martin and martin, incorporated
37 south main street • suite A • chambersburg, pennsylvania • 17201-2251

(717) 264-6759
(717) 264-7339 (fax)
www.martinandmartininc.com

February 19, 2021

PaDEP – BWM
Attn: Ms. Erika Bloxham – Facilities Specialist
2 Public Square, 4th floor
Wilkes-Barre, PA 18701-1915

RE: Bethlehem Landfill
Permit #100020
Major Modification –Northern Realignment
Updated Forms G(A) & G(B)
Our file: b/1162.4/NR/021921

Dear Erika:

Following up on our emails, please find enclosed updated Forms G(A) and G(B) for the Northern Realignment. Please replace these forms in your application binder (volume 1) with the enclosed forms.

We are transmitting copies of this Modification to Northampton County, Lower Saucon Township, and LVPC. In the event any questions should arise concerning this correspondence, please do not hesitate to contact this office at your convenience.

Very truly yours,
MARTIN AND MARTIN, INCORPORATED

Kevin N. Bodner

cc: Bethlehem Landfill
Lower Saucon Township
Northampton County
LVPC

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTE MANAGEMENT

Date Prepared/Revised September 2020
DEP USE ONLY
Date Received

FORM G (A)
AIR RESOURCES PROTECTION DUST EMISSIONS ESTIMATE AND CONTROL PLAN

This form must be fully and accurately completed. All required information must be typed or legibly printed in the spaces provided. If additional space is necessary, identify each attached sheet as Form G(A), reference the item number and identify the date prepared. The "date prepared/revised" on any attached sheets needs to match the "date prepared/revised" on this page.
General Reference: Pa Code 121.7, 123.1(c), 123.2, 131.2, 131.3, 273.217, 277.217, 279.218, 281.217, 288.217, 289.227, 293.218, 295.217, 297.218

CHECK TYPE OF FACILITY and whether ☐ NEW or ☒ EXISTING / EXPANSION Facility

Municipal (☒) / Residual (☐) Waste Landfill

Construction/Demolition Waste Landfill.........☐ If existing: Permit # 100020

Composting Facility ....☐

Demonstration Facility...................................☐ Proposed Waste through put in tons/day ________

Incinerator or Resource Recovery Facility .....☐ Proposed operating schedule:

Oil and Gas Wastewater Storage Impoundment..☐ Proposed operating schedule:

Other Municipal (☐) / Residual (☐) Waste Processing Facility

312 days/yr (OD) Mon.-Fri.: 6:00AM to 6:00PM

Facility (Describe) Muncipal solid waste landfill

Sat.-Sun.: 6:00AM to6:00PM

Total: 3,744 (hr./yr.) (OH)

INSTRUCTIONS/APPLICABILITY: The purpose of this form is to obtain information necessary to determine whether the proposed facility will be operated in such a manner as to prevent particulate matter emitted from the facility from causing air pollution or causing an exceedance of ambient standards and to determine if dust prevention measures comply with applicable operational standards.

I. Unpaved/Paved Road Particulate Emissions Potential

Vehicle Type	Vehicle Wt. Unloaded (ton)	Vehicle Wt. Loaded (ton)	No. of Wheels	Unpaved (lb./VMT)		Paved (lb./VMT)	
				E_{in}	E_{out}	E_{in}	E_{out}
Transfer	19.06	40	18	10.02	5.96	0.27	0.16
Dump Trucks (large)	23.7	40	14	8.83	6.12	0.27	0.19
Front Loader	8	27.5	10	5.74	2.42	0.21	0.09
Light Weight	17.32	28.22	12	6.41	4.55	0.21	0.15
Rear Loader	12.5	32.5	10	6.46	3.31	0.24	0.12
Dump Trucks (small)	10	12	6	2.49	2.19	0.12	0.10
On-Site Pickup Trucks	1.6	2	4	0.58	0.50	0.03	0.03

$$Unpaved\ Road:\ E_{in/out} = 5.9K\left(\frac{s}{12}\right)\left(\frac{S_{in/out}}{30}\right)\left(\frac{W_{in/out}}{3}\right)^{0.7}\left(\frac{w}{4}\right)^{0.5}\left(\frac{365-P}{365}\right) lb./VMT$$

$$Paved\ Road:\ E_{in/out} = .077I\left(\frac{4}{n}\right)\left(\frac{s}{10}\right)\left(\frac{L}{1000}\right)\left(\frac{W_{in/out}}{3}\right)^{0.7} lb./VMT$$

Where:

E_{in} = Emission factor loaded trucks in (lb./VMT)

E_{out} = Emission factor unloaded trucks out (lb./VMT)

K = Particle size multiplier - 1 (total); 0.8 (TSP); 0.36 (PM-10)

VMT = Vehicle mile traveled

Surface Material:

s = Mean silt content
- Gravel = 5%
- Limestone = 10%
- Dirt = 28%
- Other =7.3% (Explain) Assume 90% gravel/10% dirt (0.9)(0.05)+(0.1)(0.28) = 7.3%

S_{in} = Mean vehicle speed in (10 MPH); S_{out} = Mean vehicle speed out (10 MPH)

W = Number of wheels

W_{in} = Vehicle weight loaded (tons); W_{out} = vehicle weight unloaded (tons)

P = Number of days/yr with at least .01 inches of precipitation per day = 130 days

n = number of paved traffic lanes

I = Industrial augmentation factor =
- 7.0 (paved to unpaved)[1]
- 3.5 (unpaved shoulders)
- Other (explain) ______

L = Surface dust loading (lb./mile) = 53 lb./mile

UPR = Total length of unpaved roads 8,342 ft. or 1.58 miles

PR = Total length of paved roads 8,553 ft. or 1.62 miles

[1] For a conservative estimate of potential dust emissions, a value of 7.0 is assumed.

Vehicle Type	Trucks/ Yr	UPR (mile)	PR (mile)	Unpaved (lb./VMT)		Paved (lb./VMT)		Total Dust (lb./yr)			
								Unpaved		Paved	
	(A)	(B)	(C)	E_{in} (D)	E_{out} (E)	E_{in} (F)	E_{out} (G)	in (AxBxD) (lb./yr)	out (AxBxE) (lb./yr)	in (AxCxF) (lb./yr)	out (AxCxG) (lb./yr)
Transfer	14,916	1.58	1.62	10.02	5.96	0.27	0.16	236,059	140,496	6,628	3,945
Dump Trucks (large)	11,544	1.58	1.62	8.83	6.12	0.27	0.19	161,121	111,695	5,129	3,556
Front Loader	3,744	1.58	1.62	5.74	2.42	0.21	0.09	33,975	14,315	1,280	539
Light Weight	2,808	1.58	1.62	6.41	4.55	0.21	0.15	28,423	20,196	977	694
Rear Loader	8,736	1.58	1.62	6.46	3.31	0.24	0.12	89,109	45,650	3,357	1,720
Dump Trucks (small)	312	1.58	1.62	2.49	2.19	0.12	0.10	1,227	1,080	60	53
On-Site Pickup Trucks	1,872	1.58	1.62	0.58	0.50	0.03	0.03	1,715	1,467	102	87
Other											
							TOTAL:	551,629	334,899	17,533	10,594
								(h)	(i)	(j)	(k)

Total potential dust emissions from roads ((h+i+j+k) x (1 ton/2,000 lb))= 457.3 t/yr
(T)

II. Construction/Operation Particlate Emissions Potential

Note: General emission factors are given in the following calculations. Should site specific factors be used, please provide reference.

A. Total potential dust emissions from topsoil removal/daily cover:
$6x10^{-5}$ (tons of dust emissions/tons of topsoil removed or covered) X
[(tons topsoil removed/yr)$_{avg.}$ + (tons topsoil daily cover/yr)$_{avg.}$]

$(6*10^{-5})*[10,000 + 64,000]$ = 4.44 t/yr

B. Total potential dust emissions from dozers onsite:
$1.6x10^{-2}$ (tons of dust emissions/dozer hr) X [(#dozers)$_{avg.}$ X
(hr/day dozer opr)$_{avg.}$ X OD]

$(1.6*10^{-2})*[3*9*312]$ = 134.8 t/yr

C. Overburden drilling potential dust emissions:
$7.5x10^{-4}$ (tons of dust emissions/hole drilled) X (holes drilled/yr)$_{avg.}$

No drilling = 0.0 t/yr

D. Blasting potential dust emissions:
$6x10^{-4}$ (tons of dust emissions/tons of overburden removed) X
(tons/yr of overburden removed)$_{avg.}$

No blasting = 0.0 t/yr

E. Overburden removal potential dust emissions:
$1.85x10^{-5}$ (tons of dust emissions/tons of overburden removed) X
(tons/yr of overburden removed)$_{avg.}$

$(1.85*10^{-5})*(42,000)$ = 0.8 t/yr

F. Overburden truck dumping potential dust emissions:
$4.0x10^{-6}$ (tons of dust emissions/tons of overburden dumped) X
(tons/yr of overburden dumped)$_{avg.}$

$(4.0*10^{-6})*(42,000)$ = 0.2 t/yr

G. Road maintenance potential dust emissions:
$1.6x10^{-2}$ (tons of dust emissions/dozer hour opr.) X [(hr/day road maintenance)$_{avg.}$ X OD]

$1.6*10^{-2}*[11*312]$ = 54.9 t/yr

H. Total: 195.1 t/yr
(H)

III. Summary of Potential/Actual Total Dust, & PM-10 Emissions

Total potential dust emissions = T + H = 652.4 t/yr (M)

Total potential PM-10 emissions = 0.36 X M = 234.9 t/yr (N)

Total actual dust emissions = 0.5 X M = 326.2 t/yr (O)

Total actual PM-10 dust emissions = 0.5 X N = 117.5 t/yr (P)

IV. Stationary Sources Standards

1. Will the proposed solid waste facility dust emissions be visible off the permit boundary?

   ☐ Yes ☒ No

2. Are any stationary sources of air contamination other than landfill gas emissions [see Form G (B)] subject to the new source performance standards of 25 PA Code Chapter 122 planned for this proposed facility?

   ☐ Yes ☒ No

   Describe source(s) ____________________

   If "yes", what is the air quality application # ____________________

3. Will the proposed facility accept asbestos waste subject to national standard for hazardous air pollutants adopted under 25 PA. Code Chapter 124? ☐ Yes ☒ No

   If yes, describe compliance with Chapter 124.

4. Is the proposed facility subject to any other national standard for hazardous air pollutants?

   ☐ Yes ☒ No

   Identify pollutant(s) ____________________

V. Entrance Roads, Access Roads, and Parking Areas

Describe plans for monitoring, maintaining and cleaning all entrance roads, access roads, and parking areas. This plan must effectively control the dust and particulate emissions calculated in Parts I-III above. The use of waste oil for dust suppression is prohibited.

a. For each paved parking lot/area, paved facility haul road, the required paved access roadways from public highway to the facility, and public highways, describe the method and frequency of road cleaning and/or maintenance.

A power sweeper and/or water truck will be used to clean paved areas to control fugitive dust. The sweeper and/or water truck will be used as necessary to keep dust accumulation to a minimum at the following locations:

- Parking lot areas
- The access roadway
- Haul roads

b. For the shoulders of: paved parking lot/areas; paved facility haul roads; the required paved access roadways from public highways to the facility; and public highways, describe the extent of application and frequency of water or other chemical dust suppressants to reduce fugitive dusts. Application of dust suppressants or water on public highway shoulders must be completed for a distance of 500 feet in both directions from the facility. Identify any road maintenance agreements with the local municipality or PennDOT.

The water truck will be used to apply water to the paved and unpaved parking lots, paved and unpaved haul roads and access roads including shoulders, and other dust generation areas as necessary to minimize dusty conditions.

c. For unpaved parking lot areas, and unpaved access roads near unloading areas, describe the application and frequency of use of water or other chemical dust suppressants to reduce fugitive dust emissions.

The water truck will be used to apply water to the paved and unpaved parking lots, paved and unpaved haul roads and access roads including shoulders, and other dust generation areas as necessary to minimize dusty conditions.

d. Describe how vehicles which transport waste or earth into the facility, will be cleaned before exiting the site.

Tire/truck wash used as needed.

e. State the roadway speed limit for the proposed facility, and include the locations and size specifications of speed limit signs. 10 miles per hour. Signs on access road per PADEP requirements.

f. Will all trucks entering and leaving the facility be covered? ☒ Yes ☐ No

If no, explain why a cover is not needed to prevent fugitive dust emissions from becoming airborne.

VI. Records Keeping

Describe the records to be kept at the site to insure that the plan discussed in Item IV (2) above is being implemented. These records must include, at a minimum, the following:

a. for paved roads and parking areas:

   i. daily log of time and location of any vacuum sweeping conducted,

   ii. log explaining the reasons any required vacuum sweeping was not performed.

b. for unpaved roads and shoulders of paved roads:

   i. daily log of time and location of treated areas,

   ii. identification of dust suppressants,

   iii. daily log of the dilution ratios of the dust suppressants and dilutent used if chemical suppressants are used, and

   iv. purchase records of the chemical suppressants, if used.

c. Quarterly reports of the above records must be submitted to this Department upon request.

Bethlehem Landfill
Form G(A) Dust Emissions - Bethlehem Landfill Northern Realignment

Unpaved/Paved Road Particulate Matter Emissions

Vehicle Type	Vehicle Wt. (ton)		No. of Wheels	Unpaved (lb/VMT)		Paved (lb/VMT)	
	Unloaded	Loaded		E_{in}	E_{out}	E_{in}	E_{out}
Transfer Trailer	19.06	40	18	10.02	5.96	0.27	0.16
Dump Trucks (large)	23.7	40	14	8.83	6.12	0.27	0.19
Front Loader	8	27.5	10	5.74	2.42	0.21	0.09
Light Weight	17.32	28.22	12	6.41	4.55	0.21	0.15
Rear Loader	12.5	32.5	10	6.46	3.31	0.24	0.12
Dump Trucks (small)	10	12	6	2.49	2.19	0.12	0.10
On-Site Pickup Trucks	1.6	2	4	0.58	0.50	0.03	0.03

Unpaved Road: $E_{in/out}$ (lb/VMT) = $[5.9K * (s/12) * (S_{in/out}/30) * (W_{in/out}/3)^{0.7} * (w/4)^{0.5} * ((365\text{-}P)/365)$

Paved Road: $E_{in/out}$ (lb/VMT) = $0.0771I * (4/n) * (s/10) * (L/1000) * (W_{in/out}/3)^{0.7}$

Variables - Unpaved Roads

E_{in} =	Emission factor loaded trucks (lb/vehicle mile traveled)
E_{out} =	Emission factor unloaded trucks (lb/vehicle mile traveled)
K =	Particle size multiplier (1 - total, 0.8 - TSP, 0.36 - PM_{10})
s =	Mean silt content (7.3%)
$S_{in/out}$ =	Mean vehicle speed (in/out) (10 mph)
$W_{in/out}$ =	Vehicle weight loaded (in)/unloaded (out)
P =	Number of days/yr with at least 0.01 inches of precipitation (130 days)
UPR =	Paved road length (miles) (1.58 miles)

Variables - Paved Roads

E_{in} =	Emission factor loaded trucks (lb/vehicle mile traveled)
E_{out} =	Emission factor unloaded trucks (lb/vehicle mile traveled)
I =	Industrial augmentation factor (7.5)
L =	Surface dust loading (53 lb/mile)
$W_{in/out}$ =	Vehicle weight loaded (in)/unloaded (out)
PR =	Unpaved road length (miles) (1.62 miles)

Vehicle Type	Trucks/yr	UPR (mile)	PR (mile)	Unpaved (lb/VMT)		Paved (lb/VMT)		Total TSP			
								Unpaved (lb/yr)		Paved (lb/yr)	
				E_{in}	E_{out}	E_{in}	E_{out}	In	Out	In	Out
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(A*B*D)	(A*B*E)	(A*C*F)	(A*C*G)
Transfer Trailer	14,916	1.58	1.62	10.02	5.96	0.27	0.16	236,059	140,496	6,628	3,945
Dump Trucks (large)	11,544	1.58	1.62	8.83	6.12	0.27	0.19	161,121	111,695	5,129	3,556
Front Loader	3,744	1.58	1.62	5.74	2.42	0.21	0.09	33,975	14,315	1,280	539
Light Weight	2,808	1.58	1.62	6.41	4.55	0.21	0.15	28,423	20,196	977	694
Rear Loader	8,736	1.58	1.62	6.46	3.31	0.24	0.12	89,109	45,650	3,357	1,720
Dump Trucks (small)	312	1.58	1.62	2.49	2.19	0.12	0.10	1,227	1,080	60	53
On-Site Pickup Trucks	1,872	1.58	1.62	0.58	0.50	0.03	0.03	1,715	1,467	102	87

2540-PM-BWM0391b 6/2005

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTE MANAGEMENT

Date Prepared/Revised September 2020
DEP USE ONLY
Date Received

FORM G (B)

AIR RESOURCES PROTECTION
NMOC EMISSIONS ESTIMATE AND CONTROL PLAN

General Reference: 25 Pa Code §§ 121.7, 123.31, 131.2, 273.217, 273.218, 277.217, 279.218, 281.217, 281.218.

CHECK whether ☐ NEW or ☒ EXISTING / EXPANSION municipal waste landfill

If existing: Permit #100020

Proposed waste throughput in tons/day 1,375

Proposed operating schedule:

312 (OD) days/yr — Mon.-Fri. 6:00 AM to 6:00 PM

Sat. 6:00 AM to 6:00 PM

Total: 3,744 (OH) (hrs/yr)

INSTRUCTIONS/APPLICABILITY: The purpose of this form is to obtain information necessary to determine whether the proposed facility will be operated in such a manner as to prevent VOC emissions from the facility from causing air pollution or causing an exceedance of ambient air quality standards, and to determine if VOC emissions and controls comply with applicable emission standards. The facility may also be required to fulfill the NSPS requirements of 40 CFR Part 60, Subparts WWW and Cc.

I. POTENTIAL / ACTUAL VOC EMISSIONS FROM EXISTING DISPOSAL FACILITIES

A. Summarize Existing Disposal Facilities Potential/Actual VOC Emissions as NMOC Expressed as Hexane

Number of existing cells Existing Landfill (all cells). For each existing cell provide the following data summary:

Cell	Average Refuse Disposed Megagrams/Year	Years Opened (A)	Years Closed * (B)	PER (VOC)** tons	AER (VOC)*** tons
All	See Table 1 for Annual Refuse Disposal Rates	65 (1954-Current)	0	12.8[1]	3.4[2]

Total PER (VOC) 12.8
TPER (VOC)

* If the cell is not closed, B equals 0
** PER: potential emission rate at current year
*** AER: actual emission rate at current year

[1] See attached **Table 1**.
[2] AER calculated as (PER) * (75%) * (1-98%) + (PER * 25%)

1. Existing Disposal Facilities Potential VOC Emissions

For each cell, calculate the PER (VOC) as follows:

PER (VOC) = Potential VOC emissions (tons/year) / cell as NMOC expressed as Hexane

$$= 2\, R_i L_o \left[e^{-kB} - e^{-kA}\right] C_{NMOC} \; x\, 10^{-9} \left(\frac{1050.2}{273+T}\right) \frac{1x10^6\, g}{Mg}\, x \frac{lb.}{454\, g}\, x \frac{ton}{2000\, lb.}$$

k = Landfill gas generation rate constant (1/yr) = .05/yr or 0.04 (AP-42) (provide proposed EPA method 2E derivation)

L_o = Methane generation potential (m^3/Mg) = 170 m^3CH^4/Mg refuse or 100 (AP-42) (provide proposed EPA method 2E derivation)

C_{NMOC} = NMOC gas concentration as hexane equivalent NMOC (ppmv) = 4000 ppmv or 207 (2018 gas testing) (provide proposed EPA method 25C derivation)

R_i = Average annual disposal rate (Megagrams)

A = years since waste was first disposed in landfill cell (years)

B = years since landfill cell was closed (years) (B=0 for active cell/landfill)

e = base log = 2.718

T = temperature of landfill gas in °C. If unknown, use 25°C.

2. Existing Disposal Facilities Actual VOC Emissions

For each cell, calculate the AER (VOC) as follows:

AER (VOC) = actual VOC emissions (tons/year) /cell as NMOC expressed as hexane
= PER (VOC) x (1 - CE * DE)

where:

PER (VOC) = Potential VOC emission rate

AER (VOC) = Actual VOC emission rate

CE = cell gas collection efficiency = 75 %/100. If gas collection efficiency is unknown, use 75%. If no gas collection system is in operation use 0%.

DE = NMOC gas burner destruction efficiency = 98 %/100. If gas burner destruction efficiency is unknown, use 95%/100 or greater for a flare.

What is Air Quality permit number for system? 48-00027 .

B. Malodorant Emissions from Existing Disposal Facility

1. Are odors detectable off the permit boundary? ☐ yes ☒ no

2. What are the control measures currently being implemented?

   Please attach a copy of your approved "Nuisance Minimization and Control Plan."

   Landfill gas (LFG) collection from vertical extraction wells and horizontal collectors. LFG routed to flare for destruction. Final cap placed on closed cells. For "Nuisance Minimization and Control Plan" see Form 14.

3. Calculate maximum actual emission rates:

Malodorants	Actual Emission Rate (AER)
Dimethyl sulfide	54.8 x AER (VOC) / C_{NMOC} = 54.8*3.4/207=0.9 t/yr
Hydrogen sulfide	14.4 x AER (VOC) / C_{NMOC} = 14.4*3.4/207=0.2 t/yr
Methyl mercaptan	5.84 x AER (VOC) / C_{NMOC} = 5.84*3.4/207=0.1 t/yr
Other ________	____ x AER (VOC) / C_{NMOC} = ________ t/yr

II. ESTIMATED ACTUAL VOC EMISSIONS FROM PROPOSED / EXPANDED LANDFILL

A. Determination of Year of Maximum Actual VOC Emissions

Number of proposed/expanded disposal cells: Northern Realignment. For each proposed disposal cell provide the following Data Summary.

Maximum Estimated AER (VOC) Tons/Year[1,2]

Cell i / Yr (j)	Year 1 (2025)	Year 2 (2026)	Year 3 (2027)	Year 4 (2028)	Year 5 (2029)	Year 6 (2030)	Year 7 (2031)
Northern Realignment	0.11	0.37	0.61	0.85	0.95	0.93	0.87
TOTAL	0.11	0.37	0.61	0.85	0.95	0.93	0.87

[1] See attached **Table 2**.
[2] AER calculated as [VOC generation rate (tons/year)] * (75%) * (1 – 98%) + [VOC Generation Rate (tons/year)] * 25%).

$$AER_{ij} = 2\,(ADV * OD)\,L_O\left[e^{-kCj} - e^{-kTj}\right]C_{NMOC}x10^{-9}\left(\frac{1050.2}{273+T}\right)x\frac{1x10^6\,g}{Mg}x\frac{lb.}{454\,g}x\frac{ton}{2000\,lb.}(1 - CE_i * DE_i)$$

k = Landfill gas generation constant (1/yr) = .05/yr or 0.04 (AP-42) (provide proposed method 2F derivation).

L_o = Methane gas generation potential (M^3/M_s) = $170m^3CH_4/M_g$ refuse or 100 (AP-42) (provide proposed method 2E derivation).

ADV = Proposed average daily disposal volume 1,375 Ton/day

OD = Proposed operating days/year.

C_{NMOC} = NMOC gas concentration as hexane equivalent NMOC (ppmv) = 4,000 ppmv or 207 (2018 gas testing) (provide proposed method 25C derivation).

C_j = Years since $cell_i$ disposal ceases at yr_j.

T_j = Years since $cell_i$ disposal began from yr_j.

Ce_i = Cell gas collection efficiency = 75 /100. Use 75% or ______ and 0% before installed.

De_i = NMOC gas burner destruction efficiency = 98 /100. If unknown, use 95% or greater for flare.

T = Temperature of landfill gas. If unknown, use 25°C.

B. Malodorant Emissions from Proposed Disposal / Expanded Facility

1. Will odors be detectable off the permit boundary? ☐ yes ☒ no

2. What are the measures to be taken to remediate problem?

Landfill gas collection system will be expanded into the new cells and is expected to include vertical extraction wells and horizontal collectors. Collected LFG will be routed to flare for destruction.

3. Estimate maximum actual emission rate:

Malodorants	Actual Emission Rate (AER)
Dimethyl sulfide	54.8 x AER (VOC) / C_{NMOC} = 54.8*0.95/207=0.25 t/yr
Hydrogen sulfide	14.4 x AER (VOC) / C_{NMOC} = 14.4*0.95/207=0.07 t/yr
Methyl mercaptan	5.84 x AER (VOC) / C_{NMOC} = 5.84*0.95/207=0.03 t/yr
Other ______	______ x AER (VOC) / C_{NMOC} = ______ t/yr

III. AIR TOXIC COMPOUNDS

Will the proposed facility emit air toxic compounds identified in Section 112 of the 1990 CAAA? ☒ yes ☐ no

If yes, identify the air toxic contaminants by compound **See attached Table 3.**

Will the air toxic compounds identified be detectable off the permit boundary? ☐ yes ☒ no

Table 1: LFG and VOC Generation Rate Model - Existing Landfill
Bethlehem Landfill Company

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	LFG Generation (scfm)	LFG Generation (m^3/min)	LFG Generation (Million ft^3/yr)	NMOC Generation Rate (tons/yr)	VOC Generation Rate (tons/yr)
1954	43,189	0	39,180	0	0	0.0	0	0.0	0.0
1955	43,200	43,189	39,190	39,180	21	0.6	11	0.3	0.1
1956	43,244	86,388	39,230	78,370	41	1.2	21	0.5	0.2
1957	43,100	129,632	39,100	117,600	60	1.7	31	0.7	0.3
1958	43,211	172,732	39,200	156,700	78	2.2	41	1.0	0.4
1959	43,211	215,943	39,200	195,900	96	2.7	50	1.2	0.5
1960	43,211	259,153	39,200	235,100	113	3.2	59	1.4	0.5
1961	43,211	302,364	39,200	274,300	129	3.7	68	1.6	0.6
1962	43,211	345,574	39,200	313,500	145	4.1	76	1.8	0.7
1963	43,100	388,785	39,100	352,700	160	4.5	84	1.9	0.8
1964	43,211	431,885	39,200	391,800	174	4.9	92	2.1	0.8
1965	43,211	475,096	39,200	431,000	188	5.3	99	2.3	0.9
1966	43,211	518,307	39,200	470,200	202	5.7	106	2.5	1.0
1967	43,211	561,517	39,200	509,400	214	6.1	113	2.6	1.0
1968	43,211	604,728	39,200	548,600	227	6.4	119	2.8	1.1
1969	43,100	647,938	39,100	587,800	239	6.8	125	2.9	1.1
1970	43,211	691,039	39,200	626,900	250	7.1	131	3.0	1.2
1971	43,211	734,249	39,200	666,100	261	7.4	137	3.2	1.2
1972	43,211	777,460	39,200	705,300	271	7.7	143	3.3	1.3
1973	43,211	820,671	39,200	744,500	281	8.0	148	3.4	1.3
1974	43,211	863,881	39,200	783,700	291	8.2	153	3.5	1.4
1975	43,100	907,092	39,100	822,900	301	8.5	158	3.7	1.4
1976	43,211	950,192	39,200	862,000	309	8.8	163	3.8	1.5
1977	43,211	993,403	39,200	901,200	318	9.0	167	3.9	1.5
1978	43,211	1,036,613	39,200	940,400	326	9.2	172	4.0	1.5
1979	43,431	1,079,824	39,400	979,600	334	9.5	176	4.1	1.6
1980	41,888	1,123,255	38,000	1,019,000	342	9.7	180	4.2	1.6
1981	41,888	1,165,143	38,000	1,057,000	349	9.9	183	4.2	1.7
1982	41,888	1,207,031	38,000	1,095,000	355	10.1	187	4.3	1.7
1983	41,888	1,248,918	38,000	1,133,000	361	10.2	190	4.4	1.7
1984	41,888	1,290,806	38,000	1,171,000	367	10.4	193	4.5	1.7
1985	41,888	1,332,694	38,000	1,209,000	373	10.6	196	4.5	1.8
1986	41,888	1,374,582	38,000	1,247,000	378	10.7	199	4.6	1.8
1987	67,241	1,416,470	61,000	1,285,000	384	10.9	202	4.7	1.8
1988	67,241	1,483,711	61,000	1,346,000	401	11.4	211	4.9	1.9
1989	67,241	1,550,952	61,000	1,407,000	417	11.8	219	5.1	2.0
1990	58,422	1,618,193	53,000	1,468,000	433	12.3	228	5.3	2.1
1991	58,422	1,676,615	53,000	1,521,000	444	12.6	234	5.4	2.1
1992	59,525	1,735,038	54,000	1,573,999	455	12.9	239	5.5	2.2
1993	0	1,794,562	0	1,627,999	466	13.2	245	5.7	2.2
1994	0	1,794,562	0	1,627,999	448	12.7	235	5.4	2.1
1995	95,901	1,794,562	87,000	1,627,999	430	12.2	226	5.2	2.0
1996	85,980	1,890,463	78,000	1,714,999	459	13.0	241	5.6	2.2
1997	117,947	1,976,444	107,000	1,792,999	482	13.7	254	5.9	2.3
1998	138,891	2,094,391	126,000	1,899,999	520	14.7	273	6.3	2.5
1999	177,472	2,233,282	161,000	2,025,999	566	16.0	298	6.9	2.7
2000	234,549	2,410,754	212,779	2,186,999	629	17.8	331	7.7	3.0
2001	233,906	2,645,303	212,196	2,399,779	717	20.3	377	8.7	3.4
2002	235,899	2,879,209	214,004	2,611,974	801	22.7	421	9.8	3.8
2003	356,357	3,115,108	323,282	2,825,978	883	25.0	464	10.8	4.2
2004	431,022	3,471,465	391,017	3,149,260	1,020	28.9	536	12.4	4.8
2005	424,074	3,902,487	384,713	3,540,277	1,187	33.6	624	14.4	5.6
2006	428,615	4,326,561	388,833	3,924,990	1,344	38.0	706	16.4	6.4
2007	428,932	4,755,176	389,121	4,313,823	1,497	42.4	787	18.2	7.1
2008	426,122	5,184,108	386,571	4,702,944	1,644	46.5	864	20.0	7.8
2009	420,517	5,610,230	381,487	5,089,515	1,784	50.5	938	21.7	8.5
2010	423,219	6,030,748	383,938	5,471,002	1,916	54.3	1,007	23.3	9.1
2011	433,364	6,453,967	393,141	5,854,940	2,044	57.9	1,074	24.9	9.7
2012	439,551	6,887,331	398,754	6,248,081	2,172	61.5	1,141	26.4	10.3
2013	405,329	7,326,882	367,708	6,646,835	2,298	65.1	1,208	28.0	10.9
2014	364,349	7,732,210	330,532	7,014,543	2,402	68.0	1,263	29.2	11.4
2015	259,875	8,096,559	235,755	7,345,075	2,483	70.3	1,305	30.2	11.8
2016	228,267	8,356,434	207,080	7,580,829	2,510	71.1	1,319	30.6	11.9
2017	356,072	8,584,701	323,023	7,787,910	2,521	71.4	1,325	30.7	12.0
2018	410,053	8,940,773	371,994	8,110,933	2,593	73.4	1,363	31.6	12.3
2019	393,780	9,350,826	357,231	8,482,927	2,689	76.1	1,413	32.7	12.8
2020	429,000	9,744,606	389,182	8,840,158	2,772	78.5	1,457	33.7	13.2
2021	429,000	10,173,606	389,182	9,229,340	2,869	81.3	1,508	34.9	13.6
2022	429,000	10,602,606	389,182	9,618,522	2,963	83.9	1,557	36.1	14.1
2023	429,000	11,031,606	389,182	10,007,705	3,053	86.4	1,604	37.2	14.5
2024	429,000	11,460,606	389,182	10,396,887	3,139	88.9	1,650	38.2	14.9

Methane Content of LFG Adjusted to:	50%	
Selected Decay Rate Constant (k):	0.040	
Selected Ultimate Methane Recovery Rate (Lo):	100 m^3/Mg =	3,204 cu ft/ton
NMOC Concentration in LFG:	207 ppmv as Hexane	[2018 gas testing]

Table 2: LFG and VOC Generation Rate Model - Northern Realignment Expansion Area
Bethlehem Landfill

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	LFG Generation (scfm)	LFG Generation (m^3/min)	LFG Generation (Million ft^3/yr)	VOC Generation Rate (tons/yr)	VOC Generation Rate (Mg/yr)
2024	182,847	0	165,876	0	0	0.0	0	0.0	0.0
2025	429,000	182,847	389,182	165,876	88	2.5	46	0.4	0.4
2026	429,000	611,847	389,182	555,058	290	8.2	153	1.4	1.3
2027	429,000	1,040,847	389,182	944,240	485	13.7	255	2.3	2.1
2028	241,428	1,469,847	219,020	1,333,423	672	19.0	353	3.2	2.9
2029	0	1,711,275	0	1,552,442	761	21.6	400	3.6	3.3
2030	0	1,711,275	0	1,552,442	731	20.7	384	3.5	3.2
2031	0	1,711,275	0	1,552,442	703	19.9	369	3.3	3.0
2032	0	1,711,275	0	1,552,442	675	19.1	355	3.2	2.9
2033	0	1,711,275	0	1,552,442	649	18.4	341	3.1	2.8
2034	0	1,711,275	0	1,552,442	623	17.6	328	3.0	2.7
2035	0	1,711,275	0	1,552,442	599	17.0	315	2.8	2.6
2036	0	1,711,275	0	1,552,442	575	16.3	302	2.7	2.5
2037	0	1,711,275	0	1,552,442	553	15.7	291	2.6	2.4
2038	0	1,711,275	0	1,552,442	531	15.0	279	2.5	2.3
2039	0	1,711,275	0	1,552,442	510	14.4	268	2.4	2.2
2040	0	1,711,275	0	1,552,442	490	13.9	258	2.3	2.1

Methane Content of LFG Adjusted to: 50%
Selected Decay Rate Constant (k): 0.040
Selected Ultimate Methane Recovery Rate (Lo): 100 m^3/Mg =
NMOC Concentration in LFG: 207 ppmv as Hexane

Table 3: Bethlehem Landfill Company
Northern Realignment Hazardous Air Pollutant (HAP) Emission Rate Calculations

HAP	MW	Conc. (ppmv)	HAP Emissions: Pre-Control Emissions (lb/yr)	HAP Emissions: Pre-Control Emissions (tpy)	HAP Emissions: Post-Control Potential Emissions (lb/yr)	HAP Emissions: Post-Control Potential Emissions (tpy)
1,1,1-trichloroethane[1]	133.42	0.48	65.3	0.0	16.3	0.0
1,1,2,2-tetrachloroethane[1]	167.85	1.11	189.9	0.1	47.5	0.0
1,1-dichloroethane[1]	98.97	2.35	237.1	0.1	59.3	0.0
1,1-dichloroethene[1]	96.94	0.20	19.8	0.0	4.9	0.0
1,2-dichloroethane[1]	98.96	0.41	41.4	0.0	10.3	0.0
1,2-dichloropropane[1]	112.99	0.18	20.7	0.0	5.2	0.0
acrylonitrile[1]	53.06	6.33	342.4	0.2	85.6	0.0
benzene[1]	78.11	1.91	152.1	0.1	38.0	0.0
carbon disulfide[1]	76.13	0.58	45.0	0.0	11.3	0.0
carbon tetrachloride[1]	153.84	0.00	0.6	0.0	0.2	0.0
carbonyl sulfide[1]	60.07	0.49	30.0	0.0	7.5	0.0
chlorobenzene[1]	112.56	0.25	28.7	0.0	7.2	0.0
chloroethane[1]	64.52	1.25	82.2	0.0	20.6	0.0
chloroform[1]	119.39	0.03	3.7	0.0	0.9	0.0
chloromethane[1]	50.49	1.21	62.3	0.0	15.6	0.0
dichlorobenzene[1]	147.00	0.21	31.5	0.0	7.9	0.0
dichloromethane[1]	84.94	14.30	1,238.3	0.6	309.6	0.2
ethylbenzene[1]	106.16	4.61	498.9	0.3	124.7	0.1
ethylene dibromide[1]	187.88	0.001	0.2	0.0	0.0	0.0
hexane[1]	86.18	6.57	577.3	0.3	144.3	0.1
mercury (total)[1]	200.61	2.92E-04	0.1	0.0	0.0	0.0
methyl isobutyl ketone[1]	100.16	1.87	191.0	0.1	47.7	0.0
perchloroethylene[1]	165.83	3.73	630.6	0.3	157.7	0.1
toluene[1]	92.13	39.30	3,691.4	1.9	922.8	0.5
trichloroethylene[1]	131.40	2.82	377.8	0.2	94.4	0.0
vinyl chloride[1]	62.50	7.34	467.7	0.2	116.9	0.1
xylenes[1]	106.16	12.10	1,309.6	0.7	327.4	0.2
			Total:	5.2	Total:	1.3

Landfill Emission Data:

LFG Generation Rate (cfm) =	761	[see Table 2]
Collection Efficiency (%) =	75%	

Notes:

1. Pollutant concentrations used to compute the estimated emissions are from EPA's AP-42.