



August 22, 1992

RECEIVED

SEP - 1 1992

DEPT. OF ENVIRONMENTAL REG.
WEST PALM BEACH

Ms. Stephanie Brooks
Department of Environmental Regulation
Air Quality
1900 South Congress Avenue
Suite A
W. Palm Beach, Florida 33406

Re: Medley Sanitary Landfill and Recycling Center
Application To Operate/Construct Air Pollution Sources

Dear Ms. Brooks:

Enclosed please find an application to operate/construct an air pollution source at the Medley Landfill and Recycling Center in Medley, Florida. The air pollution source is a landfill gas flare which is a component of the site's landfill gas collection system. The gas collection system was permitted as a modification to the Department of Environmental Regulation Permit No. SC 13-179974.

The installation of the collection system was incorporated as a specific condition to this permit, (Specific Cond. No. 22).

The flare is an integral component to the collection system as it is used for the effective combustion of the landfill gas.

The attached information includes theoretical emissions rates of the flare based on the known properties of landfill gas and the flare technology. The emissions are based on the maximum gas flow rate capacity for the flare. Once the flare is put into operation, emission data will be submitted to your department which utilizes the actual field gas flow rate.

Attached also, please find a \$4500.00 check for the application fee.



Please review the attached application and emission calculations. As the gas collection system installation has been completed, we would like to begin operating the flare as soon as possible. Your timely response to the permit application would be greatly appreciated. Please call me at (305)977-9551, ext. 15, should you have any questions or require further information.

Sincerely,

A handwritten signature in cursive script that reads "Charlene Pisatowski".

Charlene Pisatowski
Staff Engineer

cc:

Mike Berg
Harvey Bush
Jim Barret
E.L. Anderson/w att





State of Florida
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Routing to Other Than The Addressee

To	_____	Location	_____
To	_____	Location	_____
To	_____	Location	_____
From	_____	Date	_____

Interoffice Memorandum

TO: Broward County Environmental Quality Control Board
 Broward County Health Department
 Dade County Public Health Unit
~~Metropolitan Dade County Environmental Resource Management~~
 Palm Beach County Public Health Unit

FROM: I. Goldman, P.E., West Palm Beach

DATE:

Sept 2, 1992

SUBJECT: Application

Application File No.

AC 13-218495

Application Name:

Waste Management North America

This office has received the following application for:

- | | | | |
|-------------------------------------|--------------------------|--------------------------|-------------------------|
| <input checked="" type="checkbox"/> | Air Pollution Source | <input type="checkbox"/> | Industrial Wastewater |
| <input type="checkbox"/> | Domestic Wastewater | <input type="checkbox"/> | Injection Well |
| <input type="checkbox"/> | Drainage Well | <input type="checkbox"/> | Public Water Well/Plant |
| <input type="checkbox"/> | Hazardous Waste Facility | <input type="checkbox"/> | Solid Waste Facility |

for

- | | |
|-------------------------------------|----------------------------|
| <input checked="" type="checkbox"/> | Construction Permit |
| <input type="checkbox"/> | Operating Permit |
| <input type="checkbox"/> | Temporary Operating Permit |

Your comments regarding completeness of the application are requested by

9/14/92

A copy of the application has been provided to you by:

- | | |
|-------------------------------------|-----------------------------------|
| <input checked="" type="checkbox"/> | The applicant or his engineer; or |
| <input type="checkbox"/> | Is attached |

If you have any questions please call (407)433-2650.



Florida Department of Environmental Regulation
 Twin Towers Office Bldg • 2500 Blair Stone Road • Tallahassee, Florida 32399-2400

Stephanie 9/1

Permit Data Form

Project Source Name Waste Management North America
 Type Code AC Subcode 1C Check if: GP Exempt
 Correct Fee 1500
 Amount Received \$4500.00
 Amount Refund 0
 Permit Processor's Initial _____ Data Entry Operator's Initial BJ
 Comments: AC 13-218495



CENTRAL DISPOSAL

A Division of Waste Management, Inc. of Florida
 3000 N.W. 48th Street, Pompano Beach, Florida 33073

No. 10119

8 - 26
430

DATE 08/17/92

PAY

REGISTERED 4500 DOLLARS 00 CTS
 R8N315863

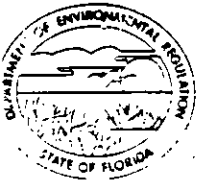
\$ 4,500.00

MELLON BANK N.A.
 PITTSBURGH, PENNSYLVANIA
 Also available if desired at
 Barnett Bank of Jacksonville, Fla.

TO THE ORDER OF
 Department of Environmental Regulations
 Air Quality

Wallace Berg

⑈010119⑈ ⑆043000261⑆ 157⑈2385⑈



Florida Department of Environmental Regulation
Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

AC 13-218495

\$ 4500 pd
9-1-92

DER Form # _____
Form Title _____
Effective Date _____
DER Application No. _____
(Filed in by DER)

RECEIVED
SEP - 1 1992

DEPT. OF ENVIRONMENTAL REG.
WEST PALM BEACH

APPLICATION TO OPERATE/CONSTRUCT AIR POLLUTION SOURCES

SOURCE TYPE: Landfill Gas Flare [X] New¹ [] Existing¹

APPLICATION TYPE: [X] Construction [X] Operation [X] Modification

COMPANY NAME: Waste Management of North America COUNTY: Dade

Identify the specific emission point source(s) addressed in this application (i.e. Lime
Kiln No. 4 with Venturi Scrubber; Peaking Unit No. 2, Gas Fired) Flare

SOURCE LOCATION: Street 9350 NW 89th Street City Medley

UTM: East _____ North _____

Latitude 25 ° 51 ' 31 "N Longitude 80 ° 21 ' 03 "W

APPLICANT NAME AND TITLE: Harvey H. Bush, Jr., Senior Environmental Vice President

APPLICANT ADDRESS: 500 Cypress Creek Road, Suite 300, Ft. Lauderdale, FL 33309

SECTION I: STATEMENTS BY APPLICANT AND ENGINEER

A. APPLICANT

I am the undersigned owner or authorized representative* of Waste Management of North America
I certify that the statements made in this application for a Construction/Operation permit are true, correct and complete to the best of my knowledge and belief. Further, I agree to maintain and operate the pollution control source and pollution control facilities in such a manner as to comply with the provision of Chapter 403, Florida Statutes, and all the rules and regulations of the department and revisions thereof. I also understand that a permit, if granted by the department, will be non-transferable and I will promptly notify the department upon sale or legal transfer of the permitted establishment.

*Attach letter of authorization

Signed: James A. Waters
James A. Waters, Group Vice President
Name and Title (Please Type)
Date: 8/25/92 Telephone No. 305/771-9850

B. PROFESSIONAL ENGINEER REGISTERED IN FLORIDA (where required by Chapter 471, F.S.)

This is to certify that the engineering features of this pollution control project have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgment, that

¹ See Florida Administrative Code Rule 17-2.100(57) and (104)

the pollution control facilities, when properly maintained and operated, will discharge an effluent that complies with all applicable statutes of the State of Florida and the rules and regulations of the department. It is also agreed that the undersigned will furnish, if authorized by the owner, the applicant a set of instructions for the proper maintenance and operation of the pollution control facilities and, if applicable, pollution sources.

Signed Harvey H. Bush, Jr.

Harvey H. Bush, Jr., P.E.
Name (Please Type)

Waste Management Inc.
Company Name (Please Type)

500 Cypress Creek Rd., Suite 300
Ft. Lauderdale, FL 33309
Mailing Address (Please Type)

Florida Registration No. 6267 Date: 8/31/92 Telephone No. 305/771-9850

SECTION II: GENERAL PROJECT INFORMATION

A. Describe the nature and extent of the project. Refer to pollution control equipment, and expected improvements in source performance as a result of installation. State whether the project will result in full compliance. Attach additional sheet if necessary.

Landfill gas collection system utilizing a flare for efficient thermal disposal
of landfill gas consisting of approx. 60% CH₄ and 40% CO₂. Gas flow rate is
estimated at 3140 CFM.

B. Schedule of project covered in this application (Construction Permit Application Only)

Start of Construction 4/92 Completion of Construction 8/92

C. Costs of pollution control system(s): (Note: Show breakdown of estimated costs only for individual components/units of the project serving pollution control purposes. Information on actual costs shall be furnished with the application for operation permit.)

Flare price = \$100,000

D. Indicate any previous DER permits, orders and notices associated with the emission point, including permit issuance and expiration dates.

Landfill gas collection system installation permitted as modification to
solid waste permit, SC-13-179974

E. Requested permitted equipment operating time: hrs/day 24; days/wk 7; wks/yr 52; if power plant, hrs/yr N/A; if seasonal, describe: N/A

F. If this is a new source or major modification, answer the following questions. (Yes or No)

1. Is this source in a non-attainment area for a particular pollutant? Yes

a. If yes, has "offset" been applied? N/A

b. If yes, has "Lowest Achievable Emission Rate" been applied? N/A

c. If yes, list non-attainment pollutants. Ozone - Flare does not contribute

2. Does best available control technology (BACT) apply to this source? No
If yes, see Section VI. ozone to atmosphere

3. Does the State "Prevention of Significant Deterioration" (PSD) requirement apply to this source? If yes, see Sections VI and VII. No

4. Do "Standards of Performance for New Stationary Sources" (NSPS) apply to this source? No

5. Do "National Emission Standards for Hazardous Air Pollutants" (NESHAP) apply to this source? No

H. Do "Reasonably Available Control Technology" (RACT) requirements apply to this source? No

a. If yes, for what pollutants? _____

b. If yes, in addition to the information required in this form, any information requested in Rule 17-2.650 must be submitted.

Attach all supportive information related to any answer of "Yes". Attach any justification for any answer of "No" that might be considered questionable.

SECTION III: AIR POLLUTION SOURCES & CONTROL DEVICES (Other than Incinerators)

A. Raw Materials and Chemicals Used in your Process, if applicable:

Description	Contaminants		Utilization Rate - lbs/hr	Relate to Flow Diagram
	Type	% Wt		
Landfill Gas	CH ₄	60	3140 SCFM	
	CO ₂	35		
	H ₂ S	.0004		

B. Process Rate, if applicable: (See Section V, Item 1)

1. Total Process Input Rate (lbs/hr): 3140 SCFM

2. Product Weight (lbs/hr): _____

C. Airborne Contaminants Emitted: (Information in this table must be submitted for each emission point, use additional sheets as necessary)

Name of Contaminant	Emission ^{1*}		Allowed Emission Rate per Rule 17-2	Allowable ³ Emission lbs/hr	Potential ⁴ Emission		Relate to Flow Diagram
	Maximum lbs/hr	Actual T/yr			lbs/yr	T/yr	
CO ₂	20,500	90,000	* *		Potential		
N ₂	136,000	600,000	* *		has not been		
O ₂	22,000	93,000	* *		determined		
NO _x	7.7	34	* *		Actual gas flow		
CO	27.7	122	* *		rate necessary to		
CH ₄	21.2	93	* *		determine actual		
SO ₂	.0004	.0002	* *		emissions		

¹See Section V, Item 2.

²Reference applicable emission standards and units (e.g. Rule 17-2.600(5)(b)2. Table II, E. (1) - 0.1 pounds per million BTU heat input)

³Calculated from operating rate and applicable standard.

⁴Emission, if source operated without control (See Section V, Item 3).

* Theoretical gas flow rate used to determine these emissions
 ** Not specified in F.A.C. 17-2.600 emission limiting and performance standards for a landfill gas flare

D. Control Devices: (See Section V, Item 4)

Name and Type (Model & Serial No.)	Contaminant	Efficiency	Range of Particles Size Collected (in microns) (If applicable)	Basis for Efficiency (Section V Item 5)
LFG Specialties, Inc.	Landfill Gas	98%	N/A	
Utility "candle stick" flares				

E. Fuels

Type (Be Specific)	Consumption*		Maximum Heat Input (MMBTU/hr)
	avg/hr	max./hr	
N/A			

*Units: Natural Gas--MMCF/hr; Fuel Oils--gallons/hr; Coal, wood, refuse, other--lbs/hr.

Fuel Analysis: N/A

Percent Sulfur: N/A Percent Ash: N/A

Density: N/A lbs/gal Typical Percent Nitrogen: N/A

Heat Capacity: N/A BTU/lb N/A BTU/gal

Other Fuel Contaminants (which may cause air pollution): N/A

F. If applicable, indicate the percent of fuel used for space heating.

Annual Average N/A Maximum N/A

G. Indicate liquid or solid wastes generated and method of disposal.

 N/A

H. Emission Stack Geometry and Flow Characteristics (Provide data for each stack):*

Stack Height: 34' ft. Stack Diameter: 14" ft.
 Gas Flow Rate: 3140 ACFM DSCFM Gas Exit Temperature: 840 °F.
 Water Vapor Content: % Velocity: 496 FPS

SECTION IV: INCINERATOR INFORMATION
 Not Applicable

Type of Waste	Type O (Plastics)	Type I (Rubbish)	Type II (Refuse)	Type III (Garbage)	Type IV (Pathological)	Type V (Liq. & Gas By-prod.)	Type VI (Solid By-prod.)
Actual lb/hr Incinerated							
Uncontrolled (lbs/hr)							

Description of Waste _____
 Total Weight Incinerated (lbs/hr) _____ Design Capacity (lbs/hr) _____
 Approximate Number of Hours of Operation per day _____ day/wk _____ wks/yr. _____
 Manufacturer: _____
 Date Constructed _____ Model No. _____

	Volume (ft) ³	Heat Release (BTU/hr)	Fuel		Temperature (°F)
			Type	BTU/hr	
Primary Chamber					
Secondary Chamber					

Stack Height: _____ ft. Stack Diameter: _____ Stack Temp. _____
 Gas Flow Rate: _____ ACFM _____ DSCFM* Velocity: _____ FPS

*If 50 or more tons per day design capacity, submit the emissions rate in grains per standard cubic foot dry gas corrected to 50% excess air.

Type of pollution control device: [] Cyclone [] Wet Scrubber [] Afterburner
 [] Other (specify) _____

Brief description of operating characteristics of control devices: _____

N/A

Ultimate disposal of any effluent other than that emitted from the stack (scrubber water, ash, etc.):

N/A

NOTE: Items 2, 3, 4, 6, 7, 8, and 10 in Section V must be included where applicable.

SECTION V: SUPPLEMENTAL REQUIREMENTS

Please provide the following supplements where required for this application.

1. Total process input rate and product weight -- show derivation [Rule 17-2.100(127)]
N/A
2. To a construction application, attach basis of emission estimate (e.g., design calculations, design drawings, pertinent manufacturer's test data, etc.) and attach proposed methods (e.g., FR Part 60 Methods 1, 2, 3, 4, 5) to show proof of compliance with applicable standards. To an operation application, attach test results or methods used to show proof of compliance. Information provided when applying for an operation permit from a construction permit shall be indicative of the time at which the test was made.
3. Attach basis of potential discharge (e.g., emission factor, that is, AP42 test).
4. With construction permit application, include design details for all air pollution control systems (e.g., for baghouse include cloth to air ratio; for scrubber include cross-section sketch, design pressure drop, etc.)
5. With construction permit application, attach derivation of control device(s) efficiency. Include test or design data. Items 2, 3 and 5 should be consistent: actual emissions = potential (1-efficiency).
6. An 8 1/2" x 11" flow diagram which will, without revealing trade secrets, identify the individual operations and/or processes. Indicate where raw materials enter, where solid and liquid waste exit, where gaseous emissions and/or airborne particles are evolved and where finished products are obtained.
7. An 8 1/2" x 11" plot plan showing the location of the establishment, and points of airborne emissions, in relation to the surrounding area, residences and other permanent structures and roadways (Example: Copy of relevant portion of USGS topographic map).
8. An 8 1/2" x 11" plot plan of facility showing the location of manufacturing processes and outlets for airborne emissions. Relate all flows to the flow diagram.

- 9. The appropriate application fee in accordance with Rule 17-4.05. The check should be made payable to the Department of Environmental Regulation.
- 10. With an application for operation permit, attach a Certificate of Completion of Construction indicating that the source was constructed as shown in the construction permit.

SECTION VI: BEST AVAILABLE CONTROL TECHNOLOGY

A. Are standards of performance for new stationary sources pursuant to 40 C.F.R. Part 60 applicable to the source? Not Applicable

Yes No

Contaminant	Rate or Concentration

B. Has EPA declared the best available control technology for this class of sources (If yes, attach copy)

Yes No

Contaminant	Rate or Concentration

C. What emission levels do you propose as best available control technology?

Contaminant	Rate or Concentration

D. Describe the existing control and treatment technology (if any).

- | | |
|---------------------------|--------------------------|
| 1. Control Device/System: | 2. Operating Principles: |
| 3. Efficiency:* | 4. Capital Costs: |

*Explain method of determining



STATE OF FLORIDA
 DEPARTMENT OF ENVIRONMENTAL REGULATION
 AIR POLLUTION SOURCES
 CERTIFICATE OF COMPLETION OF CONSTRUCTION*

PERMIT NO. _____ DATE: _____

Company Name: _____ County: _____

Source Identification(s): _____

Actual costs of serving pollution control purpose: \$ _____

Operating Rates: _____ Design Capacity: _____

Expected Normal _____ During Compliance Test _____

Date of Compliance Test: _____ (Attach detailed test report)

Test Results:	Pollutant	Actual Discharge	Allowed Discharge
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Date plant placed in operat : _____

This is to certify that, with the exception of deviations noted**, the construction of the project has been completed in accordance with the application to construct and Construction Permit No. _____ dated _____.

A. Applicant:

 Name of Person Signing (Type) Signature of Owner or Authorized Representative and Title

Date: _____ Telephone: _____

B. Professional Engineer:

 Name of Person Signing (Type) Signature of Professional Engineer

 Company Name Florida Registration No. _____

 Date: _____

(Seal)

 Mailing Address

 Telephone Number

*This form, satisfactorily completed, submitted in conjunction with an existing application to construct permit and payment of application processing fee will be accepted in lieu of an application to operate.

**As built, if not built as indicated include process flow sketch, plot plan sketch, and updates of applicable pages of application form.

- 5. Useful Life:
- 7. Energy:
- 9. Emissions:

- 6. Operating Costs:
- 8. Maintenance Cost:

Contaminant	Rate or Concentration

10. Stack Parameters

- a. Height: ft. b. Diameter: ft.
- c. Flow Rate: ACFM d. Temperature: °F.
- e. Velocity: FPS

E. Describe the control and treatment technology available (As many types as applicable, use additional pages if necessary).

1.

- a. Control Device: b. Operating Principles:
- c. Efficiency:¹ d. Capital Cost:
- e. Useful Life: f. Operating Cost:
- g. Energy:² h. Maintenance Cost:
- i. Availability of construction materials and process chemicals:
- j. Applicability to manufacturing processes:
- k. Ability to construct with control device, install in available space, and operate within proposed levels:

2.

- a. Control Device: b. Operating Principles:
- c. Efficiency:¹ d. Capital Cost:
- e. Useful Life: f. Operating Cost:
- g. Energy:² h. Maintenance Cost:
- i. Availability of construction materials and process chemicals:

¹Explain method of determining efficiency.

²Energy to be reported in units of electrical power - KWH design rate.

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

3.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Cost:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

4.

a. Control Device:

b. Operating Principles:

c. Efficiency:¹

d. Capital Costs:

e. Useful Life:

f. Operating Cost:

g. Energy:²

h. Maintenance Cost:

i. Availability of construction materials and process chemicals:

j. Applicability to manufacturing processes:

k. Ability to construct with control device, install in available space, and operate within proposed levels:

f. Describe the control technology selected:

1. Control Device:

2. Efficiency:¹

3. Capital Cost:

4. Useful Life:

5. Operating Cost:

6. Energy:²

7. Maintenance Cost:

8. Manufacturer:

9. Other locations where employed on similar processes:

e. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

¹Explain method of determining efficiency.

²Energy to be reported in units of electrical power - KWH design rate.

- (5) Environmental Manager: Harvey H. Bush, Jr., P.E.
- (6) Telephone No.: 305/771-9050
- (7) Emissions:¹

Contaminant	Rate or Concentration

(8) Process Rate:¹

b. (1) Company:

(2) Mailing Address:

(3) City:

(4) State:

(5) Environmental Manager:

(6) Telephone No.:

(7) Emissions:¹

Contaminant	Rate or Concentration

(8) Process Rate:¹

10. Reason for selection and description of systems:

¹Applicant must provide this information when available. Should this information not be available, applicant must state the reason(s) why.

SECTION VII - PREVENTION OF SIGNIFICANT DETERIORATION

A. Company Monitored Data

1. _____ no. sites _____ TSP _____ () SO₂* _____ Wind spd/dir

Period of Monitoring _____ / _____ / _____ to _____ / _____ / _____
month day year month day year

Other data recorded _____

Attach all data or statistical summaries to this application.

*Specify bubbler (B) or continuous (C).

2. Instrumentation, Field and Laboratory

- a. Was instrumentation EPA referenced or its equivalent? Yes No
- b. Was instrumentation calibrated in accordance with Department procedures?
 Yes No Unknown

B. Meteorological Data Used for Air Quality Modeling

- 1. _____ Year(s) of data from _____ / _____ / _____ to _____ / _____ / _____
month day year month day year
- 2. Surface data obtained from (location) _____
- 3. Upper air (mixing height) data obtained from (location) _____
- 4. Stability wind rose (STAR) data obtained from (location) _____

C. Computer Models Used

- 1. _____ Modified? If yes, attach description.
- 2. _____ Modified? If yes, attach description.
- 3. _____ Modified? If yes, attach description.
- 4. _____ Modified? If yes, attach description.

Attach copies of all final model runs showing input data, receptor locations, and principle output tables.

D. Applicants Maximum Allowable Emission Data

Pollutant	Emission Rate	
TSP	_____	grams/sec
SO ₂	_____	grams/sec

E. Emission Data Used in Modeling

Attach list of emission sources. Emission data required is source name, description of point source (on NEDS point number), UTM coordinates, stack data, allowable emissions, and normal operating time.

F. Attach all other information supportive to the PSD review.

G. Discuss the social and economic impact of the selected technology versus other applicable technologies (i.e., jobs, payroll, production, taxes, energy, etc.). Include assessment of the environmental impact of the sources.

H. Attach scientific, engineering, and technical material, reports, publications, journals, and other competent relevant information describing the theory and application of the requested best available control technology.



SUBJECT: FLARE SYSTEM AIR PERMIT

APPL. - MAY GAS COMPONENT EMISSIONS

PREPARED BY
CF

CHECKED BY

REVISED BY

8/6/92

____/____/____

____/____/____

This simple analysis will assume constant load operation.
Information required: Blower motor driving centrifugal fan.

1. Motor full load horsepower = 25 (hp)
 2. Number of hours per year motor is in operation
= 24 (hr/day) * 365 days/yr = 8760 (hr/year)
 3. Cost of electricity in dollars per kilowatt
hr = \$.08 / (kW-hr)
 4. Standard motor efficiency " μ " = 88% = 0.88
- First, calculate the kilowatts requirements:

$$\text{Kilowatts required} = \frac{25(\text{hp}) * 0.746 (\text{KW}/\text{hp})}{0.88} = 21.2 (\text{KW})$$

Second, calculate the yearly operating cost:

$$\text{Yearly operating cost} = 21.2 (\text{KW}) * .08 / (\text{KW}/\text{hr}) * 8760 (\text{hr}/\text{yr}) = 14,856 / \text{yr}$$

Assumptions:

A 25 horsepower motor is going to operate continuously for the entire year. Thus, total hours of operation per year are 8760. Also, assume the cost of electricity at \$.08 per kilowatt hour. The industry efficiency average for a standard motor is 88 percent.

Energy to be reported in units of electrical power, KW-hr design rate:

$$\text{Electrical power design rate} = 21.2 (\text{KW}) * 8,760 (\text{hr}/\text{yr}) = 185,712 (\text{KW-hr}/\text{yr})$$



SUBJECT: Flare System Air Permit Appl.
Gas Flow Rate and Exit Velocity

PREPARED BY
CP
8/10/82

CHECKED BY

REVISED BY

This analysis will assume constant max. landfill gas flow rate

Information required: enclosed flare unit

1. Maximum landfill gas flow rate = 3140 (ft³/min) standard (theoretical rate)
2. Maximum concentration of methane in landfill gas = 60% = 0.6
3. Design basis for flue gas flow = 22.1 (ft³/min) actual per one (ft³/min) of methane standard
4. Inside diameter of flare = 14 inches

First, calculate methane input flow rate:

$$0.6 \times 3140 \text{ (ft}^3\text{/min) standard} = 1884 \text{ (ft}^3\text{/min) methane std.}$$

Second, calculate flare gas emission flow rate:

$$\left(\frac{22.1 \text{ (ft}^3\text{/min) actual}}{1 \text{ (ft}^3\text{/min) methane std.}} \right) \times 1884 \text{ (ft}^3\text{/min) methane std.} = 41636.4 \text{ (ft}^3\text{/min) actual gas emission volumetric flow rate}$$

Third, calculate cross-sectional area of flare:

$$\begin{aligned} \text{AREA} &= \pi r^2 = \frac{1}{4} \pi d^2 = .25 \times \pi \times (14 \text{ in.})^2 \\ &= 201 \text{ in}^2 = 1.4 \text{ ft}^2 \end{aligned}$$

Calculate gas exit velocity:

$$\frac{41636.4 \text{ (ft}^3\text{/min)}}{1.4 \text{ ft}^2 \times 60 \text{ (sec/min)}} = 496 \text{ (ft/sec)}$$



SUBJECT: Flare System Air Permit Appl.
Max. Gas Component Emissions 8/10/92

PREPARED BY
CP

CHECKED BY

REVISED BY

1 1

1 1

Average molecular weight of landfill gas -
Basis 100 (lb mol) of landfill gas

COMPONENT	MOLE PERCENT	MOLEC WT.	LB.	WT. %
CH ₄	60	16.041	962.46	36.4
CO ₂	35	44.01	1540.35	58.2
O ₂	1	32	32	1.2
N ₂	4	28.016	112.06	4.2
* H ₂ S	.0004	34.076	.014	.000005
			2646.98	100.00

* Separate calc. made for combustion of H₂S to SO₂

* Combustion of hydrogen sulfide:

Density (lbm/ft³)
H₂S .0911
SO₂ 1.733
at std. conditions of 60°F and 30 (in Hg) abs.

Gas flow rate = 41,636 (ft³/hr)

Hydrogen Sulfide Volume Flow Rate:

$$41,636 \text{ (ft}^3\text{/hr)} * (.000004) = .17 \text{ (ft}^3\text{/hr)} \text{ H}_2\text{S}$$

Convert volume flow rate to mass flow rate using density:

$$(.17 \text{ ft}^3\text{/hr}) (.0911 \text{ (lbm/ft}^3\text{)}) = .015 \text{ (lbm/hr)} \text{ H}_2\text{S}$$

Convert mass flow rate to mole flow rate using molecular weight:

$$\frac{.015 \text{ (lbm/hr)}}{34.076 \text{ (lbm/lbmole)}} = .0004 \text{ (lbmole/hr)} \text{ H}_2\text{S}$$



SUBJECT: Flare System Air Permit App.
Max. Gas Component Emissions

PREPARED BY
CF
8/10/72

CHECKED BY

REVISED BY

CONVERSION FACTOR FOR EMISSIONS FROM
(lbm/hr) TO (T/year)

$$1 \text{ (lbm/hr)} \times 24 \text{ (hr/day)} \times 365 \text{ (days/year)} =$$

$$2000 \text{ (lbm/T)}$$

4.38

EMISSIONS IN (T/year)

CO₂ 89,615

H₂O 52,082

N₂ 598,662

O₂ 92,571

NO_x 33.7

CO 121.3

CH₄ 92.85

SO₂ 0.0017