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March 31, 2022

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

***Gude Landfill
Rockville, Maryland
2021 Annual Emissions Certification Report***

Dear Ms. McIlroy:

Aptim Environmental and Infrastructure, LLC (APTIM) is submitting one copy of the 2021 Annual Emissions Certification Report for the Gude 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 in hard copy to MDE at the address below.

Maryland Department of the Environment
Air and Radiation Management Administration
1800 Washington Boulevard Suite 715
Baltimore, MD 21230-1720
Attn: Daniel Davis, 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 toxics assessment during the 2021 calendar year.

Should you have any questions and/or comments, please do not hesitate to contact the undersigned at 570-446-8256.

Respectfully Submitted,

Aptim Environmental & Infrastructure, LLC

A handwritten signature in black ink, appearing to read 'Greg Autolitano', is written over a light grey signature line.

Gregory Autolitano
Operations Manager

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

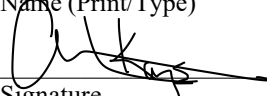
FORM 1:

**GENERAL FACILITY INFORMATION
 EMISSIONS CERTIFICATION REPORT**

Calendar Year: 2021

A. FACILITY IDENTIFICATION				Do Not Write in This Space	
Facility Name <i>Gude Landfill</i>				Date Received Regional	
Address <i>600 E. Gude Drive</i>				Date Received State	
City <i>Rockville</i>	County <i>Montgomery</i>	Zip Code <i>20850</i>	AIRS Code		
B. Briefly describe the major function of the facility				FINDS Code	
<i>Municipal Solid Waste Landfill</i>				SIC Code	
				Facility Number:	
				TEMPO ID:	
C. SEASONAL PRODUCTION (% if applicable)				Reviewed by:	
<u>Winter</u> (<i>Dec.-Feb.</i>)	<u>Spring</u> (<i>Mar – May</i>)	<u>Summer</u> (<i>Jun – Aug</i>)	<u>Fall</u> (<i>Sept – Nov</i>)		
<i>25%</i>	<i>25%</i>	<i>25%</i>	<i>25%</i>		
				Name _____ Date _____	
D. Explain any increases or decreases in emissions from the previous calendar year for each registration at this facility.					
<i>Small variation due to changes in operation and gas collection</i>					
E. CONTROL DEVICE INFORMATION (for NOx and VOC sources only)					
Control Device		Capture Efficiency		Removal Efficiency	
<i>Landfill Gas Collection Flare System</i>		<i>N/A</i>		<i>98.0% (Permit)</i>	

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.

<i>Andrew Kays</i>	<i>EXECUTIVE DIRECTOR</i>	<i>04.01.2022</i>
_____ Name (Print/Type)	_____ Title	_____ Date
		<i>410-333-2730</i>
_____ Signature		_____ Telephone

FORM 2:

**CRITERIA AIR POLLUTANTS
EMISSIONS CERTIFICATION REPORT**

Calendar Year: 2021

Facility Name: Gude Landfill

Facility ID: 031-9-0738M

Pollutant: VOC

Equipment Description/ Registration No.	SCC Number	Fuel	Actual Emissions		Operating Schedule (Actual)			TOSD Lbs/dy	Operating Schedule		Emissions Methods
			Tons/yr	Lbs/day	Hrs/dy	Dys/wk	Wk/yr		Days/yr	Hrs/dy	
<u>Landfill Gas Flare System</u>		<u>Landfill Gas</u>	<u>0.09</u>	<u>0.52</u>	<u>24</u>	<u>7</u>	<u>52</u>	<u>357</u>	<u>24</u>		<u>C3</u>
-----			--	--				--			

Total			0.09	0.52				0.18			

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: 2021

Facility Name: Gude Landfill

Facility ID: 031-9-0738M

Pollutant: NOX

Equipment Description/ Registration No.	SCC Number	Fuel	Actual Emissions		Operating Schedule (Actual)			TOSD Lbs/dy	Operating Schedule		Emissions Methods
			Tons/yr	Lbs/day	Hrs/dy	Dys/wk	Wk/yr		Days/yr	Hrs/dy	
<u>Landfill Gas Flare System</u> <u>9-0738</u>		<u>Landfill Gas</u>	<u>2.48</u>	<u>13.88</u>	<u>24</u>	<u>7</u>	<u>52</u>	<u>357</u>	<u>24</u>		<u>C1</u>
-----			--	--				--			

Total			2.48	13.88				13.66			

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: 2021

Facility Name: Gude Landfill

Facility ID: 031-9-0738M

Pollutant: SO2

Equipment Description/ Registration No.	SCC Number	Fuel	Actual Emissions		Operating Schedule (Actual)			TOSD Lbs/dy	Operating Schedule		Emissions Methods
			Tons/yr	Lbs/day	Hrs/dy	Dys/wk	Wk/yr		Days/yr	Hrs/dy	
Landfill Gas Flare System 9-0738		Landfill Gas	0.05	0.29	24	7	52	357			C1, C3
-----			--	--							

Total			0.05	0.29							

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: 2021

Facility Name: Gude Landfill

Facility ID: 031-9-0738M

Pollutant: CO

Equipment Description/ Registration No.	SCC Number	Fuel	Actual Emissions		Operating Schedule (Actual)			TOSD Lbs/dy	Operating Schedule		Emissions Methods
			Tons/yr	Lbs/day	Hrs/dy	Dys/wk	Wk/yr		Days/yr	Hrs/dy	
<u>Landfill Gas Flare System 9-0738</u>		<u>Landfill Gas</u>	<u>6.19</u>	<u>34.70</u>	<u>24</u>	<u>7</u>	<u>52</u>	<u>357</u>			<u>C1</u>
-----			--	--							

Total			6.19	34.70							

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

Calendar Year: 2021

Particulate Matter

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 Days/yr	Emissions Methods
			Tons/yr	Lbs/day	Tons/yr	Lbs/day	Tons/yr	Lbs/day	Tons/yr	Lbs/day		
Landfill Gas Flare System 9-0738		Landfill Gas	S 0.12	0.651	S 0.12	0.651	S 0.12	0.651	S 0.35	1.95	357	C3
-----			F --	--	F --	--	F --	--	F --	--		
-----			S		S		S		S			
-----			F		F		F		F			
-----			S		S		S		S			
-----			F		F		F		F			
-----			S		S		S		S			
-----			F		F		F		F			
-----			S		S		S		S			
-----			F		F		F		F			
-----			S		S		S		S			
-----			F		F		F		F			
-----			S		S		S		S			
-----			F		F		F		F			
-----			S		S		S		S			
-----			F		F		F		F			
Total			0.12	0.65	0.12	0.65	0.12	0.65	0.35	1.95		

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

FORM 4:

TOXIC AIR POLLUTANTS

2021

Calendar Year: _____

EMISSIONS CERTIFICATION REPORT

Gude Landfill

031-9-0738M

Hydrochloric Acid

Facility Name: _____

Facility ID: _____

Pollutant: _____

*

Equipment Description/ Registration Number ¹	Actual Emissions				Control Device**	% Efficiency
	Tons/yr	Lbs/day	Lbs/hr			
Landfill Gas Flare System 9-0738	0.3	1.95	0.1		O	0

TOTALS	0.3	1.95	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 = Adsorption
 O = Other

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

FORM 5:

BILLABLE TOXIC AIR POLLUTANTS

Calendar Year: 2021

Emissions Certification Report

Gude Landfill

031-9-0738M

Facility Name:

Facility ID#:

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	1.95	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	1.95	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

2021

Calendar Year: _____

EMISSIONS CERTIFICATION REPORT

Gude Landfill

031-9-0738M

Carbon Dioxide

Facility Name: _____ Facility ID: _____ Pollutant: _____ *

Equipment Description/ Registration Number ¹	Actual Emissions		
	Tons/yr	Lbs/day	Lbs/hr
Landfill Gas Flare System 9-0738	6,060.7	33,979.6	1,415.8

TOTALS	6,060.7	33,979.6	1,415.8

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.

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

FORM 6: Greenhouse Gases

GREENHOUSE GAS AIR POLLUTANTS

2021

Calendar Year: _____

EMISSIONS CERTIFICATION REPORT

Gude Landfill

031-9-0738M

Methane

Pollutant: _____ *

Facility ID: _____

Equipment Description/ Registration Number ¹	Actual Emissions		
	Tons/yr	Lbs/day	Lbs/hr
Landfill Gas Flare System 9-0738	25.4	142.2	5.9

TOTALS	25.4	142.2	5.9

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.

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

FORM 6: Greenhouse Gases

GREENHOUSE GAS AIR POLLUTANTS

2021

Calendar Year: _____

EMISSIONS CERTIFICATION REPORT

Gude Landfill

031-9-0738M

N2O

Facility Name: _____ Facility ID: _____ Pollutant: _____ *

Equipment Description/ Registration Number ¹	Actual Emissions		
	Tons/yr	Lbs/day	Lbs/hr
Landfill Gas Flare System 9-0738	0.04	0.24	0.01

TOTALS	0.04	0.24	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.

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

Northeast Maryland Waste Disposal Authority - Gude Landfill

Reporting Year: **2021**

OPERATING DATA

Month	Flare Operation	
	Hours	Days
Jan	736.8	30.7
Feb	622.1	25.9
Mar	679.4	28.3
Apr	720.0	30.0
May	733.3	30.6
Jun	718.8	30.0
Jul	720.3	30.0
Aug	728.4	30.4
Sep	711.1	29.6
Oct	742.4	30.9
Nov	713.1	29.7
Dec	735.7	30.7
TOTAL	8,561.4	356.7

LANDFILL GAS USAGE DATA

Month	LFG to Flare	Avg LFG Flare Flow Rate	Avg Flare Methane Content ¹	Avg Flare Carbon Dioxide Content ²
	(MMscf)	(cfm)	(%)	(%)
Jan	14.47	327.4	38.72%	27.37%
Feb	10.87	291.1	40.29%	27.20%
Mar	12.33	302.4	43.44%	30.16%
Apr	12.25	283.7	40.42%	27.78%
May	16.00	363.7	33.91%	25.21%
Jun	16.44	381.2	30.34%	24.29%
Jul	17.07	395.0	31.32%	23.75%
Aug	16.94	387.7	31.01%	24.84%
Sep	16.17	379.1	30.02%	23.77%
Oct	15.40	345.7	31.55%	24.70%
Nov	14.79	345.7	30.53%	24.75%
Dec	15.26	345.7	35.71%	26.06%
TOTAL	178.0	-	-	-
AVERAGE	-	345.7	34.77%	25.8%

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: 2021

Summary of LFG Flow Data and Operating Parameters		
Parameter	Units	Flare System
Site-specific CH4 Content	%	34.8%
Site-specific CO2 Content	%	25.8%
Site-specific LFG Heat Content	Btu/scf of LFG	347.72
Site-specific LFG Flow to Device	MMscf/yr	178.00
CH4 Flow to Device	MMscf/yr	61.90
Days per Year of Operation	Days/Yr	356.73
Hours per Year of Operation	Hrs/Yr	8,561.40
LFG Flow to Device, Apr-Sep	MMscf	94.89
CH4 Flow to Device, Apr-Sep	MMscf	30.83
Hours of Operation, Apr-Sep	Hours	4,331.87
Days of Operation, Apr-Sep	Days	180.49

Sample Calculations:

1. Site-specific LFG Heat Content

$$\text{Standard CH4 heat content} = 1000 \text{ Btu/scf}$$

$$\text{LFG Heat Content (Btu/scf)} = \text{CH4 Content of LFG (\%)} * \text{CH4 Heat Content (Btu/scf)}$$

2. CH4 Flow to Device

$$\text{CH4 Flow to Device (MMscf)} = \text{CH4 Content (\%)} * \text{LFG Flow to Device (MMscf)}$$

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

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

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
32	g/gmol
64	g/gmol
8.21E-05	m ³ - atm/gmol - K
35.31	ft ³ /m ³
453.6	g/lb
86.18	g/gmol

Default temperature of LFG, 25 deg C, AP-42 Section 2.4
MW of total reduced sulfur (TRS)
MW of SO2
Ideal gas constant
conversion factor
conversion factor
MW of VOC as Hexane (AP-42 Table 2.4-2)

Criteria Pollutant Emissions Summary
Northeast Maryland Waste Disposal Authority - Gude Landfill
Reporting Year: 2021

Device: **Landfill Gas Flare System**

Pollutant	Actual Emissions		Emissions Basis	TOSD*
	TPY	lb/day		
NOx	2.48	13.88	Manufacturer Data	13.66
CO	6.19	34.70	Manufacturer Data	-
VOC	0.09	0.52	AP-42, manuf control eff.	0.18
TPM	0.46	2.60	AP-42	-
TPM10	0.46	2.60	AP-42	-
TPM2.5	0.46	2.60	AP-42	-
FPM	0.12	0.65	Historical calcs, AP-42	-
FPM10	0.12	0.65	Historical calcs, AP-42	-
FPM2.5	0.12	0.65	Historical calcs, AP-42	-
CPM	0.35	1.95	Historical calcs, AP-42	-
SO2	0.05	0.29	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 - Guide Landfill
 Reporting Year: 2021

LFG Flow to Flares = 178.00 MMsct/yr
 Flare Operating Days = 356.73 days/yr
 Flare Operating Hours = 8561.4 hrs/yr

Pollutant	Molecular Weight (g/gmol)	Concentration (ppmv)	Flare Pollutant Inflow (lb/yr)	Flare Destruction Efficiency	Flare Emissions (ton/yr)	
					(lb/day)	(ton/yr)
1,1,1-Trichloroethane (methyl chloroform)	133.4	0.04	2.4	98.0%	0.00	0
1,1,1,2-Tetrachloroethane	167.85	0.06	4.6	98.0%	0.00	0.00
1,1,2,3,4,4-Hexachloro-1,3-butadiene (hexachlorobutadiene)	260.76	0.06	7.1	98.0%	0.00	0.00
1,1,2-Trichloroethane	133.4	0.06	3.6	98.0%	0.00	0
1,1-Dichloroethane (ethylidene dichloride)	98.96	1.18	53.0	98.0%	0.00	0
1,1-Dichloroethane (vinylidene chloride)	96.94	0.06	2.6	98.0%	0.00	0
1,2,4-Trichlorobenzene	181.45	0.06	4.9	98.0%	0.00	0
1,2-Dichloroethane (ethylene dichloride)	98.96	0.06	2.7	98.0%	0.00	0.00
1,2-Dichloropropane (propylene dichloride)	112.99	0.06	3.1	98.0%	0.00	0
1,3-Butadiene (vinyl ethylene)	54.09	0.06	1.5	98.0%	0.00	0.00
1,3-Dichloropropene	110.97	0.06	3.0	98.0%	0.00	0.00
1,4-Dichlorobenzene	147.02	0.04	2.7	98.0%	0.00	0.00
1,4-Dioxane (1,4-diethylene dioxide)	88.11	0.06	2.4	98.0%	0.00	0.00
2,2,4-Trimethylpentane	114.23	0.06	3.1	98.0%	0.00	0
2-Butanone (methyl ethyl ketone)	72.11	1.27	41.6	98.0%	0.00	0
4-Methyl-2-pentanone (Methyl isobutyl ketone)	100.16	0.06	2.7	98.0%	0.00	0
Acrylonitrile *	53.06	6.33	152.6	98.0%	0.01	0.00
Allyl chloride (3-Chloro-1-propene)	76.52	0.06	2.1	98.0%	0.00	0.00
Benzene	78.11	0.272	9.7	98.0%	0.00	0.00
Benzyl chloride	126.58	0.06	3.4	98.0%	0.00	0.00
Bromomethane (Methyl bromide)	94.94	0.06	2.6	98.0%	0.00	0.00
Bromoethene (Vinyl bromide)	106.95	0.06	2.9	98.0%	0.00	0
Carbon disulfide	76.14	0.06	2.1	98.0%	0.00	0
Carbon tetrachloride	153.82	0.04	2.8	98.0%	0.00	0.00
Carbonyl sulfide (Carbon oxysulfide) *	60.08	0.49	13.4	98.0%	0.00	0
Chlorine *	35.45	42	676.3	n/a	n/a	n/a
Chlorobenzene	112.56	0.06	3.1	98.0%	0.00	0
Chloroethane (Ethyl chloride)	64.51	0.208	6.1	98.0%	0.00	0.00
Chloromethane (Methyl chloride)	50.49	0.06	1.4	98.0%	0.00	0.00
Dichloromethane (Methylene chloride)	84.93	0.115	4.4	98.0%	0.00	0
Ethylbenzene	106.17	0.868	41.9	98.0%	0.00	0
Hexachlorobutadiene	260.76	0.06	7.1	98.0%	0.00	0.00
n-Hexane	86.18	0.78	30.5	98.0%	0.00	0
Hydrochloric Acid *	36.46	42	695.6	0.0%	1.95	0.1
Mercury (Total) *	200.59	0.000292	0.0	0.0%	0.00	0.0000
Methyl tert-butyl ether (MTBE)	88.15	0.084	3.4	98.0%	0.00	0
Styrene (Vinylbenzene)	104.15	0.06	2.8	98.0%	0.00	0
Tetrachloroethylene (Perchloroethylene)	165.83	0.265	20.0	98.0%	0.00	0
Toluene (Methyl benzene)	92.14	4.16	174.1	98.0%	0.01	0
Tribromomethane (Bromoform)	252.73	0.04	4.6	98.0%	0.00	0.00
Trichloroethylene (Trichloroethene)	131.39	0.158	9.4	98.0%	0.00	0
Trichloromethane (Chloroform)	119.38	0.04	2.2	98.0%	0.00	0.00
Vinyl acetate	86.09	0.06	2.3	98.0%	0.00	0
Vinyl chloride (Chloroethene)	62.5	1.78	50.5	98.0%	0.00	0.00
Xylenes (o-, m-, p-, mixtures)	106.17	0.39	18.8	98.0%	0.00	0
Total Air Toxics			18.8		1.99	0.10
						0.30

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

Pollutant Inflow (lb/yr) = Conc (ppmv)/10⁶ * MW (g/gmol) / 8.21E-05 (atm-m3/gmol-K) / 298 K / 35.31 (ft3/m3) / 453.6 (g/lb) * 10⁶

Greenhouse Gas Emissions
Northeast Maryland Waste Disposal Authority - Gude Landfill
Reporting Year: 2021

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	%	25.8%
Site-specific CH4 Content of LFG	%	34.8%
Site-specific LFG heat content	Btu/scf	347.7
LFG Flow to Device	MMscf/yr	178.00
Days of Operation	Days/Yr	356.73
Hours of Operation	Hrs/Yr	8561.40
Destruction Efficiency	%	98.0%
Volume of CO2 Emissions	MMscf/yr	107.86
Mass of CO2 Emissions	TPY	6060.7
	lb/day	33979.6
	lb/hr	1415.8
Volume of CH4 Emissions	MMscf/yr	1.238
Mass of CH4 Emissions	TPY	25.4
	lb/day	142.2
	lb/hr	5.9
Mass of N2O Emissions	TPY	0.04
	lb/day	0.24
	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 :

- Volume of Emissions (MMscf/yr) = LFG flow to device (MMscf/yr) * (LFG CO2 content % + LFG CH4 content %)
- Mass of Emissions (lb/yr) = Volume Emissions (MMscf/yr) * 10⁶ (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:

- Volume of Emissions (MMscf/yr) = LFG flow to device (MMscf/yr) * LFG CH4 content (%) * (1-Destruction Efficiency %)
- Mass of Emissions (lb/yr) = Volume Emissions (MMscf/yr) * 10⁶ (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)