignition, and "SI" means spark ignition

Table 2-B: Insignificant Activities[1] (20.2.70 NMAC) OR Exempted Equipment (20.2.72 NMAC)

All 20.2.70 NMAC (Title V) applications must list all Insignificant Activities in this table. All 20.2.72 NMAC applications must list Exempted Equipment in this table. If equipment listed on this table is exempt under 20.2.72.202.B.5, include emissions calculations and emissions totals for 202.B.5 "similar functions" units, operations, and activities in Section 6, Calculations. Equipment and activities exempted under 20.2.72.202 NMAC may not necessarily be Insignificant under 20.2.70 NMAC (and vice versa). Unit & stack numbering must be consistent throughout the application package. Per Exemptions Policy 02-012.00 (see http://www.env.nm.gov/aqb/permit/aqb_pol.html), 20.2.72.202.B NMAC Exemptions do not apply, but 20.2.72.202.A NMAC exemptions do apply to NOI facilities under 20.2.73 NMAC. List 20.2.72.301.D.4 NMAC Auxiliary Equipment for Streamline applications in Table 2-A. The List of Insignificant Activities (for TV) can be found online at https://www.env.nm.gov/wp-content/uploads/sites/2/2017/10/InsignificantListTitleV.pdf. TV sources may elect to enter both TV Insignificant Activities and Part 72 Exemptions on this form.

Unit Number	Source Description	Manufacturer	Model No.	Max Capacity	List Specific 20.2.72.202 NMAC Exemption (e.g. 20.2.72.202.B.5)	Date of Manufacture /Reconstruction[2]	For Each Piece of Equipment, Check Onc
			Serial No.	Capacity Units	Insignificant Activity citation (e.g. IA List Item #1.a)	Date of Installation /Construction[2]	
355	Tire Baler	N/A	V2203-IN0686	N/A	N/A	N/A	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
			N/A	N/A	Insignificant Activity 1.a.	N/A	
-	Leachate Pumps	Miller	N/A	8 hp	N/A	N/A	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
			N/A	8 hp	Insignificant Activity 1.a.	N/A	
-	Welder	Briggs & Stratton	N/A	11 hp	N/A	N/A	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
			N/A	11 hp	Insignificant Activity 1.a.	N/A	
-	Generator	Honda	N/A	5 hp	N/A	N/A	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
			N/A	5 hp	Insignificant Activity 1.a.	N/A	
Tank-2	Diesel Tank	N/A	N/A	3,000 gallons	N/A	N/A	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
			N/A	3,000 gallons	Insignificant Activity 1.a.	1999	
-	Fire Water Pumps	N/A	N/A	N/A	N/A	N/A	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
			N/A	N/A	Insignificant Activity 1.a.	N/A	
-	Water Pumps	Honda	N/A	8 hp	N/A	N/A	☑ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
			N/A	8 hp	Insignificant Activity 1.a.	N/A	
							☐ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
							☐ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
							☐ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced
							☐ Existing (unchanged) ☐ To be Removed ☐ New/Additional ☐ Replacement Unit ☐ To Be Modified ☐ To be Replaced

[1] Insignificant activities exempted due to size or production rate are defined in 20.2.70.300.D.6, 20.2.70.7.Q NMAC, and the NMED/AQB List of Insignificant Activities, dated September 15, 2008. Emissions from these insignificant activities do not need to be reported, unless specifically requested.

[2] Specify date(s) required to determine regulatory applicability.

Table 2-C: Emissions Control Equipment

Unit and stack numbering must correspond throughout the application package. Only list control equipment for TAPs if the TAP's maximum uncontrolled emissions rate is over its respective threshold as listed in 20.2.72 NMAC, Subpart V, Tables A and B. In accordance with 20.2.72.203.A(3) and (8) NMAC, 20.2.70.300.D(5)(b) and (e) NMAC, and 20.2.73.200.B(7) NMAC, the permittee shall report all control devices and list each pollutant controlled by the control device regardless if the applicant takes credit for the reduction in emissions.

Control Equipment Unit No.	Control Equipment Description	Date Installed	Controlled Pollutant(s)	Controlling Emissions for Unit Number(s)[1]	Efficiency (% Control by Weight)	Method used to Estimate Efficiency
WW	Water wagon with spray bar, unpaved roads	1989	TSP, PM10, PM2.5	HAUL-1, LF-OP (Scraper Operations)	80%	NMED default value for base course and watering of gravel roads
WW	Water wagon with spray bar, paved roads	1989	TSP, PM10, PM2.5	HAUL-2, LF-OP (Scraper Operations)	99%	WRAP Guidance

[1] List each control device on a separate line. For each control device, list all emission units controlled by the control device.

Table 2-D: Maximum Emissions (under normal operating conditions)

☐ **This Table was intentionally left blank because it would be identical to Table 2-E.**

Maximum Emissions are the emissions at maximum capacity and prior to (in the absence of) pollution control, emission-reducing process equipment, or any other emission reduction. Calculate the hourly emissions using the worst case hourly emissions for each pollutant. For each pollutant, calculate the annual emissions as if the facility were operating at maximum plant capacity without pollution controls for 8760 hours per year, unless otherwise approved by the Department. List Hazardous Air Pollutants (HAP) & Toxic Air Pollutants (TAPs) in Table 2-I. Unit & stack numbering must be consistent throughout the application package. Fill all cells in this table with the emission numbers or a "-" symbol. A "-" symbol indicates that emissions of this pollutant are not expected. Numbers shall be expressed to at least 2 decimal points (e.g. 0.41, 1.41, or 1.41E-4).

Unit No.	NOx		CO		VOC		SOx		PM[1]		PM10[1]		PM2.5[1]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
LF-OP	-	-	-	-	-	-	-	-	19.52	41.72	8.04	17.49	1.23	3.34	-	-	-	-
LG-1	-	-	0.26	1.15	1.67	7.34	-	-	-	-	-	-	-	-	0.08	0.36	-	-
Tank-1	-	-	-	-	0.16	0.70	-	-	-	-	-	-	-	-	-	-	-	-
HAUL-1	-	-	-	-	-	-	-	-	116.68	68.27	31.50	18.43	3.15	1.84	-	-	-	-
HAUL-2	-	-	-	-	-	-	-	-	26.75	10.22	5.35	1.93	1.31	0.43	-	-	-	-
PSV 1-20	-	-	-	-	0.69	3.04	-	-	-	-	-	-	-	-	-	-	-	-
Totals	-	-	0.3	1.2	2.5	11.1	-	-	163.0	120.2	44.9	37.9	5.7	5.6	0.1	0.4	-	-

[1]**Condensable Particulate Matter:** Include condensable particulate matter emissions for PM10 and PM2.5 if the source is a combustion source. Do not include condensable particulate matter for PM unless PM is set equal to PM10 and PM2.5. Particulate matter (PM) is not subject to an ambient air quality standard, but PM is a regulated air pollutant under PSD (20.2.74 NMAC) and Title V (20.2.70 NMAC).

Table 2-E: Requested Allowable Emissions

Unit & stack numbering must be consistent throughout the application package. Fill all cells in this table with the emission numbers or a "-" symbol. A "-" symbol indicates that emissions of this pollutant are not expected. Numbers shall be expressed to at least 2 decimal points (e.g. 0.41, 1.41, or 1.41E^{-4}).

Unit No.	NOx		CO		VOC		SOx		PM[1]		PM10[1]		PM2.5[1]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
LF-OP	-	-	-	-	-	-	-	-	11.90	29.01	5.98	14.29	1.02	3.00	-	-	-	-
LG-1	-	-	0.26	1.15	1.67	7.34	-	-	-	-	-	-	-	-	0.08	0.36	-	-
Tank-1	-	-	-	-	0.16	0.70	-	-	-	-	-	-	-	-	-	-	-	-
HAUL-1	-	-	-	-	-	-	-	-	23.34	13.65	6.30	3.69	0.63	0.37	-	-	-	-
HAUL-2	-	-	-	-	-	-	-	-	1.34	0.51	0.27	0.10	0.07	0.02	-	-	-	-
PSV 1-20	-	-	-	-	0.69	3.04	-	-	-	-	-	-	-	-	-	-	-	-
Totals	-	-	0.3	1.2	2.5	11.1	-	-	36.6	43.2	12.6	18.1	1.7	3.4	0.1	0.4	-	-

[1] **Condensable Particulate Matter:** Include condensable particulate matter emissions for PM10 and PM2.5 if the source is a combustion source. Do not include condensable particulate matter for PM unless PM is set equal to PM10 and PM2.5. Particulate matter (PM) is not subject to an ambient air quality standard, but it is a regulated air pollutant under PSD (20.2.74 NMAC) and Title V (20.2.70 NMAC).

Table 2-F: Additional Emissions during Startup, Shutdown, and Routine Maintenance (SSM)

☑ This table is intentionally left blank since all emissions at this facility due to routine or predictable startup, shutdown, or scehduled maintenance are no higher than those listed in Table 2-E and a malfunction emission limit is not already permitted or requested. If you are required to report GHG emissions as described in Section 6a, include any GHG emissions during Startup, Shutdown, and/or Scheduled Maintenance (SSM) in Table 2-P. Provide an explanations of SSM emissions in Section 6 and 6a.

All applications for facilities that have emissions during routine our predictable startup, shutdown or scheduled maintenance (SSM)[1], including NOI applications, must include in this table the Maximum Emissions during routine or predictable startup, shutdown and scheduled maintenance (20.2.7 NMAC, 20.2.72.203.A.3 NMAC, 20.2.73.200.D.2 NMAC). In Section 6 and 6a, provide emissions calculations for all SSM emissions reported in this table. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (https://www.env.nm.gov/aqb/permit/aqb_pol.html) for more detailed instructions. Numbers shall be expressed to at least 2 decimal points (e.g. 0.41, 1.41, or 1.41E-4).

Unit No.	NOx		CO		VOC		SOx		PM[2]		PM10[2]		PM2.5[2]		H_2S		Lead	
	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
Totals																		

[1] **For instance**, if the short term steady-state Table 2-E emissions are 5 lb/hr and the SSM rate is 12 lb/hr, enter 7 lb/hr in this table. If the annual steady-state Table 2-E emissions are 21.9 TPY, and the number of scheduled SSM events result in annual emissions of 31.9 TPY, enter 10.0 TPY in the table below.

[2] **Condensable Particulate Matter:** Include condensable particulate matter emissions for PM10 and PM2.5 if the source is a combustion source. Do not include condensable particulate matter for PM unless PM is set equal to PM10 and PM2.5. Particulate matter (PM) is not subject to an ambient air quality standard, but it is a regulated air pollutant under PSD (20.2.74 NMAC) and Title V (20.2.70 NMAC).

Table 2-G: Stack Exit and Fugitive Emission Rates for Special Stacks

☑ I have elected to leave this table blank because this facility does not have any stacks/vents that split emissions from a single source or combine emissions from more than one source listed in table 2-A. Additionally, the emission rates of all stacks match the Requested allowable emission rates stated in Table 2-E.

Use this table to list stack emissions (requested allowable) from split and combined stacks. List Toxic Air Pollutants (TAPs) and Hazardous Air Pollutants (HAPs) in Table 2-I. List all fugitives that are associated with the normal, routine, and non-emergency operation of the facility. Unit and stack numbering must correspond throughout the application package. Refer to Table 2-E for instructions on use of the "-" symbol and on significant figures.

Stack No.	Serving Unit Number(s) from Table 2-A	NOx		CO		VOC		SOx		PM		PM10		PM2.5		☐ H_2S or ☐ Lead	
		lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
Totals:																	

Table 2-H: Stack Exit Conditions

Unit and stack numbering must correspond throughout the application package. Include the stack exit conditions for each unit that emits from a stack, including blowdown venting parameters and tank emissions. If the facility has multiple operating scenarios, complete a separate Table 2-H for each scenario and, for each, type scenario name here:

Stack Number	Serving Unit Number(s) from Table 2-A	Orientation (H-Horizontal V=Vertical)	Rain Caps (Yes or No)	Height Above Ground (ft)	Temp. (F)	Flow Rate		Moisture by Volume (%)	Velocity (ft/sec)	Inside Diameter (ft)
						(acfs)	(dscfs)			
PSV 1-20	PSV 1-20	V	No	5.5	Ambient	0.5	-	-	2.55	0.50

Table 2-I: Stack Exit and Fugitive Emission Rates for HAPs and TAPs

In the table below, report the Potential to Emit for each HAP from each regulated emission unit listed in Table 2-A, only if the entire facility emits the HAP at a rate greater than or equal to one (1) ton per year For each such emission unit, HAPs shall be reported to the nearest 0.1 tpy. Each facility-wide Individual HAP total and the facility-wide Total HAPs shall be the sum of all HAP sources calculated to the nearest 0.1 ton per year. Per 20.2.72.403.A.1 NMAC, facilities not exempt [see 20.2.72.402.C NMAC] from TAP permitting shall report each TAP that has an uncontrolled emission rate in excess of its pounds per hour screening level specified in 20.2.72.502 NMAC. TAPs shall be reported using one more significant figure than the number of significant figures shown in the pound per hour threshold corresponding to the substance. Use the HAP nomenclature as it appears in Section 112 (b) of the 1990 CAAA and the TAP nomenclature as it listed in 20.2.72.502 NMAC. Include tank-flashing emissions estimates of HAPs in this table. For each HAP or TAP listed, fill all cells in this table with the emission numbers or a "-" symbol. A "-" symbol indicates that emissions of this pollutant are not expected or the pollutant is emitted in a quantity less than the threshold amounts described above.

Stack No.	Unit No.(s)	Total HAPs		Toluene X HAP or ☐ TAP		Provide Pollutant Name Here ☐ HAP or ☐ TAP		Provide Pollutant Name Here ☐ HAP or ☐ TAP		Provide Pollutant Name Here ☐ HAP or ☐ TAP		Provide Pollutant Name Here ☐ HAP or ☐ TAP		Provide Pollutant Name Here ☐ HAP or ☐ TAP		Provide Pollutant Name Here ☐ HAP or ☐ TAP		Provide Pollutant Name Here ☐ HAP or ☐ TAP	
		lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr	lb/hr	ton/yr
N/A	LF-OP	-	-																
N/A	LG-1	1.6	6.9	1.1	4.6														
N/A	Tank-1	0.004	0.02																
N/A	HAUL-1	-	-																
N/A	HAUL-2	-	-																
Totals:		1.6	6.9	1.1	4.6														

Table 2-J: Fuel

Specify fuel characteristics and usage. Unit and stack numbering must correspond throughout the application package.

Unit No.	Fuel Type (low sulfur Diesel, ultra low sulfur diesel, Natural Gas, Coal, …)	Fuel Source: purchased commercial, pipeline quality natural gas, residue gas, raw/field natural gas, process gas (e.g. SRU tail gas) or other	Specify Units				
			Lower Heating Value	Hourly Usage	Annual Usage	% Sulfur	% Ash
Not applicable as none of the permitted units use fuel.							

Table 2-K: Liquid Data for Tanks Listed in Table 2-L

For each tank, list the liquid(s) to be stored in each tank. If it is expected that a tank may store a variety of hydrocarbon liquids, enter "mixed hydrocarbons" in the Composition column for that tank and enter the corresponding data of the most volatile liquid to be stored in the tank. If tank is to be used for storage of different materials, list all the materials in the "All Calculations" attachment, run the newest version of TANKS on each, and use the material with the highest emission rate to determine maximum uncontrolled and requested allowable emissions rate. The permit will specify the most volatile category of liquids that may be stored in each tank. Include appropriate tank-flashing modeling input data. Use additional sheets if necessary. Unit and stack numbering must correspond throughout the application package.

Tank No.	SCC Code	Material Name	Composition	Liquid Density (lb/gal)	Vapor Molecular Weight (lb/lb*mol)	Average Storage Conditions		Max Storage Conditions	
						Temperature (°F)	True Vapor Pressure (psia)	Temperature (°F)	True Vapor Pressure (psia)
Tank-1	40301008	Gasoline	Gasoline (RVP 10)	5.6	66	76.33	7.4	93.23	8.8

Table 2-L: Tank Data

Include appropriate tank-flashing modeling input data. Use an addendum to this table for unlisted data categories. Unit and stack numbering must correspond throughout the application package. Use additional sheets if necessary. See reference Table 2-L2. Note: 1.00 bbl = 10.159 M3 = 42.0 gal

Tank No.	Date Installed	Materials Stored	Seal Type (refer to Table 2-LR below)	Roof Type (refer to Table 2-LR below)	Capacity		Diameter (M)	Vapor Space (M)	Color (from Table VI-C)		Paint Condition (from Table VI-C)	Annual Throughput (gal/yr)	Turn-overs (per year)
					(bbl)	(M^3)			Roof	Shell			
Tank-1	1999	Gasoline (RVP 10)	N/A	FX	24	4	1.2	1.5	OT: Red Primer	OT: Red Primer	Poor	10,000	10.00

Table 2-L2: Liquid Storage Tank Data Codes Reference Table

Roof Type	Seal Type, Welded Tank Seal Type		Seal Type, Riveted Tank Seal Type		Roof, Shell Color	Paint Condition
	Mechanical Shoe Seal	**Liquid-mounted resilient seal**	**Vapor-mounted resilient seal**	**Seal Type**		
FX: Fixed Roof					**WH**: White	Good
IF: Internal Floating Roof	**A**: Primary only	**A**: Primary only	**A**: Primary only	**A**: Mechanical shoe, primary only	**AS**: Aluminum (specular)	Poor
EF: External Floating Roof	**B**: Shoe-mounted secondary	**B**: Weather shield	**B**: Weather shield	**B**: Shoe-mounted secondary	**AD**: Aluminum (diffuse)	
P: Pressure	**C**: Rim-mounted secondary	**C**: Rim-mounted secondary	**C**: Rim-mounted secondary	**C**: Rim-mounted secondary	**LG**: Light Gray	
					MG: Medium Gray	
					BL: Black	
					OT: Other (specify)	

Note: 1.00 bbl = 0.159 M^3 = 42.0 gal

Table 2-M: Materials Processed and Produced (Use additional sheets as necessary.)

Material Processed				Material Produced			
Description	**Chemical Composition**	**Phase (Gas, Liquid, or Solid)**	**Quantity (specify units)**	**Description**	**Chemical Composition**	**Phase**	**Quantity (specify units)**
Municipal Solid Waste	Miscellaneous Garbage	Solid	95,000 tons/yr	N/A	N/A	N/A	N/A

Table 2-N: CEM Equipment

Enter Continuous Emissions Measurement (CEM) Data in this table. If CEM data will be used as part of a federally enforceable permit condition, or used to satisfy the requirements of a state or federal regulation, include a copy of the CEM's manufacturer specification sheet in the Information Used to Determine Emissions attachment. Unit and stack numbering must correspond throughout the application package. Use additional sheets if necessary.

Stack No.	Pollutant(s)	Manufacturer	Model No.	Serial No.	Sample Frequency	Averaging Time	Range	Sensitivity	Accuracy
Not applicable as there is no CEM equipment at this facility.									

Table 2-O: Parametric Emissions Measurement Equipment

Unit and stack numbering must correspond throughout the application package. Use additional sheets if necessary.

Unit No.	Parameter/Pollutant Measured	Location of Measurement	Unit of Measure	Acceptable Range	Frequency of Maintenance	Nature of Maintenance	Method of Recording	Averaging Time
Not aplicable as there is no PEM equipment at this facility.								

Table 2-P: Greenhouse Gas Emissions

Applications submitted under 20.2.70, 20.2.72, & 20.2.74 NMAC are required to complete this Table. Power plants, Title V major sources, and PSD major sources must report and calculate all GHG emissions for each unit. Applicants must report potential emission rates in short tons per year (see Section 6.a for assistance). Include GHG emissions during Startup, Shutdown, and Scheduled Maintenance in this table. For minor source facilities that are not power plants, are not Title V, or are not PSD, there are three options for reporting GHGs 1) report GHGs for each individual piece of equipment; 2) report all GHGs from a group of unit types, for example report all combustion source GHGs as a single unit and all venting GHG as a second separate unit; OR 3) check the following box ☐ By checking this box, the applicant acknowledges the total CO2e emissions are less than 75,000 tons per year.

		CO_2 ton/yr	N_2O ton/yr	CH_4 ton/yr	SF_6 ton/yr	PFC/HFC ton/yr[2]									Total GHG Mass Basis ton/yr[4]	Total CO_2e ton/yr[5]
Unit No.	GWPs [1]	1	298	25	22,800	footnote 3										
LF-OP	mass GHG	-	-	-	-	-									-	-
	CO_2e	-	-	-	-	-									-	-
LG-1	mass GHG	6,471.1	-	2,358.5	-	-									8,829.6	-
	CO_2e	6,471.1	-	58,962.3	-	-									-	65,433.4
Tank-1	mass GHG	-	-	-	-	-									-	-
	CO_2e	-	-	-	-	-									-	-
HAUL-1	mass GHG	-	-	-	-	-									-	-
	CO_2e	-	-	-	-	-									-	-
HAUL-2	mass GHG	-	-	-	-	-									-	-
	CO_2e	-	-	-	-	-									-	-
	mass GHG															
	CO_2e															
	mass GHG															
	CO2e															
Total	mass GHG	6,471	-	2,358	-	-									8,830	-
	CO_2e	6,471	-	58,962	-	-									-	65,433

[1] **GWP** (Global Warming Potential): Applicants must use the most current GWPs codified in Table A-1 of 40 CFR part 98. GWPs are subject to change, therefore, applicants need to check 40 CFR 98 to confirm GWP values.

[2] For **HFCs** or **PFCs** describe the specific HFC or PFC compound and use a separate column for each individual compound.

[3] For each new compound, enter the appropriate GWP for each HFC or PFC compound from Table A-1 in 40 CFR 98.

[4] Green house gas emissions on a **mass basis** is the ton per year green house gas emission before adjustment with its GWP.

[5] **CO_2e** means Carbon Dioxide Equivalent and is calculated by multiplying the TPY mass emissions of the green house gas by its GWP.

Section 3

Application Summary

The **Application Summary** shall include a brief description of the facility and its process, the type of permit application, the applicable regulation (i.e. 20.2.72.200.A.X, or 20.2.73 NMAC) under which the application is being submitted, and any air quality permit numbers associated with this site. If this facility is to be collocated with another facility, provide details of the other facility including permit number(s). In case of a revision or modification to a facility, provide the lowest level regulatory citation (i.e. 20.2.72.219.B.1.d NMAC) under which the revision or modification is being requested. Also describe the proposed changes from the original permit, how the proposed modification will affect the facility's operations and emissions, de-bottlenecking impacts, and changes to the facility's major/minor status (both PSD & Title V).

The **Process Summary** shall include a brief description of the facility and its processes.

Startup, Shutdown, and Maintenance (SSM) routine or predictable emissions: Provide an overview of how SSM emissions are accounted for in this application. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.env.nm.gov/aqb/permit/app_form.html) for more detailed instructions on SSM emissions.

The City of Roswell (City) is submitting a Title V renewal application to the New Mexico Environment Department (NMED) Air Quality Bureau (AQB) in accordance with 20.2.70.300.B(2) NMAC. The Roswell Municipal Landfill (RMLF) is an active landfill operating under the NMED Solid Waste Bureau (SWB) Permit Facility ID No. SWM-040334 and Title V Operating Permit No. P187L-R1.

The current Title V permit expires on February 17, 2022 and per 20.2.70.300.B(2) NMAC, a renewal application must be filed within 12 months of expiration. There are no revisions to existing equipment or landfill operating procedures included with this application. All equipment will continue to operate as represented in Title V permit No. P187L-R1.

RMLF is implementing a passive landfill gas system on the closed Unit 1. The system design addresses vadose zone soil vapor. Upon full implementation, the system will include the installation of 20 passive landfill vapor vents within the northern portion of Unit 1. The system will allow venting of VOCs within soil vapor. The venting of landfill gases will help prevent contamination of vadose soil gas and vadose zone perched water, and will help to mitigate a potential source of contamination that could affect the regional aquifer located within the San Andres Formation underlying the vadose sediments. VOC emissions estimates were prepared and are included in this renewal application. A plot plan of the proposed vent locations and a vent design diagram are attached.

RMLF accepts municipal solid waste from the City of Roswell and Chaves County. The revised solid waste permit of 2007 expanded the entire solid waste facility boundary by 282 acres, for a total of 390 acres.

The facility's routine operations include the following:

- Trucks bring in waste daily except Sundays and holidays.
- Waste delivery occurs in enclosed vehicles designed for hauling municipal solid waste.
- Waste is placed in solid waste cells.
- Soil fill is used to cover solid waste daily and calculated to be 20 percent of total waste brought in daily.
- Waste received every day is encapsulated.

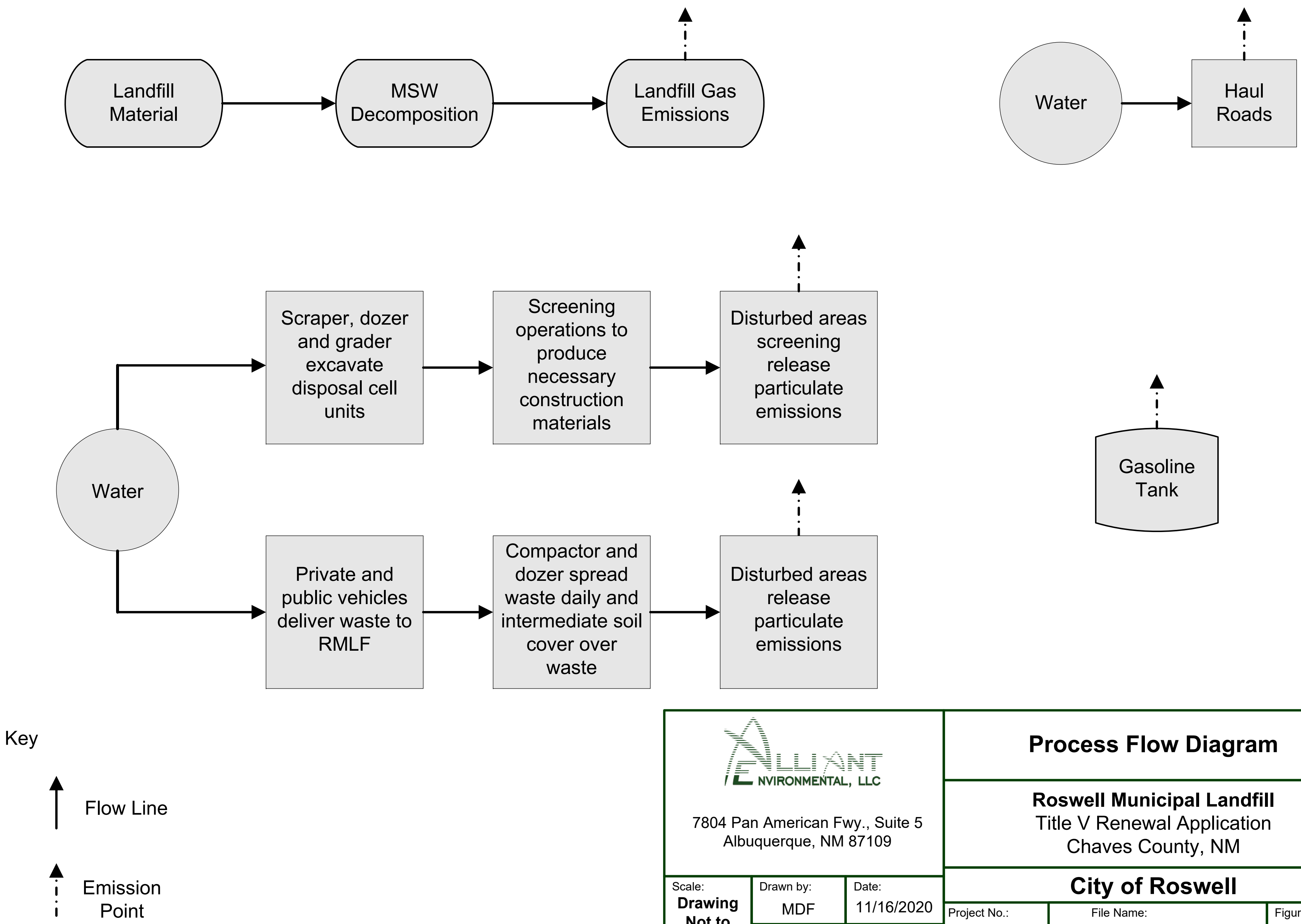
The City uses soil for daily and intermediate cover over the waste during routine operations. The soil cover is inert material that occupies a portion of the waste envelope and reduces the amount of waste that is disposed within the overall waste unit volume. The design capacity presented in the 2007 solid waste facility application was based on calculation of daily and intermediate cover as 20 percent of the waste envelope, with 80 percent of the waste envelope filled with waste.

Section 4

Process Flow Sheet

A **process flow sheet** and/or block diagram indicating the individual equipment, all emission points and types of control applied to those points. The unit numbering system should be consistent throughout this application.

A process flow diagram is provided on the following page.



ALLIANT ENVIRONMENTAL, LLC
7804 Pan American Fwy., Suite 5
Albuquerque, NM 87109

Process Flow Diagram

Roswell Municipal Landfill
Title V Renewal Application
Chaves County, NM

City of Roswell

Scale:	Drawn by:	Date:	Project No.:	File Name:	Figure:
Drawing Not to Scale	MDF	11/16/2020	091-003	**Roswell Landfill Diagrams**	Section 4
	Chk'd by: MRS	Date: 02/09/2021			

Section 5

Plot Plan Drawn To Scale

A **plot plan drawn to scale** showing emissions points, roads, structures, tanks, and fences of property owned, leased, or under direct control of the applicant. This plot plan must clearly designate the restricted area as defined in UA1, Section 1-D.12. The unit numbering system should be consistent throughout this application.

A plot plan is provided on the following page.

Aerial Photo from Google Earth Pro (2015)

N

0 500 1000 2000

SCALE: 1" = 1000'

LEGEND

LANDFILL BOUNDARY

NOTES:

UNITS 5-9 WILL BE CONSTRUCTED SEQUENTIALLY AS NEEDED.

MAP CREATED:
FEBRUARY, 2016

MAP REVISED:
1. JUNE 28, 2018

UNIT PROGRESSION
ROSWELL MUNCIPAL LANDFILL OPERATIONS PLAN
ROSWELL, CHAVES COUNTY, NEW MEXICO

SOUDER, MILLER & ASSOCIATES
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Engineering Environmental Surveying

Designed	Drawn	Checked
MAE	MAE	SAM

THIS DRAWING IS INCOMPLETE AND NOT TO BE USED FOR CONSTRUCTION UNLESS IT IS STAMPED, SIGNED AND DATED

Date: JUNE, 2018

Scale: Horiz: 1"=600'
Vert: N/A

Project No: 4422745

Sheet: Site Map

\\192.168.4.10\Projects\4-Roswell Municipal Landfill\ACAD\2021 Title V Figure.dwg, AJE, 12/30/2020 8:10 AM

Section 6

All Calculations

Show all calculations used to determine both the hourly and annual controlled and uncontrolled emission rates. All calculations shall be performed keeping a minimum of three significant figures. Document the source of each emission factor used (if an emission rate is carried forward and not revised, then a statement to that effect is required). If identical units are being permitted and will be subject to the same operating conditions, submit calculations for only one unit and a note specifying what other units to which the calculations apply. All formulas and calculations used to calculate emissions must be submitted. The "Calculations" tab in the UA2 has been provided to allow calculations to be linked to the emissions tables. Add additional "Calc" tabs as needed. If the UA2 or other spread sheets are used, all calculation spread sheet(s) shall be submitted electronically in Microsoft Excel compatible format so that formulas and input values can be checked. Format all spread sheets and calculations such that the reviewer can follow the logic and verify the input values. Define all variables. If calculation spread sheets are not used, provide the original formulas with defined variables. Additionally, provide subsequent formulas showing the input values for each variable in the formula. All calculations, including those calculations are imbedded in the Calc tab of the UA2 portion of the application, the printed Calc tab(s), should be submitted under this section.

Tank Flashing Calculations: The information provided to the AQB shall include a discussion of the method used to estimate tank-flashing emissions, relative thresholds (i.e., NOI, permit, or major source (NSPS, PSD or Title V)), accuracy of the model, the input and output from simulation models and software, all calculations, documentation of any assumptions used, descriptions of sampling methods and conditions, copies of any lab sample analysis. If Hysis is used, all relevant input parameters shall be reported, including separator pressure, gas throughput, and all other relevant parameters necessary for flashing calculation.

SSM Calculations: It is the applicant's responsibility to provide an estimate of SSM emissions or to provide justification for not doing so. In this Section, provide emissions calculations for Startup, Shutdown, and Routine Maintenance (SSM) emissions listed in the Section 2 SSM and/or Section 22 GHG Tables and the rational for why the others are reported as zero (or left blank in the SSM/GHG Tables). Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.env.nm.gov/aqb/permit/app_form.html) for more detailed instructions on calculating SSM emissions. If SSM emissions are greater than those reported in the Section 2, Requested Allowables Table, modeling may be required to ensure compliance with the standards whether the application is NSR or Title V. Refer to the Modeling Section of this application for more guidance on modeling requirements.

Glycol Dehydrator Calculations: The information provided to the AQB shall include the manufacturer's maximum design recirculation rate for the glycol pump. If GRI-Glycalc is used, the full input summary report shall be included as well as a copy of the gas analysis that was used.

Road Calculations: Calculate fugitive particulate emissions and enter haul road fugitives in Tables 2-A, 2-D and 2-E for:

1. If you transport raw material, process material and/or product into or out of or within the facility and have PER emissions greater than 0.5 tpy.
2. If you transport raw material, process material and/or product into or out of the facility more frequently than one round trip per day.

Significant Figures:

A. All emissions standards are deemed to have at least two significant figures, but not more than three significant figures.
B. At least 5 significant figures shall be retained in all intermediate calculations.
C. In calculating emissions to determine compliance with an emission standard, the following rounding off procedures shall be used:

(1) If the first digit to be discarded is less than the number 5, the last digit retained shall not be changed;
(2) If the first digit discarded is greater than the number 5, or if it is the number 5 followed by at least one digit other than the number zero, the last figure retained shall be increased by one unit; **and**
(3) If the first digit discarded is exactly the number 5, followed only by zeros, the last digit retained shall be rounded upward if it is an odd number, but no adjustment shall be made if it is an even number.
(4) The final result of the calculation shall be expressed in the units of the standard.

Control Devices: In accordance with 20.2.72.203.A(3) and (8) NMAC, 20.2.70.300.D(5)(b) and (e) NMAC, and 20.2.73.200.B(7) NMAC, the permittee shall report all control devices and list each pollutant controlled by the control device regardless if the applicant takes credit for the reduction in emissions. The applicant can indicate in this section of the application if they chose to not take credit for the reduction in emission rates. For notices of intent submitted under 20.2.73 NMAC, only uncontrolled emission rates can be considered to determine applicability unless the state or federal Acts require the control. This information is necessary to determine if federally enforceable conditions are necessary for the control device, and/or if the control device produces its own regulated pollutants or increases emission rates of other pollutants.

U.S. EPA's AP-42 emission factors were used to determine particulate emission rates (PM, PM_{10}, and $PM_{2.5}$) from this facility. RMLF does not have any combustion sources that operate routinely. Landfill gas emissions were calculated using U.S. EPA's LandGEM model.

RMLF emissions are fugitive emissions and arise from the following operations:

- Landfill Operations
    - Stockpile Handling
    - Bulldozer Operations
    - Compactor Operations
    - Grader Operations
    - Scraper Operations
- Haul road traffic
    - Paved
    - Unpaved
- Landfill Gas
    - Methane, Ethane, and VOCs from LandGEM model
    - Greenhouse Gas Report
    - Passive Vent VOC Emissions Calculations

The following AP-42 chapters were used to calculate equipment, road travel, and aggregate pile transfer emissions:

- Chapter 11.9 Western Surface Coal Mining
- Chapter 13.2.1 Paved Roads
- Chapter 13.2.2 Unpaved Roads
- Chapter 13.2.3 Heavy Construction Operations
- Chapter 13.2.4 Aggregate Handling and Storage Piles.

Section 6.a

Green House Gas Emissions

(Submitting under 20.2.70, 20.2.72 20.2.74 NMAC)

Title V (20.2.70 NMAC), Minor NSR (20.2.72 NMAC), and PSD (20.2.74 NMAC) applicants must estimate and report greenhouse gas (GHG) emissions to verify the emission rates reported in the public notice, determine applicability to 40 CFR 60 Subparts, and to evaluate Prevention of Significant Deterioration (PSD) applicability. GHG emissions that are subject to air permit regulations consist of the sum of an aggregate group of these six greenhouse gases: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Calculating GHG Emissions:

1. Calculate the ton per year (tpy) GHG mass emissions and GHG CO_2e emissions from your facility.
2. GHG mass emissions are the sum of the total annual tons of greenhouse gases without adjusting with the global warming potentials (GWPs). GHG CO_2e emissions are the sum of the mass emissions of each individual GHG multiplied by its GWP found in Table A-1 in 40 CFR 98 Mandatory Greenhouse Gas Reporting.
3. Emissions from routine or predictable start up, shut down, and maintenance must be included.
4. Report GHG mass and GHG CO_2e emissions in Table 2-P of this application. Emissions are reported in **short** tons per year and represent each emission unit's Potential to Emit (PTE).
5. All Title V major sources, PSD major sources, and all power plants, whether major or not, must calculate and report GHG mass and CO2e emissions for each unit in Table 2-P.
6. For minor source facilities that are not power plants, are not Title V, and are not PSD there are three options for reporting GHGs in Table 2-P: 1) report GHGs for each individual piece of equipment; 2) report all GHGs from a group of unit types, for example report all combustion source GHGs as a single unit and all venting GHGs as a second separate unit; 3) or check the following ☐ By checking this box, the applicant acknowledges the total CO2e emissions are less than 75,000 tons per year.

Sources for Calculating GHG Emissions:

- Manufacturer's Data
- AP-42 Compilation of Air Pollutant Emission Factors at http://www.epa.gov/ttn/chief/ap42/index.html
- EPA's Internet emission factor database WebFIRE at http://cfpub.epa.gov/webfire/
- 40 CFR 98 Mandatory Green House Gas Reporting except that tons should be reported in short tons rather than in metric tons for the purpose of PSD applicability.
- API Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Natural Gas Industry. August 2009 or most recent version.
- Sources listed on EPA's NSR Resources for Estimating GHG Emissions at http://www.epa.gov/nsr/clean-air-act-permitting-greenhouse-gases:

Global Warming Potentials (GWP):
Applicants must use the Global Warming Potentials codified in Table A-1 of the most recent version of 40 CFR 98 Mandatory Greenhouse Gas Reporting. The GWP for a particular GHG is the ratio of heat trapped by one unit mass of the GHG to that of one unit mass of CO_2 over a specified time period.

"Greenhouse gas" for the purpose of air permit regulations is defined as the aggregate group of the following six gases: carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. **(20.2.70.7 NMAC, 20.2.74.7 NMAC).** You may also find GHGs defined in 40 CFR 86.1818-12(a).

Metric to Short Ton Conversion:
Short tons for GHGs and other regulated pollutants are the standard unit of measure for PSD and title V permitting programs. 40 CFR 98 Mandatory Greenhouse Reporting requires metric tons.
1 metric ton = 1.10231 short tons (per Table A-2 to Subpart A of Part 98 – Units of Measure Conversions)

GHG emissions are included in this application (see emission calculations and Section 2, Table 2-P).

Emissions Summary

Maximum Uncontrolled Emissions

		NO_x		CO		VOC		SO_x		PM		PM_{10}		$PM_{2.5}$		HAPs		H_2S		NMOC		Methane		Ethane		CO_2e	
Unit	**Description**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**
LF-OP	Stockpile Handling Emissions	-	-	-	-	-	-	-	-	0.059	0.087	0.028	0.041	0.004	0.006	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Bulldozer Operation Emissions	-	-	-	-	-	-	-	-	3.15	4.64	2.36	3.48	0.33	0.49	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Compactor Operation Emissions	-	-	-	-	-	-	-	-	0.073	0.11	0.055	0.081	0.008	0.011	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Grader Operation Emissions	-	-	-	-	-	-	-	-	0.35	0.52	0.21	0.31	0.011	0.016	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Scraper Operation Emissions	-	-	-	-	-	-	-	-	11.44	16.87	3.16	3.83	0.32	0.38	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Wind Erosion Emissions	-	-	-	-	-	-	-	-	4.45	19.49	2.23	9.75	0.56	2.44	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	**LF-OP Total Emissions**	-	-	-	-	-	-	-	-	**19.52**	**41.72**	**8.04**	**17.49**	**1.23**	**3.34**	-	-	-	-	-	-	-	-	-	-	-	-
LG-1	Landfill Gas Emissions	-	-	0.26	1.15	1.67	7.34	-	-	-	-	-	-	-	-	1.57	6.90	0.08	0.36	-	15.21	-	2358.49	-	7.87	-	65,433.39
Tank-1	Gasoline Tank Emisisons	-	-	-	-	0.16	0.70	-	-	-	-	-	-	-	-	0.004	0.02	-	-	-	-	-	-	-	-	-	-
PSV 1-20	Passive Vents 1-20	-	-	-	-	0.69	3.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAUL-1	Unpaved Haul Road Emissions	-	-	-	-	-	-	-	-	116.68	68.27	31.50	18.43	3.15	1.84	-	-	-	-	-	-	-	-	-	-	-	-
HAUL-2	Paved Haul Road Emissions	-	-	-	-	-	-	-	-	26.75	10.22	5.35	1.93	1.31	0.43	-	-	-	-	-	-	-	-	-	-	-	-
Totals		***-***	***-***	***0.3***	***1.2***	***2.5***	***11.1***	***-***	***-***	***162.9***	***120.2***	***44.9***	***37.9***	***5.7***	***5.6***	***1.58***	***6.9***	***0.1***	***0.4***	***-***	***15.2***	***-***	***2358***	***-***	***7.9***	***-***	***65,433***

Maximum Controlled Emissions

		NO_x		CO		VOC		SO_x		PM		PM_{10}		$PM_{2.5}$		HAPs		H_2S		NMOC		Methane		Ethane		CO_2e	
Unit	**Description**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**
LF-OP	Stockpile Handling Emissions	-	-	-	-	-	-	-	-	0.06	0.07	0.03	0.03	0.004	0.01	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Bulldozer Operation Emissions	-	-	-	-	-	-	-	-	3.15	3.81	2.36	2.86	0.33	0.40	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Compactor Operation Emissions	-	-	-	-	-	-	-	-	0.07	0.09	0.06	0.07	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Grader Operation Emissions	-	-	-	-	-	-	-	-	0.35	0.43	0.21	0.26	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Scraper Operation Emissions	-	-	-	-	-	-	-	-	3.81	5.12	1.10	1.33	0.11	0.13	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	Wind Erosion Emissions	-	-	-	-	-	-	-	-	4.45	19.49	2.23	9.75	0.56	2.44	-	-	-	-	-	-	-	-	-	-	-	-
LF-OP	**LF-OP Total Emissions**	-	-	-	-	-	-	-	-	**11.90**	**29.01**	**5.98**	**14.29**	**1.02**	**3.00**	-	-	-	-	-	-	-	-	-	-	-	-
LG-1	Landfill Gas Emissions	-	-	0.26	1.15	1.67	7.34	-	-	-	-	-	-	-	-	1.57	6.90	0.08	0.36	-	15.21	-	2358.49	-	7.87	-	65,433.4
Tank-1	Gasoline Tank Emisisons	-	-	-	-	0.16	0.70	-	-	-	-	-	-	-	-	0.004	0.02	-	-	-	-	-	-	-	-	-	-
PSV 1-20	Passive Vents 1-20	-	-	-	-	0.69	3.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAUL-1	Unpaved Haul Road Emissions	-	-	-	-	-	-	-	-	23.34	13.65	6.30	3.69	0.63	0.37	-	-	-	-	-	-	-	-	-	-	-	-
HAUL-2	Paved Haul Road Emissions	-	-	-	-	-	-	-	-	1.34	0.51	0.27	0.10	0.07	0.02	-	-	-	-	-	-	-	-	-	-	-	-
Totals		***-***	***-***	***0.3***	***1.2***	***2.5***	***11.1***	***-***	***-***	***36.6***	***43.2***	***12.6***	***18.1***	***1.7***	***3.4***	***1.6***	***6.9***	***0.1***	***0.4***	***-***	***15.2***	***-***	***2358***	***-***	***7.9***	***-***	***65,433***

"-" Indicates emissions of this pollutant are not expected or not appropriate.
LG-1 VOC Emissions based on LandGEM predicted 2027 emissions

Stockpile Handling

Unit Information		
Unit:	LF-OP	
Description:	Stockpile Handling Emissions (SPH)	
Stockpile Dimension	200 x 250	ft
Stockpile Area	50,000	ft^2
Stockpile Height	15	ft
Stockpile Volume	750,000	ft^3
Density of Soil	100	lb/ft^3
Mass of Stockpile	37,500	tons
Daily Cover Amount	324	tons/day
Hourly Cover Amount	32.4	tons/hour
Operational Hours	10	hours/day
Operational days per year	312	days per year
Rainy Days[1]	70	days/year
Mean Moisture Content[2]	11	%
Number of Drops	2	drops/event

Notes:

[1] NMED allows a default value of 70 wet days (0.01 inches of precipitation) per year.

[2] AP-42 Table 13.2.4-1, "Typical Silt and Moisture Contents of Materials at Various Industries" specifies a mean moisture content for miscellaneous materials at Municipal Solid Waste Landfills of 11%.

AP-42 Section 13.2.4, Equation (1)

$$E = k(0.0032)\frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \quad \text{(pound [lb]/ton)}$$

E = Emission Factor
k = particle size multiplier (dimensionless)
U - mean wind speed (miles per hour)
M = material moisture content (%)

Equation Variables			
Pollutant	**k**	**U[3]**	**M**
PM30	0.74	15.00	11.00
PM10	0.35	15.00	11.00
PM2.5	0.053	15.00	11.00

Calculated Emission Factors (lb/ton)[4]		
PM30	**PM10**	**PM2.5**
0.000908	0.000430	0.0000650

Notes:

[3] Assumed worst case wind speed for fugitive dust generation from stockpile.

[4] Emission factors were calculated according to Equation 1 in AP-42 13.2.4.

Uncontrolled Emission Rates			
PM30	**PM10**	**PM2.5**	**Units**
0.0588	0.0278	0.0042	lb/hr
0.0868	0.0411	0.0062	tons/year

Controlled Emission Rates			
PM30	**PM10**	**PM2.5**	**Units**
0.0588	0.0278	0.0042	lb/hr
0.0712	0.0337	0.0051	tons/year

Sample Calculations:
Emissions (lb/hr) = E (lb/ton) * (tons/hour) * number of drops
Emissions (ton/year) = E (lb/ton) * (hours/day) * (Annual Operating Days - Rainy Days) * (1 ton/2000 pounds)

Bulldozer Operations

Unit Information		
Unit:	LF-OP	
Description:	Bulldozer Operation Emissions (BD)	
Operational Hours	10	hours/day
Operational days per year	312	days per year
Rainy Days[1]	70	days/year

Notes:
[1] NMED allows a default value of 70 wet days (0.01 inches of precipitation) per year.

AP-42 Section 11.9, Table 11.9-1 Equations
PM30 (lb/hr) = (5.7 * (s^1.2)) / (M^1.3)
PM10 (lb/hr) = ((5.7 * (s^1.2)) / (M^1.3)) * 0.75
PM2.5 (lb/hr) = ((5.7 * (s^1.2)) / (M^1.3)) * 0.105

s = material silt content (%)
M = material moisture content (%)

Equation Variables[2]		
Pollutant	**s**	**M**
PM30	9.00	12.00
PM10	9.00	12.00
PM2.5	9.00	12.00

Notes:
[2] Equation variables are from AP-42 13.2.4 Aggregate Handling & Storage Piles - Table 13.2.4-1 Typical Silt and Moisture Contents for dirt cove

Uncontrolled Emission Rates			
PM30	**PM10**	**PM2.5**	**Units**
3.15	2.36	0.33	lb/hr
4.64	3.48	0.49	tons/year

Controlled Emission Rates			
PM30	**PM10**	**PM2.5**	**Units**
3.15	2.36	0.33	lb/hr
3.81	2.86	0.40	tons/year

Sample Calculations:
PM30 (lb/hr) = (5.7 * (s^1.2)) / (M^1.3)
Emissions (ton/year) = E (lb/ton) * (hours/day) * (Annual Operating Days - Rainy Days) * (1 ton/2000 pounds)

Compactor Operations

Unit Information		
Unit:	LF-OP	
Description:	Compactor Operation Emissions (COM)	
Operational Hours	10	hours/day
Operational days per year	312	days per year
Rainy Days[1]	70	days/year

Notes:
[1] NMED allows a default value of 70 wet days (0.01 inches of precipitation) per year.

AP-42 Section 11.9, Table 11.9-1 Equations
PM30 (lb/hr) = (5.7 * (s^1.2)) / (M^1.3)
PM10 (lb/hr) = ((5.7 * (s^1.2)) / (M^1.3)) * 0.75
PM2.5 (lb/hr) = ((5.7 * (s^1.2)) / (M^1.3)) * 0.105

s = material silt content (%)
M = material moisture content (%)

Equation Variables[2]		
Pollutant	**s**	**M**
PM30	0.50	15.00
PM10	0.50	15.00
PM2.5	0.50	15.00

Notes:
[2] Equation variables are from AP-42 13.2.4 Aggregate Handling & Storage Piles - Table 13.2.4-1 Typical Silt and Moisture Contents

Unontrolled Emission Rates[3]			
PM30	**PM10**	**PM2.5**	**Units**
0.073	0.055	0.008	lb/hr
0.108	0.081	0.011	tons/year

Controlled Emission Rates[3]			
PM30	**PM10**	**PM2.5**	**Units**
0.073	0.055	0.008	lb/hr
0.089	0.067	0.009	tons/year

Notes:
[3] The compactor operations occur at the fill face. The caluclation methodology discussed in AP-42 Chapters 13.2.3 (Table 13.2.3-1) states that dozer equations shown in Chpater 11.9 (Table 11.9-1) be used for compacting.

Sample Calculations:
PM30 (lb/hr) = (5.7 * (s^1.2)) / (M^1.3)
Emissions (ton/year) = E (lb/ton) * (hours/day) * (Annual Operating Days - Rainy Days) * (1 ton/2000 pounds)

Grader Operations

Unit Information		
Unit:	LF-OP	
Description:	Grader Operation Emissions (GR)	
Operational Hours	10	hours/day
Operational days per year	312	days per year
Rainy Days[1]	70	days/year
Grader Speed	6	mph
Miles Traveled per Day	1	miles/day

Notes:
[1] NMED allows a default value of 70 wet days (0.01 inches of precipitation) per year.

AP-42 Section 11.9, Table 11.9-1 Equations
PM30 (lb/VMT) = 0.040 * (S^2.5)
PM10 (lb/VMT) = (0.040 * (S^2.5)) * 0.60
PM2.5 (lb/VMT) = (0.040 * (S^2.5) * 0.031

S = mean vehicle speed (mph)

Equation Factors	
Pollutant	**(lb/VMT)**
PM30	3.53
PM10	2.12
PM2.5	0.11

Uncontrolled Emission Rates[2]			
PM30	**PM10**	**PM2.5**	**Units**
0.35	0.21	0.011	lb/hr
0.52	0.31	0.016	tons/year

Controlled mission Rates[2]			
PM30	**PM10**	**PM2.5**	**Units**
0.35	0.21	0.011	lb/hr
0.43	0.26	0.013	tons/year

Notes:
[2] Graders are used in the construction landfill cells. The fugitive emission rate calculations for grader operations are based on calculations shown in AP-42, Section 11.9 - Western Surface Coal Mining

Sample Calculations:

PM30 Emissions (lb/hr) = (lb/VMT) * (miles/day) / (hours/day)
Emissions (ton/year) = E (lb/ton) * (hours/day) * (Annual Operating Days - Rainy Days) * (1 ton/2000 pounds)

Scraper Operations

Unit Information		
Unit:	LF-OP	
Description:	Scraper Operation Emissions (SCR)	
Operational Hours	10	hours/day; 6 days/wk
Operational days per year	312	days per year
Rainy Days[1]	70	days/year
Scraper Road Length	1	miles
Number of Trips	1	trips/hour
Weight of Scraper	35	tons
Scraper Road Watering	80	%
Amount of Top Soil Removed	324	tons/day

Notes:
[1] NMED allows a default value of 70 wet days (0.01 inches of precipitation) per year.

Scraper Haul Road Emissions:

AP-42 Section 13.2.2, Equation (1a)

$$E = k\,(s/12)^a(W/3)^b$$

E = Emission Factor (lb/VMT)
k, a, b = empirical constants from Table 13.2.2-2
s = surface material silt content (%)
W = mean vehicle weight (tons)

Equation Variables				
Pollutant	**k**	**a**	**b**	**s**
PM30	4.90	0.70	0.45	6.40
PM10	1.50	0.90	0.45	6.40
PM2.5	0.150	0.90	0.45	6.40

Calculated Haul Road Emission Factors (lb/VMT)		
PM30	**PM10**	**PM2.5**
9.53	2.57	0.26

Uncontrolled Haul Road Emission Rates			
PM30	**PM10**	**PM2.5**	**Units**
9.53	2.57	0.26	lb/hr
14.06	3.11	0.31	tons/year

Controlled Haul Road Emission Rates			
PM30	**PM10**	**PM2.5**	**Units**
1.91	0.51	0.051	lb/hr
2.81	0.62	0.062	tons/year

Sample Calculations:
Uncontrolled Emissions (lb/hr) = E (lb/VMT) * (road length) * (number of trips)
Emissions (ton/year) = E (lb/ton) * (hours/day) * (365- Rainy Days) * (1 ton/2000 pounds)

Top Soil Removal Emissions:

Unit Information		
TSP Emission Factor[2]	0.058	lb TSP/ton of Top Soil
Amount of Top Soil Removed	324	tons/day

[2] AP-42 Chapter 11.9 Western Surface Coal Mining, Table 11.9-4 factor for soil removal by scraper was used in the calculations

Uncontrolled Top Soil Removal Emission Rates			
TSP	PM10[3]	PM2.5[4]	Units
1.88	0.58	0.06	lb/hr
2.77	0.85	0.08	tons/year

Controlled Top Soil Removal Emission Rates			
TSP	PM10[3]	PM2.5[4]	Units
1.88	0.58	0.06	lb/hr
2.27	0.70	0.07	tons/year

[3] The PM10 emission rate is calculated based on the ratio of PM10/TSP established in Table 13.2.2-2 (PM10/TSP = 1.5/4.9)
[4] The PM2.5 emission rate is calculated based on the ratio of PM2.5/PM10 from "Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors" prepared by the Midwest Research Institute (PM2.5/PM10 = 0.1).

Sample Calculations:
Emissions (lb/hr) = E (lb/ton) * (tons/day) / (hour/day)
Emissions (ton/year) = E (lb/ton) * (hours/day) * (Annual Operating Days - Rainy Days) * (1 ton/2000 pounds)

Unloading Emissions:

AP-42 Section 13.2.4, Equation (1)

$$E = k(0.0032) \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \quad \text{(pound [lb]/ton)}$$

E = Emission Factor
k = particle size multiplier (dimensionless)
U - mean wind speed (miles per hour)
M = material moisture content (%)

Unloading Equation Variables			
Pollutant	k	U[5]	M
PM30	0.74	15.00	12.00
PM10	0.35	15.00	12.00
PM2.5	0.035	15.00	12.00

Unloading Calculated Emission Factors (lb/ton)[6]		
PM30	PM10	PM2.5
0.000804	0.000380	0.0000380

Notes:
[5] Assumed worst case wind speed for fugitive dust generation from stockpile.
[6] Emission factors were calculated according to Equation 1 in AP-42 13.2.4.

Uncontrolled Unloading Emission Rates			
PM30	PM10	PM2.5	Units
0.026	0.012	0.0012	lb/hr
0.038	0.018	0.0018	tons/year

Controlled Unloading Emission Rates			
PM30	PM10	PM2.5	Units
0.026	0.012	0.0012	lb/hr
0.032	0.015	0.0015	tons/year

Sample Calculations:
Emissions (lb/hr) = E (lb/ton) * (tons/day) / (hour/day)
Emissions (ton/year) = E (lb/ton) * (hours/day) * (365- Rainy Days) * (1 ton/2000 pounds)

Total Scraper Emissions:

Total Uncontrolled Emission Rates			
PM30	PM10	PM2.5	Units
11.44	3.16	0.32	lb/hr
16.87	3.83	0.38	tons/year

Total Controlled Emission Rates			
PM30	PM10	PM2.5	Units
3.81	1.10	0.110	lb/hr
5.12	1.33	0.133	tons/year

Wind Erosion Emissions

Unit Information		
Unit:	LF-OP	
Description:	Wind Erosion Emissions (WIND)	
Erosion Unit 4 Area	13.2	Acres
Erosion Unit 5 Area	37.1	Acres
Dirt Stockpile Area	1	Acres

Notes:

[1] The landfill will be using units 4 and 5 for refuse fill in the next 25 years; for Title V purposes, these two active cells will be considered in wind erosion calculations. Other areas have grass seeded and road dust emissions are contained by base course and water spray.

Emission Factors (AP-42 Table 11.9-4)			
TSP	**PM10[2]**	**PM2.5[3]**	**Units**
0.38	0.19	0.05	ton/acre-yr

Notes:

[2] Air Quality Bureau ratio between TSP and PM10 was used to calculate PM10 emission factor (PM10 = TSP*0.5).

[3] Ratio between the PM10 factor and the PM2.5 factor was found using "Examination of the Multiplier Used to Estimate PM2.5 Fugitive Dust Emissions from PM10, Thompson G. Pace, US EPA (PM2.5 = PM10*0.25).

Emission Rates			
TSP	**PM10**	**PM2.5**	**Units**
4.45	2.23	0.56	lb/hr
19.49	9.75	2.44	tons/year

Sample Calculations:

TSP (lb/hr) = (TSP (tpy)) * (2000 lb/ton) * (1 year/8760 hour)

Emissions (ton/year) = (0.38 ton/acre-year) * (Total Erosion Acres)

Landfill Gas Emissions

Unit Information	
Unit:	LG-1
Description:	Landfill Gas Emissions

Gas/Pollutant	lb/hr	tpy	tpy CO2e
Methane	-	2,358.49	58,962
Carbon Dioxide (CO2)	-	6,471.14	6,471
Carbon Dioxide Equivalent (CO2e)	-		**65,433**
Carbon Monoxide (CO)	0.26	1.15	
Ethane	-	7.87	
NMOC	-	15.21	
VOC	**1.67**	**7.34**	
Hydrogen Sulfide (H2S)	**0.08**	**0.36**	
Toluene	**1.05**	**4.61**	
Total HAPs	**1.57**	**6.90**	

Note:
The above estimated future emissions in 2027 are based on EPA's LandGEM modeling and maximum potential emissions for the operating permit renewal period.
Total HAP emissions may not agree with the sum of individual HAPs because only individual HAPs greater than 1.0 tpy are listed.

Gasoline Tank

Unit Information		
Unit:	Tank-1	
Description:	1,000-Gallon Gasoline Tank	
Volume	1,000	Gallons
Volume	23.81	Barrels
Length (Shell)	10.8	Feet
Diameter	4.0	Feet
Daily Throughput	0.65	bbl/day
Annual Troughput	238	bbl/yr
Annual Troughput	10,000	gallons/yr
Turnovers	10.0	turnovers/yr

Emission Rates		
Component	**Emissions (lb/yr)[1]**	**Emissions (tpy)**
VOC	1404.03	0.70
n-Hexane	8.0	0.004
Benzene	9.0	0.0045
Toluene	10.5	0.0052
Ethylbenzene	0.7	0.0004
Xylenes	3.1	0.0015
1,2,4-Trimethylbenzene	0.3	0.00014
Total HAPs	31.6	0.016

Notes:

[1] The lb/yr emissions were estimated using TANKs 4.0.9d.

Passive Vents 1-20

Unit Information		
Unit:	PSV 1-20	
Description:	Passive Vent System	
Operational Hours	24	hours/day
Operational hours per year	8760	hours/year
Operational days per year	365	days per year

Notes:
[1] Passive vent emission calculations are based on total propsed passive vents to be installed. Phase 1 includes four (4) passive vents (PSV-3, PSV-4, PSV-15, and PSV-16. See plot plan.

Average flow per vent =	30.0	Cubic feet per minute (cfm)	**A**
Average estimated VOC concentration =	309.0	micro grams per liter (ug/L)	**B**
Maximum proposed number of PSV's	20.0		

Mass VOC released by per PSV per time unit = concentratioln (mass/volume) x flow (volume/time)
Conversion = (1 ug/L) x (1 cf/min) x (28.3 L/cf) x (525,600 min/year) x (1 g/1,000,000 ug) = (14.87) x (A) x (B) g/year x (0.002205 lb/g)

Pounds of VOCs vented per year per vent =	303.95
Total pounds of VOCs vented per year all 20 vents =	6078.96

Maximum lb/hr of VOCs vented =	**0.69**	**lb/hr VOCs**
Maximum tons/year of VOCs vented per year =	**3.04**	**tpy VOCs**

Haul Road Emissions

Unit Information		
Unit:	HAUL-1	
Description:	Unpaved Haul Roads	
Operational Hours	10	hours/day
Operational days per year	312	days per year
Rainy Days[1]	70	days/year
Controlled Emission Rate[2]	80	%

Notes:
[1] NMED allows a default value of 70 wet days (0.01 inches of precipitation) per year.
[2] Control is due to base course and water spray application.

Unpaved Haul Road Use						
Waste Type	**Vehicles per Day[3]**	**Daily Travel Distance (miles)**	**Vehicles per Year**	**Unpaved Distance (round trip)**	**Unpaved Miles Traveled per Year**	**Vehicle Mean Weight (tons)[4]**
Solid Waste	65	81	20819	4000	15772	28.67
Clean Fill	1	2	363	5550	382	17.50
E-Waste	1	1	26	1000	5	7.16
Green Waste	78	42	5920	2750	3083	20.90
Tipping Area	458	11	14335	125	339	12.98
Tire Area	1	4	223	1150	49	14.94
White Goods	4	4	1334	1750	442	18.02

Notes:
[3] The number fo vehicles per day is based on traffic recorded on a community-free day. During this time, the number of non-commercial vehicles increases to the tipping and green waste areas. Using this day results in a conservative emission estimate.

[4] Average weight used is the same for annual calculations for all areas except the tipping area. During community-free day, the tipping area traffic is dominated by pickups at the recylcing and disposal area; therefore, the maximum daily tipping area traffic is higher than for the annual traffic.

AP-42 Section 13.2.2, Equation (1a)

$$E = k\,(s/12)^a (W/3)^b$$

E = Emission Factor (lb/VMT)
k, a, b = empirical constants from Table 13.2.2-2
s = surface material silt content (%)
W = mean vehicle weight (tons)

Equation Variables				
Pollutant	**k**	**a**	**b**	**s**
PM30	4.9	0.70	0.45	6.40
PM10	1.50	0.90	0.45	6.40
PM2.5	0.15	0.90	0.45	6.40

Calculated Emission Factors (lb/VMT)			
Waste Type	**PM30**	**PM10**	**PM2.5**
Solid Waste	8.71	2.35	0.24
Clean Fill	6.98	1.88	0.19
E-Waste	4.67	1.26	0.13
Green Waste	7.56	2.04	0.20
Tipping Area	6.10	1.65	0.16
Tire Area	6.50	1.75	0.18
White Goods	7.07	1.91	0.19

Uncontrolled Emission Rates						
Waste Type	**PM30 (lb/hr)**	**PM30 (tpy)**	**PM10 (lb/hr)**	**PM10 (tpy)**	**PM2.5 (lb/hr)**	**PM2.5 (tpy)**
Solid Waste	70.58	55.54	19.05	14.99	1.91	1.50
Clean Fill	1.40	1.08	0.38	0.29	0.04	0.03
E-Waste	0.47	0.01	0.13	0.003	0.01	0.0003
Green Waste	32.10	9.42	8.66	2.54	0.87	0.25
Tipping Area	6.71	0.84	1.81	0.23	0.18	0.02
Tire Area	2.60	0.13	0.70	0.03	0.07	0.003
White Goods	2.83	1.26	0.76	0.34	0.08	0.03
Total Uncontrolled Emissions	**116.68**	**68.27**	**31.50**	**18.43**	**3.15**	**1.84**

Sample Calculations:
Emissions (lb/hr) = E (lb/VMT) * (VMT/day) / (hours/day)
Emissions (ton/year) = E (lb/VMT) * (VMT/year) * ((365- Rainy Days)/365) * (1 ton/2000 pounds)

Controlled Emission Rates						
Waste Type	**PM30 (lb/hr)**	**PM30 (tpy)**	**PM10 (lb/hr)**	**PM10 (tpy)**	**PM2.5 (lb/hr)**	**PM2.5 (tpy)**
Solid Waste	14.12	11.11	3.81	3.00	0.38	0.30
Clean Fill	0.28	0.22	0.08	0.06	0.01	0.01
E-Waste	0.09	0.00	0.03	0.00	0.00	0.00
Green Waste	6.42	1.88	1.73	0.51	0.17	0.05
Tipping Area	1.34	0.17	0.36	0.05	0.04	0.00
Tire Area	0.52	0.03	0.14	0.01	0.01	0.00
White Goods	0.57	0.25	0.15	0.07	0.02	0.01
Total Uncontrolled Emissions	**23.34**	**13.65**	**6.30**	**3.69**	**0.63**	**0.37**

Haul Road Emissions

Unit Information		
Unit:	HAUL-2	
Description:	Paved Haul Roads	
Operational Hours	10	hours/day
Operational days per year	312	days per year
Rainy Days[1]	70	days/year

Notes:
[1] NMED allows a default value of 70 wet days (0.01 inches of precipitation) per year.

Unpaved Haul Road Use						
Waste Type	**Vehicles per Day[1]**	**Daily Travel Distance (miles)**	**Vehicles per Year**	**Paved Distance (round trip)**	**Paved Miles Traveled per Year**	**Vehicle Mean Weight (tons)[2]**
Solid Waste	65	31	20819	2000	7886	28.67
Clean Fill	1	1	363	2000	138	17.50
E-Waste	1	1	26	2000	10	7.16
Green Waste	78	29	5920	2000	2242	20.90
Tipping Area	458	168	14335	2000	5430	12.98
Tire Area	1	1	223	2000	84	14.94
White Goods	4	1	1334	3750	947	18.02

Notes:
[1] The number fo vehicles per day is based on traffic recorded on a community-free day. During this time, the number of non-commercial vehicles increases to the tipping and green waste areas. Using this day results in a conservative emission estimate.

[2] Average weight used is the same for annual calculations for all areas except the tipping area. During community-free day, the tipping area traffic is dominated by pickups at the recylcing and disposal area; therefore, the maximum daily tipping area traffic is higher than for the annual traffic.

AP-42 Section 13.2.1, Equation 1

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

E = Emission Factor (lb/VMT)
k = Particle size multiplier for particle size range and units of interest
sL = road surface silt loading (g/m^2)
W = average vehicle weight (tons)

Equation Variables		
Pollutant	**k**	**sL**
PM30	0.011	7.40
PM10	0.0022	7.40
PM2.5	0.00054	7.40

Calculated Emission Factors (lb/VMT)			
Waste Type	**PM30**	**PM10**	**PM2.5**
Solid Waste	2.08	0.42	0.10
Clean Fill	1.26	0.25	0.06
E-Waste	0.51	0.10	0.02
Green Waste	1.51	0.30	0.07
Tipping Area	0.93	0.19	0.05
Tire Area	1.07	0.21	0.05
White Goods	1.30	0.26	0.06

Emission Rates						
Waste Type	**PM30 (lb/hr)**	**PM30 (tpy)**	**PM10 (lb/hr)**	**PM10 (tpy)**	**PM2.5 (lb/hr)**	**PM2.5 (tpy)**
Solid Waste	6.46	6.37	1.29	1.27	0.32	0.27
Clean Fill	0.13	0.07	0.03	0.01	0.01	0.003
E-Waste	0.05	0.002	0.01	0.0003	0.002	0.0001
Green Waste	4.32	1.31	0.86	0.22	0.21	0.06
Tipping Area	15.56	1.96	3.11	0.33	0.76	0.08
Tire Area	0.11	0.03	0.02	0.006	0.01	0.001
White Goods	0.13	0.48	0.03	0.08	0.01	0.02
Total Uncontrolled Emissions	**26.75**	**10.22**	**5.35**	**1.93**	**1.31**	**0.43**
Total Controlled Emissions	**1.34**	**0.51**	**0.27**	**0.10**	**0.07**	**0.02**

Sample Calculations:
Emissions (lb/hr) = E (lb/VMT) * (VMT/day) / (hours/day)
Emissions (ton/year) = E (lb/VMT) * (VMT/year) * ((365- Rainy Days)/365) * (1 ton/2000 pounds)

Note:
A control efficiency of 95% may be apoplied for paved haul roads according to NMED's Memo on "Department Accepted Values For Haul Road Emissions".

Truck Weight Calculations

Emission ID: -
Emission Group: -
Source Description: Supporting calculations for haul road average truck weight

Percent of Waste and Traffic Distance

Type	Vehicles/Yr	Waste Hauled (tons)	Dump Truck	Flat Bed	Pickup	Pickup+ Trailer	Paved (ft)	Unpaved (ft)	Mean weight (tons)
Solid waste	20819	72426.32	0.88	0.09	0.03	0.00	2000	4000	28.67
Clean fill	363	630.40	0.00	1.00	0.00	0.00	2000	5550	17.50
E-Waste	26	14.67	0.00	0.04	0.96	0.00	2000	1000	7.16
Green waste	5920	7332.94	0.58	0.00	0.36	0.05	2000	2750	20.90
Tipping area	14335	7204.93	0.00	0.58	0.42	0.00	2000	125	12.98
Tire area	223	250.08	0.09	0.57	0.34	0.00	2000	1150	14.94
White goods	1334	1860.22	0.04	0.96	0.00	0.00	3750	1750	18.02

Vehicle	Empty GVW	Weight with Waste	Average Weight
Dump truck	25.5	35.5	30.50
Flat bed	12.5	22.5	17.50
Pickup	4.25	9.25	6.75
Pickup and trailer	8.5	15.5	12.00

City of Roswell - Roswell Municipal Landfill

Traffic Summary Calculations

Emission Unit: -

Source Description: Supporting calculations for haul road distances

Annual Analysis

Material	Tickets	Veight, ton	%/Total Tons	Ave Tons/Ticket	%/Total Tickets	Disposal Area	Round Trip, ft	Updated Round Trip (ft)	Distance on Pavement	Distance on Dirt.	Total Mileage	Paved Mileage	Dirt Mileage	Vehicle Type	GVW[1,2], lbs	load/vehicle (tons)
Clean Fill 2	422	1986.82	2.21%	4.71	0.98%	3B	6000	6000	2000	4000	480	160	320	Dump Truck	51,000	4.71
Commercial 1	1965	1386.83	1.55%	0.71	4.57%	3B	6000	6000	2000	4000	2233	744	1489	flat-bed	25,000	0.71
Residential	6139	32162.91	35.85%	5.24	14.27%	3B	6000	6000	2000	4000	6977	2325	4651	Garbage Truck	51,000	5.24
Commercial 2	1962	11410.76	12.72%	5.82	4.56%	3B	6000	6000	2000	4000	2230	743	1486	Garbage Truck	51,000	5.82
Hvy Wast 2	2641	8414.28	9.38%	3.19	6.14%	3B	6000	6000	2000	4000	3002	1000	2001	Garbage Truck	51,000	3.19
SW Mixed 2	7059	16559.89	18.46%	2.35	16.40%	3B	6000	6000	2000	4000	8022	2674	5348	Garbage Truck	51,000	2.35
Problem Waste	78	346.98	0.39%	4.45	0.18%	3B	6000	6000	2000	4000	89	30	59	Garbage Truck	51,000	4.45
Ag Waste	164	33.28	0.04%	0.20	0.38%	3B	6000	6000	2000	4000	187	62	124	pick-up	8,500	0.20
Ag Waste 2	90	58.11	0.06%	0.65	0.21%	3B	6000	6000	2000	4000	103	34	68	pick-up	8,500	0.65
Ag Waste 3	299	66.46	0.07%	0.22	0.69%	3B	6000	6000	2000	4000	340	113	227	pick-up	8,500	0.22
Clean Fill	363	630.4	0.70%	1.74	0.84%	Cleanfill Area	7550	7550	2000	5550	520	138	382	flat-bed	25,000	1.74
E-waste 2	1	9.92	0.01%	9.92	0.00%	E waste Area	3000	3000	2000	1000	1	0	0	flat-bed	8,500	9.92
E-Waste	25	4.75	0.01%	0.19	0.06%	E waste Area	3000	3000	2000	1000	15	9	5	pick-up	8,500	0.19
Yard Waste 2	3455	6710.78	7.48%	1.94	8.03%	Green	4750	4750	2000	2750	3109	1309	1799	Garbage Truck	51,000	1.94
Yard Waste 1	2130	494.85	0.55%	0.23	4.95%	Green	4750	4750	2000	2750	1917	807	1109	pick-up	8,500	0.23
Xmas	11	0	0.00%	0.00	0.03%	Green	4750	4750	2000	2750	10	4	6	pick-up	8,500	0.00
R Woodchip	324	127.31	0.14%	0.39	0.75%	Green	4750	4750	2000	2750	292	123	169	pick-up and trailer	17,000	0.39
Waste Oil	1	0	0.00%	0.00	0.00%	Hazmat	2000	2000	2000	0	1	0	0	pick-up	8,500	0.00
R Paint	10	-7.22	-0.01%	-0.72	0.02%	Hazmat	2000	2000	2000	0	4	4	0	pick-up	8,500	-0.72
SW Mixed	8302	5469.4	6.10%	0.66	19.29%	Tipping Area	2125	2125	2000	125	3342	0	197	flat-bed	25,000	0.66
Res, Card Board	345	36.77	0.04%	0.11	0.80%	Tipping Area	2125	2125	2000	125	139	0	8	pick-up	8,500	0.11
Res, Burn Barrel	202	0.26	0.00%	0.00	0.47%	Tipping Area	2125	2125	2000	125	82	0	5	pick-up	8,500	0.00
SW Mixed	4984	1680.98	1.87%	0.34	11.58%	Tipping Area	2125	2125	2000	125	2006	1888	118	pick-up	8,500	0.34
Household 1	5	0.87	0.00%	0.17	0.01%	Tipping Area	2125	2125	2000	125	3	2	0	pick-up	8,500	0.17
Comm. Household	33	5.93	0.01%	0.18	0.08%	Tipping Area	2125	2125	2000	125	14	13	1	pick-up	8,500	0.18
Household 2	134	1.94	0.00%	0.01	0.31%	Tipping Area	2125	2125	2000	125	54	51	3	pick-up	8,500	0.01
Rolloff PU	330	8.78	0.01%	0.03	0.77%	Tipping Area	2125	2125	2000	125	133	125	8	pick-up	8,500	0.03
R Tires	19	129.21	0.14%	6.80	0.04%	Tire Area	3150	3150	2000	1150	12	7	4	Dump Truck	51,000	6.80
Tires	128	119.7	0.13%	0.94	0.30%	Tire Area	3150	3150	2000	1150	77	48	28	flat-bed	25,000	0.94
Passenger	57	1.17	0.00%	0.02	0.13%	Tire Area	3150	3150	2000	1150	35	22	12	pick-up	8,500	0.02
Truck Tires	14	0	0.00%	0.00	0.03%	Tire Area	3150	3150	2000	1150	9	5	3	pick-up	8,500	0.00
Large Tires	5	0	0.00%	0.00	0.01%	Tire Area	3150	3150	2000	1150	3	2	1	pick-up	8,500	0.00
Metal Commercial	134	64.22	0.07%	0.48	0.31%	White	3750	3750	2000	1750	96	51	44	flat-bed	25,000	0.48
R Metal	53	340.79	0.38%	6.43	0.12%	White Area	3750	3750	2000	1750	38	20	18	Dump Truck	51,000	6.43
Heavy Waste	1147	1455.21	1.62%	1.27	2.67%	White Goods	3750	3750	2000	1750	815	434	380	flat-bed	25,000	1.27

Total Tickets for 1 Year	43031
Total Tonnage for 1 Year	89712.34
Ave Num of Daily Tickets	137
Percentage of Commercial Ticket out of Total ticket	61%
Ave Num of Daily Commercial Tickets	83
Number of tickets on Highest Peak Day	608
Number of Non-commercial tickets on Peak Day	525
Site Total Mileage	36,390
Total Paved Mileage	12948
Total Dirt Mileage	20072

Non-commercial Tickets - Busiest Single Day

Material	Tickets	Veight, ton	%/Total Tons	Ave Tons/Ticket	%/Total Tickets	Breakdown of tickets for Peak Free Day	Disposal Area	Round Trip, ft	Updated Round Trip (ft)	Distance on Pavement	Distance on Dirt.	Mileage Based per Ticket Type	Paved Mileage per Ticket Type	Dirt Mileage per Ticket Type	Vehicle Type	GVW, lbs
E-Waste	25	4.75	0.01%	0.19	0.15%	1	E waste Area	3000	3000	2000	1000	1	0	0.1	pick-up	8,500
Yard Waste 1	2130	494.85	0.55%	0.23	12.54%	66	Green	4750	4750	2000	2750	60	25	34.3	pick-up	8,500
Xmas	11	0	0.00%	0.00	0.06%	0	Green Area	4750	4750	2000	2750	1	0	0.2	pick-up	8,500
R Paint	10	-7.22	-0.01%	-0.72	0.06%	0	Hazmat	2000	2000	2000	0	1	0	0.0	pick-up	8,500
SW Mixed	8302	5469.4	6.10%	0.66	48.90%	257	Tipping Area	2125	2125	2000	125	104	97	6.1	·bed or pickup, and tra	17,000
Res, Card Board	345	36.77	0.04%	0.11	2.03%	11	Tipping Area	2125	2125	2000	125	5	4	0.3	pick-up	8,500
Res, Burn Barrel	202	0.26	0.00%	0.00	1.19%	6	Tipping Area	2125	2125	2000	125	3	2	0.1	pick-up	8,500
Ag Waste	164	33.28	0.04%	0.20	0.97%	5	Tipping Area	2125	2125	2000	125	3	2	0.1	pick-up	8,500
Ag Waste 3	299	66.46	0.07%	0.22	1.76%	9	Tipping Area	2125	2125	2000	125	4	4	0.2	pick-up	8,500
SW Mixed	4984	1680.98	1.87%	0.34	29.35%	154	Tipping Area	2125	2125	2000	125	62	58	3.6	pick-up	8,500
Household 1	5	0.87	0.00%	0.17	0.03%	0	Tipping Area	2125	2125	2000	125	1	0	0.0	pick-up	8,500
Comm. Household	33	5.93	0.01%	0.18	0.19%	1	Tipping Area	2125	2125	2000	125	1	0	0.0	pick-up	8,500
Household 2	134	1.94	0.00%	0.01	0.79%	4	Tipping Area	2125	2125	2000	125	2	2	0.1	pick-up	8,500
Rolloff PU	330	8.78	0.01%	0.03	1.94%	10	Tipping Area	2125	2125	2000	125	5	4	0.2	pick-up	8,500
Large Tires	5	0	0.00%	0.00	0.03%	0	Tire Area	3000	3000	2000	1000	1	0	0.0	pick-up	8,500
						525					Total Mileage			45.5		

Tickets for Noncommercial Usage 16979

Mileage Free Day Noncommer 254

Mileage Free Day Noncommer 199

Mileage Free Day Noncommer 45

Commercial Tickets - Average Day

Material	Tickets	Veight, ton	%/Total Tons	Ave Tons/Ticket	%/Total Tickets	commercial tickets for Ave Day	Disposal Area	Round Trip with Unit 3, ft	Updated Round Trip (ft)	Distance on Pavement, ft	Distance on Dirt, Unit 3, ft	Dirt Mileage, Unit 3	Mileage, Unit 3	Round Trip with Unit 4, ft	Distance on Dirt, Unit 4, ft	Dirt Mileage, Unit 4	Mileage, Unit 4	Vehicle Type	GVW, lbs
Clean Fill	363	630.4	0.77%	1.74	1.39%	1	Cleanfill Area	7550	7550	2000	5550	2	2	8050	6050	2.0	2	flat-bed	25,000
E-waste 2	1	9.92	0.01%	9.92	0.00%	0	E waste Area	3000	3000	2000	1000	1	1	3500	1500	1.0	1	flat-bed	25,000
Yard Waste 2	3455	6710.78	8.19%	1.94	13.26%	11	Green	4750	4750	2000	2750	6	10	5250	3250	7.0	11	Garbage Truck	51,000
R Woodchip	324	127.31	0.16%	0.39	1.24%	1	Green	4750	4750	2000	2750	1	1	5250	3250	1.0	2	pick-up and trailer	17,000
Waste Oil	1	0	0.00%	0.00	0.00%	0	Hazmat	2000	2000	2000	0	0	1	2500	500	1.0	1	pick-up	51,000
R Tires	19	129.21	0.16%	6.80	0.07%	0	Tire Area	3150	3150	2000	1150	1	1	3650	1650	1.0	1	Dump Truck	51,000
Tires	128	119.7	0.15%	0.94	0.49%	0	Tire Area	3150	3150	2000	1150	1	1	3650	1650	1.0	1	flat-bed	25,000
Passenger	57	1.17	0.00%	0.02	0.22%	0	Tire Area	3150	3150	2000	1150	1	1	3650	1650	1.0	1	flat-bed	25,000
Truck Tires	14	0	0.00%	0.00	0.05%	0	Tire Area	3150	3150	2000	1150	1	1	3650	1650	1.0	1	pick-up	8,500
Hvy Wast 2	2641	8414.28	10.27%	3.19	10.14%	8	Unit 3, Unit 4	6000	6000	2000	4000	7	10	8250	6250	10.0	14	Dump Truck	51,000
Clean Fill 2	422	1986.82	2.43%	4.71	1.62%	1	Unit 3, Unit 4	6000	6000	2000	4000	2	2	8250	6250	2.0	3	Dump Truck	51,000
Commercial 1	1965	1386.83	1.69%	0.71	7.54%	6	Unit 3, Unit 4	6000	6000	2000	4000	5	8	8250	6250	8.0	10	flat-bed	25,000
Ag Waste 2	90	58.11	0.07%	0.65	0.35%	0	Unit 3, Unit 4	6000	6000	2000	4000	1	1	8250	6250	1.0	1	flat-bed	25,000
Residential	6139	32162.91	39.26%	5.24	23.56%	20	Unit 3, Unit 4	6000	6000	2000	4000	15	23	8250	6250	24.0	31	Garbage Truck	51,000
Commercial 2	1962	11410.76	13.93%	5.82	7.53%	6	Unit 3, Unit 4	6000	6000	2000	4000	5	8	8250	6250	8.0	10	Garbage Truck	51,000
SW Mixed 2	7059	16559.89	20.22%	2.35	27.10%	23	Unit 3, Unit 4	6000	6000	2000	4000	18	26	8250	6250	27.0	36	Garbage Truck	51,000
Problem Waste	78	346.98	0.42%	4.45	0.30%	0	Unit 3, Unit 4	6000	6000	2000	4000	1	1	8250	6250	1.0	1	Garbage Truck	51,000
Metal Commercial	134	64.22	0.08%	0.48	0.51%	0	White	3750	3750	2000	1750	1	1	4250	2250	1.0	1	flat-bed	25,000
R Metal	53	340.79	0.42%	6.43	0.20%	0	White Area	3750	3750	2000	1750	1	1	4250	2250	1.0	1	Dump Truck	51,000
Heavy Waste	1147	1455.21	1.78%	1.27	4.40%	4	White Goods	3750	3750	2000	1750	2	3	4250	2250	2.0	3	flat-bed	25,000
															101				

Tickets for Commercial 26052

Total 103

Paved Mileage, 31

Mileage, Unit 3 72

Mileage, 132

Total Paved Mileage Unit 4 31

Total Dirt Mileage, 101

Daily RMLF Operatio	GVW	mph	Productivity	Reported Productivity	Units	Days per Week	Miles Travelled, Highest Productivity	Miles Travelled, Reporteed Productivity
Caterpiller D8N dozer	84,850	3.8	9	6.5	hrs	6	34.2	24.7
erpiller 623G Scrapper	81,196	6.8	9	6.5	hrs	6	61.2	44.2
erpiller 623G Scrapper	81,196	6.8	9	6.5	hrs	6	61.2	44.2
pillar 826G Compactor	81,498	3.6	9	10	hrs	6	32.4	36
BC772RB Compactor	81,205	3.6	9	2	hrs	6	32.4	7.2
Bobcat 220	7,483	6.9	9	2	hrs	1	62.1	13.8
Volvo L150D Loader	57,320	6.8	9	2	hrs	6	61.2	13.6
MC C6V Water Wagon	50,000	10	9	2	hrs	6	90	20
Dodge Ram 1500 4x2	7,300	10	9	2	hrs	6	90	20
liner FL7 Rolloff Truck	65,000	10	9	4	hrs	6	90	40
liner FL7 Rolloff Truck	65,000	10	9	4	hrs	6	90	40
Ford F150, x5	7,500	10	9	2	hrs	6	90	20
Fuel Truck Ford F250	8,500	10	9	4	hrs	6	90	40
Shop Truck, Ford F250	8,500	10	9	4	hrs	6	90	40
Dodge Ram 2500	8,500	10	9	4	hrs	6	90	40
n Deere Motor Grader	46,800	6	9	1.7	hrs	6	54	10.2
						Total Miles Travelle	1118.7	453.9

Notes	
1	The values for GVW used in the column are best estimates from research i.e. garbage truck was found to be anywhere from 33, 000 lb GVWR to 59,000 lb GVWR. So conservatively 51,000 lb GVW was assigned.
2	These values are called from sheet 2. The values of GVW used for the RMLF equipment are entered in manual on this shee

Diesel Tank (Exempt Source)

Unit Information		
Unit:	Tank-2	
Description:	3,000-Gallon Diesel Tank	
Volume	3,000	Gallons
Volume	71	Barrels
Length (Shell)	17.7	Feet
Diameter	5.4	Feet
Daily Throughput	9.78	bbl/day
Annual Troughput	3571	bbl/yr
Annual Troughput	150,000	gallons/yr
Turnovers	50.0	turnovers/yr

Emission Rates		
Component	**Emissions (lb/yr)**	**Emissions (tpy)**
VOC	6.8	0.003
n-Hexane	0.00	0.00000
Benzene	0.01	0.00001
Toluene	0.2	0.0001
Ethylbenzene	0.02	0.00001
Xylenes	0.4	0.0002
1,2,4-Trimethylbenzene	0.3	0.00017
Total HAPs	0.9	0.0005

Notes:

[1] The lb/yr emissions were estimated using TANKs 4.0.9d.

[2] This tank is listed as an exempt source in Title V permit P187L-R1.
Emission listed above are from previous applications.

INTRODUCTION

LandGEM - Landfill Gas Emissions Model, Version 3.03

U.S. Environmental Protection Agency

Model Design:

Worksheet Name	Function
INTRO	Contains an overview of the model and important notes about using LandGEM
USER INPUTS	Allows users to provide landfill characteristics, determine model parameters, select up to four gases/pollutants (total landfill gas, methane, carbon dioxide, NMOC, and 46 air pollutants), and enter waste acceptance rates
POLLUTANTS	Allows users to edit air pollutant concentrations and molecular weights for existing pollutants and add up to 10 new pollutants
INPUT REVIEW	Allows users to review and print model inputs
METHANE	Calculates methane emission estimates using the first-order decomposition rate equation
RESULTS	Shows tabular emission estimates for up to four gases/pollutants (selected in the USER INPUTS worksheet) in megagrams per year, cubic meters per year, and user's choice of a third unit of measure (average cubic feet per minute, cubic feet per year, or short tons per year)
GRAPHS	Shows graphical emission estimates for up to four gases/pollutants (selected in the USER INPUTS worksheet) in megagrams per year, cubic meters per year, and user's choice of a third unit of measure (selected in the RESULTS worksheet)
INVENTORY	Displays tabular emission estimates for all gases/pollutants for a single year specified by users
REPORT	Allows users to review and print model inputs and outputs in a summary report

IMPORTANT NOTES!

The following user inputs MUST be completed in the USER INPUTS worksheet:

- Landfill open year
- Landfill closure year or Waste design capacity
- Annual waste acceptance rates from open year to current year or closure year

Other Important Notes:

- LandGEM is based on the gas generated from anaerobic decomposition of landfilled waste which has a methane content between 40 and 60 percent.
- When using LandGEM to comply with the CAA, the methane content of the landfill gas must remain fixed at 50% by volume (the model default value).
- Default pollutant concentrations used by LandGEM have already been corrected for air infiltration, as stated in AP-42. If a user-specified value for NMOC concentration is used based on site-specific data, then it must be corrected for air infiltration.
- When comparing results from LandGEM with measurements of extracted gas collected at a site, the landfill owner/operator must adjust for air infiltration prior to any comparisons.
- One megagram is equivalent to one metric ton.

About LandGEM:

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.

USER INPUTS

Landfill Name or Identifier:

Clear ALL Non-Parameter Inputs/Selections

1: PROVIDE LANDFILL CHARACTERISTICS

Landfill Open Year	1980	
Landfill Closure Year	2050	
Have Model Calculate Closure Year?	Yes ● No	
Waste Design Capacity		*megagrams*

Restore Default Model Parameters

2: DETERMINE MODEL PARAMETERS

Methane Generation Rate, k (*year^{-1}*)

CAA Arid Area - 0.02

Potential Methane Generation Capacity, L_0 (*m^3/Mg*)

Inventory Conventional - 100

NMOC Concentration (*ppmv as hexane*)

Inventory No or Unknown Co-disposal - 600

Methane Content (*% by volume*)

CAA - 50% by volume

3: SELECT GASES/POLLUTANTS

Default pollutant parameters are currently being used by model.

Gas / Pollutant #1

Total landfill gas

Gas / Pollutant #2

Methane

Gas / Pollutant #3

Carbon dioxide

Gas / Pollutant #4

NMOC

Edit Existing or Add New Pollutant Parameters

Restore Default Pollutant Parameters

Description/Comments:

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *short tons/year*

Year	Input Units *(short tons/year)*	Calculated Units *(Mg/year)*
1980	45,000	40,909
1981	45,000	40,909
1982	45,000	40,909
1983	45,000	40,909
1984	45,000	40,909
1985	45,000	40,909
1986	45,000	40,909
1987	45,000	40,909
1988	45,000	40,909
1989	45,000	40,909
1990	45,109	41,008
1991	52,700	47,909
1992	59,990	54,536
1993	51,525	46,841
1994	51,525	46,841
1995	51,210	46,555
1996	48,636	44,215
1997	33,721	30,655
1998	45,537	41,397
1999	31,240	28,400
2000	33,430	30,391
2001	33,838	30,762
2002	46,548	42,316
2003	46,275	42,068
2004	48,748	44,316
2005	65,207	59,279
2006	49,573	45,066
2007	54,405	49,459
2008	51,918	47,198
2009	50,554	45,958
2010	51,713	47,012
2011	47,492	43,175
2012	52,184	47,440
2013	52,300	47,545
2014	63,501	57,728
2015	58,567	53,243
2016	54,501	49,547
2017	50,817	46,197
2018	54,879	49,890
2019	54,595	49,632
2020	55,000	50,000
2021	95,000	86,364
2022	95,000	86,364
2023	95,000	86,364
2024	95,000	86,364
2025	95,000	86,364
2026	95,000	86,364
2027	95,000	86,364

POLLUTANTS

Landfill Name or Identifier: ______________________

Enter New Pollutant Parameters **Edit Existing Pollutant Parameters**

Default parameters will be used by model unless alternate parameters are entered.

Gas / Pollutant Default Parameters:

Enter User-specified Pollutant Parameters for Existing Pollutants:

	Compound	Concentration (*ppmv*)	Molecular Weight	Notes	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		30.03			
	Methane		16.04			
	Carbon dioxide		44.01			
	NMOC	600	86.18			
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41	A		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85	A, B		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97	A, B		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94	A, B		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96	A, B		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99	A, B		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11	B		
	Acetone	7.0	58.08			
	Acrylonitrile - HAP/VOC	6.3	53.06	A, B		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11	A, B		
	Benzene - Co-disposal - HAP/VOC	11	78.11	A, B		
	Bromodichloromethane - VOC	3.1	163.83	B		
	Butane - VOC	5.0	58.12	B		
	Carbon disulfide - HAP/VOC	0.58	76.13	A, B		
	Carbon monoxide	140	28.01			
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84	A, B		
	Carbonyl sulfide - HAP/VOC	0.49	60.07	A, B		
	Chlorobenzene - HAP/VOC	0.25	112.56	A, B		
	Chlorodifluoromethane	1.3	86.47			
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52	A, B		
	Chloroform - HAP/VOC	0.03	119.39	A, B		
	Chloromethane - VOC	1.2	50.49	B		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147	B, C		
	Dichlorodifluoromethane	16	120.91			
	Dichlorofluoromethane - VOC	2.6	102.92	B		
	Dichloromethane (methylene chloride) - HAP	14	84.94	A		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13	B		
	Ethane	890	30.07			
	Ethanol - VOC	27	46.08	B		
	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13	B		
	Ethylbenzene - HAP/VOC	4.6	106.16	A, B		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88	A, B		
	Fluorotrichloromethane - VOC	0.76	137.38	B		
	Hexane - HAP/VOC	6.6	86.18	A, B		
	Hydrogen sulfide	36	34.08			
	Mercury (total) - HAP	2.9E-04	200.61	A		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11	A, B		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16	A, B		
	Methyl mercaptan - VOC	2.5	48.11	B		
	Pentane - VOC	3.3	72.15	B		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83	A		
	Propane - VOC	11	44.09	B		
	t-1,2-Dichloroethene - VOC	2.8	96.94	B		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13	A, B		
	Toluene - Co-disposal - HAP/VOC	170	92.13	A, B		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40	A, B		
	Vinyl chloride - HAP/VOC	7.3	62.50	A, B		
	Xylenes - HAP/VOC	12	106.16	A, B		

Enter New Compound	Enter Concentration (*ppmv*)	Enter Molecular Weight

Return to USER INPUTS

A. Hazardous air pollutants (HAP) listed in Title III of the 1990 Clean Air Act Amendments.
B. Considered volatile organic compounds (VOC), as defined by U.S. EPA in 40 CFR 51.100(s).
C. Source tests did not indicate whether this compound was the para- or ortho- isomer. The para- isomer is a Title III-listed HAP.

Source: Tables 2.4-1 and 2.4-2 of *Compilation of Air Pollutant Emission Factors, AP-42, Volume 1: Stationary Point and Area Sources* , 5th ed., Chapter 2.4 Municipal Solid Waste Landfills. U.S. EPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC. November 1998. http://www.epa.gov/ttn/chief/ap42/ch02/final/c02s04.pdf

INPUT REVIEW

Landfill Name or Identifier: ______________________

LANDFILL CHARACTERISTICS

Landfill Open Year	**1980**	
Landfill Closure Year (with 80-year limit)	**2050**	
Actual Closure Year (without limit)	***2050***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity		*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*$year^{-1}$*
Potential Methane Generation Capacity, L_0	**100**	*m^3/Mg*
NMOC Concentration	**600**	*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**

Description/Comments:

WASTE ACCEPTANCE RATES

Year	*(Mg/year)*	*(short tons/year)*
1980	40,909	45,000
1981	40,909	45,000
1982	40,909	45,000
1983	40,909	45,000
1984	40,909	45,000
1985	40,909	45,000
1986	40,909	45,000
1987	40,909	45,000
1988	40,909	45,000
1989	40,909	45,000
1990	41,008	45,109
1991	47,909	52,700
1992	54,536	59,990
1993	46,841	51,525
1994	46,841	51,525
1995	46,555	51,210
1996	44,215	48,636
1997	30,655	33,721
1998	41,397	45,537
1999	28,400	31,240
2000	30,391	33,430
2001	30,762	33,838
2002	42,316	46,548
2003	42,068	46,275
2004	44,316	48,748
2005	59,279	65,207
2006	45,066	49,573
2007	49,459	54,405
2008	47,198	51,918
2009	45,958	50,554
2010	47,012	51,713
2011	43,175	47,492
2012	47,440	52,184
2013	47,545	52,300
2014	57,728	63,501
2015	53,243	58,567
2016	49,547	54,501
2017	46,197	50,817
2018	49,890	54,879
2019	49,632	54,595
2020	50,000	55,000
2021	86,364	95,000
2022	86,364	95,000

WASTE ACCEPTANCE RATES

Year	*(Mg/year)*	*(short tons/year)*
2023	86,364	95,000
2024	86,364	95,000
2025	86,364	95,000
2026	86,364	95,000
2027	86,364	95,000
2028	86,364	95,000
2029	86,364	95,000
2030	86,364	95,000
2031	86,364	95,000
2032	86,364	95,000
2033	86,364	95,000
2034	86,364	95,000
2035	86,364	95,000
2036	86,364	95,000
2037	86,364	95,000
2038	86,364	95,000
2039	86,364	95,000
2040	86,364	95,000
2041	86,364	95,000
2042	86,364	95,000
2043	86,364	95,000
2044	86,364	95,000
2045	86,364	95,000
2046	86,364	95,000
2047	86,364	95,000
2048	86,364	95,000
2049	86,364	95,000
2050	0	0
2051	0	0
2052	0	0
2053	0	0
2054	0	0
2055	0	0
2056	0	0
2057	0	0
2058	0	0
2059	0	0

METHANE

Landfill Name or Identifier:

First-Order Decomposition Rate Equation:

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

Where,

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

i = 1-year time increment

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

j = 0.1-year time increment

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

L_0 = 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)

Model Parameters from User Inputs:

k =	0.020	*$year^{-1}$*
L_0 =	100	*m^3/Mg*

When Model Calculates Closure Year…

Final Non-Zero Acceptance Entered =	86,364	*megagrams* in	2027
Waste Design Capacity =		*megagrams*	
Closure Year (with 80-year limit) =	2050		
Actual Closure Year (without limit) =	2050		
Model Waste Acceptance Limit =	80	*years*	

Year	User Waste Acceptance Inputs *(Mg/year)*	User Waste-In-Place *(Mg)*	Waste Acceptance *(Mg/year)*	Waste-In-Place *(Mg)*
1980	40,909	0	40,909	0
1981	40,909	40,909	40,909	40,909
1982	40,909	81,818	40,909	81,818
1983	40,909	122,727	40,909	122,727
1984	40,909	163,636	40,909	163,636
1985	40,909	204,545	40,909	204,545
1986	40,909	245,455	40,909	245,455
1987	40,909	286,364	40,909	286,364
1988	40,909	327,273	40,909	327,273
1989	40,909	368,182	40,909	368,182
1990	41,008	409,091	41,008	409,091
1991	47,909	450,099	47,909	450,099
1992	54,536	498,008	54,536	498,008
1993	46,841	552,545	46,841	552,545
1994	46,841	599,385	46,841	599,385
1995	46,555	646,226	46,555	646,226
1996	44,215	692,781	44,215	692,781
1997	30,655	736,995	30,655	736,995
1998	41,397	767,651	41,397	767,651
1999	28,400	809,048	28,400	809,048
2000	30,391	837,448	30,391	837,448
2001	30,762	867,839	30,762	867,839
2002	42,316	898,601	42,316	898,601
2003	42,068	940,917	42,068	940,917
2004	44,316	982,985	44,316	982,985
2005	59,279	1,027,302	59,279	1,027,302
2006	45,066	1,086,581	45,066	1,086,581
2007	49,459	1,131,647	49,459	1,131,647
2008	47,198	1,181,106	47,198	1,181,106
2009	45,958	1,228,305	45,958	1,228,305
2010	47,012	1,274,263	47,012	1,274,263
2011	43,175	1,321,275	43,175	1,321,275
2012	47,440	1,364,449	47,440	1,364,449
2013	47,545	1,411,889	47,545	1,411,889
2014	57,728	1,459,435	57,728	1,459,435
2015	53,243	1,517,163	53,243	1,517,163
2016	49,547	1,570,405	49,547	1,570,405
2017	46,197	1,619,952	46,197	1,619,952
2018	49,890	1,666,149	49,890	1,666,149
2019	49,632	1,716,039	49,632	1,716,039
2020	50,000	1,765,671	50,000	1,765,671
2021	86,364	1,815,671	86,364	1,815,671
2022	86,364	1,902,035	86,364	1,902,035
2023	86,364	1,988,398	86,364	1,988,398
2024	86,364	2,074,762	86,364	2,074,762
2025	86,364	2,161,126	86,364	2,161,126
2026	86,364	2,247,489	86,364	2,247,489
2027	86,364	2,333,853	86,364	2,333,853
2028	0	2,420,217	86,364	2,420,217
2029	0	2,420,217	86,364	2,506,580
2030	0	2,420,217	86,364	2,592,944
2031	0	2,420,217	86,364	2,679,307
2032	0	2,420,217	86,364	2,765,671
2033	0	2,420,217	86,364	2,852,035
2034	0	2,420,217	86,364	2,938,398
2035	0	2,420,217	86,364	3,024,762
2036	0	2,420,217	86,364	3,111,126
2037	0	2,420,217	86,364	3,197,489
2038	0	2,420,217	86,364	3,283,853
2039	0	2,420,217	86,364	3,370,217

Year	User Waste Acceptance Inputs *(Mg/year)*	User Waste-In-Place *(Mg)*	Waste Acceptance *(Mg/year)*	Waste-In-Place *(Mg)*
2040	0	2,420,217	86,364	3,456,580
2041	0	2,420,217	86,364	3,542,944
2042	0	2,420,217	86,364	3,629,307
2043	0	2,420,217	86,364	3,715,671
2044	0	2,420,217	86,364	3,802,035
2045	0	2,420,217	86,364	3,888,398
2046	0	2,420,217	86,364	3,974,762
2047	0	2,420,217	86,364	4,061,126
2048	0	2,420,217	86,364	4,147,489
2049	0	2,420,217	86,364	4,233,853
2050	0	2,420,217	0	4,320,217
2051	0	2,420,217	0	4,320,217
2052	0	2,420,217	0	4,320,217
2053	0	2,420,217	0	4,320,217
2054	0	2,420,217	0	4,320,217
2055	0	2,420,217	0	4,320,217
2056	0	2,420,217	0	4,320,217
2057	0	2,420,217	0	4,320,217
2058	0	2,420,217	0	4,320,217
2059	0	2,420,217	0	4,320,217

RESULTS **Landfill Name or Identifier:** ______________________________

Closure Year (with 80-year limit) = 2050
Methane = 50 *% by volume*

Please choose a third unit of measure to represent all of the emission rates below.
User-specified Unit: short tons/year

Year	Waste Accepted		Waste-In-Place		Total landfill gas			Methane			Carbon dioxide			NMOC		
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
1980	40,909	45,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	40,909	45,000	40,909	45,000	2.025E+02	1.622E+05	2.228E+02	5.410E+01	8.109E+04	5.951E+01	1.484E+02	8.109E+04	1.633E+02	3.488E-01	9.730E+01	3.837E-01
1982	40,909	45,000	81,818	90,000	4.010E+02	3.211E+05	4.411E+02	1.071E+02	1.606E+05	1.178E+02	2.939E+02	1.606E+05	3.233E+02	6.907E-01	1.927E+02	7.597E-01
1983	40,909	45,000	122,727	135,000	5.956E+02	4.769E+05	6.552E+02	1.591E+02	2.385E+05	1.750E+02	4.365E+02	2.385E+05	4.802E+02	1.026E+00	2.862E+02	1.128E+00
1984	40,909	45,000	163,636	180,000	7.864E+02	6.297E+05	8.650E+02	2.100E+02	3.148E+05	2.310E+02	5.763E+02	3.148E+05	6.339E+02	1.354E+00	3.778E+02	1.490E+00
1985	40,909	45,000	204,545	225,000	9.733E+02	7.794E+05	1.071E+03	2.600E+02	3.897E+05	2.860E+02	7.133E+02	3.897E+05	7.847E+02	1.676E+00	4.676E+02	1.844E+00
1986	40,909	45,000	245,455	270,000	1.157E+03	9.261E+05	1.272E+03	3.089E+02	4.631E+05	3.398E+02	8.476E+02	4.631E+05	9.324E+02	1.992E+00	5.557E+02	2.191E+00
1987	40,909	45,000	286,364	315,000	1.336E+03	1.070E+06	1.470E+03	3.569E+02	5.350E+05	3.926E+02	9.793E+02	5.350E+05	1.077E+03	2.301E+00	6.420E+02	2.531E+00
1988	40,909	45,000	327,273	360,000	1.512E+03	1.211E+06	1.663E+03	4.039E+02	6.055E+05	4.443E+02	1.108E+03	6.055E+05	1.219E+03	2.604E+00	7.266E+02	2.865E+00
1989	40,909	45,000	368,182	405,000	1.685E+03	1.349E+06	1.853E+03	4.500E+02	6.746E+05	4.950E+02	1.235E+03	6.746E+05	1.358E+03	2.902E+00	8.095E+02	3.192E+00
1990	41,008	45,109	409,091	450,000	1.854E+03	1.485E+06	2.039E+03	4.952E+02	7.423E+05	5.447E+02	1.359E+03	7.423E+05	1.495E+03	3.193E+00	8.908E+02	3.512E+00
1991	47,909	52,700	450,099	495,109	2.020E+03	1.618E+06	2.222E+03	5.396E+02	8.089E+05	5.936E+02	1.481E+03	8.089E+05	1.629E+03	3.479E+00	9.707E+02	3.827E+00
1992	54,536	59,990	498,008	547,809	2.217E+03	1.776E+06	2.439E+03	5.923E+02	8.878E+05	6.515E+02	1.625E+03	8.878E+05	1.788E+03	3.819E+00	1.065E+03	4.201E+00
1993	46,841	51,525	552,545	607,799	2.444E+03	1.957E+06	2.688E+03	6.527E+02	9.783E+05	7.180E+02	1.791E+03	9.783E+05	1.970E+03	4.208E+00	1.174E+03	4.629E+00
1994	46,841	51,525	599,385	659,324	2.627E+03	2.104E+06	2.890E+03	7.017E+02	1.052E+06	7.719E+02	1.925E+03	1.052E+06	2.118E+03	4.524E+00	1.262E+03	4.977E+00
1995	46,555	51,210	646,226	710,849	2.807E+03	2.248E+06	3.088E+03	7.498E+02	1.124E+06	8.247E+02	2.057E+03	1.124E+06	2.263E+03	4.834E+00	1.349E+03	5.317E+00
1996	44,215	48,636	692,781	762,059	2.982E+03	2.388E+06	3.280E+03	7.965E+02	1.194E+06	8.761E+02	2.185E+03	1.194E+06	2.404E+03	5.135E+00	1.433E+03	5.649E+00
1997	30,655	33,721	736,995	810,695	3.142E+03	2.516E+06	3.456E+03	8.392E+02	1.258E+06	9.231E+02	2.302E+03	1.258E+06	2.533E+03	5.410E+00	1.509E+03	5.952E+00
1998	41,397	45,537	767,651	844,416	3.231E+03	2.587E+06	3.554E+03	8.631E+02	1.294E+06	9.494E+02	2.368E+03	1.294E+06	2.605E+03	5.565E+00	1.552E+03	6.121E+00
1999	28,400	31,240	809,048	889,953	3.372E+03	2.700E+06	3.709E+03	9.007E+02	1.350E+06	9.908E+02	2.471E+03	1.350E+06	2.719E+03	5.807E+00	1.620E+03	6.388E+00
2000	30,391	33,430	837,448	921,193	3.446E+03	2.759E+06	3.791E+03	9.205E+02	1.380E+06	1.013E+03	2.526E+03	1.380E+06	2.778E+03	5.935E+00	1.656E+03	6.528E+00
2001	30,762	33,838	867,839	954,623	3.528E+03	2.825E+06	3.881E+03	9.424E+02	1.413E+06	1.037E+03	2.586E+03	1.413E+06	2.844E+03	6.076E+00	1.695E+03	6.684E+00
2002	42,316	46,548	898,601	988,461	3.611E+03	2.891E+06	3.972E+03	9.644E+02	1.446E+06	1.061E+03	2.646E+03	1.446E+06	2.911E+03	6.218E+00	1.735E+03	6.840E+00
2003	42,068	46,275	940,917	1,035,009	3.749E+03	3.002E+06	4.124E+03	1.001E+03	1.501E+06	1.101E+03	2.747E+03	1.501E+06	3.022E+03	6.456E+00	1.801E+03	7.101E+00
2004	44,316	48,748	982,985	1,081,284	3.883E+03	3.109E+06	4.271E+03	1.037E+03	1.555E+06	1.141E+03	2.846E+03	1.555E+06	3.130E+03	6.687E+00	1.865E+03	7.355E+00
2005	59,279	65,207	1,027,302	1,130,032	4.025E+03	3.223E+06	4.428E+03	1.075E+03	1.612E+06	1.183E+03	2.950E+03	1.612E+06	3.245E+03	6.932E+00	1.934E+03	7.625E+00
2006	45,066	49,573	1,086,581	1,195,239	4.239E+03	3.394E+06	4.663E+03	1.132E+03	1.697E+06	1.245E+03	3.107E+03	1.697E+06	3.417E+03	7.300E+00	2.037E+03	8.030E+00
2007	49,459	54,405	1,131,647	1,244,812	4.378E+03	3.506E+06	4.816E+03	1.169E+03	1.753E+06	1.286E+03	3.209E+03	1.753E+06	3.530E+03	7.540E+00	2.103E+03	8.294E+00
2008	47,198	51,918	1,181,106	1,299,217	4.536E+03	3.632E+06	4.990E+03	1.212E+03	1.816E+06	1.333E+03	3.325E+03	1.816E+06	3.657E+03	7.812E+00	2.179E+03	8.593E+00
2009	45,958	50,554	1,228,305	1,351,135	4.680E+03	3.748E+06	5.148E+03	1.250E+03	1.874E+06	1.375E+03	3.430E+03	1.874E+06	3.773E+03	8.060E+00	2.249E+03	8.866E+00
2010	47,012	51,713	1,274,263	1,401,689	4.815E+03	3.856E+06	5.296E+03	1.286E+03	1.928E+06	1.415E+03	3.529E+03	1.928E+06	3.882E+03	8.292E+00	2.313E+03	9.121E+00
2011	43,175	47,492	1,321,275	1,453,402	4.952E+03	3.966E+06	5.448E+03	1.323E+03	1.983E+06	1.455E+03	3.630E+03	1.983E+06	3.992E+03	8.529E+00	2.379E+03	9.382E+00
2012	47,440	52,184	1,364,449	1,500,894	5.068E+03	4.058E+06	5.575E+03	1.354E+03	2.029E+06	1.489E+03	3.714E+03	2.029E+06	4.086E+03	8.728E+00	2.435E+03	9.601E+00
2013	47,545	52,300	1,411,889	1,553,078	5.203E+03	4.166E+06	5.723E+03	1.390E+03	2.083E+06	1.529E+03	3.813E+03	2.083E+06	4.194E+03	8.960E+00	2.500E+03	9.856E+00
2014	57,728	63,501	1,459,435	1,605,378	5.335E+03	4.272E+06	5.868E+03	1.425E+03	2.136E+06	1.568E+03	3.910E+03	2.136E+06	4.301E+03	9.188E+00	2.563E+03	1.011E+01
2015	53,243	58,567	1,517,163	1,668,879	5.515E+03	4.416E+06	6.067E+03	1.473E+03	2.208E+06	1.620E+03	4.042E+03	2.208E+06	4.446E+03	9.498E+00	2.650E+03	1.045E+01
2016	49,547	54,501	1,570,405	1,727,446	5.669E+03	4.540E+06	6.236E+03	1.514E+03	2.270E+06	1.666E+03	4.155E+03	2.270E+06	4.571E+03	9.764E+00	2.724E+03	1.074E+01
2017	46,197	50,817	1,619,952	1,781,947	5.802E+03	4.646E+06	6.383E+03	1.550E+03	2.323E+06	1.705E+03	4.253E+03	2.323E+06	4.678E+03	9.993E+00	2.788E+03	1.099E+01
2018	49,890	54,879	1,666,149	1,832,764	5.916E+03	4.737E+06	6.508E+03	1.580E+03	2.369E+06	1.738E+03	4.336E+03	2.369E+06	4.770E+03	1.019E+01	2.842E+03	1.121E+01
2019	49,632	54,595	1,716,039	1,887,643	6.046E+03	4.841E+06	6.651E+03	1.615E+03	2.421E+06	1.776E+03	4.431E+03	2.421E+06	4.874E+03	1.041E+01	2.905E+03	1.145E+01
2020	50,000	55,000	1,765,671	1,942,238	6.172E+03	4.942E+06	6.789E+03	1.649E+03	2.471E+06	1.813E+03	4.523E+03	2.471E+06	4.976E+03	1.063E+01	2.965E+03	1.169E+01
2021	86,364	95,000	1,815,671	1,997,238	6.297E+03	5.043E+06	6.927E+03	1.682E+03	2.521E+06	1.850E+03	4.615E+03	2.521E+06	5.077E+03	1.085E+01	3.026E+03	1.193E+01
2022	86,364	95,000	1,902,035	2,092,238	6.600E+03	5.285E+06	7.260E+03	1.763E+03	2.643E+06	1.939E+03	4.837E+03	2.643E+06	5.321E+03	1.137E+01	3.171E+03	1.250E+01
2023	86,364	95,000	1,988,398	2,187,238	6.897E+03	5.523E+06	7.587E+03	1.842E+03	2.761E+06	2.027E+03	5.055E+03	2.761E+06	5.560E+03	1.188E+01	3.314E+03	1.307E+01
2024	86,364	95,000	2,074,762	2,282,238	7.188E+03	5.756E+06	7.907E+03	1.920E+03	2.878E+06	2.112E+03	5.268E+03	2.878E+06	5.795E+03	1.238E+01	3.454E+03	1.362E+01
2025	86,364	95,000	2,161,126	2,377,238	7.473E+03	5.984E+06	8.221E+03	1.996E+03	2.992E+06	2.196E+03	5.477E+03	2.992E+06	6.025E+03	1.287E+01	3.591E+03	1.416E+01
2026	86,364	95,000	2,247,489	2,472,238	7.753E+03	6.208E+06	8.528E+03	2.071E+03	3.104E+06	2.278E+03	5.682E+03	3.104E+06	6.250E+03	1.335E+01	3.725E+03	1.469E+01
2027	86,364	95,000	2,333,853	2,567,238	8.027E+03	6.428E+06	8.830E+03	2.144E+03	3.214E+06	2.358E+03	5.883E+03	3.214E+06	6.471E+03	1.382E+01	3.857E+03	1.521E+01
2028	86,364	95,000	2,420,217	2,662,238	8.296E+03	6.643E+06	9.125E+03	2.216E+03	3.321E+06	2.437E+03	6.080E+03	3.321E+06	6.688E+03	1.429E+01	3.986E+03	1.571E+01
2029	86,364	95,000	2,506,580	2,757,238	8.559E+03	6.854E+06	9.415E+03	2.286E+03	3.427E+06	2.515E+03	6.273E+03	3.427E+06	6.900E+03	1.474E+01	4.112E+03	1.621E+01
2030	86,364	95,000	2,592,944	2,852,238	8.817E+03	7.060E+06	9.699E+03	2.355E+03	3.530E+06	2.591E+03	6.462E+03	3.530E+06	7.108E+03	1.518E+01	4.236E+03	1.670E+01
2031	86,364	95,000	2,679,307	2,947,238	9.070E+03	7.263E+06	9.977E+03	2.423E+03	3.631E+06	2.665E+03	6.647E+03	3.631E+06	7.312E+03	1.562E+01	4.358E+03	1.718E+01
2032	86,364	95,000	2,765,671	3,042,238	9.318E+03	7.461E+06	1.025E+04	2.489E+03	3.731E+06	2.738E+03	6.829E+03	3.731E+06	7.512E+03	1.605E+01	4.477E+03	1.765E+01
2033	86,364	95,000	2,852,035	3,137,238	9.561E+03	7.656E+06	1.052E+04	2.554E+03	3.828E+06	2.809E+03	7.007E+03	3.828E+06	7.708E+03	1.647E+01	4.594E+03	1.811E+01
2034	86,364	95,000	2,938,398	3,232,238	9.799E+03	7.847E+06	1.078E+04	2.617E+03	3.923E+06	2.879E+03	7.182E+03	3.923E+06	7.900E+03	1.688E+01	4.708E+03	1.856E+01
2035	86,364	95,000	3,024,762	3,327,238	1.003E+04	8.034E+06	1.104E+04	2.680E+03	4.017E+06	2.948E+03	7.353E+03	4.017E+06	8.088E+03	1.728E+01	4.820E+03	1.901E+01
2036	86,364	95,000	3,111,126	3,422,238	1.026E+04	8.217E+06	1.129E+04	2.741E+03	4.108E+06	3.015E+03	7.521E+03	4.108E+06	8.273E+03	1.767E+01	4.930E+03	1.944E+01
2037	86,364	95,000	3,197,489	3,517,238	1.049E+04	8.397E+06	1.153E+04	2.801E+03	4.198E+06	3.081E+03	7.685E+03	4.198E+06	8.454E+03	1.806E+01	5.038E+03	1.986E+01
2038	86,364	95,000	3,283,853	3,612,238	1.071E+04	8.573E+06	1.178E+04	2.860E+03	4.286E+06	3.146E+03	7.846E+03	4.286E+06	8.631E+03	1.844E+01	5.144E+03	2.028E+01
2039	86,364	95,000	3,370,217	3,707,238	1.092E+04	8.745E+06	1.201E+04	2.917E+03	4.373E+06	3.209E+03	8.004E+03	4.373E+06	8.805E+03	1.881E+01	5.247E+03	2.069E+01
2040	86,364	95,000	3,456,580	3,802,238	1.113E+04	8.915E+06	1.225E+04	2.974E+03	4.457E+06	3.271E+03	8.159E+03	4.457E+06	8.975E+03	1.917E+01	5.349E+03	2.109E+01
2041	86,364	95,000	3,542,944	3,897,238	1.134E+04	9.080E+06	1.247E+04	3.029E+03	4.540E+06	3.332E+03	8.311E+03	4.540E+06	9.142E+03	1.953E+01	5.448E+03	2.148E+01
2042	86,364	95,000	3,629,307	3,992,238	1.154E+04	9.243E+06	1.270E+04	3.083E+03	4.621E+06	3.392E+03	8.460E+03	4.621E+06	9.306E+03	1.988E+01	5.546E+03	2.187E+01
2043	86,364	95,000	3,715,671	4,087,238	1.174E+04	9.402E+06	1.292E+04	3.136E+03	4.701E+06	3.450E+03	8.605E+03	4.701E+06	9.466E+03	2.022E+01	5.641E+03	2.224E+01
2044	86,364	95,000	3,802,035	4,182,238	1.194E+04	9.558E+06	1.313E+04	3.188E+03	4.779E+06	3.507E+03	8.748E+03	4.779E+06	9.623E+03	2.056E+01	5.735E+03	2.261E+01
2045	86,364	95,000	3,888,398	4,277,238	1.213E+04	9.712E+06	1.334E+04	3.240E+03	4.856E+06	3.563E+03	8.889E+03	4.856E+06	9.777E+03	2.089E+01	5.827E+03	2.298E+01
2046	86,364	95,000	3,974,762	4,372,238	1.232E+04	9.862E+06	1.355E+04	3.290E+03	4.931E+06	3.619E+03	9.026E+03	4.931E+06	9.928E+03	2.121E+01	5.917E+03	2.333E+01
2047	86,364	95,000	4,061,126	4,467,238	1.250E+04	1.001E+07	1.375E+04	3.339E+03	5.004E+06	3.673E+03	9.160E+03	5.004E+06	1.008E+04	2.153E+01	6.005E+03	2.368E+01
2048	86,364	95,000	4,147,489	4,562,238	1.268E+04	1.015E+07	1.395E+04	3.387E+03	5.076E+06	3.725E+03	9.292E+03	5.076E+06	1.022E+04	2.184E+01	6.092E+03	2.402E+01
2049	86,364	95,000	4,233,853	4,657,238	1.286E+04	1.029E+07	1.414E+04	3.434E+03	5.147E+06	3.777E+03	9.422E+03	5.147E+06	1.036E+04	2.214E+01	6.177E+03	2.435E+01
2050	0	0	4,320,217	4,752,238	1.303E+04	1.043E+07	1.433E+04	3.480E+03	5.216E+06	3.828E+03	9.549E+03	5.216E+06	1.050E+04	2.244E+01	6.260E+03	2.468E+01
2051	0	0	4,320,217	4,752,238	1.277E+04	1.023E+07	1.405E+04	3.411E+03	5.113E+06	3.752E+03	9.359E+03	5.113E+06	1.030E+04	2.199E+01	6.136E+03	2.419E+01
2052	0	0	4,320,217	4,752,238	1.252E+04	1.002E+07	1.377E+04	3.344E+03	5.012E+06	3.678E+03	9.174E+03	5.012E+06	1.009E+04	2.156E+01	6.014E+03	2.371E+01
2053	0	0	4,320,217	4,752,238	1.227E+04	9.825E+06	1.350E+04	3.277E+03	4.913E+06	3.605E+03	8.993E+03	4.913E+06	9.892E+03	2.113E+01	5.895E+03	2.324E+01
2054	0	0	4,320,217	4,752,238	1.203E+04	9.631E+06	1.323E+04	3.213E+03	4.815E+06	3.534E+03	8.814E+03	4.815E+06	9.696E+03	2.071E+01	5.778E+03	2.278E+01
2055	0	0	4,320,217	4,752,238	1.179E+04	9.440E+06	1.297E+04	3.149E+03	4.720E+06	3.464E+03	8.640E+03	4.720E+06	9.504E+03	2.030E+01	5.664E+03	2.233E+01

RESULTS **Landfill Name or Identifier:** ______________________

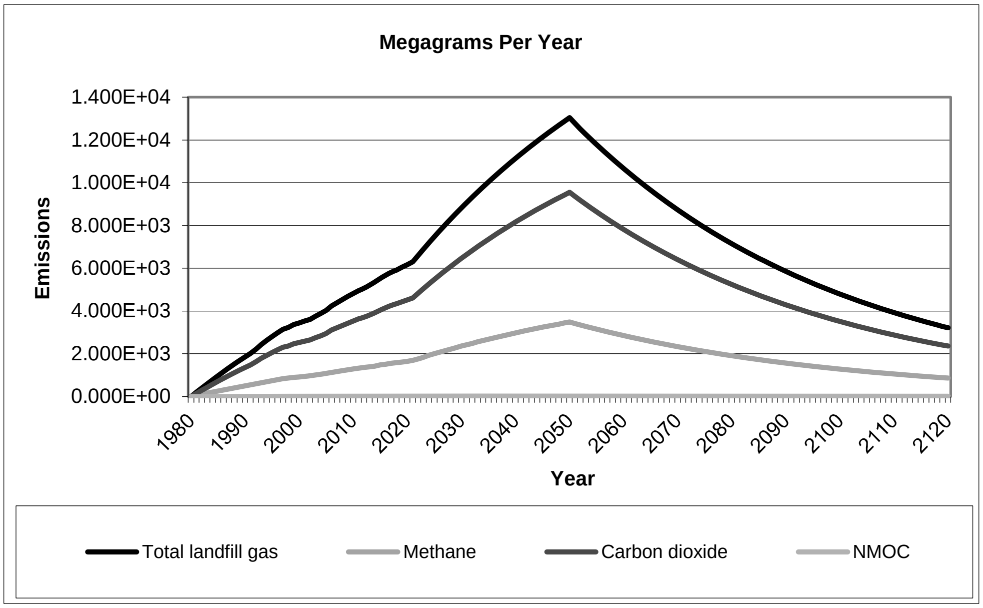
Closure Year (with 80-year limit) = 2050
Methane = 50 *% by volume*

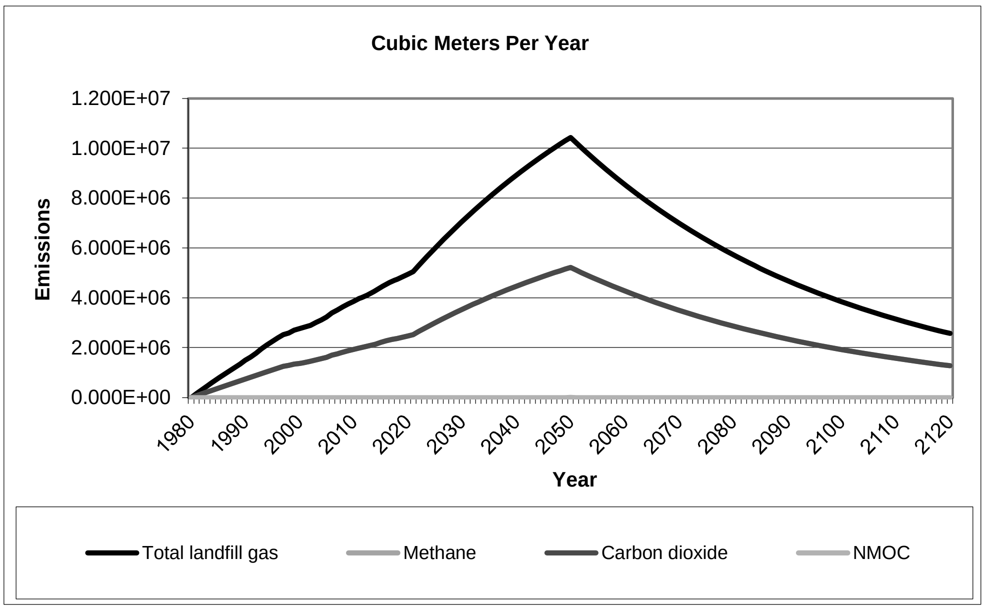
Please choose a third unit of measure to represent all of the emission rates below.
User-specified Unit: *short tons/year*

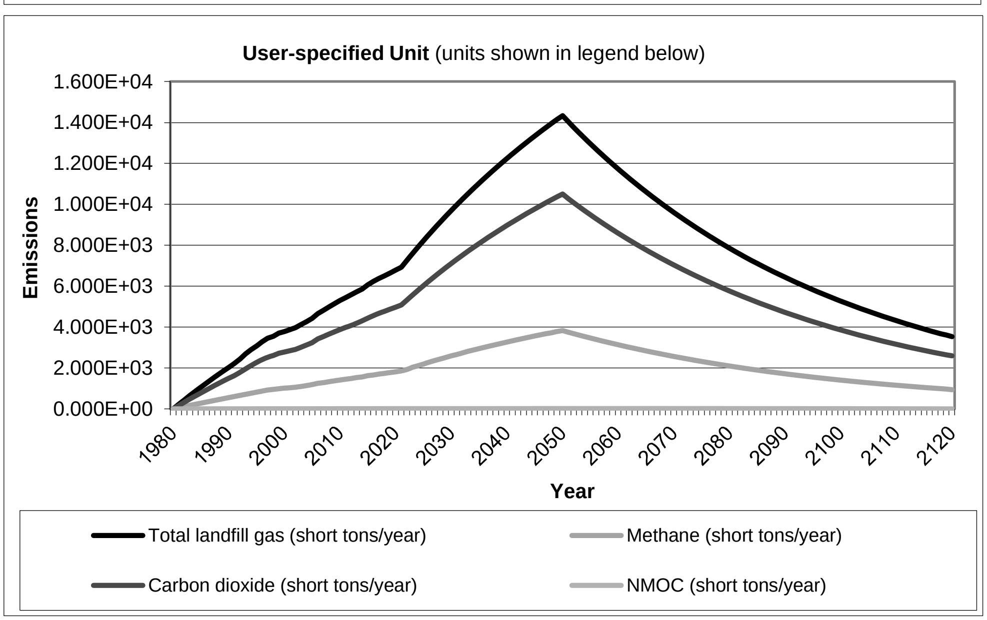
Year	Waste Accepted		Waste-In-Place		Total landfill gas			Methane			Carbon dioxide			NMOC		
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2056	0	0	4,320,217	4,752,238	1.156E+04	9.253E+06	1.271E+04	3.087E+03	4.627E+06	3.395E+03	8.469E+03	4.627E+06	9.316E+03	1.990E+01	5.552E+03	2.189E+01
2057	0	0	4,320,217	4,752,238	1.133E+04	9.070E+06	1.246E+04	3.025E+03	4.535E+06	3.328E+03	8.301E+03	4.535E+06	9.131E+03	1.951E+01	5.442E+03	2.146E+01
2058	0	0	4,320,217	4,752,238	1.110E+04	8.890E+06	1.221E+04	2.966E+03	4.445E+06	3.262E+03	8.137E+03	4.445E+06	8.950E+03	1.912E+01	5.334E+03	2.103E+01
2059	0	0	4,320,217	4,752,238	1.088E+04	8.714E+06	1.197E+04	2.907E+03	4.357E+06	3.198E+03	7.976E+03	4.357E+06	8.773E+03	1.874E+01	5.228E+03	2.062E+01
2060	0	0	4,320,217	4,752,238	1.067E+04	8.542E+06	1.173E+04	2.849E+03	4.271E+06	3.134E+03	7.818E+03	4.271E+06	8.599E+03	1.837E+01	5.125E+03	2.021E+01
2061	0	0	4,320,217	4,752,238	1.046E+04	8.372E+06	1.150E+04	2.793E+03	4.186E+06	3.072E+03	7.663E+03	4.186E+06	8.429E+03	1.801E+01	5.023E+03	1.981E+01
2062	0	0	4,320,217	4,752,238	1.025E+04	8.207E+06	1.127E+04	2.738E+03	4.103E+06	3.011E+03	7.511E+03	4.103E+06	8.262E+03	1.765E+01	4.924E+03	1.941E+01
2063	0	0	4,320,217	4,752,238	1.005E+04	8.044E+06	1.105E+04	2.683E+03	4.022E+06	2.952E+03	7.362E+03	4.022E+06	8.099E+03	1.730E+01	4.827E+03	1.903E+01
2064	0	0	4,320,217	4,752,238	9.847E+03	7.885E+06	1.083E+04	2.630E+03	3.942E+06	2.893E+03	7.217E+03	3.942E+06	7.938E+03	1.696E+01	4.731E+03	1.865E+01
2065	0	0	4,320,217	4,752,238	9.652E+03	7.729E+06	1.062E+04	2.578E+03	3.864E+06	2.836E+03	7.074E+03	3.864E+06	7.781E+03	1.662E+01	4.637E+03	1.828E+01
2066	0	0	4,320,217	4,752,238	9.461E+03	7.576E+06	1.041E+04	2.527E+03	3.788E+06	2.780E+03	6.934E+03	3.788E+06	7.627E+03	1.629E+01	4.545E+03	1.792E+01
2067	0	0	4,320,217	4,752,238	9.273E+03	7.426E+06	1.020E+04	2.477E+03	3.713E+06	2.725E+03	6.796E+03	3.713E+06	7.476E+03	1.597E+01	4.455E+03	1.757E+01
2068	0	0	4,320,217	4,752,238	9.090E+03	7.279E+06	9.999E+03	2.428E+03	3.639E+06	2.671E+03	6.662E+03	3.639E+06	7.328E+03	1.565E+01	4.367E+03	1.722E+01
2069	0	0	4,320,217	4,752,238	8.910E+03	7.135E+06	9.801E+03	2.380E+03	3.567E+06	2.618E+03	6.530E+03	3.567E+06	7.183E+03	1.534E+01	4.281E+03	1.688E+01
2070	0	0	4,320,217	4,752,238	8.733E+03	6.993E+06	9.607E+03	2.333E+03	3.497E+06	2.566E+03	6.401E+03	3.497E+06	7.041E+03	1.504E+01	4.196E+03	1.654E+01
2071	0	0	4,320,217	4,752,238	8.560E+03	6.855E+06	9.416E+03	2.287E+03	3.427E+06	2.515E+03	6.274E+03	3.427E+06	6.901E+03	1.474E+01	4.113E+03	1.622E+01
2072	0	0	4,320,217	4,752,238	8.391E+03	6.719E+06	9.230E+03	2.241E+03	3.360E+06	2.465E+03	6.150E+03	3.360E+06	6.765E+03	1.445E+01	4.031E+03	1.590E+01
2073	0	0	4,320,217	4,752,238	8.225E+03	6.586E+06	9.047E+03	2.197E+03	3.293E+06	2.417E+03	6.028E+03	3.293E+06	6.631E+03	1.416E+01	3.952E+03	1.558E+01
2074	0	0	4,320,217	4,752,238	8.062E+03	6.456E+06	8.868E+03	2.153E+03	3.228E+06	2.369E+03	5.908E+03	3.228E+06	6.499E+03	1.388E+01	3.873E+03	1.527E+01
2075	0	0	4,320,217	4,752,238	7.902E+03	6.328E+06	8.693E+03	2.111E+03	3.164E+06	2.322E+03	5.791E+03	3.164E+06	6.371E+03	1.361E+01	3.797E+03	1.497E+01
2076	0	0	4,320,217	4,752,238	7.746E+03	6.202E+06	8.520E+03	2.069E+03	3.101E+06	2.276E+03	5.677E+03	3.101E+06	6.245E+03	1.334E+01	3.721E+03	1.467E+01
2077	0	0	4,320,217	4,752,238	7.592E+03	6.080E+06	8.352E+03	2.028E+03	3.040E+06	2.231E+03	5.564E+03	3.040E+06	6.121E+03	1.308E+01	3.648E+03	1.438E+01
2078	0	0	4,320,217	4,752,238	7.442E+03	5.959E+06	8.186E+03	1.988E+03	2.980E+06	2.187E+03	5.454E+03	2.980E+06	6.000E+03	1.282E+01	3.576E+03	1.410E+01
2079	0	0	4,320,217	4,752,238	7.295E+03	5.841E+06	8.024E+03	1.948E+03	2.921E+06	2.143E+03	5.346E+03	2.921E+06	5.881E+03	1.256E+01	3.505E+03	1.382E+01
2080	0	0	4,320,217	4,752,238	7.150E+03	5.726E+06	7.865E+03	1.910E+03	2.863E+06	2.101E+03	5.240E+03	2.863E+06	5.764E+03	1.231E+01	3.435E+03	1.355E+01
2081	0	0	4,320,217	4,752,238	7.009E+03	5.612E+06	7.710E+03	1.872E+03	2.806E+06	2.059E+03	5.137E+03	2.806E+06	5.650E+03	1.207E+01	3.367E+03	1.328E+01
2082	0	0	4,320,217	4,752,238	6.870E+03	5.501E+06	7.557E+03	1.835E+03	2.751E+06	2.019E+03	5.035E+03	2.751E+06	5.538E+03	1.183E+01	3.301E+03	1.301E+01
2083	0	0	4,320,217	4,752,238	6.734E+03	5.392E+06	7.407E+03	1.799E+03	2.696E+06	1.979E+03	4.935E+03	2.696E+06	5.429E+03	1.160E+01	3.235E+03	1.276E+01
2084	0	0	4,320,217	4,752,238	6.601E+03	5.285E+06	7.261E+03	1.763E+03	2.643E+06	1.939E+03	4.837E+03	2.643E+06	5.321E+03	1.137E+01	3.171E+03	1.250E+01
2085	0	0	4,320,217	4,752,238	6.470E+03	5.181E+06	7.117E+03	1.728E+03	2.590E+06	1.901E+03	4.742E+03	2.590E+06	5.216E+03	1.114E+01	3.108E+03	1.226E+01
2086	0	0	4,320,217	4,752,238	6.342E+03	5.078E+06	6.976E+03	1.694E+03	2.539E+06	1.863E+03	4.648E+03	2.539E+06	5.113E+03	1.092E+01	3.047E+03	1.201E+01
2087	0	0	4,320,217	4,752,238	6.216E+03	4.978E+06	6.838E+03	1.660E+03	2.489E+06	1.826E+03	4.556E+03	2.489E+06	5.011E+03	1.071E+01	2.987E+03	1.178E+01
2088	0	0	4,320,217	4,752,238	6.093E+03	4.879E+06	6.702E+03	1.628E+03	2.440E+06	1.790E+03	4.466E+03	2.440E+06	4.912E+03	1.049E+01	2.927E+03	1.154E+01
2089	0	0	4,320,217	4,752,238	5.972E+03	4.782E+06	6.570E+03	1.595E+03	2.391E+06	1.755E+03	4.377E+03	2.391E+06	4.815E+03	1.029E+01	2.869E+03	1.131E+01
2090	0	0	4,320,217	4,752,238	5.854E+03	4.688E+06	6.440E+03	1.564E+03	2.344E+06	1.720E+03	4.290E+03	2.344E+06	4.719E+03	1.008E+01	2.813E+03	1.109E+01
2091	0	0	4,320,217	4,752,238	5.738E+03	4.595E+06	6.312E+03	1.533E+03	2.297E+06	1.686E+03	4.205E+03	2.297E+06	4.626E+03	9.882E+00	2.757E+03	1.087E+01
2092	0	0	4,320,217	4,752,238	5.625E+03	4.504E+06	6.187E+03	1.502E+03	2.252E+06	1.653E+03	4.122E+03	2.252E+06	4.534E+03	9.687E+00	2.702E+03	1.066E+01
2093	0	0	4,320,217	4,752,238	5.513E+03	4.415E+06	6.065E+03	1.473E+03	2.207E+06	1.620E+03	4.041E+03	2.207E+06	4.445E+03	9.495E+00	2.649E+03	1.044E+01
2094	0	0	4,320,217	4,752,238	5.404E+03	4.327E+06	5.944E+03	1.443E+03	2.164E+06	1.588E+03	3.961E+03	2.164E+06	4.357E+03	9.307E+00	2.596E+03	1.024E+01
2095	0	0	4,320,217	4,752,238	5.297E+03	4.242E+06	5.827E+03	1.415E+03	2.121E+06	1.556E+03	3.882E+03	2.121E+06	4.270E+03	9.122E+00	2.545E+03	1.003E+01
2096	0	0	4,320,217	4,752,238	5.192E+03	4.158E+06	5.711E+03	1.387E+03	2.079E+06	1.526E+03	3.805E+03	2.079E+06	4.186E+03	8.942E+00	2.495E+03	9.836E+00
2097	0	0	4,320,217	4,752,238	5.089E+03	4.075E+06	5.598E+03	1.359E+03	2.038E+06	1.495E+03	3.730E+03	2.038E+06	4.103E+03	8.765E+00	2.445E+03	9.641E+00
2098	0	0	4,320,217	4,752,238	4.989E+03	3.995E+06	5.487E+03	1.333E+03	1.997E+06	1.466E+03	3.656E+03	1.997E+06	4.022E+03	8.591E+00	2.397E+03	9.450E+00
2099	0	0	4,320,217	4,752,238	4.890E+03	3.916E+06	5.379E+03	1.306E+03	1.958E+06	1.437E+03	3.584E+03	1.958E+06	3.942E+03	8.421E+00	2.349E+03	9.263E+00
2100	0	0	4,320,217	4,752,238	4.793E+03	3.838E+06	5.272E+03	1.280E+03	1.919E+06	1.408E+03	3.513E+03	1.919E+06	3.864E+03	8.254E+00	2.303E+03	9.080E+00
2101	0	0	4,320,217	4,752,238	4.698E+03	3.762E+06	5.168E+03	1.255E+03	1.881E+06	1.380E+03	3.443E+03	1.881E+06	3.787E+03	8.091E+00	2.257E+03	8.900E+00
2102	0	0	4,320,217	4,752,238	4.605E+03	3.688E+06	5.066E+03	1.230E+03	1.844E+06	1.353E+03	3.375E+03	1.844E+06	3.712E+03	7.931E+00	2.213E+03	8.724E+00
2103	0	0	4,320,217	4,752,238	4.514E+03	3.614E+06	4.965E+03	1.206E+03	1.807E+06	1.326E+03	3.308E+03	1.807E+06	3.639E+03	7.774E+00	2.169E+03	8.551E+00
2104	0	0	4,320,217	4,752,238	4.424E+03	3.543E+06	4.867E+03	1.182E+03	1.771E+06	1.300E+03	3.243E+03	1.771E+06	3.567E+03	7.620E+00	2.126E+03	8.382E+00
2105	0	0	4,320,217	4,752,238	4.337E+03	3.473E+06	4.771E+03	1.158E+03	1.736E+06	1.274E+03	3.178E+03	1.736E+06	3.496E+03	7.469E+00	2.084E+03	8.216E+00
2106	0	0	4,320,217	4,752,238	4.251E+03	3.404E+06	4.676E+03	1.135E+03	1.702E+06	1.249E+03	3.116E+03	1.702E+06	3.427E+03	7.321E+00	2.042E+03	8.053E+00
2107	0	0	4,320,217	4,752,238	4.167E+03	3.337E+06	4.583E+03	1.113E+03	1.668E+06	1.224E+03	3.054E+03	1.668E+06	3.359E+03	7.176E+00	2.002E+03	7.894E+00
2108	0	0	4,320,217	4,752,238	4.084E+03	3.271E+06	4.493E+03	1.091E+03	1.635E+06	1.200E+03	2.993E+03	1.635E+06	3.293E+03	7.034E+00	1.962E+03	7.737E+00
2109	0	0	4,320,217	4,752,238	4.003E+03	3.206E+06	4.404E+03	1.069E+03	1.603E+06	1.176E+03	2.934E+03	1.603E+06	3.227E+03	6.895E+00	1.923E+03	7.584E+00
2110	0	0	4,320,217	4,752,238	3.924E+03	3.142E+06	4.317E+03	1.048E+03	1.571E+06	1.153E+03	2.876E+03	1.571E+06	3.164E+03	6.758E+00	1.885E+03	7.434E+00
2111	0	0	4,320,217	4,752,238	3.846E+03	3.080E+06	4.231E+03	1.027E+03	1.540E+06	1.130E+03	2.819E+03	1.540E+06	3.101E+03	6.624E+00	1.848E+03	7.287E+00
2112	0	0	4,320,217	4,752,238	3.770E+03	3.019E+06	4.147E+03	1.007E+03	1.510E+06	1.108E+03	2.763E+03	1.510E+06	3.040E+03	6.493E+00	1.811E+03	7.142E+00
2113	0	0	4,320,217	4,752,238	3.696E+03	2.959E+06	4.065E+03	9.871E+02	1.480E+06	1.086E+03	2.708E+03	1.480E+06	2.979E+03	6.364E+00	1.776E+03	7.001E+00
2114	0	0	4,320,217	4,752,238	3.622E+03	2.901E+06	3.985E+03	9.676E+02	1.450E+06	1.064E+03	2.655E+03	1.450E+06	2.920E+03	6.238E+00	1.740E+03	6.862E+00
2115	0	0	4,320,217	4,752,238	3.551E+03	2.843E+06	3.906E+03	9.484E+02	1.422E+06	1.043E+03	2.602E+03	1.422E+06	2.863E+03	6.115E+00	1.706E+03	6.726E+00
2116	0	0	4,320,217	4,752,238	3.480E+03	2.787E+06	3.828E+03	9.297E+02	1.393E+06	1.023E+03	2.551E+03	1.393E+06	2.806E+03	5.994E+00	1.672E+03	6.593E+00
2117	0	0	4,320,217	4,752,238	3.411E+03	2.732E+06	3.753E+03	9.112E+02	1.366E+06	1.002E+03	2.500E+03	1.366E+06	2.750E+03	5.875E+00	1.639E+03	6.463E+00
2118	0	0	4,320,217	4,752,238	3.344E+03	2.678E+06	3.678E+03	8.932E+02	1.339E+06	9.825E+02	2.451E+03	1.339E+06	2.696E+03	5.759E+00	1.607E+03	6.335E+00
2119	0	0	4,320,217	4,752,238	3.278E+03	2.625E+06	3.606E+03	8.755E+02	1.312E+06	9.631E+02	2.402E+03	1.312E+06	2.642E+03	5.645E+00	1.575E+03	6.209E+00
2120	0	0	4,320,217	4,752,238	3.213E+03	2.573E+06	3.534E+03	8.582E+02	1.286E+06	9.440E+02	2.355E+03	1.286E+06	2.590E+03	5.533E+00	1.544E+03	6.086E+00

GRAPHS

Landfill Name or Identifier: ______________________





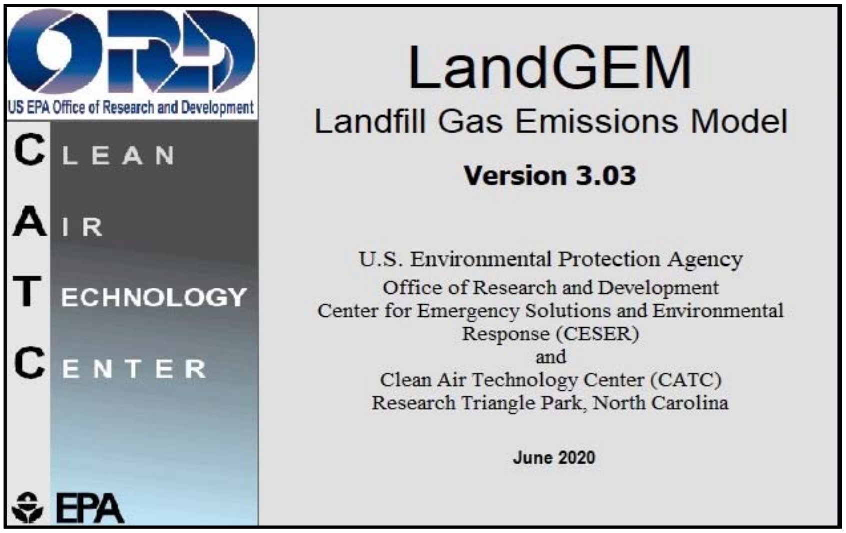


INVENTORY

Landfill Name or Identifier: ____________________

Enter year of emissions inventory: 2027

Gas / Pollutant	Emission Rate				
	(Mg/year)	(m^3/year)	(av ft^3/min)	(ft^3/year)	(short tons/year)
Total landfill gas	8.027E+03	6.428E+06	4.319E+02	2.270E+08	8.830E+03
Methane	2.144E+03	3.214E+06	2.159E+02	1.135E+08	2.358E+03
Carbon dioxide	5.883E+03	3.214E+06	2.159E+02	1.135E+08	6.471E+03
NMOC	1.382E+01	3.857E+03	2.591E-01	1.362E+05	1.521E+01
1,1,1-Trichloroethane (methyl chloroform) - HAP	1.712E-02	3.085E+00	2.073E-04	1.090E+02	1.883E-02
1,1,2,2-Tetrachloroethane - HAP/VOC	4.936E-02	7.070E+00	4.751E-04	2.497E+02	5.430E-02
1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	6.350E-02	1.543E+01	1.036E-03	5.448E+02	6.985E-02
1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	5.183E-03	1.286E+00	8.637E-05	4.540E+01	5.702E-03
1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	1.085E-02	2.635E+00	1.771E-04	9.307E+01	1.193E-02
1,2-Dichloropropane (propylene dichloride) - HAP/VOC	5.437E-03	1.157E+00	7.774E-05	4.086E+01	5.981E-03
2-Propanol (isopropyl alcohol) - VOC	8.035E-01	3.214E+02	2.159E-02	1.135E+04	8.838E-01
Acetone	1.087E-01	4.499E+01	3.023E-03	1.589E+03	1.196E-01
Acrylonitrile - HAP/VOC	8.937E-02	4.049E+01	2.721E-03	1.430E+03	9.830E-02
Benzene - No or Unknown Co-disposal - HAP/VOC	3.968E-02	1.221E+01	8.206E-04	4.313E+02	4.364E-02
Benzene - Co-disposal - HAP/VOC	2.297E-01	7.070E+01	4.751E-03	2.497E+03	2.527E-01
Bromodichloromethane - VOC	1.358E-01	1.993E+01	1.339E-03	7.037E+02	1.494E-01
Butane - VOC	7.769E-02	3.214E+01	2.159E-03	1.135E+03	8.546E-02
Carbon disulfide - HAP/VOC	1.180E-02	3.728E+00	2.505E-04	1.317E+02	1.299E-02
Carbon monoxide	1.048E+00	8.999E+02	6.046E-02	3.178E+04	1.153E+00
Carbon tetrachloride - HAP/VOC	1.645E-04	2.571E-02	1.727E-06	9.080E-01	1.810E-04
Carbonyl sulfide - HAP/VOC	7.869E-03	3.150E+00	2.116E-04	1.112E+02	8.656E-03
Chlorobenzene - HAP/VOC	7.523E-03	1.607E+00	1.080E-04	5.675E+01	8.275E-03
Chlorodifluoromethane	3.005E-02	8.356E+00	5.614E-04	2.951E+02	3.306E-02
Chloroethane (ethyl chloride) - HAP/VOC	2.242E-02	8.356E+00	5.614E-04	2.951E+02	2.467E-02
Chloroform - HAP/VOC	9.575E-04	1.928E-01	1.296E-05	6.810E+00	1.053E-03
Chloromethane - VOC	1.620E-02	7.713E+00	5.182E-04	2.724E+02	1.782E-02
Dichlorobenzene - (HAP for para isomer/VOC)	8.253E-03	1.350E+00	9.069E-05	4.767E+01	9.078E-03
Dichlorodifluoromethane	5.172E-01	1.028E+02	6.910E-03	3.632E+03	5.689E-01
Dichlorofluoromethane - VOC	7.154E-02	1.671E+01	1.123E-03	5.902E+02	7.869E-02
Dichloromethane (methylene chloride) - HAP	3.179E-01	8.999E+01	6.046E-03	3.178E+03	3.497E-01
Dimethyl sulfide (methyl sulfide) - VOC	1.296E-01	5.014E+01	3.369E-03	1.771E+03	1.425E-01
Ethane	7.155E+00	5.721E+03	3.844E-01	2.020E+05	7.870E+00
Ethanol - VOC	3.326E-01	1.735E+02	1.166E-02	6.129E+03	3.659E-01
Ethyl mercaptan (ethanethiol) - VOC	3.820E-02	1.478E+01	9.933E-04	5.221E+02	4.202E-02
Ethylbenzene - HAP/VOC	1.306E-01	2.957E+01	1.987E-03	1.044E+03	1.436E-01
Ethylene dibromide - HAP/VOC	5.023E-05	6.428E-03	4.319E-07	2.270E-01	5.525E-05
Fluorotrichloromethane - VOC	2.791E-02	4.885E+00	3.282E-04	1.725E+02	3.070E-02
Hexane - HAP/VOC	1.521E-01	4.242E+01	2.850E-03	1.498E+03	1.673E-01
Hydrogen sulfide	3.280E-01	2.314E+02	1.555E-02	8.172E+03	3.608E-01
Mercury (total) - HAP	1.555E-05	1.864E-03	1.252E-07	6.583E-02	1.711E-05
Methyl ethyl ketone - HAP/VOC	1.369E-01	4.564E+01	3.066E-03	1.612E+03	1.506E-01
Methyl isobutyl ketone - HAP/VOC	5.088E-02	1.221E+01	8.206E-04	4.313E+02	5.596E-02
Methyl mercaptan - VOC	3.215E-02	1.607E+01	1.080E-03	5.675E+02	3.537E-02
Pentane - VOC	6.365E-02	2.121E+01	1.425E-03	7.491E+02	7.002E-02
Perchloroethylene (tetrachloroethylene) - HAP	1.640E-01	2.378E+01	1.598E-03	8.399E+02	1.804E-01
Propane - VOC	1.297E-01	7.070E+01	4.751E-03	2.497E+03	1.426E-01
t-1,2-Dichloroethene - VOC	7.257E-02	1.800E+01	1.209E-03	6.356E+02	7.982E-02
Toluene - No or Unknown Co-disposal - HAP/VOC	9.606E-01	2.507E+02	1.684E-02	8.853E+03	1.057E+00
Toluene - Co-disposal - HAP/VOC	4.187E+00	1.093E+03	7.342E-02	3.859E+04	4.606E+00
Trichloroethylene (trichloroethene) - HAP/VOC	9.836E-02	1.800E+01	1.209E-03	6.356E+02	1.082E-01
Vinyl chloride - HAP/VOC	1.220E-01	4.692E+01	3.153E-03	1.657E+03	1.342E-01
Xylenes - HAP/VOC	3.406E-01	7.713E+01	5.182E-03	2.724E+03	3.746E-01



Summary Report

Landfill Name or Identifier:

Date: Wednesday, December 23, 2020

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

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

Where,

Q_{CH4} = annual methane generation in the year of the calculation *(m^3/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate (*$year^{-1}$*)
L_0 = potential methane generation capacity (*m^3/Mg*)

M_i = mass of waste accepted in the i^{th} year (*Mg*)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**1980**	
Landfill Closure Year (with 80-year limit)	**2050**	
Actual Closure Year (without limit)	***2050***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity		*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*year* $^{-1}$
Potential Methane Generation Capacity, L_0	**100**	m^3 */Mg*
NMOC Concentration	**600**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

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

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1980	40,909	45,000	0	0
1981	40,909	45,000	40,909	45,000
1982	40,909	45,000	81,818	90,000
1983	40,909	45,000	122,727	135,000
1984	40,909	45,000	163,636	180,000
1985	40,909	45,000	204,545	225,000
1986	40,909	45,000	245,455	270,000
1987	40,909	45,000	286,364	315,000
1988	40,909	45,000	327,273	360,000
1989	40,909	45,000	368,182	405,000
1990	41,008	45,109	409,091	450,000
1991	47,909	52,700	450,099	495,109
1992	54,536	59,990	498,008	547,809
1993	46,841	51,525	552,545	607,799
1994	46,841	51,525	599,385	659,324
1995	46,555	51,210	646,226	710,849
1996	44,215	48,636	692,781	762,059
1997	30,655	33,721	736,995	810,695
1998	41,397	45,537	767,651	844,416
1999	28,400	31,240	809,048	889,953
2000	30,391	33,430	837,448	921,193
2001	30,762	33,838	867,839	954,623
2002	42,316	46,548	898,601	988,461
2003	42,068	46,275	940,917	1,035,009
2004	44,316	48,748	982,985	1,081,284
2005	59,279	65,207	1,027,302	1,130,032
2006	45,066	49,573	1,086,581	1,195,239
2007	49,459	54,405	1,131,647	1,244,812
2008	47,198	51,918	1,181,106	1,299,217
2009	45,958	50,554	1,228,305	1,351,135
2010	47,012	51,713	1,274,263	1,401,689
2011	43,175	47,492	1,321,275	1,453,402
2012	47,440	52,184	1,364,449	1,500,894
2013	47,545	52,300	1,411,889	1,553,078
2014	57,728	63,501	1,459,435	1,605,378
2015	53,243	58,567	1,517,163	1,668,879
2016	49,547	54,501	1,570,405	1,727,446
2017	46,197	50,817	1,619,952	1,781,947
2018	49,890	54,879	1,666,149	1,832,764
2019	49,632	54,595	1,716,039	1,887,643

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
2020	50,000	55,000	1,765,671	1,942,238
2021	86,364	95,000	1,815,671	1,997,238
2022	86,364	95,000	1,902,035	2,092,238
2023	86,364	95,000	1,988,398	2,187,238
2024	86,364	95,000	2,074,762	2,282,238
2025	86,364	95,000	2,161,126	2,377,238
2026	86,364	95,000	2,247,489	2,472,238
2027	86,364	95,000	2,333,853	2,567,238
2028	86,364	95,000	2,420,217	2,662,238
2029	86,364	95,000	2,506,580	2,757,238
2030	86,364	95,000	2,592,944	2,852,238
2031	86,364	95,000	2,679,307	2,947,238
2032	86,364	95,000	2,765,671	3,042,238
2033	86,364	95,000	2,852,035	3,137,238
2034	86,364	95,000	2,938,398	3,232,238
2035	86,364	95,000	3,024,762	3,327,238
2036	86,364	95,000	3,111,126	3,422,238
2037	86,364	95,000	3,197,489	3,517,238
2038	86,364	95,000	3,283,853	3,612,238
2039	86,364	95,000	3,370,217	3,707,238
2040	86,364	95,000	3,456,580	3,802,238
2041	86,364	95,000	3,542,944	3,897,238
2042	86,364	95,000	3,629,307	3,992,238
2043	86,364	95,000	3,715,671	4,087,238
2044	86,364	95,000	3,802,035	4,182,238
2045	86,364	95,000	3,888,398	4,277,238
2046	86,364	95,000	3,974,762	4,372,238
2047	86,364	95,000	4,061,126	4,467,238
2048	86,364	95,000	4,147,489	4,562,238
2049	86,364	95,000	4,233,853	4,657,238
2050	0	0	4,320,217	4,752,238
2051	0	0	4,320,217	4,752,238
2052	0	0	4,320,217	4,752,238
2053	0	0	4,320,217	4,752,238
2054	0	0	4,320,217	4,752,238
2055	0	0	4,320,217	4,752,238
2056	0	0	4,320,217	4,752,238
2057	0	0	4,320,217	4,752,238
2058	0	0	4,320,217	4,752,238
2059	0	0	4,320,217	4,752,238

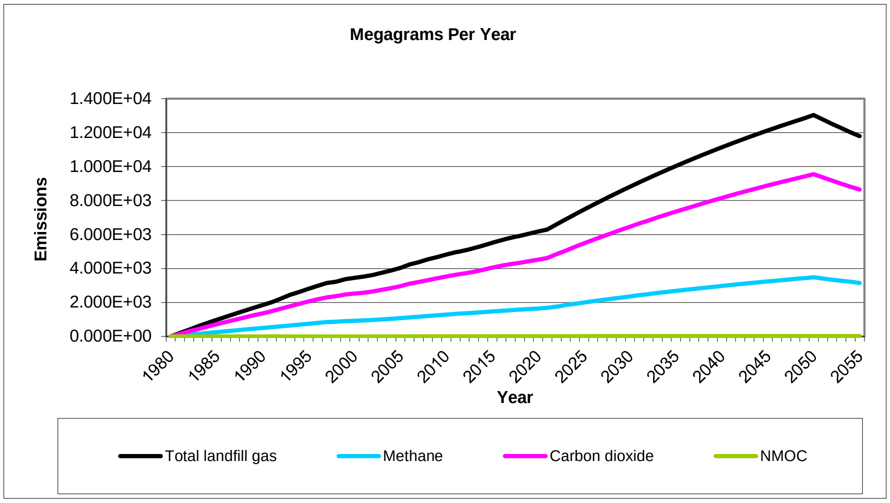
Pollutant Parameters

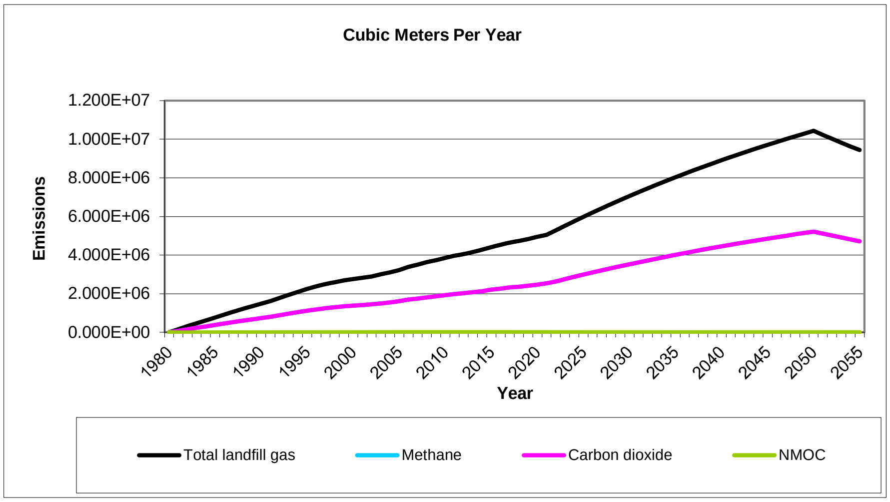
	Compound	Gas / Pollutant Default Parameters: Concentration (*ppmv*)	Molecular Weight	User-specified Pollutant Parameters: Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

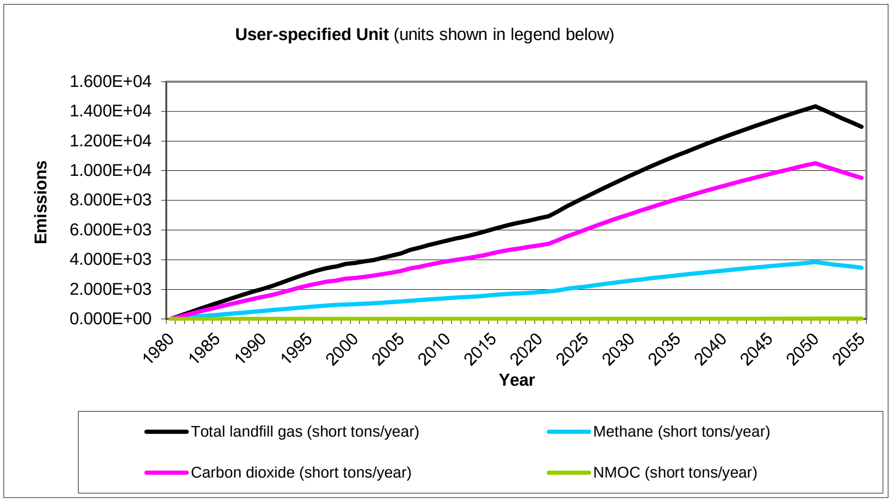
Pollutant Parameters (Continued)

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

Graphs


Megagrams Per Year
1.400E+04
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
Emissions
1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
1.200E+07
1.000E+07
8.000E+06
6.000E+06
4.000E+06
2.000E+06
0.000E+00
Emissions
1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
1.600E+04
1.400E+04
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
Emissions
1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055
Year
Total landfill gas (short tons/year)
Methane (short tons/year)
Carbon dioxide (short tons/year)
NMOC (short tons/year)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(short tons/year)	(Mg/year)	(m^3/year)	(short tons/year)
1980	0	0	0	0	0	0
1981	2.025E+02	1.622E+05	2.228E+02	5.410E+01	8.109E+04	5.951E+01
1982	4.010E+02	3.211E+05	4.411E+02	1.071E+02	1.606E+05	1.178E+02
1983	5.956E+02	4.769E+05	6.552E+02	1.591E+02	2.385E+05	1.750E+02
1984	7.864E+02	6.297E+05	8.650E+02	2.100E+02	3.148E+05	2.310E+02
1985	9.733E+02	7.794E+05	1.071E+03	2.600E+02	3.897E+05	2.860E+02
1986	1.157E+03	9.261E+05	1.272E+03	3.089E+02	4.631E+05	3.398E+02
1987	1.336E+03	1.070E+06	1.470E+03	3.569E+02	5.350E+05	3.926E+02
1988	1.512E+03	1.211E+06	1.663E+03	4.039E+02	6.055E+05	4.443E+02
1989	1.685E+03	1.349E+06	1.853E+03	4.500E+02	6.746E+05	4.950E+02
1990	1.854E+03	1.485E+06	2.039E+03	4.952E+02	7.423E+05	5.447E+02
1991	2.020E+03	1.618E+06	2.222E+03	5.396E+02	8.089E+05	5.936E+02
1992	2.217E+03	1.776E+06	2.439E+03	5.923E+02	8.878E+05	6.515E+02
1993	2.444E+03	1.957E+06	2.688E+03	6.527E+02	9.783E+05	7.180E+02
1994	2.627E+03	2.104E+06	2.890E+03	7.017E+02	1.052E+06	7.719E+02
1995	2.807E+03	2.248E+06	3.088E+03	7.498E+02	1.124E+06	8.247E+02
1996	2.982E+03	2.388E+06	3.280E+03	7.965E+02	1.194E+06	8.761E+02
1997	3.142E+03	2.516E+06	3.456E+03	8.392E+02	1.258E+06	9.231E+02
1998	3.231E+03	2.587E+06	3.554E+03	8.631E+02	1.294E+06	9.494E+02
1999	3.372E+03	2.700E+06	3.709E+03	9.007E+02	1.350E+06	9.908E+02
2000	3.446E+03	2.759E+06	3.791E+03	9.205E+02	1.380E+06	1.013E+03
2001	3.528E+03	2.825E+06	3.881E+03	9.424E+02	1.413E+06	1.037E+03
2002	3.611E+03	2.891E+06	3.972E+03	9.644E+02	1.446E+06	1.061E+03
2003	3.749E+03	3.002E+06	4.124E+03	1.001E+03	1.501E+06	1.101E+03
2004	3.883E+03	3.109E+06	4.271E+03	1.037E+03	1.555E+06	1.141E+03
2005	4.025E+03	3.223E+06	4.428E+03	1.075E+03	1.612E+06	1.183E+03
2006	4.239E+03	3.394E+06	4.663E+03	1.132E+03	1.697E+06	1.245E+03
2007	4.378E+03	3.506E+06	4.816E+03	1.169E+03	1.753E+06	1.286E+03
2008	4.536E+03	3.632E+06	4.990E+03	1.212E+03	1.816E+06	1.333E+03
2009	4.680E+03	3.748E+06	5.148E+03	1.250E+03	1.874E+06	1.375E+03
2010	4.815E+03	3.856E+06	5.296E+03	1.286E+03	1.928E+06	1.415E+03
2011	4.952E+03	3.966E+06	5.448E+03	1.323E+03	1.983E+06	1.455E+03
2012	5.068E+03	4.058E+06	5.575E+03	1.354E+03	2.029E+06	1.489E+03
2013	5.203E+03	4.166E+06	5.723E+03	1.390E+03	2.083E+06	1.529E+03
2014	5.335E+03	4.272E+06	5.868E+03	1.425E+03	2.136E+06	1.568E+03
2015	5.515E+03	4.416E+06	6.067E+03	1.473E+03	2.208E+06	1.620E+03
2016	5.669E+03	4.540E+06	6.236E+03	1.514E+03	2.270E+06	1.666E+03
2017	5.802E+03	4.646E+06	6.383E+03	1.550E+03	2.323E+06	1.705E+03
2018	5.916E+03	4.737E+06	6.508E+03	1.580E+03	2.369E+06	1.738E+03
2019	6.046E+03	4.841E+06	6.651E+03	1.615E+03	2.421E+06	1.776E+03
2020	6.172E+03	4.942E+06	6.789E+03	1.649E+03	2.471E+06	1.813E+03
2021	6.297E+03	5.043E+06	6.927E+03	1.682E+03	2.521E+06	1.850E+03
2022	6.600E+03	5.285E+06	7.260E+03	1.763E+03	2.643E+06	1.939E+03
2023	6.897E+03	5.523E+06	7.587E+03	1.842E+03	2.761E+06	2.027E+03
2024	7.188E+03	5.756E+06	7.907E+03	1.920E+03	2.878E+06	2.112E+03
2025	7.473E+03	5.984E+06	8.221E+03	1.996E+03	2.992E+06	2.196E+03
2026	7.753E+03	6.208E+06	8.528E+03	2.071E+03	3.104E+06	2.278E+03
2027	8.027E+03	6.428E+06	8.830E+03	2.144E+03	3.214E+06	2.358E+03
2028	8.296E+03	6.643E+06	9.125E+03	2.216E+03	3.321E+06	2.437E+03
2029	8.559E+03	6.854E+06	9.415E+03	2.286E+03	3.427E+06	2.515E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2030	8.817E+03	7.060E+06	9.699E+03	2.355E+03	3.530E+06	2.591E+03
2031	9.070E+03	7.263E+06	9.977E+03	2.423E+03	3.631E+06	2.665E+03
2032	9.318E+03	7.461E+06	1.025E+04	2.489E+03	3.731E+06	2.738E+03
2033	9.561E+03	7.656E+06	1.052E+04	2.554E+03	3.828E+06	2.809E+03
2034	9.799E+03	7.847E+06	1.078E+04	2.617E+03	3.923E+06	2.879E+03
2035	1.003E+04	8.034E+06	1.104E+04	2.680E+03	4.017E+06	2.948E+03
2036	1.026E+04	8.217E+06	1.129E+04	2.741E+03	4.108E+06	3.015E+03
2037	1.049E+04	8.397E+06	1.153E+04	2.801E+03	4.198E+06	3.081E+03
2038	1.071E+04	8.573E+06	1.178E+04	2.860E+03	4.286E+06	3.146E+03
2039	1.092E+04	8.745E+06	1.201E+04	2.917E+03	4.373E+06	3.209E+03
2040	1.113E+04	8.915E+06	1.225E+04	2.974E+03	4.457E+06	3.271E+03
2041	1.134E+04	9.080E+06	1.247E+04	3.029E+03	4.540E+06	3.332E+03
2042	1.154E+04	9.243E+06	1.270E+04	3.083E+03	4.621E+06	3.392E+03
2043	1.174E+04	9.402E+06	1.292E+04	3.136E+03	4.701E+06	3.450E+03
2044	1.194E+04	9.558E+06	1.313E+04	3.188E+03	4.779E+06	3.507E+03
2045	1.213E+04	9.712E+06	1.334E+04	3.240E+03	4.856E+06	3.563E+03
2046	1.232E+04	9.862E+06	1.355E+04	3.290E+03	4.931E+06	3.619E+03
2047	1.250E+04	1.001E+07	1.375E+04	3.339E+03	5.004E+06	3.673E+03
2048	1.268E+04	1.015E+07	1.395E+04	3.387E+03	5.076E+06	3.725E+03
2049	1.286E+04	1.029E+07	1.414E+04	3.434E+03	5.147E+06	3.777E+03
2050	1.303E+04	1.043E+07	1.433E+04	3.480E+03	5.216E+06	3.828E+03
2051	1.277E+04	1.023E+07	1.405E+04	3.411E+03	5.113E+06	3.752E+03
2052	1.252E+04	1.002E+07	1.377E+04	3.344E+03	5.012E+06	3.678E+03
2053	1.227E+04	9.825E+06	1.350E+04	3.277E+03	4.913E+06	3.605E+03
2054	1.203E+04	9.631E+06	1.323E+04	3.213E+03	4.815E+06	3.534E+03
2055	1.179E+04	9.440E+06	1.297E+04	3.149E+03	4.720E+06	3.464E+03
2056	1.156E+04	9.253E+06	1.271E+04	3.087E+03	4.627E+06	3.395E+03
2057	1.133E+04	9.070E+06	1.246E+04	3.025E+03	4.535E+06	3.328E+03
2058	1.110E+04	8.890E+06	1.221E+04	2.966E+03	4.445E+06	3.262E+03
2059	1.088E+04	8.714E+06	1.197E+04	2.907E+03	4.357E+06	3.198E+03
2060	1.067E+04	8.542E+06	1.173E+04	2.849E+03	4.271E+06	3.134E+03
2061	1.046E+04	8.372E+06	1.150E+04	2.793E+03	4.186E+06	3.072E+03
2062	1.025E+04	8.207E+06	1.127E+04	2.738E+03	4.103E+06	3.011E+03
2063	1.005E+04	8.044E+06	1.105E+04	2.683E+03	4.022E+06	2.952E+03
2064	9.847E+03	7.885E+06	1.083E+04	2.630E+03	3.942E+06	2.893E+03
2065	9.652E+03	7.729E+06	1.062E+04	2.578E+03	3.864E+06	2.836E+03
2066	9.461E+03	7.576E+06	1.041E+04	2.527E+03	3.788E+06	2.780E+03
2067	9.273E+03	7.426E+06	1.020E+04	2.477E+03	3.713E+06	2.725E+03
2068	9.090E+03	7.279E+06	9.999E+03	2.428E+03	3.639E+06	2.671E+03
2069	8.910E+03	7.135E+06	9.801E+03	2.380E+03	3.567E+06	2.618E+03
2070	8.733E+03	6.993E+06	9.607E+03	2.333E+03	3.497E+06	2.566E+03
2071	8.560E+03	6.855E+06	9.416E+03	2.287E+03	3.427E+06	2.515E+03
2072	8.391E+03	6.719E+06	9.230E+03	2.241E+03	3.360E+06	2.465E+03
2073	8.225E+03	6.586E+06	9.047E+03	2.197E+03	3.293E+06	2.417E+03
2074	8.062E+03	6.456E+06	8.868E+03	2.153E+03	3.228E+06	2.369E+03
2075	7.902E+03	6.328E+06	8.693E+03	2.111E+03	3.164E+06	2.322E+03
2076	7.746E+03	6.202E+06	8.520E+03	2.069E+03	3.101E+06	2.276E+03
2077	7.592E+03	6.080E+06	8.352E+03	2.028E+03	3.040E+06	2.231E+03
2078	7.442E+03	5.959E+06	8.186E+03	1.988E+03	2.980E+06	2.187E+03
2079	7.295E+03	5.841E+06	8.024E+03	1.948E+03	2.921E+06	2.143E+03
2080	7.150E+03	5.726E+06	7.865E+03	1.910E+03	2.863E+06	2.101E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2081	7.009E+03	5.612E+06	7.710E+03	1.872E+03	2.806E+06	2.059E+03
2082	6.870E+03	5.501E+06	7.557E+03	1.835E+03	2.751E+06	2.019E+03
2083	6.734E+03	5.392E+06	7.407E+03	1.799E+03	2.696E+06	1.979E+03
2084	6.601E+03	5.285E+06	7.261E+03	1.763E+03	2.643E+06	1.939E+03
2085	6.470E+03	5.181E+06	7.117E+03	1.728E+03	2.590E+06	1.901E+03
2086	6.342E+03	5.078E+06	6.976E+03	1.694E+03	2.539E+06	1.863E+03
2087	6.216E+03	4.978E+06	6.838E+03	1.660E+03	2.489E+06	1.826E+03
2088	6.093E+03	4.879E+06	6.702E+03	1.628E+03	2.440E+06	1.790E+03
2089	5.972E+03	4.782E+06	6.570E+03	1.595E+03	2.391E+06	1.755E+03
2090	5.854E+03	4.688E+06	6.440E+03	1.564E+03	2.344E+06	1.720E+03
2091	5.738E+03	4.595E+06	6.312E+03	1.533E+03	2.297E+06	1.686E+03
2092	5.625E+03	4.504E+06	6.187E+03	1.502E+03	2.252E+06	1.653E+03
2093	5.513E+03	4.415E+06	6.065E+03	1.473E+03	2.207E+06	1.620E+03
2094	5.404E+03	4.327E+06	5.944E+03	1.443E+03	2.164E+06	1.588E+03
2095	5.297E+03	4.242E+06	5.827E+03	1.415E+03	2.121E+06	1.556E+03
2096	5.192E+03	4.158E+06	5.711E+03	1.387E+03	2.079E+06	1.526E+03
2097	5.089E+03	4.075E+06	5.598E+03	1.359E+03	2.038E+06	1.495E+03
2098	4.989E+03	3.995E+06	5.487E+03	1.333E+03	1.997E+06	1.466E+03
2099	4.890E+03	3.916E+06	5.379E+03	1.306E+03	1.958E+06	1.437E+03
2100	4.793E+03	3.838E+06	5.272E+03	1.280E+03	1.919E+06	1.408E+03
2101	4.698E+03	3.762E+06	5.168E+03	1.255E+03	1.881E+06	1.380E+03
2102	4.605E+03	3.688E+06	5.066E+03	1.230E+03	1.844E+06	1.353E+03
2103	4.514E+03	3.614E+06	4.965E+03	1.206E+03	1.807E+06	1.326E+03
2104	4.424E+03	3.543E+06	4.867E+03	1.182E+03	1.771E+06	1.300E+03
2105	4.337E+03	3.473E+06	4.771E+03	1.158E+03	1.736E+06	1.274E+03
2106	4.251E+03	3.404E+06	4.676E+03	1.135E+03	1.702E+06	1.249E+03
2107	4.167E+03	3.337E+06	4.583E+03	1.113E+03	1.668E+06	1.224E+03
2108	4.084E+03	3.271E+06	4.493E+03	1.091E+03	1.635E+06	1.200E+03
2109	4.003E+03	3.206E+06	4.404E+03	1.069E+03	1.603E+06	1.176E+03
2110	3.924E+03	3.142E+06	4.317E+03	1.048E+03	1.571E+06	1.153E+03
2111	3.846E+03	3.080E+06	4.231E+03	1.027E+03	1.540E+06	1.130E+03
2112	3.770E+03	3.019E+06	4.147E+03	1.007E+03	1.510E+06	1.108E+03
2113	3.696E+03	2.959E+06	4.065E+03	9.871E+02	1.480E+06	1.086E+03
2114	3.622E+03	2.901E+06	3.985E+03	9.676E+02	1.450E+06	1.064E+03
2115	3.551E+03	2.843E+06	3.906E+03	9.484E+02	1.422E+06	1.043E+03
2116	3.480E+03	2.787E+06	3.828E+03	9.297E+02	1.393E+06	1.023E+03
2117	3.411E+03	2.732E+06	3.753E+03	9.112E+02	1.366E+06	1.002E+03
2118	3.344E+03	2.678E+06	3.678E+03	8.932E+02	1.339E+06	9.825E+02
2119	3.278E+03	2.625E+06	3.606E+03	8.755E+02	1.312E+06	9.631E+02
2120	3.213E+03	2.573E+06	3.534E+03	8.582E+02	1.286E+06	9.440E+02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(short tons/year)	(Mg/year)	(m^3/year)	(short tons/year)
1980	0	0	0	0	0	0
1981	1.484E+02	8.109E+04	1.633E+02	3.488E-01	9.730E+01	3.837E-01
1982	2.939E+02	1.606E+05	3.233E+02	6.907E-01	1.927E+02	7.597E-01
1983	4.365E+02	2.385E+05	4.802E+02	1.026E+00	2.862E+02	1.128E+00
1984	5.763E+02	3.148E+05	6.339E+02	1.354E+00	3.778E+02	1.490E+00
1985	7.133E+02	3.897E+05	7.847E+02	1.676E+00	4.676E+02	1.844E+00
1986	8.476E+02	4.631E+05	9.324E+02	1.992E+00	5.557E+02	2.191E+00
1987	9.793E+02	5.350E+05	1.077E+03	2.301E+00	6.420E+02	2.531E+00
1988	1.108E+03	6.055E+05	1.219E+03	2.604E+00	7.266E+02	2.865E+00
1989	1.235E+03	6.746E+05	1.358E+03	2.902E+00	8.095E+02	3.192E+00
1990	1.359E+03	7.423E+05	1.495E+03	3.193E+00	8.908E+02	3.512E+00
1991	1.481E+03	8.089E+05	1.629E+03	3.479E+00	9.707E+02	3.827E+00
1992	1.625E+03	8.878E+05	1.788E+03	3.819E+00	1.065E+03	4.201E+00
1993	1.791E+03	9.783E+05	1.970E+03	4.208E+00	1.174E+03	4.629E+00
1994	1.925E+03	1.052E+06	2.118E+03	4.524E+00	1.262E+03	4.977E+00
1995	2.057E+03	1.124E+06	2.263E+03	4.834E+00	1.349E+03	5.317E+00
1996	2.185E+03	1.194E+06	2.404E+03	5.135E+00	1.433E+03	5.649E+00
1997	2.302E+03	1.258E+06	2.533E+03	5.410E+00	1.509E+03	5.952E+00
1998	2.368E+03	1.294E+06	2.605E+03	5.565E+00	1.552E+03	6.121E+00
1999	2.471E+03	1.350E+06	2.719E+03	5.807E+00	1.620E+03	6.388E+00
2000	2.526E+03	1.380E+06	2.778E+03	5.935E+00	1.656E+03	6.528E+00
2001	2.586E+03	1.413E+06	2.844E+03	6.076E+00	1.695E+03	6.684E+00
2002	2.646E+03	1.446E+06	2.911E+03	6.218E+00	1.735E+03	6.840E+00
2003	2.747E+03	1.501E+06	3.022E+03	6.456E+00	1.801E+03	7.101E+00
2004	2.846E+03	1.555E+06	3.130E+03	6.687E+00	1.865E+03	7.355E+00
2005	2.950E+03	1.612E+06	3.245E+03	6.932E+00	1.934E+03	7.625E+00
2006	3.107E+03	1.697E+06	3.417E+03	7.300E+00	2.037E+03	8.030E+00
2007	3.209E+03	1.753E+06	3.530E+03	7.540E+00	2.103E+03	8.294E+00
2008	3.325E+03	1.816E+06	3.657E+03	7.812E+00	2.179E+03	8.593E+00
2009	3.430E+03	1.874E+06	3.773E+03	8.060E+00	2.249E+03	8.866E+00
2010	3.529E+03	1.928E+06	3.882E+03	8.292E+00	2.313E+03	9.121E+00
2011	3.630E+03	1.983E+06	3.992E+03	8.529E+00	2.379E+03	9.382E+00
2012	3.714E+03	2.029E+06	4.086E+03	8.728E+00	2.435E+03	9.601E+00
2013	3.813E+03	2.083E+06	4.194E+03	8.960E+00	2.500E+03	9.856E+00
2014	3.910E+03	2.136E+06	4.301E+03	9.188E+00	2.563E+03	1.011E+01
2015	4.042E+03	2.208E+06	4.446E+03	9.498E+00	2.650E+03	1.045E+01
2016	4.155E+03	2.270E+06	4.571E+03	9.764E+00	2.724E+03	1.074E+01
2017	4.253E+03	2.323E+06	4.678E+03	9.993E+00	2.788E+03	1.099E+01
2018	4.336E+03	2.369E+06	4.770E+03	1.019E+01	2.842E+03	1.121E+01
2019	4.431E+03	2.421E+06	4.874E+03	1.041E+01	2.905E+03	1.145E+01
2020	4.523E+03	2.471E+06	4.976E+03	1.063E+01	2.965E+03	1.169E+01
2021	4.615E+03	2.521E+06	5.077E+03	1.085E+01	3.026E+03	1.193E+01
2022	4.837E+03	2.643E+06	5.321E+03	1.137E+01	3.171E+03	1.250E+01
2023	5.055E+03	2.761E+06	5.560E+03	1.188E+01	3.314E+03	1.307E+01
2024	5.268E+03	2.878E+06	5.795E+03	1.238E+01	3.454E+03	1.362E+01
2025	5.477E+03	2.992E+06	6.025E+03	1.287E+01	3.591E+03	1.416E+01
2026	5.682E+03	3.104E+06	6.250E+03	1.335E+01	3.725E+03	1.469E+01
2027	5.883E+03	3.214E+06	6.471E+03	1.382E+01	3.857E+03	1.521E+01
2028	6.080E+03	3.321E+06	6.688E+03	1.429E+01	3.986E+03	1.571E+01
2029	6.273E+03	3.427E+06	6.900E+03	1.474E+01	4.112E+03	1.621E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2030	6.462E+03	3.530E+06	7.108E+03	1.518E+01	4.236E+03	1.670E+01
2031	6.647E+03	3.631E+06	7.312E+03	1.562E+01	4.358E+03	1.718E+01
2032	6.829E+03	3.731E+06	7.512E+03	1.605E+01	4.477E+03	1.765E+01
2033	7.007E+03	3.828E+06	7.708E+03	1.647E+01	4.594E+03	1.811E+01
2034	7.182E+03	3.923E+06	7.900E+03	1.688E+01	4.708E+03	1.856E+01
2035	7.353E+03	4.017E+06	8.088E+03	1.728E+01	4.820E+03	1.901E+01
2036	7.521E+03	4.108E+06	8.273E+03	1.767E+01	4.930E+03	1.944E+01
2037	7.685E+03	4.198E+06	8.454E+03	1.806E+01	5.038E+03	1.986E+01
2038	7.846E+03	4.286E+06	8.631E+03	1.844E+01	5.144E+03	2.028E+01
2039	8.004E+03	4.373E+06	8.805E+03	1.881E+01	5.247E+03	2.069E+01
2040	8.159E+03	4.457E+06	8.975E+03	1.917E+01	5.349E+03	2.109E+01
2041	8.311E+03	4.540E+06	9.142E+03	1.953E+01	5.448E+03	2.148E+01
2042	8.460E+03	4.621E+06	9.306E+03	1.988E+01	5.546E+03	2.187E+01
2043	8.605E+03	4.701E+06	9.466E+03	2.022E+01	5.641E+03	2.224E+01
2044	8.748E+03	4.779E+06	9.623E+03	2.056E+01	5.735E+03	2.261E+01
2045	8.889E+03	4.856E+06	9.777E+03	2.089E+01	5.827E+03	2.298E+01
2046	9.026E+03	4.931E+06	9.928E+03	2.121E+01	5.917E+03	2.333E+01
2047	9.160E+03	5.004E+06	1.008E+04	2.153E+01	6.005E+03	2.368E+01
2048	9.292E+03	5.076E+06	1.022E+04	2.184E+01	6.092E+03	2.402E+01
2049	9.422E+03	5.147E+06	1.036E+04	2.214E+01	6.177E+03	2.435E+01
2050	9.549E+03	5.216E+06	1.050E+04	2.244E+01	6.260E+03	2.468E+01
2051	9.359E+03	5.113E+06	1.030E+04	2.199E+01	6.136E+03	2.419E+01
2052	9.174E+03	5.012E+06	1.009E+04	2.156E+01	6.014E+03	2.371E+01
2053	8.993E+03	4.913E+06	9.892E+03	2.113E+01	5.895E+03	2.324E+01
2054	8.814E+03	4.815E+06	9.696E+03	2.071E+01	5.778E+03	2.278E+01
2055	8.640E+03	4.720E+06	9.504E+03	2.030E+01	5.664E+03	2.233E+01
2056	8.469E+03	4.627E+06	9.316E+03	1.990E+01	5.552E+03	2.189E+01
2057	8.301E+03	4.535E+06	9.131E+03	1.951E+01	5.442E+03	2.146E+01
2058	8.137E+03	4.445E+06	8.950E+03	1.912E+01	5.334E+03	2.103E+01
2059	7.976E+03	4.357E+06	8.773E+03	1.874E+01	5.228E+03	2.062E+01
2060	7.818E+03	4.271E+06	8.599E+03	1.837E+01	5.125E+03	2.021E+01
2061	7.663E+03	4.186E+06	8.429E+03	1.801E+01	5.023E+03	1.981E+01
2062	7.511E+03	4.103E+06	8.262E+03	1.765E+01	4.924E+03	1.941E+01
2063	7.362E+03	4.022E+06	8.099E+03	1.730E+01	4.827E+03	1.903E+01
2064	7.217E+03	3.942E+06	7.938E+03	1.696E+01	4.731E+03	1.865E+01
2065	7.074E+03	3.864E+06	7.781E+03	1.662E+01	4.637E+03	1.828E+01
2066	6.934E+03	3.788E+06	7.627E+03	1.629E+01	4.545E+03	1.792E+01
2067	6.796E+03	3.713E+06	7.476E+03	1.597E+01	4.455E+03	1.757E+01
2068	6.662E+03	3.639E+06	7.328E+03	1.565E+01	4.367E+03	1.722E+01
2069	6.530E+03	3.567E+06	7.183E+03	1.534E+01	4.281E+03	1.688E+01
2070	6.401E+03	3.497E+06	7.041E+03	1.504E+01	4.196E+03	1.654E+01
2071	6.274E+03	3.427E+06	6.901E+03	1.474E+01	4.113E+03	1.622E+01
2072	6.150E+03	3.360E+06	6.765E+03	1.445E+01	4.031E+03	1.590E+01
2073	6.028E+03	3.293E+06	6.631E+03	1.416E+01	3.952E+03	1.558E+01
2074	5.908E+03	3.228E+06	6.499E+03	1.388E+01	3.873E+03	1.527E+01
2075	5.791E+03	3.164E+06	6.371E+03	1.361E+01	3.797E+03	1.497E+01
2076	5.677E+03	3.101E+06	6.245E+03	1.334E+01	3.721E+03	1.467E+01
2077	5.564E+03	3.040E+06	6.121E+03	1.308E+01	3.648E+03	1.438E+01
2078	5.454E+03	2.980E+06	6.000E+03	1.282E+01	3.576E+03	1.410E+01
2079	5.346E+03	2.921E+06	5.881E+03	1.256E+01	3.505E+03	1.382E+01
2080	5.240E+03	2.863E+06	5.764E+03	1.231E+01	3.435E+03	1.355E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	(m^3/year)	(short tons/year)	(Mg/year)	(m^3/year)	(short tons/year)
2081	5.137E+03	2.806E+06	5.650E+03	1.207E+01	3.367E+03	1.328E+01
2082	5.035E+03	2.751E+06	5.538E+03	1.183E+01	3.301E+03	1.301E+01
2083	4.935E+03	2.696E+06	5.429E+03	1.160E+01	3.235E+03	1.276E+01
2084	4.837E+03	2.643E+06	5.321E+03	1.137E+01	3.171E+03	1.250E+01
2085	4.742E+03	2.590E+06	5.216E+03	1.114E+01	3.108E+03	1.226E+01
2086	4.648E+03	2.539E+06	5.113E+03	1.092E+01	3.047E+03	1.201E+01
2087	4.556E+03	2.489E+06	5.011E+03	1.071E+01	2.987E+03	1.178E+01
2088	4.466E+03	2.440E+06	4.912E+03	1.049E+01	2.927E+03	1.154E+01
2089	4.377E+03	2.391E+06	4.815E+03	1.029E+01	2.869E+03	1.131E+01
2090	4.290E+03	2.344E+06	4.719E+03	1.008E+01	2.813E+03	1.109E+01
2091	4.205E+03	2.297E+06	4.626E+03	9.882E+00	2.757E+03	1.087E+01
2092	4.122E+03	2.252E+06	4.534E+03	9.687E+00	2.702E+03	1.066E+01
2093	4.041E+03	2.207E+06	4.445E+03	9.495E+00	2.649E+03	1.044E+01
2094	3.961E+03	2.164E+06	4.357E+03	9.307E+00	2.596E+03	1.024E+01
2095	3.882E+03	2.121E+06	4.270E+03	9.122E+00	2.545E+03	1.003E+01
2096	3.805E+03	2.079E+06	4.186E+03	8.942E+00	2.495E+03	9.836E+00
2097	3.730E+03	2.038E+06	4.103E+03	8.765E+00	2.445E+03	9.641E+00
2098	3.656E+03	1.997E+06	4.022E+03	8.591E+00	2.397E+03	9.450E+00
2099	3.584E+03	1.958E+06	3.942E+03	8.421E+00	2.349E+03	9.263E+00
2100	3.513E+03	1.919E+06	3.864E+03	8.254E+00	2.303E+03	9.080E+00
2101	3.443E+03	1.881E+06	3.787E+03	8.091E+00	2.257E+03	8.900E+00
2102	3.375E+03	1.844E+06	3.712E+03	7.931E+00	2.213E+03	8.724E+00
2103	3.308E+03	1.807E+06	3.639E+03	7.774E+00	2.169E+03	8.551E+00
2104	3.243E+03	1.771E+06	3.567E+03	7.620E+00	2.126E+03	8.382E+00
2105	3.178E+03	1.736E+06	3.496E+03	7.469E+00	2.084E+03	8.216E+00
2106	3.116E+03	1.702E+06	3.427E+03	7.321E+00	2.042E+03	8.053E+00
2107	3.054E+03	1.668E+06	3.359E+03	7.176E+00	2.002E+03	7.894E+00
2108	2.993E+03	1.635E+06	3.293E+03	7.034E+00	1.962E+03	7.737E+00
2109	2.934E+03	1.603E+06	3.227E+03	6.895E+00	1.923E+03	7.584E+00
2110	2.876E+03	1.571E+06	3.164E+03	6.758E+00	1.885E+03	7.434E+00
2111	2.819E+03	1.540E+06	3.101E+03	6.624E+00	1.848E+03	7.287E+00
2112	2.763E+03	1.510E+06	3.040E+03	6.493E+00	1.811E+03	7.142E+00
2113	2.708E+03	1.480E+06	2.979E+03	6.364E+00	1.776E+03	7.001E+00
2114	2.655E+03	1.450E+06	2.920E+03	6.238E+00	1.740E+03	6.862E+00
2115	2.602E+03	1.422E+06	2.863E+03	6.115E+00	1.706E+03	6.726E+00
2116	2.551E+03	1.393E+06	2.806E+03	5.994E+00	1.672E+03	6.593E+00
2117	2.500E+03	1.366E+06	2.750E+03	5.875E+00	1.639E+03	6.463E+00
2118	2.451E+03	1.339E+06	2.696E+03	5.759E+00	1.607E+03	6.335E+00
2119	2.402E+03	1.312E+06	2.642E+03	5.645E+00	1.575E+03	6.209E+00
2120	2.355E+03	1.286E+06	2.590E+03	5.533E+00	1.544E+03	6.086E+00

Section 7

Information Used To Determine Emissions

Information Used to Determine Emissions shall include the following:

- ☐ If manufacturer data are used, include specifications for emissions units and control equipment, including control efficiencies specifications and sufficient engineering data for verification of control equipment operation, including design drawings, test reports, and design parameters that affect normal operation.
- ☐ If test data are used, include a copy of the complete test report. If the test data are for an emissions unit other than the one being permitted, the emission units must be identical. Test data may not be used if any difference in operating conditions of the unit being permitted and the unit represented in the test report significantly effect emission rates.
- ☑ If the most current copy of AP-42 is used, reference the section and date located at the bottom of the page. Include a copy of the page containing the emissions factors, and clearly mark the factors used in the calculations.
- ☐ If an older version of AP-42 is used, include a complete copy of the section.
- ☐ If an EPA document or other material is referenced, include a complete copy.
- ☐ Fuel specifications sheet.
- ☑ If computer models are used to estimate emissions, include an input summary (if available) and a detailed report, and a disk containing the input file(s) used to run the model. For tank-flashing emissions, include a discussion of the method used to estimate tank-flashing emissions, relative thresholds (i.e., permit or major source (NSPS, PSD or Title V)), accuracy of the model, the input and output from simulation models and software, all calculations, documentation of any assumptions used, descriptions of sampling methods and conditions, copies of any lab sample analysis.

U.S. EPA's AP-42 emission factors were used to determine particulate emission rates (PM, PM_{10}, and $PM_{2.5}$) from this facility. RMLF does not have any combustion sources that operate routinely. Landfill gas emissions were calculated using U.S. EPA's LandGEM model.

The following AP-42 chapters were used to calculate equipment, road travel, and aggregate pile transfer emissions:

- Chapter 11.9 Western Surface Coal Mining
- Chapter 13.2.1 Paved Roads
- Chapter 13.2.2 Unpaved Roads
- Chapter 13.2.3 Heavy Construction Operations
- Chapter 13.2.4 Aggregate Handling and Storage Piles

Roswell Municipal Landfill Final Vent Design

Passive Vent Flow Calculations

8" Turbine Vent System

Flow Rate Calculations

Average Wind Speed for Roswell, NM from NCDC, NOAA database 8.7 mph

Maximum Flow Rate from 12" Turbine **600 cfm**
(from Miller, 1996, assuming 9mph average wind speed, building installation)

Anticipated Flow Rate (calculated using methods of Miller, 1996) **7 cfm**

--4" Casing Diameter Flow Restriction (area 12" outlet vs. 4" outlet)

Area 4" outlet = 0.087ft2

Area 12" outlet =0.785 ft2

Ratio of area 4"/12" outlet =0.11

Max Casing Flow = maximum flow turbine(cfm) * 0.11

=600*0.11 66 cfm

--4" Flow Restrictions from Alluvium (silt with gravel)

Assume 10% of maximum flow from screened interval

= 66 cfm * 0.10= 6.6 cfm

Hydrocarbon Removal Calculations

Maximum Unit 1 Cell Measured VOC concentration (SB-2) 870 ug/L

Assume Conservative Estimate of 900 ug/L from each well

Mass VOCs released per well per time unit = concentration (mass/volume) * flow (volume/time)

Conversion: 1 ug/L * 1 cf/min * 28.3L/cf* 525600 min/year*1 g/1,000,000 ug = **14.87*A*B g/year**

Concentration of VOCs in Effluent (A)	900	ug/L
Flow Rate of Vent (B)	7	cfm
Maximum Proposed Number of Vents	8	

Grams VOCS vented per year per vent	93681
Grams VOCs vented per year from 8 vents	749448
Megagrams (tons) VOCs per year from 8 vents	**0.75**

References

Miller, M.D. (1996). Soil Vapor Extraction using Passive Venting and Wind Turbine Ventilation. Master's Thesis, Brigham Young Univesity: Provo, UT

SMA

N

0 100 200 400

SCALE: 1" = 200'

EXPLANATION

PSV-1 PROPOSED PHASE 1 PASSIVE VENT LOCATION

PSV-2 PROPOSED PHASE 2 PASSIVE VENT LOCATION

TOTAL VOC CONCENTRATION ISO-CONTOURS (DASHED WHERE INFERRED)

Drawn MAE | Checked LVA | Approved SAM

Date: JULY, 2016

Scale: Horiz:1"=600' Vert:

Project No: 4422745

Sheet: SHEET 4

UNIT 1 PHASE 1&2 PROPOSED VENT LOCATIONS

ROSWELL MUNICIPAL LANDFILL

ROSWELL, NEW MEXICO

SOUDER, MILLER & ASSOCIATES
3451 Candelaria Rd. NE, Suite D
Albuquerque, NM 87107
SMA
Engineering ◆ Environmental
Surveying
Phone (505) 299-0942 Fax (505) 293-0942
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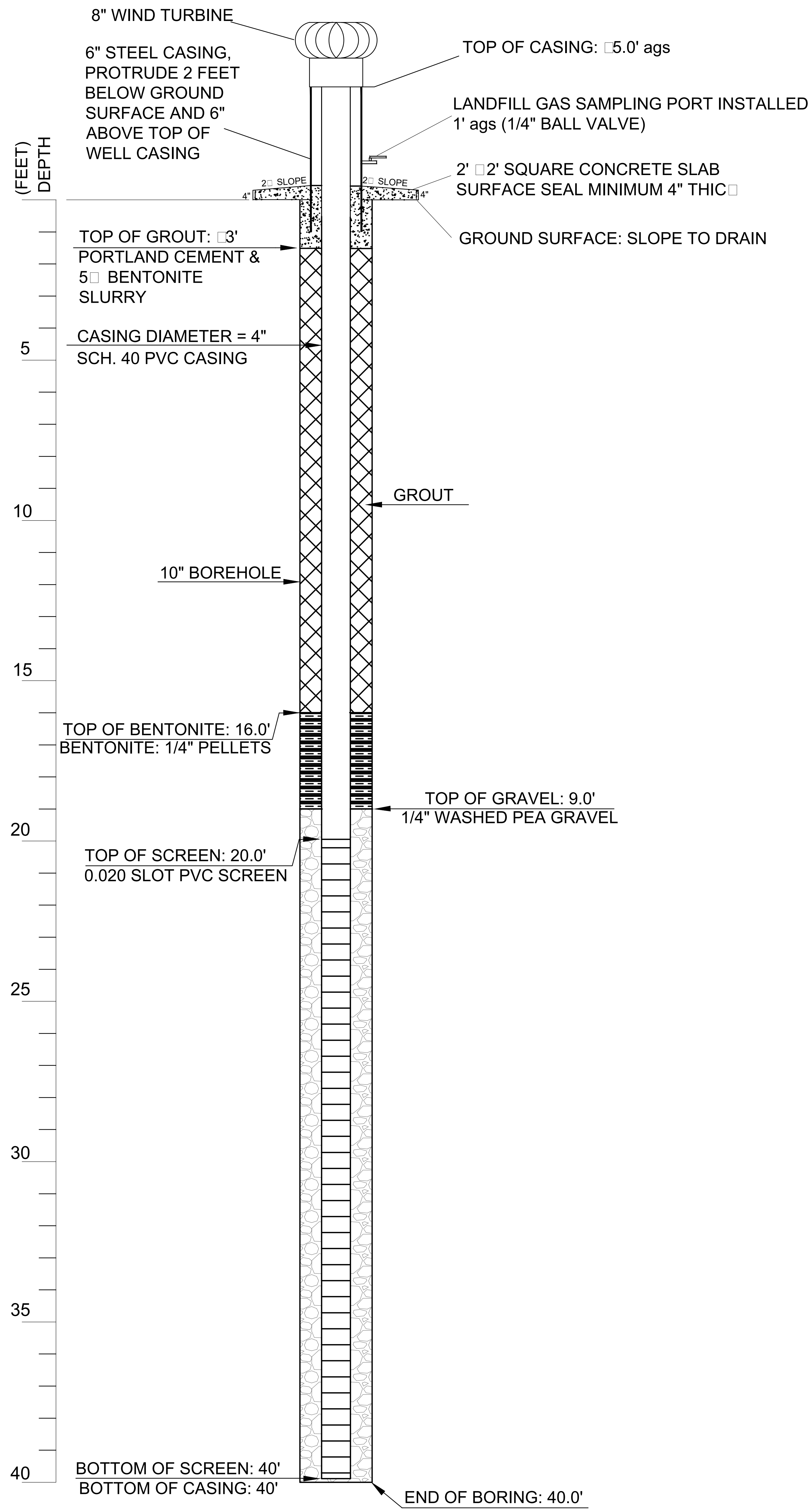
P:\4-Roswell Municipal Landfill\ACAD\Passive Vent Design\2016-04 Revised Final Passive Vent Design Drafting.dwg PLOT DATE: 21 July 2016 Mae



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11.9 Western Surface Coal Mining

11.9.1 General[1]

There are 12 major coal fields in the western states (excluding the Pacific Coast and Alaskan fields), as shown in Figure 11.9-1. Together, they account for more than 64 percent of the surface minable coal reserves in the United States.[2] The 12 coal fields have varying characteristics that may influence fugitive dust emission rates from mining operations including overburden and coal seam thicknesses and structure, mining equipment, operating procedures, terrain, vegetation, precipitation and surface moisture, wind speeds, and temperatures. The operations at a typical western surface mine are shown in Figure 11.9-2. All operations that involve movement of soil or coal, or exposure of erodible surfaces, generate some amount of fugitive dust.

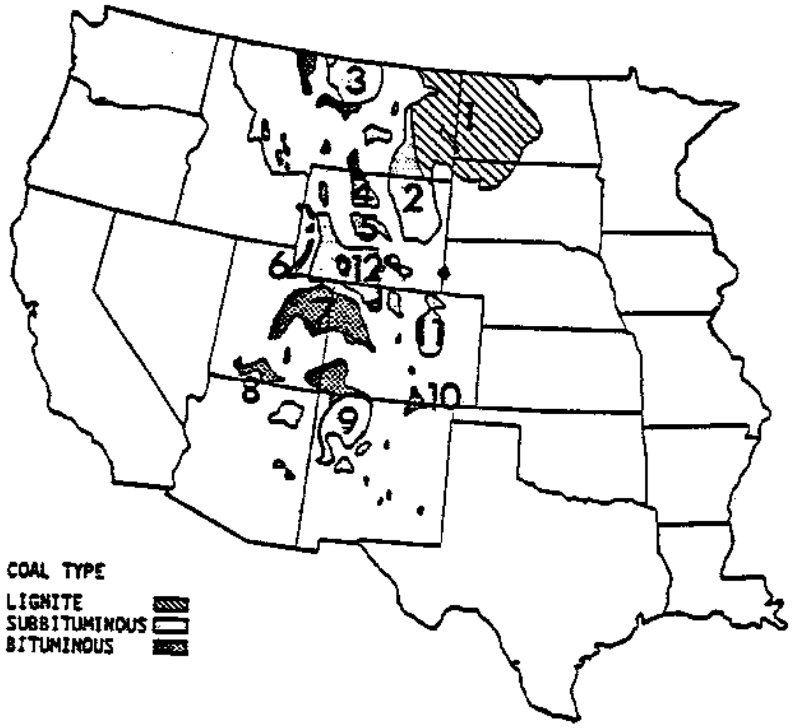
The initial operation is removal of topsoil and subsoil with large scrapers. The topsoil is carried by the scrapers to cover a previously mined and regraded area as part of the reclamation process or is placed in temporary stockpiles. The exposed overburden, the earth that is between the topsoil and the coal seam, is leveled, drilled, and blasted. Then the overburden material is removed down to the coal seam, usually by a dragline or a shovel and truck operation. It is placed in the adjacent mined cut, forming a spoils pile. The uncovered coal seam is then drilled and blasted. A shovel or front end loader loads the broken coal into haul trucks, and it is taken out of the pit along graded haul roads to the tipple, or truck dump. Raw coal sometimes may be dumped onto a temporary storage pile and later rehandled by a front end loader or bulldozer.

At the tipple, the coal is dumped into a hopper that feeds the primary crusher, then is conveyed through additional coal preparation equipment such as secondary crushers and screens to the storage area. If the mine has open storage piles, the crushed coal passes through a coal stacker onto the pile. The piles, usually worked by bulldozers, are subject to wind erosion. From the storage area, the coal is conveyed to a train loading facility and is put into rail cars. At a captive mine, coal will go from the storage pile to the power plant.

During mine reclamation, which proceeds continuously throughout the life of the mine, overburden spoils piles are smoothed and contoured by bulldozers. Topsoil is placed on the graded spoils, and the land is prepared for revegetation by furrowing, mulching, etc. From the time an area is disturbed until the new vegetation emerges, all disturbed areas are subject to wind erosion.

11.9.2 Emissions

Predictive emission factor equations for open dust sources at western surface coal mines are presented in Tables 11.9-1 and 11.9-2. Each equation applies to a single dust-generating activity, such as vehicle traffic on haul roads. The predictive equation explains much of the observed variance in emission factors by relating emissions to three sets of source parameters: (1) measures of source activity or energy expended (e. g., speed and weight of a vehicle traveling on an unpaved road); (2) properties of the material being disturbed (e. g., suspendable fines in the surface material of an unpaved road); and (3) climate (in this case, mean wind speed).



	Coal field	Strippable reserves (10^6 tons)
1	Fort Union	23,529
2	Powder River	56,727
3	North Central	All underground
4	Bighorn Basin	All underground
5	Wind River	3
6	Hams Fork	1,000
7	Uinta	308
8	Southwestern Utah	224
9	San Juan River	2,318
10	Raton Mesa	All underground
11	Denver	All underground
12	Green River	2,120

Figure 11.9-1. Coal fields of the western United States.[3]

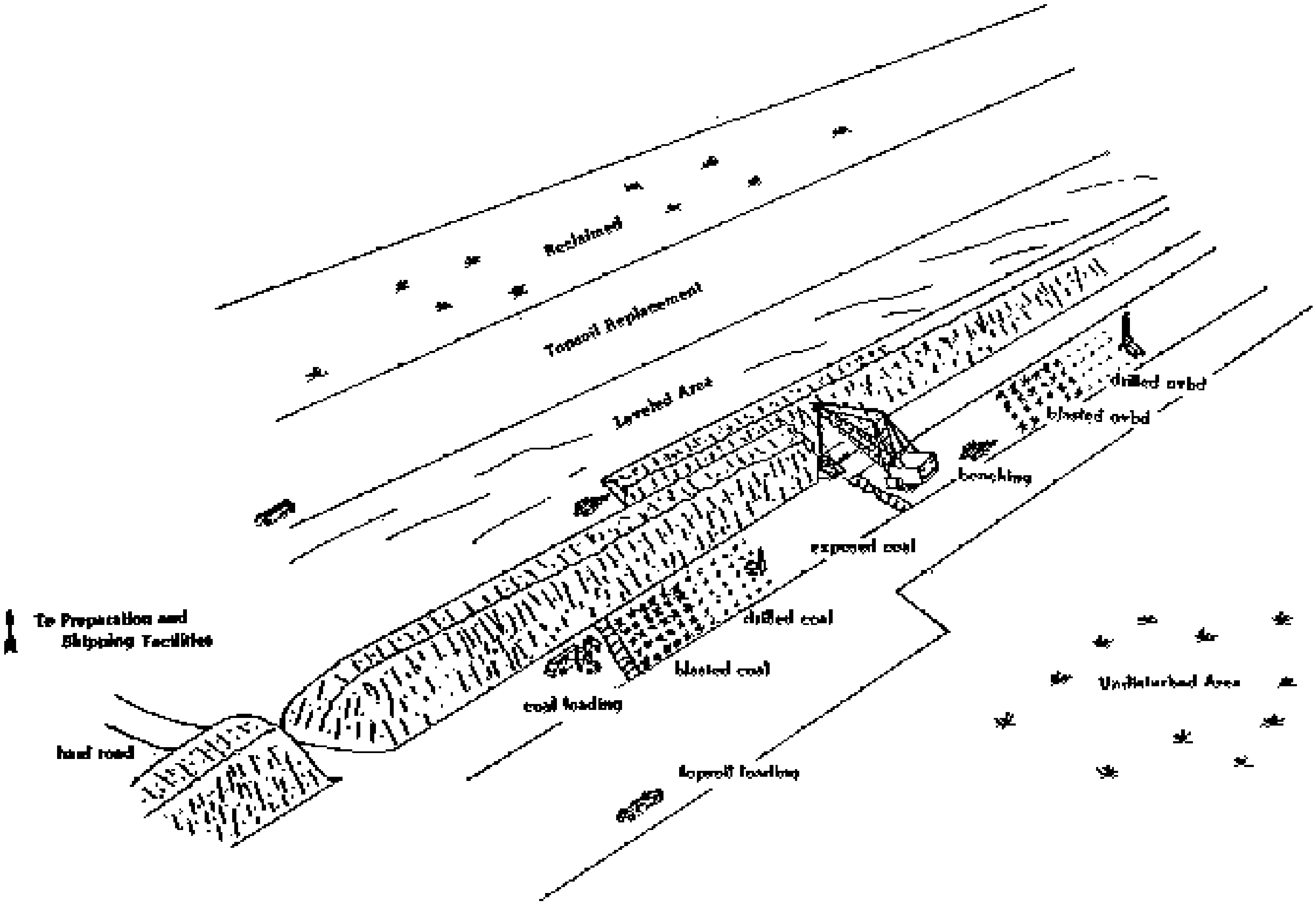


Figure 11.9-2. Operations at typical western surface coal mines.

The equations may be used to estimate particulate emissions generated per unit of source extent or activity (e. g., distance traveled by a haul truck or mass of material transferred). The equations were developed through field sampling of various western surface mine types and are thus applicable to any of the surface coal mines located in the western United States.

In Tables 11.9-1 and 11.9-2, the assigned quality ratings apply within the ranges of source conditions that were tested in developing the equations given in Table 11.9-3. However, the equations should be derated 1 letter value (e. g., A to B) if applied to eastern surface coal mines.

In using the equations to estimate emissions from sources found in a specific western surface mine, it is necessary that reliable values for correction parameters be determined for the specific sources of interest if the assigned quality ratings of the equations are to be applicable. For example, actual silt content of coal or overburden measured at a facility should be used instead of estimated values. In the event that site-specific values for correction parameters cannot be obtained, the appropriate geometric mean values from Table 11.9-3 may be used, but the assigned quality rating of each emission factor equation should be reduced by 1 level (e. g., A to B).

Emission factors for open dust sources not covered in Table 11.9-3 are in Table 11.9-4. These factors were determined through source testing at various western coal mines.

The factors in Table 11.9-4 for mine locations I through V were developed for specific geographical areas. Tables 11.9-5 and 11.9-6 present characteristics of each of these mines (areas). A "mine-specific" emission factor should be used only if the characteristics of the mine for which an emissions estimate is needed are very similar to those of the mine for which the emission factor was developed. The other (nonspecific) emission factors were developed at a variety of mine types and thus are applicable to any western surface coal mine.

As an alternative to the single valued emission factors given in Table 11.9-4 for train or truck loading and for truck or scraper unloading, two empirically derived emission factor equations are presented in Section 13.2.4 of this document. Each equation was developed for a source operation (i. e., batch drop and continuous drop, respectively) comprising a single dust-generating mechanism that crosses industry lines.

Because the predictive equations allow emission factor adjustment to specific source conditions, the equations should be used in place of the single-valued factors in Table 11.9-4 for the sources identified above, if emission estimates for a specific western surface coal mine are needed. However, the generally higher quality ratings assigned to the equations are applicable only if: (1) reliable values of correction parameters have been determined for the specific sources of interest, and (2) the correction parameter values lie within the ranges tested in developing the equations. Caution must be exercised so that only the unbound (sorbed) moisture (i. e., not any bound moisture) is used in determining the moisture content for input to the Chapter 13 equations.

Table 11.9-1 (English Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

		Emissions By Particle Size Range (Aerodynamic Diameter)[b,c]					
		Emission Factor Equations		Scaling Factors			EMISSION FACTOR RATING
Operation	Material	TSP ≤30 µm	≤15 µm	≤10 µm[d]	≤2.5 µm/TSP[e]	Units	
Blasting[f]	Coal or overburden	$0.000014(A)^{1.5}$	ND	0.52[e]	0.03	lb/blast	C_DD
Truck loading	Coal	$\frac{1.16}{(M)^{1.2}}$	$\frac{0.119}{(M)^{0.9}}$	0.75	0.019	lb/ton	BBCC
Bulldozing	Coal	$\frac{78.4\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{18.6\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	lb/hr	CCDD
	Overburden	$\frac{5.7\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{1.0\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.105	lb/hr	BCDD
Dragline	Overburden	$\frac{0.0021\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0021\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	lb/yd^3	BCDD
Vehicle traffic[g]							
Grading		$0.040\ (S)^{2.5}$	$0.051\ (S)^{2.0}$	0.60	0.031	lb/VMT	CCDD
Active storage pile[h] (wind erosion and maintenance)	Coal	0.72 u	ND	ND	ND	$\frac{lb}{(acre)(hr)}$	C[i]_ _ _

[a] Reference 1, except as noted. VMT = vehicle miles traveled. ND = no data. Quality ratings coded where "Q, X, Y, Z" are ratings for ≤30 µm, ≤15 µm, ≤10 µm, and ≤2.5 µm, respectively. See also note below.

[b] Particulate matter less than or equal to 30 µm in aerodynamic diameter is sometimes termed "suspendable particulate" and is often used as a surrogate for TSP (total suspended particulate). TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:

A = horizontal area (ft^2), with blasting depth ≤ 70 ft. Not for vertical face of a bench.
M = material moisture content (%)
s = material silt content (%)
u = wind speed (mph)
d = drop height (ft)
W = mean vehicle weight (tons)
S = mean vehicle speed (mph)
w = mean number of wheels

Table 11.9-1 (cont.).

[d] Multiply the ≤15-μm equation by this fraction to determine emissions, except as noted.
[e] Multiply the TSP predictive equation by this fraction to determine emissions.
[f] Blasting factor taken from a reexamination of field test data reported in Reference 1. See Reference 4.
[g] To estimate emissions from traffic on unpaved surfaces by vehicles such as haul trucks, light-to-medium duty vehicles, or scrapers in the travel mode, see the unpaved road emission factor equation in AP-42 Section 13.2.2.
[h] Coal storage pile factor taken from Reference 5. To estimate emissions on a shorter time scale (e. g., worst-case day), see the procedure presented in Section 13.2.5.
[i] Rating applicable to mine types I, II, and IV (see Tables 11.9-5 and 11.9-6).

Note: Section 234 of the Clean Air Act of 1990 required EPA to review and revise the emission factors in this Section (and models used to evaluate ambient air quality impact), to ensure that they did not overestimate emissions from western surface coal mines. Due to resource and technical limitations, the haul road emission factors were isolated to receive the most attention during these studies, as the largest contributor to emissions. Resultant model evaluation with revised emission factors have improved model prediction for total suspended particulate (TSP); however, there is still a tendency for overprediction of particulate matter impact for PM-10, for as yet undetermined causes, prompting the Agency to make a policy decision not to use them for regulatory applications to these sources. However, the technical consideration exists that no better alternative data are currently available and the information should be made known. Users should accordingly use these factors with caution and awareness of their likely limitations.

Table 11.9-2 (Metric Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

Operation	Material	Emissions By Particle Size Range (Aerodynamic Diameter)[b,c]				Units	EMISSION FACTOR RATING
		Emission Factor Equations		Scaling Factors			
		TSP $\leq 30\ \mu m$	$\leq 15\ \mu m$	$\leq 10\ \mu m$[d]	$\leq 2.5\ \mu m$/TSP[e]		
Blasting[f]	Coal or overburden	$0.00022(A)^{1.5}$	ND	0.52[e]	0.03	kg/blast	C_DD
Truck loading	Coal	$\frac{0.580}{(M)^{1.2}}$	$\frac{0.0596}{(M)^{0.9}}$	0.75	0.019	kg/Mg	BBCC
Bulldozing	Coal	$\frac{35.6\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{8.44\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	kg/hr	CCDD
	Overburden	$\frac{2.6\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{0.45\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.105	kg/hr	BCDD
Dragline	Overburden	$\frac{0.0046\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0029\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	kg/m^3	BCDD
Vehicle traffic[g]							
Grading		$0.0034\ (S)^{2.5}$	$0.0056\ (S)^{2.0}$	0.60	0.031	kg/VKT	CCDD
Active storage pile[h] (wind erosion and maintenance)	Coal	1.8 u	ND	ND	ND	$\frac{kg}{(hectare)(hr)}$	C[i] _ _ _

[a] Reference 1, except as noted. VKT = vehicle kilometers traveled. ND = no data. Quality ratings coded as "QXYZ", where Q, X, Y, and Z are quality ratings for $\leq 30\ \mu m$, $\leq 15\ \mu m$, $\leq 10\ \mu m$, and $\leq 2.5\ \mu m$, respectively. See also note below.

[b] Particulate matter less than or equal to 30 µm in aerodynamic diameter is sometimes termed "suspendable particulate" and is often used as a surrogate for TSP (total suspended particulate). TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:

- A = horizontal area (m^2), with blasting depth $\leq$ 21 m. Not for vertical face of a bench.
- M = material moisture content (%)
- s = material silt content (%)
- u = wind speed (m/sec)
- d = drop height (m)
- W = mean vehicle weight (Mg)
- S = mean vehicle speed (kph)
- w = mean number of wheels

Table 11.9-2 (cont.).

[d] Multiply the $\leq$ 15-µm equation by this fraction to determine emissions, except as noted.
[e] Multiply the TSP predictive equation by this fraction to determine emissions.
[f] Blasting factor taken from a reexamination of field test data reported in Reference 1. See Reference 4.
[g] To estimate emissions from traffic on unpaved surfaces by vehicles such as haul trucks, light-to-medium duty vehicles, or scrapers in the travel mode, see the unpaved road emission factor equation in AP-42 Section 13.2.2
[h] Coal storage pile factor taken from Reference 5. To estimate emissions on a shorter time scale (e. g., worst-case day), see the procedure presented in Section 13.2.5.
[i] Rating applicable to mine types I, II, and IV (see Tables 11.9-5 and 11.9-6).

Note: Section 234 of the Clean Air Act of 1990 required EPA to review and revise the emission factors in this Section (and models used to evaluate ambient air quality impact), to ensure that they did not overestimate emissions from western surface coal mines. Due to resource and technical limitations, the haul road emission factors were isolated to receive the most attention during these studies, as the largest contributor to emissions. Resultant model evaluation with revised emission factors have improved model prediction for total suspended particulate (TSP); however, there is still a tendency for overprediction of particulate matter impact for PM-10, for as yet undetermined causes, prompting the Agency to make a policy decision not to use them for regulatory applications to these sources. However, the technical consideration exists that no better alternative data are currently available and the information should be made known. Users should accordingly use these factors with caution and awareness of their likely limitations.

Table 11.9-3 (Metric And English Units). TYPICAL VALUES FOR CORRECTION FACTORS APPLICABLE TO THE PREDICTIVE EMISSION FACTOR EQUATIONS[a]

Source	Correction Factor	Number Of Test Samples	Range	Geometric Mean	Units
Blasting	Area blasted	17	100 - 6,800	1,590	m^2
	Area blasted	17	1100 - 73,000	17,000	ft^2
Coal loading	Moisture	7	6.6 - 38	17.8	%
Bulldozers					
Coal	Moisture	3	4.0 - 22.0	10.4	%
	Silt	3	6.0 - 11.3	8.6	%
Overburden	Moisture	8	2.2 - 16.8	7.9	%
	Silt	8	3.8 - 15.1	6.9	%
Dragline	Drop distance	19	1.5 - 30	8.6	m
	Drop distance	19	5 - 100	28.1	ft
	Moisture	7	0.2 - 16.3	3.2	%
Scraper	Silt	10	7.2 - 25.2	16.4	%
	Weight	15	33 - 64	48.8	Mg
	Weight	15	36 - 70	53.8	ton
Grader	Speed	7	8.0 - 19.0	11.4	kph
	Speed		5.0 - 11.8	7.1	mph
Haul truck	Silt content	61	1.2 - 19.2	4.3	%
	Moisture	60	0.3 - 20.1	2.4	%
	Weight	61	20.9 - 260	110	mg
	Weight	61	23.0 - 290	120	ton

[a] Reference 1,6.

Table 11.9-4 (English And Metric Units). UNCONTROLLED PARTICULATE EMISSION FACTORS FOR OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES

Source	Material	Mine Location[a]	TSP Emission Factor[b]	Units	EMISSION FACTOR RATING
Drilling	Overburden	Any	1.3 0.59	lb/hole kg/hole	C C
	Coal	V	0.22 0.10	lb/hole kg/hole	E E
Topsoil removal by scraper	Topsoil	Any	0.058 0.029	lb/ton kg/Mg	E E
		IV	0.44 0.22	lb/ton kg/Mg	E E
Overburden replacement	Overburden	Any	0.012 0.0060	lb/ton kg/Mg	C C
Truck loading by power shovel (batch drop)[c]	Overburden	V	0.037 0.018	lb/ton kg/Mg	E E
Train loading (batch or continuous drop)[c]	Coal	Any	0.028 0.014	lb/ton kg/Mg	E E
		III	0.0002 0.0001	lb/ton kg/Mg	E E
Bottom dump truck unloading (batch drop)[c]	Overburden	V	0.002 0.001	lb/ton kg/Mg	E E
	Coal	IV	0.027 0.014	lb/ton kg/Mg	E E
		III	0.005 0.002	lb/ton kg/Mg	E E
		II	0.020 0.010	lb/ton kg/Mg	E E
		I	0.014 0.0070	lb/T kg/Mg	E E
		Any	0.066 0.033	lb/T kg/Mg	D D

Table 11.9-4 (cont.).

Source	Material	Mine Location[a]	TSP Emission Factor[b]	Units	EMISSION FACTOR RATING
End dump truck unloading (batch drop)[c]	Coal	V	0.007 0.004	lb/T kg/Mg	E E
Scraper unloading (batch drop)[c]	Topsoil	IV	0.04 0.02	lb/T kg/Mg	E E
Wind erosion of exposed areas[d]	Seeded land, stripped overburden, graded overburden	Any	0.38	$\frac{T}{(acre)(yr)}$	C
			0.85	$\frac{Mg}{(hectare)(yr)}$	C

[a] Roman numerals I through V refer to specific mine locations for which the corresponding emission factors were developed (Reference 5). Tables 11.9-4 and 11.9-5 present characteristics of each of these mines. See text for correct use of these "mine-specific" emission factors. The other factors (from Reference 7, except for overburden drilling from Reference 1) can be applied to any western surface coal mine.

[b] Total suspended particulate (TSP) denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Predictive emission factor equations, which generally provide more accurate estimates of emissions, are presented in Chapter 13.

[d] To estimate wind erosion on a shorter time scale (e. g., worst-case day), see Section 13.2.5.

Table 11.9-5 (Metric And English Units). GENERAL CHARACTERISTICS OF SURFACE COAL MINES REFERRED TO IN TABLE 11.9-4[a]

Mine	Location	Type Of Coal Mined	Terrain	Vegetative Cover	Surface Soil Type And Erodibility Index	Mean Wind Speed		Mean Annual Precipitation	
						m/s	mph	cm	in.
I	N.W. Colorado	Subbitum.	Moderately steep	Moderate, sagebrush	Clayey loamy (71)	2.3	5.1	38	15
II	S.W. Wyoming	Subbitum.	Semirugged	Sparse, sagebrush	Arid soil with clay and alkali or carbonate accumulation (86)	6.0	13.4	36	14
III	S.E. Montana	Subbitum.	Gently rolling to semirugged	Sparse, moderate, prairie grassland	Shallow clay loamy deposits on bedrock (47)	4.8	10.7	28 - 41	11 - 16
IV	Central North Dakota	Lignite	Gently rolling	Moderate, prairie grassland	Loamy, loamy to sandy (71)	5.0	11.2	43	17
V	N.E. Wyoming	Subbitum.	Flat to gently rolling	Sparse, sagebrush	Loamy, sandy, clayey, and clay loamy (102)	6.0	13.4	36	14

[a] Reference 4.

Table 11.9-6 (English Units). OPERATING CHARACTERISTICS OF THE COAL MINES REFERRED TO IN TABLE 11.9-4[a]

Parameter	Required Information	Units	Mine				
			I	II	III	IV	V
Production rate	Coal mined	10^6 ton/yr	1.13	5.0	9.5	3.8	12.0[b]
Coal transport	Avg. unit train frequency	per day	NA	NA	2	NA	2
Stratigraphic data	Overburden thickness	ft	21	80	90	65	35
	Overburden density	lb/yd^3	4000	3705	3000	ND	ND
	Coal seam thicknesses	ft	9,35	15,9	27	2,4,8	70
	Parting thicknesses	ft	50	15	NA	32,16	NA
	Spoils bulking factor	%	22	24	25	20	ND
	Active pit depth	ft	52	100	114	80	105
Coal analysis data	Moisture	%	10	18	24	38	30
	Ash	%, wet	8	10	8	7	6
	Sulfur	%, wet	0.46	0.59	0.75	0.65	0.48
	Heat content	Btu/lb	11000	9632	8628	8500	8020
Surface disposition	Total disturbed land	acre	168	1030	2112	1975	217
	Active pit	acre	34	202	87	ND	71
	Spoils	acre	57	326	144	ND	100
	Reclaimed	acre	100	221	950	ND	100
	Barren land	acre	ND	30	455	ND	ND
	Associated disturbances	acre	12	186	476	ND	46
Storage	Capacity	ton	NA	NA	ND	NA	48000
Blasting	Frequency, total	per week	4	4	3	7	7[b]
	Frequency, overburden	per week	3	0.5	3	NA	7[b]
	Area blasted, coal	ft^2	16000	40000	ND	30000	ND
	Area blasted, overburden	ft^2	20000	ND	ND	NA	ND

[a] Reference 5. NA = not applicable. ND = no data.
[b] Estimate.

11.9.3 Updates Since the Fifth Edition

The Fifth Edition which was released in January 1995 reformatted the section that was dated September 1988. Revisions to this section since these dates are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section. These and other documents can be found on the CHIEF WEB site (home page http://www.epa.gov/ttn/chief/).

Supplement E

- The predictive equations for emission factors for haul trucks and light/medium duty vehicles were removed and replaced with a footnote refering users to the recently revised unpaved road section in the Miscellaneous Sources chapter.

- The emission factor quality ratings were revised based upon a revised predictive equation and single value criteria.

- The typographical errors for the TSP equation and the omission of the PM-2.5 scaling factor for blasting were corrected.

References For Section 11.9

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4. G. E. Muleski, *Update Of AP-42 Emission Factors For Western Surface Coal Mines And Related Sections*, Summary Report, Prepared for Emission Factors And Inventory Group (MD-14), Emissions, Modeling And Analysis Division, Office Of Air Quality, Planning, And Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711.

5. K. Axetell, *Survey Of Fugitive Dust From Coal Mines*, EPA-908/1-78-003, U. S. Environmental Protection Agency, Denver, CO, February 1978.

6. G. E. Muleski, *et al.*, *Surface Coal Mine Emission Factor Field Study*, EPA-454/R-95-010, U. S. Environmental Protection Agency, Research Triangle Park, NC, January 1994.

7. D. L. Shearer, *et al.*, *Coal Mining Emission Factor Development And Modeling Study*, Amax Coal Company, Carter Mining Company, Sunoco Energy Development Company, Mobil Oil Corporation, and Atlantic Richfield Company, Denver, CO, July 1981.

13.2.1 Paved Roads

13.2.1.1 General

Particulate emissions occur whenever vehicles travel over a paved surface such as a road or parking lot. Particulate emissions from paved roads are due to direct emissions from vehicles in the form of exhaust, brake wear and tire wear emissions and resuspension of loose material on the road surface. In general terms, resuspended particulate emissions from paved roads originate from, and result in the depletion of, the loose material present on the surface (i.e., the surface loading). In turn, that surface loading is continuously replenished by other sources. At industrial sites, surface loading is replenished by spillage of material and trackout from unpaved roads and staging areas. Figure 13.2.1-1 illustrates several transfer processes occurring on public streets.

Various field studies have found that public streets and highways, as well as roadways at industrial facilities, can be major sources of the atmospheric particulate matter within an area.[1-9] Of particular interest in many parts of the United States are the increased levels of emissions from public paved roads when the equilibrium between deposition and removal processes is upset. This situation can occur for various reasons, including application of granular materials for snow and ice control, mud/dirt carryout from construction activities in the area, and deposition from wind and/or water erosion of surrounding unstabilized areas. In the absence of continuous addition of fresh material (through localized track out or application of antiskid material), paved road surface loading should reach an equilibrium value in which the amount of material resuspended matches the amount replenished. The equilibrium surface loading value depends upon numerous factors. It is believed that the most important factors are: mean speed of vehicles traveling the road; the average daily traffic (ADT); the number of lanes and ADT per lane; the fraction of heavy vehicles (buses and trucks); and the presence/absence of curbs, storm sewers and parking lanes.[10]

The particulate emission factors presented in a previous version of this section of AP-42, dated October 2002, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material. EPA included these sources in the emission factor equation for paved roads since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the paved road emission factor equation only estimates particulate emissions from resuspended road surface material[28]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOVES[29] model. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOVES to estimate particulate emissions from vehicle traffic on paved roads. It also incorporates the decrease in exhaust emissions that has occurred since the paved road emission factor equation was developed. Earlier versions of the paved road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.1.2 Emissions And Correction Parameters

Dust emissions from paved roads have been found to vary with what is termed the "silt loading" present on the road surface. In addition, the average weight and speed of vehicles traveling the road influence road dust emissions. The term silt loading (sL) refers to the mass of silt-size material (equal to or less than 75 micrometers [µm] in physical diameter) per unit area of the travel surface. The total road surface dust loading consists of loose material that can be collected by broom sweeping and vacuuming of the traveled portion of the paved road. The silt fraction is determined by measuring the proportion of the loose dry surface dust that passes through a 200-mesh screen, using the ASTM-C-136 method. Silt loading is the product of the silt fraction and the total loading, and is abbreviated "sL". Additional details on the sampling and analysis of such material are provided in AP-42 Appendices C.1 and C.2.

The surface sL provides a reasonable means of characterizing seasonal variability in a paved road emission inventory. In many areas of the country, road surface loadings [11-21] are heaviest during the late winter and early spring months when the residual loading from snow/ice controls is greatest. As noted earlier, once replenishment of fresh material is eliminated, the road surface loading can be expected to reach an equilibrium value, which is substantially lower than the late winter/early spring values.

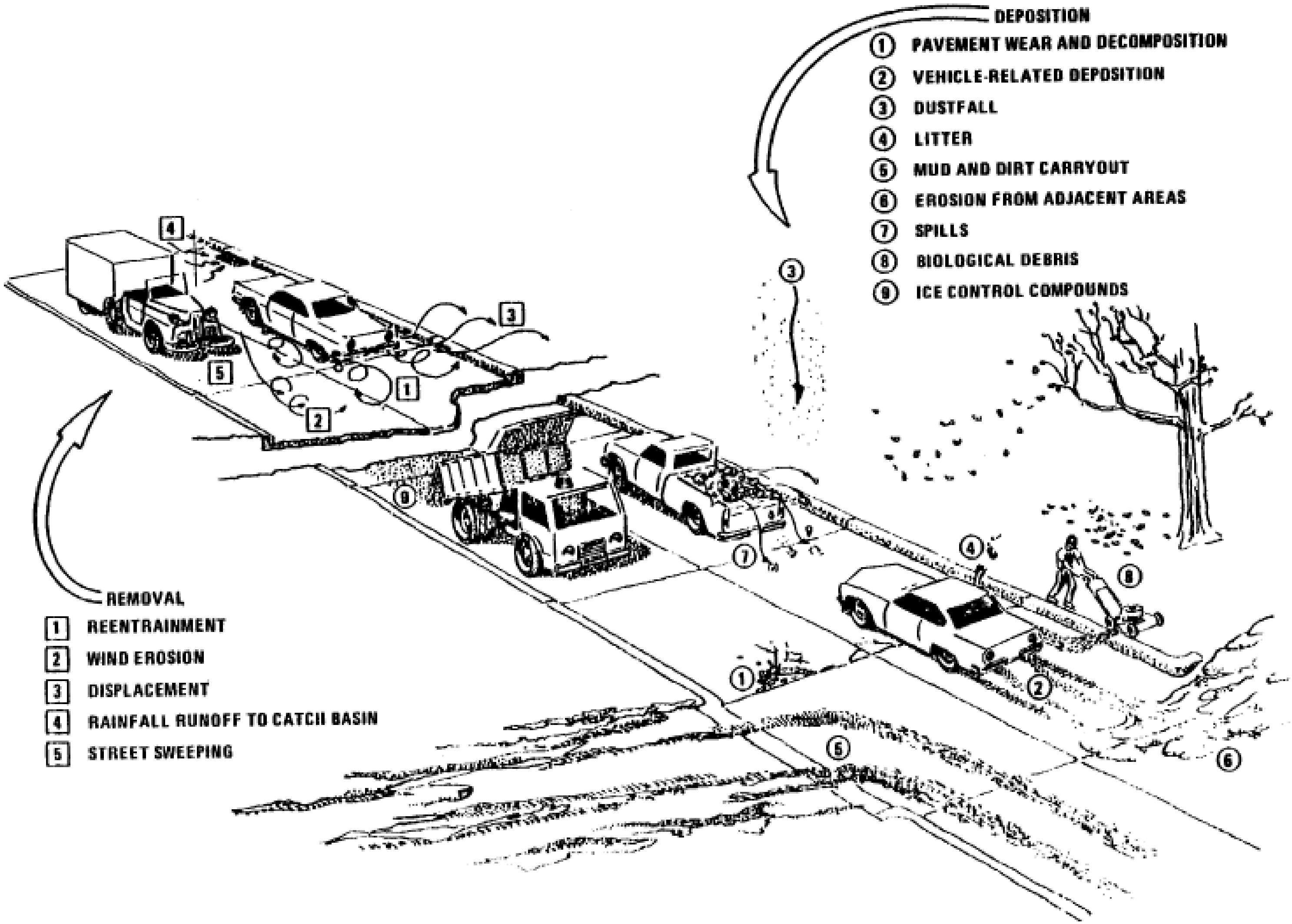

Figure 13.2.1-1. Deposition and removal processes.

13.2.1.3 Predictive Emission Factor Equations[10,29]

The quantity of particulate emissions from resuspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression:

$$E = k\,(sL)^{0.91} \times (W)^{1.02} \qquad (1)$$

where:
- E = particulate emission factor (having units matching the units of k),
- k = particle size multiplier for particle size range and units of interest (see below),
- sL = road surface silt loading (grams per square meter) (g/m^2), and
- W = average weight (tons) of the vehicles traveling the road.

It is important to note that Equation 1 calls for the average weight of all vehicles traveling the road. For example, if 99 percent of traffic on the road are 2 ton cars/trucks while the remaining 1 percent consists of 20 ton trucks, then the mean weight "W" is 2.2 tons. More specifically, Equation 1 is *not* intended to be used to calculate a separate emission factor for each vehicle weight class. Instead, only one emission factor should be calculated to represent the "fleet" average weight of all vehicles traveling the road.

The particle size multiplier (k) above varies with aerodynamic size range as shown in Table 13.2.1-1. To determine particulate emissions for a specific particle size range, use the appropriate value of k shown in Table 13.2.1-1.

To obtain the total emissions factor, the emissions factors for the exhaust, brake wear and tire wear obtained from either EPA's MOBILE6.2 [27] or most recent MOVES [29] software model should be added to the emissions factor calculated from the empirical equation.

Table 13.2.1-1. PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Size range[a]	Particle Size Multiplier k[b]		
	g/VKT	g/VMT	lb/VMT
PM-2.5[c]	0.15	0.25	0.00054
PM-10	0.62	1.00	0.0022
PM-15	0.77	1.23	0.0027
PM-30[d]	3.23	5.24	0.011

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.

[b] Units shown are grams per vehicle kilometer traveled (g/VKT), grams per vehicle mile traveled (g/VMT), and pounds per vehicle mile traveled (lb/VMT). The multiplier k includes unit conversions to produce emission factors in the units shown for the indicated size range from the mixed units required in Equation 1.

[c] The k-factors for $PM_{2.5}$ were based on the average $PM_{2.5}$:PM_{10} ratio of test runs in Reference 30.

[d] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

Equation 1 is based on a regression analysis of 83 tests for PM-10.[3, 5-6, 8, 27-29, 31-36] Sources tested include public paved roads, as well as controlled and uncontrolled industrial paved roads. The majority of tests involved freely flowing vehicles traveling at constant speed on relatively level roads. However, 22 tests of slow moving or "stop-and-go" traffic or vehicles under load were available for inclusion in the data base.[32-36] Engine exhaust, tire wear and break wear were subtracted from the emissions measured in the test programs prior to stepwise regression to determine Equation 1.[37, 39] The equations retain the quality rating of A (D for PM-2.5), if applied within the range of source conditions that were tested in developing the equation as follows:

Silt loading:	0.03 - 400 g/m^2 0.04 - 570 grains/square foot (ft^2)
Mean vehicle weight:	1.8 - 38 megagrams (Mg) 2.0 - 42 tons
Mean vehicle speed:	1 - 88 kilometers per hour (kph) 1 - 55 miles per hour (mph)

The upper and lower 95% confidence levels of equation 1 for PM_{10} is best described with equations using an exponents of 1.14 and 0.677 for silt loading and an exponents of 1.19 and 0.85 for weight. Users are cautioned that application of equation 1 outside of the range of variables and operating conditions specified above, e.g., application to roadways or road networks with speeds above 55 mph and average vehicle weights of 42 tons, will result in emission estimates with a higher level of uncertainty. In these situations, users are encouraged to consider an assessment of the impacts of the influence of extrapolation to the overall emissions and alternative methods that are equally or more plausible in light of local emissions data and/or ambient concentration or compositional data.

To retain the quality rating for the emission factor equation when it is applied to a specific paved road, it is necessary that reliable correction parameter values for the specific road in question be determined. With the exception of limited access roadways, which are difficult to sample, the collection and use of site-specific silt loading (sL) data for public paved road emission inventories are strongly recommended. The field and laboratory procedures for determining surface material silt content and surface dust loading are summarized in Appendices C.1 and C.2. In the event that site-specific values cannot be obtained, an appropriate value for a paved public road may be selected from the values in Table 13.2.1-2, but the quality rating of the equation should be reduced by 2 levels.

Equation 1 may be extrapolated to average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual (or other long-term) average emissions are inversely proportional to the frequency of measurable (> 0.254 mm [0.01 inch]) precipitation by application of a precipitation correction term. The precipitation correction term can be applied on a daily or an hourly basis [26, 38].

For the daily basis, Equation 1 becomes:

$$E_{ext} = [\ k\ (sL)^{0.91} \times (W)^{1.02}\ ]\ (1 - P/4N) \qquad (2)$$

where k, sL, W, and S are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as k,

P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and

N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly).

Note that the assumption leading to Equation 2 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2. However, Equation 2 above incorporates an additional factor of "4" in the denominator to account for the fact that paved roads dry more quickly than unpaved roads and that the precipitation may not occur over the complete 24-hour day.

For the hourly basis, equation 1 becomes:

$$E_{ext} = [\ k\ (sL)^{0.91} \times (W)^{1.02}\ ]\ (1 - 1.2P/N) \qquad (3)$$

where k, sL, W, and S are as defined in Equation 1 and

E_{ext} = annual or other long-term average emission factor in the same units as k,

P = number of hours with at least 0.254 mm (0.01 in) of precipitation during the averaging period, and

N = number of hours in the averaging period (e.g., 8760 for annual, 2124 for season 720 for monthly)

Note: In the hourly moisture correction term (1-1.2P/N) for equation 3, the 1.2 multiplier is applied to account for the residual mitigative effect of moisture. For most applications, this equation will produce satisfactory results. Users should select a time interval to include sufficient "dry" hours such that a reasonable emissions averaging period is evaluated. For the special case where this equation is used to calculate emissions on an hour by hour basis, such as would be done in some emissions modeling situations, the moisture correction term should be modified so that the moisture correction "credit" is applied to the first hours following cessation of precipitation. In this special case, it is suggested that this 20% "credit" be applied on a basis of one hour credit for each hour of precipitation up to a maximum of 12 hours.

Note that the assumption leading to Equation 3 is based on analogy with the approach used to develop long-term average unpaved road emission factors in Section 13.2.2.

Figure 13.2.1-2 presents the geographical distribution of "wet" days on an annual basis for the United States. Maps showing this information on a monthly basis are available in the *Climatic Atlas of the United States*[23] . Alternative sources include other Department of Commerce publications (such as local climatological data summaries). The National Climatic Data Center (NCDC) offers several products that provide hourly precipitation data. In particular, NCDC offers *Solar and Meteorological Surface Observation Network 1961-1990* (SAMSON) CD-ROM, which contains 30 years worth of hourly meteorological data for first-order National Weather Service locations. Whatever meteorological data are used, the source of that data and the averaging period should be clearly specified.

It is emphasized that the simple assumption underlying Equations 2 and 3 has not been verified in any rigorous manner. For that reason, the quality ratings for Equations 2 and 3 should be downgraded one letter from the rating that would be applied to Equation 1.

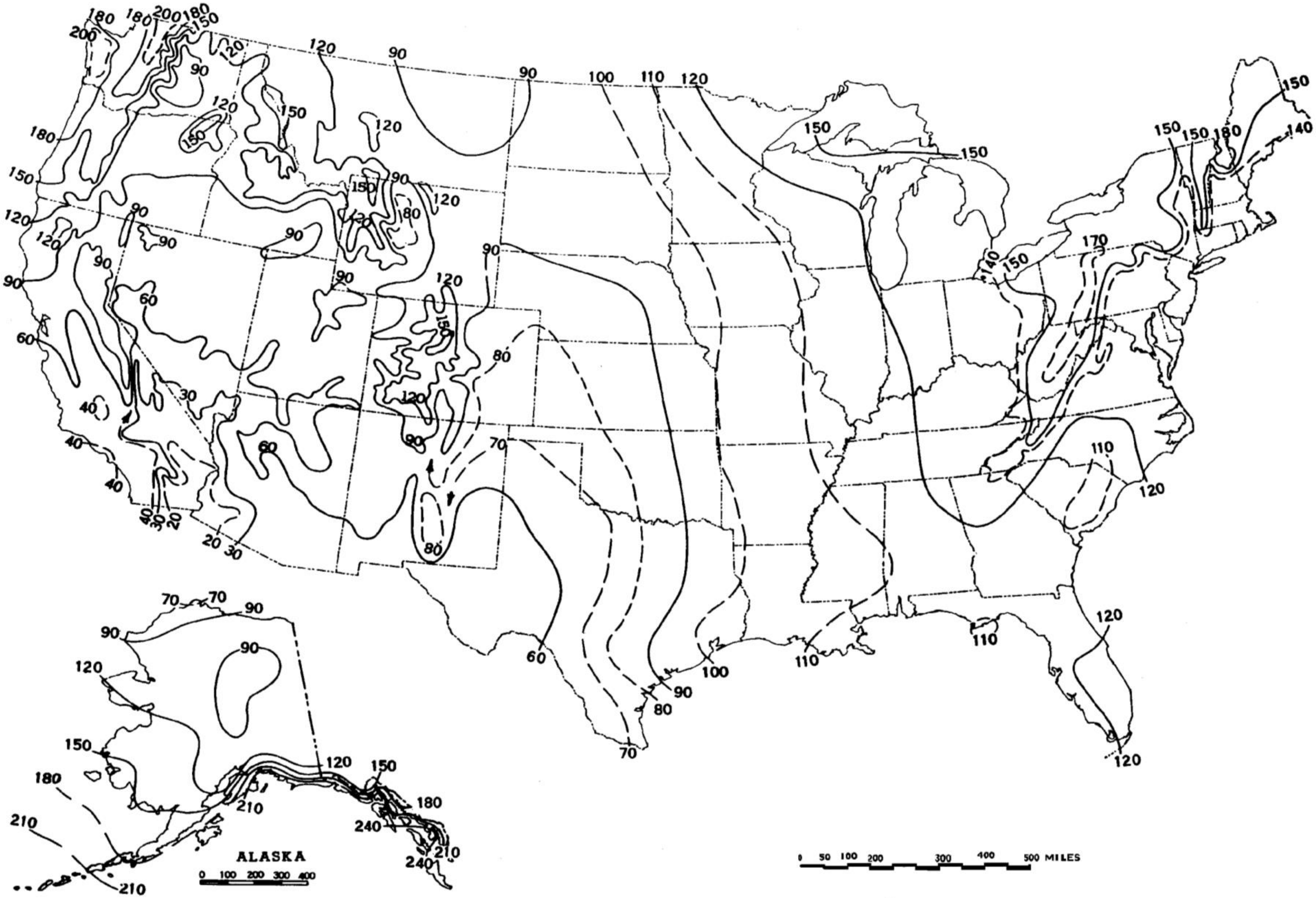

Figure 13.2.1-2. Mean number of days with 0.01 inch or more of precipitation in the United States.

Table 13.2.1-2 presents recommended default silt loadings for normal baseline conditions and for wintertime baseline conditions in areas that experience frozen precipitation with periodic application of antiskid material[24]. The winter baseline is represented as a multiple of the non-winter baseline, depending on the ADT value for the road in question. As shown, a multiplier of 4 is applied for low volume roads (< 500 ADT) to obtain a wintertime baseline silt loading of 4 X 0.6 = 2.4 g/m^2.

Table 13.2.1-2. Ubiquitous Silt Loading Default Values with Hot Spot Contributions from Anti-Skid Abrasives (g/m^2)

ADT Category	< 500	500-5,000	5,000-10,000	> 10,000
Ubiquitous Baseline g/m^2	0.6	0.2	0.06	0.03 0.015 limited access
Ubiquitous Winter Baseline Multiplier during months with frozen precipitation	X4	X3	X2	X1
Initial peak additive contribution from application of antiskid abrasive (g/m^2)	2	2	2	2
Days to return to baseline conditions (assume linear decay)	7	3	1	0.5

It is suggested that an additional (but temporary) silt loading contribution of 2 g/m^2 occurs with each application of antiskid abrasive for snow/ice control. This was determined based on a typical application rate of 500 lb per lane mile and an initial silt content of 1 % silt content. Ordinary rock salt and other chemical deicers add little to the silt loading, because most of the chemical dissolves during the snow/ice melting process.

To adjust the baseline silt loadings for mud/dirt trackout, the number of trackout points is required. It is recommended that in calculating PM_{10} emissions, six additional miles of road be added for each active trackout point from an active construction site, to the paved road mileage of the specified category within the county. In calculating $PM_{2.5}$ emissions, it is recommended that three additional miles of road be added for each trackout point from an active construction site.

It is suggested the number of trackout points for activities other than road and building construction areas be related to land use. For example, in rural farming areas, each mile of paved road would have a specified number of trackout points at intersections with unpaved roads. This value could be estimated from the unpaved road density (mi/sq. mi.).

The use of a default value from Table 13.2.1-2 should be expected to yield only an order-of-magnitude estimate of the emission factor. Public paved road silt loadings are dependent upon: traffic characteristics (speed, ADT, and fraction of heavy vehicles); road characteristics (curbs, number of lanes, parking lanes); local land use (agriculture, new residential construction) and regional/seasonal factors (snow/ice controls, wind blown dust). As a result, the collection and use of site-specific silt loading data is highly recommended. In the event that default silt loading values are used, the quality ratings for the equation should be downgraded 2 levels.

Limited access roadways pose severe logistical difficulties in terms of surface sampling, and few silt loading data are available for such roads. Nevertheless, the available data do not suggest great variation in silt loading for limited access roadways from one part of the country to another. For annual conditions, a default value of 0.015 g/m^2 is recommended for limited access roadways.[9,22] Even fewer of the available data correspond to worst-case situations, and elevated loadings are observed to be quickly depleted because of high traffic speeds and high ADT rates. A default value of 0.2 g/m^2 is recommended for short periods of time following application of snow/ice controls to limited access roads.[22]

The limited data on silt loading values for industrial roads have shown as much variability as public roads. Because of the variations of traffic conditions and the use of preventive mitigative controls, the data probably do not reflect the full extent of the potential variation in silt loading on industrial roads. However, the collection of site specific silt loading data from industrial roads is easier and safer than for public roads. Therefore, the collection and use of site-specific silt loading data is preferred and is highly recommended. In the event that site-specific values cannot be obtained, an appropriate value for an industrial road may be selected from the mean values given in Table 13.2.1-3, but the quality rating of the equation should be reduced by 2 levels.

The predictive accuracy of Equation 1 requires thorough on-site characterization of road silt loading. Road surface sampling is time-consuming and potentially hazardous because of the need to block traffic lanes. In addition, large number of samples is required to represent spatial and temporal variations across roadway networks. Mobile monitoring is a new alternative silt loading or road dust emission characterization method for either paved or unpaved roads. It utilizes a test vehicle that generates and monitors its own dust plume concentration (mass basis) at a fixed sampling probe location. A calibration factor is needed for each mobile monitoring configuration (test vehicle and sampling system), to convert the relative dust emission intensity to an equivalent silt loading or emission factor. Typically, portable continuous particle concentration monitors do not comply with Federal Reference Method (FRM) standards. Therefore, a controlled study must be performed to correlate the portable monitor response to the road silt loading or size specific particle concentration measured with an approved FRM sampling system. In the calibration tests, multiple test conditions should be performed to provide an average correlation with known precision and to accommodate variations in road silt loading, vehicle speed, road dust characteristics and other road conditions that may influence mobile monitoring measurements or emissions characteristics. Because the paved road dust emissions are also dependent on the average vehicle weight for the road segment, it is important that the weight of the test vehicle correspond closely to the average vehicle weight for the road segment or be adjusted using the average vehicle weight relationship in Equation 1. In summary, it is believed that the Mobile Monitoring Method will provide improved capabilities to provide reliable temporally and spatially resolved silt loading or emissions factors with increased coverage, improved safety, reduced traffic interference and decreased cost.[40, 41, 42]

Table 13.2.1-3 (Metric And English Units). TYPICAL SILT CONTENT AND LOADING VALUES FOR PAVED ROADS AT INDUSTRIAL FACILITIES [a]

Industry	No. of Sites	No. Of Samples	Silt Content (%)		No. of Travel Lanes	Total Loading x 10^{-3}			Silt Loading (g/m^2)	
			Range	Mean		Range	Mean	Units[b]	Range	Mean
Copper smelting	1	3	15.4-21.7	19.0	2	12.9 - 19.5	15.9	kg/km	188-400	292
						45.8 - 69.2	55.4	lb/mi		
Iron and steel production	9	48	1.1-35.7	12.5	2	0.006 - 4.77	0.495	kg/km	0.09-79	9.7
						0.020 -16.9	1.75	lb/mi		
Asphalt batching	1	3	2.6 - 4.6	3.3	1	12.1 - 18.0	14.9	kg/km	76-193	120
						43.0 - 64.0	52.8	lb/mi		
Concrete batching	1	3	5.2 - 6.0	5.5	2	1.4 - 1.8	1.7	kg/km	11-12	12
						5.0 - 6.4	5.9	lb/mi		
Sand and gravel processing	1	3	6.4 - 7.9	7.1	1	2.8 - 5.5	3.8	kg/km	53-95	70
						9.9 - 19.4	13.3	lb/mi		
Municipal solid waste landfill	2	7		-	2	-			1.1-32.0	7.4
Quarry	1	6		-	2	-			2.4-14	8.2
Corn wet mills	3	15		-	2	-			0.05 – 2.9	1.1

[a] References 1-2,5-6,11-13. Values represent samples collected from *industrial* roads. Public road silt loading values are presented in Table-13.2.1-2. Dashes indicate information not available.[b] Multiply entries by 1000 to obtain stated units; kilograms per kilometer (kg/km) and pounds per mile (lb/mi).

13.2.1.4 Controls[6,25]

Because of the importance of the silt loading, control techniques for paved roads attempt either to prevent material from being deposited onto the surface (preventive controls) or to remove from the travel lanes any material that has been deposited (mitigative controls). Covering of loads in trucks, and the paving of access areas to unpaved lots or construction sites, are examples of preventive measures. Examples of mitigative controls include vacuum sweeping, water flushing, and broom sweeping and flushing. Actual control efficiencies for any - of these techniques can be highly variable. Locally measured silt loadings before and after the application of controls is the preferred method to evaluate controls. It is particularly important to note that street sweeping of gutters and curb areas may actually increase the silt loading on the traveled portion of the road. Redistribution of loose material onto the travel lanes will actually produce a short-term increase in the emissions.

In general, preventive controls are usually more cost effective than mitigative controls. The cost-effectiveness of mitigative controls falls off dramatically as the size of an area to be treated increases. The cost-effectiveness of mitigative measures is also unfavorable if only a short period of time is required for the road to return to equilibrium silt loading condition. That is to say, the number and length of public roads within most areas of interest preclude any widespread and routine use of mitigative controls. On the other hand, because of the more limited scope of roads at an industrial site, mitigative measures may be used quite successfully (especially in situations where truck spillage occurs). Note, however, that public agencies could make effective use of mitigative controls to remove sand/salt from roads after the winter ends.

Because available controls will affect the silt loading, controlled emission factors may be obtained by substituting controlled silt loading values into the equation. (Emission factors from controlled industrial roads were used in the development of the equation.) The collection of surface loading samples from treated, as well as baseline (untreated), roads provides a means to track effectiveness of the controls over time. The use of Mobile Monitoring Methodologies provide an improved means to track progress in controlling silt loading values.

13.2.1.5 Changes since Fifth Edition

The following changes were made since the publication of the Fifth Edition of AP-42:

October 2002

1) The particle size multiplier for $PM_{2.5}$ was revised to 25% of PM_{10}. The approximately 55% reduction was a result of emission testing using FRM monitors. The monitoring was specifically intended to evaluate the PM-2.5 component of the emissions.

2) Default silt loading values were included in Table 13.2.1-2 replacing the Tables and Figures containing silt loading statistical information.

3) Editorial changes within the text were made indicating the possible causes of variations in the silt loading between roads within and among different locations. The uncertainty of using the default silt loading value was discussed.

4) Section 13.2.1.1 was revised to clarify the role of dust loading in resuspension. Additional minor text changes were made.

5) Equations 2 and 3, Figure 13.2.1-2, and text were added to incorporate natural mitigation into annual or other long-term average emission factors.

December 2003

1) The emission factor equation was adjusted to remove the component of particulate emissions- from exhaust, brake wear, and tire wear. A parameter C representing these emissions was included in the predictive equation. The parameter C varied with aerodynamic size range of the particulate matter. Table 13.2.1-2 was added to present the new coefficients.

2) The default silt loading values in Table 13.2.1-3 were revised to incorporate the results from a recent analysis of silt loading data.

November 2006

1) The $PM_{2.5}$ particle size multiplier was revised to 15% of PM_{10} as the result of wind tunnel studies of a variety of dust emitting surface materials.

2) References were rearranged and renumbered.

January 2011

1) The empirical predictive equation was revised. The revision is based upon stepwise regression of 83 profile emissions tests and an adjustment of individual test data for the exhaust; break wear and tire wear emissions prior to regression of the data.

2) The C term is removed from the empirical predictive equation and Table 13.2.1-2 with the C term values is removed since the exhaust; break wear and tire wear emissions were no longer part of the regressed data.

3) The $PM_{2.5}$ particle size multiplier was revised to 25% of PM_{10} since the PM_{10} test data used to develop the equation did not meet the necessary PM_{10} concentrations for a ratio of 15%.

4) The lower speed of the vehicle speed range supported by the empirical predictive equation was revised to 1 mph.

5) Information was added on an improved methodology to develop spatially and temporally resolved silt loadings or emissions factors by Mobile Monitoring Methodologies.

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13.2.2 Unpaved Roads

13.2.2.1 General

When a vehicle travels an unpaved road, the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

The particulate emission factors presented in the previous draft version of this section of AP-42, dated October 2001, implicitly included the emissions from vehicles in the form of exhaust, brake wear, and tire wear as well as resuspended road surface material[25]. EPA included these sources in the emission factor equation for unpaved public roads (equation 1b in this section) since the field testing data used to develop the equation included both the direct emissions from vehicles and emissions from resuspension of road dust.

This version of the unpaved public road emission factor equation only estimates particulate emissions from resuspended road surface material [23, 26]. The particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using EPA's MOBILE6.2 [24]. This approach eliminates the possibility of double counting emissions. Double counting results when employing the previous version of the emission factor equation in this section and MOBILE6.2 to estimate particulate emissions from vehicle traffic on unpaved public roads. It also incorporates the decrease in exhaust emissions that has occurred since the unpaved public road emission factor equation was developed. The previous version of the unpaved public road emission factor equation includes estimates of emissions from exhaust, brake wear, and tire wear based on emission rates for vehicles in the 1980 calendar year fleet. The amount of PM released from vehicle exhaust has decreased since 1980 due to lower new vehicle emission standards and changes in fuel characteristics.

13.2.2.2 Emissions Calculation And Correction Parameters[1-6]

The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume of traffic. Field investigations also have shown that emissions depend on source parameters that characterize the condition of a particular road and the associated vehicle traffic. Characterization of these source parameters allow for "correction" of emission estimates to specific road and traffic conditions present on public and industrial roadways.

Dust emissions from unpaved roads have been found to vary directly with the fraction of silt (particles smaller than 75 micrometers [µm] in diameter) in the road surface materials.[1] The silt fraction is determined by measuring the proportion of loose dry surface dust that passes a 200-mesh screen, using the ASTM-C-136 method. A summary of this method is contained in Appendix C of AP-42. Table 13.2.2-1 summarizes measured silt values for industrial unpaved roads. Table 13.2.2-2 summarizes measured silt values for public unpaved roads. It should be noted that the ranges of silt content vary over two orders of magnitude. Therefore, the use of data from this table can potentially introduce considerable error. Use of this data is strongly discouraged when it is feasible to obtain locally gathered data.

Since the silt content of a rural dirt road will vary with geographic location, it should be measured for use in projecting emissions. As a conservative approximation, the silt content of the parent soil in the area can be used. Tests, however, show that road silt content is normally lower than in the surrounding parent soil, because the fines are continually removed by the vehicle traffic, leaving a higher percentage of coarse particles.

Other variables are important in addition to the silt content of the road surface material. For example, at industrial sites, where haul trucks and other heavy equipment are common, emissions are highly correlated with vehicle weight. On the other hand, there is far less variability in the weights of cars and pickup trucks that commonly travel publicly accessible unpaved roads throughout the United States. For those roads, the moisture content of the road surface material may be more dominant in determining differences in emission levels between, for example a hot, desert environment and a cool, moist location.

The PM-10 and TSP emission factors presented below are the outcomes from stepwise linear regressions of field emission test results of vehicles traveling over unpaved surfaces. Due to a limited amount of information available for PM-2.5, the expression for that particle size range has been scaled against the result for PM-10. Consequently, the quality rating for the PM-2.5 factor is lower than that for the PM-10 expression.

Table 13.2.2-1. TYPICAL SILT CONTENT VALUES OF SURFACE MATERIAL ON INDUSTRIAL UNPAVED ROADS[a]

Industry	Road Use Or Surface Material	Plant Sites	No. Of Samples	Silt Content (%)	
				Range	Mean
Copper smelting	Plant road	1	3	16 - 19	17
Iron and steel production	Plant road	19	135	0.2 - 19	6.0
Sand and gravel processing	Plant road	1	3	4.1 - 6.0	4.8
	Material storage area	1	1	-	7.1
Stone quarrying and processing	Plant road	2	10	2.4 - 16	10
	Haul road to/from pit	4	20	5.0-15	8.3
Taconite mining and processing	Service road	1	8	2.4 - 7.1	4.3
	Haul road to/from pit	1	12	3.9 - 9.7	5.8
Western surface coal mining	Haul road to/from pit	3	21	2.8 - 18	8.4
	Plant road	2	2	4.9 - 5.3	5.1
	Scraper route	3	10	7.2 - 25	17
	Haul road (freshly graded)	2	5	18 - 29	24
Construction sites	Scraper routes	7	20	0.56-23	8.5
Lumber sawmills	Log yards	2	2	4.8-12	8.4
Municipal solid waste landfills	Disposal routes	4	20	2.2 - 21	6.4

[a]References 1,5-15.

The following empirical expressions may be used to estimate the quantity in pounds (lb) of size-specific particulate emissions from an unpaved road, per vehicle mile traveled (VMT):

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation:

$$E = k\ (s/12)^a (W/3)^b \tag{1a}$$

and, for vehicles traveling on publicly accessible roads, dominated by light duty vehicles, emissions may be estimated from the following:

$$E = \frac{k\ (s/12)^a (S/30)^d}{(M/0.5)^c} - C \tag{1b}$$

where k, a, b, c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

The source characteristics s, W and M are referred to as correction parameters for adjusting the emission estimates to local conditions. The metric conversion from lb/VMT to grams (g) per vehicle kilometer traveled (VKT) is as follows:

1 lb/VMT = 281.9 g/VKT

The constants for Equations 1a and 1b based on the stated aerodynamic particle sizes are shown in Tables 13.2.2-2 and 13.2.2-4. The PM-2.5 particle size multipliers (k-factors) are taken from Reference 27.

Table 13.2.2-2. CONSTANTS FOR EQUATIONS 1a AND 1b

Constant	Industrial Roads (Equation 1a)			Public Roads (Equation 1b)		
	PM-2.5	PM-10	PM-30*	PM-2.5	PM-10	PM-30*
k (lb/VMT)	0.15	1.5	4.9	0.18	1.8	6.0
a	0.9	0.9	0.7	1	1	1
b	0.45	0.45	0.45	-	-	-
c	-	-	-	0.2	0.2	0.3
d	-	-	-	0.5	0.5	0.3
Quality Rating	B	B	B	B	B	B

*Assumed equivalent to total suspended particulate matter (TSP)
"-" = not used in the emission factor equation

Table 13.2.2-2 also contains the quality ratings for the various size-specific versions of Equation 1a and 1b. The equation retains the assigned quality rating, if applied within the ranges of source conditions, shown in Table 13.2.2-3, that were tested in developing the equation:

Table 13.2.2-3. RANGE OF SOURCE CONDITIONS USED IN DEVELOPING EQUATION 1a AND 1b

Emission Factor	Surface Silt Content, %	Mean Vehicle Weight		Mean Vehicle Speed		Mean No. of Wheels	Surface Moisture Content, %
		Mg	ton	km/hr	mph		
Industrial Roads (Equation 1a)	1.8-25.2	1.8-260	2-290	8-69	5-43	4-17[a]	0.03-13
Public Roads (Equation 1b)	1.8-35	1.4-2.7	1.5-3	16-88	10-55	4-4.8	0.03-13

[a] See discussion in text.

As noted earlier, the models presented as Equations 1a and 1b were developed from tests of traffic on unpaved surfaces. Unpaved roads have a hard, generally nonporous surface that usually dries quickly after a rainfall or watering, because of traffic-enhanced natural evaporation. (Factors influencing how fast a road dries are discussed in Section 13.2.2.3, below.) The quality ratings given above pertain to the mid-range of the measured source conditions for the equation. A higher mean vehicle weight and a higher than normal traffic rate may be justified when performing a worst-case analysis of emissions from unpaved roads.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [23]. The emission factor also varies with aerodynamic size range as shown in Table 13.2.2-4

Table 13.2.2-4. EMISSION FACTOR FOR 1980'S VEHICLE FLEET EXHAUST, BRAKE WEAR AND TIRE WEAR

Particle Size Range[a]	*C*, Emission Factor for Exhaust, Brake Wear and Tire Wear[b] lb/VMT
$PM_{2.5}$	0.00036
PM_{10}	0.00047
PM_{30}[c]	0.00047

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.
[b] Units shown are pounds per vehicle mile traveled (lb/VMT).
[c] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

It is important to note that the vehicle-related source conditions refer to the average weight, speed, and number of wheels for all vehicles traveling the road. For example, if 98 percent of traffic on the road are 2-ton cars and trucks while the remaining 2 percent consists of 20-ton trucks, then the mean weight is 2.4 tons. More specifically, Equations 1a and 1b are *not* intended to be used to calculate a separate emission factor for each vehicle class within a mix of traffic on a given unpaved road. That is, in the example, one should *not* determine one factor for the 2-ton vehicles and a second factor for the 20-ton trucks. Instead, only one emission factor should be calculated that represents the "fleet" average of 2.4 tons for all vehicles traveling the road.

Moreover, to retain the quality ratings when addressing a group of unpaved roads, it is necessary that reliable correction parameter values be determined for the road in question. The field and laboratory procedures for determining road surface silt and moisture contents are given in AP-42 Appendices C.1 and C.2. Vehicle-related parameters should be developed by recording visual observations of traffic. In some cases, vehicle parameters for industrial unpaved roads can be determined by reviewing maintenance records or other information sources at the facility.

In the event that site-specific values for correction parameters cannot be obtained, then default values may be used.In the absence of site-specific silt content information, an appropriate mean value from Table 13.2.2-1 may be used as a default value, but the quality rating of the equation is reduced by two letters. Because of significant differences found between different types of road surfaces and between different areas of the country, use of the default moisture content value of 0.5 percent in Equation 1b is discouraged. The quality rating should be downgraded two letters when the default moisture content value is used. (It is assumed that readers addressing industrial roads have access to the information needed to develop average vehicle information in Equation 1a for their facility.)

The effect of routine watering to control emissions from unpaved roads is discussed below in Section 13.2.2.3, “Controls”. However, all roads are subject to some natural mitigation because of rainfall and other precipitation. The Equation 1a and 1b emission factors can be extrapolated to annual average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual average emissions are inversely proportional to the number of days with measurable (more than 0.254 mm [0.01 inch]) precipitation:

$$E_{ext} = E\ [(365 - P)/365] \tag{2}$$

where:

E_{ext} = annual size-specific emission factor extrapolated for natural mitigation, lb/VMT

E = emission factor from Equation 1a or 1b

P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation (see below)

Figure 13.2.2-1 gives the geographical distribution for the mean annual number of "wet" days for the United States.

Equation 2 provides an estimate that accounts for precipitation on an annual average basis for the purpose of inventorying emissions. It should be noted that Equation 2 does not account for differences in the temporal distributions of the rain events, the quantity of rain during any event, or the potential for the rain to evaporate from the road surface. In the event that a finer temporal and spatial resolution is desired for inventories of public unpaved roads, estimates can be based on a more complex set of assumptions. These assumptions include:

1. The moisture content of the road surface material is increased in proportion to the quantity of water added;
2. The moisture content of the road surface material is reduced in proportion to the Class A pan evaporation rate;
3. The moisture content of the road surface material is reduced in proportion to the traffic volume; and
4. The moisture content of the road surface material varies between the extremes observed in the area. The CHIEF Web site (http://www.epa.gov/ttn/chief/ap42/ch13/related/c13s02-2.html) has a file which contains a spreadsheet program for calculating emission factors which are temporally and spatially resolved. Information required for use of the spreadsheet program includes monthly Class A pan evaporation values, hourly meteorological data for precipitation, humidity and snow cover, vehicle traffic information, and road surface material information.

It is emphasized that <u>the simple assumption underlying Equation 2 and the more complex set of assumptions underlying the use of the procedure which produces a finer temporal and spatial resolution</u> have not been verified in any rigorous manner. For this reason, the quality ratings for either approach should be downgraded one letter from the rating that would be applied to Equation 1.

13.2.2.3 Controls[18-22]

A wide variety of options exist to control emissions from unpaved roads. Options fall into the following three groupings:

1. <u>Vehicle restrictions</u> that limit the speed, weight or number of vehicles on the road;

2. Surface improvement, by measures such as (a) paving or (b) adding gravel or slag to a dirt road; and

3. Surface treatment, such as watering or treatment with chemical dust suppressants.

Available control options span broad ranges in terms of cost, efficiency, and applicability. For example, traffic controls provide moderate emission reductions (often at little cost) but are difficult to enforce. Although paving is highly effective, its high initial cost is often prohibitive. Furthermore, paving is not feasible for industrial roads subject to very heavy vehicles and/or spillage of material in transport. Watering and chemical suppressants, on the other hand, are potentially applicable to most industrial roads at moderate to low costs. However, these require frequent reapplication to maintain an acceptable level of control. Chemical suppressants are generally more cost-effective than water but not in cases of temporary roads (which are common at mines, landfills, and construction sites). In summary, then, one needs to consider not only the type and volume of traffic on the road but also how long the road will be in service when developing control plans.

Vehicle restrictions. These measures seek to limit the amount and type of traffic present on the road or to lower the mean vehicle speed. For example, many industrial plants have restricted employees from driving on plant property and have instead instituted bussing programs. This eliminates emissions due to employees traveling to/from their worksites. Although the heavier average vehicle weight of the busses increases the base emission factor, the decrease in vehicle-miles-traveled results in a lower overall emission rate.

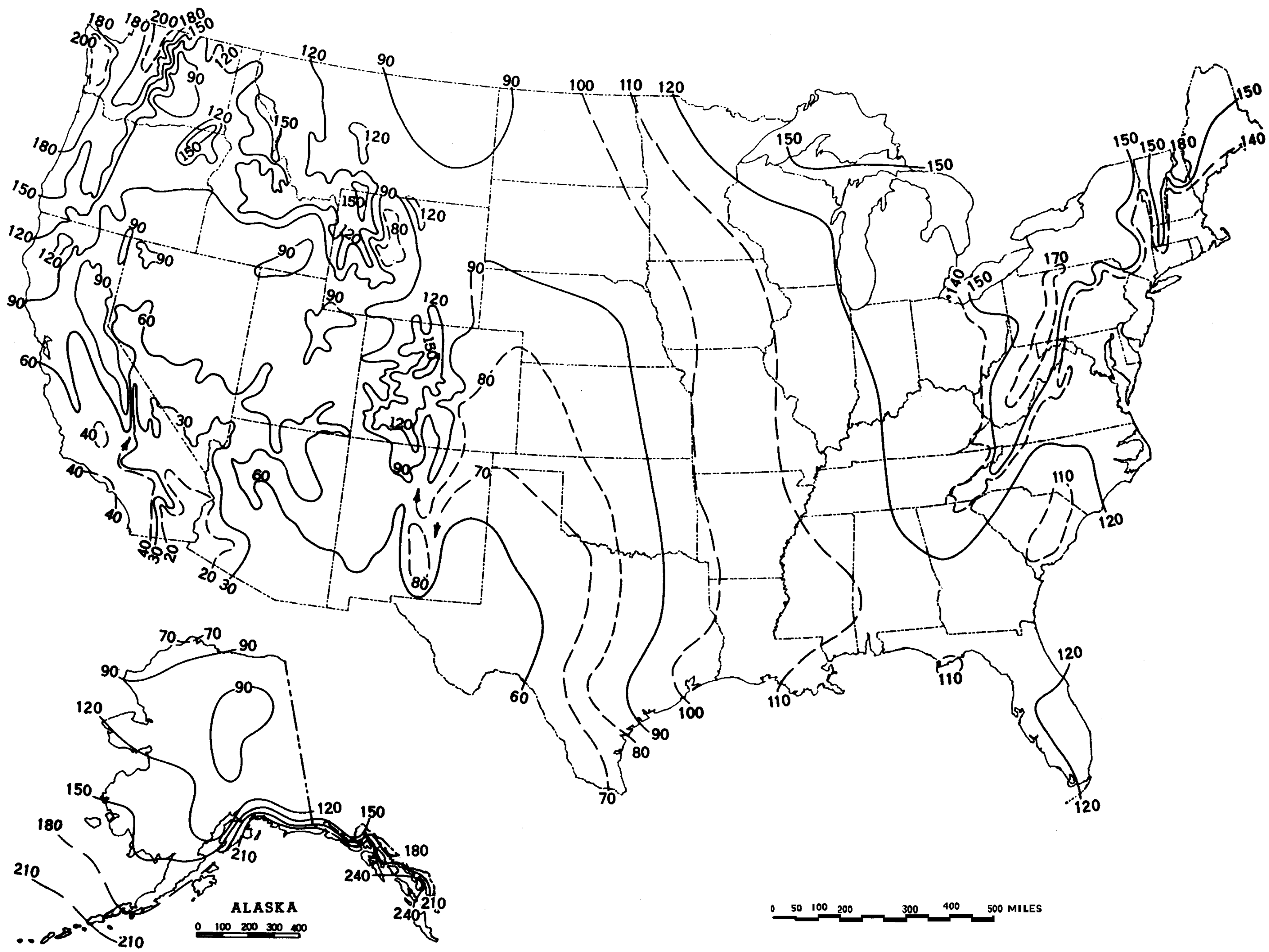

Figure 13.2.2-1. Mean number of days with 0.01 inch or more of precipitation in United States.

Surface improvements. Control options in this category alter the road surface. As opposed to the "surface treatments" discussed below, improvements are relatively "permanent" and do not require periodic retreatment.

The most obvious surface improvement is paving an unpaved road. This option is quite expensive and is probably most applicable to relatively short stretches of unpaved road with at least several hundred vehicle passes per day. Furthermore, if the newly paved road is located near unpaved areas or is used to transport material, it is essential that the control plan address routine cleaning of the newly paved road surface.

The control efficiencies achievable by paving can be estimated by comparing emission factors for unpaved and paved road conditions. The predictive emission factor equation for paved roads, given in Section 13.2.1, requires estimation of the silt loading on the traveled portion of the paved surface, which in turn depends on whether the pavement is periodically cleaned. Unless curbing is to be installed, the effects of vehicle excursion onto unpaved shoulders (berms) also must be taken into account in estimating the control efficiency of paving.

Other improvement methods cover the road surface with another material that has a lower silt content. Examples include placing gravel or slag on a dirt road. Control efficiency can be estimated by comparing the emission factors obtained using the silt contents before and after improvement. The silt content of the road surface should be determined after 3 to 6 months rather than immediately following placement. Control plans should address regular maintenance practices, such as grading, to retain larger aggregate on the traveled portion of the road.

Surface treatments refer to control options which require periodic reapplication. Treatments fall into the two main categories of (a) "wet suppression" (i. e., watering, possibly with surfactants or other additives), which keeps the road surface wet to control emissions and (b) "chemical stabilization/ treatment", which attempts to change the physical characteristics of the surface. The necessary reapplication frequency varies from several minutes for plain water under summertime conditions to several weeks or months for chemical dust suppressants.

Watering increases the moisture content, which conglomerates particles and reduces their likelihood to become suspended when vehicles pass over the surface. The control efficiency depends on how fast the road dries after water is added. This in turn depends on (a) the amount (per unit road surface area) of water added during each application; (b) the period of time between applications; (c) the weight, speed and number of vehicles traveling over the watered road during the period between applications; and (d) meteorological conditions (temperature, wind speed, cloud cover, etc.) that affect evaporation during the period.

Figure 13.2.2-2 presents a simple bilinear relationship between the instantaneous control efficiency due to watering and the resulting increase in surface moisture. The moisture ratio "M" (i.e., the x-axis in Figure 13.2.2-2) is found by dividing the surface moisture content of the watered road by the surface moisture content of the uncontrolled road. As the watered road surface dries, both the ratio M and the predicted instantaneous control efficiency (i.e., the y-axis in the figure) decrease. The figure shows that between the uncontrolled moisture content and a value twice as large, a small increase in moisture content results in a large increase in control efficiency. Beyond that, control efficiency grows slowly with increased moisture content.

Given the complicated nature of how the road dries, characterization of emissions from watered roadways is best done by collecting road surface material samples at various times between water truck passes. (Appendices C.1 and C.2 present the sampling and analysis procedures.) The moisture content measured can then be associated with a control efficiency by use of Figure 13.2.2-2. Samples that reflect average conditions during the watering cycle can take the form of either a series of samples between water applications or a single sample at the midpoint. It is essential that samples be collected during periods with active traffic on the road. Finally, because of different evaporation rates, it is recommended that samples be collected at various times during the year. If only one set of samples is to be collected, these must be collected during hot, summertime conditions.

When developing watering control plans for roads that do not yet exist, it is strongly recommended that the moisture cycle be established by sampling similar roads in the same geographic area. If the moisture cycle cannot be established by similar roads using established watering control plans, the more complex methodology used to estimate the mitigation of rainfall and other precipitation can be used to estimate the control provided by routine watering. An estimate of the maximum daytime Class A pan evaporation (based upon daily evaporation data published in the monthly Climatological Data for the state by the National Climatic Data Center) should be used to insure that adequate watering capability is available during periods of highest evaporation. The hourly precipitation values in the spreadsheet should be replaced with the equivalent inches of precipitation (where the equivalent of 1 inch of precipitation is provided by an application of 5.6 gallons of water per square yard of road). Information on the long term average annual evaporation and on the percentage that occurs between May and October was published in the Climatic Atlas (Reference 16). Figure 13.2.2-3 presents the geographical distribution for "Class A pan evaporation" throughout the United States. Figure 13.2.2-4 presents the geographical distribution of the percentage of this evaporation that occurs between May and October. The U. S. Weather Bureau Class A evaporation pan is a cylindrical metal container with a depth of 10 inches and a diameter of 48 inches. Periodic measurements are made of the changes of the water level.

The above methodology should be used <u>only for prospective analyses</u> and for designing watering programs for existing roadways. The quality rating of an emission factor for a watered road that is based on this methodology should be downgraded two letters. Periodic road surface samples should be collected and analyzed to verify the efficiency of the watering program.

As opposed to watering, chemical dust suppressants have much less frequent reapplication requirements. These materials suppress emissions by changing the physical characteristics of the existing road surface material. Many chemical unpaved road dust suppressants form a hardened surface that binds particles together. After several applications, a treated road often resembles a paved road except that the surface is not uniformly flat. Because the improved surface results in more grinding of small particles, the silt content of loose material on a highly controlled surface may be substantially higher than when the surface was uncontrolled. For this reason, the models presented as Equations 1a and 1b cannot be used to estimate emissions from chemically stabilized roads. Should the road be allowed to return to an uncontrolled state with no visible signs of large-scale cementing of material, the Equation 1a and 1b emission factors could then be used to obtain conservatively high emission estimates.

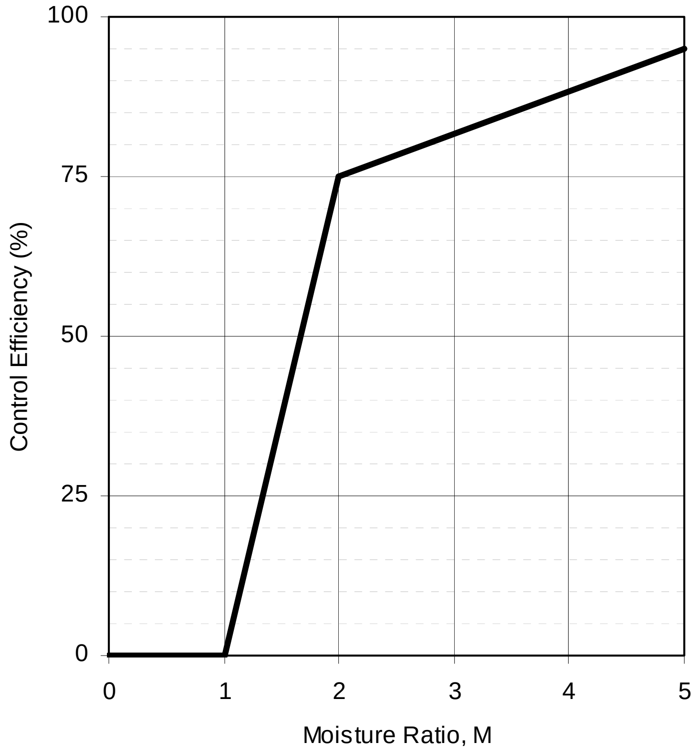

Figure 13.2.2-2. Watering control effectiveness for unpaved travel surfaces

The control effectiveness of chemical dust suppressants appears to depend on (a) the dilution rate used in the mixture; (b) the application rate (volume of solution per unit road surface area); (c) the time between applications; (d) the size, speed and amount of traffic during the period between applications; and (e) meteorological conditions (rainfall, freeze/thaw cycles, etc.) during the period. Other factors that affect the performance of dust suppressants include other traffic characteristics (e. g., cornering, track-on from unpaved areas) and road characteristics (e. g., bearing strength, grade). The variabilities in the above factors and differences between individual dust control products make the control efficiencies of chemical dust suppressants difficult to estimate. Past field testing of emissions from controlled unpaved roads has shown that chemical dust suppressants provide a PM-10 control efficiency of about 80 percent when applied at regular intervals of 2 weeks to 1 month.

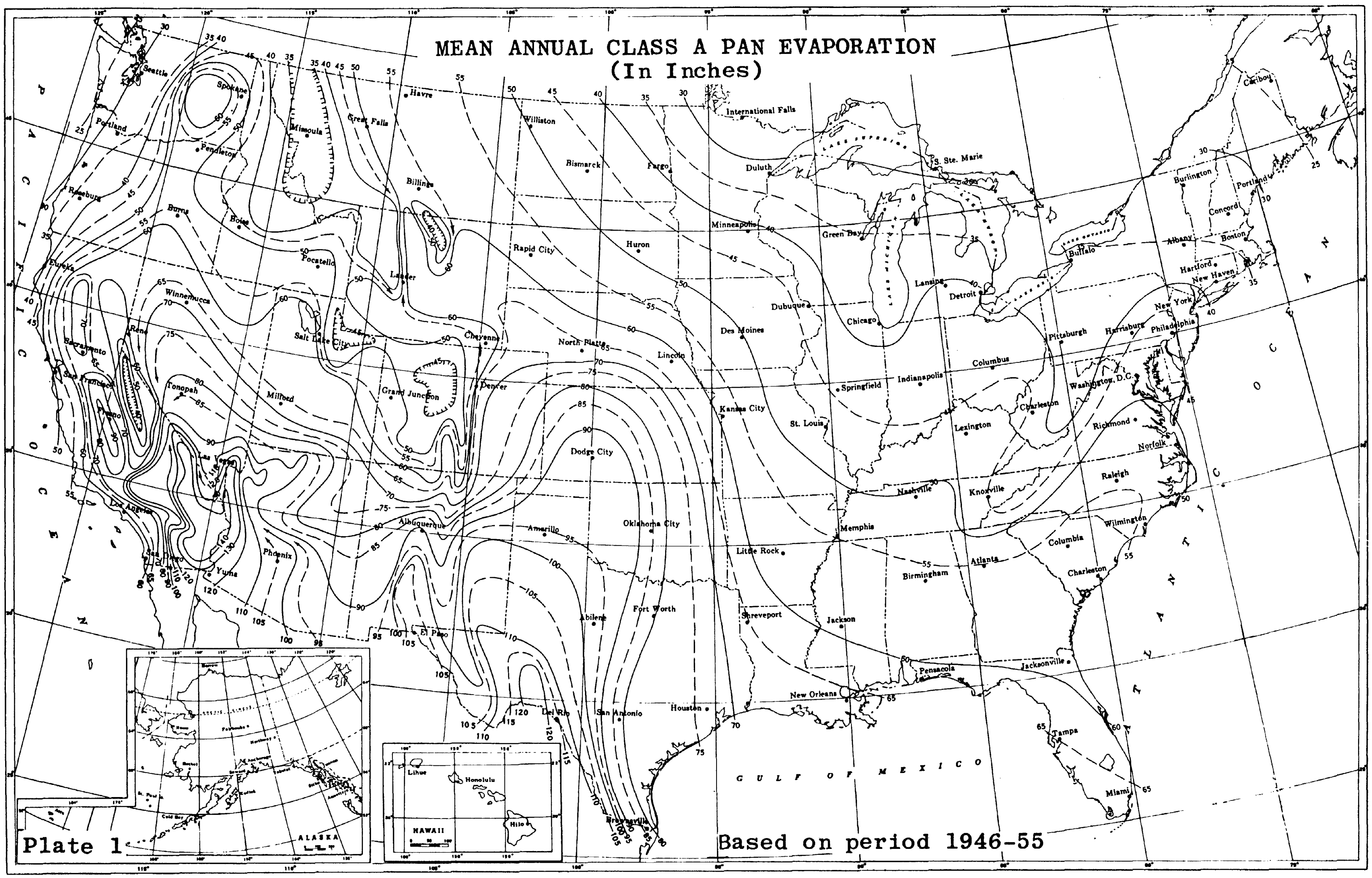

Figure 13.2.2-3. Annual evaporation data.

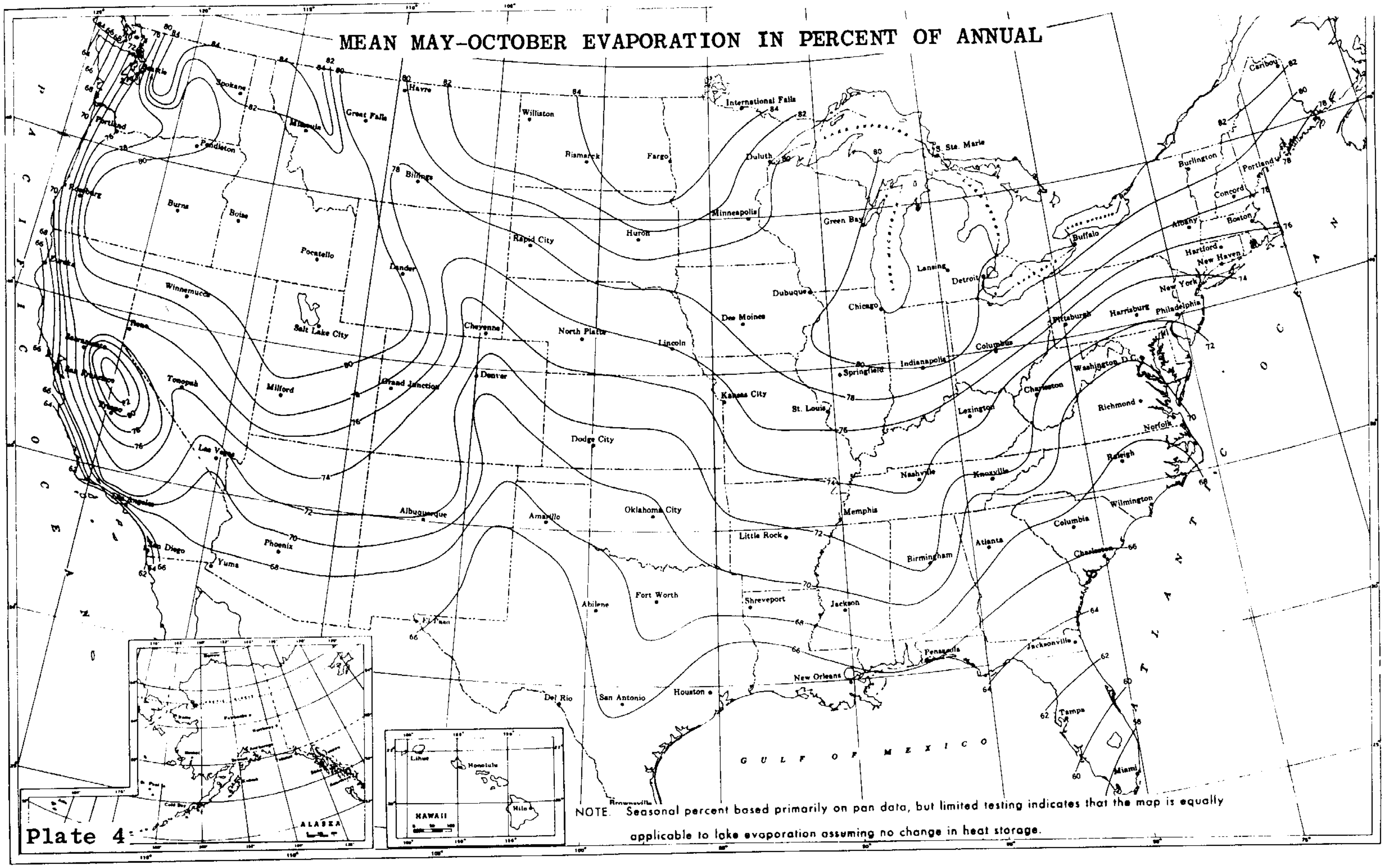

Figure 13.2.2-4. Geographical distribution of the percentage of evaporation occurring between May and October.

Petroleum resin products historically have been the dust suppressants (besides water) most widely used on industrial unpaved roads. Figure 13.2.2-5 presents a method to estimate average control efficiencies associated with petroleum resins applied to unpaved roads.[20] Several items should be noted:

1. The term "ground inventory" represents the total volume (per unit area) of petroleum resin concentrate (*not solution*) applied since the start of the dust control season.

2. Because petroleum resin products must be periodically reapplied to unpaved roads, the use of a time-averaged control efficiency value is appropriate. Figure 13.2.2-5 presents control efficiency values averaged over two common application intervals, 2 weeks and 1 month. Other application intervals will require interpolation.

3. Note that zero efficiency is assigned until the ground inventory reaches 0.05 gallon per square yard (gal/yd^2). Requiring a minimum ground inventory ensures that one must apply a reasonable amount of chemical dust suppressant to a road before claiming credit for emission control. Recall that the ground inventory refers to the amount of petroleum resin concentrate rather than the total solution.

As an example of the application of Figure 13.2.2-5, suppose that Equation 1a was used to estimate an emission factor of 7.1 lb/VMT for PM-10 from a particular road. Also, suppose that, starting on May 1, the road is treated with 0.221 gal/yd^2 of a solution (1 part petroleum resin to 5 parts water) on the first of each month through September. Then, the average controlled emission factors, shown in Table 13.2.2-5, are found.

Table 13.2-2-5. EXAMPLE OF AVERAGE CONTROLLED EMISSION FACTORS FOR SPECIFIC CONDITIONS

Period	Ground Inventory, gal/yd^2	Average Control Efficiency, %[a]	Average Controlled Emission Factor, lb/VMT
May	0.037	0	7.1
June	0.073	62	2.7
July	0.11	68	2.3
August	0.15	74	1.8
September	0.18	80	1.4

[a] From Figure 13.2.2-5, $\leq$10 µm. Zero efficiency assigned if ground inventory is less than 0.05 gal/yd^2. 1 lb/VMT = 281.9 g/VKT. 1 gal/yd^2 = 4.531 L/m^2.

Besides petroleum resins, other newer dust suppressants have also been successful in controlling emissions from unpaved roads. Specific test results for those chemicals, as well as for petroleum resins and watering, are provided in References 18 through 21.

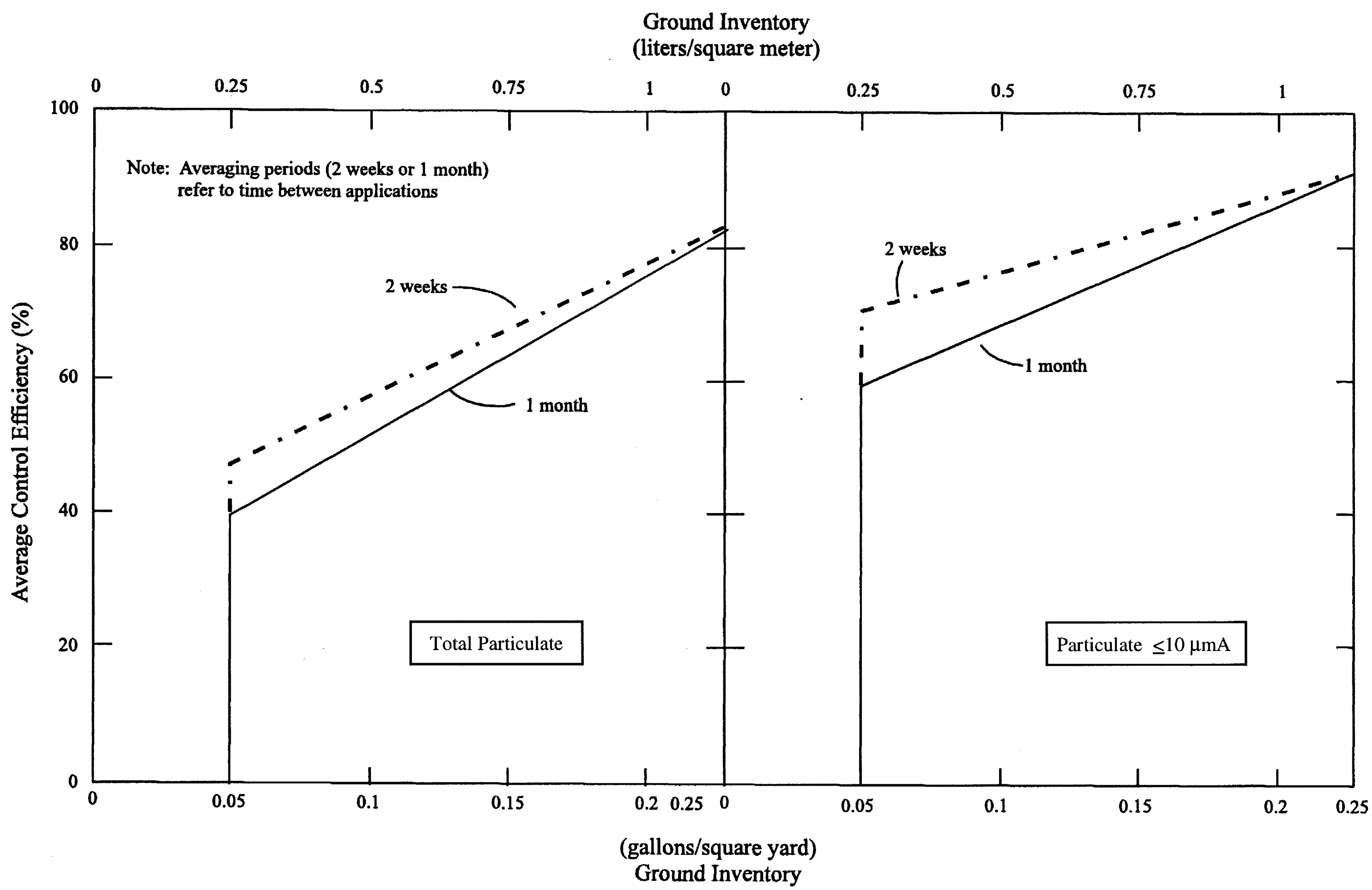

Figure 13.2.2-5. Average control efficiencies over common application intervals.

13.2.2.4 Updates Since The Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the background report for this section (Reference 6).

October 1998 (Supplement E)– This was a major revision of this section. Significant changes to the text and the emission factor equations were made.

October 2001 – Separate emission factors for unpaved surfaces at industrial sites and publicly accessible roads were introduced. Figure 13.2.2-2 was included to provide control effectiveness estimates for watered roads.

December 2003 – The public road emission factor equation (equation 1b) was adjusted to remove the component of particulate emissions from exhaust, brake wear, and tire wear. The parameter C in the new equation varies with aerodynamic size range of the particulate matter. Table 13.2.2-4 was added to present the new coefficients.

January 2006 – The PM-2.5 particle size multipliers (i.e., factors) in Table 13.2.2-2 were modified and the quality ratings were upgraded from C to B based on the wind tunnel studies of a variety of dust emitting surface materials.

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20. C. Cowherd, Jr., and J. S. Kinsey, *Identification, Assessment And Control Of Fugitive Particulate Emissions*, EPA-600/8-86-023, U. S. Environmental Protection Agency, Cincinnati, OH, August 1986.

21. G. E. Muleski and C. Cowherd, Jr., *Evaluation Of The Effectiveness Of Chemical Dust Suppressants On Unpaved Roads*, EPA-600/2-87-102, U. S. Environmental Protection Agency, Cincinnati, OH, November 1986.

22. *Fugitive Dust Background Document And Technical Information Document For Best Available Control Measures*, EPA-450/2-92-004, Office Of Air Quality Planning And Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1992.

23. Written communication (Technical Memorandum) from P. Hemmer, E.H. Pechan & Associates, Inc., Durham, NC to B. Kuykendal, U. S. Environmental Protection Agency, Research Triangle Park, NC, August, 21, 2003.

24. MOBILE6 User Guide, United States Environmental Protection Agency, Office of Transportation and Air Quality. EPA420-R-02-028, October 2002.

25. Written communication (Technical Memorandum) from G. Muleski, Midwest Research Institute, Kansas City, MO, to B. Kuykendal, U. S. Environmental Protection Agency, Research Triangle Park, NC, Subject "Unpaved Roads", September 27, 2001.

26. Written communication (Technical Memorandum) from W. Kuykendal, U. S. Environmental Protection Agency, to File, Subject "Decisions on Final AP-42 Section 13.2.2 Unpaved Roads", November 24, 2003.

27. C. Cowherd, *Background Document for Revisions to Fine Fraction Ratios &sed for AP-42 Fugitive Dust Emission Factors*. Prepared by Midwest Research Institute for Western Governors Association, Western Regional Air Partnership, Denver, CO, February 1, 2006.

13.2.3 Heavy Construction Operations

13.2.3.1 General

Heavy construction is a source of dust emissions that may have substantial temporary impact on local air quality. Building and road construction are 2 examples of construction activities with high emissions potential. Emissions during the construction of a building or road can be associated with land clearing, drilling and blasting, ground excavation, cut and fill operations (i.e., earth moving), and construction of a particular facility itself. Dust emissions often vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A large portion of the emissions results from equipment traffic over temporary roads at the construction site.

The temporary nature of construction differentiates it from other fugitive dust sources as to estimation and control of emissions. Construction consists of a series of different operations, each with its own duration and potential for dust generation. In other words, emissions from any single construction site can be expected (1) to have a definable beginning and an end and (2) to vary substantially over different phases of the construction process. This is in contrast to most other fugitive dust sources, where emissions are either relatively steady or follow a discernable annual cycle. Furthermore, there is often a need to estimate areawide construction emissions, without regard to the actual plans of any individual construction project. For these reasons, following are methods by which either areawide or site-specific emissions may be estimated.

13.2.3.2 Emissions And Correction Parameters

The quantity of dust emissions from construction operations is proportional to the area of land being worked and to the level of construction activity. By analogy to the parameter dependence observed for other similar fugitive dust sources,[1] one can expect emissions from heavy construction operations to be positively correlated with the silt content of the soil (that is, particles smaller than 75 micrometers [µm] in diameter), as well as with the speed and weight of the average vehicle, and to be negatively correlated with the soil moisture content.

13.2.3.3 Emission Factors

Only 1 set of field studies has been performed that attempts to relate the emissions from construction directly to an emission factor.[1-2] Based on field measurements of total suspended particulate (TSP) concentrations surrounding apartment and shopping center construction projects, the approximate emission factors for construction activity operations are:

$E = 2.69$ megagrams (Mg)/hectare/month of activity
$E = 1.2$ tons/acre/month of activity

These values are most useful for developing estimates of overall emissions from construction scattered throughout a geographical area. The value is most applicable to construction operations with: (1) medium activity level, (2) moderate silt contents, and (3) semiarid climate. Test data were not sufficient to derive the specific dependence of dust emissions on correction parameters. Because the above emission factor is referenced to TSP, use of this factor to estimate particulate matter (PM) no greater than 10 µm in aerodynamic diameter (PM-10) emissions will result in conservatively high estimates. Also, because derivation of the factor assumes that construction activity occurs 30 days per month, the above estimate is somewhat conservatively high for TSP as well.

Although the equation above represents a relatively straightforward means of preparing an areawide emission inventory, at least 2 features limit its usefulness for specific construction sites. First, the conservative nature of the emission factor may result in too high an estimate for PM-10 to be of much use for a specific site under consideration. Second, the equation provides neither information about which particular construction activities have the greatest emission potential nor guidance for developing an effective dust control plan.

For these reasons, it is strongly recommended that when emissions are to be estimated for a particular construction site, the construction process be broken down into component operations. (Note that many general contractors typically employ planning and scheduling tools, such as critical path method [CPM], that make use of different sequential operations to allocate resources.) This approach to emission estimation uses a unit or phase method to consider the more basic dust sources of vehicle travel and material handling. That is to say, the construction project is viewed as consisting of several operations, each involving traffic and material movements, and emission factors from other AP-42 sections are used to generate estimates. Table 13.2.3-1 displays the dust sources involved with construction, along with the recommended emission factors.[3]

In addition to the on-site activities shown in Table 13.2.3-1, substantial emissions are possible because of material tracked out from the site and deposited on adjacent paved streets. Because all traffic passing the site (i. e., not just that associated with the construction) can resuspend the deposited material, this "secondary" source of emissions may be far more important than all the dust sources actually within the construction site. Furthermore, this secondary source will be present during all construction operations. Persons developing construction site emission estimates must consider the potential for increased adjacent emissions from off-site paved roadways (see Section 13.2.1, "Paved Roads"). High wind events also can lead to emissions from cleared land and material stockpiles. Section 13.2.5, "Industrial Wind Erosion", presents an estimation methodology that can be used for such sources at construction sites.

13.2.3.4 Control Measures[4]

Because of the relatively short-term nature of construction activities, some control measures are more cost effective than others. Wet suppression and wind speed reduction are 2 common methods used to control open dust sources at construction sites, because a source of water and material for wind barriers tend to be readily available on a construction site. However, several other forms of dust control are available.

Table 13.2.3-2 displays each of the preferred control measures, by dust source.[3-4] Because most of the controls listed in the table modify independent variables in the emission factor models, the effectiveness can be calculated by comparing controlled and uncontrolled emission estimates from Table 13.2.3-1. Additional guidance on controls is provided in the AP-42 sections from which the recommended emission factors were taken, as well as in other documents, such as Reference 4.

Table 13.2.3-1. RECOMMENDED EMISSION FACTORS FOR CONSTRUCTION OPERATIONS[a]

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
I. Demolition and debris removal	1. Demolition of buildings or other (natural) obstacles such as trees, boulders, etc.			
	a. Mechanical dismemberment ("headache ball") of existing structures	NA		—
	b. Implosion of existing structures	NA		—
	c. Drilling and blasting of soil	Drilling factor in Table 11.9-4		-1
		Blasting factor NA	Blasting factor in Tables 11.9-1 and 11.9-2 not considered appropriate for general construction activities	NA
	d. General land clearing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Loading of debris into trucks	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	3. Truck transport of debris	Unpaved road emission factor in Section 13.2.2, or paved road emission factor in Section 13.2.1		-0/-1[c]
	4. Truck unloading of debris	Material handling emission factor equation in Section 13.2.4	May occur offsite	-0/-1[c]

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
II. Site Preparation (earth moving)	1. Bulldozing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Scrapers unloading topsoil	Scraper unloading factor in Table 11.9-4		-1
	3. Scrapers in travel	Scraper (travel mode) expression in Tables 11.9-1 and 11.9-2		-0/-1[c]
	4. Scrapers removing topsoil	5.7 kg/vehicle kilometer traveled (VKT) (20.2 lb/vehicle mile traveled [VMT])		E[d]
	5. Loading of excavated material into trucks	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	6. Truck dumping of fill material, road base, or other materials	Material handling emission factor equation in Section 13.2.4	May occur offsite	-0/-1[c]
	7. Compacting	Dozer equation in Tables 11.9-1 and 11.9-2	Emission factor downgraded because of differences in operating equipment	-1/-2[c]
	8. Motor grading	Grading equation in Tables 11.9-1 and 11.9-2		-1/-2[c]

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
III. General Construction	1. Vehicular traffic	Unpaved road emission factor in Section 13.2.2, or paved road emission factor in Section 13.2.1		-0/-1[c] -0/-1[c]
	2. Portable plants			
	a. Crushing	Factors for similar material/operations in Section 11.19.2		-1/-2[c]
	b. Screening	Factors for similar material/operations in Section 11.19.2		-1/-2[c]
	c. Material transfers	Material handling emission factor equation in Section 13.2.4		-0/-1[c]
	3. Other operations	Factors for similar material/operations in the Mineral Products Industry, Chapter 11 of this document		—

[a] NA = not applicable.
[b] Refers to how many additional letters the emission factor should be downrated (beyond the guidance given in the other sections of AP-42) for application to construction activities. For example, "-2" means that an A-rated factor should be considered of C quality in estimating construction emissions. All emission factors assumed to have site-specific input values; otherwise, additional downgrading of one letter should be employed. Note that no rating can be lower than E.
[c] First value for cases with independent variables within range given in AP-42 section; second value for cases with at least 1 variable outside the range.
[d] Rating for emission factor given. Reference 5.
[e] In the event that individual operations cannot be identified, one may very conservatively overestimate PM-10 emissions by using Equation 1.

Table 13.2.3-2. CONTROL OPTIONS FOR GENERAL CONSTRUCTION OPEN SOURCES OF PM-10

Emission Source	Recommended Control Method(s)
Debris handling	Wind speed reduction Wet suppression[a]
Truck transport[b]	Wet suppression Paving Chemical stabilization[c]
Bulldozers	Wet suppression[d]
Pan scrapers	Wet suppression of travel routes
Cut/fill material handling	Wind speed reduction Wet suppression
Cut/fill haulage	Wet suppression Paving Chemical stabilization
General construction	Wind speed reduction Wet suppression Early paving of permanent roads

[a] Dust control plans should contain precautions against watering programs that confound trackout problems.
[b] Loads could be covered to avoid loss of material in transport, especially if material is transported offsite.
[c] Chemical stabilization usually cost-effective for relatively long-term or semipermanent unpaved roads.
[d] Excavated materials may already be moist and not require additional wetting. Furthermore, most soils are associated with an "optimum moisture" for compaction.

References For Section 13.2.3

1. C. Cowherd, Jr., *et al.*, *Development Of Emissions Factors For Fugitive Dust Sources*, EPA-450/3-74-03, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

2. G. A. Jutze, *et al.*, *Investigation Of Fugitive Dust Sources Emissions And Control*, EPA-450/3-74-036a, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

3. *Background Documentation For AP-42 Section 11.2.4, Heavy Construction Operations*, EPA Contract No. 69-D0-0123, Midwest Research Institute, Kansas City, MO, April 1993.

4. C. Cowherd, *et al.*, *Control Of Open Fugitive Dust Sources*, EPA-450/3-88-008, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1988.

5. M. A. Grelinger, *et al.*, *Gap Filling PM-10 Emission Factors For Open Area Fugitive Dust Sources*, EPA-450/4-88-003, U. S. Environmental Protection Agency, Research Triangle Park, NC, March 1988.

13.2.4 Aggregate Handling And Storage Piles

13.2.4.1 General

Inherent in operations that use minerals in aggregate form is the maintenance of outdoor storage piles. Storage piles are usually left uncovered, partially because of the need for frequent material transfer into or out of storage.

Dust emissions occur at several points in the storage cycle, such as material loading onto the pile, disturbances by strong wind currents, and loadout from the pile. The movement of trucks and loading equipment in the storage pile area is also a substantial source of dust.

13.2.4.2 Emissions And Correction Parameters

The quantity of dust emissions from aggregate storage operations varies with the volume of aggregate passing through the storage cycle. Emissions also depend on 3 parameters of the condition of a particular storage pile: age of the pile, moisture content, and proportion of aggregate fines.

When freshly processed aggregate is loaded onto a storage pile, the potential for dust emissions is at a maximum. Fines are easily disaggregated and released to the atmosphere upon exposure to air currents, either from aggregate transfer itself or from high winds. As the aggregate pile weathers, however, potential for dust emissions is greatly reduced. Moisture causes aggregation and cementation of fines to the surfaces of larger particles. Any significant rainfall soaks the interior of the pile, and then the drying process is very slow.

Silt (particles equal to or less than 75 micrometers [µm] in diameter) content is determined by measuring the portion of dry aggregate material that passes through a 200-mesh screen, using ASTM-C-136 method.[1] Table 13.2.4-1 summarizes measured silt and moisture values for industrial aggregate materials.

Table 13.2.4-1. TYPICAL SILT AND MOISTURE CONTENTS OF MATERIALS AT VARIOUS INDUSTRIES[a]

Industry	No. Of Facilities	Material	Silt Content (%)			Moisture Content (%)		
			No. Of Samples	Range	Mean	No. Of Samples	Range	Mean
Iron and steel production	9	Pellet ore	13	1.3 - 13	4.3	11	0.64 - 4.0	2.2
		Lump ore	9	2.8 - 19	9.5	6	1.6 - 8.0	5.4
		Coal	12	2.0 - 7.7	4.6	11	2.8 - 11	4.8
		Slag	3	3.0 - 7.3	5.3	3	0.25 - 2.0	0.92
		Flue dust	3	2.7 - 23	13	1	—	7
		Coke breeze	2	4.4 - 5.4	4.9	2	6.4 - 9.2	7.8
		Blended ore	1	—	15	1	—	6.6
		Sinter	1	—	0.7	0	—	—
		Limestone	3	0.4 - 2.3	1.0	2	ND	0.2
Stone quarrying and processing	2	Crushed limestone	2	1.3 - 1.9	1.6	2	0.3 - 1.1	0.7
		Various limestone products	8	0.8 - 14	3.9	8	0.46 - 5.0	2.1
Taconite mining and processing	1	Pellets	9	2.2 - 5.4	3.4	7	0.05 - 2.0	0.9
		Tailings	2	ND	11	1	—	0.4
Western surface coal mining	4	Coal	15	3.4 - 16	6.2	7	2.8 - 20	6.9
		Overburden	15	3.8 - 15	7.5	0	—	—
		Exposed ground	3	5.1 - 21	15	3	0.8 - 6.4	3.4
Coal-fired power plant	1	Coal (as received)	60	0.6 - 4.8	2.2	59	2.7 - 7.4	4.5
Municipal solid waste landfills	4	Sand	1	—	2.6	1	—	7.4
		Slag	2	3.0 - 4.7	3.8	2	2.3 - 4.9	3.6
		Cover	5	5.0 - 16	9.0	5	8.9 - 16	12
		Clay/dirt mix	1	—	9.2	1	—	14
		Clay	2	4.5 - 7.4	6.0	2	8.9 - 11	10
		Fly ash	4	78 - 81	80	4	26 - 29	27
		Misc. fill materials	1	—	12	1	—	11

[a] References 1-10. ND = no data.

13.2.4.3 Predictive Emission Factor Equations

Total dust emissions from aggregate storage piles result from several distinct source activities within the storage cycle:

1. Loading of aggregate onto storage piles (batch or continuous drop operations).
2. Equipment traffic in storage area.
3. Wind erosion of pile surfaces and ground areas around piles.
4. Loadout of aggregate for shipment or for return to the process stream (batch or continuous drop operations).

Either adding aggregate material to a storage pile or removing it usually involves dropping the material onto a receiving surface. Truck dumping on the pile or loading out from the pile to a truck with a front-end loader are examples of batch drop operations. Adding material to the pile by a conveyor stacker is an example of a continuous drop operation.

The quantity of particulate emissions generated by either type of drop operation, per kilogram (kg) (ton) of material transferred, may be estimated, with a rating of A, using the following empirical expression:[11]

$$E = k(0.0016)\ \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\ \text{(kg/megagram [Mg])}$$

$$E = k(0.0032)\ \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\ \text{(pound [lb]/ton)} \qquad (1)$$

where:

E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (m/s) (miles per hour [mph])
M = material moisture content (%)

The particle size multiplier in the equation, k, varies with aerodynamic particle size range, as follows:

Aerodynamic Particle Size Multiplier (k) For Equation 1				
< 30 µm	< 15 µm	< 10 µm	< 5 µm	< 2.5 µm
0.74	0.48	0.35	0.20	0.053[a]

[a] Multiplier for < 2.5 µm taken from Reference 14.

The equation retains the assigned quality rating if applied within the ranges of source conditions that were tested in developing the equation, as follows. Note that silt content is included, even though silt content does not appear as a correction parameter in the equation. While it is reasonable to expect that silt content and emission factors are interrelated, no significant correlation between the 2 was found during the derivation of the equation, probably because most tests with high silt contents were conducted under lower winds, and vice versa. It is recommended that estimates from the equation be reduced 1 quality rating level if the silt content used in a particular application falls outside the range given:

Ranges Of Source Conditions For Equation 1			
Silt Content (%)	Moisture Content (%)	Wind Speed	
		m/s	mph
0.44 - 19	0.25 - 4.8	0.6 - 6.7	1.3 - 15

To retain the quality rating of the equation when it is applied to a specific facility, reliable correction parameters must be determined for specific sources of interest. The field and laboratory procedures for aggregate sampling are given in Reference 3. In the event that site-specific values for correction parameters cannot be obtained, the appropriate mean from Table 13.2.4-1 may be used, but the quality rating of the equation is reduced by 1 letter.

For emissions from equipment traffic (trucks, front-end loaders, dozers, etc.) traveling between or on piles, it is recommended that the equations for vehicle traffic on unpaved surfaces be used (see Section 13.2.2). For vehicle travel between storage piles, the silt value(s) for the areas among the piles (which may differ from the silt values for the stored materials) should be used.

Worst-case emissions from storage pile areas occur under dry, windy conditions. Worst-case emissions from materials-handling operations may be calculated by substituting into the equation appropriate values for aggregate material moisture content and for anticipated wind speeds during the worst case averaging period, usually 24 hours. The treatment of dry conditions for Section 13.2.2, vehicle traffic, "Unpaved Roads", follows the methodology described in that section centering on parameter p. A separate set of nonclimatic correction parameters and source extent values corresponding to higher than normal storage pile activity also may be justified for the worst-case averaging period.

13.2.4.4 Controls[12-13]

Watering and the use of chemical wetting agents are the principal means for control of aggregate storage pile emissions. Enclosure or covering of inactive piles to reduce wind erosion can also reduce emissions. Watering is useful mainly to reduce emissions from vehicle traffic in the storage pile area. Watering of the storage piles themselves typically has only a very temporary slight effect on total emissions. A much more effective technique is to apply chemical agents (such as surfactants) that permit more extensive wetting. Continuous chemical treating of material loaded onto piles, coupled with watering or treatment of roadways, can reduce total particulate emissions from aggregate storage operations by up to 90 percent.[12]

References For Section 13.2.4

1. C. Cowherd, Jr., *et al., Development Of Emission Factors For Fugitive Dust Sources*, EPA-450/3-74-037, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

2. R. Bohn, *et al., Fugitive Emissions From Integrated Iron And Steel Plants*, EPA-600/2-78-050, U. S. Environmental Protection Agency, Cincinnati, OH, March 1978.

3. C. Cowherd, Jr., *et al., Iron And Steel Plant Open Dust Source Fugitive Emission Evaluation*, EPA-600/2-79-103, U. S. Environmental Protection Agency, Cincinnati, OH, May 1979.

4. *Evaluation Of Open Dust Sources In The Vicinity Of Buffalo, New York*, EPA Contract No. 68-02-2545, Midwest Research Institute, Kansas City, MO, March 1979.

5. C. Cowherd, Jr., and T. Cuscino, Jr., *Fugitive Emissions Evaluation*, MRI-4343-L, Midwest Research Institute, Kansas City, MO, February 1977.

6. T. Cuscino, Jr., *et al., Taconite Mining Fugitive Emissions Study*, Minnesota Pollution Control Agency, Roseville, MN, June 1979.

7. *Improved Emission Factors For Fugitive Dust From Western Surface Coal Mining Sources,* 2 Volumes, EPA Contract No. 68-03-2924, PEDCo Environmental, Kansas City, MO, and Midwest Research Institute, Kansas City, MO, July 1981.

8. *Determination Of Fugitive Coal Dust Emissions From Rotary Railcar Dumping,* TRC, Hartford, CT, May 1984.

9. *PM-10 Emission Inventory Of Landfills In the Lake Calumet Area*, EPA Contract No. 68-02-3891, Midwest Research Institute, Kansas City, MO, September 1987.

10. *Chicago Area Particulate Matter Emission Inventory — Sampling And Analysis*, EPA Contract No. 68-02-4395, Midwest Research Institute, Kansas City, MO, May 1988.

11. *Update Of Fugitive Dust Emission Factors In AP-42 Section 11.2*, EPA Contract No. 68-02-3891, Midwest Research Institute, Kansas City, MO, July 1987.

12. G. A. Jutze, *et al., Investigation Of Fugitive Dust Sources Emissions And Control*, EPA-450/3-74-036a, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

13. C. Cowherd, Jr., *et al., Control Of Open Fugitive Dust Sources*, EPA-450/3-88-008, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1988.

14. C. Cowherd, *Background Document for Revisions to Fine Fraction Ratios &sed for AP-42 Fugitive Dust Emission Factors*. Prepared by Midwest Research Institute for Western Governors Association, Western Regional Air Partnership, Denver, CO, February 1, 2006.

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification	
User Identification:	City of Roswell-Gasoline Tank
City:	
State:	New Mexico
Company:	
Type of Tank:	Horizontal Tank
Description:	1,000-gallon gasoline tank
Tank Dimensions	
Shell Length (ft):	10.80
Diameter (ft):	4.00
Volume (gallons):	1,000.00
Turnovers:	10.00
Net Throughput(gal/yr):	10,000.00
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N
Paint Characteristics	
Shell Color/Shade:	Red/Primer
Shell Condition	Poor
Breather Vent Settings	
Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Roswell, New Mexico (Avg Atmospheric Pressure = 12.73 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

City of Roswell-Gasoline Tank - Horizontal Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 10)	All	76.33	59.43	93.23	65.28	7.0490	5.1283	9.5024	66.0000			92.00	Option 4: RVP=10, ASTM Slope=3
1,2,4-Trimethylbenzene						0.0383	0.0200	0.0699	120.1900	0.0265	0.0002	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						1.8062	1.1494	2.7453	78.1100	0.0180	0.0064	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Ethylbenzene						0.1875	0.1064	0.3165	106.1700	0.0134	0.0005	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Hexane (-n)						2.8812	1.8851	4.2700	86.1700	0.0100	0.0057	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Toluene						0.5386	0.3243	0.8617	92.1300	0.0700	0.0075	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Unidentified Components						8.6100	8.5272	8.5277	65.6269	0.7912	0.9775	90.43	Option 4: RVP=12, ASTM Slope=3
Xylenes (mixed isomers)						0.1570	0.0886	0.2665	106.1700	0.0710	0.0022	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

City of Roswell-Gasoline Tank - Horizontal Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Benzene	0.71	8.31	9.03
Toluene	0.83	9.64	10.47
Gasoline (RVP 10)	110.77	1,293.26	1,404.03
Hexane (-n)	0.63	7.37	8.00
Ethylbenzene	0.05	0.64	0.70
Xylenes (mixed isomers)	0.24	2.85	3.09
1,2,4-Trimethylbenzene	0.02	0.26	0.28
Unidentified Components	108.28	1,264.18	1,372.46

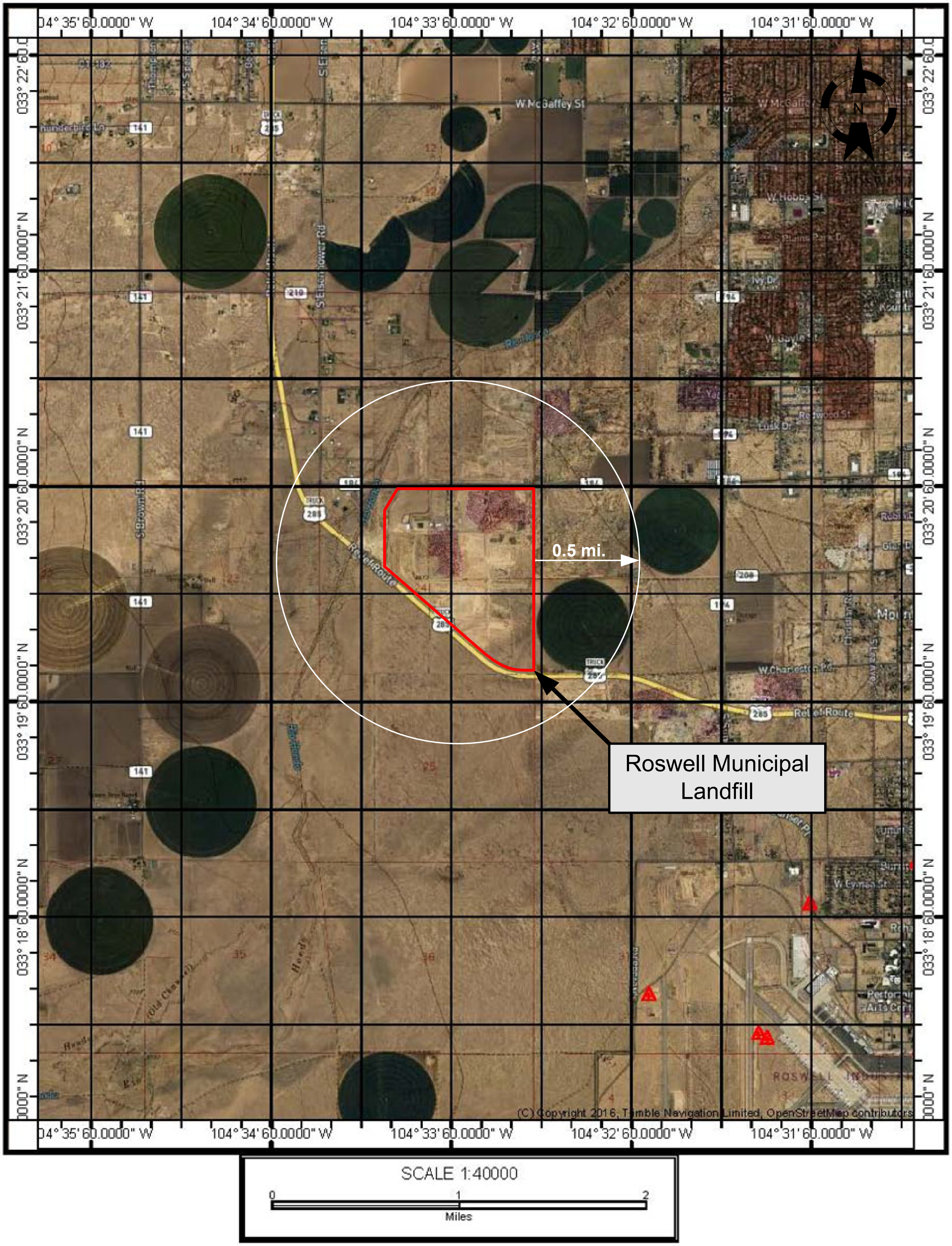
Section 8

Map(s)

A map such as a 7.5 minute topographic quadrangle showing the exact location of the source. The map shall also include the following:

The UTM or Longitudinal coordinate system on both axes	An indicator showing which direction is north
A minimum radius around the plant of 0.8km (0.5 miles)	Access and haul roads
Topographic features of the area	Facility property boundaries
The name of the map	The area which will be restricted to public access
A graphical scale	

An area map is provided on the following page.



ALLIANT ENVIRONMENTAL, LLC

Area Map	City of Roswell

Scale:	Drawn by:	Date:		Project No.:	File Name:	Figure:
1:40,000	MDF	11/16/2020	**Roswell Municipal Landfill** N 33° 20' 39.76" Latitude W 104° 33' 56.22" Longitude	091-003	**Roswell Landfill Diagrams**	Section 8
	Chk'd by: MRS	Date: 02/09/2021				

Section 9

Proof of Public Notice

(for NSR applications submitting under 20.2.72 or 20.2.74 NMAC)
(This proof is required by: 20.2.72.203.A.14 NMAC "Documentary Proof of applicant's public notice")

Public notice is not required for a Title V permit renewal application, submitted under 20.2.70 NMAC.

Section 10

Written Description of the Routine Operations of the Facility

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A written description of the routine operations of the facility. Include a description of how each piece of equipment will be operated, how controls will be used, and the fate of both the products and waste generated. For modifications and/or revisions, explain how the changes will affect the existing process. In a separate paragraph describe the major process bottlenecks that limit production. The purpose of this description is to provide sufficient information about plant operations for the permit writer to determine appropriate emission sources.

RMLF accepts municipal solid waste from the City of Roswell and Chaves County. The revised solid waste permit of 2007 expanded the entire solid waste facility boundary by 282 acres, for a total of 390 acres.

The facility's routine operations include the following:

- Trucks bring in waste daily except Sundays and holidays.
- Waste delivery occurs in enclosed vehicles designed for hauling municipal solid waste.
- Waste is placed in solid waste cells.
- Soil fill is used to cover solid waste daily and calculated to be 20 percent of total waste brought in daily.
- Waste received every day is encapsulated.

The equipment used at this Facility includes:

- **Compactors -** designed for waste receiving, compaction, daily cover application, and related fill face activities.
- **Scrapers -** used for earthmoving activities, such as excavation of new cells and hauling of cover material from designated stockpiles. Scrapers also deliver soil directly from the excavation of a new cell to an area near the active fill face.
- **Dozers -** move soil and waste usually for short distances and work in conjunction with scrapers in preparation of new cells and can apply cover at the fill face.
- **Front-end loaders -** used for earthmoving activities and cell construction tasks.
- **Water pumps** -used on a daily basis to control dust that could originate from on-site roads, covered areas and other areas, and moved throughout the facility.

The City uses soil for daily and intermediate cover over the waste during routine operations. The soil cover is inert material that occupies a portion of the waste envelope and reduces the amount of waste that is disposed within the overall waste unit volume. The design capacity presented in the 2007 solid waste facility application was based on calculation of daily and intermediate cover as 20 percent of the waste envelope, with 80 percent of the waste envelope filled with waste.

Section 11

Source Determination

Source submitting under 20.2.70, 20.2.72, 20.2.73, and 20.2.74 NMAC

Sources applying for a construction permit, PSD permit, or operating permit shall evaluate surrounding and/or associated sources (including those sources directly connected to this source for business reasons) and complete this section. Responses to the following questions shall be consistent with the Air Quality Bureau's permitting guidance, Single Source Determination Guidance, which may be found on the Applications Page in the Permitting Section of the Air Quality Bureau website.

Typically, buildings, structures, installations, or facilities that have the same SIC code, that are under common ownership or control, and that are contiguous or adjacent constitute a single stationary source for 20.2.70, 20.2.72, 20.2.73, and 20.2.74 NMAC applicability purposes. Submission of your analysis of these factors in support of the responses below is optional, unless requested by NMED.

A. Identify the emission sources evaluated in this section (list and describe)**:**
See Table 2-A for a list of equipment.

B. Apply the 3 criteria for determining a single source:

SIC Code: Surrounding or associated sources belong to the same 2-digit industrial grouping (2-digit SIC code) as this facility, OR surrounding or associated sources that belong to different 2-digit SIC codes are support facilities for this source.

☑ **Yes** ☐ **No**

Common Ownership or Control: Surrounding or associated sources are under common ownership or control as this source.

☑ **Yes** ☐ **No**

Contiguous or Adjacent: Surrounding or associated sources are contiguous or adjacent with this source.

☑ **Yes** ☐ **No**

C. Make a determination:

☑ The source, as described in this application, constitutes the entire source for 20.2.70, 20.2.72, 20.2.73, or 20.2.74 NMAC applicability purposes. If in "A" above you evaluated only the source that is the subject of this application, all "**YES**" boxes should be checked. If in "A" above you evaluated other sources as well, you must check **AT LEAST ONE** of the boxes "**NO**" to conclude that the source, as described in the application, is the entire source for 20.2.70, 20.2.72, 20.2.73, and 20.2.74 NMAC applicability purposes.

☐ The source, as described in this application, **does not** constitute the entire source for 20.2.70, 20.2.72, 20.2.73, or 20.2.74 NMAC applicability purposes (A permit may be issued for a portion of a source). The entire source consists of the following facilities or emissions sources (list and describe):

Section 12

Section 12.A
PSD Applicability Determination for All Sources

(Submitting under 20.2.72, 20.2.74 NMAC)

A PSD applicability determination for all sources. For sources applying for a significant permit revision, apply the applicable requirements of 20.2.74.AG and 20.2.74.200 NMAC and to determine whether this facility is a major or minor PSD source, and whether this modification is a major or a minor PSD modification. It may be helpful to refer to the procedures for Determining the Net Emissions Change at a Source as specified by Table A-5 (Page A.45) of the EPA New Source Review Workshop Manual to determine if the revision is subject to PSD review.

A. This facility is:

- ☑ **a minor PSD source before and after this modification (if so, delete C and D below).**
- ☐ **a major PSD source before this modification. This modification will make this a PSD minor source.**
- ☐ **an existing PSD Major Source that has never had a major modification requiring a BACT analysis.**
- ☐ **an existing PSD Major Source that has had a major modification requiring a BACT analysis**
- ☐ **a new PSD Major Source after this modification.**

The Roswell Municipal Landfill is a minor source of pollutants but, as required by NMED, must obtain and Title V Operating permit. A PSD determination is not required for this application as this is a Title V renewal application being submitted under 20.2.70 NMAC.

Section 13

Determination of State & Federal Air Quality Regulations

<u>This section lists each state and federal air quality regulation that may apply to your facility and/or equipment that are stationary sources of regulated air pollutants.</u>

Not all state and federal air quality regulations are included in this list. Go to the Code of Federal Regulations (CFR) or to the Air Quality Bureau's regulation page to see the full set of air quality regulations.

Required Information for Specific Equipment:
For regulations that apply to specific source types, in the 'Justification' column **provide any information needed to determine if the regulation does or does not apply**. **For example**, to determine if emissions standards at 40 CFR 60, Subpart IIII apply to your three identical stationary engines, we need to know the construction date as defined in that regulation; the manufacturer date; the date of reconstruction or modification, if any; if they are or are not fire pump engines; if they are or are not emergency engines as defined in that regulation; their site ratings; and the cylinder displacement.

Required Information for Regulations that Apply to the Entire Facility:
See instructions in the 'Justification' column for the information that is needed to determine if an 'Entire Facility' type of regulation applies (e.g. 20.2.70 or 20.2.73 NMAC).

Regulatory Citations for Regulations That Do Not, but Could Apply:
If there is a state or federal air quality regulation that does not apply, but you have a piece of equipment in a source category for which a regulation has been promulgated, you must **provide the low level regulatory citation showing why your piece of equipment is not subject to or exempt from the regulation. For example** if you have a stationary internal combustion engine that is not subject to 40 CFR 63, Subpart ZZZZ because it is an existing 2 stroke lean burn stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions, your citation would be 40 CFR 63.6590(b)(3)(i). **We don't want a discussion of every non-applicable regulation, but if it is possible a regulation could apply, explain why it does not. For example,** if your facility is a power plant, you do not need to include a citation to show that 40 CFR 60, Subpart OOO does not apply to your non-existent rock crusher.

Regulatory Citations for Emission Standards:
For each unit that is subject to an emission standard in a source specific regulation, such as 40 CFR 60, Subpart OOO or 40 CFR 63, Subpart HH, include the low level regulatory citation of that emission standard. Emission standards can be numerical emission limits, work practice standards, or other requirements such as maintenance. **Here are examples:** a glycol dehydrator is subject to the general standards at 63.764C(1)(i) through (iii); an engine is subject to 63.6601, Tables 2a and 2b; a crusher is subject to 60.672(b), Table 3 and all transfer points are subject to 60.672(e)(1)

Federally Enforceable Conditions:
All federal regulations are federally enforceable. All Air Quality Bureau State regulations are federally enforceable except for the following: affirmative defense portions at 20.2.7.6.B, 20.2.7.110(B)(15), 20.2.7.11 through 20.2.7.113, 20.2.7.115, and 20.2.7.116; 20.2.37; 20.2.42; 20.2.43; 20.2.62; 20.2.63; 20.2.86; 20.2.89; and 20.2.90 NMAC. Federally enforceable means that EPA can enforce the regulation as well as the Air Quality Bureau and federally enforceable regulations can count toward determining a facility's potential to emit (PTE) for the Title V, PSD, and nonattainment permit regulations.

INCLUDE ANY OTHER INFORMATION NEEDED TO COMPLETE AN APPLICABILITY DETERMINATION OR THAT IS RELEVENT TO YOUR FACILITY'S NOTICE OF INTENT OR PERMIT.

EPA Applicability Determination Index for 40 CFR 60, 61, 63, etc: http://cfpub.epa.gov/adi/

Table for STATE REGULATIONS:

STATE REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION: (You may delete instructions or statements that do not apply in the justification column to shorten the document.)
20.2.1 NMAC	General Provisions	Yes	Facility	General Provisions apply to Notice of Intent, Construction, and Title V permit applications.
20.2.3 NMAC	Ambient Air Quality Standards NMAAQS	Yes	Facility	As this site has obtained a permit from NMED, the NMAAQS have been met. The 2015 Title V renewal application included the most recent air dispersion modeling for this site. As this is a Title V renewal application, with no revisions, air dispersion modeling is not required.
20.2.7 NMAC	Excess Emissions	Yes	Facility	This regulation establishes requirements for the facility if operations at the facility result in any excess emissions. The owner or operator will operate the source at the facility having an excess emission, to the extent practicable, in a manner consistent with good air pollution control practices for minimizing emissions. The facility will also notify the NMED of any excess emissions per 20.2.7.110 NMAC.
20.2.23 NMAC	Fugitive Dust Control	No	N/A	As of December 2020, the only areas of the State subject to a mitigation plan per 40 CFR 51.930 are in Doña Ana and Luna Counties. As this facility is located in Chaves County, 20.2.23 NMAC does not apply.
20.2.33 NMAC	Gas Burning Equipment - Nitrogen Dioxide	No	N/A	This facility does not operate gas burning equipment.
20.2.34 NMAC	Oil Burning Equipment: NO_2	No	N/A	This facility does not have oil burning equipment (external combustion emission sources, such as oil-fired boilers and heaters) having a heat input of greater than 1,000,000 million British Thermal Units per year per unit.
20.2.35 NMAC	Natural Gas Processing Plant – Sulfur	No	N/A	This facility is not a natural gas processing plant.
20.2.37 and 20.2.36 NMAC	Petroleum Processing Facilities and Petroleum Refineries	N/A	N/A	**These regulations were repealed by the Environmental Improvement Board. If you had equipment subject to 20.2.37 NMAC before the repeal, your combustion emission sources are now subject to 20.2.61 NMAC.**
20.2.38 NMAC	Hydrocarbon Storage Facility	No	N/A	This facility is not a petroleum production facility, processing facility, tanks battery, or hydrocarbon storage facility.
20.2.39 NMAC	Sulfur Recovery Plant - Sulfur	No	N/A	This facility is not a sulfur recovery plant and does not include a sulfur recovery plant.
20.2.61.109 NMAC	Smoke & Visible Emissions	No	N/A	This facility does not have Stationary Combustion Equipment, such as engines, boilers, heaters, and flares.
20.2.70 NMAC	Operating Permits	Yes	Facility	An operating permit is required for landfills with higher than 2.5 megagram capacity per NSPS 40 CFR PART 60 Subpart WWW.
20.2.71 NMAC	Operating Permit Fees	Yes	Facility	As 20.2.70 NMAC is applicable to this facility, 20.2.71 NMAC is also applicable.
20.2.72 NMAC	Construction Permits	No	N/A	Landfills **are not** subject to 20.2.72 NMAC unless there is a combustion sources or if there is a process that can trigger 20.2.72. This landfill is subject to NSPS Subpart WWW and is subject to Title V permit but is not required to file for a construction permit.
20.2.73 NMAC	NOI & Emissions Inventory Requirements	Yes	Facility	All facilities that are a Title V Major Source as defined at 20.2.70.7.R NMAC, are subject to Emissions Inventory Reporting.

STATE REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION: (You may delete instructions or statements that do not apply in the justification column to shorten the document.)
20.2.74 NMAC	Permits – Prevention of Significant Deterioration (PSD)	No	N/A	This facility is not a PSD major source.
20.2.75 NMAC	Construction Permit Fees	No	N/A	This facility is not subject to 20.2.72 NMAC and therefore, is not subject to 20.2.75 NMAC.
20.2.77 NMAC	New Source Performance	Yes	Facility	This facility is subject to the requirements of 40 CFR Part 60, Subpart WWW: Standards of Performance for Municipal Solid Waste Landfills.
20.2.78 NMAC	Emission Standards for HAPS	No	N/A	There are no applicable requirements of 40 CFR Part 61 which apply to this facility.
20.2.79 NMAC	Permits – Nonattainment Areas	No	N/A	This facility is located in Chaves County which is in attainment for all pollutants.
20.2.80 NMAC	Stack Heights	No	N/A	Nota applicable as this facility does not contain any sources which contain stacks.
20.2.82 NMAC	MACT Standards for source categories of HAPS	No	N/A	This facility has no sources emitting hazardous air pollutants, which are subject to the requirements of 40 CFR Part 63.

Table for FEDERAL REGULATIONS:

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
40 CFR 50	NAAQS	Yes	Facility	This applies if you are subject to 20.2.70 NMAC.
NSPS 40 CFR 60, Subpart A	General Provisions	Yes	Units subject to 40 CFR 60	Applies as this facility is subject to the requirements of 40 CFR Part 60, Subpart WWW.
NSPS 40 CFR60.40a, Subpart Da	Subpart Da, Performance Standards for **Electric Utility Steam Generating Units**	No	N/A	Does not apply as this facility does not contain an electric utility steam generating unit.
NSPS 40 CFR60.40b Subpart Db	**Electric Utility Steam Generating Units**	No	N/A	(Does not apply as this facility does not contain an electric utility steam generating unit.

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
40 CFR 60.40c, Subpart Dc	Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units	No	N/A	Does not apply as this facility does not contain a steam generating unit.
NSPS 40 CFR 60, Subpart Ka	Standards of Performance for **Storage Vessels for Petroleum Liquids** for which Construction, Reconstruction, or Modification Commenced After May 18, 1978, and **Prior** to July 23, 1984	No	N/A	This facility does not have storage vessels with a storage capacity greater than 151,416 liters (40,000 gallons) that are used to store petroleum liquids for which construction is commenced after May 18, 1978.
NSPS 40 CFR 60, Subpart Kb	Standards of Performance for **Volatile Organic Liquid Storage Vessels** (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced **After** July 23, 1984	No	N/A	This facility does not have storage vessels with a capacity greater than or equal to 75 cubic meters (m^3) that is used to store volatile organic liquids (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984.
NSPS 40 CFR 60.330 Subpart GG	**Stationary Gas Turbines**	No	N/A	There are no turbines at this facility.
NSPS 40 CFR 60, Subpart KKK	Leaks of VOC from **Onshore Gas Plants**	No	N/A	This facility is not an onshore gas plant.
NSPS 40 CFR Part 60 Subpart LLL	Standards of Performance for **Onshore Natural Gas Processing**: SO_2 Emissions	No	N/A	This facility is not an onshore natural gas processing plant.

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
NSPS 40 CFR Part 60 Subpart OOOO	Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution for which construction, modification or reconstruction commenced after August 23, 2011 and before September 18, 2015	No	N/A	This facility is not a crude oil or natural gas facility.
NSPS 40 CFR Part 60 Subpart OOOOa	Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced After September 18, 2015	No	N/A	This facility is not a crude oil or natural gas facility.
NSPS 40 CFR 60 Subpart IIII	Standards of performance for Stationary Compression Ignition Internal Combustion Engines	No	N/A	There are no stationary engines located at this facility that fall into any of the applicable categories under this Subpart.
NSPS 40 CFR Part 60 Subpart JJJJ	Standards of Performance for Stationary Spark Ignition Internal Combustion Engines	No	N/A	There are no stationary engines located at this facility that fall into any of the applicable categories under this Subpart.
NSPS 40 CFR 60 Subpart TTTT	Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units	No	N/A	This facility does not have and electric generating units onsite.
NSPS 40 CFR 60 Subpart UUUU	Emissions Guidelines for Greenhouse Gas Emissions and Compliance Times for Electric Utility Generating Units	No	N/A	This facility does not have and electric utility generating units onsite.

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
NSPS 40 CFR 60, Subparts WWW, XXX, Cc, and Cf	Standards of performance for Municipal Solid Waste (MSW) Landfills	Yes	Facility	40 CFR Part 60, Subpart WWW is applicable to this facility as it applies to MSW Landfills constructed, reconstructed, or modified after May 30, 1991 and has a capacity greater than 2.5 million megagrams. As this facility has not commenced construction, reconstruction or modification after July 17, 2014, 40 CFR Part 60, Subpart XXX does not apply. 40 CFR Part 60, Subpart Cc is not applicable as the site was constructed, reconstructed, or modified after May 30, 1991. This facility must comply with 40 CFR Part 60, Subpart Cf as it was constructed before July 17, 2014.
NESHAP 40 CFR 61 Subpart A	General Provisions	No	N/A	Does not apply as no other Subpart in 40 CFR 61 applies.
NESHAP 40 CFR 61 Subpart E	National Emission Standards for **Mercury**	No	N/A	Not applicable as this site is not a mercury plant.
NESHAP 40 CFR 61 Subpart V	National Emission Standards for **Equipment Leaks** (Fugitive Emission Sources)	No	N/A	This facility does not have sources that are intended to operate in volatile hazardous air pollutant (VHAP) service.
MACT 40 CFR 63, Subpart A	General Provisions	No	N/A	As there are no other Subparts in 40 CFR 63 that apply to this facility, Subpart A does not apply.
MACT 40 CFR 63.760 Subpart HH	**Oil and Natural Gas Production Facilities**	No	N/A	This facility is not an oil or natural gas production facility.
MACT 40 CFR 63 Subpart HHH	National Emission Standards for Hazardous Air Pollutants for Natural Gas Transmission and Storage Facilities	No	N/A	This facility is not a natural gas transmission or storage facility.
MACT 40 CFR 63 Subpart DDDDD	National Emission Standards for Hazardous Air Pollutants for Major Industrial, Commercial, and Institutional Boilers & Process Heaters	No	N/A	There are no boilers or process heaters at this facility.
MACT 40 CFR 63 Subpart UUUUU	National Emission Standards for Hazardous Air Pollutants Coal & Oil Fire Electric Utility Steam Generating Unit	No	N/A	There are no utility steam generating units onsite.

FEDERAL REGU-LATIONS CITATION	Title	Applies? Enter Yes or No	Unit(s) or Facility	JUSTIFICATION:
MACT 40 CFR 63 Subpart ZZZZ	National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (**RICE MACT**)	No	N/A	There are no stationary engines located at this facility that fall into any of the applicable categories under this Subpart.
MACT 40 CFR 63 Subpart CCCCCC	National Emission Standards for Hazardous Air Pollutants for Gasoline Dispensing Facilities	No	N/A	NSPS 40 CFR 63.11116 Subpart CCCCCC applies to this facility because it has a monthly gasoline throughput of 833 gallons per month.
40 CFR 64	**Compliance Assurance Monitoring**	No	N/A	Sources that are subject to emissions standards under either Section 111 or 112 of the federal Clean Air Act (CAA) are exempted from CAM applicability as stated under §64.2(b)(1)(i). This includes 40 CFR Part 60, Subpart WWW. All other equipment onsite does not fall under the general applicability of §64.2(a).
40 CFR 68	**Chemical Accident Prevention**	No	N/A	This facility does not have more than a threshold quantity of a regulated substance in a process, as determined under §68.115.
Title IV – Acid Rain 40 CFR 72	**Acid Rain**	No	N/A	Not applicable as this facility does not generate commercial electric power or electric power for sale.
Title IV – Acid Rain 40 CFR 73	**Sulfur Dioxide** Allowance Emissions	No	N/A	Not applicable as this facility does not generate commercial electric power or electric power for sale.
Title IV-Acid Rain 40 CFR 75	**Continuous Emissions Monitoring**	No	N/A	Not applicable as this facility does not generate commercial electric power or electric power for sale.
Title IV – Acid Rain 40 CFR 76	**Acid Rain** Nitrogen Oxides **Emission Reduction Program**	No	N/A	Not applicable as this facility does not generate commercial electric power or electric power for sale.
Title VI – 40 CFR 82	Protection of **Stratospheric Ozone**	No	N/A	The facility accepts appliances for recycling. The facility operates freon collection equipment to remove freon from appliances. The freon is delivered to a commercial collection site in Roswell. The facility does not "service", "maintain" or "repair" class I or class II appliances nor "disposes" of the appliances. As such, activities at the facility do not qualify as disposal according to the disposal definition in 82.152.

Section 14

Operational Plan to Mitigate Emissions

(Submitting under 20.2.70, 20.2.72, 20.2.74 NMAC)

☑ **Title V Sources** (20.2.70 NMAC)**:** By checking this box and certifying this application the permittee certifies that it has developed an **Operational Plan to Mitigate Emissions During Startups, Shutdowns, and Emergencies** defining the measures to be taken to mitigate source emissions during startups, shutdowns, and emergencies as required by 20.2.70.300.D.5(f) and (g) NMAC. This plan shall be kept on site to be made available to the Department upon request. This plan should not be submitted with this application.

☐ **NSR** (20.2.72 NMAC)**, PSD** (20.2.74 NMAC) **& Nonattainment** (20.2.79 NMAC) **Sources:** By checking this box and certifying this application the permittee certifies that it has developed an **Operational Plan to Mitigate Source Emissions During Malfunction, Startup, or Shutdown** defining the measures to be taken to mitigate source emissions during malfunction, startup, or shutdown as required by 20.2.72.203.A.5 NMAC. This plan shall be kept on site to be made available to the Department upon request. This plan should not be submitted with this application.

☑ **Title V** (20.2.70 NMAC)**, NSR** (20.2.72 NMAC)**, PSD** (20.2.74 NMAC) **& Nonattainment** (20.2.79 NMAC) **Sources:** By checking this box and certifying this application the permittee certifies that it has established and implemented a Plan to Minimize Emissions During Routine or Predictable Startup, Shutdown, and Scheduled Maintenance through work practice standards and good air pollution control practices as required by 20.2.7.14.A and B NMAC. This plan shall be kept on site or at the nearest field office to be made available to the Department upon request. This plan should not be submitted with this application.

The landfill may experience high wind effects during equipment operation and particulate emissions during these events may become excessive as evidenced by visible emissions that are higher than 15 percent continuously. During such times, RMLF staff will try to suppress dust emissions by water spray. If it is difficult to control high visible emission events, the landfill will stop the operations and will commence operation when the wind is calmer.

Section 15

Alternative Operating Scenarios

(Submitting under 20.2.70, 20.2.72, 20.2.74 NMAC)

Alternative Operating Scenarios: Provide all information required by the department to define alternative operating scenarios. This includes process, material and product changes; facility emissions information; air pollution control equipment requirements; any applicable requirements; monitoring, recordkeeping, and reporting requirements; and compliance certification requirements. Please ensure applicable Tables in this application are clearly marked to show alternative operating scenario.

Construction Scenarios: When a permit is modified authorizing new construction to an existing facility, NMED includes a condition to clearly address which permit condition(s) (from the previous permit and the new permit) govern during the interval between the date of issuance of the modification permit and the completion of construction of the modification(s). There are many possible variables that need to be addressed such as: Is simultaneous operation of the old and new units permitted and, if so for example, for how long and under what restraints? In general, these types of requirements will be addressed in Section A100 of the permit, but additional requirements may be added elsewhere. Look in A100 of our NSR and/or TV permit template for sample language dealing with these requirements. Find these permit templates at: https://www.env.nm.gov/aqb/permit/aqb_pol.html. Compliance with standards must be maintained during construction, which should not usually be a problem unless simultaneous operation of old and new equipment is requested.

In this section, under the bolded title "Construction Scenarios", specify any information necessary to write these conditions, such as: conservative-realistic estimated time for completion of construction of the various units, whether simultaneous operation of old and new units is being requested (and, if so, modeled), whether the old units will be removed or decommissioned, any PSD ramifications, any temporary limits requested during phased construction, whether any increase in emissions is being requested as SSM emissions or will instead be handled as a separate Construction Scenario (with corresponding emission limits and conditions, etc.

No alternative operating scenarios are proposed for this facility.

Section 16

Air Dispersion Modeling

1) Minor Source Construction (20.2.72 NMAC) and Prevention of Significant Deterioration (PSD) (20.2.74 NMAC) ambient impact analysis (modeling): Provide an ambient impact analysis as required at 20.2.72.203.A(4) and/or 20.2.74.303 NMAC and as outlined in the Air Quality Bureau's Dispersion Modeling Guidelines found on the Planning Section's modeling website. If air dispersion modeling has been waived for one or more pollutants, attach the AQB Modeling Section modeling waiver approval documentation.
2) SSM Modeling: Applicants must conduct dispersion modeling for the total short term emissions during routine or predictable startup, shutdown, or maintenance (SSM) using realistic worst case scenarios following guidance from the Air Quality Bureau's dispersion modeling section. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.env.nm.gov/aqb/permit/app_form.html) for more detailed instructions on SSM emissions modeling requirements.
3) Title V (20.2.70 NMAC) ambient impact analysis: Title V applications must specify the construction permit and/or Title V Permit number(s) for which air quality dispersion modeling was last approved. Facilities that have only a Title V permit, such as landfills and air curtain incinerators, are subject to the same modeling required for preconstruction permits required by 20.2.72 and 20.2.74 NMAC.

What is the purpose of this application?	Enter an X for each purpose that applies
New PSD major source or PSD major modification (20.2.74 NMAC). See #1 above.	
New Minor Source or significant permit revision under 20.2.72 NMAC (20.2.72.219.D NMAC). See #1 above. **Note:** Neither modeling nor a modeling waiver is required for VOC emissions.	
Reporting existing pollutants that were not previously reported.	
Reporting existing pollutants where the ambient impact is being addressed for the first time.	
Title V application (new, renewal, significant, or minor modification. 20.2.70 NMAC). See #3 above.	
Relocation (20.2.72.202.B.4 or 72.202.D.3.c NMAC)	
Minor Source Technical Permit Revision 20.2.72.219.B.1.d.vi NMAC for like-kind unit replacements.	
Other: i.e. SSM modeling. See #2 above.	
This application does not require modeling since this is a No Permit Required (NPR) application.	
This application does not require modeling since this is a Notice of Intent (NOI) application (20.2.73 NMAC).	
This application does not require modeling according to 20.2.70.7.E(11), 20.2.72.203.A(4), 20.2.74.303, 20.2.79.109.D NMAC and in accordance with the Air Quality Bureau's Modeling Guidelines.	X

Check each box that applies:

☐ See attached, approved modeling **waiver for all** pollutants from the facility.
☐ See attached, approved modeling **waiver for some** pollutants from the facility.
☐ Attached in Universal Application Form 4 (UA4) is a **modeling report for all** pollutants from the facility.
☐ Attached in UA4 is a **modeling report for some** pollutants from the facility.
☑ No modeling is required.

As this is a Title V renewal application and there are no revisions being made to the facility which result in emissions increases that would require modeling, air dispersion modeling is not included in this renewal application. AERMOD Air dispersion modeling for this facility was last performed for the June 2015 Title V application.

Section 17

Compliance Test History

(Submitting under 20.2.70, 20.2.72, 20.2.74 NMAC)

To show compliance with existing NSR permits conditions, you must submit a compliance test history. The table below provides an example.

There is no compliance test history for this facility as the landfill is not required to perform compliance tests for the equipment onsite.

Section 18

Addendum for Streamline Applications

Do not print this section unless this is a streamline application.

Streamline Applications do not require a complete application. Submit Sections 1-A, 1-B, 1-D, 1-F, 1-G, 2-A, 2-C thru L, Sections 3 thru 8, Section 13, Section 18, Section 22, and Section 23 (Certification). Other sections may be required at the discretion of the Department. 20.2.72.202 NMAC Exemptions do not apply to Streamline sources. 20.2.72.219 NMAC revisions and modifications do not apply to Streamline sources, thus 20.2.72.219 type actions require a complete new application submittal. Please do not print sections of a streamline application that are not required.

Not applicable as this is not a Streamline Application.

Section 19

Requirements for Title V Program

Do not print this section unless this is a Title V application.

Who Must Use this Attachment:

* Any major source as defined in 20.2.70 NMAC.
* Any source, including an area source, subject to a standard or other requirement promulgated under Section 111 - Standards of Performance for New Stationary Sources, or Section 112 Hazardous Air Pollutants, of the 1990 federal Clean Air Act ("federal Act"). Non-major sources subject to Sections 111 or 112 of the federal Act are exempt from the obligation to obtain an 20.2.70 NMAC operating permit until such time that the EPA Administrator completes rulemakings that require such sources to obtain operating permits. In addition, sources that would be required to obtain an operating permit solely because they are subject to regulations or requirements under Section 112(r) of the federal Act are exempt from the requirement to obtain an Operating Permit.
* Any Acid Rain source as defined under title IV of the federal Act. The Acid Rain program has additional forms. See http://www.env.nm.gov/aqb/index.html. Sources that are subject to both the Title V and Acid Rain regulations are encouraged to submit both applications simultaneously.
* Any source in a source category designated by the EPA Administrator ("Administrator"), in whole or in part, by regulation, after notice and comment.

19.1 - 40 CFR 64, Compliance Assurance Monitoring (CAM) (20.2.70.300.D.10.e NMAC)

Any source subject to 40CFR, Part 64 (Compliance Assurance Monitoring) must submit all the information required by section 64.7 with the operating permit application. The applicant must prepare a separate section of the application package for this purpose; if the information is already listed elsewhere in the application package, make reference to that location. Facilities not subject to Part 64 are invited to submit periodic monitoring protocols with the application to help the AQB to comply with 20.2.70 NMAC. Sources subject to 40 CFR Part 64, must submit a statement indicating your source's compliance status with any enhanced monitoring and compliance certification requirements of the federal Act.

Sources that are subject emissions standards under either Section 111 or 112 of the federal Clean Air Act (CAA) are exempted from CAM applicability as stated under §64.2(b)(1)(i).

19.2 - Compliance Status (20.2.70.300.D.10.a & 10.b NMAC)

Describe the facility's compliance status with each applicable requirement at the time this permit application is submitted. This statement should include descriptions of or references to all methods used for determining compliance. This statement should include descriptions of monitoring, recordkeeping and reporting requirements and test methods used to determine compliance with all applicable requirements. Refer to Section 2, Tables 2-N and 2-O of the Application Form as necessary. (20.2.70.300.D.11 NMAC) For facilities with existing Title V permits, refer to most recent Compliance Certification for existing requirements. Address new requirements such as CAM, here, including steps being taken to achieve compliance.

At this time, the RMLF is in compliance with each applicable requirement, as required by all state and federal regulations. The most recent Compliance Certification is included within this Section.

19.3 - Continued Compliance (20.2.70.300.D.10.c NMAC)

Provide a statement that your facility will continue to be in compliance with requirements for which it is in compliance at the time of permit application. This statement must also include a commitment to comply with other applicable requirements as they come into effect during the permit term. This compliance must occur in a timely manner or be consistent with such schedule expressly required by the applicable requirement.

At the time of this application, RMLF is in compliance with all applicable state and federal standards promulgated by the Clean Air Act.

19.4 - Schedule for Submission of Compliance (20.2.70.300.D.10.d NMAC)

You must provide a proposed schedule for submission to the department of compliance certifications during the permit term. This certification must be submitted annually unless the applicable requirement or the department specifies a more frequent period. A sample form for these certifications will be attached to the permit.

As per the current Title V permit P187L-R1, the annual certification will be submitted within 30 days following the end of every 12-month reporting period. The 12-month reporting period starts on June 1 of each year. In addition, the semi-annual report of monitoring activities will be submitted within 45 days following the end of every 6-month reporting period. The six-month reporting periods start on June 1st and December 1st of each year.

19.5 - Stratospheric Ozone and Climate Protection

In addition to completing the four (4) questions below, you must submit a statement indicating your source's compliance status with requirements of Title VI, Section 608 (National Recycling and Emissions Reduction Program) and Section 609 (Servicing of Motor Vehicle Air Conditioners).

---

1. Does your facility have any air conditioners or refrigeration equipment that uses CFCs, HCFCs or other ozone-depleting substances? ☑ **Yes** ☐ **No**

2. Does any air conditioner(s) or any piece(s) of refrigeration equipment contain a refrigeration charge greater than 50 lbs? ☐ **Yes** ☑ **No**

   (If the answer is yes, describe the type of equipment and how many units are at the facility.)

3. Do your facility personnel maintain, service, repair, or dispose of any motor vehicle air conditioners (MVACs) or appliances ("appliance" and "MVAC" as defined at 82. 152)? ☐ **Yes** ☑ **No**

4. Cite and describe which Title VI requirements are applicable to your facility (i.e. 40 CFR Part 82, Subpart A through G.)

RMLF is in compliance with requirements of Title VI, Section 608 (National Recycling and Emissions Reduction Program) and Section 609 (Servicing of Motor Vehicle Air Conditioners). The facility accepts appliances for recycling. The facility operates freon collection equipment to remove freon from appliances. The freon is delivered to a commercial collection site in Roswell. The facility does not “service”, “maintain” or “repair” class I or class II appliances nor “disposes” of the appliances. As such, activities at the facility do not qualify as disposal according to the disposal definition in 82.152.

19.6 - Compliance Plan and Schedule

Applications for sources, which are not in compliance with all applicable requirements at the time the permit application is submitted to the department, must include a proposed compliance plan as part of the permit application package. This plan shall include the information requested below:

A. Description of Compliance Status: (20.2.70.300.D.11.a NMAC)
A narrative description of your facility's compliance status with respect to all applicable requirements (as defined in 20.2.70 NMAC) at the time this permit application is submitted to the department.

B. Compliance plan: (20.2.70.300.D.11.B NMAC)
A narrative description of the means by which your facility will achieve compliance with applicable requirements with which it is not in compliance at the time you submit your permit application package.

C. Compliance schedule: (20.2.70.300D.11.c NMAC)
A schedule of remedial measures that you plan to take, including an enforceable sequence of actions with milestones, which will lead to compliance with all applicable requirements for your source. This schedule of compliance must be at least as stringent as that contained in any consent decree or administrative order to which your source is subject. The obligations of any consent decree or administrative order are not in any way diminished by the schedule of compliance.

D. Schedule of Certified Progress Reports: (20.2.70.300.D.11.d NMAC)
A proposed schedule for submission to the department of certified progress reports must also be included in the compliance schedule. The proposed schedule must call for these reports to be submitted at least every six (6) months.

E. Acid Rain Sources: (20.2.70.300.D.11.e NMAC)
If your source is an acid rain source as defined by EPA, the following applies to you. For the portion of your acid rain source subject to the acid rain provisions of title IV of the federal Act, the compliance plan must also include any additional requirements under the acid rain provisions of title IV of the federal Act. Some requirements of title IV regarding the schedule and methods the source will use to achieve compliance with the acid rain emissions limitations may supersede the requirements of title V and 20.2.70 NMAC. You will need to consult with the Air Quality Bureau permitting staff concerning how to properly meet this requirement.

NOTE: The Acid Rain program has additional forms. See http://www.env.nm.gov/aqb/index.html. Sources that are subject to both the Title V and Acid Rain regulations are **encouraged** to submit both applications **simultaneously**.

At this time, the RMLF is in compliance with each applicable requirement, as required by all state and federal regulations. The most recent annual Compliance Certification included within this Section. See the discussions above about schedules of reports.

19.7 - 112(r) Risk Management Plan (RMP)

Any major sources subject to section 112(r) of the Clean Air Act must list all substances that cause the source to be subject to section 112(r) in the application. The permittee must state when the RMP was submitted to and approved by EPA.

Not applicable; municipal landfills are not subject to Section 112R.

19.8 - Distance to Other States, Bernalillo, Indian Tribes and Pueblos

Will the property on which the facility is proposed to be constructed or operated be closer than 80 km (50 miles) from other states, local pollution control programs, and Indian tribes and pueblos (20.2.70.402.A.2 and 20.2.70.7.B NMAC)?

(If the answer is yes, state which apply and provide the distances.)

The facility is not located within 80 kilometers of other states, local pollution control programs, or pueblos.

19.9 - Responsible Official

Provide the Responsible Official as defined in 20.2.70.7.AD NMAC:

Joe Neeb - Roswell City Manager
(575) 624-6746
j.neeb@roswell-nm.gov

TIER 2 SITE NON-METHANE ORGANIC COMPOUND SAMPLING REPORT

ROSWELL MUNICIPAL LANDFILL

ROSWELL, NEW MEXICO

Permit No. P187L-R1

PREPARED FOR:
City of Roswell
425 N. Richardson Avenue
Roswell, NM 88203

Souder, Miller & Associates
Engineering • Environmental • Surveying
8000 W. 14th Avenue • Lakewood, CO 80214
(303 239-9011 • fax (303) 239-0745 • www.soudermiller.com

April 16, 2018 #4422745

Mr. Michael Mayes, Landfill Supervisor
City of Roswell Municipal Landfill
3006 West Brasher Road
Roswell, New Mexico 88203

RE: Tier 2 Sampling Report, Roswell Municipal Landfill, Roswell, New Mexico, Permit No. P187L-R1

Dear Mr. Mayes:

Souder, Miller & Associates is pleased to submit the enclosed Tier 2 Sampling Report for the Roswell Municipal Landfill.

The Roswell Municipal Landfill operates under Title V Operating Permit No. P187L-R1, which was issued by the New Mexico Environment Department (NMED) Air Quality Bureau (AQB) on February 17, 2017. According to Condition A110.A.1 of the operating permit, the facility is required to perform Tier 2 sampling in accordance with New Source Performance Standards (NSPS) 40 CFR 60, Subpart WWW within one year of the issuance date of the operating permit. The testing results must be used to complete calculation of the facility's NMOC emissions required under 40 CFR 60.754 and Condition A701.A of the operating permit. The 2018 Tier 2 sampling event was completed in compliance with this condition from January 22-26, 2018

If you have any questions or comments, please feel free to call me at the above number, on my cell at 505.220.6542, or to e-mail me at scott.mckitrick@soudermiller.com .

Sincerely,
SOUDER, MILLER AND ASSOCIATES

Scott A. McKitrick, P.G.
Senior Geoscientist / Environmental Services Manager

Encl: Tier 2 Sampling Report

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LIST OF APPENDICES

1.0 INTRODUCTION

The Tier 2 sampling event for Roswell Municipal Landfill (hereafter referred to as “facility”) located in Roswell, New Mexico, was conducted from January 22-26, 2018.

This report summarizes the field sampling, analytical results, and emissions estimates in support of a Tier 2 evaluation of non-methane organic carbon (NMOC) emissions at the facility, which is a municipal solid waste (MSW) landfill located approximately 6 miles southwest of Roswell, New Mexico.

The facility operates under Title V Operating Permit No. P187L-R1, which was issued by the New Mexico Environment Department (NMED) Air Quality Bureau (AQB) on February 17, 2017. According to Condition A110.A.1 of the operating permit, the facility is required to perform Tier 2 sampling in accordance with New Source Performance Standards (NSPS) 40 CFR 60, Subpart WWW within one year of the issuance date of the operating permit. The testing results must be used to complete calculation of the facility’s NMOC emissions required under 40 CFR 60.754 and Condition A701.A of the operating permit. The 2018 Tier 2 sampling event was completed in compliance with this condition.

2.0 FIELD PROCEDURES

To date, approximately 67 acres (27 hectares) of permitted disposal area have received wastes that are more than two years old. According to 40 CFR 60.754, there shall be at least two sample probes per hectare of landfill surface that has retained waste for at least two years. If the landfill surface is over 25 hectares, then only 50 sample probes are required. Therefore, 50 samples were taken at the facility.

A total of 50 sampling points were selected on an evenly spaced pattern across the facility. All sampling points were marked on the landfill by the subcontractor hired to complete the sampling event, Vista Geoscience LLC of Golden, CO. The *Google Earth Map of Sample Locations* in Appendix A presents the sampling points.

All samples were collected between January 22-26, 2018. Field sampling was conducted in a manner consistent with the United States Environmental Protection Agency (EPA) Air Quality Test Method 25C. Soil gas samples were collected through the use of a direct push rig operation by Vista Geoscience. The standard Tier 2 method requires penetrating the landfill surface and interim cover, so the sample depths were approximately 10 feet below the landfill surface.

A total of 17 Summa® canisters were used to collected 50 landfill gas samples from within the waste mass. All samples were collected in stainless steel Summa® canisters partially filled with helium by the analytical laboratory. All steel canisters were leak-tested by the analytical laboratory to verify that the valve and collection port on each tank was not leaking. Each canister was used to collect composite samples of two to three samples per canister. Each sampling point was documented in a field log with the laboratory canister number and sampling point. Date, time, depth of sampling point and initial sampling vacuum were also recorded in field logs. A copy of the field log, and sampling standard operating procedures used by Vista Geoscience is provided in Appendix 1.

3.0 LABORATORY RESULTS

Samples were packaged by Vista Geoscience and shipped to Air Technology Laboratories, Inc. in City of Industry, California for analysis by EPA Method 25C and Method 3C. All samples were processed in the laboratory with a gas chromatographic column to separate NMOC from fixed gases. Consistent with EPA Method 25C quality control requirements, each sample was first testing according to EPA Method 3C protocols for nitrogen and oxygen concentration using a thermal conductivity detector. Laboratory report for the EPA Method 25C and 3C results is located in Appendix 1. Table 1 (Appendix B) presents a summary of these results.

The laboratory results for 14 of the 17 Summa® canisters were also corrected for oxygen, as applicable if the tested volume of nitrogen is greater than 20% and the volume of oxygen is less than 5%. Three of the 17 canisters were corrected for nitrogen and moisture as applicable for samples if the tested volume of nitrogen is less than 20% and the volume of oxygen is less than 5%.

A weighted average of the NMOC concentration (ppmv as carbon) for each sample was calculated. Results were within the acceptable range of data collected at landfills. This value was then divided by six to convert from ppmv NMOC as carbon to ppmv NMOC as hexane and used as the site-specific NMOC concentration for the facility.

The EPA Method 25C results revealed that the weighted average NMOC concentration at the facility was 384 ppmv as hexane. This value was used to evaluate NMOC emissions consistent with Tier 2 protocols.

4.0 NMOC EMISSION RATE CALCULATION

A revised NMOC emission rate calculation was performed with the site-specific NMOC concentration as described in Section 3.0. The calculation was performed using the EPA LFG Emission Model Version 3.02 (LandGEM). Default values (as appropriate), the site-specific NMOC concentration, historical waste receipts for degradable solid waste, and the projected future waste acceptance rates for Roswell Municipal Landfill were used.

The equation specified in 40 CFR 60.754 when the year-to-year solid waste acceptance rate is known is shown below:

$$M_{NMOC} = \sum_{i=1}^{n} 2\,k\,L_o M_i \left(e^{-kt_i}\right)\left(C_{NMOC}\right)\left(3.6\times10^{-9}\right)$$

where:

M_{NMOC} = Total emission rate from landfill (Mg/yr)
K = Methane generation constant = 0.02/yr, arid climate default value
L_0 = Methane generation potential = 170 cubic meters per megagram (m^3/Mg), default value
M_i = Mass of waste in the ith section – Mg
t_i = Age of ith section of waste – years

C_{NMOC} = Site-specific NMOC concentration of 384 ppmv

LandGEM determined the NMOC emissions for year 2018 at the facility to be 10.89 Mg/year. The results of the LandGEM calculations are presented in Appendix 3. The NMOC emission rate calculation indicates that the facility does not exceed the 34 Mg/year threshold for installation of a gas collection and control system (GCCS) for 2018 and is not expected to exceed the threshold limit value over the next five years.

Table 1 - NMOC Emission Rate

Year	Refuse in Place (Mg)	NMOC (Mg/year)	NMOC (m^3/year)
2018	1,644,856	10.89	3,038
2019	1,695,448	11.14	3,108
2020	1,746,041	11.39	3,178
2021	1,796,634	11.63	3,246
2022	1,847,227	11.87	3,312
2023	1,897,819	12.11	3,378

The calculated NMOC emissions for year 2018 using the newly determine C_{NMOC} value of 384 ppmv is less than the previously calculated NMOC emissions of 1,184 ppmv using the previously determined C_{NMOC} value of 710 ppmv.

The facility will continue to calculate NMOC emissions annually (per condition A701.A of the operating permit) using the C_{NMOC} value from Section 3.0 of this report. The next Tier 2 sampling event will occur in January 2023.

APPENDIX 1

Field Data and Laboratory Results

Expert Environmental
Support Services for Site
Investigation & Remediation

February 12, 2018

Scott McKitrick
Souder, Miller & Associates
3451 Candelaria Rd., NE, #D
PHONE: 505-299-0942

RE: **Project No. 17317.01; Final Field Collection Data Report**
Roswell Municipal Landfill Tier II NMOC Gas Survey
3006 W. Brasher Road, Roswell, NM, 88203

Dear Mr McKitrick,

Please find the enclosed report containing the compiled data for the Tier-2 NMOC Landfill Gas Survey, conducted Janurary 22nd through the 26th, at the Roswell Municipal Landfill. The enclosed report contains the following information:

1. Tier-2 Sampling Data Log
2. Table of Sample Location Coordinates
3. Google Earth Map of Sample Locations
4. Laboratory Results
5. Daily Reports, Field Notes, and Calibration Logs
6. Vista GeoScience Tier-2 NMOC Landfill Gas Sampling SOP

Please feel free to call us if you have any questions regarding the data or collection methods described herein.

Sincerely,

Ted Stockwell
Geologist
(O): 303.277.1694
(M): 815.545.1117

Final Field Collection Data Report

Roswell Municipal Landfill

3006 W Brasher Road

Roswell, New Mexico

Prepared for:

Souder, Miller & Associates
Engineering ♦ Environmental
Surveying

February 12, 2018

Tier-2 Sampling Data Logs

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EPA TEST METHOD 25C TIER-2 LANDFILL GAS SAMPLING LOG

Page _ 1

Vista GeoScience

www.VistaGeoScience.com
130 Capital Drive, Suite C
Golden, CO 80401
PH: 303-277-1694

Project No.: 17317.01 | **Sampling Technician:** Ted Stockwell | **Signature:**________________________

CLIENT: Sounder Miller | **Gas Meter:** Gem 2000+ | **Calibration Check** (date/time): 1/22/18 - 1/26/18

CLIENT FIELD REP: Alice | **Rig/Probe:** 7822DT | **Flowmeter** (ml/min): Omega Mod:SMR101-0011

LANDFILL NAME: Roswell Municipal LF | **Vacuum Guage:** Ashcroft 2074

LANDFILL ADDRESS: 3006 W. Brasher Rd, Roswell, NM

			SYSTEM PRE-PURGE TIME				IR GAS METER ANALYSIS					SUMMA CANNISTER PRESSURE- VOLUME								Depth (ft.)		Temp.	Temp.		Summa
Date	Sample Location Number	Canister Lab I.D.	Start Time	End Time	Flow (ml/min)	Est. Vol. (Liters)	CH_4 %	CO_2 %	O_2 %	N_2 % Bal.	Total Check	Start Time	End Time	Start Flow	End Flow	Initial P. (mm Hg)	Final P. (mm Hg)	Δ Press. mmHg	Est. Δ Vol. Calc. (Liters)	Top	Btm	Bottom °F	Ambient °F	Ambient Press. (IN HG)	Initial Pressure
01/22/18	RNM1-1	1356	11:28	11:30	400	0.8	17.4	28.1	0.0	54.4	99.9	11:36	11:41	200	200	-454.80	-336.2	118.6	1.06	9	10	90.5	28	26.34	-454.8
01/22/18	RNM1-2	1356	11:56	11:57	400	0.4	16.4	27.8	0.0	55.7	99.9	11:59	12:08	200	200	-334.35	-201.55	132.8	1.1910	9	10	89.1	34	26.34	-454.8
01/22/18	RNM1-3	1356	12:15	12:17	400	0.8	11.9	26.3	0.0	61.7	99.9	12:19	12:26	200	200	-206.25	-46.65	159.6	1.43	9	10	91.4	40	26.34	-454.8
01/22/18	RNM1-4	1479	13:01	13:04	400	1.2	20.5	29.8	0.0	50.0	100.3	13:04	13:10	200	200	-442.60	-314.65	128.0	1.1475	9	10	91	51	26.33	-442.6
01/22/18	RNM1-5	1479	13:39	13:42	400	1.2	22.6	31.4	0.0	45.9	99.9	13:42	13:50	200	200	-309.25	-189.40	119.9	1.07	9	10	85	53	26.33	-442.6
01/22/18	RNM1-6	1479	14:02	14:04	400	0.8	26.2	31.0	0.0	42.6	99.8	14:04	14:11	200	200	-189.95	-62.15	127.8	1.1462	9	10	78	54	26.32	-442.6
01/22/18	RNM1-7	3545	14:34	14:36	400	0.8	42.4	35.6	0.0	21.9	99.9	14:36	14:42	200	200	-445.70	-312.8	132.9	1.19	9	10	80	57	26.32	-445.7
01/22/18	RNM1-8	3545	15:02	15:04	400	0.8	31.8	34.7	0.0	33.4	99.9	15:04	16:10	200	200	-310.0	-190.8	119.2	1.0691	9	10	85	58	26.32	-445.7
01/22/18	RNM1-9	3545	15:20	15:32	400	4.8	35.5	31.9	0.2	32.2	99.8	15:32	15:40	200	200	-190.80	-60.95	129.9	1.16	9	10	85	58	26.33	-445.7
01/22/18	RNM1-10	5476	15:54	15:57	400	1.2	9.6	25.6	0.0	64.8	100.0	15:57	16:05	200	200	-442.40	-311.1	131.3	1.1776	9	10	87	60	26.33	-442.4
01/23/18	RNM1-11	5476	8:46	8:54	400	3.2	37.5	34.1	0.1	28.3	100.0	8:54	9:04	200	200	-312.30	-181.75	130.6	1.17	9	10	71	33	26.45	-442.4
01/23/18	RNM1-12	5476	9:19	9:22	400	1.2	44.4	38.1	0.0	17.0	99.5	9:22	9:31	200	200	-181.75	-48	133.8	1.1996	9	10	73	33	26.46	-442.4
01/23/18	RNM1-13	3182	9:55	10:11	400	2.4	36.9	33.8	1.0	28.3	100.0	10:11	10:20	200	200	-450.00	-321.4	128.6	1.15	9	10	80	35	26.46	-450
01/23/18	RNM1-14	3182	11:00	11:02	400	0.8	36.4	35.3	0.0	27.4	99.1	11:02	11:10	200	200	-321.4	-190.65	130.8	1.1726	9	10	88	40	26.46	-450
01/23/18	RNM1-15	3182	15:55	16:00	400	2	20.0	28.3	0.0	51.4	99.7	16:00	16:10	200	200	-189.40	-59.1	130.3	1.17	9	10	78	50	26.40	-450
01/23/18	RNM1-16	1466	16:30	16:44	400	5.6	22.4	30.1	0.1	47.2	99.8	16:44	16:52	200	200	-447.2	-311.8	135.4	1.2143	8	10	77	50	26.41	-447.2
01/24/18	RNM1-17	1466	9:05	9:15	400	2.4	54.2	33.5	0.2	11.9	99.8	9:15	9:23	200	200	-303.6	-171.25	132.4	1.19	9	10	75	32	26.61	-447.2
01/24/18	RNM1-18	1466	9:38	9:47	400	3.6	8.5	24.2	0.9	66.3	99.9	9:47	9:55	200	200	-169.70	-40.4	129.3	1.1596	9	10	78	34	26.61	-447.2
01/24/18	RNM1-19	1350	10:37	10:47	400	4	14.2	24.2	0.3	60.9	99.6	10:47	10:58	200	200	-428.7	-301.45	127.3	1.14	9	10	78	36	26.61	-428.7
01/24/18	RNM1-20	1350	11:03	11:05	400	0.8	24.3	30.4	0.0	45.2	99.9	11:05	11:13	200	200	-305.00	-176.50	128.5	1.1525	14	15	78	40	26.59	-428.7
01/24/18	RNM1-21	1350	12:02	12:06	400	1.6	22.5	29.7	0.0	47.7	99.9	12:06	12:15	200	200	-181.30	-50.5	130.8	1.17	9	10	78	40	26.53	-428.7
01/24/18	RNM1-22	5461	12:40	12:42	400	0.8	5.7	22.6	0.0	71.7	100.0	12:42	12:50	200	200	-428.15	-296.4	131.8	1.1816	9	10	76	40	26.51	-428.15
01/24/18	RNM1-23	5461	13:32	13:34	400	0.8	10.2	25.6	0.0	64.1	99.9	13:34	13:44	200	200	-296.00	-164.9	131.1	1.18	9	10	80	44	26.49	-428.15
01/24/18	RNM1-24	5461	14:00	14:03	400	1.2	45.3	34.6	0.0	20.0	99.9	14:12	14:12	200	200	-162.75	-33.7	129.1	1.1574	9	10	74	50	26.49	-428.15

EPA TEST METHOD 25C TIER-2 LANDFILL GAS SAMPLING LOG

Page ___ of ___

Vista GeoScience
www.VistaGeoScience.com
130 Capital Drive, Suite C
Golden, CO 80401
PH: 303-277-1694

Project No.: 17317.01
Sampling Technician: Ted Stockwell **Signature:**________________________
CLIENT: Sounder Miller
Gas Meter: Gem 2000+
Calibration Check (date/time): 1/22/18 - 1/26/18
CLIENT FIELD REP: Alice
Rig/Probe: 7822DT
Flowmeter (ml/min): Omega Mod:SMR101-0011
LANDFILL NAME: Roswell Municipal LF
Vacuum Guage: Ashcroft 2074
LANDFILL ADDRESS: 3006 W. Brasher Rd, Roswell, NM

			SYSTEM PRE-PURGE TIME				IR GAS METER ANALYSIS					SUMMA CANNISTER PRESSURE- VOLUME								Depth (ft.)		Temp.	Temp.		Summa
Date	Sample Location Number	Canister Lab I.D.	Start Time	End Time	Flow (ml/min)	Est. Vol. (Liters)	CH_4 %	CO_2 %	O_2 %	N_2 % Bal.	Total Check	Start Time	End Time	Start Flow	End Flow	Initial P. (mm Hg)	Final P. (mm Hg)	Δ Press. mmHg	Est. Δ Vol. Calc. (Liters)	Top	Btm	Bottom °F	Ambient °F	Ambient Press. (IN HG)	Initial Pressure
01/24/18	RNM1-25	3744	14:32	14:35	400	1.2	25.6	30.1	0.0	44.3	100.0	14:35	14:42	200	200	-436.95	-305	132.0	1.18	9	10	78	50	26.48	-436.95
01/24/18	RNM1-26	3744	15:12	15:17	400	2	5.5	24.0	0.0	70.3	99.8	15:17	15:26	200	200	-306.45	-176.65	129.8	1.1641	9	10	78	48	26.47	-436.95
01/24/18	RNM1-27	3744	15:40	15:44	400	1.6	11.2	24.6	0.1	64.1	100.0	15:44	15:54	200	200	-175.60	-32.15	143.5	1.29	9	10	76	46	26.47	-436.95
01/24/18	RNM1-28	1382	16:13	16:18	400	2	13.4	24.3	0.0	61.8	99.5	16:18	16:26	200	200	-442.35	-311.8	130.55	1.1709	9	10	80	46	26.47	-442.35
01/25/18	RNM1-29	1382	9:09	9:12	400	1.2	1.1	20.4	0.0	78.5	100.0	9:12	9:20	200	200	-307.80	-177.55	130.3	1.17	9	10	77	34	26.42	-442.35
01/25/18	RNM1-30	1382	9:35	9:38	400	1.2	14.8	26.8	0.0	58.2	99.8	9:38	9:46	200	200	-177.95	-46.85	131.1	1.1758	9	10	78	34	26.43	-442.35
01/25/18	RNM1-31	1377	10:16	10:19	400	1.2	20.0	30.9	0.0	49.0	99.9	10:19	10:26	200	200	-436.70	-306.1	130.6	1.17	14	15	78	36	26.41	-436.7
01/25/18	RNM1-32	1377	10:43	10:46	400	1.2	18.0	27.8	0.0	53.9	99.7	10:46	10:54	200	200	-305.10	-176.6	128.5	1.1525	9	10	80	38	26.42	-436.7
01/25/18	RNM1-33	1377	11:04	11:07	400	1.2	8.4	23.2	0.0	68.3	99.9	11:07	11:15	200	200	-175.20	-45.2	130.0	1.17	9	10	82	40	26.40	-436.7
01/25/18	RNM1-34	3588	11:36	11:38	400	0.8	13.4	26.9	0.0	59.7	100.0	11:38	11:46	200	200	-422.80	-292	130.8	1.1731	9	10	80	42	26.38	-422.8
01/25/18	RNM1-35	3588	12:03	12:06	400	1.2	10.3	25.6	0.0	64.1	100.0	12:06	12:14	200	200	-287.3	-153.4	133.9	1.20	8	10	80	44	26.36	-422.8
01/25/18	RNM3-1	3588	12:36	12:40	400	1.6	51.8	44.6	0.0	3.4	99.8	12:40	12:48	200	200	-152.4	-32.45	119.95	1.0758	9	10	78	44	26.36	-422.8
01/25/18	RNM3-2	1423	13:02	13:05	400	1.2	45.7	49.2	0.0	4.8	99.7	13:05	13:13	200	200	-428.35	-300.55	127.8	1.15	9	10	77	44	26.34	-428.35
01/25/18	RNM3-3	1423	13:23	13:26	400	1.2	57.9	40.5	0.0	1.5	99.9	13:26	13:34	200	200	-298.1	-168.4	129.7	1.1632	9	10	79	44	26.32	-428.35
01/25/18	RNM3-4	1423	13:47	13:50	400	1.2	47.1	49.5	0.0	3.2	99.8	13:50	13:58	200	200	-168.35	-36	132.4	1.19	8	10	80	44	26.30	-428.35
01/25/18	RNM3-5	1474	14:17	14:20	400	1.2	43.8	54.5	0.0	1.5	99.8	14:20	14:28	200	200	-433.90	-303.4	130.5	1.1704	9	10	80	42	26.28	-433.9
01/25/18	RNM3-6	1474	14:42	14:45	400	1.2	39.6	53.4	0.2	3.2	96.4	14:45	14:53	200	200	-303.2	-171.25	132.0	1.18	9	10	78	42	26.26	-433.9
01/25/18	RNM3-7	1474	15:08	15:11	400	1.2	46.6	50.2	0.0	3.2	100.0	15:11	15:19	200	200	-169.85	-33.4	136.45	1.2238	9	10	76	40	26.24	-433.9
01/25/18	RNM2-8	5432	16:07	16:10	400	1.2	27.8	29.4	0.0	42.5	99.7	16:10	16:18	200	200	-432.7	-303.25	129.5	1.16	9	10	78	42	26.22	-432.7
01/26/18	RNM2-7	5432	9:05	9:16	400	2.8	19.7	28.7	0.2	51.3	99.9	9:16	9:24	200	200	-308.2	-178.25	129.95	1.1655	9	10	80	32	26.23	-432.7
01/26/18	RNM2-6	5432	9:36	9:39	400	1.2	11.9	25.9	0.0	62.1	99.9	9:39	9:47	200	200	-174.95	-42.15	132.8	1.19	9	10	80	32	26.23	-432.7
01/26/18	RNM2-5	5435	10:06	10:09	400	1.2	43.8	27.9	0.0	28.1	99.8	10:09	10:17	200	200	-420.60	-193.8	226.8	2.0341	9	10	76	34	26.25	-420.6
01/26/18	RNM2-4	5435	10:38	10:41	400	1.2	59.4	34.7	0.0	6.0	100.1	10:41	10:49	200	200	-291.05	-160.9	130.2	1.17	9	10	78	36	26.25	-420.6
01/26/18	RNM2-3	5435	11:17	11:20	400	1.2	49.4	38.8	0.0	11.8	100.0	11:20	11:28	200	200	-160.9	-30.45	130.45	1.1700	9	10	77	40	26.25	-420.6
01/26/18	RNM2-2	3108	11:45	11:50	400	2	50.2	37.1	0.0	13.3	100.6	11:50	11:58	200	200	-422.4	-277.10	145.3	1.30	9	10	80	44	26.22	-422.4
01/26/18	RNM2-1	3108	13:11	13:14	400	1.2	14.6	25.0	0.0	60.1	99.7	13:14	13:22	200	200	-278.6	-140.4	138.2	1.2395	9	10	78	48	26.20	-422.4

Tables of Sample Location Coordinates

Location	Date	Zone (UTM)	Easting (UTM)	Northing (UTM)	Latitude	Longitude
RNM1-1	1/22/2018	13S	540070	3689734	N33.34605	W104.56937
RNM1-2	1/22/2018	13S	540136	3689730	N33.34601	W104.56867
RNM1-3	1/22/2018	13S	540184	3689729	N33.34600	W104.56815
RNM1-4	1/22/2018	13S	540226	3689728	N33.34599	W104.56770
RNM1-5	1/22/2018	13S	540285	3689727	N33.34598	W104.56706
RNM1-6	1/22/2018	13S	540288	3689679	N33.34554	W104.56703
RNM1-7	1/22/2018	13S	540230	3689681	N33.34557	W104.56766
RNM1-8	1/22/2018	13S	540190	3689684	N33.34560	W104.56808
RNM1-9	1/22/2018	13S	540144	3689690	N33.34565	W104.56858
RNM1-10	1/22/2018	13S	540067	3689695	N33.34569	W104.56940
RNM1-11	1/23/2018	13S	540068	3689653	N33.34532	W104.56939
RNM1-12	1/23/2018	13S	540137	3689651	N33.34530	W104.56865
RNM1-13	1/23/2018	13S	540189	3689655	N33.34533	W104.56809
RNM1-14	1/23/2018	13S	540232	3689653	N33.34531	W104.56763
RNM1-15	1/23/2018	13S	540283	3689646	N33.34525	W104.56709
RNM1-16	1/23/2018	13S	540295	3689599	N33.34483	W104.56696
RNM1-17	1/24/2018	13S	540240	3689605	N33.34488	W104.56755
RNM1-18	1/24/2018	13S	540196	3689615	N33.34497	W104.56803
RNM1-19	1/24/2018	13S	540137	3689613	N33.34495	W104.56866
RNM1-20	1/24/2018	13S	540055	3689612	N33.34495	W104.56953
RNM1-21	1/24/2018	13S	540048	3689575	N33.34462	W104.56961
RNM1-22	1/24/2018	13S	540154	3689581	N33.34467	W104.56847
RNM1-23	1/24/2018	13S	540203	3689576	N33.34462	W104.56795
RNM1-24	1/24/2018	13S	540235	3689575	N33.34461	W104.56761
RNM1-25	1/24/2018	13S	540288	3689565	N33.34452	W104.56703
RNM1-26	1/24/2018	13S	540306	3689518	N33.34409	W104.56684
RNM1-27	1/24/2018	13S	540249	3689515	N33.34407	W104.56746
RNM1-28	1/24/2018	13S	540202	3689526	N33.34417	W104.56796
RNM1-29	1/25/2018	13S	540157	3689533	N33.34424	W104.56844
RNM1-30	1/25/2018	13S	540044	3689536	N33.34427	W104.56966
RNM1-31	1/25/2018	13S	540042	3689480	N33.34376	W104.56968
RNM1-32	1/25/2018	13S	540148	3689451	N33.34349	W104.56855
RNM1-33	1/25/2018	13S	540179	3689456	N33.34354	W104.56821
RNM1-34	1/25/2018	13S	540246	3689457	N33.34355	W104.56749
RNM1-35	1/25/2018	13S	540302	3689459	N33.34356	W104.56689

Location	Date	Zone (UTM)	Easting (UTM)	Northing (UTM)	Latitude	Longitude
RNM3-1	1/25/2018	13S	540471	3689485	N33.34379	W104.56508
RNM3-2	1/25/2018	13S	540489	3689479	N33.34373	W104.56488
RNM3-3	1/25/2018	13S	540522	3689489	N33.34382	W104.56452
RNM3-4	1/25/2018	13S	540526	3689524	N33.34421	W104.56447
RNM3-5	1/25/2018	13S	540468	3689522	N33.34369	W104.56510
RNM3-6	1/25/2018	13S	540474	3689546	N33.34318	W104.56503
RNM3-7	1/25/2018	13S	540527	3689550	N33.34273	W104.56446
RNM2-1	1/26/2018	13S	539917	3689713	N33.34587	W104.57101
RNM2-2	1/26/2018	13S	539907	3689665	N33.34543	W104.57112
RNM2-3	1/26/2018	13S	539905	3689589	N33.34475	W104.57115
RNM2-4	1/26/2018	13S	539908	3689529	N33.34421	W104.57112
RNM2-5	1/26/2018	13S	539929	3689472	N33.34369	W104.57090
RNM2-6	1/26/2018	13S	539940	3689415	N33.34318	W104.57078
RNM2-7	1/26/2018	13S	539973	3689366	N33.34273	W104.57043
RNM2-8	1/25/2018	13S	540009	3689319	N33.34231	W104.57004

Google Earth Map of Sample Locations

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Roswell Municpal Landfill
3006 W Brasher Road, Roswell, NM
Legend
Gas Sampling Location
RNM2-1
RNM2-2
RNM2-3
RNM2-4
RNM2-5
RNM2-6
RNM2-7
RNM2-8
RNM1-1
RNM1-3
RNM1-5
RNM1-10
RNM1-9
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RNM1-34
RNM1-32
RNM3-7
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RNM3-4
RNM3-5
RNM3-3
RNM3-1
Google Earth
©2018 Google
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1000 ft

Laboratory Results

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Client: Vista Geoscience
Attn: Jeff Zajdel
Project Name: Roswell LF Tier II Sampling
Project No.: 17317.01
Date Received: 2/1/2018
Matrix: Air

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

Lab No.:		J020108-01		J020108-02		J020108-03		J020108-04	
Client Sample I.D.:		Can 1356 / RNMI 1-1, 1-2, 1-3		Can 1479 / RNMI 1-4, 1-5, 1-6		Can 5476 / RNMI 1-10, 1-11, 1-12		Can 3545 / RNMI 1-7, 1-8, 1-9	
Date/Time Sampled:		1/22/18 12:26		1/22/18 14:11		1/22/18 9:31		1/22/18 15:40	
Date/Time Analyzed:		2/5/18 11:09		2/5/18 11:55		2/5/18 12:39		2/5/18 13:23	
QC Batch No.:		180205GC8A1		180205GC8A1		180205GC8A1		180205GC8A1	
Analyst Initials:		AS		AS		AS		AS	
Dilution Factor:		3.0		3.2		3.0		3.2	
ANALYTE	(Units)	Result	RL	Result	RL	Result	RL	Result	RL
TNMOC O2 corrected	(ppmv-C)	1,700	30	2,100	32	1,100	30	1,500	32
TNMOC uncorrected	(ppmv-C)	1,500	30	2,000	32	970	30	1,400	32
Nitrogen	(% v/v)	70	3.0	50	3.2	38	3.0	38	3.2
Oxygen	(% v/v)	ND	1.5	ND	1.6	ND	1.5	ND	1.6
Carbon Dioxide	(% v/v)	25	0.030	28	0.032	29	0.030	31	0.032
Methane	(% v/v)	13	0.0030	21	0.0032	34	0.0030	34	0.0032

RL = Reporting Limit
ND = Not detected at or above the RL.
TNMOC = Total Non-Methane Organic Compounds
ppmv-C = parts per million by volume as carbon
TNMOC O2 corrected (applicable if N2 > 20% and O2 < 5%)
TNMOC uncorrected = not corrected for N2, O2 or moisture
NA = Nitrogen/oxygen/moisture correction causes division by zero.

Reviewed/Approved By: Mark Johnson
Operations Manager

Date 2/13/18

The cover letter is an integral part of this analytical report

Client:	**Vista Geoscience**
Attn:	**Jeff Zajdel**
Project Name:	**Roswell LF Tier II Sampling**
Project No.:	**17317.01**
Date Received:	**2/1/2018**
Matrix:	**Air**

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

	Lab No.:	J020108-05		J020108-06		J020108-07		J020108-08	
	Client Sample I.D.:	Can 3182 / RNMI 1-13, 1-14, 1-15		Can 1466 / RNMI 1-16, 1-17, 1-18		Can 1350 / RNMI 1-19, 1-20, 1-21		Can 5461 / RNMI 1-22, 1-23, 1-24	
	Date/Time Sampled:	1/23/18 16:10		1/23/18 9:53		1/24/18 12:15		1/24/18 14:12	
	Date/Time Analyzed:	2/5/18 16:06		2/5/18 15:05		2/5/18 17:04		2/5/18 18:02	
	QC Batch No.:	180205GC8A1		180205GC8A1		180205GC8A1		180205GC8A1	
	Analyst Initials:	AS		AS		AS		AS	
	Dilution Factor:	3.2		3.2		3.2		3.2	
ANALYTE	(Units)	Result	RL	Result	RL	Result	RL	Result	RL
TNMOC O2 corrected	(ppmv-C)	2,400	32	2,400	32	1,200	32	970	32
TNMOC uncorrected	(ppmv-C)	2,100	32	2,100	32	1,100	32	880	32
Nitrogen	(% v/v)	44	3.2	51	3.2	52	3.2	52	3.2
Oxygen	(% v/v)	2.4	1.6	2.0	1.6	ND	1.6	ND	1.6
Carbon Dioxide	(% v/v)	30	0.032	28	0.032	26	0.032	26	0.032
Methane	(% v/v)	34	0.0032	31	0.0032	20	0.0032	21	0.0032

RL = Reporting Limit
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TNMOC = Total Non-Methane Organic Compounds
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TNMOC O2 corrected (applicable if N2 > 20% and O2 < 5%)
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NA = Nitrogen/oxygen/moisture correction causes division by zero.

Reviewed/Approved By: [signature]
Mark Johnson
Operations Manager

Date 2/13/18

The cover letter is an integral part of this analytical report

Client: Vista Geoscience
Attn: Jeff Zajdel
Project Name: Roswell LF Tier II Sampling
Project No.: 17317.01
Date Received: 2/1/2018
Matrix: Air

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

	Lab No.:	J020108-09		J020108-10		J020108-11		J020108-12	
	Client Sample I.D.:	Can 3744 / RNMI 1-25, 1-26, 1-27		Can 1382 / RNMI 1-28, 1-29, 1-30		Can 1377 / RNMI 1-31, 1-32, 1-33		Can 3588 / RNMI 1-34, 1-35, 3-1	
	Date/Time Sampled:	1/24/18 15:54		1/24/18 9:46		1/25/18 11:15		1/25/18 12:48	
	Date/Time Analyzed:	2/5/18 19:01		2/5/18 19:59		2/5/18 20:57		2/5/18 21:56	
	QC Batch No.:	180205GC8A1		180205GC8A1		180205GC8A1		180205GC8A1	
	Analyst Initials:	AS		AS		AS		AS	
	Dilution Factor:	3.0		3.2		3.3		3.1	
ANALYTE	(Units)	Result	RL	Result	RL	Result	RL	Result	RL
TNMOC O2 corrected	(ppmv-C)	2,300	30	810	32	1,500	33	1,700	31
TNMOC uncorrected	(ppmv-C)	2,100	30	730	32	1,400	33	1,600	31
Nitrogen	(% v/v)	62	3.0	71	3.2	59	3.3	42	3.1
Oxygen	(% v/v)	ND	1.5	ND	1.6	ND	1.6	ND	1.5
Carbon Dioxide	(% v/v)	25	0.030	24	0.032	27	0.033	30	0.031
Methane	(% v/v)	13	0.0030	11	0.0032	17	0.0033	26	0.0031

RL = Reporting Limit
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ppmv-C = parts per million by volume as carbon
TNMOC O2 corrected (applicable if N2 > 20% and O2 < 5%)
TNMOC uncorrected = not corrected for N2, O2 or moisture
NA = Nitrogen/oxygen/moisture correction causes division by zero.

Reviewed/Approved By: Mark Johnson
Operations Manager

Date 2/13/18

The cover letter is an integral part of this analytical report

Client:	**Vista Geoscience**
Attn:	**Jeff Zajdel**
Project Name:	**Roswell LF Tier II Sampling**
Project No.:	**17317.01**
Date Received:	**2/1/2018**
Matrix:	**Air**

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

Lab No.:		J020108-13		J020108-14		J020108-15		J020108-16	
Client Sample I.D.:		Can 1423 / RNMI 3-2, 3-3, 3-4		Can 1474 / RNMI 3-5, 3-6, 3-7		Can 5432 / RNMI 2-8, 2-7, 2-6		Can 5435 / RNMI 2-5, 2-4, 2-3	
Date/Time Sampled:		1/25/18 13:58		1/25/18 15:19		1/25/18 9:47		1/26/18 11:28	
Date/Time Analyzed:		2/5/18 22:54		2/5/18 23:52		2/6/18 0:50		2/6/18 1:49	
QC Batch No.:		180205GC8A1		180205GC8A1		180205GC8A1		180205GC8A1	
Analyst Initials:		AS		AS		AS		AS	
Dilution Factor:		3.2		3.2		3.2		3.2	
ANALYTE	(Units)	Result	RL	Result	RL	Result	RL	Result	RL
TNMOC N2 corrected	(ppmv-C)	3,800	32	6,600	32	14,000	32	2,500	32
TNMOC O2 corrected	(ppmv-C)	3,700	32	6,000	32	3,800	32	2,200	32
TNMOC uncorrected	(ppmv-C)	3,500	32	5,500	32	3,400	32	2,000	32
Nitrogen	(% v/v)	3.4	3.2	11	3.2	57	3.2	13	3.2
Oxygen	(% v/v)	ND	1.6	ND	1.6	ND	1.6	ND	1.6
Carbon Dioxide	(% v/v)	44	0.032	52	0.032	26	0.032	30	0.032
Methane	(% v/v)	53	0.0032	41	0.0032	19	0.0032	53	0.0032

RL = Reporting Limit
ND = Not detected at or above the RL.
TNMOC = Total Non-Methane Organic Compounds
ppmv-C = parts per million by volume as carbon
TNMOC N2 corrected (applicable if N2 < 20%)
TNMOC O2 corrected (applicable if N2 > 20% and O2 < 5%)
TNMOC uncorrected = not corrected for N2, O2 or moisture
NA = Nitrogen/oxygen/moisture correction causes division by zero.

Reviewed/Approved By: Mark Johnson
Operations Manager

Date 2/13/18

The cover letter is an integral part of this analytical report

Client:	Vista Geoscience
Attn:	Jeff Zajdel
Project Name:	Roswell LF Tier II Sampling
Project No.:	17317.01
Date Received:	2/1/2018
Matrix:	Air

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

Lab No.:		J020108-17							
Client Sample I.D.:		Can 3108 / RNMI 2-2, 2-1							
Date/Time Sampled:		1/26/18 13:22							
Date/Time Analyzed:		2/6/18 2:47							
QC Batch No.:		180205GC8A1							
Analyst Initials:		AS							
Dilution Factor:		4.6							
ANALYTE	**(Units)**	**Result**	**RL**						
TNMOC O2 corrected	(ppmv-C)	3,000	46						
TNMOC uncorrected	(ppmv-C)	2,800	46						
Nitrogen	(% v/v)	41	4.6						
Oxygen	(% v/v)	ND	2.3						
Carbon Dioxide	(% v/v)	29	0.046						
Methane	(% v/v)	29	0.0046						

RL = Reporting Limit
ND = Not detected at or above the RL.
TNMOC = Total Non-Methane Organic Compounds
ppmv-C = parts per million by volume as carbon
TNMOC O2 corrected (applicable if N2 > 20% and O2 < 5%)
TNMOC uncorrected = not corrected for N2, O2 or moisture
NA = Nitrogen/oxygen/moisture correction causes division by zero.

Reviewed/Approved By: [signature] Date 2/13/18
Mark Johnson
Operations Manager

The cover letter is an integral part of this analytical report

Daily Reports, Field Notes, and Calibration Logs

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Vista GeoScience Daily Drilling Services Report

This is NOT an invoice, but the information will be used for invoicing purposes.
To be completed at the end of each day and signed by Vista GeoScience and Client Representatives.

PROJECT INFORMATION **VISTA Project#:** 173170.01 **DATE:** ~~173170.01~~ 1-22-18 **RIG:** 7822DT

Vista Field Engineers: TS	Utility Locate Ticket Number:
Client: Souder Miller	Site Manager: Alice
Client Project Name:	Client Project Number:
Site Description: Roswell Landfill	Site Address: 3006 W. Basher Road

Time Exceeded 4 Hr Min: YES / NO

DAILY TIME REPORT (use 24-hour clock)

		Mobilization Mileage:
Day Number: 1	Total Hours on Site: 9.5	To Site: 15
Time Requested on Location: 8:00	Client's Standby Hours:	Return: 15
Time on Location: 8:00	- Vista's Standby Hours:	Total: 30
Time off Location: 1730	- Lunch / Break Hours:	Drive Hours: .5
Lunch Break - From: — To: —	= Total Bill Hours @ Level: [10]: 9.5	

Standby Sessions (describe):

EXPENDABLES USED AND DAMAGED TOOLS (circle or fill in bracketed items)

QTY	ITEM
	LINERS/TUBING
	[ ]' Soil Core Liners (ea) Type:
	[ ]' Soil Core Liners (ea) Type:
	Other Liners:[ ]
	[1/4"] , [3/8"] or [1/2"] Polyethylene Tubing (ft)
	3/8" Silicone Tubing (ft)
15	Other Tubing:[Teflon lined poly]
	EXPENDABLES/PVC
10	[1]" Expendable Points (ea):
	[ ]" [Grip Anchor Point] or [Expendable Cutting Shoe] (circle)
	[ ]" x 5' PVC Riser (section) Sch [ ]
	[ ]" x 10' PVC Riser (section) Sch [ ]
	[ ]" x 5' PVC Screen (section) Sch [ ]
	[ ]" x 10' PVC Screen (section) Sch [ ]
	[ ]" TFJ PVC Plug/Cap (ea)
	[ ]" PVC Slip Cap (ea)
	SUPPLIES
	[ ]" J-Plug and Lock (set)
	[ ]" x [ ]' Prepacked Screen (ea)
	Flush-Mount Traffic Cover ["] Diameter
	4" x 4" x 5' Sq. Steel Protective Well Cover/Riser
	Concrete Anchor Bolts
	[30] or [55] gallon Drum, each

QTY	ITEM
	ABANDONMENT MATERIALS
2	Bentonite [Granular] [Chip], [Powder] (50# bag)
	Silica Sand (50# bag)
	Portland Cement (94# bag)
	[Asphalt Patch], [Concrete] (lb. bag)
	RENTAL EQUIPMENT/CONTRACT:
	Pump: [ ]
1	[PID/OVM] or [LandTec] 2000+ Gem
	Exhaust Fan / Ductwork / CO Monitor
	Subcontracted Concrete Coring / Barricading
	3.25" Casing and Auger Add-On
	[Decon] or [Support] Trailer / Truck
	Gamma Logger
	Core Drill: [ ]" x [ ]" x [ ]"
	Generator
	Additional Items Used / Damaged Tools / PPE:

APPROVALS & SIGNATURES

Vista Field Engineer: Ted Stockwell Client's Supervisor: Alice

Samples Returned to Vista Lab ☐

NOTES: 10 points sampled and completed

OPS DPT footage:[ ] **OPS 1" Well Material Footage:**[ ] **OPS Auger Footage:**[ ] **OPS 2" Well Material Footage:**[ ]
#Total Test Holes:[ ] **#Cores:**[ ] **H2O Samples:**[ ] **Gamma Log Ft:**[ ] **Total Drilled Ft:**[ ] **Well Ft:**[ ] **#Wells:**[ ]

Vista GeoScience Daily Drilling Services Report

This is NOT an invoice, but the information will be used for invoicing purposes.
To be completed at the end of each day and signed by Vista GeoScience and Client Representatives.

PROJECT INFORMATION	VISTA Project#: 173120	DATE: 1-23-18	RIG: 7822DT
Vista Field Engineers: Ted Stockwell		Utility Locate Ticket Number:	
Client: Souder Miller		Site Manager: Alice	
Client Project Name:		Client Project Number:	
Site Description: Roswell Landfill		Site Address: 3006 W Brasher Rd	

DAILY TIME REPORT	(use 24-hour clock)	Time Exceeded 4 Hr Min: YES / NO
Day Number: 3	Total Hours on Site: 10	Mobilization Mileage:
Time Requested on Location: 7:30	Client's Standby Hours:	To Site: 15
Time on Location: 7:30	- Vista's Standby Hours:	Return: 15
Time off Location: 17:30	- Lunch / Break Hours:	Total: 30
Lunch Break - From: — To: —	= Total Bill Hours @ Level: [D]: 10	Drive Hours: .5

Standby Sessions (describe):

EXPENDABLES USED AND DAMAGED TOOLS (circle or fill in bracketed items)

QTY	ITEM
	LINERS/TUBING
	[ ]' Soil Core Liners (ea) Type:
	[ ]' Soil Core Liners (ea) Type:
	Other Liners:[ ]
	[1/4"] , [3/8"] or [1/2"] Polyethylene Tubing (ft)
	3/8" Silicone Tubing (ft)
15'	Other Tubing:[teflon lined poly]
	EXPENDABLES/PVC
6	[1]" Expendable Points (ea):
	[ ]" [Grip Anchor Point] or [Expendable Cutting Shoe] (circle)
	[ ]" x 5' PVC Riser (section) Sch [ ]
	[ ]" x 10' PVC Riser (section) Sch [ ]
	[ ]" x 5' PVC Screen (section) Sch [ ]
	[ ]" x 10' PVC Screen (section) Sch [ ]
	[ ]" TFJ PVC Plug/Cap (ea)
	[ ]" PVC Slip Cap (ea)
	SUPPLIES
	[ ]" J-Plug and Lock (set)
	[ ]" x [ ]' Prepacked Screen (ea)
	Flush-Mount Traffic Cover ["] Diameter
	4" x 4" x 5' Sq. Steel Protective Well Cover/Riser
	Concrete Anchor Bolts
	[30] or [55] gallon Drum, each

QTY	ITEM
	ABANDONMENT MATERIALS
2	Bentonite [Granular], [Chip], [Powder] (50# bag)
	Silica Sand (50# bag)
	Portland Cement (94# bag)
	[Asphalt Patch], [Concrete] (lb. bag)
	RENTAL EQUIPMENT/CONTRACT:
	Pump: [ ]
1	[PID/OVM] or [LandTec] 2000+
	Exhaust Fan / Ductwork / CO Monitor
	Subcontracted Concrete Coring / Barricading
	3.25" Casing and Auger Add-On
	[Decon] or [Support] Trailer / Truck
	Gamma Logger
	Core Drill: [ ]" x [ ]" x [ ]"
	Generator
	Additional Items Used / Damaged Tools / PPE:

APPROVALS & SIGNATURES

Vista Field Engineer: Ted Stockwell Client's Supervisor: [signature]

NOTES: 6 Points completed, Rig hydraulic line broke, fixed Samples Returned to Vista Lab ☐

OPS DPT footage:[ ] OPS 1" Well Material Footage:[ ] OPS Auger Footage:[ ] OPS 2" Well Material Footage:[ ]

#Total Test Holes:[ ] #Cores:[ ] H2O Samples:[ ] Gamma Log Ft:[ ] Total Drilled Ft:[ ] Well Ft:[ ] #Wells:[ ]

Vista GeoScience Daily Drilling Services Report

This is NOT an invoice, but the information will be used for invoicing purposes.
To be completed at the end of each day and signed by Vista GeoScience and Client Representatives.

PROJECT INFORMATION	VISTA Project#: 17317.01 DATE: 1-24-18 RIG: 7822DT
Vista Field Engineers: Ted Stockwell	Utility Locate Ticket Number:
Client: Souder Miller	Site Manager: Alice
Client Project Name:	Client Project Number:
Site Description: Roswell LF	Site Address: 3006 W. Brasher Rd

DAILY TIME REPORT	(use 24-hour clock)	Time Exceeded 4 Hr Min: YES / NO
Day Number: 3	Total Hours on Site: 10	**Mobilization Mileage:**
Time Requested on Location: NA	Client's Standby Hours:	To Site: 15
Time on Location: 7:15	- Vista's Standby Hours:	Return: 15
Time off Location: 17:15	- Lunch / Break Hours:	Total: 30
Lunch Break - From: — To: —	= Total Bill Hours @ Level: [D]: 10	Drive Hours: .5
Standby Sessions (describe):		

EXPENDABLES USED AND DAMAGED TOOLS **(circle or fill in bracketed items)**

QTY	ITEM	QTY	ITEM
LINERS/TUBING		**ABANDONMENT MATERIALS**	
	[ ]' Soil Core Liners (ea) Type:	3	Bentonite [Granular], [Chip], [Powder] (50# bag)
	[ ]' Soil Core Liners (ea) Type:		Silica Sand (50# bag)
	Other Liners:[ ]		Portland Cement (94# bag)
	[1/4"] , [3/8"] or [1/2"] Polyethylene Tubing (ft)		[Asphalt Patch], [Concrete] (lb. bag)
	3/8" Silicone Tubing (ft)		
20'	Other Tubing:[Teflon lined poly]		
EXPENDABLES/PVC		**RENTAL EQUIPMENT/CONTRACT:**	
15	[1]" Expendable Points (ea):		Pump: [ ]
	[ ]" [Grip Anchor Point] or [Expendable Cutting Shoe] (circle)	1	[PID/OVM] or ~~[LandTec]~~ 2000+
	[ ]" x 5' PVC Riser (section) Sch [ ]		Exhaust Fan / Ductwork / CO Monitor
	[ ]" x 10' PVC Riser (section) Sch [ ]		Subcontracted Concrete Coring / Barricading
	[ ]" x 5' PVC Screen (section) Sch [ ]		3.25" Casing and Auger Add-On
	[ ]" x 10' PVC Screen (section) Sch [ ]		[Decon] or [Support] Trailer / Truck
	[ ]" TFJ PVC Plug/Cap (ea)		Gamma Logger
	[ ]" PVC Slip Cap (ea)		Core Drill: [ ]" x [ ]" x [ ]"
			Generator
SUPPLIES			
	[ ]" J-Plug and Lock (set)		
	[ ]" x [ ]' Prepacked Screen (ea)	**Additional Items Used / Damaged Tools / PPE:**	
	Flush-Mount Traffic Cover ["] Diameter		
	4" x 4" x 5' Sq. Steel Protective Well Cover/Riser		
	Concrete Anchor Bolts		
	[30] or [55] gallon Drum, each		

APPROVALS & SIGNATURES

Vista Field Engineer: Ted Stockwell Client's Supervisor: [signature]

NOTES: 12 points completed Samples Returned to Vista Lab ☐

OPS DPT footage:['] OPS 1" Well Material Footage:['] OPS Auger Footage:['] OPS 2" Well Material Footage:[']

#Total Test Holes:[ ] #Cores:[ ] H2O Samples:[ ] Gamma Log Ft:[ ] Total Drilled Ft:[ ] Well Ft:[ ] #Wells:[ ]

Vista GeoScience Daily Drilling Services Report

This is NOT an invoice, but the information will be used for invoicing purposes.
To be completed at the end of each day and signed by Vista GeoScience and Client Representatives.

PROJECT INFORMATION	VISTA Project#: 17317.01 DATE: 1-25-18 RIG: 7822DT
Vista Field Engineers: Ted Stockwell	Utility Locate Ticket Number:
Client: Souder Miller	Site Manager: Alice
Client Project Name:	Client Project Number:
Site Description: Roswell LF	Site Address: 3006 W. Brasher Rd

DAILY TIME REPORT	(use 24-hour clock)	Time Exceeded 4 Hr Min: YES NO
Day Number: 4	Total Hours on Site: 9.5	Mobilization Mileage:
Time Requested on Location: —	Client's Standby Hours:	To Site: 15
Time on Location: 7:15	- Vista's Standby Hours:	Return: 15
Time off Location: 16:45	- Lunch / Break Hours:	Total: 30
Lunch Break - From: — To: —	= Total Bill Hours @ Level: [D]: 9.5	Drive Hours: .5

Standby Sessions (describe):

EXPENDABLES USED AND DAMAGED TOOLS (circle or fill in bracketed items)

QTY	ITEM	QTY	ITEM
	LINERS/TUBING		**ABANDONMENT MATERIALS**
	[ ]' Soil Core Liners (ea) Type:	4	Bentonite [Granular], [Chip], [Powder] (50# bag)
	[ ]' Soil Core Liners (ea) Type:		Silica Sand (50# bag)
	Other Liners:[ ]		Portland Cement (94# bag)
	[1/4"], [3/8"] or [1/2"] Polyethylene Tubing (ft)		[Asphalt Patch], [Concrete] (lb. bag)
	3/8" Silicone Tubing (ft)		
	Other Tubing:[ ]		
	EXPENDABLES/PVC		**RENTAL EQUIPMENT/CONTRACT:**
17	[1"~~X~~]" Expendable Points (ea): X"		Pump: [ ]
	[ ]" [Grip Anchor Point] or [Expendable Cutting Shoe] (circle)	1	[PID/OVM] or [LandTec] Gem 2000+
	[ ]" x 5' PVC Riser (section) Sch [ ]		Exhaust Fan / Ductwork / CO Monitor
	[ ]" x 10' PVC Riser (section) Sch [ ]		Subcontracted Concrete Coring / Barricading
	[ ]" x 5' PVC Screen (section) Sch [ ]		3.25" Casing and Auger Add-On
	[ ]" x 10' PVC Screen (section) Sch [ ]		[Decon] or [Support] Trailer / Truck
	[ ]" TFJ PVC Plug/Cap (ea)		Gamma Logger
	[ ]" PVC Slip Cap (ea)		Core Drill: [ ]" x [ ]" x [ ]"
			Generator
	SUPPLIES		
	[ ]" J-Plug and Lock (set)		
	[ ]" x [ ]' Prepacked Screen (ea)		**Additional Items Used / Damaged Tools / PPE:**
	Flush-Mount Traffic Cover ["] Diameter		
	4" x 4" x 5' Sq. Steel Protective Well Cover/Riser		
	Concrete Anchor Bolts		
	[30] or [55] gallon Drum, each		

APPROVALS & SIGNATURES

Vista Field Engineer: Ted Stockwell Client's Supervisor: [signature]

NOTES: 15 points completed, 2 repushes Samples Returned to Vista Lab ☐

OPS DPT footage:['] **OPS 1" Well Material Footage:**['] **OPS Auger Footage:**['] **OPS 2" Well Material Footage:**[']

#Total Test Holes:[ ] **#Cores:**[ ] **H2O Samples:**[ ] **Gamma Log Ft:**[ ] **Total Drilled Ft:**[ ] **Well Ft:**[ ] **#Wells:**[ ]

Vista GeoScience Daily Drilling Services Report

This is NOT an invoice, but the information will be used for invoicing purposes.
To be completed at the end of each day and signed by Vista GeoScience and Client Representatives.

PROJECT INFORMATION	VISTA Project#: 17317.01	DATE: 1-26-18	RIG: 7822 DT
Vista Field Engineers: Ted Stockwell		Utility Locate Ticket Number:	
Client: Souder Miller		Site Manager: Alice	
Client Project Name:		Client Project Number:	
Site Description: Roswell LF		Site Address: 3006 W. Brasher Rd	

DAILY TIME REPORT	(use 24-hour clock)	Time Exceeded 4 Hr Min: YES / NO
Day Number: 5	Total Hours on Site: 7.75	Mobilization Mileage:
Time Requested on Location: —	Client's Standby Hours:	To Site: 15
Time on Location: 7:15	- Vista's Standby Hours:	Return: 15
Time off Location: 1500	- Lunch / Break Hours:	Total: 30
Lunch Break - From: — To: —	= Total Bill Hours @ Level: [0]: 7.75	Drive Hours: .5

Standby Sessions (describe):

EXPENDABLES USED AND DAMAGED TOOLS (circle or fill in bracketed items)

QTY	ITEM	QTY	ITEM
	LINERS/TUBING		**ABANDONMENT MATERIALS**
	[ ]' Soil Core Liners (ea) Type:	3	Bentonite [Granular], [Chip], [Powder] (50# bag)
	[ ]' Soil Core Liners (ea) Type:		Silica Sand (50# bag)
	Other Liners:[ ]		Portland Cement (94# bag)
	[1/4"] , [3/8"] or [1/2"] Polyethylene Tubing (ft)		[Asphalt Patch], [Concrete] (lb. bag)
	3/8" Silicone Tubing (ft)		
	Other Tubing:[ ]		
	EXPENDABLES/PVC		**RENTAL EQUIPMENT/CONTRACT:**
8	[1]" Expendable Points (ea):		Pump: [ ]
	[ ]" [Grip Anchor Point] or [Expendable Cutting Shoe] (circle)	1	[PID/OVM] or [LandTec] Gem 2000+
	[ ]" x 5' PVC Riser (section) Sch [ ]		Exhaust Fan / Ductwork / CO Monitor
	[ ]" x 10' PVC Riser (section) Sch [ ]		Subcontracted Concrete Coring / Barricading
	[ ]" x 5' PVC Screen (section) Sch [ ]		3.25" Casing and Auger Add-On
	[ ]" x 10' PVC Screen (section) Sch [ ]		[Decon] or [Support] Trailer / Truck
	[ ]" TFJ PVC Plug/Cap (ea)		Gamma Logger
	[ ]" PVC Slip Cap (ea)		Core Drill: [ ]" x [ ]" x [ ]"
			Generator
	SUPPLIES		
	[ ]" J-Plug and Lock (set)		
	[ ]" x [ ]' Prepacked Screen (ea)		**Additional Items Used / Damaged Tools / PPE:**
	Flush-Mount Traffic Cover ["] Diameter		
	4" x 4" x 5' Sq. Steel Protective Well Cover/Riser		
	Concrete Anchor Bolts		
	[30] or [55] gallon Drum, each		

APPROVALS & SIGNATURES

Vista Field Engineer: Ted Stockwell   Client's Supervisor: [signature]

NOTES: 8 points completed, packed up, mob out   Samples Returned to Vista Lab ☐

OPS DPT footage:['] **OPS 1" Well Material Footage:[']** **OPS Auger Footage:[']** **OPS 2" Well Material Footage:[']**

#Total Test Holes:[ ] **#Cores:[ ]** **H2O Samples:[ ]** **Gamma Log Ft:[ ]** **Total Drilled Ft:[ ]** **Well Ft:[ ]** **#Wells:[ ]**

EPA TEST METHOD 25C TIER-2 LANDFILL GAS SAMPLING LOG

Page ___ of ___

Vista GeoScience
www.VistaGeoScience.com
130 Capital Drive, Suite C
Golden, CO 80401
PH: 303-277-1694

Project No.: 17317.01
CLIENT: Souder Miller
CLIENT FIELD REP: Allee
LANDFILL NAME: Roswell
LANDFILL ADDRESS: 3006 W. Brasher Road

Sampling Technician: Ted Stockwell Signature: Ted Stockwell
Gas Meter: Gem 2000+
Rig/Probe: 7822 DT
Flowmeter:
Calibration Check (date/time):
Barometer:
Vacuum Guage:

	SAMPLE	CANISTER	SYSTEM PRE-PURGE TIME				IR GAS METER ANALYSIS					SUMMA CANNISTER PRESSURE- VOLUME								Depth (ft.)		Temp.	Temp.	
DATE	LOCATION NUMBER	LAB I.D.	START TIME	END TIME	Flow (ml/min)	Est. Vol. (Liters)	CH_4 %	CO_2 %	O_2 %	N_2 % Bal.	TOTAL CHECK	Start Time	End Time	Start Flow (ml/min)	End Flow (ml/min)	INITIAL (mm Hg)	FINAL (mm Hg)	Δ Press. (mm Hg)	Est. Δ Vol. Calc. Liters	Top	Btm	Bottom °F	Ambient °F	Ambient Press. (IN HG)
1-26	RNM2-2	3108	11:45	11:50	400		50.2	37.1	0.0	12.33		11:50	11:59	200	200	-422.4	-277.10			9	10	80	44	26.22
1-26	RNM2-1	3108	13:11	13:14	400		14.6	25.0	0.0	60.1		13:14	13:22	200	200	-278.60	-140.40			9	10	78	48	26.20

EPA TEST METHOD 25C TIER-2 LANDFILL GAS SAMPLING LOG

Page 1 of __

Vista GeoScience
www.VistaGeoScience.com
130 Capital Drive, Suite C
Golden, CO 80401
PH: 303-277-1694

Project No.: 17317.01	Sampling Technician: Ted Stockwell — Signature: Ted Stockwell
CLIENT: Souder Miller	Gas Meter: Gem 2000 — Calibration Check (date/time):
CLIENT FIELD REP: Allice	Rig/Probe: 7822DT — Barometer:
LANDFILL NAME: Roswell LF	Flowmeter: — Vacuum Guage:
LANDFILL ADDRESS:	

	SAMPLE	CANISTER	SYSTEM PRE-PURGE TIME				IR GAS METER ANALYSIS					SUMMA CANNISTER PRESSURE- VOLUME								Depth (ft.)		Temp.	Temp.	
DATE	LOCATION NUMBER	LAB I.D.	START TIME	END TIME	Flow (ml/min)	Est. Vol. (Liters)	CH_4 %	CO_2 %	O_2 %	N_2 % Bal.	TOTAL CHECK	Start Time	End Time	Start Flow (ml/min)	End Flow (ml/min)	INITIAL (mm Hg)	FINAL (mm Hg)	Δ Press. (mm Hg)	Est. Δ Vol. Calc. Liters	Top	Btm	Bottom °F	Ambient °F	Ambient Press. (IN HG)
1-22	RNM1-1	1356	11:28	11:30	400		17.4	28.1	0.0	54.4		11:36	11:41	200	200	-457.80	-336.20			9	10	90.5	28	26.34
1-22	RNM1-2	1356	11:56	11:57	400		16.4	27.8	0.0	55.7		11:59	12:08	200	200	-334.35	-201.55			9	10	88.1	34	26.34
1-22	RNM1-3	1356	12:15	12:19	400		11.9	26.3	0.0	61.7		12:19	12:26	200	200	-206.25	-46.65			9	10	91.4	40	26.34
1-22	RNM1-4	1479	13:01	13:04	400		20.5	29.8	0.0	50.0		13:04	13:10	200	200	-442.60	-311.65			9	10	91	51	26.33
1-22	RNM1-5	1479	13:39	13:42	400		22.6	31.4	0.0	45.9		13:42	13:50	200	200	-308.25	-189.90			9	10	85	53	26.33
1-22	RNM1-6	1479	14:02	14:04	400		26.2	31.0	0.0	42.6		14:01	14:11	200	200	-189.95	-62.15			9	10	79	54	26.32
1-22	RNM1-7	3545	14:34	14:36	400		42.4	35.6	0.0	21.9		14:36	14:42	200	200	-445.20	-312.80			9	10	80	57	26.32
1-22	RNM1-8	3545	15:02	15:04	400		31.8	34.7	0.0	33.4		15:04	16:00	200	200	-310.00	-190.80			9	10	85	58	26.32
1-22	RNM1-9	3545	15:30	15:32	400		35.5	31.9	0.2	32.2		15:32	15:40	200	200	-190.80	-69.95			9	10	85	58	26.33
1-22	RNM1-10	5476	15:54	15:57	400		9.6	25.6	0.0	64.8		15:57	16:05	200	200	-442.10	-311.10			9	10	87	60	26.33
1-23	RNM1-11	5476	8:46	8:54	400		37.5	34.1	0.1	28.3		8:54	9:04	200	200	-312.30	-181.75			9	10	71	33	26.45
1-23	RNM1-12	5476	9:19	9:22	400		44.4	38.1	0.0	17.0		9:22	9:31	200	200	-181.75	-48.00			9	10	73	33	26.46
1-23	RNM1-13	3182	9:55	10:11	400		36.9	33.8	1.0	28.3		10:11	10:20	200	200	-450.00	-321.40			9	10	80	35	26.46
1-23	RNM1-14	3182	11:00	11:02	400		36.4	35.7	0.0	27.9		11:02	11:10	200	200	-321.4	-190.65			9	10	88	40	26.46
1-23	RNM1-15	3182	15:55	16:00	400		20.0	28.3	0.3	51.4		16:00	16:10	200	200	-189.70	-59.10			9	10	78	50	26.40
1-23	RNM1-16	1466	16:30	16:44	400		22.4	30.1	0.1	47.3		16:44	16:52	200	200	-447.2	-316.80			8	10	77	50	26.41
1-24	RNM1-17	1466	9:05	9:15	400		54.2	33.5	0.2	11.9		9:15	9:23	200	200	-303.60	-171.25			9	10	75	37	26.61
1-24	RNM1-18	1466	9:38	9:41	400		8.5	24.2	0.9	66.3		9:47	9:55	200	200	-169.70	-40.40			9	10	78	34	26.61
1-24	RNM1-19	1350	10:37	10:47	400		14.2	24.2	0.3	60.9		10:47	10:58	200	200	-428.7	-301.45			9	10	78	36	26.61
1-24	RNM1-20	1350	11:03	11:05	400		24.3	30.4	0.0	45.2		11:05	11:13	200	200	-305.00	-176.50			14	15	78	40	26.57
1-24	RNM1-21	1350	12:02	12:06	400		22.5	29.7	0.0	47.7		12:06	12:15	200	200	-181.30	-50.50			9	10	78	40	26.53
1-24	RNM1-22	5461	12:40	12:42	400		5.7	22.6	0.0	71.7		12:42	12:50	200	200	-428.15	-296.40			9	10	76	46	26.51
1-24	RNM1-23	5461	13:32	13:34	400		10.2	25.6	0.0	64.1		13:34	13:44	200	200	-296.00	-164.40			9	10	80	44	26.49
1-24	RNM1-24	5461	14:00	14:03	400		45.3	34.6	0.0	20.0		14:03	14:12	200	200	-162.75	-33.70			9	10	74	50	26.49

EPA TEST METHOD 25C TIER-2 LANDFILL GAS SAMPLING LOG

Page 2 of ___

Project No.: 173170.01
CLIENT: Souder Miller
CLIENT FIELD REP: Alice
LANDFILL NAME: Roswell
LANDFILL ADDRESS: 3006 W. Brasher Rd

Sampling Technician: Ted Stockwell **Signature:** Ted Stockwell
Gas Meter: Gem 2000+
Rig/Probe: 7822DT
Flowmeter:
Calibration Check (date/time):
Barometer:
Vacuum Guage:

Vista GeoScience
www.VistaGeoScience.com
130 Capital Drive, Suite C
Golden, CO 80401
PH: 303-277-1694

RNM3-1

DATE	SAMPLE LOCATION NUMBER	CANISTER LAB I.D.	PRE-PURGE START TIME	PRE-PURGE END TIME	Flow (ml/min)	Est. Vol. (Liters)	CH4 %	CO2 %	O2 %	N2 % Bal.	TOTAL CHECK	Start Time	End Time	Start Flow (ml/min)	End Flow (ml/min)	INITIAL (mm Hg)	FINAL (mm Hg)	Δ Press. (mm Hg)	Est. Δ Vol. Calc. Liters	Depth Top (ft.)	Depth Btm (ft.)	Temp. Bottom °F	Temp. Ambient °F	Ambient Press. (IN HG)
1-24	RNM1-25	3744	14:32	14:35	400		25.6	30.1	0.0	44.3		14:35	14:42	200	200	-426.95	-305.00			9	10	78	50	26.48
1-24	RNM1-26	3744	15:12	15:17	400		5.5	24.0	0.0	70.3		1517	15:26	200	220	-306.45	-176.65			9	10	78	48	26.47
1-24	RNM1-27	3744	15:40	15:44	400		11.2	24.6	0.0	64.1		1544	15:54	200	200	-175.60	-32.15			9	10	76	46	26.47
1-24	RNM1-28	1382	16:13	16:18	400		13.4	24.3	0.0	61.8		16:18	16:26	200	200	-441.35	-311.80			9	10	80	46	26.47
1-25	RNM1-29	1382	9:09	9:12	400		1.1	20.4	0.0	78.5		9:12	9:20	200	200	-307.80	-177.55			9	10	77	39	26.42
1-25	RNM1-30	1382	9:35	9:38	400		14.8	26.8	0.0	58.2		9:38	9:46	200	200	-177.45	-46.85			9	10	78	34	26.43
1-25	RNM1-31	1377	10:16	10:19	400		20.0	30.9	0.0	49.0		10:19	10:24	200	200	-436.70	-306.10			14	15	78	36	26.41
1-25	RNM1-32	1377	10:43	10:46	400		18.0	27.8	0.0	53.9		10:46	10:54	200	200	-305.10	-176.60			9	10	80	38	26.42
1-25	RNM1-33	1377	11:04	11:07	400		8.4	23.2	0.0	68.3		11:07	11:15	200	200	-175.20	-45.20			9	10	82	40	26.40
1-25	RNM1-34	3588	11:36	11:38	400		13.4	26.9	0.0	59.7		11:38	11:46	200	200	-422.80	-292.00			9	10	80	42	26.38
1-25	RNM1-35	3588	12:03	12:06	400		10.3	25.6	0.0	64.1		12:06	12:14	200	200	-287.3	-153.40			8	10	80	44	26.36
1-25	RNM3-6	3588	12:36	12:40	400		51.8	44.6	0.0	3.4		12:40	12:48	200	200	-152.40	-32.45			9	10	78	44	26.36
1-25	RNM3-2	1423	13:02	13:05	400		45.7	49.2	0.0	4.8		13:05	13:13	200	200	-428.35	-300.55			9	10	77	44	26.34
1-25	RNM3-3	1423	13:23	13:26	400		57.9	40.5	0.0	1.5		13:26	13:34	200	200	-298.1	-168.40			9	10	79	44	26.32
1-25	RNM3-4	1423	13:47	13:50	400		47.1	49.5	0.0	3.2		13:50	13:58	200	200	-168.35	-36.00			8	10	80	44	26.30
1-25	RNM3-5	1474	1417	1420	400		43.8	54.5	0.0	1.5		1420	1428	200	200	-453.90	-303.4			8	10	80	42	26.28
1-25	RNM3-6	1474	1442	1445	400		39.6	53.4	0.2	6.2		1445	1453	200	200	-303.26	-171.35			9	10	78	42	26.26
1-25	RNM3-7	1474	15:08	15:11	400		46.6	50.2	0.0	3.2		15:11	15:19	200	200	-169.85	-33.40			9	10	76	40	26.24
1-25	RNM2-8	5432	16:07	1610	400		27.8	29.4	0.0	42.5		1610	1618	200	200	-432.70	-303.25			9	10	78	42	26.22
1-26	RNM2-7	5432	9:05	9:16	400		19.7	28.7	0.2	51.3		9:16	9:24	200	200	-308.20	-179.25			9	10	80	37	26.23
1-26	RNM2-6	5432	9:36	9:39	400		11.9	25.9	0.0	62.1		9:39	9:47	200	200	-174.95	-42.15			9	10	40	32	26.23
1-26	RNM2-5	5435	10:06	10:09	400		43.3	27.9	0.0	24.1		10:09	10:17	200	200	-420.60	-293.80			9	10	76	34	26.25
1-26	RNM2-4	5435	10:38	10:41	400		59.4	34.7	0.0	6.0		10:41	10:49	200	200	-291.05	-160.90			9	10	78	36	26.25
1-26	RNM2-3	5435	11:17	11:20	400		49.4	38.8	0.0	11.8		11:20	11:28	200	200	-160.90	-30.45			9	10	77	40	26.25

EPA TEST METHOD 25C TIER-2 LANDFILL GAS SAMPLING LOG

Vista GeoScience
www.VistaGeoScience.com
130 Capital Drive, Suite C
Golden, CO 80401
PH: 303-277-1694

Project No.: 17317.01
CLIENT: Souder Miller
CLIENT FIELD REP: Allee
LANDFILL NAME: Roswell
LANDFILL ADDRESS: 3006 W. Brasher Road

Sampling Technician: Ted Stockwell Signature: Ted Stockwell
Gas Meter: Gem 2000+
Rig/Probe: 7822 DT
Flowmeter:

Calibration Check (date/time):
Barometer:
Vacuum Guage:

	SAMPLE	CANISTER	SYSTEM PRE-PURGE TIME				IR GAS METER ANALYSIS					SUMMA CANNISTER PRESSURE- VOLUME								Depth (ft.)		Temp.	Temp.	
DATE	LOCATION NUMBER	LAB I.D.	START TIME	END TIME	Flow (ml/min)	Est. Vol. (Liters)	CH_4 %	CO_2 %	O_2 %	N_2 % Bal.	TOTAL CHECK	Start Time	End Time	Start Flow (ml/min)	End Flow (ml/min)	INITIAL (mm Hg)	FINAL (mm Hg)	Δ Press. (mm Hg)	Est. Δ Vol. Calc. Liters	Top	Btm	Bottom °F	Ambient °F	Ambient Press. (IN HG)
1-26	RNM2-2	3108	11:45	11:50	400		50.2	37.1	0.0	13.3		11:50	11:59	200	200	-422.4	-277.10			9	10	80	44	26.22
1-26	RNM2-1	3108	13:11	13:14	400		14.6	25.0	0.0	60.1		13:14	13:22	200	200	-278.60	-140.40			9	10	78	48	26.20

Vista GeoScience

Daily Site Safety Meeting (Tailgate Meeting) Topics Check List

Check Boxes as Completed

Location / Project Number / Client
Roswell LF / 17317.01 / Souder Miller
Todays Date
1/22-26/18
Utility Locate Ticket Number

	A. "Administrative" Topics
	1. Introduce All Persons Present
	2. Identify Roles & Responsibilities/Chain of Command (e.g., Client Project Manager (PM), Vista HSO/Field Operations Manager, and Sub Contractor PM)
	3. Emphasize the Stop Work Authority Policy:
	Anyone has the authority and right to Stop Work because of Unsafe Conditions
	4. Identify the On-Site Person Who Fills Each Role for Client, Vista, and Each Subcontractor.
	5. Identify and discuss the role of any visitors (e.g., client representatives, regulatory representatives, citizens, etc.)
	6. Identify persons who require the Initial Health and Safety Plan (HASP) Training
	7. Identify persons who require the Initial Site Briefing
	8. Identify Any Short-Service Employees (SSE) and discuss the requirements if any present.

	B. General Health and Safety Topics
	1. Emphasize that the Health and Safety of Citizens and Residents Must Always be Considered First.
	2. Weather forecast for the day
	3. Buddy system (While lifting, moving of equipment, etc.)
	4. Physical, chemical and/or biological hazards anticipated
	5. PPE required
	6. Air monitoring requirements
	7. Site control requirements and possible hazards stemming from site hazards. (e.g. aggressive terrain, peds, traffic control)
	8. Communication requirements
	9. Decontamination requirements
	10. Material handling requirements (place emphasis on proper lifting techniques)
	11. Fire and/or explosion hazards
	12. Emergency procedures including routes to hospital and escape, emergency medical treatment, medical evacuation from the site, and assembly/rally location for site workers to meet.
	13. Equipment inspection requirements (Geoprobe are to be inspected daily to ensure properly working)
	14. Emergency shut off for all equipment. Geoprobe rigs - all members of a field team must know the location of the kill switches and how to operate them.
	15. Testing emergency shut off for all equipment. (e.g., Geoprobe rigs - kill switches must be tested daily prior to work)
	16. Review refueling process of equipment. Equipment will be off and cool before refueling with proper fuel can.
	17. Review out of service procedures
	18. Location of first aid fire extinguisher
	19. Traffic Control Plan (TCP) - TCP Requirements
	20. Underground utilities confirmed marked - confirm paint on ground for suspected underground utilities

	C. Specific Work To Be Conducted, and Related Health and Safety Issues and Hazards
	1. The Leader of Each Field Team/Work Crew Shall Describe Their Specific Scheduled Work Activities for the Day
	2. Health and Safety Issues that others need to be aware of shall be discussed.

	D. Closing Activities
	1. Mid-day shared learning. (e.g., lunchtime, downtime, remobilization)
	2. Conduct visual inspections of all equipment used.
	3. Conduct site walkthrough with client P.M. (pertaining to site restoration, good housekeeping, and mitigating hazards)

	Signatures of Safety Tailgate Meeting Attendees - Signature, Print Name, and Affiliation
	[signature] / Ted Stockwell / VGS
	[signature] / Alice Amend / SMA

Vista GeoScience **FIELD SERVICES DRILLING REMEDIATION LOG**

FIELD LOG

Use 24-hour clock for time. Fill out at end of each probe hole entry. Number holes based on clients description of the location. Start with a new sheet for each day. Note operators and change of operator. **Include all PID/Landtec/FID readings etc...**

Date: 1-22-18 **Day #:** 1 **Page #:** 1 **of** 1 **Project #:** 17317.01
Client: Souder Miller **Project Name:** Roswell LF Tier II

START TIME	END TIME	LOCATION#	ACTIVITY DESCRIPTION	READINGS
			669 mmhg / 6L @ 3500' Elevation = ~111 mmhg/1L	
			☆ Minimum change in mmhg @ our elevation for 1L is ~111 mmhg	
8:00	9:00		Arrive on-site, safety meeting, meet clients + LF manager. Unload rig, setup and mob to the first point	
9:00	10:15		Calibration gas left in hotel so had to retrieve gas and then calibrate gem.	
10:15	11:30		Pushed 1st probe but got no flow. Cleaned out flowmeter and pulled the rod up a few times. Ended up pulling all the way out and noticed the exp point was still on shoe.	
11:30	11:45	RNM1-1	Pushed to 10', pulled up to 9'. Purged until values evened up and O_2 dropped. After that I sampled into summa canister. Pulled rod and backfilled hole w/ bentonite	
11:45	12:12	RNM1-2	↓	
12:12		RNM1-3		
12:30		RNM1-4	had to fix gem exhaust port as well	
13:30		RNM1-5		
14:00		RNM1-6		
14:30		RNM1-7		
15:00		RNM1-8		
15:15		RNM1-9		
15:50	16:15	RNM1-10		
16:15	17:00		Pack up, clean up, drop summa canisters off at office	
17:00	17:30		complete field notes + daily reports	

Operator Initials: TS

130 Capital Drive, Suite C Golden, CO 80401 *(303) 277-1694; Fax: (303) 278-0104*

Vista GeoScience **FIELD SERVICES DRILLING REMEDIATION LOG**

FIELD LOG

Use 24-hour clock for time. Fill out at end of each probe hole entry. Number holes based on clients description of the location. Start with a new sheet for each day. Note operators and change of operator. **Include all PID/Landtec/FID readings etc…**

Date: 1-23-18 **Day #:** 2 **Page #:** 1 **of** 1 **Project #:** 17317.01

Client: Souder Miller **Project Name:** Roswell LF Tier II Sampling

START TIME	END TIME	LOCATION#	ACTIVITY DESCRIPTION	READINGS
7:30	8:30		Arrive on site, prep, calibrate gem, setup, grab summas from office, mob rig to next location, etc.	
8:30	9:15	RNM1-11	DPT 1.5' to 10', with exp point, pull up to 9'. Start purge. This hole took longer to purge	
9:15	9:50	RNM1-12	DPT 1.5' to 10', w/ exp point. Pull up to 9'. Start purge, take sample, pull rod, backfill w/ bentonite	
9:50	10:55	RNM1-13	Purging took extra long	
10:55	11:20	RNM1-14		
11:20	3:45	RNM1-15	Pushed 5', hydraulic line burst/broke - Mechanic showed up @ ~1:40am He fixed line + replaced. I went to get hydraulic fluid to replace missing fluid	
15:45	16:20	RNM1-15	Pushed from 5'-10', Purged sample, took sample, pulled rod, + backfilled w/ bent	
16:20	17:00	RNM-16	Same as RNM1-12, had to hit off exp point because no flow, then purging took way longer than average	
17:00	17:20		Cleaned up, packed up, paperwork, head out, drop off summa canisters @ office	

Operator Initials: TS

Vista-Drillers-Field-Notes-Log

Vista GeoScience **FIELD SERVICES DRILLING REMEDIATION LOG**

FIELD LOG

Use 24-hour clock for time. Fill out at end of each probe hole entry. Number holes based on clients description of the location. Start with a new sheet for each day. Note operators and change of operator. **Include all PID/Landtec/FID readings etc…**

Date: 1-24-18 **Day #:** 3 **Page #:** 1 **of** 1 **Project #:** 1731701

Client: Souder Miller **Project Name:** Roswell LF Tier II Sampling

START TIME	END TIME	LOCATION#	ACTIVITY DESCRIPTION	READINGS
7:20	9:00		Arrive on-site, pick up summa canisters from front office, mob to rig, calibrate gem 2000+, prep supplies, rig + mob to first point. took ~20 minutes to get rig started, then fixed tree, it seemed to have a small leak	
9:00	9:30	RNM1-17	DPT 1" to 10', pull up to 9. Purge and then sample. Pull rods, backfill w/ bent, mob to next hole * Purge took way longer for RNM1-17 through RNM1-19	
9:30	10:00	RNM1-18	↓	
10:00	11:00	RNM1-19		
11:00	11:20	RNM1-20	Same as above but drilled to 15' and pulled up to 14' and purging went quicker.	
11:20	12:20	RNM1-21	Same as above but had to repush twice. The first push to 15' was in water + clogged the shoe. The second push was to 12' but the exp pt came out early. Pushing to 10' and pulling to 9' went great	
12:20	13:00	RNM1-22	Same as normal, but had to repush twice	
13:00	13:50	RNM1-23	Same as above, except had to jiggle rod w/ hammer to get point off the shoe	
13:50	14:20	RNM1-24	Same as normal but went well	
14:20	15:00	RNM1-25	Lost shoe down hole, tethered a new pt and wrenched on pipe	
15:00	15:35	RNM1-26	Same as above, went perfectly	
15:35	16:00	RNM1-27	↓	
16:00	16:30	RNM1-28		
16:30	17:15		Rig wouldn't start, packed up, cleaned up, dropped summas off @ office, left site	

Operator Initials: JS

130 Capital Drive, Suite C Golden, CO 80401 (303) 277-1694; Fax: (303) 278-0104

Vista GeoScience **FIELD SERVICES DRILLING REMEDIATION LOG**

FIELD LOG

Use 24-hour clock for time. Fill out at end of each probe hole entry. Number holes based on clients description of the location. Start with a new sheet for each day. Note operators and change of operator. **Include all PID/Landtec/FID readings etc…**

Date: 1-25-18 **Day #:** 4 **Page #:** 1 **of** 1 **Project #:** 1731701

Client: Souder Miller **Project Name:** Roswell LF Tier II Sampling

START TIME	END TIME	LOCATION#	ACTIVITY DESCRIPTION	READINGS
7:15	9:00		Arrive on site, had to fix rig and let warm up calibrated the gem 2000+, pulled the rod left in the ground, backfilled w/ bentonite, checked for leaks in the summa tree, mob to the next hole, prep supplies + rig, etc	
9:00	9:30	RNM1-29	DPT 1" to 10', pulled up to 9'. Purged sample, took a sample, pulled rod, backfilled w/ bentonite, mob to next location	
9:30	9:50	RNM1-30		
9:50	10:35	RNM1-31	Same as above except had to repush to 15' and pull up to 14' because I could not get Oxygen to drop below 5%.	
10:35	11:00	RNM1-32	Same as RNM1-29	
11:00	11:25	RNM1-33	Same as RNM1-29	
11:25	11:55	RNM1-34	Same as RNM1-29, ~~but had to~~	
11:55	12:30	RNM1-35	Same as RNM1-29, had to pull up an extra foot, and jiggle exp pt out of shoe for flow. Also had to mob to a new hill (cell 3)	
12:30		RNM3-1	Same as RNM1-29	
1300		RNM3-2		
1320		RNM3-3		
1345		RNM3-4		
14:15		RNM3-5		
1435		RNM3-6		
1500		RNM3-7	had to mob to cell 2 on other side of land fill	
1600		RNM2-8	Same as RNM1-29	
			~~311 S Virg~~ ~~575 622 4160~~	
1630	1645		Pack up, clean up, paperwork, mob out	

Operator Initials: TS

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FIELD SERVICES DRILLING REMEDIATION LOG

FIELD LOG

Use 24-hour clock for time. Fill out at end of each probe hole entry. Number holes based on clients description of the location. Start with a new sheet for each day. Note operators and change of operator. **Include all PID/Landtec/FID readings etc...**

Date: 1-26-18 **Day #:** 5 **Page #:** 1 **of** 1 **Project #:** 17317.01

Client: Souder Miller **Project Name:** Roswell LF Tier II Sampling

START TIME	END TIME	LOCATION#	ACTIVITY DESCRIPTION	READINGS
7:15	9:00		Start rig, calibrate gem 2000*, paperwork, prep supplies, let rig warm up, mob to first location, retrieved toolbox left on the last well	
9:00	9:30	RNM2-7	DPT 1" to 10', pull up to 9, purge sample, took extra long for O₂ to drop, took sample, pulled rod, backfilled w/ bent, mob to next location	
9:30		RNM2-6		
9:55		RNM2-5	★ had to repeat, ★★ H_2S >>> 600 ppm	
10:20		RNM2-4		
11:10		RNM2-3		
11:40		RNM2-2		
1300		RNM2-1	- Rig died, had to troubleshoot	
1330	1500		Rig up, pack up, grab summas, etc	

Operator Initials: TS

Vista-Drillers-Field-Notes-Log

130 Capital Drive, Suite C Golden, CO 80401

(303) 277-1694; Fax: (303) 278-0104

Landtec GEM 2000 (+) Calibration Log	
Date/Time	1-22-18 / 8:50
Technician	Ted Stockwell
VGS Project Number	173170.01

Ambient Air Readings

CH4	CO2	O2	Balance
0.0	0.1	21.3	78.6

Pre-Calibration Gas Reading (Tank 1)

CH4	CO2						
47.0	32.9						

Post-Calibration Gas Reading (Tank 1)

CH4	CO2						
50.0	34.9						

Pre-Calibration Gas Reading (Tank 2)

CH4	O2	H2S	CO				
2.7	18.4	9	52				

Pre-Calibration Gas Reading (Tank 2)

CH4	O2	H2S	CO				
2.6	18.4	9	52				

Pre-Calibration Gas Reading (Tank 3)

O2							
3.8							

Pre-Calibration Gas Reading (Tank 3)

O2							
4.0							

Calibration Gas % Used

	CH4	CO2	O2	Nitrogen Balance	H2S	CO
Tank 1	50.0	35.0	N/A	BAL	N/A	N/A
Tank 2	2.5	N/A	18.0	BAL	10ppm	50ppm
Tank 3	N/A	N/A	4	BAL	N/A	N/A

Comments

***Note:** For a complete calibration, zero Oxygen using Tank 1 and zero Methane using Tank 2. Carbon Dioxide cannot be zeroed using a GEM model 2000 or 2000 plus.

Landtec GEM 2000 (+) Calibration Log	
Date/Time	1-23-18
Technician	Ted Stockwell
VGS Project Number	1731701

Ambient Air Readings

CH4	CO2	O2	Balance
0.0	0.2	21.5	78.3

Pre-Calibration Gas Reading (Tank 1)

CH4	CO2
50.6	35.2

Post-Calibration Gas Reading (Tank 1)

CH4	CO2
50.6	35.2

Pre-Calibration Gas Reading (Tank 2)

CH4	O2	H2S	CO
2.9	18.5	9	50

Pre-Calibration Gas Reading (Tank 2)

CH4	O2	H2S	CO
2.5	18.0	9	50

Pre-Calibration Gas Reading (Tank 3)

O2
3.8

Pre-Calibration Gas Reading (Tank 3)

O2
3.8

Calibration Gas % Used

	CH4	CO2	O2	Nitrogen Balance	H2S	CO
Tank 1	50.0	35.0	N/A	BAL	N/A	N/A
Tank 2	2.5	N/A	18.0	BAL	10ppm	50ppm
Tank 3	N/A	N/A	4	BAL	N/A	N/A

Comments

***Note:** For a complete calibration, zero Oxygen using Tank 1 and zero Methane using Tank 2. Carbon Dioxide cannot be zeroed using a GEM model 2000 or 2000 plus.

Landtec GEM 2000 (+) Calibration Log							
Date/Time				1-24-18 / 7:40			
Technician				Ted Stockwell			
VGS Project Number				17317.01			
Ambient Air Readings							
CH4	**CO2**	**O2**	**Balance**				
0.0	0.2	20.8	79.0				
Pre-Calibration Gas Reading (Tank 1)							
CH4	**CO2**						
42.8	35.4						
Post-Calibration Gas Reading (Tank 1)							
CH4	**CO2**						
50.1	34.9						
Pre-Calibration Gas Reading (Tank 2)							
CH4	**O2**	**H2S**	**CO**				
~~0.1~~ 2.7	17.9	9	48				
Pre-Calibration Gas Reading (Tank 2)							
CH4	**O2**	**H2S**	**CO**				
2.5	17.9	9	49				
Pre-Calibration Gas Reading (Tank 3)							
O2							
3.7							
Pre-Calibration Gas Reading (Tank 3)							
O2							
4.0							
Calibration Gas % Used							
	CH4	**CO2**	**O2**	**Nitrogen Balance**		**H2S**	**CO**
Tank 1	50.0	35.0	N/A	BAL		N/A	N/A
Tank 2	2.5	N/A	18.0	BAL		10ppm	50ppm
Tank 3	N/A	N/A	4	BAL		N/A	N/A
Comments							

***Note:** For a complete calibration, zero Oxygen using Tank 1 and zero Methane using Tank 2. Carbon Dioxide cannot be zeroed using a GEM model 2000 or 2000 plus.

Landtec GEM 2000 (+) Calibration Log

Date/Time	1-25-18
Technician	Ted Stockwell
VGS Project Number	17317.01

Ambient Air Readings

CH4	CO2	O2	Balance
0.0	0.1	22.4	77.5

Pre-Calibration Gas Reading (Tank 1)

CH4	CO2						
45.7	34.7						

Post-Calibration Gas Reading (Tank 1)

CH4	CO2						
50.1	34.9						

Pre-Calibration Gas Reading (Tank 2)

CH4	O2	H2S	CO				
2.7	19.4	9	48				

Pre-Calibration Gas Reading (Tank 2)

CH4	O2	H2S	CO				
2.5	18.0	9	49				

Pre-Calibration Gas Reading (Tank 3)

O2							
3.7							

Pre-Calibration Gas Reading (Tank 3)

O2							
4.0							

Calibration Gas % Used

	CH4	CO2	O2	Nitrogen Balance	H2S	CO
Tank 1	50.0	35.0	N/A	BAL	N/A	N/A
Tank 2	2.5	N/A	18.0	BAL	10ppm	50ppm
Tank 3	N/A	N/A	4	BAL	N/A	N/A

Comments

***Note:** For a complete calibration, zero Oxygen using Tank 1 and zero Methane using Tank 2. Carbon Dioxide cannot be zeroed using a GEM model 2000 or 2000 plus.

Landtec GEM 2000 (+) Calibration Log							
Date/Time				1-26-18 / 7:45			
Technician				Ted Stockwell			
VGS Project Number				173170.01			
Ambient Air Readings							
CH4	**CO2**	**O2**	**Balance**				
0.0	0.1	22.3	77.6				
Pre-Calibration Gas Reading (Tank 1)							
CH4	**CO2**						
44.5	34.7						
Post-Calibration Gas Reading (Tank 1)							
CH4	**CO2**						
50.0	35.2						
Pre-Calibration Gas Reading (Tank 2)							
CH4	**O2**	**H2S**	**CO**				
2.7	19.3	9	48				
Pre-Calibration Gas Reading (Tank 2)							
CH4	**O2**	**H2S**	**CO**				
2.5	18.0	9	49				
Pre-Calibration Gas Reading (Tank 3)							
O2							
3.8							
Pre-Calibration Gas Reading (Tank 3)							
O2							
4.0							
Calibration Gas % Used							
	CH4	**CO2**	**O2**	**Nitrogen Balance**		**H2S**	**CO**
Tank 1	50.0	35.0	N/A	BAL		N/A	N/A
Tank 2	2.5	N/A	18.0	BAL		10ppm	50ppm
Tank 3	N/A	N/A	4	BAL		N/A	N/A
Comments							

***Note:** For a complete calibration, zero Oxygen using Tank 1 and zero Methane using Tank 2. Carbon Dioxide cannot be zeroed using a GEM model 2000 or 2000 plus.

Vista GeoScience EPA Method 25C Tier-2 NMOC Landfill Gas Sampling Standard Operating Procedure (SOP)

On the following page is Vista GeoScience's SOP for Method 25C Tier II NMOC Landfill Gas Sampling.

Standard Operating Procedure for:
EPA Method 25C TIER 2 LANDFILL NMOC GAS SAMPLING

SOP Number:	NFSV103	Revision Number: 6.0
Page:	1 of 9	Revision Date: Aug 2, 2017

Title:

Tier 2 Landfill Gas Sampling – EPA Method 25c

Approved By:

Signature Date

1.0 AREA OF APPLICABILITY

This method covers sampling of landfill gases (LFG) from Municipal Solid Waste (MSW) Landfills for the purpose of measuring Non-Methane Organic Compounds (NMOC). It can also be used to measure other gases emitted by landfills. The following procedure was designed to follow the sampling methods required by EPA's Method 25C, but numerous method and QC improvements have been added to insure the collection of a quality sample. To comply with EPA Method 25C, Vista GeoScience has developed the special tools and apparatus for this procedure that are slightly different from conventional environmental soil gas sampling equipment and procedures. While this method can also be used to collect soil gases for other applications, the valve assembly which all of the gas samples travel through cannot be cleaned of carryover well enough to be used for very low (below 1ppm) levels of contaminants used for other applications. The NMOC method measures higher levels of contaminants that are well beyond this carryover.

SAFETY CAUTION:

Landfill gas will contain up to 60% methane (CH_4) which is explosive in an oxygenated atmosphere. The lower explosive limit (LEL) for methane is 5% methane in air. Use caution when sampling and working in the landfill areas, especially during probing operations. Use no sources of open flame or spark. NO SMOKING. Use your Methane gas meter to test the ambient air if you suspect surface leakage of the landfill such as near large cracks in the surface.

H_2S (hydrogen sulfide gas) is also found in some landfills, and sometimes in only part of a landfill, and it is *extremely toxic*. Have calibrated personal H_2S monitor for all personnel operating on a landfill site. H_2S smells like rotten eggs, but will kill your sense of smell at high concentrations. If you smell it at all, *discontinue work and leave the area until you have personal H_2S monitors*. While using personal monitors, leave the area if H_2S readings approach 10ppm. Newer landfill gas monitors (Landtec GEM 2000 or 5000 models) have the option to measure H_2S and should be used when available.

2.0 MATERIALS REQUIRED

1) Direct Push Rig / Probing System
2) 1.25-1.5" High Carbon Steel Probe Soil Probing Push Rod, threaded flush joint, in 3' to 5' lengths
3) 1" to 1.5" Expendable Point Holder with Post-Run-Tubing (PRT) connection.
   Or a Retractable Soil Gas Point (1" – 1.5") with PRT connection.
4) Stainless Steel PRT tubing adaptor for ¼" or 3/8" OD tubing (1/8" to ¼" ID) w/ o-ring seal
5) 1" Expendable drive points
6) Point-Popper and Extension Rods, at least 20' total, more possibly if probing multiple cap layers.
7) Spare o-rings for above
8) ¼" or 3/8" OD Teflon Tubing or Teflon lined Poly-Tubing
9) Vista GeoScience's Tier-2 Sampling Valve assembly including (See Figure 1):
   a) 1-Stainless Steel 3-way valves, Swagelok connectors
   b) Shut-Off SS Toggle or 2-way Valve
   c) Accurate Vacuum gauge (digital or analog) 0 – (-30) inches Hg (1mm Hg resolution)
   d) Rotameter type flow meter with Teflon/stainless connectors 0-500cc/min *(Modified for use with vacuum so that the flow valve is on the TOP of the flow meter tube)*
   e) ¼" Teflon Tubing to connect fitting, stainless steel fittings optional.
   f) 3/8" x ¼" Silicone Tubing for connecting tubing, instruments, etc., - short lengths
10) Landtec Gem500 (or equivalent) CO_2/O_2/CH_4 Infrared Gas Meter, percent range (0.1% resol.)
    a) Calibration Gases for meter (approximately 15% each CO_2 & CH_4, 4% O_2)
    b) 45µ inline filter/water traps
    c) Tedlar Bag to calibrate meter
    d) Calibration Log Book
    e) Spare C-Cell Batteries
11) Digital Thermometer with long cable probe for bottom hole and surface ambient temperature.
12) 3/8" Silicone tubing for connecting tubing to fittings
13) Vista GeoScience Tier-2 Gas Log Forms for Method 25-C sample collection (Copy attached)
14) GPS for recording sample location coordinates.
15) Barometer/Altimeter for recording ambient pressure. (Can be combined with GPS)
16) Hydrogen Sulfide Gas (H_2S) Personal Meter
17) Summa Canisters for collecting samples (provided by laboratory or client) -or -
18) Appropriate connectors for other types of lab containers
19) OPTIONAL: Peristaltic Pump if collecting gas samples from a system under vacuum.

3.0 INSTRUCTIONS for PROBE SAMPLE COLLECTION

1) **Plan well ahead and arrange for preparation delivery of laboratory containers** (Summa canisters) and shipping back to lab. Insure that the containers have compatible connectors. Obtain any necessary adaptors for the canisters to connect to the sampling apparatus. Canisters can hold 6 liters total gas volume, but in order to ship the as "Non-pressurized non-flammable gas, the containers must have a partial helium pre-fill (about 40% of volume, see attached laboratory reference). If they are not prefilled, and contain more than the 3 liters of sample, they may contain methane above the LEL which would require hazardous shipping by a certified shipper at a significant cost. Insure that the containers partially filled with helium. **Consult the laboratory for shipping instructions. With the helium pre-fill, the canisters are shipped as "non-pressurized non-flammable gas samples."**

2) **Sample Spacing:** Tier 2 rules require two probes collected per hectare up to a maximum of 50 samples per landfill. A hectare is 2.47 acres or 107,600 sq ft.. This comes out to a minimum spacing of 53,800 sq. ft. per probe or a grid of 230' x 230'. The maximum number of samples that need to be collected on a landfill is 50 once this spacing is exceeded.

3) **Calibrate Altimeter/Barometer: T**ypically done at a known elevation. Note date and time of calibration and brand/model of meter used in log & field notes. The barometer may be integrated with your GPS unit or your landfill gas meter.

4) **Calibrate CO_2-O_2-CH_4 gas meter** at beginning of project according to manufacturer's instructions. Recalibrate if moving instrument to another elevation. Calibrate the CO_2 and CH_4 with the 15% mixture and zero the oxygen using the same mixture. Zero the CO_2 and CH_4 with ambient air in an area free of those gases, away from the landfill. (Note that ambient air contains only 0.03% CO_2 and 0.0002% CH_4) Before sampling each day, perform a daily calibration check on instrument. If the check does not meet specs, recalibrate the instrument. Oxygen is calibrated and checked using atmospheric air (which contains 21.0% oxygen) and a mixture cylinder of about 4% O_2. *Record all calibration data in the calibration log book and make a copy of all calibration data for the client report.*

5) **Check for leaks** in the valve assembly box (Figure 1) or other connectors.
   a) Connect valve assembly (box) to vacuum / purge pump/tank system and sampling canister with Teflon tubing. Short pieces of 3/8" silicone tubing can be used to connect the ¼" Teflon with fittings that do not match the ¼" tubing. (Do not open the sample canister yet).
   b) Zero vacuum gauge to local pressure if needed. (Some gauges do not do this.)
   c) Plug other outlets on assembly (tubing that goes to gas meter and probe).
   d) Open the Shut Off Toggle Valve.
   e) Place the 3 way valve in the Sampling Position (to the probe, so that the Rotameter is checked)
   f) Make sure the Rotameter valve is open partially (ideally to a flow of 250 cc/min.), and not closed all the way.
   g) Pull a vacuum on the system by first opening the valve to the vacuum tank, pump, or syringe and then closing the 3-way valve to vacuum tank. Watch the system for 10 minutes for a drop in vacuum pressure, indicating a leak. Operate the Flow Controller while testing to make sure it does not leak in certain positions. (This is a common problem with these flow meters.) The Landtec pump will be used to purge the sample from the test hole.

h) Locate and repair any leaks before sampling in the system.

i) **Log this test in field notes.**

5) **Probe Test Hole**: Assemble the probe rod, PRT tool, and an expendable drive point and drive the probe rod with probe hammer cap into the landfill cap at least 3' below the cap. Retract the probe rod to drop the expendable point and create 12-24" of open hole below the rod. A point-popper and extension rod may be required to push the point off through the center of the probe rod.

6) **Insert the stainless steel PRT adaptor and Teflon Tubing** assembly into the center of the probe rod, thread into the tool adaptor with a reverse handed (counter) thread until you feel the o-ring seat.

7) **Seal soil around probe:** If the hole has opened up around the probe rod, use a large hammer to pack dirt around probe rod to obtain a surface seal. If a poor seal is suspected, optionally a bentonite slurry or paste can be applied around the probe at the surface.

8) **Connect tubing sampling and valve assembly:** C***onnect a Filter/Water Trap with silicone tubing inline before the sampling assembly.*** Connect with Teflon tubing to sample inlet port on valve box assembly. (Teflon tubing can be re-used on other holes.) Decontaminate it if liquid was pulled through any of the system. Use silicone tubing to make short connections.

NOTE: Be sure that the filter/water trap is in line so that water cannot be pulled into the valve box or instrument, which will cause permanent damage and >$1,000 in repairs and downtime.

9) **Connect (Landtec) gas meter to "Gas Meter"** port on valve assembly using Teflon and/or silicone tubing.

10) **Calculate the System Volume:** (½" ID rod = 40cc/ft, ¼" Tubing = 5cc/ft.)

11) **Record the ambient (air) pressure** readings with a barometer/altimeter at this time in the sampling log. *Be sure to record actual ambient pressures and not barometer readings which are corrected back to sea level.*

12) **Record the surface air temperature** at this time in the sampling log**.**

13) **Purge the test hole:** Put the 3-way valve in the "LANDTEC" position, open the toggle valve, open the vacuum tank valve, and pull 3 system volumes, adjust the Rotameter to a flow of 500cc/min *or less*. Flip the toggle valve to "CLOSED" or "OFF" when the correct volume has been purged. (Optional – Purge the test hole with the Landtec GEM500, pulls at 300-400ml/min)

14) **Record the timing** of the purge (start/stop) and the total volume purged in the sampling log.

15) **Record the Purge Volume:** Estimate the purge volume by multiplying the average flow rate (ml/min) times the purge time (min.).

16) Test the Gas Content: Turn on the CO_2 -O_2-CH_4 gas meter and open the 3-way valve to the "Gas Meter Test" position and open the SAMPLE INLET toggle valve. Monitor the gas readings and wait for them to stabilize. **Record the CO_2, O_2 and CH_4 concentrations.**

17) Calculate %N_2*:* Assume the **balance** of gas (to make 100%) is nitrogen and calculate the nitrogen:

$$100\% - \%CO_2 - \%O_2 - \%CH_4 = \%N_2$$

Record the N2 balance in the log. (Landfill gas is typically about 50% CO_2 and 50% CH_4 gas with little or no oxygen and nitrogen.)

Most landfills will be completely purged of atmospheric nitrogen. **The nitrogen balance should be less than 10% of the total gas for the sample to be considered valid for the NMOC analysis. If it is less than 10% Nitrogen <u>or 2.5% Oxygen</u>, then a sample can be collected.** If it is greater than this %, then it is assumed that to much surface air has diluted the sample and the probe must be pushed deeper or offset until <10% Nitrogen is sampled. (The actual EPA cutoff is 20% Nitrogen *<u>or</u>* 5% Oxygen in a sample for a valid sample, which will cause the lab to reject the sample, but we use a 10% N_2 or 2.5% O_2 cutoff for safety margin to compensate for the potential error in field instruments and water vapor corrections.) It is OK to have high nitrogen if the oxygen is below the 2.5% value.

NOTE: *In a letter from EPA (Region 8) that Vista GeoScience has on file (attached), an exception can be made to the above in young landfills or landfills in arid areas where nitrogen may still be present. If the nitrogen is above 20%, but oxygen is below 5%, then the sample is considered valid. If oxygen is also above 5%, then the location must be pushed deeper or offset until a valid reading is achieved. Contact the client if there is significant difficulty in obtaining valid samples.*

18) If the air dilution (O_2 or N_2) is too high, then the system should be checked for leaks, the seal around the probe is leaking, or the probe must be pushed deeper or offset. Return to step (4) for retesting.

19) If the gas meter test sample is valid, close the Shut Off Toggle and move the 3-way valve to the SUMMA canister sampling position.

18) Measure the Canister Pressure*:* With the Shut Off Toggle Valve closed, check the initial vacuum pressure on the Summa Canister by opening the canister valve. It should register -29.9"Hg (inches of mercury), -760mmHg or -14.7psig *at or near sea level* if the Summa Canister has been fully evacuated. (See Table 1 for other elevations and units.) The canister should have a helium pre-fill. If the canister is not at the proper pressure, test another canister. There should be enough vacuum remaining to collect the three composite samples of 1-liter each. If the second canister is also low, **notify the client and/or the laboratory before proceeding**.

NOTE: If the canister is partially filled with helium, so you will not see a full ambient pressure vacuum on these cylinders. It will be less than this value depending on how much helium was added to the cansister. Table 1 tells you what the a full vacuum would be at your elevation if the canister was fully evacuated. You need this information to determine what the pressure drop is required for each liter of gas at your elevation. A minimum 1-liter sample is required by the method.

19) **Determine the Pressure Drop Required for a 1-liter Sample:** If composite sampling is required, then the canister pressure must be carefully measured while sampling to fill the canister equally from each hole. DO NOT USE THE FLOW METER TO MEASURE VOLUME AS THIS IS NOT ACCURATE AND ONLY USED TO ESTIMATE FLOW RATES.

- Look up your altitude in Table 1, and interpolate what a full vacuum would be at your altitude.
- Divide this by 6-liters, and this is the minimum pressure drop required for a one liter sample.
- With the sampling Toggle Valve still closed, open the summa canister and measure the pressure on the vacuum gauge.
- Divide this pressure by the number of composite samples required + 1. So if you need three composite samples, divide the canister pressure by 4.
- This pressure should be greater than the required amount for one liter you previously calculated. If it is less than the pressure required for a one liter sample, try dividing by something between 3 and 4, such as 3.5, until you get a pressure drop greater than the 1 liter requirement for each sample.
- Ideally plan to leave 5-10% of the final vacuum in the canister since it's difficult to get the last bit of vacuum out of canister. **Each pressure drop for each composite sample must be equal so the volume of each sample is equal, per the method.**

EXAMPLE: If the 6 liter Summa canister would have -600 mmHg of pressure under a full vacuum based on Table 1, dividing by 6 gives you -100 mmHg per liter in the canister. If you measure the canister initial pressure is -400 mmHg, You can collect three 1 liter composite samples with a pressure drop each of 100 mmHg, leaving -100mmHg in the canister.

If the canister had a partial helium fill from the lab, you must use Table 1 to calculate the full vacuum pressure of your canister at your altitude.

TABLE 1. Altitude and Atmospheric Pressure

Altitude above Sea Level			Absolute Atmospheric Pressure						
Feet	miles	meters	kPa	atm	psia	mm Hg	inch Hg	Bars	mbar
-500	-0.09	-152	103.20	1.02	14.96	775	30.52	1.034	1034
0	0	0	101.30	1.00	14.70	760	29.93	1.013	1013
500	0.09	152	99.50	0.98	14.43	745	29.33	0.993	993
1000	0.19	305	97.70	0.96	14.17	730	28.73	0.973	973
1500	0.28	457	96.00	0.95	13.92	722	28.43	0.963	963
2000	0.38	610	94.20	0.93	13.66	707	27.83	0.942	942
2500	0.47	762	92.50	0.91	13.42	692	27.23	0.922	922
3000	0.57	914	90.80	0.90	13.17	684	26.93	0.912	912
3500	0.66	1067	89.10	0.88	12.93	669	26.33	0.892	892
4000	0.76	1219	87.50	0.86	12.69	654	25.74	0.871	871
4500	0.85	1372	85.90	0.85	12.46	646	25.44	0.861	861

Altitude above Sea Level			Absolute Atmospheric Pressure						
Feet	**miles**	**meters**	**kPa**	**atm**	**psia**	**mm Hg**	**inch Hg**	**Bars**	**mbar**
5000	0.95	1524	84.30	0.83	12.23	631	24.84	0.841	841
6000	1.14	1829	81.20	0.80	11.78	608	23.94	0.811	811
7000	1.33	2134	78.20	0.77	11.34	585	23.04	0.780	780
8000	1.52	2438	75.30	0.74	10.92	562	22.14	0.750	750
9000	1.7	2743	72.40	0.71	10.51	540	21.25	0.719	719
10000	1.89	3048	69.70	0.69	10.11	524	20.65	0.699	699

20) **Composite Sampling Volume:** Method 25C allows the composite samples ***as long as a minimum of <u>1 liter per location</u> is collected***. Most common is to collect 3 samples in a 6 liter summa canister with a partial helium pre-fill. Five composite samples can be collected in a fully evacuated container, but this could fall under hazardous shipping requirements. A **minimum of 1 liter per sample location** is required by the method, but you don't want to pull the canister vacuum to down zero, so a little vacuum needs to be left in the canister, or collecting the final sample will be slow or difficult. A full size summa canister holds 6 liters if starting with a full vacuum.

21) **Collecting a Sample:** After measuring the initial canister pressure, turn the 3-way valve to the sample canister position, and open the toggle valve. Adjust the Rotameter to sample at 250cc or less for sampling. (In Method 25C The maximum allowed rate is 500ml/min, but stay below 250cc for better control and leak prevention.) If collecting composite samples, measure the canister pressure periodically while sampling by closing the INLET toggle valve and measuring the vacuum remaining in the canister. **NOTE: The canister vacuum cannot be read while sampling, you must turn off the flow with the toggle valve to accurately measure the vacuum pressure in the canister:**

22) **Measure Purge Volume/Pressure for Composite Sampling:** Once the correct amount of pressure has dropped on the canister, tightly close the valve on the summa canister.

23) **Record Time, Pressures, Flow Rates:** Record the initial and final sampling time, initial and final canister pressures and flows for each sample in the log. Remember, for composite samples, each sample should be of equal volume/pressure.

24) **Record the ambient (air) pressure** readings with a barometer/altimeter. *Be sure to record actual <u>ambient pressures</u> and <u>not barometer readings</u> which are corrected back to sea level.*

25) **Record the Surface Air Temperature.**

26) **Record Down-hole Temperature:** Remove the inner tubing from the probe rod and lower the probe on the digital temperature gauge down through the probe rod to the open hole. Wait for the temperature to stabilize and record the temperature. Probe rods may retain temperatures from the surface and not equilibrate right away. Alternately, you can measure the downhole temp after removing probe rods.

27) **Remove the probe rods** from the test hole.

28) Plug the test hole with cap material or hydrated bentonite.

29) Record the x-y coordinates on the GPS, flag and identify the sampling location if required by the client.

30) Decontaminate Tools by simply brushing the dirt off the threads. If the rods have become wet on the interior or extremely contaminated, they should then be cleaned using an Alconox wash and rinse procedure. All tooling should be disassembled, Alconox cleaned, pressure wash/steam-cleaned, dried and reassembled at the end of a project before use on another project.

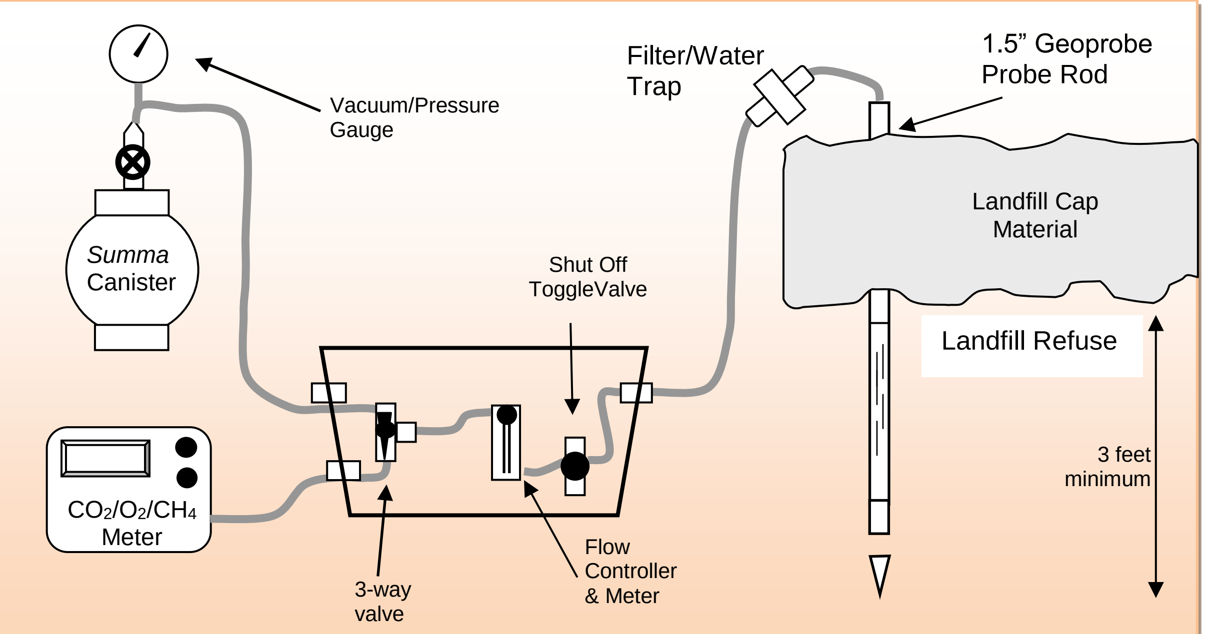


Figure 1. Equipment setup for sampling landfill gases according to Method 25C.

4.0 ADDITIONAL INSTRUCTIONS FOR COLLECTING SAMPLES FROM WELLS OR GATHERING SYSTEMS.

1) At some landfills, well and gathering systems may have been installed in some areas of the landfill. Collecting a sample from these gathering systems may be permitted as a substitute for the composite probe samples in that part of the landfill. The sampling procedures are the same as the above steps in section 3.0 with the exceptions below:

2) A well, manifold, stack or header system will have a sampling port for collecting a sample. Locate this port.

3) The sampling apparatus will be connected as above with the following exception: If the system is under a vacuum, this could draw sample out of the sampling container in the wrong direction.

4) If this is the case, then a peristaltic pump, which can pull a stronger vacuum against the system, is placed between the collection port and the above sampling apparatus.

5) The peristaltic pump is turned on, and the gas sample is pumped through the sampling apparatus to screen the sample for the correct parameters. All parameters are measured and recorded as above in the probe sampling procedure. Once a stable reading is obtained for methane, oxygen, and CO2, then a sample can be collected.

6) If the oxygen or nitrogen content is too high per the method above, check for leaks in the sampling system and connections. If no leaks are found, then the sample is considered valid. No adjustments to sampling location can be made as with the probe method.

7) If a composite sample is required from a single sampling port, and no time interval is specified by the regulations or regulator, then collect the required number of composites by shutting off the sampling port, waiting 5 minutes, and collecting each composite sample separately.

5.0 REFERENCES

Standards of Performance for New Stationary Sources and Guidelines for Control of Existing Sources: Municipal Solid Waste Landfills; 40 CFR Parts 51, 52 and 60. Federal Register, Vol. 61, No. 49, March 12, 1996; Environmental Protection Agency

March 12, 1998, William F. Hunt, Jr, Emissions, Monitoring and Analysis Division, USEPA, Letter to Utah Dept. of Environmental Quality approving use of oxygen in place of nitrogen for determining air dilution in landfill gas samples.

1996, Thomas J. Glover, Pocket Reference, Elevation vs. Air & Water (data based on ICAO Standard Atmosphere. P13, Sequoia Publishing.

Notes on Shipping Landfill Gas Samples in Summa Containers. (provided by a laboratory)

Proper Mounting of a VA Flow Meter.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

MAR 12 1998

Carol Nielsen
State of Utah Department of
Environmental Quality
Division of Air Quality
150 North 1950 West
P.O. Box 144820
Salt Lake City, Utah 84114-4820

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Dear Mrs. Nielsen:

This letter addresses your August 25, 1997 request for an alternative procedure determination for the nitrogen leak-check in EPA Method 25C as used at 40 CFR 60 Subpart WWW landfills. Method 25C requires that a valid sample have a nitrogen content less than 20 percent. A citation in your letter stated that some samples taken from sites in the initial stages of waste decomposition may have nitrogen levels greater than 20 percent while having oxygen levels substantially less than expected from its ratio in ambient air. In these cases, the high nitrogen levels would not be attributable to sampling leaks but would reflect the actual landfill gas composition. A request was made to allow the oxygen analysis as an alternative leak indicator to the nitrogen analysis.

We agree that in some cases, landfill samples may exceed the 20 percent nitrogen criteria without having ambient air sample leakage. This has been reported even though the wastes sampled were more than two years old. An oxygen analysis may be used as an alternative to the nitrogen analysis in the sample leak-check. For this alternative test, the oxygen concentration must not exceed 5 percent for the sample to be valid.

If you have further questions, please call Foston Curtis at (919) 541-1063 or you may e-mail him a message at curtis.foston@epamail.epa.gov.

Sincerely,

William F. Hunt, Jr.

William F. Hunt, Jr.
Director
Emissions, Monitoring, and
Analysis Division

cc: Foston Curtis (MD-19)
John Dale, Region VIII
Lee Hanley, Region VIII
Robin Segall (MD-19)

RECEIVED
MAR 20 1998
Air Quality

Notes on the Shipping of Landfill Gas Samples

Background

There has been some confusion regarding the various shipping regulations applicable to landfill gas samples. At the heart of the matter it seems that EPA Method 25C requires the use of a 6 liter SUMMA canister to sample, while DOT shipping regulations prohibit shipping of the same. As penalties for the unlawful shipment of hazardous goods can be severe, a reasonable amount of consideration is in order. In order to facilitate the shipment of SUMMA canisters containing landfill gas samples Air Technology Labs has put together this summary of pertinent regulations.

Classifications

A pure, non-pressurized landfill gas sample is normally classified, from (40 CFR 172.101 Hazardous Material Table), as:

Gas sample, non-pressurized, flammable, n.o.s., [not refrigerated liquid]
Hazard class / Division: 2.1
Identification Numbers: UN3167

Unfortunately, the maximum allowed shipping volume (by cargo aircraft only) is 5 liters. There has been some discussion on satisfying this rule by filling the 6 liter canister with only 5 liters of sample (at standard temperature and pressure), but at this time we have not had an official acceptance of this interpretation and do not recommend it. If a 5 liter sample were to be shipped this way it would require each canister to be individually packaged in a 4G (double walled) box with the above labeling, a "cargo aircraft only" label, and the appropriate hazardous materials paperwork. As we will show below, there is a safer and simpler way to ship samples in canisters.

Pressurized vs. non-pressurized

(40 CFR 173.306 (a)(4)(i)

"*A gas sample may only be transported as non-pressurized gas when its pressure corresponding to ambient atmospheric pressure in the container is not more than 105 kPa absolute (15.22 psia).*

This typically is not an issue for landfill samples, as the pressure in the canister is limited to the amount the canister can draw in (i.e. ambient pressure, 14.7 psia).

Flammable vs. non-flammable

(40 CFR 173.115)

(a) Division 2.1 (Flammable gas). For the purpose of this subchapter, a "flammable gas (Division 2.1)" means any material which is a gas at 20°C (68°F) or less and 101.3 kPa (14.7 psi) of pressure (a material which has a boiling point of 20°C (68°F) or less at 101.3 kPa (14.7 psi)) which --

> *(1) Is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13 percent or less by volume with air; or*
>
> *(2) Has a flammable range at 101.3 kPa (14.7 psia) with air of at least 12 percent regardless of the lower limit.*

Methane (the main flammable component in landfill gas) has a lower flammable level (LEL) of 5.3% and an upper (UEL) of 15%. This gives a flammable range of less than 10%, so (2) does not apply.

The Best Answer: Sample Canister Prefill

EPA Method 25C suggests partially filling the canister (to 325 torr) with helium before sampling. While this does have some minor drawbacks (reduces sample volume capacity by about 40% and may raise reporting limits somewhat due to sample dilution), it does reduce the methane concentration below the flammable definition. Canisters can now be shipped as regular freight in their normal boxes without hazardous material labeling or paperwork.

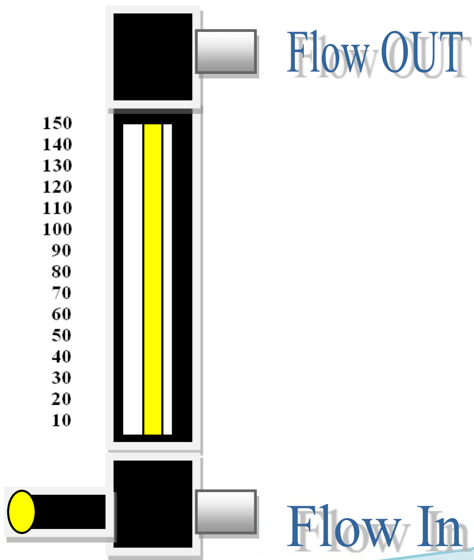
The Calculation

The goal is to get the methane content below its lower explosive limit of 5.3% "when in a mixture of 13 percent or less by volume with air" (see above). Most landfill gas has a maximum methane content of about 57-58% by volume. We will use 60% to be a little conservative. Without the prefill this would give a methane concentration of 7.8% as a 13% mixture in air, still above the lower explosive limit. Assuming an atmospheric pressure of 760 torr, a 325 torr prefill would give an additional 1.75x dilution (760/[760-325]), for a methane concentration of 4.46%. This is now below the 5.3% LEL and considered non-flammable. Working backwards we can show that any gas sample with a methane concentration less than 71% would be considered non-flammable when sampled in a canister with the 325 torr prefill.

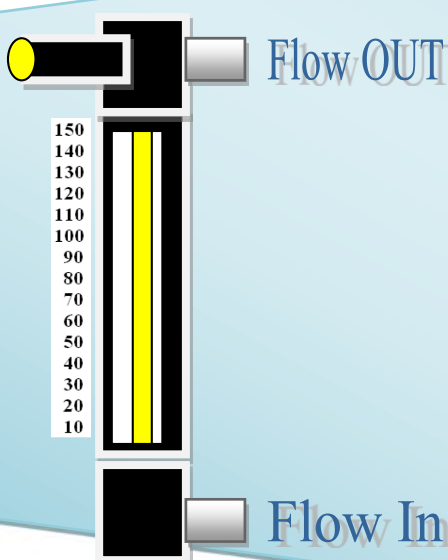
Getting the Prefill

Air Technology Labs offers canisters with the helium prefill at no additional cost. Just ask for it when ordering and the canisters will be sent clean, prefilled, and ready to sample and return via standard freight.

Proper Mounting of your Variable Area Flow Meter

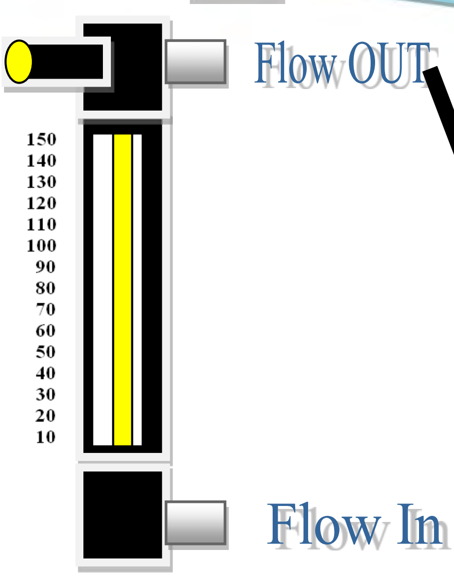


For general applications where the system is venting to atmosphere the flow meter should be mounted as shown on left. The scale should increase from bottom to top. If using a control valve it should be placed at the inlet side of the flow tube. Having the valve placed on the inlet prevents any minor fluctuations in inlet pressure from affecting the readings.

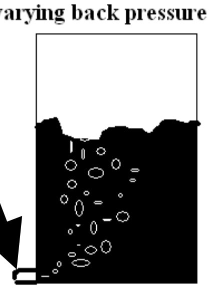


The vacuum source (or pump) is connected at the top. Flow moves from bottom to top.

For Vacuum applications, if using a valve, you want the control valve to be on top. You can do this by flipping the tube so the scale increases from bottom to the top. This way flow still goes in the same direction, but the valve acts to isolate the affect the vacuum pump has on the readings.



Reaction Vessel or other vessel with a varying back pressure



50 PSI INLET

For applications where there will be varying differential pressures due to varying outlet pressures, the valve should also be mounted on the top. The scale should still increase from bottom to top and flow should still follow the same path as shown. A correlated chart will be needed for the fixed inlet pressure (usually 50 PSI). This is most commonly used when dispensing gas from a cylinder at a fixed PSI where the outlet pressure may change. A mass flow meter should also be considered.

EPA TEST METHOD 25C TIER-2 LANDFILL GAS SAMPLING LOG

Page _____ of _____

Vista GeoScience

www.VistaGeoScience.com
130 Capital Drive, Suite C
Golden, CO 80401
PH: 303-277-1694

Project No.:

Sampling Technician: **Signature:**________________________

CLIENT:

Gas Meter:

Calibration Check (date/time)**:**

CLIENT FIELD REP.

Rig/Probe:

Barometer:

LANDFILL NAME:

Flowmeter:

Vacuum Guage:

LANDFILL ADDRESS:

DATE	SAMPLE LOCATION NUMBER	CANISTER LAB I.D.	SYSTEM PRE-PURGE TIME				IR GAS METER ANALYSIS					SUMMA CANNISTER PRESSURE- VOL.							Depth (ft.)		Bottom	Ambien	Ambient
			START TIME	END TIME	Flow (ml/min)	Est. Vol. (Liters)	O_2 %	CH_4 %	CO_2 %	N_2 % Balance	TOTAL CHECK	Start Time	INITIAL (mm Hg)	Flow (ml/min)	End Time	End Flow (ml/min)	FINAL (mm Hg)	d Press. (mm Hg)	Top	Btm	TEMP. F	TEMP. F	Press. inch-Hg
XX/XX/XX	XXXXX	XXXXXX	XX:XX	XX:XX	XXX	XX.XX	XX.X	XX.X	XX.X	XX.X	100	XX:XX	XX.XX	XXX	XX:XX	XXX	XX.XX	XX.XX	XX.X	XX.X	XX.X	XX.X	XX.XX

APPENDIX 2

Laboratory Result Calculations

Roswell Municipal Landfill
2018 Tier 2 Laboratory Result Calculations

Lab ID	Summa Cunister ID	Sample ID / Drill Location	Weighing Factor[1]	Method 3C Results		Method 25C Results		Weighted NMOC Ave as Hexane
				Nitrogen (%)	Oxygen (%)	NMOC (ppm as C_6) [2]	NMOC (ppm as C_6) [3]	
J020108-01	1356	RNM1-1, RNM1-2, RNM13	3/50	70	<1.5	1,700	283	17
J020108-02	1479	RNM1-4, RNM1-5, RNM1-6	3/50	50	<1.5	2,100	350	21
J020108-03	3545	RNM1-7, RNM1-8, RNM1-9	3/50	38	<1.5	1,500	250	15
J020108-04	5476	RNM1-10, RNM1-11, RNM1-12	3/50	38	<1.5	1,100	183	11
J020108-05	3182	RNM1-13, RNM1-14, RNM1-15	3/50	44	2.4	2,400	400	24
J020108-06	1466	RNM1-16, RNM1-17, RNM1-18	3/50	51	2	2,400	400	24
J020108-07	1350	RNM1-19, RNM1-20, RNM1-21	3/50	52	<1.6	1,200	200	12
J020108-08	5461	RNM1-22, RNM1-23, RNM1-24	3/50	52	<1.6	970	162	10
J020108-09	3744	RNM1-25, RNM1-26, RNM1-27	3/50	62	<1.5	2,300	383	23
J020108-10	1382	RNM1-28, RNM1-29, RNM1-30	3/50	71	<1.6	810	135	8
J020108-11	1377	RNM1-31, RNM1-32, RNM1-33	3/50	59	<1.6	1,500	250	15
J020108-12	3588	RNM1-34, RNM1-35, RNM3-1	3/50	42	<1.5	1,700	283	17
J020108-13	1423	RNM3-2, RNM3-3, RNM3-4	3/50	3.4	<1.6	3,800	633	38
J020108-14	1474	RNM3-5, RNM3-6, RNM3-7	3/50	11	<1.6	6,600	1,100	66
J020108-15	5432	RNM2-8, RNM2-7, RNM2-6	3/50	57	<1.6	3,800	633	38
J020108-16	5435	RNM2-5, RNM2-4, RNM2-3	3/50	13	<1.6	2,500	417	25
J020108-17	3108	RNM2-2, RNM2-1	1/25	41	<2.3	3,000	500	20
Total Weighted Average NMOC Concentration (C_{NMOC})								**384**

Notes:
1. Weighing factor is the fraction of the total number of acceptable samples each individual sample represents
2. NMOC concentration, as carbon, divided by six to obtain NMOC concentration, as hexane
3. NMOC concentration, as hexane, multiplied by the weighing factor

APPENDIX 3

EPA LandGEM (version 3.02) Tier 2 Results

Summary Report

Landfill Name or Identifier: Roswell Municipal Landfill

Date: Monday, March 5, 2018

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

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

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

M_i = mass of waste accepted in the i^{th} year (*Mg*)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

The 80-year waste acceptance limit of the model has been exceeded before the Waste Design Capacity was reached. The model will assume the 80th year of waste acceptance as the final year to estimate emissions. See Section 2.6 of the User's Manual.

LANDFILL CHARACTERISTICS

Landfill Open Year	**1980**	
Landfill Closure Year (with 80-year limit)	**2059**	
Actual Closure Year (without limit)	***2177***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**9,700,000**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**384**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

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

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1980	40,909	45,000	0	0
1981	40,909	45,000	40,909	45,000
1982	40,909	45,000	81,818	90,000
1983	40,909	45,000	122,727	135,000
1984	40,909	45,000	163,636	180,000
1985	40,909	45,000	204,545	225,000
1986	40,909	45,000	245,455	270,000
1987	40,909	45,000	286,364	315,000
1988	40,909	45,000	327,273	360,000
1989	40,909	45,000	368,182	405,000
1990	41,008	45,109	409,091	450,000
1991	47,909	52,700	450,099	495,109
1992	54,536	59,990	498,008	547,809
1993	46,841	51,525	552,545	607,799
1994	46,841	51,525	599,385	659,324
1995	46,555	51,210	646,226	710,849
1996	44,215	48,636	692,781	762,059
1997	30,655	33,721	736,995	810,695
1998	41,397	45,537	767,651	844,416
1999	28,400	31,240	809,048	889,953
2000	30,391	33,430	837,448	921,193
2001	30,762	33,838	867,839	954,623
2002	42,316	46,548	898,601	988,461
2003	42,068	46,275	940,917	1,035,009
2004	44,316	48,748	982,985	1,081,284
2005	59,279	65,207	1,027,302	1,130,032
2006	45,066	49,573	1,086,581	1,195,239
2007	49,459	54,405	1,131,647	1,244,812
2008	47,198	51,918	1,181,106	1,299,217
2009	45,958	50,554	1,228,305	1,351,135
2010	47,012	51,713	1,274,263	1,401,689
2011	43,175	47,492	1,321,275	1,453,402
2012	47,440	52,184	1,364,449	1,500,894
2013	47,545	52,300	1,411,889	1,553,078
2014	57,728	63,501	1,459,435	1,605,378
2015	53,243	58,567	1,517,163	1,668,879
2016	49,547	54,501	1,570,405	1,727,446
2017	24,904	27,394	1,619,952	1,781,947
2018	50,593	55,652	1,644,856	1,809,341
2019	50,593	55,652	1,695,448	1,864,993

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
2020	50,593	55,652	1,746,041	1,920,645
2021	50,593	55,652	1,796,634	1,976,297
2022	50,593	55,652	1,847,227	2,031,949
2023	50,593	55,652	1,897,819	2,087,601
2024	50,593	55,652	1,948,412	2,143,253
2025	50,593	55,652	1,999,005	2,198,905
2026	50,593	55,652	2,049,597	2,254,557
2027	50,593	55,652	2,100,190	2,310,209
2028	50,593	55,652	2,150,783	2,365,861
2029	50,593	55,652	2,201,376	2,421,513
2030	50,593	55,652	2,251,968	2,477,165
2031	50,593	55,652	2,302,561	2,532,817
2032	50,593	55,652	2,353,154	2,588,469
2033	50,593	55,652	2,403,747	2,644,121
2034	50,593	55,652	2,454,339	2,699,773
2035	50,593	55,652	2,504,932	2,755,425
2036	50,593	55,652	2,555,525	2,811,077
2037	50,593	55,652	2,606,117	2,866,729
2038	50,593	55,652	2,656,710	2,922,381
2039	50,593	55,652	2,707,303	2,978,033
2040	50,593	55,652	2,757,896	3,033,685
2041	50,593	55,652	2,808,488	3,089,337
2042	50,593	55,652	2,859,081	3,144,989
2043	50,593	55,652	2,909,674	3,200,641
2044	50,593	55,652	2,960,267	3,256,293
2045	50,593	55,652	3,010,859	3,311,945
2046	50,593	55,652	3,061,452	3,367,597
2047	50,593	55,652	3,112,045	3,423,249
2048	50,593	55,652	3,162,637	3,478,901
2049	50,593	55,652	3,213,230	3,534,553
2050	50,593	55,652	3,263,823	3,590,205
2051	50,593	55,652	3,314,416	3,645,857
2052	50,593	55,652	3,365,008	3,701,509
2053	50,593	55,652	3,415,601	3,757,161
2054	50,593	55,652	3,466,194	3,812,813
2055	50,593	55,652	3,516,787	3,868,465
2056	50,593	55,652	3,567,379	3,924,117
2057	50,593	55,652	3,617,972	3,979,769
2058	50,593	55,652	3,668,565	4,035,421
2059	50,593	55,652	3,719,157	4,091,073

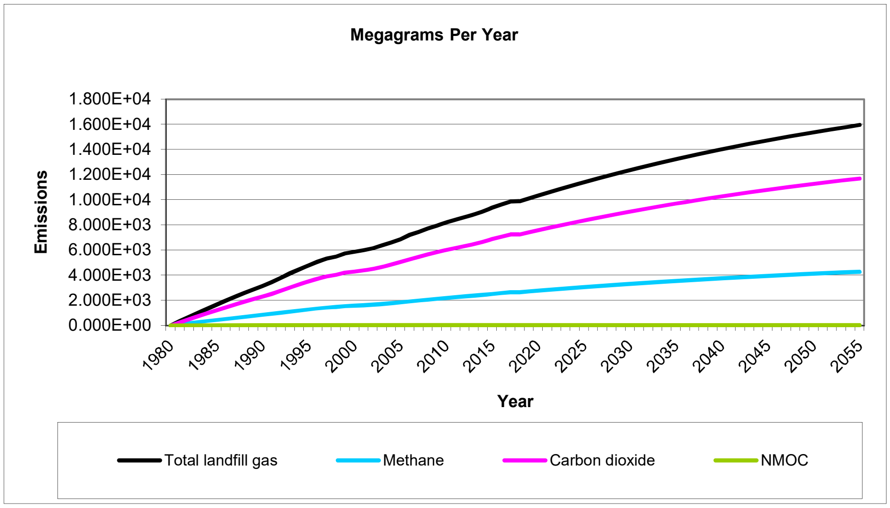
Pollutant Parameters

	Compound	Gas / Pollutant Default Parameters: Concentration (*ppmv*)	Molecular Weight	User-specified Pollutant Parameters: Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

Pollutant Parameters (Continued)

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

Graphs


Megagrams Per Year
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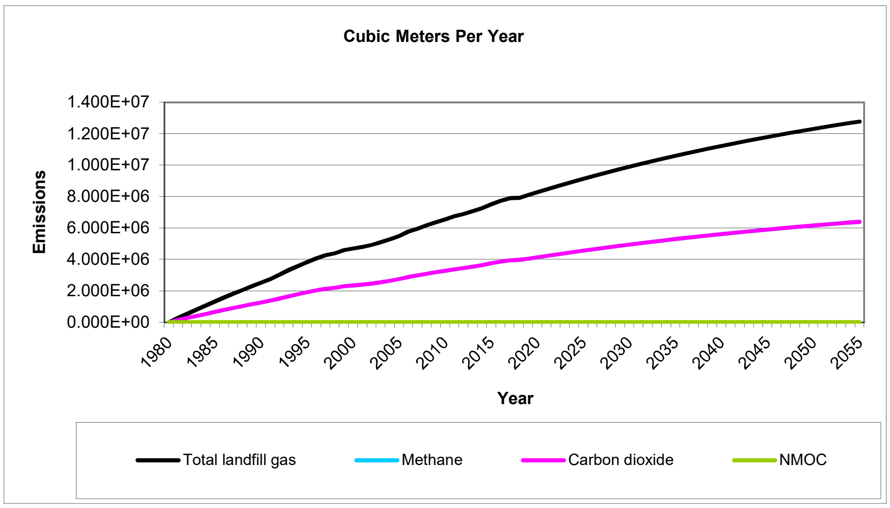
1.600E+04
1.400E+04
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055
Year
Total landfill gas
Methane
Carbon dioxide
NMOC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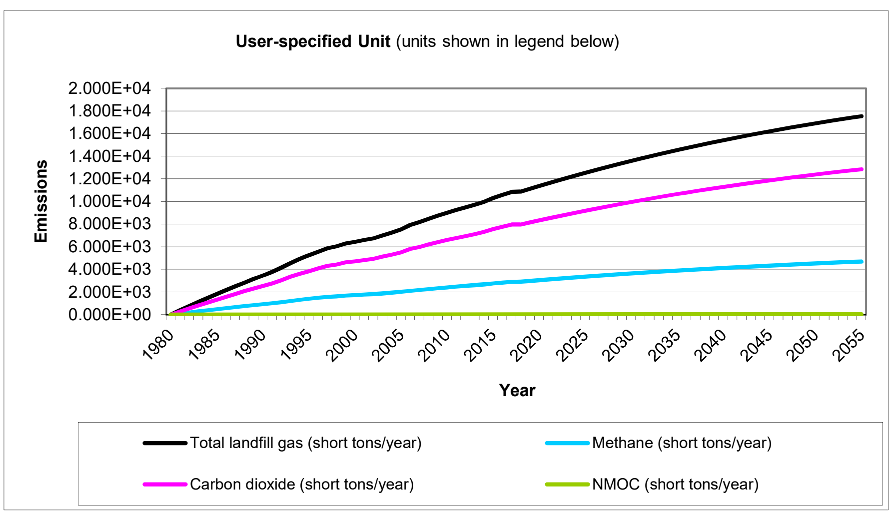
6.000E+06
4.000E+06
2.000E+06
0.000E+00
1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055
Year
Total landfill gas
Methane
Carbon dioxide
NMOC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1.600E+04
1.400E+04
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055
Year
Total landfill gas (short tons/year)
Methane (short tons/year)
Carbon dioxide (short tons/year)
NMOC (short tons/year)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(short tons/year)	(Mg/year)	(m^3/year)	(short tons/year)
1980	0	0	0	0	0	0
1981	3.443E+02	2.757E+05	3.787E+02	9.196E+01	1.378E+05	1.012E+02
1982	6.818E+02	5.459E+05	7.499E+02	1.821E+02	2.730E+05	2.003E+02
1983	1.013E+03	8.108E+05	1.114E+03	2.705E+02	4.054E+05	2.975E+02
1984	1.337E+03	1.070E+06	1.470E+03	3.571E+02	5.352E+05	3.928E+02
1985	1.655E+03	1.325E+06	1.820E+03	4.420E+02	6.625E+05	4.862E+02
1986	1.966E+03	1.574E+06	2.163E+03	5.252E+02	7.872E+05	5.777E+02
1987	2.272E+03	1.819E+06	2.499E+03	6.067E+02	9.095E+05	6.674E+02
1988	2.571E+03	2.059E+06	2.828E+03	6.867E+02	1.029E+06	7.554E+02
1989	2.864E+03	2.294E+06	3.151E+03	7.651E+02	1.147E+06	8.416E+02
1990	3.152E+03	2.524E+06	3.467E+03	8.419E+02	1.262E+06	9.261E+02
1991	3.435E+03	2.750E+06	3.778E+03	9.174E+02	1.375E+06	1.009E+03
1992	3.770E+03	3.019E+06	4.147E+03	1.007E+03	1.509E+06	1.108E+03
1993	4.154E+03	3.326E+06	4.569E+03	1.110E+03	1.663E+06	1.221E+03
1994	4.466E+03	3.576E+06	4.913E+03	1.193E+03	1.788E+06	1.312E+03
1995	4.772E+03	3.821E+06	5.249E+03	1.275E+03	1.911E+06	1.402E+03
1996	5.069E+03	4.059E+06	5.576E+03	1.354E+03	2.030E+06	1.489E+03
1997	5.341E+03	4.277E+06	5.875E+03	1.427E+03	2.138E+06	1.569E+03
1998	5.493E+03	4.399E+06	6.042E+03	1.467E+03	2.199E+06	1.614E+03
1999	5.733E+03	4.590E+06	6.306E+03	1.531E+03	2.295E+06	1.684E+03
2000	5.858E+03	4.691E+06	6.444E+03	1.565E+03	2.345E+06	1.721E+03
2001	5.998E+03	4.803E+06	6.598E+03	1.602E+03	2.401E+06	1.762E+03
2002	6.138E+03	4.915E+06	6.752E+03	1.640E+03	2.458E+06	1.804E+03
2003	6.373E+03	5.103E+06	7.010E+03	1.702E+03	2.551E+06	1.872E+03
2004	6.601E+03	5.285E+06	7.261E+03	1.763E+03	2.643E+06	1.939E+03
2005	6.843E+03	5.479E+06	7.527E+03	1.828E+03	2.740E+06	2.011E+03
2006	7.206E+03	5.770E+06	7.927E+03	1.925E+03	2.885E+06	2.117E+03
2007	7.443E+03	5.960E+06	8.187E+03	1.988E+03	2.980E+06	2.187E+03
2008	7.712E+03	6.175E+06	8.483E+03	2.060E+03	3.088E+06	2.266E+03
2009	7.956E+03	6.371E+06	8.752E+03	2.125E+03	3.185E+06	2.338E+03
2010	8.185E+03	6.555E+06	9.004E+03	2.186E+03	3.277E+06	2.405E+03
2011	8.419E+03	6.742E+06	9.261E+03	2.249E+03	3.371E+06	2.474E+03
2012	8.616E+03	6.899E+06	9.477E+03	2.301E+03	3.450E+06	2.531E+03
2013	8.844E+03	7.082E+06	9.729E+03	2.362E+03	3.541E+06	2.599E+03
2014	9.069E+03	7.262E+06	9.976E+03	2.423E+03	3.631E+06	2.665E+03
2015	9.376E+03	7.508E+06	1.031E+04	2.504E+03	3.754E+06	2.755E+03
2016	9.638E+03	7.718E+06	1.060E+04	2.574E+03	3.859E+06	2.832E+03
2017	9.864E+03	7.899E+06	1.085E+04	2.635E+03	3.949E+06	2.898E+03
2018	9.878E+03	7.910E+06	1.087E+04	2.639E+03	3.955E+06	2.903E+03
2019	1.011E+04	8.095E+06	1.112E+04	2.700E+03	4.047E+06	2.970E+03
2020	1.033E+04	8.275E+06	1.137E+04	2.760E+03	4.138E+06	3.036E+03
2021	1.056E+04	8.452E+06	1.161E+04	2.819E+03	4.226E+06	3.101E+03
2022	1.077E+04	8.626E+06	1.185E+04	2.877E+03	4.313E+06	3.165E+03
2023	1.098E+04	8.796E+06	1.208E+04	2.934E+03	4.398E+06	3.228E+03
2024	1.119E+04	8.963E+06	1.231E+04	2.990E+03	4.481E+06	3.289E+03
2025	1.140E+04	9.126E+06	1.254E+04	3.044E+03	4.563E+06	3.349E+03
2026	1.160E+04	9.287E+06	1.276E+04	3.098E+03	4.643E+06	3.408E+03
2027	1.179E+04	9.444E+06	1.297E+04	3.150E+03	4.722E+06	3.465E+03
2028	1.199E+04	9.598E+06	1.318E+04	3.201E+03	4.799E+06	3.522E+03
2029	1.217E+04	9.748E+06	1.339E+04	3.252E+03	4.874E+06	3.577E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2030	1.236E+04	9.896E+06	1.359E+04	3.301E+03	4.948E+06	3.631E+03
2031	1.254E+04	1.004E+07	1.379E+04	3.350E+03	5.021E+06	3.685E+03
2032	1.272E+04	1.018E+07	1.399E+04	3.397E+03	5.092E+06	3.737E+03
2033	1.289E+04	1.032E+07	1.418E+04	3.443E+03	5.161E+06	3.788E+03
2034	1.306E+04	1.046E+07	1.437E+04	3.489E+03	5.230E+06	3.838E+03
2035	1.323E+04	1.059E+07	1.455E+04	3.534E+03	5.297E+06	3.887E+03
2036	1.339E+04	1.072E+07	1.473E+04	3.577E+03	5.362E+06	3.935E+03
2037	1.355E+04	1.085E+07	1.491E+04	3.620E+03	5.426E+06	3.982E+03
2038	1.371E+04	1.098E+07	1.508E+04	3.662E+03	5.490E+06	4.029E+03
2039	1.387E+04	1.110E+07	1.525E+04	3.704E+03	5.551E+06	4.074E+03
2040	1.402E+04	1.122E+07	1.542E+04	3.744E+03	5.612E+06	4.118E+03
2041	1.416E+04	1.134E+07	1.558E+04	3.784E+03	5.671E+06	4.162E+03
2042	1.431E+04	1.146E+07	1.574E+04	3.822E+03	5.729E+06	4.205E+03
2043	1.445E+04	1.157E+07	1.590E+04	3.860E+03	5.786E+06	4.246E+03
2044	1.459E+04	1.168E+07	1.605E+04	3.898E+03	5.842E+06	4.287E+03
2045	1.473E+04	1.179E+07	1.620E+04	3.934E+03	5.897E+06	4.328E+03
2046	1.486E+04	1.190E+07	1.635E+04	3.970E+03	5.951E+06	4.367E+03
2047	1.499E+04	1.201E+07	1.649E+04	4.005E+03	6.003E+06	4.406E+03
2048	1.512E+04	1.211E+07	1.664E+04	4.040E+03	6.055E+06	4.444E+03
2049	1.525E+04	1.221E+07	1.677E+04	4.073E+03	6.106E+06	4.481E+03
2050	1.537E+04	1.231E+07	1.691E+04	4.106E+03	6.155E+06	4.517E+03
2051	1.549E+04	1.241E+07	1.704E+04	4.139E+03	6.204E+06	4.553E+03
2052	1.561E+04	1.250E+07	1.718E+04	4.171E+03	6.251E+06	4.588E+03
2053	1.573E+04	1.260E+07	1.730E+04	4.202E+03	6.298E+06	4.622E+03
2054	1.584E+04	1.269E+07	1.743E+04	4.232E+03	6.344E+06	4.656E+03
2055	1.596E+04	1.278E+07	1.755E+04	4.262E+03	6.389E+06	4.688E+03
2056	1.607E+04	1.287E+07	1.767E+04	4.292E+03	6.433E+06	4.721E+03
2057	1.617E+04	1.295E+07	1.779E+04	4.320E+03	6.476E+06	4.752E+03
2058	1.628E+04	1.304E+07	1.791E+04	4.349E+03	6.518E+06	4.783E+03
2059	1.638E+04	1.312E+07	1.802E+04	4.376E+03	6.559E+06	4.814E+03
2060	1.648E+04	1.320E+07	1.813E+04	4.403E+03	6.600E+06	4.844E+03
2061	1.616E+04	1.294E+07	1.777E+04	4.316E+03	6.469E+06	4.748E+03
2062	1.584E+04	1.268E+07	1.742E+04	4.231E+03	6.341E+06	4.654E+03
2063	1.552E+04	1.243E+07	1.708E+04	4.147E+03	6.216E+06	4.561E+03
2064	1.522E+04	1.219E+07	1.674E+04	4.065E+03	6.093E+06	4.471E+03
2065	1.492E+04	1.194E+07	1.641E+04	3.984E+03	5.972E+06	4.383E+03
2066	1.462E+04	1.171E+07	1.608E+04	3.905E+03	5.854E+06	4.296E+03
2067	1.433E+04	1.148E+07	1.576E+04	3.828E+03	5.738E+06	4.211E+03
2068	1.405E+04	1.125E+07	1.545E+04	3.752E+03	5.624E+06	4.127E+03
2069	1.377E+04	1.103E+07	1.515E+04	3.678E+03	5.513E+06	4.046E+03
2070	1.350E+04	1.081E+07	1.485E+04	3.605E+03	5.404E+06	3.966E+03
2071	1.323E+04	1.059E+07	1.455E+04	3.534E+03	5.297E+06	3.887E+03
2072	1.297E+04	1.038E+07	1.426E+04	3.464E+03	5.192E+06	3.810E+03
2073	1.271E+04	1.018E+07	1.398E+04	3.395E+03	5.089E+06	3.735E+03
2074	1.246E+04	9.976E+06	1.370E+04	3.328E+03	4.988E+06	3.661E+03
2075	1.221E+04	9.779E+06	1.343E+04	3.262E+03	4.889E+06	3.588E+03
2076	1.197E+04	9.585E+06	1.317E+04	3.197E+03	4.793E+06	3.517E+03
2077	1.173E+04	9.395E+06	1.291E+04	3.134E+03	4.698E+06	3.447E+03
2078	1.150E+04	9.209E+06	1.265E+04	3.072E+03	4.605E+06	3.379E+03
2079	1.127E+04	9.027E+06	1.240E+04	3.011E+03	4.514E+06	3.312E+03
2080	1.105E+04	8.848E+06	1.215E+04	2.952E+03	4.424E+06	3.247E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2081	1.083E+04	8.673E+06	1.191E+04	2.893E+03	4.337E+06	3.182E+03
2082	1.062E+04	8.501E+06	1.168E+04	2.836E+03	4.251E+06	3.119E+03
2083	1.041E+04	8.333E+06	1.145E+04	2.780E+03	4.167E+06	3.058E+03
2084	1.020E+04	8.168E+06	1.122E+04	2.725E+03	4.084E+06	2.997E+03
2085	9.998E+03	8.006E+06	1.100E+04	2.671E+03	4.003E+06	2.938E+03
2086	9.800E+03	7.848E+06	1.078E+04	2.618E+03	3.924E+06	2.880E+03
2087	9.606E+03	7.692E+06	1.057E+04	2.566E+03	3.846E+06	2.823E+03
2088	9.416E+03	7.540E+06	1.036E+04	2.515E+03	3.770E+06	2.767E+03
2089	9.230E+03	7.391E+06	1.015E+04	2.465E+03	3.695E+06	2.712E+03
2090	9.047E+03	7.244E+06	9.952E+03	2.417E+03	3.622E+06	2.658E+03
2091	8.868E+03	7.101E+06	9.755E+03	2.369E+03	3.550E+06	2.606E+03
2092	8.692E+03	6.960E+06	9.561E+03	2.322E+03	3.480E+06	2.554E+03
2093	8.520E+03	6.823E+06	9.372E+03	2.276E+03	3.411E+06	2.503E+03
2094	8.351E+03	6.687E+06	9.187E+03	2.231E+03	3.344E+06	2.454E+03
2095	8.186E+03	6.555E+06	9.005E+03	2.187E+03	3.277E+06	2.405E+03
2096	8.024E+03	6.425E+06	8.826E+03	2.143E+03	3.213E+06	2.358E+03
2097	7.865E+03	6.298E+06	8.652E+03	2.101E+03	3.149E+06	2.311E+03
2098	7.709E+03	6.173E+06	8.480E+03	2.059E+03	3.087E+06	2.265E+03
2099	7.557E+03	6.051E+06	8.312E+03	2.018E+03	3.026E+06	2.220E+03
2100	7.407E+03	5.931E+06	8.148E+03	1.978E+03	2.966E+06	2.176E+03
2101	7.260E+03	5.814E+06	7.986E+03	1.939E+03	2.907E+06	2.133E+03
2102	7.117E+03	5.699E+06	7.828E+03	1.901E+03	2.849E+06	2.091E+03
2103	6.976E+03	5.586E+06	7.673E+03	1.863E+03	2.793E+06	2.050E+03
2104	6.838E+03	5.475E+06	7.521E+03	1.826E+03	2.738E+06	2.009E+03
2105	6.702E+03	5.367E+06	7.372E+03	1.790E+03	2.683E+06	1.969E+03
2106	6.569E+03	5.261E+06	7.226E+03	1.755E+03	2.630E+06	1.930E+03
2107	6.439E+03	5.156E+06	7.083E+03	1.720E+03	2.578E+06	1.892E+03
2108	6.312E+03	5.054E+06	6.943E+03	1.686E+03	2.527E+06	1.855E+03
2109	6.187E+03	4.954E+06	6.806E+03	1.653E+03	2.477E+06	1.818E+03
2110	6.064E+03	4.856E+06	6.671E+03	1.620E+03	2.428E+06	1.782E+03
2111	5.944E+03	4.760E+06	6.539E+03	1.588E+03	2.380E+06	1.747E+03
2112	5.827E+03	4.666E+06	6.409E+03	1.556E+03	2.333E+06	1.712E+03
2113	5.711E+03	4.573E+06	6.282E+03	1.526E+03	2.287E+06	1.678E+03
2114	5.598E+03	4.483E+06	6.158E+03	1.495E+03	2.241E+06	1.645E+03
2115	5.487E+03	4.394E+06	6.036E+03	1.466E+03	2.197E+06	1.612E+03
2116	5.379E+03	4.307E+06	5.916E+03	1.437E+03	2.153E+06	1.580E+03
2117	5.272E+03	4.222E+06	5.799E+03	1.408E+03	2.111E+06	1.549E+03
2118	5.168E+03	4.138E+06	5.684E+03	1.380E+03	2.069E+06	1.518E+03
2119	5.065E+03	4.056E+06	5.572E+03	1.353E+03	2.028E+06	1.488E+03
2120	4.965E+03	3.976E+06	5.462E+03	1.326E+03	1.988E+06	1.459E+03

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
1980	0	0	0	0	0	0
1981	2.523E+02	1.378E+05	2.776E+02	3.795E-01	1.059E+02	4.174E-01
1982	4.997E+02	2.730E+05	5.496E+02	7.514E-01	2.096E+02	8.266E-01
1983	7.421E+02	4.054E+05	8.163E+02	1.116E+00	3.114E+02	1.228E+00
1984	9.797E+02	5.352E+05	1.078E+03	1.473E+00	4.111E+02	1.621E+00
1985	1.213E+03	6.625E+05	1.334E+03	1.824E+00	5.088E+02	2.006E+00
1986	1.441E+03	7.872E+05	1.585E+03	2.167E+00	6.046E+02	2.384E+00
1987	1.665E+03	9.095E+05	1.831E+03	2.504E+00	6.985E+02	2.754E+00
1988	1.884E+03	1.029E+06	2.073E+03	2.834E+00	7.905E+02	3.117E+00
1989	2.099E+03	1.147E+06	2.309E+03	3.157E+00	8.807E+02	3.473E+00
1990	2.310E+03	1.262E+06	2.541E+03	3.474E+00	9.691E+02	3.821E+00
1991	2.517E+03	1.375E+06	2.769E+03	3.785E+00	1.056E+03	4.164E+00
1992	2.763E+03	1.509E+06	3.039E+03	4.155E+00	1.159E+03	4.570E+00
1993	3.044E+03	1.663E+06	3.349E+03	4.579E+00	1.277E+03	5.036E+00
1994	3.273E+03	1.788E+06	3.600E+03	4.922E+00	1.373E+03	5.415E+00
1995	3.497E+03	1.911E+06	3.847E+03	5.259E+00	1.467E+03	5.785E+00
1996	3.715E+03	2.030E+06	4.087E+03	5.587E+00	1.559E+03	6.146E+00
1997	3.914E+03	2.138E+06	4.306E+03	5.887E+00	1.642E+03	6.475E+00
1998	4.026E+03	2.199E+06	4.428E+03	6.054E+00	1.689E+03	6.660E+00
1999	4.201E+03	2.295E+06	4.622E+03	6.319E+00	1.763E+03	6.950E+00
2000	4.293E+03	2.345E+06	4.723E+03	6.457E+00	1.801E+03	7.103E+00
2001	4.396E+03	2.401E+06	4.835E+03	6.611E+00	1.844E+03	7.272E+00
2002	4.499E+03	2.458E+06	4.948E+03	6.765E+00	1.887E+03	7.442E+00
2003	4.670E+03	2.551E+06	5.138E+03	7.024E+00	1.960E+03	7.726E+00
2004	4.837E+03	2.643E+06	5.321E+03	7.275E+00	2.030E+03	8.003E+00
2005	5.015E+03	2.740E+06	5.517E+03	7.542E+00	2.104E+03	8.296E+00
2006	5.281E+03	2.885E+06	5.810E+03	7.943E+00	2.216E+03	8.737E+00
2007	5.455E+03	2.980E+06	6.000E+03	8.203E+00	2.289E+03	9.024E+00
2008	5.652E+03	3.088E+06	6.217E+03	8.500E+00	2.371E+03	9.350E+00
2009	5.831E+03	3.185E+06	6.414E+03	8.769E+00	2.446E+03	9.646E+00
2010	5.999E+03	3.277E+06	6.599E+03	9.022E+00	2.517E+03	9.924E+00
2011	6.170E+03	3.371E+06	6.787E+03	9.279E+00	2.589E+03	1.021E+01
2012	6.314E+03	3.450E+06	6.946E+03	9.496E+00	2.649E+03	1.045E+01
2013	6.482E+03	3.541E+06	7.130E+03	9.748E+00	2.720E+03	1.072E+01
2014	6.647E+03	3.631E+06	7.312E+03	9.996E+00	2.789E+03	1.100E+01
2015	6.871E+03	3.754E+06	7.558E+03	1.033E+01	2.883E+03	1.137E+01
2016	7.064E+03	3.859E+06	7.770E+03	1.062E+01	2.964E+03	1.169E+01
2017	7.229E+03	3.949E+06	7.952E+03	1.087E+01	3.033E+03	1.196E+01
2018	7.240E+03	3.955E+06	7.964E+03	1.089E+01	3.038E+03	1.198E+01
2019	7.409E+03	4.047E+06	8.149E+03	1.114E+01	3.108E+03	1.226E+01
2020	7.574E+03	4.138E+06	8.331E+03	1.139E+01	3.178E+03	1.253E+01
2021	7.736E+03	4.226E+06	8.510E+03	1.163E+01	3.246E+03	1.280E+01
2022	7.895E+03	4.313E+06	8.684E+03	1.187E+01	3.312E+03	1.306E+01
2023	8.051E+03	4.398E+06	8.856E+03	1.211E+01	3.378E+03	1.332E+01
2024	8.203E+03	4.481E+06	9.024E+03	1.234E+01	3.442E+03	1.357E+01
2025	8.353E+03	4.563E+06	9.188E+03	1.256E+01	3.504E+03	1.382E+01
2026	8.499E+03	4.643E+06	9.349E+03	1.278E+01	3.566E+03	1.406E+01
2027	8.643E+03	4.722E+06	9.508E+03	1.300E+01	3.626E+03	1.430E+01
2028	8.784E+03	4.799E+06	9.663E+03	1.321E+01	3.685E+03	1.453E+01
2029	8.922E+03	4.874E+06	9.815E+03	1.342E+01	3.743E+03	1.476E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2030	9.058E+03	4.948E+06	9.963E+03	1.362E+01	3.800E+03	1.498E+01
2031	9.190E+03	5.021E+06	1.011E+04	1.382E+01	3.856E+03	1.520E+01
2032	9.320E+03	5.092E+06	1.025E+04	1.402E+01	3.910E+03	1.542E+01
2033	9.448E+03	5.161E+06	1.039E+04	1.421E+01	3.964E+03	1.563E+01
2034	9.573E+03	5.230E+06	1.053E+04	1.440E+01	4.016E+03	1.584E+01
2035	9.695E+03	5.297E+06	1.066E+04	1.458E+01	4.068E+03	1.604E+01
2036	9.816E+03	5.362E+06	1.080E+04	1.476E+01	4.118E+03	1.624E+01
2037	9.933E+03	5.426E+06	1.093E+04	1.494E+01	4.168E+03	1.643E+01
2038	1.005E+04	5.490E+06	1.105E+04	1.511E+01	4.216E+03	1.662E+01
2039	1.016E+04	5.551E+06	1.118E+04	1.528E+01	4.263E+03	1.681E+01
2040	1.027E+04	5.612E+06	1.130E+04	1.545E+01	4.310E+03	1.699E+01
2041	1.038E+04	5.671E+06	1.142E+04	1.561E+01	4.355E+03	1.717E+01
2042	1.049E+04	5.729E+06	1.154E+04	1.577E+01	4.400E+03	1.735E+01
2043	1.059E+04	5.786E+06	1.165E+04	1.593E+01	4.444E+03	1.752E+01
2044	1.069E+04	5.842E+06	1.176E+04	1.608E+01	4.487E+03	1.769E+01
2045	1.079E+04	5.897E+06	1.187E+04	1.623E+01	4.529E+03	1.786E+01
2046	1.089E+04	5.951E+06	1.198E+04	1.638E+01	4.570E+03	1.802E+01
2047	1.099E+04	6.003E+06	1.209E+04	1.653E+01	4.611E+03	1.818E+01
2048	1.108E+04	6.055E+06	1.219E+04	1.667E+01	4.650E+03	1.834E+01
2049	1.118E+04	6.106E+06	1.229E+04	1.681E+01	4.689E+03	1.849E+01
2050	1.127E+04	6.155E+06	1.239E+04	1.694E+01	4.727E+03	1.864E+01
2051	1.136E+04	6.204E+06	1.249E+04	1.708E+01	4.765E+03	1.879E+01
2052	1.144E+04	6.251E+06	1.259E+04	1.721E+01	4.801E+03	1.893E+01
2053	1.153E+04	6.298E+06	1.268E+04	1.734E+01	4.837E+03	1.907E+01
2054	1.161E+04	6.344E+06	1.277E+04	1.746E+01	4.872E+03	1.921E+01
2055	1.169E+04	6.389E+06	1.286E+04	1.759E+01	4.907E+03	1.935E+01
2056	1.178E+04	6.433E+06	1.295E+04	1.771E+01	4.940E+03	1.948E+01
2057	1.185E+04	6.476E+06	1.304E+04	1.783E+01	4.973E+03	1.961E+01
2058	1.193E+04	6.518E+06	1.312E+04	1.794E+01	5.006E+03	1.974E+01
2059	1.201E+04	6.559E+06	1.321E+04	1.806E+01	5.038E+03	1.986E+01
2060	1.208E+04	6.600E+06	1.329E+04	1.817E+01	5.069E+03	1.999E+01
2061	1.184E+04	6.469E+06	1.303E+04	1.781E+01	4.968E+03	1.959E+01
2062	1.161E+04	6.341E+06	1.277E+04	1.746E+01	4.870E+03	1.920E+01
2063	1.138E+04	6.216E+06	1.252E+04	1.711E+01	4.774E+03	1.882E+01
2064	1.115E+04	6.093E+06	1.227E+04	1.677E+01	4.679E+03	1.845E+01
2065	1.093E+04	5.972E+06	1.202E+04	1.644E+01	4.586E+03	1.808E+01
2066	1.072E+04	5.854E+06	1.179E+04	1.611E+01	4.496E+03	1.773E+01
2067	1.050E+04	5.738E+06	1.155E+04	1.580E+01	4.407E+03	1.738E+01
2068	1.030E+04	5.624E+06	1.132E+04	1.548E+01	4.319E+03	1.703E+01
2069	1.009E+04	5.513E+06	1.110E+04	1.518E+01	4.234E+03	1.669E+01
2070	9.891E+03	5.404E+06	1.088E+04	1.488E+01	4.150E+03	1.636E+01
2071	9.696E+03	5.297E+06	1.067E+04	1.458E+01	4.068E+03	1.604E+01
2072	9.504E+03	5.192E+06	1.045E+04	1.429E+01	3.987E+03	1.572E+01
2073	9.315E+03	5.089E+06	1.025E+04	1.401E+01	3.908E+03	1.541E+01
2074	9.131E+03	4.988E+06	1.004E+04	1.373E+01	3.831E+03	1.511E+01
2075	8.950E+03	4.889E+06	9.845E+03	1.346E+01	3.755E+03	1.481E+01
2076	8.773E+03	4.793E+06	9.650E+03	1.319E+01	3.681E+03	1.451E+01
2077	8.599E+03	4.698E+06	9.459E+03	1.293E+01	3.608E+03	1.423E+01
2078	8.429E+03	4.605E+06	9.272E+03	1.268E+01	3.536E+03	1.394E+01
2079	8.262E+03	4.514E+06	9.088E+03	1.243E+01	3.466E+03	1.367E+01
2080	8.098E+03	4.424E+06	8.908E+03	1.218E+01	3.398E+03	1.340E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2081	7.938E+03	4.337E+06	8.732E+03	1.194E+01	3.330E+03	1.313E+01
2082	7.781E+03	4.251E+06	8.559E+03	1.170E+01	3.265E+03	1.287E+01
2083	7.627E+03	4.167E+06	8.389E+03	1.147E+01	3.200E+03	1.262E+01
2084	7.476E+03	4.084E+06	8.223E+03	1.124E+01	3.137E+03	1.237E+01
2085	7.328E+03	4.003E+06	8.061E+03	1.102E+01	3.074E+03	1.212E+01
2086	7.183E+03	3.924E+06	7.901E+03	1.080E+01	3.014E+03	1.188E+01
2087	7.040E+03	3.846E+06	7.744E+03	1.059E+01	2.954E+03	1.165E+01
2088	6.901E+03	3.770E+06	7.591E+03	1.038E+01	2.895E+03	1.142E+01
2089	6.764E+03	3.695E+06	7.441E+03	1.017E+01	2.838E+03	1.119E+01
2090	6.630E+03	3.622E+06	7.293E+03	9.971E+00	2.782E+03	1.097E+01
2091	6.499E+03	3.550E+06	7.149E+03	9.774E+00	2.727E+03	1.075E+01
2092	6.370E+03	3.480E+06	7.007E+03	9.580E+00	2.673E+03	1.054E+01
2093	6.244E+03	3.411E+06	6.869E+03	9.391E+00	2.620E+03	1.033E+01
2094	6.121E+03	3.344E+06	6.733E+03	9.205E+00	2.568E+03	1.013E+01
2095	5.999E+03	3.277E+06	6.599E+03	9.023E+00	2.517E+03	9.925E+00
2096	5.881E+03	3.213E+06	6.469E+03	8.844E+00	2.467E+03	9.728E+00
2097	5.764E+03	3.149E+06	6.341E+03	8.669E+00	2.418E+03	9.536E+00
2098	5.650E+03	3.087E+06	6.215E+03	8.497E+00	2.371E+03	9.347E+00
2099	5.538E+03	3.026E+06	6.092E+03	8.329E+00	2.324E+03	9.162E+00
2100	5.429E+03	2.966E+06	5.971E+03	8.164E+00	2.278E+03	8.980E+00
2101	5.321E+03	2.907E+06	5.853E+03	8.002E+00	2.232E+03	8.802E+00
2102	5.216E+03	2.849E+06	5.737E+03	7.844E+00	2.188E+03	8.628E+00
2103	5.112E+03	2.793E+06	5.624E+03	7.688E+00	2.145E+03	8.457E+00
2104	5.011E+03	2.738E+06	5.512E+03	7.536E+00	2.102E+03	8.290E+00
2105	4.912E+03	2.683E+06	5.403E+03	7.387E+00	2.061E+03	8.126E+00
2106	4.815E+03	2.630E+06	5.296E+03	7.241E+00	2.020E+03	7.965E+00
2107	4.719E+03	2.578E+06	5.191E+03	7.097E+00	1.980E+03	7.807E+00
2108	4.626E+03	2.527E+06	5.088E+03	6.957E+00	1.941E+03	7.653E+00
2109	4.534E+03	2.477E+06	4.988E+03	6.819E+00	1.902E+03	7.501E+00
2110	4.445E+03	2.428E+06	4.889E+03	6.684E+00	1.865E+03	7.352E+00
2111	4.357E+03	2.380E+06	4.792E+03	6.552E+00	1.828E+03	7.207E+00
2112	4.270E+03	2.333E+06	4.697E+03	6.422E+00	1.792E+03	7.064E+00
2113	4.186E+03	2.287E+06	4.604E+03	6.295E+00	1.756E+03	6.924E+00
2114	4.103E+03	2.241E+06	4.513E+03	6.170E+00	1.721E+03	6.787E+00
2115	4.022E+03	2.197E+06	4.424E+03	6.048E+00	1.687E+03	6.653E+00
2116	3.942E+03	2.153E+06	4.336E+03	5.928E+00	1.654E+03	6.521E+00
2117	3.864E+03	2.111E+06	4.250E+03	5.811E+00	1.621E+03	6.392E+00
2118	3.787E+03	2.069E+06	4.166E+03	5.696E+00	1.589E+03	6.265E+00
2119	3.712E+03	2.028E+06	4.084E+03	5.583E+00	1.558E+03	6.141E+00
2120	3.639E+03	1.988E+06	4.003E+03	5.472E+00	1.527E+03	6.020E+00

Souder, Miller & Associates ♦ 3451 Candelaria Road NE, Suite D
Albuquerque, NM 87107-1948 ♦ (505) 299-0942 ♦ (877) 299-0942 ♦ fax (505) 293-3430

June 30, 2020

#4422745

Manager, Compliance and Enforcement Section
Air Quality Bureau
New Mexico Environment Department
525 Camino de los Marquez, Suite 1
Santa Fe, New Mexico, 87505-1816

RE: Annual Compliance Certification Report and Semi-Annual Monitoring Report, Operating Permit No. P187L-R1, Roswell Municipal Landfill, Roswell, New Mexico

Manager:

Attached please find the Annual Compliance Certification Report and Semi-Annual Monitoring Report for the Roswell Municipal Landfill, Operating Permit No. P187L-R1. It is submitted by Souder, Miller & Associates on behalf of the City of Roswell.

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Chief Enforcement
1445 Ross Ave
Dallas TX 75202

9590 9403 0470 5173 1074 80

2. Article Number (Transfer from service label)
7015 1520 0000 0087 7395

PS Form 3811, April 2015 PSN 7530-02-000-9053

COMPLETE THIS SECTION ON DELIVERY

A. Signature ☐ Agent ☒ Addressee
B. Received by (Printed Name) C. Date of Delivery
D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☒ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
Mail
Mail Restricted Delivery (over $500)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☒ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

Domestic Return Receipt

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Air Quality Bureau
525 Camino de los Marquez
Santa Fe, NM 87505

9590 9403 0470 5173 1074 73

2. Article Number (Transfer from service label)
7015 1520 0000 0087 7388

PS Form 3811, April 2015 PSN 7530-02-000-9053

COMPLETE THIS SECTION ON DELIVERY

A. Signature ☐ Agent ☐ Addressee
B. Received by (Printed Name) C. Date of Delivery
D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☒ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
Mail
Mail Restricted Delivery
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☒ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

Domestic Return Receipt

Souder, Miller & Associates ♦ 3451 Candelaria Road NE, Suite D
Albuquerque, NM 87107-1948 ♦ (505) 299-0942 ♦ (877) 299-0942 ♦ fax (505) 293-3430

June 30, 2020 #4422745

Manager, Compliance and Enforcement Section
Air Quality Bureau
New Mexico Environment Department
525 Camino de los Marquez, Suite 1
Santa Fe, New Mexico, 87505-1816

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Manager:

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If you have any questions or comments, please feel free to call me at the above number, on my cell at 505.220.6542, or to e-mail me at scott.mckitrick@soudermiller.com .

Sincerely,
SOUDER, MILLER AND ASSOCIATES

Scott A. McKitrick, P.G.
Senior Geoscientist / Environmental Services Manager

cc: Chief, Air Enforcement Section, US EPA Region 6, 6EN-AA, 1445 Ross Avenue, Suite 1200, Dallas, TX 75202-2733
Mr. Abraham Chaparro, Director of Sanitation, Recycling & Landfill, 3006 West Brasher Road, Roswell, NM 88203, a.chaparro@roswell-nm.gov
Mr. Michael Mayes, Landfill Supervisor, 3006 West Brasher Road, Roswell, NM 88203, m.mayes@roswell-nm.gov

Encl: NMED-AQB Reporting Submittal Form - ACCR
Title V Report Certification Form – ACCR
Annual Compliance Certification Report
NMED-AQB Reporting Submittal Form – Semi Annual Monitoring Report
Title V Report Certification Form – Semi Annual Monitoring Report
Semi-Annual Monitoring Report

Operating Hours Log
Waste Acceptance Records
Solid Waste Facility Annual Report submitted to NMED-SWB
Emission Inventory
Water Truck Usage Records
Visible Particulate Emission (Method 22) Monitoring Forms

NMED Air Quality Bureau Reporting Submittal Form - ACCR

Permit P187L-R1

New Mexico Environment Department
Air Quality Bureau
Compliance and Enforcement Section
525 Camino de los Marquez, Suite 1
Santa Fe, NM 87505
Phone (505) 476-4300 Fax (505) 476-4375

Version 05.02.13

NMED USE ONLY	
TEMPO	

REPORTING SUBMITTAL FORM

NMED USE ONLY	
Staff	
Admin	

PLEASE NOTE: ® - Indicates required field

SECTION I - GENERAL COMPANY AND FACILITY INFORMATION

A. ® Company Name: City of Roswell			D. ® Facility Name: Roswell Municipal Landfill		
B.1 ® Company Address: 425 N. Richardson			E.1 ® Facility Address: 3006 W. Brasher		
B.2 ® City: Roswell	B.3 ® State: NM	B.4 ® Zip: 8 8 2 0 1	E.2 ® City: Roswell	E.3 ® State: NM	E.4 ® Zip: 88203
C.1 ® Company Environmental Contact: Abraham Chaparro	C.2 ® Title: Director of Sanitation, Recycling and Landfill		F.1 ® Facility Contact: Michael Mayes	F.2 ® Title: Landfill Manager	
C.3 ® Phone Number: 575.624.6746	C.4 ® Fax Number:		F.3 ® Phone Number: 575.624.6746	F.4 ® Fax Number:	
C.5 ® Email Address: a.chaparro@roswell-nm.gov			F.5 ® Email Address: m.mayes@roswell-nm.gov		
G. Responsible Official: (Title V only): Joe Neeb	H. Title: City Manager		I. Phone Number: 575.637.6240	J. Fax Number: 575.624.6709	

K. ® AI Number: 61-PRT20150001	L. Title V Permit Number: P187L-R1	M. Title V Permit Issue Date: February 17, 2017	N. NSR Permit Number:	O. NSR Permit Issue Date:
P. Reporting Period: From: June 1, 2019 To: May 30, 2020				

SECTION II – TYPE OF SUBMITTAL (check one that applies)

	Type			
A. ☒	Title V Annual Compliance Certification	Permit Condition(s): A101, A102, A103, A104, A105, A108, A109, A110, A701, A702, A703	Description: Permit Duration, Facility Description, , Facility App. Regulations, Facility Regulated Sources, Facility Control Equipment, Facility Hours of Operation, Facility Reporting Schedules, Compliance Plan, LF Operations and NMOC Emissions, Haul Road Operations, Tanks	
B. ☐	Title V Semi-annual Monitoring Report	Permit Condition(s):	Description:	
C. ☐	NSPS Requirement (40CFR60)	Regulation:	Section(s):	Description:
D. ☐	MACT Requirement (40CFR63)	Regulation:	Section(s):	Description:
E. ☐	NMAC Requirement (20.2.xx) or NESHAP Requirement (40CFR61)	Regulation:	Section(s):	Description:
F. ☐	Permit or Notice of Intent (NOI) Requirement	Permit No.☐: or NOI No.☐:	Condition(s):	Description:
G. ☐	Requirement of an Enforcement Action	NOV No. ☐: or SFO No. ☐: or CD No. ☐: or Other ☐:	Section(s):	Description:

SECTION IV - CERTIFICATION

After reasonable inquiry, I Michael Mayes (name of reporting official) certify that the information in this submittal is true, accurate and complete.

® Signature of Reporting Official:	® Title:	® Date	® Responsible Official for Title V?
Michael Mayes	Landfill Supervisor	22 June 2020	☒ Yes ☐ No

Reviewed By: ______________________ Date Reviewed: ______________

Title V Report Certification Form - ACCR

Permit P187L-R1

Title V Report Certification Form

I. Report Type
☒ **Annual Compliance Certification**
☐ **Semi-Annual Monitoring Report**
☐ **Other Specify:**

II. Identifying Information		
Facility Name: Roswell Municipal Landfill		
Facility Address: 3006 W. Brasher	State: NM	Zip: 88203
Responsible Official (RO): Michael Mayes	Phone: 575.624.6746	Fax: 575.624.6709
RO Title: Landfill Supervisor	RO e-mail: m.mayes@roswell-nm.gov	
Permit No.: P187L-R1	Date Permit Issued: 2/17/2017	
Report Due Date (as required by the permit): 6/30/2020	Permit AI number: 61	
Time period covered by this Report: From: 6/1/2019	To: 5/31/2020	

III. Certification of Truth, Accuracy, and Completeness

I am the Responsible Official indicated above. I, (Michael Mayes) certify that I meet the requirements of 20.2.70.7.AE NMAC. I certify that, based on information and belief formed after reasonable inquiry, the statements and information contained in the attached Title V report are true, accurate, and complete.

Signature Michael R Mayes Date: 22 June 2020

Section 20

Other Relevant Information

Other relevant information. Use this attachment to clarify any part in the application that you think needs explaining. Reference the section, table, column, and/or field. Include any additional text, tables, calculations or clarifying information.

Additionally, the applicant may propose specific permit language for AQB consideration. In the case of a revision to an existing permit, the applicant should provide the old language and the new language in track changes format to highlight the proposed changes. If proposing language for a new facility or language for a new unit, submit the proposed operating condition(s), along with the associated monitoring, recordkeeping, and reporting conditions. In either case, please limit the proposed language to the affected portion of the permit.

There is no other relevant information included with this application.

Section 21

Addendum for Landfill Applications

Do not print this section unless this is a landfill application.

Landfill Applications are not required to complete Sections 1-C Input Capacity and Production Rate, 1-E Operating Schedule, 17 Compliance Test History, and 18 Streamline Applications. Section 12 – PSD Applicability is required only for Landfills with Gas Collection and Control Systems and/or landfills with other non-fugitive stationary sources of air emissions such as engines, turbines, boilers, heaters. All other Sections of the Universal Application Form are required.

EPA Background Information for MSW Landfill Air Quality Regulations:
https://www3.epa.gov/airtoxics/landfill/landflpg.html

NM Solid Waste Bureau Website: https://www.env.nm.gov/swb/

21-A: Municipal Solid Waste Landfill Information

1	How long will the landfill be operated? **Indefinite or planned capacity (17 years)**			
2	Maximum operational hours per year: **8,760**			
3	Landfill Operating hours (open to the public) M-F: **6AM-6PM**		Sat. **6AM-6PM**	Sun. **Closed**
4	To determine to what NSPS and emissions guidelines the landfill is subject, what is the date that the landfill was constructed, modified, or reconstructed as defined at 40 CFR 60, Subparts A, WWW, XXX, Cc, and Cf.			
5	Landfill Design Capacity. Enter all 3	Tons: **10,692,420**	Megagrams (Mg): **9.7 million**	Cubic meters: **15.9 million**
6	Landfill NMOC Emission Rate (NSPS XXX)	☐ Less than 34 Mg/year using Tiers 1 to 3	☐ Equal to or Greater than 34 Mg/year using Tiers 1 to 3	
	Landfill NMOC Emission Rate (NSPS XXX)	☐ Less than 500 ppm using Tier 4	☐ Equal to or Greater than 500 ppm using Tier 4	
	Landfill NMOC Emission Rate (NSPS WWW)	☒ Less than 50 Mg/yr	☐ Equal to or Greater than 50 Mg/yr	
7	Annual Waste Acceptance Rate: **95,000 tpy**			
8	Is Petroleum Contaminated Soil Accepted? **No**		If so, what is the annual acceptance rate? **N/A**	
9	NM Solid Waste Bureau (SWB) Permit No.: **SWM-040334**		SWB Permit Date: **May 2007**	
10	Describe the NM Solid Waste Bureau Permit, Status, and Type of waste deposited at the landfill. **The Roswell Municipal Landfill (RMLF) is an active landfill operating under the NMED Solid Waste Bureau (SWB) Permit Facility ID No. SWM-040334.** **RMLF began accepting waste from Chaves County in 1980. Under the New Mexico Solid Waste Management Regulations of October 27, 1995 (20 NMAC 9.1), the City submitted an Application for a Solid Waste Facility Permit (SWFP) for the RMLF on September 17, 1996; the permit SWM-040334 was approved on May 27, 1997. A design capacity report for the original permit was submitted to the AQB on April 21, 1998. The City subsequently submitted a modified solid waste permit application in April 2006 (revised May 2007) for an increased landfill capacity, including an expanded Unit 3 and an additional four waste units. Landfill accepts municipal solid waste, used tires, green waste, appliances, and electronic waste.**			
11	Describe briefly any process(es) or any other operations conducted at the landfill. **None.**			

21-B: NMOC Emissions Determined Pursuant to 40 CFR 60, Subparts WWW or XXX

	Enter the regulatory citation of all Tier 1, 2, 3, and/or 4 procedures used to determine NMOC emission rates and the date(s) that each Tier procedure was conducted. In Section 7 of the application, include the input data and results.
1	Tier 1 equations (e.g. LandGEM): **None**
2	Tier 2 Sampling: **LandGEM emission estimates based on Tier 2 sampling inputs performed in 2015 Title V application.**
3	Tier 3 Rate Constant: **None**
4	Tier 4 Surface Emissions Monitoring: **None**
5	Attach all Tier Procedure calculations, procedures, and results used to determine the Gas Collection and Control System (GCCS) requirements.

Facilities that have a landfill GCCS must complete Section 21-C.

21-C: Landfill Gas Collection and Control System (GCCS) Design Plan

1	Was the GCCS design certified by a Professional Engineer? **N/A**
2	Attach a copy of the GCCS Design Plan and enter the submittal date of the Plan pursuant to the deadlines in either NSPS WWW or NSPS XXX. The NMOC applicability threshold requiring a GCCS plan is 50Mg/yr for NSPS WWW and 34 Mg/yr or 500 ppm for NSPS XXX. **N/A**
3	Is/Was the GCCS planned to be operational within 30 months of reporting NMOC emission rates equal to or greater than 50 Mg/yr, 34 Mg/yr, or 500 ppm pursuant to the deadlines specified in NSPS WWW or NSPS XXX? **N/A**
4	Does the GCCS comply with the design and operational requirements found at 60.752, 60.753, and 69.759 (NSPS WWW) or at 60.762, 60.763, and 60.769 (NSPS XXX)? **N/A**
5	Enter the control device(s) to which the landfill gas will be/is routed such as an open flare, enclosed combustion device, boiler, process heater, or other. **N/A**
6	Do the control device(s) meet the operational requirements at 60.752 and 60.756 (NSPS WWW) or 60.762, 60.763, 60.766 (NSPS XXX)? **N/A**

Section 22: Certification

Company Name: City of Roswell, Roswell Municipal Landfill

I, Joe Neeb, hereby certify that the information and data submitted in this application are true and as accurate as possible, to the best of my knowledge and professional expertise and experience.

Signed this 11 day of February, 2021, upon my oath or affirmation, before a notary of the State of

New Mexico.

*Signature Date February 11, 2021

Joe Neeb
Printed Name

Roswell City Manager
Title

Scribed and sworn before me on this 11 day of February, 2021.

My authorization as a notary of the State of New Mexico expires on the

22 day of July, 2023.

Notary's Signature Date February 11, 2021

Stephanie Garay
Notary's Printed Name

OFFICIAL SEAL
STEPHANIE GARAY
NOTARY PUBLIC
STATE OF NEW MEXICO
Com. Expires 7/22/23

*For Title V applications, the signature must be of the Responsible Official as defined in 20.2.70.7.AE NMAC.