Medley Landfill and Recycling Center
9350 N.W. 89th Avenue
Medley, Florida 33178
305/883-7670

A Waste Management Company

RECEIVED
NOV 18 1993
Division of Air
Resources Management

November 17, 1993

Mr. Tom Cascio
Department of Environmental Protection
Twin Tower Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Dear Mr. Cascio:

SUBJECT: FILE #AC13-218495
MEDLEY LANDFILL FLARE APPLICATION

As we discussed by telephone on November 12, 1993, we have discovered an error in the original calculation of the percentage of H_2S contained in the landfill gas at the above-referenced site. The calculations were intended to be based on an H_2S content of 400 ppm or 0.04 percent. An error was made in the calculation, and 0.0004 percent (4 ppm) was reported.

The 400 ppm was an estimate based on readings taken at Medley Landfill. Since that time, we have made additional measurements and have observed readings up to 500 ppm. It is anticipated that once the system becomes dynamic, readings could increase up to 20 percent.

Based on this recent field data, we have modified the calculation of H_2S and corresponding emissions to reflect an incoming content of 600 ppm. This results in a calculated SO_2 emission of 35.1 tons per year at the maximum flow of 1250 scfm.

We apologize for any inconvenience this has caused but believe it is important to correct the calculation error prior to issue of the permit.

A:\FLARE.MED

If you have any questions, please call Richard Dormier at (305) 977-9551, Ext. 47.

Sincerely,

Michael J. Berg
General Manager

RD/dt

cc: E. L. Anderson, DERM
Ron Antevy, WMX
Mary Ardiff, WMX
Jim Barrett, WMX
S. Brooks, FDEP, West Palm Beach
Joey Litchfield
File

FLARE SYSTEM AIR PERMIT APPLICATION

GAS FLOW RATE AND EXIT VELOCITY

This analysis will assume constant maximum landfill gas flow rate.

Maximum landfill gas flow rate = 1,250 scfm

Maximum concentration of methane in landfill gas is 60%, 40% CO_2.

H_2S content = 600 parts H_2S ÷ 1,000,000 parts landfill gas x 100 = 0.06%.

Calculate gas exit velocity:

Flare designed to achieve minimum of 98% destruction efficiency of total hydrocarbons in accordance with EPA criteria 40 CFR 60.18.

To achieve destruction efficiency, gas exit velocity at flare tip must be less than 60 ft./sec. with net heating value of gas maintained at 200 BTU/scfm or greater.

With methane content of 40% - 60%, the net gas heating value would be between 404-607 BTU/scfm.

Flare tip and tip velocity:
Assume tip temperature of 120°F and a gas flow of 1,250 scfm (maximum design capacity for flare).

Flow corrected for 120°F =

$$1{,}250 \text{ scfm} \times \frac{460 + 120}{520} = 1394 \text{ ACFM}$$

$$\text{Flare tip velocity} = \frac{\text{actual flow}}{\text{tip cross-sectional area}}$$

$$= \frac{1394 \text{ ACFM}}{\frac{\pi \times 14^2 \text{ in.}}{4 \times 144 \frac{\text{in}^2}{\text{ft}^2}}} = 1304 \text{ fpm}$$

$$= \frac{1304 \text{ fpm}}{60 \frac{\text{sec}}{\text{min}}} = 21.7 \text{ ft/sec} < 60 \text{ ft/sec}$$

Revised 11/15/93

A:\FLARE

Utilization Rate:

CH_4 = 1250 scfm x 60/100 x 16 lb/lb mol x 1/359 lb mol/ft^3 x 60 min/hour = 2006 lbs/hr.

CO_2 = 1250 scfm x 40/100 x 44 lb/lbmol x 1/359 lbmol/ft^3 x 60 min/hr = 3677 lbs/hr.

H_2S = 1250 scfm x .06/100 x 34 x 1/359 x 60 = 4.26 lbs/hr.

TOTAL INPUT RATE = 2006 + 3677 + 4.26 = 5,687 lbs/hr.

Air needed for combustion at 1400° F.

$$1250 \text{ scfm} \times 60\% \times 31.42 \frac{\text{scfm air}}{\text{scfm } CH_4} = 23{,}565 \text{ scfm.}$$

Total product flow = 1,250 scfm + 23,565 scfm = 24,815 scfm.

Combustion heat release:

1,250 scfm x 60/100 x 1,012 BTU/ft^3 CH^4 x 60 =

45,540,000 BTU/hr.

Theoretical stack effluent at 1400° F.

Combustion Temp:

N_2 = 75%
O_2 = 13.9%
CO_2 = 5.04%
H_2O = 6.045%

Stack Effluent by weight:

N_2 = 24,815 scfm x .75 x 28 lb/lbmol x 60 min/hr. x 1/359 lbmol/ft^3 = 87,094 lbs/hr.

O_2 = 24,815 scfm x .139 x 32 lb/lbmol x 60 x 1/359 = 18,447 lb/hr

CO_2= 24,815 scfm x .0504 x 44 lb/lbmol x 60 x 1/359 = 9,197 lbs/hr.

H_2O= 24,815 scfm x .06045 x 18 lb/lbmol x 60 x 1/359 = 4,513 lbs/hr.

Revised 11/15/93

A:\FLARE

Product Weight:

87,094 + 18,447 + 9,197 + 4,513 = 119,251 lbs/hr.

Expected Emission:

NO_x = 12 PPMV

CO = 480 PPMV

NO_x = $12/10^6$ x 24,815 scfm x 46 lb/lbmol x 1/359 x 60 = 2.29 lbs/hr.

CO = $480/10^6$ x 24,815 x 28 lb/lbmol x 1/359 x 60 = 55.74 lbs/hr.

SO_2 = mols in = mols out = $\frac{4.26 \times 64}{34}$ = 8.02 lbs/hr.

Convert to Tons/Year:

N_2 = 87,094 lbs/hr x 24 hr/day x 365 days/year x 1 ton/2000 lbs = 381,472 tons/year.

O_2 = 18,447 lbs/hr x 24 x 365 x 1 ton/2000 lbs = 80,798 tons/year.

CO_2 = 9,197 lbs/hr x 24 x 365 x 1 ton/2000 lbs = 40,283 tons/year.

H_2O = 4,513 lbs/hr x 24 x 365 x 1 ton/2000 lbs = 19,767 tons/year.

NO_x = 2.29 lbs/hr. x 24 x 365 x 1 to/2000 lbs. = 10 tons/year.

CO = 55.74 lbs/hr x 24 x 365 x 1 ton/2000 lbs.=244 tons/year.

SO_2 = 8.02 lbs/hr x 24 x 365 x 1 ton/2000 lbs.=35.1 tons/year.

Gas Flow Exit Velocity:

Gas inflow rate = 1250 scfm at 60% methane
Methane inflow rate = 1250 scfm x 0.6 = 750 scfm
Total air required = 31.416 cf air/cf methane
Total air required = 750 scfm x 31.416 = 23,562 scfm
Flare cross section area = $(\pi)(14\ in^2) \div (4)(144\ in^2/ft^2) = 1.07\ ft^2$
Exit velocity = total flow/area = 23,562 scfm ÷ (1.07 ft^2) (60 sec/min) = 367 ft/sec

Revised 11/15/93

A:\FLARE

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		
	CO_2	35	1250 scfm	
	H_2S	0.06		

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

1. Total Process Input Rate (lbs/hr): 1250 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[2] 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	
N_2	87,094	381,472	* *		same as maximum		
O_2	18,447	80,798	* *		emissions		
CO_2	9,197	40,283	* *				
H_2O	4,513	19,767	* *				
NO_x	2.29	10	* *				
CO	55.74	244	* *				
SO_2	8.02	35.1	* *				

[1]See Section V, Item 2.

[2]Reference 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)

[3]Calculated from operating rate and applicable standard.

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

* Based on maximum flow rate
** Not specified in F.A.C. 17-2.600 emission limiting and performance standards for a landfill gas flare.

Central Disposal
3000 N.W. 48th Street
Pompano Beach, Florida 33073
305/977-9551

A Waste Management Company

E M D

FAX COVER SHEET

TO: Tom Cascio

Company: FDEP

FAX #: (904) 922-6979

Phone #: (904) 488-1344

FROM: RICHARD DORMIER / RON ANTEVY

Phone Number: (305) 977-9551 Ext. 47 / 45

FAX #: (305) 969-9343

DATE: 11-17-93

# of pages (including cover sheet) 7

Tom:

Thanks for looking at this for me. I think I marked everything that's new. I'll FedEx out as soon as I hear from you. Richard

RECEIVED
NOV 17 1993
Division of Air
Resources Management

Medley Landfill and Recovering Corner
8250 N.W. 58th Avenue
Medley, Florida 33178
305/888-7370

A Waste Management Company

DRAFT

November 17, 1993

Mr. Tom Cascio
Department of Environmental Protection
Twin Tower Office Building
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Dear Mr. Cascio:

SUBJECT: FILE #AC13-218495
MEDLEY LANDFILL FLARE APPLICATION

As we discussed by telephone on November 12, 1993, we have discovered an error in the original calculation of the percentage of H_2S contained in the landfill gas at the above-referenced site. The calculations were intended to be based on an H_2S content of 400 ppm or 0.04 percent. An error was made in the calculation, and 0.0004 percent (4 ppm) was reported.

The 400 ppm was an estimate based on readings taken at Medley Landfill. Since that time, we have made additional measurements and have observed readings up to 500 ppm. It is anticipated that once the system becomes dynamic, readings could increase up to 20 percent.

Based on this recent field data, we have modified the calculation of H_2S and corresponding emissions to reflect an incoming content of 600 ppm. This results in a calculated SO_2 emission of 35.1 tons per year at the maximum flow of 1250 scfm.

We apologize for any inconvenience this has caused but believe it is important to correct the calculation error prior to issue of the permit.

A:\FLARE.MED

DRAFT

If you have any questions, please call Richard Dormier at (305) 977-9551, Ext. 47.

Sincerely,

Michael J. Berg
General Manager

RD/dt

cc: E. L. Anderson, DERM
Ron Antevy, WMX
Mary Ardiff, WMX
Jim Barrett, WMX
S. Brooks, FDEP, West Palm Beach
Joey Litchfield
File

DRAFT

FLARE SYSTEM AIR PERMIT APPLICATION

GAS FLOW RATE AND EXIT VELOCITY

This analysis will assume constant maximum landfill gas flow rate.

Maximum landfill gas flow rate = 1,250 scfm

Maximum concentration of methane in landfill gas is 60%, 40% CO_2.

NEW → H_2S content = 600 parts H_2S ÷ 1,000,000 parts landfill gas x 100 = 0.06%.

Calculate gas exit velocity:

Flare designed to achieve minimum of 98% destruction efficiency of total hydrocarbons in accordance with EPA criteria 40 CFR 60.18.

To achieve destruction efficiency, gas exit velocity at flare tip must be less than 60 ft./sec. with net heating value of gas maintained at 200 BTU/scfm or greater.

With methane content of 40% - 60%, the net gas heating value would be between 404-607 BTU/scfm.

Flare tip and tip velocity:
Assume tip temperature of 120°F and a gas flow of 1,250 scfm (maximum design capacity for flare).

Flow corrected for 120°F =

$$1{,}250 \text{ scfm} \times \frac{460 + 120}{520} = 1394 \text{ ACFM}$$

$$\text{Flare tip velocity} = \frac{\text{actual flow}}{\text{tip cross-sectional area}}$$

$$= \frac{1394 \text{ ACFM}}{\frac{\pi \times 14^2 \text{ in.}}{4 \times 144 \frac{\text{in}^2}{\text{ft}^2}}} = 1304 \text{ fpm}$$

$$= \frac{1304 \text{ fpm}}{60 \frac{\text{sec}}{\text{min}}} = 21.7 \text{ ft/sec} < 60 \text{ ft/sec}$$

Revised 11/15/93

A:\FLARE

DRAFT

Utilization Rate:

CH_4 = 1250 scfm x 60/100 x 16 lb/lb mol x 1/359 lb mol/ft³ x 60 min/hour = 2006 lbs/hr.

CO_2 = 1250 scfm x 40/100 x 44 lb/lbmol x 1/359 lbmol/ft³ x 60 min/hr = 3677 lbs/hr.

NEW → H_2S = 1250 scfm x .06/100 x 34 x 1/359 x 60 = 4.26 lbs/hr.

→ TOTAL INPUT RATE = 2006 + 3677 + 4.26 = 5,687 lbs/hr.

Air needed for combustion at 1400° F.

1250 scfm x 60% x 31.42 $\frac{\text{scfm air}}{\text{scfm } CH_4}$ = 23,565 scfm.

Total product flow = 1,250 scfm + 23,565 scfm = 24,815 scfm.

Combustion heat release:

1,250 scfm x 60/100 x 1,012 BTU/ft³ CH^4 x 60 =

45,540,000 BTU/hr.

Theoretical stack effluent at 1400° F.

Combustion Temp:

N_2 = 75%
O_2 = 13.9%
CO_2 = 5.04%
H_2O = 6.045%

Stack Effluent by weight:

N_2 = 24,815 scfm x .75 x 28 lb/lbmol x 60 min/hr. x 1/359 lbmol/ft³ = 87,094 lbs/hr.

O_2 = 24,815 scfm x .139 x 32 lb/lbmol x 60 x 1/359 = 18,447 lb/hr

CO_2= 24,815 scfm x .0504 x 44 lb/lbmol x 60 x 1/359 = 9,197 lbs/hr.

H_2O= 24,815 scfm x .06045 x 18 lb/lbmol x 60 x 1/359 = 4,513 lbs/hr.

Revised 11/15/93

A:\FLARE

DRAFT

Product Weight:

87,094 + 18,447 + 9,197 + 4,513 = 119,251 lbs/hr.

Expected Emission:

NO_x = 12 PPMV

CO = 480 PPMV

NO_x = $12/10^6$ x 24,815 scfm x 46 lb/lbmol x 1/359 x 60 = 2.29 lbs/hr.

CO = $480/10^6$ x 24,815 x 28 lb/lbmol x 1/359 x 60 = 55.74 lbs/hr.

New → SO_2 = mols in = mols out = $\frac{4.26 \times 64}{34}$ = 8.02 lbs/hr.

Convert to Tons/Year:

N_2 = 87,094 lbs/hr x 24 hr/day x 365 days/year x 1 ton/2000 lbs = 381,472 tons/year.

O_2 = 18,447 lbs/hr x 24 x 365 x 1 ton/2000 lbs = 80,798 tons/year.

CO_2 = 9,197 lbs/hr x 24 x 365 x 1 ton/2000 lbs = 40,283 tons/year.

H_2O = 4,513 lbs/hr x 24 x 365 x 1 ton/2000 lbs = 19,767 tons/year.

NO_x = 2.29 lbs/hr. x 24 x 365 x 1 to/2000 lbs. = 10 tons/year.

CO = 55.74 lbs/hr x 24 x 365 x 1 ton/2000 lbs.=244 tons/year.

New → SO_2 = 8.02 lbs/hr x 24 x 365 x 1 ton/2000 lbs.=35.1 tons/year.

Gas Flow Exit Velocity:

Gas inflow rate = 1250 scfm at 60% methane
Methane inflow rate = 1250 scfm x 0.6 = 750 scfm
Total air required = 31.416 cf air/cf methane
Total air required = 750 scfm x 31.416 = 23,562 scfm
Flare cross section area = $(\pi)(14\ in^2) \div (4)(144\ in^2/ft^2) = 1.07\ ft^2$
Exit velocity = total flow/area = 23,562 scfm ÷ (1.07 ft^2) (60 sec/min) = 367 ft/sec

Revised 11/15/93

A:\FLARE

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

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

Description	Contaminants Type	Contaminants % Wt	Utilization Rate - lbs/hr	Relate to Flow Diagram
LANDFILL GAS	CH_4	60		
	CO_2	35	1250 scfm	
	H_2S	0.06		

DRAFT

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

1. Total Process Input Rate (lbs/hr): 1250 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]* Maximum lbs/hr	Emission[1]* Actual T/yr	Allowed[2] Emission Rate per Rule 17-2	Allowable[3] Emission lbs/hr	Potential[4] Emission lbs/yr	Potential[4] Emission T/yr	Relate to Flow Diagram
N_2	87,094	381,472	* *		same as maximum		
O_2	18,447	80,798	* *		emissions		
CO_2	9,197	40,283	* *				
H_2O	4,513	19,767	* *				
NO_x	2.29	10	* *				
CO	55.74	244	* *				
SO_2	8.02	35.1	* *				

[1]See Section V, Item 2.

[2]Reference 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)

[3]Calculated from operating rate and applicable standard.

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

* Based on maximum flow rate
** Not specified in F.A.C. 17-2.600 emission limiting and performance standards for a landfill gas flare.