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March 31, 2021

Ms. Katherine McIlroy
Project Manager
Northeast Maryland Waste Disposal Authority
100 South Charles Street
Tower II – Suite 402
Baltimore, MD 21201

Gude Landfill
Rockville, Maryland
2020 Annual Emissions Certification Report

Dear Ms. McIlroy:

Aptim Environmental and Infrastructure, LLC (APTIM) is submitting one copy of the 2020 Annual Emissions Certification Report for the Gude Landfill Gas to Energy Facility/Landfill Gas Flare System in Rockville, Maryland, in accordance with Permit to Construct (PTC) 031-9-0738M. Two copies of the report must be submitted to the MDE offices by April 1, 2021, addressed to:

Maryland Department of the Environment
Air and Radiation Management Administration
1800 Washington Boulevard Suite 715
Baltimore, MD 21230-1720
Attn: Laramie Daniel, Compliance Program

The Responsible Official for the site must complete and submit the Certification of Truth, Accuracy, and Completeness with the report. In addition, a statement should be included certifying that the site is in compliance with the air toxic regulations, and there have been no changes in the air toxic assessment during the 2020 calendar year.

Should you have any questions and/or comments, please do not hesitate to contact the undersigned at 609-588-6398.

Respectfully Submitted,

Aptim Environmental & Infrastructure, LLC

John V. Esmet
Project Manager

Attachment

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard, Suite 715 • Baltimore Maryland 21230-1720
410-537-3000 • 1-800-633-6101 • http://www.mde.state.md.us
Air and Radiation Management Administration
Air Quality Compliance Program
410-537-3220

FORM 1:

GENERAL FACILITY INFORMATION
EMISSIONS CERTIFICATION REPORT

Calendar Year: 2020

A. FACILITY IDENTIFICATION	**Do Not Write in This Space**
Facility Name *Gude Landfill*	Date Received Regional
Address *600 E. Gude Drive*	Date Received State
City *Rockville* County *Montgomery* Zip Code *20850*	AIRS Code
B. Briefly describe the major function of the facility	FINDS Code
Municipal Solid Waste Landfill	SIC Code
	Facility Number:
	TEMPO ID:
C. SEASONAL PRODUCTION (%, if applicable)	Reviewed by:

Winter *(Dec.-Feb.)*	Spring *(Mar – May)*	Summer *(Jun – Aug)*	Fall *(Sept – Nov)*	Name Date
25%	*25%*	*25%*	*25%*	

D. Explain any increases or decreases in emissions from the previous calendar year for each registration at this facility.

Small variation due to changes in operation and gas collection

E. CONTROL DEVICE INFORMATION (for NOx and VOC sources only)

Control Device	Capture Efficiency	Removal Efficiency
Landfill Gas Collection Flare System	*N/A*	*98.0% (Permit)*

I am familiar with the facility and the installations and sources for which this report is submitted. I have personally examined the information in this report, which consists of 18 pages (including attachments), and certify that the information is correct to the best of my knowledge.

CHRISTOPHER SKAGGS *EXECUTIVE DIRECTOR*

Name (Print/Type) Title Date

410-333-2730

Signature Telephone

1/09/08

FORM 2:

CRITERIA AIR POLLUTANTS
EMISSIONS CERTIFICATION REPORT

Calendar Year: 2020

Facility Name: Gude Landfill   Facility ID: 031-9-0738M   Pollutant: VOC

Equipment Description/ Registration No.	SCC Number	Fuel		Actual Emissions Tons/yr	Actual Emissions Lbs/day	Operating Schedule (Actual) Hrs/dy	Dys/wk	Wk/yr	Days/yr	TOSD Lbs/dy	Operating Schedule Hrs/dy	Start	End	Emissions Methods
Landfill Gas Flare System 9-0738		Landfill Gas	S	0.08	0.47	24	7	52	351	0.24	24			C3
			F	--	--					--				
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
Total				0.08	0.47					0.19				

S - Stack Emissions   F - Fugitive Emissions   Daily emissions (lbs/day) are lbs/operating day of the source

TOSD: Typical Ozone Season Day means a typical day of that period of the year during which conditions for photochemical conditions are most favorable, which is generally during sustained periods of direct sunlight and warm temperatures (April-September). This section needs to be completed only for VOC and NOx sources.

Fuel: Include emissions for each fuel used. If more than one fuel is used, calculate and list emissions separately for each fuel.

Emission Estimation Method

A1-U.S. EPA Reference Method
A2-Other Particulate Sampling Train
A3-Liquid Absorption Technique
A4-Solid Absorption Technique
A5-Freezing Out Technique
A9-Other, Specify

C1-User calculated based on source test or other measurement
C2-User calculated based on material balance using engineering knowledge of the process
C3-User calculated based on AP-42
C4-User calculated by best guess/engineering Judgment

C5-User calculated based on a State or local agency emission factor
C6-New construction, not operational
C7-Source closed, operation ceased
C8-Computer calculated based on standard

FORM 2:

CRITERIA AIR POLLUTANTS
EMISSIONS CERTIFICATION REPORT

Calendar Year: 2020

Facility Name: Gude Landfill   Facility ID: 031-9-0738M   Pollutant: NOx

Equipment Description/ Registration No.	SCC Number	Fuel		Actual Emissions Tons/yr	Actual Emissions Lbs/day	Operating Schedule (Actual) Hrs/dy	Dys/wk	Wk/yr	Days/yr	TOSD Lbs/dy	Operating Schedule Hrs/dy	Start	End	Emissions Methods
Landfill Gas Flare System		Landfill Gas	S	2.62	14.91	24	7	52	351	14.69	24			C1
9-0738			F	--	--					--				
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
Total				2.62	14.91					14.69				

S - Stack Emissions   F - Fugitive Emissions   Daily emissions (lbs/day) are lbs/operating day of the source

TOSD: Typical Ozone Season Day means a typical day of that period of the year during which conditions for photochemical conditions are most favorable, which is generally during sustained periods of direct sunlight and warm temperatures (April-September). This section needs to be completed only for VOC and NOx sources.

Fuel: Include emissions for each fuel used. If more than one fuel is used, calculate and list emissions separately for each fuel.

Emission Estimation Method

A1-U.S. EPA Reference Method
A2-Other Particulate Sampling Train
A3-Liquid Absorption Technique
A4-Solid Absorption Technique
A5-Freezing Out Technique
A9-Other, Specify

C1-User calculated based on source test or other measurement
C2-User calculated based on material balance using engineering knowledge of the process
C3-User calculated based on AP-42
C4-User calculated by best guess/engineering Judgment

C5-User calculated based on a State or local agency emission factor
C6-New construction, not operational
C7-Source closed, operation ceased
C8-Computer calculated based on standard

FORM 2:

CRITERIA AIR POLLUTANTS
EMISSIONS CERTIFICATION REPORT

Calendar Year: 2020

Facility Name: Gude Landfill Facility ID: 031-9-0738M Pollutant: SO2

Equipment Description/ Registration No.	SCC Number	Fuel		Actual Emissions		Operating Schedule (Actual)				TOSD	Operating Schedule			Emissions Methods
				Tons/yr	Lbs/day	Hrs/dy	Dys/wk	Wk/yr	Days/yr	Lbs/dy	Hrs/dy	Start	End	
Landfill Gas Flare System		Landfill Gas	S	0.05	0.26	24	7	52	351					C1, C3
9-0738			F	--	--									
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
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			S											
			F											
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			F											
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			F											
			S											
			F											
Total				0.05	0.26									

S - Stack Emissions F - Fugitive Emissions Daily emissions (lbs/day) are lbs/operating day of the source

TOSD: Typical Ozone Season Day means a typical day of that period of the year during which conditions for photochemical conditions are most favorable, which is generally during sustained periods of direct sunlight and warm temperatures (April-September). This section needs to be completed only for VOC and NOx sources.

Fuel: Include emissions for each fuel used. If more than one fuel is used, calculate and list emissions separately for each fuel.

Emission Estimation Method

A1-U.S. EPA Reference Method
A2-Other Particulate Sampling Train
A3-Liquid Absorption Technique
A4-Solid Absorption Technique
A5-Freezing Out Technique
A9-Other, Specify

C1-User calculated based on source test or other measurement
C2-User calculated based on material balance using engineering knowledge of the process
C3-User calculated based on AP-42
C4-User calculated by best guess/engineering Judgment

C5-User calculated based on a State or local agency emission factor
C6-New construction, not operational
C7-Source closed, operation ceased
C8-Computer calculated based on standard

1/09/08

FORM 2:

CRITERIA AIR POLLUTANTS
EMISSIONS CERTIFICATION REPORT

Calendar Year: 2020

Facility Name: Gude Landfill   Facility ID: 031-9-0738M   Pollutant: CO

Equipment Description/ Registration No.	SCC Number	Fuel		Actual Emissions		Operating Schedule (Actual)				TOSD	Operating Schedule			Emissions
				Tons/yr	Lbs/day	Hrs/dy	Dys/wk	Wk/yr	Days/yr	Lbs/dy	Hrs/dy	Start	End	Methods
Landfill Gas Flare System 9-0738		Landfill Gas	S	6.54	37.28	24	7	52	351					C1
			F	--	--									
			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
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			S											
			F											
			S											
			F											
			S											
			F											
			S											
			F											
Total				6.54	37.28									

S - Stack Emissions   F - Fugitive Emissions   Daily emissions (lbs/day) are lbs/operating day of the source

TOSD: Typical Ozone Season Day means a typical day of that period of the year during which conditions for photochemical conditions are most favorable, which is generally during sustained periods of direct sunlight and warm temperatures (April-September). This section needs to be completed only for VOC and NOx sources.

Fuel: Include emissions for each fuel used. If more than one fuel is used, calculate and list emissions separately for each fuel.

Emission Estimation Method

A1-U.S. EPA Reference Method
A2-Other Particulate Sampling Train
A3-Liquid Absorption Technique
A4-Solid Absorption Technique
A5-Freezing Out Technique
A9-Other, Specify

C1-User calculated based on source test or other measurement
C2-User calculated based on material balance using engineering knowledge of the process
C3-User calculated based on AP-42
C4-User calculated by best guess/engineering Judgment

C5-User calculated based on a State or local agency emission factor
C6-New construction, not operational
C7-Source closed, operation ceased
C8-Computer calculated based on standard

FORM 3: PM

EMISSIONS CERTIFICATION REPORT

Particulate Matter

Calendar Year: 2020

Facility Name: Gude Landfill **Facility ID:** 031-9-0738M **Pollutant:** PM

Equipment Description/ Registration No.	SCC Number	Fuel		PM – Filterable		PM 10 –Filterable		PM 2.5 – Filterable		PM Condensable		Operation	Emissions Methods
				Tons/yr	Lbs/day	Tons/yr	Lbs/day	Tons/yr	Lbs/day	Tons/yr	Lbs/day	Days/yr	
Landfill Gas Flare		Landfill Gas	S	0.12	0.699	0.12	0.699	0.12	0.699	0.37	2.10	351	C3
System 9-0738			F	--	--	--	--	--	--	--	--		
			S										
			F										
			S										
			F										
			S										
			F										
			S										
			F										
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			F										
			S										
			F										
			S										
			F										
			S										
			F										
			S										
			F										
Total				0.12	0.699	0.12	0.699	0.12	0.699	0.37	2.10		

S - Stack Emissions F - Fugitive Emissions Daily emissions (lbs/day) are lbs/operating day of the source

Fuel: Include emissions for each fuel used. If more than one fuel is used, calculate and list emissions separately for each fuel.

Emission Estimation Method

A1-U.S. EPA Reference Method
A2-Other Particulate Sampling Train
A3-Liquid Absorption Technique
A4-Solid Absorption Technique
A5-Freezing Out Technique
A9-Other, Specify

C1-User calculated based on source test or other measurement
C2-User calculated based on material balance using engineering knowledge of the process
C3-User calculated based on AP-42
C4-User calculated by best guess/engineering Judgment

C5-User calculated based on a State or local agency emission factor
C6-New construction, not operational
C7-Source closed, operation ceased
C8-Computer calculated based on standard

2/21/08

FORM 4:

TOXIC AIR POLLUTANTS **Calendar Year:** 2020

EMISSIONS CERTIFICATION REPORT

Facility Name: Gude Landfill **Facility ID**: 031-9-0738M **Pollutant**: Hydrochloric Acid*

Equipment Description/ Registration Number[1]	Actual Emissions			Control Device**	% Efficiency
	Tons/yr	Lbs/day	Lbs/hr		
Landfill Gas Flare System 9-0738	0.3	1.77	0.1	O	0
TOTALS	0.3	1.77	0.1		

* Please attach all calculations.

* See Attachment 1 for the minimum reporting values.

**Control Device
S = Scrubber
B = Baghouse
ESP = Electrostatic Precipitator
A = Afterburner
C = Condenser
AD = Adsorbtion
O = Other

[1]Emissions must be broken down by equipment registration number (ex. 9-0076, 9-0077)

FORM 5:

BILLABLE TOXIC AIR POLLUTANTS

Calendar Year: 2020

Emissions Certification Report

Facility Name: Gude Landfill Facility ID#: 031-9-0738M

Chemical Name	CAS Number		Actual Emissions				Estimation Method
			Tons/year	Lbs/day	Lbs/hr		
carbon disulfide	75-15-0	S	0.00	0.0001	0.00		C1
		F					
carbonyl sulfide	463-58-1	S	0.00	0.0007	0.00		C3
		F					
chlorine	7782-50-5	S	N/A	N/A	N/A		
		F					
cyanide compounds	57-12-5	S	N/A	N/A	N/A		
		F					
hydrochloric acid	7647-01-0	S	0.3	1.77	0.1		C3
		F					
hydrogen fluoride	7664-39-3	S	N/A	N/A	N/A		
		F					
methyl chloroform	71-55-6	S	0.00	0.0001	0.00		C1
		F					
methylene chloride	75-09-2	S	0.00	0.0002	0.00		C1
		F					
perchloroethylene	127-18-4	S	0.00	0.0000	0.00		C1
		F					
phosphine	7803-51-2	S	N/A	N/A	N/A		
		F					
titanium tetrachloride	7550-45-0	S	N/A	N/A	N/A		
		F					
TOTALS			0.3	1.78	0.10		

S-Stack Emissions F-Fugitive Emissions Daily emissions (lbs/day) are lbs/operating day of the source

Emission Estimation Method

A1-U.S. EPA Reference Method
A2-Other Particulate Sampling Train
A3-Liquid Absorption Technique
A4-Solid Absorption Technique
A5-Freezing Out Technique
A9-Other, Specify

C1-User calculated based on source test or other measurement
C2-User calculated based on material balance using engineering knowledge of the process
C3-User calculated based on AP-42
C4-User calculated by engineering judgment
C5-User calculated based on a State or local agency factor
C6-New construction, not operational
C7-Source closed, operation ceased
C8-Computer calculated based on standards

This form is to include only the chemicals identified.

PLEASE NOTE: Be sure to attach all data and calculations necessary to support the emissions figures shown above.

FORM 6: Greenhouse Gases

GREENHOUSE GAS AIR POLLUTANTS **Calendar Year:** 2020

EMISSIONS CERTIFICATION REPORT

Facility Name: Gude Landfill **Facility ID**: 031-9-0738M **Pollutant**: Carbon Dioxide*

Equipment Description/ Registration Number[1]	Actual Emissions		
	Tons/yr	Lbs/day	Lbs/hr
Landfill Gas Flare System 9-0738	6,360.3	36,269.4	1,511.2
TOTALS	6,360.3	36,269.4	1,511.2

This form must be used to report Greenhouse gas emissions:

- carbon dioxide (CO2)
- methane (CH4)
- nitrous oxide (N2O)
- hydrofluorocarbons (HFCs)
- perfluorocarbons (PFCs)
- sulfur hexafluoride (SF6)

* Use a separate form for each pollutant.

* Please attach all calculations.

[1]Emissions must be broken down by equipment registration number (ex. 9-0076, 9-0077)

FORM 6: Greenhouse Gases

GREENHOUSE GAS AIR POLLUTANTS **Calendar Year:** 2020

EMISSIONS CERTIFICATION REPORT

Facility Name: Gude Landfill **Facility ID**: 031-9-0738M **Pollutant**: Methane*

Equipment Description/ Registration Number[1]	Actual Emissions		
	Tons/yr	Lbs/day	Lbs/hr
Landfill Gas Flare System 9-0738	26.8	152.7	6.4
TOTALS	26.8	152.7	6.4

This form must be used to report Greenhouse gas emissions:

- carbon dioxide (CO2)
- methane (CH4)
- nitrous oxide (N2O)
- hydrofluorocarbons (HFCs)
- perfluorocarbons (PFCs)
- sulfur hexafluoride (SF6)

* Use a separate form for each pollutant.

* Please attach all calculations.

[1]Emissions must be broken down by equipment registration number (ex. 9-0076, 9-0077)

FORM 6: Greenhouse Gases

GREENHOUSE GAS AIR POLLUTANTS **Calendar Year:** 2020

EMISSIONS CERTIFICATION REPORT

Facility Name: Gude Landfill **Facility ID**: 031-9-0738M **Pollutant**: N20*

Equipment Description/ Registration Number[1]	Actual Emissions		
	Tons/yr	Lbs/day	Lbs/hr
Landfill Gas Flare System 9-0738	0.05	0.26	0.01
TOTALS	0.05	0.26	0.01

This form must be used to report Greenhouse gas emissions:

- carbon dioxide (CO2)
- methane (CH4)
- nitrous oxide (N2O)
- hydrofluorocarbons (HFCs)
- perfluorocarbons (PFCs)
- sulfur hexafluoride (SF6)

* Use a separate form for each pollutant.

* Please attach all calculations.

[1]Emissions must be broken down by equipment registration number (ex. 9-0076, 9-0077)

Northeast Maryland Waste Disposal Authority - Gude Landfill
Reporting Year: **2020**

OPERATING DATA

Month	Flare Operation	
	Hours	Days
Jan	671.0	28.0
Feb	677.8	28.2
Mar	719.9	30.0
Apr	713.7	29.7
May	744.0	31.0
Jun	707.5	29.5
Jul	735.5	30.6
Aug	678.7	28.3
Sep	698.1	29.1
Oct	744.0	31.0
Nov	631.2	26.3
Dec	696.0	29.0
TOTAL	**8,417.4**	**350.7**

LANDFILL GAS USAGE DATA

Month	LFG to Flare (MMscf)	Avg LFG Flare Flow Rate (cfm)	Avg Flare Methane Content[1] (%)	Avg Flare Carbon Dioxide Content[2] (%)
Jan	15.68	389.6	40.41%	30.9%
Feb	9.76	240.0	42.28%	31.0%
Mar	13.58	314.4	41.60%	31.3%
Apr	12.50	291.9	41.45%	30.9%
May	13.17	294.9	42.35%	30.3%
Jun	13.11	308.7	40.34%	30.1%
Jul	13.28	300.8	42.00%	30.0%
Aug	14.02	344.4	38.50%	29.0%
Sep	12.97	309.7	43.97%	31.1%
Oct	14.93	334.5	39.40%	29.5%
Nov	12.00	316.8	40.20%	28.5%
Dec	14.27	341.7	40.08%	27.7%
TOTAL	**159.3**	-	-	-
AVERAGE	-	**315.6**	**41.05%**	**30.0%**

[1] CH4 readings derived from daily operator plant readings.

[2] CO2 readings derived from monthly GEM readings. For missing readings, the months prior and following a missing reading are averaged.

DEVICE DESTRUCTION EFFICIENCIES FOR LFG CONSTITUENTS

Flare System 98.0% Manufacturer design for NMOC; Permit 031-2253

LFG ANALYSIS DATA

Component	Concentration (ppmv)	
Total Reduced Sulfur (TRS)	3.52	
VOC (as Hexane)	235	AP-42 Table 2.4-2 footnote

Northeast Maryland Waste Disposal Authority - Gude Landfill
Reporting Year: 2020

Summary of LFG Flow Data and Operating Parameters		
Parameter	Units	Flare System
Site-specific CH4 Content	%	41.0%
Site-specific CO2 Content	%	30.0%
Site-specific LFG Heat Content	Btu/scf of LFG	410.49
Site-specific LFG Flow to Device	MMscf/yr	159.27
CH4 Flow to Device	MMscf/yr	65.38
Days per Year of Operation	Days/Yr	350.73
Hours per Year of Operation	Hrs/Yr	8,417.40
LFG Flow to Device, Apr-Sep	MMscf	79.04
CH4 Flow to Device, Apr-Sep	MMscf	32.72
Hours of Operation, Apr-Sep	Hours	4,277.50
Days of Operation, Apr-Sep	Days	178.23

Sample Calculations:

1. Site-specific LFG Heat Content

Standard CH4 heat content = 1000 Btu/scf

LFG Heat Content (Btu/scf) = CH4 Content of LFG (%) * CH4 Heat Content (Btu/scf)

2. CH4 Flow to Device

CH4 Flow to Device (MMScf) = CH4 Content (%) * LFG Flow to Device (MMscf)

3. Normalized LFG Flow to Device (adjusted to 50% CH4)

Normalized LFG Flow to Device (MMscf) = Site-specific LFG flow (MMscf) * Site-specific CH4 Content (%) / Standard CH4 Content (50%)

Equipment	Pollutant	Factor	Units	Reference
Flare	NOx	80	lb/MMdscf CH4	Manufacturer data
Flare	CO	200	lb/MMdscf CH4	Manufacturer data
Flare	VOC	51.71	lb/MMdscf LFG	Concentration in LFG; AP-42 Section 2.4, equations 3 and 4
Flare	TPM	15	lb/MMdscf CH4	AP-42 Table 2.4-4 (10/08)
Flare	TPM10	15	lb/MMdscf CH4	AP-42 Table 2.4-4 (10/08)
Flare	TPM2.5	15	lb/MMdscf CH4	AP-42 Table 2.4-4 (10/08)
Flare	FPM	3.75	lb/MMdscf CH4	Historical calculations; FPM/TPM = 0.25, AP-42 Table 1.4-2
Flare	FPM10	3.75	lb/MMdscf CH4	Historical calculations; FPM/TPM = 0.25, AP-42 Table 1.4-2
Flare	FPM2.5	3.75	lb/MMdscf CH4	Historical calculations; FPM/TPM = 0.25, AP-42 Table 1.4-2
Flare	CPM	11.25	lb/MMdscf CH4	Historical calculations; CPM/TPM = 0.75, AP-42 Table 1.4-2
Flare	SO2	0.58	lb/MMdscf LFG	TRS concentration in LFG; AP-42 Section 2.4, equations 3 and 4
Flare	CH4	Mass Balance		
Flare	CO2	Mass Balance		
Flare	N2O	6.30E-04	kg/MMBtu	40 CFR 98 Table C-2

Calculation Constants		
298	deg K	Default temperature of LFG, 25 deg C, AP-42 Section 2.4
32	g/gmol	MW of total reduced sulfur (TRS)
64	g/gmol	MW of SO2
8.21E-05	m^3 - atm/gmol - K	Ideal gas constant
35.31	ft^3/m^3	conversion factor
453.6	g/lb	conversion factor
86.18	g/gmol	MW of VOC as Hexane (AP-42 Table 2.4-2)

Criteria Pollutant Emissions Summary
Northeast Maryland Waste Disposal Authority - Gude Landfill
Reporting Year: 2020

Device: **Landfill Gas Flare System**

Pollutant	Actual Emissions		Emissions	TOSD*
	TPY	lb/day	Basis	lb/day
NOx	2.62	14.91	Manufacturer Data	14.69
CO	6.54	37.28	Manufacturer Data	-
VOC	0.08	0.47	AP-42, manuf control eff.	0.19
TPM	0.49	2.80	AP-42	-
TPM10	0.49	2.80	AP-42	-
TPM2.5	0.49	2.80	AP-42	-
FPM	0.12	0.70	Historical calcs, AP-42	-
FPM10	0.12	0.70	Historical calcs, AP-42	-
FPM2.5	0.12	0.70	Historical calcs, AP-42	-
CPM	0.37	2.10	Historical calcs, AP-42	-
SO2	0.05	0.26	LFG test data, AP-42	-

* TOSD = Typical Ozone Season Day (Apr-Sep), applies to NOx and VOC only.

Toxic Air Pollutant Emissions
Northeast Maryland Waste Disposal Authority - Gude Landfill
Reporting Year: 2020

LFG Flow to Flares =	159.27	MMscf/yr
Flare Operating Days =	350.73	days/yr
Flare Operating Hours =	8417.4	hrs/yr

Pollutant	Molecular Weight (g/gmol)	Concentration (ppmv)	Flare Pollutant Inflow (lb/yr)	Flare Destruction Efficiency	Flare Emissions (lb/day)	(lb/hr)	(ton/yr)
1,1,1-Trichloroethane (methyl chloroform)	133.4	0.04	2.2	98.0%	0.00	0	0
1,1,2,2-Tetrachloroethane	167.85	0.06	4.1	98.0%	0.00	0.0	0.0
1,1,2,3,4,4-Hexachloro-1,3-butadiene (Hexachlorobutadiene)	260.76	0.06	6.4	98.0%	0.00	0.000	0.00
1,1,2-Trichloroethane	133.4	0.06	3.3	98.0%	0.00	0.0	0
1,1-Dichloroethane (ethylidene dichloride)	98.96	1.18	47.5	98.0%	0.00	0	0
1,1-Dichloroethene (vinylidene chloride)	96.94	0.06	2.4	98.0%	0.00	0.0	0
1,2,4-Trichlorobenzene	181.45	0.06	4.4	98.0%	0.00	0.0	0
1,2-Dichloroethane (ethylene dichloride)	98.96	0.06	2.4	98.0%	0.00	0.0	0.00
1,2-Dichloropropane (propylene dichloride)	112.99	0.06	2.8	98.0%	0.00	0	0
1,3-Butadiene (vinyl ethylene)	54.09	0.06	1.3	98.0%	0.00	0.00	0.000
1,3-Dichloropropene	110.97	0.06	2.7	98.0%	0.00	0.00	0.00
1,4-Dichlorobenzene	147.02	0.04	2.4	98.0%	0.00	0	0.0
1,4-Dioxane (1,4-diethylene dioxide)	88.11	0.06	2.1	98.0%	0.00	0	0.0
2,2,4-Trimethylpentane	114.23	0.06	2.8	98.0%	0.00	0.0	0
2-Butanone (methyl ethyl ketone)	72.11	1.27	37.2	98.0%	0.00	0	0
4-Methyl-2-pentanone (Methyl isobutyl ketone)	100.16	0.06	2.4	98.0%	0.00	0	0
Acrylonitrile *	53.06	6.33	136.5	98.0%	0.01	0.00	0.00
Allyl chloride (3-Chloro-1-propene)	76.52	0.06	1.9	98.0%	0.00	0.00	0.0
Benzene	78.11	0.272	8.6	98.0%	0.00	0.00	0.0
Benzyl chloride	126.58	0.06	3.1	98.0%	0.00	0.00	0.0
Bromomethane (Methyl bromide)	94.94	0.06	2.3	98.0%	0.00	0.00	0.00
Bromoethene (Vinyl bromide)	106.95	0.06	2.6	98.0%	0.00	0.0	0
Carbon disulfide	76.14	0.06	1.9	98.0%	0.00	0.0	0
Carbon tetrachloride	153.82	0.04	2.5	98.0%	0.00	0.0	0.00
Carbonyl sulfide (Carbon oxysulfide) *	60.08	0.49	12.0	98.0%	0.00	0.0	0
Chlorine *	35.45	42	605.1	n/a	n/a	n/a	n/a
Chlorobenzene	112.56	0.06	2.7	98.0%	0.00	0.0	0
Chloroethane (Ethyl chloride)	64.51	0.208	5.5	98.0%	0.00	0.000	0.00
Chloromethane (Methyl chloride)	50.49	0.06	1.2	98.0%	0.00	0.0	0.0
Dichloromethane (Methylene chloride)	84.93	0.115	4.0	98.0%	0.00	0	0
Ethylbenzene	106.17	0.868	37.5	98.0%	0.00	0	0
Hexachlorobutadiene	260.76	0.06	6.4	98.0%	0.00	0.000	0.00
n-Hexane	86.18	0.78	27.3	98.0%	0.00	0	0
Hydrochloric Acid *	36.46	42	622.4	0.0%	1.77	0.1	0.3
Mercury (Total) *	200.59	0.000292	0.0	0.0%	0.00	0.0000	0.000
Methyl tert-butyl ether (MTBE)	88.15	0.084	3.0	98.0%	0.00	0	0
Styrene (Vinylbenzene)	104.15	0.06	2.5	98.0%	0.00	0	0
Tetrachloroethylene (Perchloroethylene)	165.83	0.265	17.9	98.0%	0.00	0	0
Toluene (Methyl benzene)	92.14	4.16	155.8	98.0%	0.01	0	0
Tribromomethane (Bromoform)	252.73	0.04	4.1	98.0%	0.00	0.00	0.0
Trichloroethylene (Trichloroethene)	131.39	0.158	8.4	98.0%	0.00	0	0
Trichloromethane (Chloroform)	119.38	0.04	1.9	98.0%	0.00	0.0	0.00
Vinyl acetate	86.09	0.06	2.1	98.0%	0.00	0.0	0
Vinyl chloride (Chloroethene)	62.5	1.78	45.2	98.0%	0.00	0.0	0.00
Xylenes (o-, m-, p-, mixtures)	106.17	0.39	16.8	98.0%	0.00	0	0
Total Air Toxics					**1.81**	**0.10**	**0.30**

* Laboratory data not available; default values from AP-42 Section 2.4 were used.

Pollutant Inflow (lb/yr) = Conc (ppmv)/10^6 * MW (g/gmol) / 8.21E-05 (atm-m3/gmol-K)/ 298 K / 35.31 (ft3/m3) / 453.6 (g/lb) * 10^6

Greenhouse Gas Emissions
Northeast Maryland Waste Disposal Authority - Gude Landfill
Reporting Year: 2020

Calculation Constants and Input Parameters

Description	Value	Units
Default temperature of LFG, 25 deg C, AP-42 Section 2.4	298	deg K
Ideal gas constant	8.21E-05	(m^3 - atm) / (gmol - K)
MW of CO2	44.01	g/gmol
MW of CH4	16.044	g/gmol
Default N2O factor, 40 CFR 98 Table C-2	6.30E-04	kg/MMBtu

Emissions Parameter	Units	Flares
Site-specific CO2 Content of LFG	%	30.0%
Site-specific CH4 Content of LFG	%	41.0%
Site-specific LFG heat content	Btu/scf	410.5
LFG Flow to Device	MMscf/yr	159.27
Days of Operation	Days/Yr	350.73
Hours of Operation	Hrs/Yr	8417.40
Destruction Efficiency	%	98.0%
Volume of CO2 Emissions	MMscf/yr	113.19
Mass of CO2 Emissions	TPY	6360.3
	lb/day	36269.4
	lb/hr	1511.2
Volume of CH4 Emissions	MMscf/yr	1.308
Mass of CH4 Emissions	TPY	26.8
	lb/day	152.7
	lb/hr	6.4
Mass of N2O Emissions	TPY	0.05
	lb/day	0.26
	lb/hr	0.01

Calculation Notes:

1. CO2 Emissions

-Burning LFG produces CO2, and LFG also contains CO2.

- The CO2 emissions from burning LFG are calculated using the site-specific CH4 and CO2 contents of the LFG and assuming that all CH4 in the LFG is burned. 1 mole of CH4 produces 1 mole of CO2.

Sample Calculations for CO2 :

a. Volume of Emissions (MMscf/yr) = LFG flow to device (MMscf/yr) * (LFG CO2 content % + LFG CH4 content %)

b. Mass of Emissions (lb/yr) = Volume Emissions (MMscf/yr) * 10^6 (scf/MMscf) / 35.31 (cf/m3)* MW (g/gmol) / Gas Constant (atm-m3/gmol-K) / LFG Temperature (K) / 453.6 (g/lb)

2. CH4 Emissions

- LFG contains CH4. Uncombusted CH4 is released from the flares.

Sample Calculations for CH4:

a. Volume of Emissions (MMscf/yr) = LFG flow to device (MMscf/yr) * LFG CH4 content (%) * (1-Destruction Efficiency %)

b. Mass of Emissions (lb/yr) = Volume Emissions (MMscf/yr) * 10^6 (scf/MMscf) / 35.31 (cf/m3)* MW (g/gmol) / Gas Constant (atm-m3/gmol-K) / LFG Temperature (K) / 453.6 (g/lb)

3. N2O Emissions

N2O Emissions (ton/yr) = LFG flow to device (MMscf/yr) * LFG Heat content (Btu/scf) * N2O factor (kg/MMBtu) * 2.2 (lb/kg)/ / 2000 (lb/ton)