Application Review

Issue Date: TBD

Region: Fayetteville Regional Office	
County: Robeson	
NC Facility ID: 7800222	
Inspector's Name: Jeffrey D. Cole	
Date of Last Inspection: 06/09/2021	
Compliance Code: 3 / Compliance - inspection	

Facility Data

Applicant (Facility's Name): Robeson County Landfill

Facility Address:
Robeson County Landfill
246 Landfill Road
Saint Pauls, NC 28384

SIC: 4953 / Refuse Systems
NAICS: 562212 / Solid Waste Landfill

Facility Classification: Before: Synthetic Minor **After:** Title V
Fee Classification: Before: Synthetic Minor **After:** Title V

Permit Applicability (this application only)

SIP: 15A NCAC 02D .0516, .0521, 0524, .1110, .1111 and .1806
NSPS: Subparts JJJJ and XXX
NESHAP/MACT: Subpart 61, Subpart ZZZZ
PSD: N/A
PSD Avoidance: N/A
NC Toxics:
112(r): N/A
Other: NCGS 62-133(g) – Senate Bill 3 (SB3)

Contact Data

Facility Contact	**Authorized Contact**	**Technical Contact**
Gene Walters	Gene Walters	Mousa Maimoun
Solid Waste Director	Solid Waste Director	Project Consultant
(910) 865-3348	(910) 865-3348	(704) 941-2164
PO Box 366	PO Box 366	400 South Tryon Road,
St. Pauls, NC 28384	St. Pauls, NC 28384	Suite 1300
		Charlotte, NC 28285
harrell.walters@co.robeson.nc.us	harrell.walters@co.robeson.nc.us	MMaimoun@LaBellaPC.com

Application Data

Application Number: 7800222.17B and .20A
Dates Received: 10/11/2017 and 09/25/2020
Application Type: Modifications
Application Schedule: TV-1st Time
Existing Permit Data
Existing Permit Number: 09771/R05
Existing Permit Issue Date: 04/18/2017
Existing Permit Expiration Date: 03/31/2025

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP
2015	0.4200	14.27	3.59	53.57	1.73	3.11	1.01 [Toluene]
2010	0.4800	2.35	3.02	13.88	0.5100	3.05	1.01 [Toluene]

Review Engineer: Joshua L. Harris/Booker T. Pullen

Review Engineer's Signature: **Date:** TBD

Comments / Recommendations:
Issue: 09771T06
Permit Issue Date: TBD
Permit Expiration Date: TBD

1. Purpose of Application

The Robeson County Landfill is an existing municipal solid waste (MSW) landfill located in Saint Pauls, Robeson County, NC. The landfill is currently permitted as a Synthetic Minor facility under the Title V program. This modification of the Permit (R00) is to issue a 1st Time Title V permit to be issued as 09771T06. The facility has submitted the following applications.

- Application No. 7800222.17B was received on October 11, 2017 and was considered complete on that date. This application was submitted in order to be reclassified as a Title III Major source due to the formaldehyde emissions from the two operating landfill gas-fired engines.

Shortly after the submittal of this application, there was a catastrophic failure of landfill gas-fired engine #2 (ID No. ES-3). Robeson County has decided to remove the engine from the permit with plans to later install a rebuilt or new engine. This addition will be done through a subsequent permit modification. Therefore, application 7800222.17B is not necessary to process the 1st Time Title V application (7800222.20A) because the largest individual HAP emission rate (formaldehyde at 7.14 tpy) from one engine, instead of two engines, is not greater than 10 tons per year of a single HAP. Also, this facility by itself is not a major source of HAPs, nor does it have NMOC emissions that are greater than the MACT AAAA thresholds (50 Mg per year). As such, the Robeson County Landfill is not subject to the requirements 40 CFR Subpart AAAA.

● Application No. 7800222.20A was received on September 25, 2020 and was considered complete on the date. This application was submitted for a 1st-Time Title V air permit because the landfill site was expanded (the addition of phases 5 and 6 to the site) such that the design capacity exceeded the 2.5 million megagrams (Mg) and 2.5 million cubic meter (m^3) mass and volume thresholds of NSPS Subpart XXX (modification after July 17, 2014).

These two applications will be consolidated and processed under Application No. 7800222.20A and are required to go through the 30-day public notice and 45-day EPA review periods prior to issuance.

A consultant, LaBella Associates P.C. (LaBella), was used to prepare the application. The contact at LaBella is Mousa Maimoun, Project Consultant, (phone: 704-941-2164). The facility contact for this application is Gene Walters, Solid Waste Director, (phone: 910-865-3348, email: harrell.walters@co.robeson.nc.us).

2. Facility Description

The Robeson County Landfill is an existing MSW landfill that has triggered NSPS Subpart XXX, located in Saint Pauls, Robeson County, North Carolina. The landfill operates under Permit No. 7803, issued by the Division of Waste Management's Solid Waste Section. The landfill's design capacity exceeds the 2.5 million Mg and 2.5 million m^3 mass and volume thresholds and is required by NSPS Subpart XXX to maintain a Title V permit. Currently, the landfill is not required to install and operate a landfill gas collection and control system (GCCS) because it is below the 34 Mg NMOC/year threshold. A revised Tier 2 evaluation, received by the Fayetteville Regional Office on January 31, 2022, indicates that the NMOC emissions in 2021 (phases 1, 2, 3, 4) are 13.6 Mg/year and that the maximum NMOC emissions will occur in the year 2040 at a rate of 19.6 Mg/year (phases 1, 2, 3, 4). Both of these NMOC values are well below the threshold requirements to install a gas collection and control system. However, this landfill does operate an existing voluntary system gas collection system that is in-place. The landfill gas that is collected, is treated via compression, dewatered and filtered by a treatment system (ID No. CD-Treatment), then routed to one 1,468 hp LFG-fired engine/generator set (GE Jenbacher J 320 GS-C82, ID No. ES-2) for electricity production. Excess gas is routed to a 1,000 scfm utility flare (ID No. CD-1) for incineration.

Note: the NMOC emission rate estimated by the Landgem "Landfill Gas Emissions Model" (received on January 31, 2022) did not include phases 5 and 6 for the landfill. This facility is required to continue to submit an annual NMOC report, with Tier 2 site-specific NMOC concentration testing every five years.

3. Permit History

Revision No.	Issue Date	Description
R00	06/19/2007	Initial Small source permit issued for installation of a flare and LFG-fired generator.
R01	05/14/2012	Renewal.
R03	01/16/2015	Modification to install second LFG-fired generator. Facility reclassified as Synthetic Minor due to CO emissions.
R04	03/03/2016	Modification to increase SB3 BACT limit for CO.
R05	04/18/2017	Renewal and modification to update SB3 BACT limits for NOx and CO to match NSPS JJJJ requirements.

4. Application Chronology

10/11/17   Application No. 7800222.17B was received requesting a Title V air permit due to the landfill being classified as Title III Major Source of HAPs. This classification change was requested as the landfill recalculated formaldehyde emissions from the two operating LFG-fired engines, which resulted in a HAP emission rate in excess of 10 tons per year of formaldehyde using DAQ-derived emission factors.

10/20/17   RCO sent the facility a letter acknowledging receipt of the complete permit application.

10/20/17   Greg Reeves, FRO, provided Regional Office comments on the permit application.

09/24/20   The Division of Air Quality (DAQ), Fayetteville Regional Office (FRO), received Application No. 7800222.20A, for a 1st-Time Title V air permit. A copy was forwarded to the Raleigh Central Office (RCO). The application contained the required forms, and there was no request for confidentiality. The application included the required $988 application fee.

           Application No. 7800222.17B will be consolidated and processed with Application No. 7800222.20A.

09/25/20   RCO sent the facility a letter acknowledging receipt of the complete permit application.

10/16/20   Jeff Cole, FRO, provided Regional Office comments on the permit application.

05/26/21   Mousa Maimoun submitted electronic copies of the GCCS Design Plan to the FRO on behalf of the Robeson County Landfill.

06/03/21   Tier 2 test results received by DAQ.

06/09/21   Jeff Cole conducted a compliance inspection at the facility. Mr. Cole found the facility to be operating in compliance, however in discussing the status of the LFG-fired engines with Mr. Gene Walters, Mr. Walters indicated that the damaged engine may be repaired and operated. This will be done at a much later date and will be submitted as a separate modification.

06/28/21   Joshua Harris sent Mousa Maimoun an email regarding the status of the damaged LFG-fired engine.

06/30/21   Tier 2 results were approved by SSCB.

07/21/21   Joshua Harris sent a follow-up email to Mousa Maimoun with additional questions. Mr. Harris had a question regarding the emission rate calculations and a request for modeling, as well as whether the landfill is subject to NESHAP Subpart M for asbestos disposal.

           Mr. Maimoun replied stating that the County is not planning to repair the engine in the near future and would like to proceed with removing the engine as a permitted source. Mr. Harris verified with Gary Saunders, SSCB, that the County can leave the engine in place as an inoperable piece of equipment, but that DAQ will need some idea of what is required to repair the engine so that it can be verified as inoperable during compliance inspections. Mr. Harris relayed this to Mr. Maimoun and requested that he provide some description of the engine damage and repairs that will be required to make it operational.

10/29/21   Joshua Harris sent Mousa Maimoun a follow-up email.

11/02/21   Joshua Harris received an email from Mousa Maimoun with a description of the damage sustained by the inoperable LFG-fired engine, as well as information regarding SO_2 and HCl calculation discrepancies in the emission rate calculations for the flare and remaining LFG-fired engine. Mr. Maimoun also stated that the landfill does accept asbestos-containing waste. Mr. Maimoun will check on the status of whether the solar flares are still on-site and is still trying to obtain purchasing information for the gasoline tank in order to determine the requirements under GACT CCCCCC.

01/31/2022   The Fayetteville Regional Office received a revised NMOC emission rate report for the Robeson County Landfill (for phases 1, 2, 3, 4). This report was forwarded to the Raleigh Central Office on March 14, 2022.

02/10/2022   Booker Pullen sent the information to the Air Quality Analysis Branch to model the worse-case scenario (voluntary GCCS that is not required to be operated by regulation) at the facility for air toxics.

03/18/2022   Booker Pullen sent electronic copies of the draft permit and review documents to Stationary Source Compliance (Samir Parekh). Stationary Compliance had no comments.

04/25/2022   Booker Pullen sent electronic copies of the draft permit and review documents to the Fayetteville Regional Office (Jeff Cole).

04/25/2022   Booker Pullen sent electronic copies of the draft permit and review documents to the applicant (Harrell Walters). No comments were received as of 05/19/2022.

04/29/2022   FRO submitted comments and they were incorporated into the Permit and the review.

XXXXXX   Public Notice period ended.

Xx/xx/xx   Public comments received…..

Xx/xx/xx   EPA review period ends, [comments received].

Xx/xx/xx   Air Quality Permit No. 09771T06 issued.

5. Table of Changes to Existing Permit No. 09771R05

The following changes were made to Air Permit No. 09771R05*

Page No.	Section	Description of Changes
Page 1	Cover letter	Updated letterhead Changed Permit revision number and date
Page 2	Cover letter	Revised PSD increment tracking statement, changed engineer's name to Booker Pullen along with contact information
Page 3	Cover letter	Added page containing "Notice Regarding The Right to Contest A Division Of Air Quality Permit".
Page 4	Cover letter	Revised the Summary Of "Changes To The Permits" table.
Cover page	Permit	Changed Permit number Changed "Replaces Permit" number Revised effective date of Permit Revised application number Revised complete application date
Page 2	Table of Contents	Added Insignificant Activities list as Section 3 of the permit and the General Conditions as Section 4 of the permit

Page 3	List of Acronyms	Add this list to the front of the permit
Page 4	Permitted Sources Table	Removed engine ES-3 from the permit per the applicant and the application.
Pages 6-9	Section 2.1	Added NSPS XXX the landfill
Pages 9-10	Section 2.1	Added 02D .1110, 40 CFR, NESHAP M regulations for landfill
Pages 11-13	Section 2.1	Added 02D .0516, .0521, .1806, .0524 (NSPS JJJJ) .02D .1111 (MACT ZZZZ), SB-3 for engine/generator set
Page 14	Section 2.2	Added Multiple emissions regulations (02D .0516, and .0521) for engine/generator set and flare
		Added facility-wide odor emission regulation (02D .1806)
Page 15	Section 2.3	Added Permit Shield for Non-applicable Requirements
Page 16	Section 3	Insignificant activities list, removed the eight solar flares from the list per the application request
Pages 17-25	Section 4	General Conditions in Section 4 (version 6, 01/07/2022)

* This list is not intended to be a detailed record of every change made to the permit but a summary of those changes.

The facility's permitted emission sources are as follows:

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description
ES-1 **NSPS XXX** **NESHAP M**	Municipal solid waste landfill	CD-GCCS CD-1 CD-Treatment	Landfill gas collection system* Landfill gas-fired utility candlestick flare (36.5 million Btu per hour heat input, 1,000 scfm flow rate)* Landfill gas treatment system*
ES-2 **NSPS JJJJ** **GACT ZZZZ**	1,468 HP Landfill gas-fired engine powering a 1.059 MW output electricity generator	N/A	N/A

* This is a voluntary gas collection and control system. Landfill gas is sent to the engine/generator unit to produce electricity which is sent to the power grid.

The facility's insignificant/exempt activities that will be listed in the 1st Time Title V permit as follows:

Emission Source ID No.	Emission Source Description
IES-1 **GACT ZZZZ**	125 kW Diesel-fired emergency generator
IES-2	Two (2) Leachate storage tanks (250,000 gallons each)
IES-3	Diesel fuel storage tank (7,000 gallons)
IES-4 **GACT CCCCCC**	Gasoline storage tank (5,000 gallons)
IES-5	Off-road diesel fuel storage tank (13,000 gallons)
IES-6	Used motor oil tank (250 gallons)
IES-7	Hydraulics tank (500 gallons)
IES-8	Fresh oil tank (500 gallons)
IES-9	Waste oil tank (500 gallons)

6. NSPS, NESHAP/MACT, PSD, 112(r), CAM & Attainment Status

- **NSPS** –

  ✓ The MSW landfill (ID No. ES-1) is subject to 40 CFR 60, Subpart XXX "Municipal Solid Waste Landfills that Commenced Construction, Reconstruction, or Modification After July 17, 2014" since the facility has been modified after the July 17, 2014 applicability date.

  ✓ The MSW landfill (ID No. ES-1) is not subject to 40 CFR 60, Subpart WWW "Municipal Solid Waste Landfills" since it is superseded by NSPS Subpart XXX.

  ✓ The LFG-fired engine (ID No. ES-2) is subject to 40 CFR 60, Subpart JJJJ "Stationary Spark Ignition Internal Combustion Engines" because they were each manufactured after the applicability threshold date.

  ✓ The diesel-fired emergency generator (ID No. IES-1) is not subject to 40 CFR 60, Subpart IIII "Stationary Compression Ignition Internal Combustion Engines" because the manufacture date of December 10, 1993, is prior to the applicability date of the NSPS regulation.

- **NESHAP/MACT** –

  ✓ The Robeson County MSW Landfill (ID No. ES-1) is not subject to 40 CFR 63, Subpart AAAA "Municipal Solid Waste Landfills." The NMOC emissions are not greater than the MACT AAAA thresholds (50 Mg per year), the landfill itself is not a major source, and this facility is not co-located at a major source of HAPs as defined in 40 CFR 63.2.

  ✓ The MSW Landfill (ID No. ES-1) is subject to 40 CFR 61, Subpart M "National Emission Standard for Asbestos," since it is an active asbestos-containing waste disposal site. Work Practice requirements will be placed in the Permit.

  ✓ The LFG-fired engine (ID No. ES-2) is subject to 40 CFR 63, Subpart ZZZZ "Reciprocating Internal Combustion Engines," and is considered a new engine under this regulation. The facility complies with this regulation by complying with the requirements of NSPS Subpart JJJJ.

  ✓ The diesel-fired emergency generator (ID No. IES-1) is subject to 40 CFR 63, Subpart ZZZZ "Reciprocating Internal Combustion Engines," and is considered an existing emergency engine under this regulation.

  ✓ The gasoline storage tank (ID No. IES-4) is subject to 40 CFR 63, Subpart CCCCCC "Gasoline Dispensing Facilities" since the facility is an area source of HAPs, and the facility meets the definition of a gasoline dispensing facility as any stationary facility which dispenses gasoline into the tank of a motor vehicle, motor vehicle engine, nonroad vehicle, or nonroad engine, including a nonroad vehicle or nonroad engine used solely for competition. Gasoline storage tanks are listed as affected sources under §63.11111(a), and there are no size distinctions.

    Since IES-4 is an insignificant activity at this Area Source, there is no permit condition. However, the facility is still required to comply with Subpart CCCCCC. The facility has the general duty to minimize emissions by operating and maintaining affected sources, and their associated air pollution control and monitoring equipment, in a manner consistent with safety and good air pollution practices for minimizing emissions. In addition, since the facility's throughput is expected to be less than 10,000 gallons per month based on information provided in the application, the facility is subject to the requirements of §63.11116.

This section states that the facility must handle the gasoline in a manner which will not result in vapor release to the atmosphere for an extended period of time. Measures to be taken include, but are not limited to:

- Minimize gasoline spills;
- Clean up spills as expeditiously as practicable;
- Cover all open gasoline containers and all gasoline storage tank fill-pipes with a gasketed seal when not in use; and
- Minimize gasoline sent to open waste collection systems that collect and transport gasoline to reclamation and recycling devices.

There are no notification or reporting requirements for facilities with a throughput of less than 10,000 gallons per month, however, the facility shall supply records of gasoline throughput within 24 hours of a request by DAQ. Additionally, should the facility's monthly gasoline throughput exceed 10,000 gallons, the facility will be subject to the requirements of §63.11117 for facilities with a monthly throughput of 10,000 gallons of gasoline or more, or §63.11118 for facilities with a monthly throughput of 100,000 gallons of gasoline or more, whichever is applicable, and must meet the applicable notification, testing, monitoring, recordkeeping, and reporting requirements. If an affected source's throughput ever exceeds an applicable throughput threshold, the affected source will remain subject to the requirements for sources above the threshold, even if the affected source throughput later falls below the applicable source threshold. [§63.11111(i)]

- **PSD** – PSD is not impacted by this application.

  ✓ Robeson County has triggered increment tracking under PSD for PM_{10} and SO_2, however this 1st Time Title V permit <u>does not</u> increase or decrease increment. Normal operation of the gas system would have been to operate both engines. The fact that one engine has been removed does not decrease PM_{10} emissions from the increment calculation because the extra gas would still be burned in the flare when necessary.

- **112(r)** – The facility <u>does not</u> store any of the listed 112(r) chemicals in amounts that exceed the threshold quantities. Therefore, the facility is not required to maintain a written Risk Management Plan (RMP).

- **CAM** – CAM <u>does not</u> apply since the facility is regulated by NSPS and MACT regulations that were promulgated after 1990 and control the pollutants that would be subject to CAM.

- **Attainment status** –Robeson County is in attainment for all criteria pollutants.

7. Regulatory Review

The facility <u>is subject</u> to the following air quality regulations in addition to the General Conditions:

- 15A NCAC 02D .0516: Sulfur Dioxide Emissions from Combustion Sources
- 15A NCAC 02D .0521: Control of Visible Emissions
- 15A NCAC 02D .0524: New Source Performance Standards, 40 CFR 60, Subpart XXX
- 15A NCAC 02D .0524: New Source Performance Standards, 40 CFR 60, Subpart JJJJ
- 15A NCAC 02D .1110: National Emission Standards for Hazardous Air Pollutants, 40 CFR 61, NESHAP M
- 15A NCAC 02D .1111: Generally Achievable Control Technology, 40 CFR 63, GACT ZZZZ
- 15A NCAC 02D .1806: Control and Prohibition of Odorous Emissions
- NCGS 62-133.8(g): Senate Bill 3 (SB3) Best Available Control Technology

15A NCAC 02D .0516: Sulfur Dioxide Emissions from Combustion Sources
SO_2 emissions from combustion sources are limited to 2.3 pounds per million Btu heat input. LFG combustion in the flare and the LFG-fired engine (ID Nos. CD-1 and ES-2) results in an emission rate of 0.011 lb SO_2/mmBtu each for both the flare and LFG-fired engines, with an assumed heat value of approximately 500 Btu per cubic foot of LFG. No monitoring, recordkeeping or reporting is required for LFG combustion. Compliance is expected.

15A NCAC 02D .0521: Control of Visible Emissions
Visible emissions from the flare and LFG-fired engine (ID Nos. CD-1, ES-2) are limited to a six-minute average opacity of 20%. Visible emissions from a properly maintained and operated flare and engines commonly not a concern. No visible emissions issues have been noted during previous testing or compliance inspections. No monitoring, recordkeeping, or reporting are required for LFG combustion in these sources. Compliance is expected.

15A NCAC 02D .0524: New Source Performance Standards, 40 CFR 60, Subpart XXX
The facility (ES-1) is subject to 40 CFR 60, Subpart XXX since it was modified after July 17, 2014, having commenced construction on an expansion into Phases 5 and 6 on May 26, 2020. A revised design capacity report was submitted on June 22, 2020, which also contained the Tier 1 calculation indicating that the facility would exceed the 34 Mg/yr NMOC threshold by which a GCCS is required to be installed and operated.

A Tier 2 sample was planned; however, the test was delayed a number of times, and was eventually conducted with the final sample taken on April 29, 2021. The Tier 2 results were reviewed and approved by DAQ, and demonstrated that the NMOC emission rate was below the threshold at 13.1 Mg/yr. However, because the sample results were submitted more than 180 days after the initial report, the facility was required to submit a design plan, as has been required previously based on EPA determinations.

The Robeson County Landfill submitted a GCCS design plan on May 26, 2021. This plan is under review, but the County is not required to install the GCCS at this time. The Robeson County Landfill will continue to conduct Tier 2 testing and actually submitted a revised NMOC emission rate report to the DEQ Fayetteville Regional Office on January 31, 2022. The NMOC emissions rates for phases 1, 2, 3, and 4 still remain well below the 34 Mg per year threshold to install a GCCS. If at some point in the future the facility cannot demonstrate through Tier 2 testing that the NMOC emission rate is below the threshold, then the County will be required to install an approved GCCS and submit a permit modification to include the appropriate requirements for operation and monitoring or attempt to demonstrate that the NMOC emission rate is below the threshold via other test Tiers. Compliance is expected.

15A NCAC 02D .0524: New Source Performance Standards, 40 CFR 60, Subpart JJJJ
The LFG-fired engine (ID No. ES-2) is subject to this regulation. The engines were manufactured after the applicability threshold date and are subject to New Source Performance Standards (NSPS) for Stationary Spark Ignition Internal Combustion Engines – specifically the standards that apply to LFG-fired lean burn engines with a maximum engine power greater than or equal to 500 hp and manufactured after July 1, 2010. LFG-fired engines have no fuel requirements but must be maintained and operated in a manner consistent with good air pollution control practice for minimizing emissions. The engines must also meet the emission standards in §60.4233(e). The applicable NSPS emissions standards are as follows:

Pollutant	Emission Standard*		
NOx	2.0 g/hp-hr	-or-	150 ppmvd at 15% O_2
CO	5.0 g/hp-hr	-or-	610 ppmvd at 15% O_2
VOC	1.0 g/hp-hr	-or-	80 ppmvd at 15% O_2

* The permittee may choose to comply with the emission standard in either g/hp-hr or ppmvd at 15% O_2.

The facility's engine has not been certified to these standards for combusting LFG, and compliance must be demonstrated via periodic source testing.

LFG contains small amounts of nitrogen, oxygen, carbon monoxide (CO), and nonmethane organic compounds including volatile organic compounds (VOC). Some of the nitrogen content in the fuel is oxidized to nitrogen oxides (NOx) and emitted along with other LFG constituents during the combustion process. Additional NOx is formed from the high temperature oxidation of nitrogen present in the combustion air. Most CO emissions result from incomplete combustion of LFG. Good combustion practices employed by the Robeson County Landfill provide compliance with the emissions standards.

Testing is required to be performed every 8,760 hours of operation or every three years, whichever comes first. Source testing has been performed on ES-2 and has consistently demonstrated compliance with the standards as shown in the table below. Engine ES-3 has been inoperable for a long period of time.

Test Date	Load During Test (As engine hp)	NOx		CO		VOC	
		ppmvd	g/hp-hr	ppmvd	g/hp-hr	ppmvd	g/hp-hr
05/17/12	1,449	76.26	1.14	402.97	3.66	6.17	0.09
05/21/13	1,449	50.0	0.71	337.6	2.9	15.4	0.21
05/14/14	1,451	72.24	1.26	366.95	3.89	12.97	0.22
06/24/15	1,379	56.8	0.84	377.8	3.42	22.8	0.33
07/10/17	1,380	59.6	0.85	278.6	2.42	10.7	0.15
07/29/20	586	36.7	0.79	260.4	3.43	9.97	0.21
NSPS Emission Standard		150	2.0	610	5.0	80	1.0
Compliance Indicated?		Yes	Yes	Yes	Yes	Yes	Yes

All source test results have been reviewed and accepted by the NCDAQ Stationary Source Compliance Branch. Continued compliance is expected.

15A NCAC 02D .1110: National Emission Standards for Hazardous Air Pollutants, 40 CFR 61, Subpart M
The facility is an active disposal site for asbestos-containing wastes; therefore, it is subject to the requirements of this regulation. To comply, the facility must adhere to a general set of work practices which may include ensuring there are no visible emissions at the disposal site, covering waste daily with at least six inches of compacted non-asbestos material or use another dust suppression agent, or the landfill may propose alternative methods for DAQ approval. The facility will be required to post signage and barriers if the method of compliance does not include covering the asbestos-containing waste. Closed portions of the landfill which have previously received asbestos-containing waste are also subject and are required to comply with the requirements of 40 CFR 61.151 for inactive waste disposal sites. Compliance is expected.

15A NCAC 02D .1111: Generally Achievable Control Technology, 40 CFR 63, Subpart ZZZZ
The LFG-fired engine (ID No. ES-2) is the subject source. As a "new" engine, located at an area source of HAPs, compliance with this regulation is determined by compliance with NSPS Subpart JJJJ. Continued compliance is expected.

15A NCAC 02D .1806: Control and Prohibition of Odorous Emissions
This is a "State-Enforceable Only" requirement and is applicable facility wide. The Permittee shall implement practices or controls sufficient to prevent odorous emissions from causing or contributing to objectionable odors beyond the property boundary. In the past, inspectors have noted light odors in the immediate vicinity of the gas mover equipment for the gas collection and control system, but no odors were noted beyond the property boundary or in other areas of the landfill. Continued compliance is expected.

NCGS 62-133.8(g): Senate Bill 3 (SB3) Best Available Control Technology
This is a "State-Enforceable Only" requirement that is applicable to the LFG-fired engine (ID No. ES-2). North Carolina General Statute §62-133.8 (g) requires the Robeson County Landfill to control the emissions of carbon monoxide (CO), nitrogen oxides (NOx), volatile organic compounds (VOCs), particulate matter (PM$_{10}$/PM$_{2.5}$), sulfur dioxide (SO$_2$), mercury and lead from the engine to the maximum extent that has been determined to be achievable at the facility using Best Available Control Technology (BACT). Since the initial BACT analysis was completed for this facility, DAQ adopted a policy to set State BACT for Biogas and LFG-fired engines to be equivalent to the emission standards of NSPS Subpart JJJJ. A separate BACT analysis was completed for that purpose on February 25, 2016, approving those new limits for CO and NOx.

Robeson County burns only LFG in the engine and follows good combustion practices. Source testing for both NOx and CO (DAQ approved on March 5, 2021) demonstrates that the Robeson County Landfill can comply with these State BACT limits. Continued compliance is expected.

8. Other Regulatory Requirements

- A Zoning Consistency Determination was submitted with the application. Dixon Ivey Jr., Zoning Administrator, determined that the proposed operation is consistent with applicable zoning ordinances.

- The application was sealed by Mousa Maimoun, who is a registered Professional Engineer in the State of North Carolina (Seal #049153).

- The required permit application fee of $988 was received by the Fayetteville Regional Office.

9. Air Toxics

The volume emissions from the landfill surface have never been evaluated for toxics. Since the landfill is not required to operate the GCCS, the volume emissions are assumed to be 100% uncontrolled.

The flare and LFG-fired engine was also evaluated assuming the maximum capacity, which is an unrealistic scenario, but one which provides the largest margin of compliance. The surface emission rates for the landfill were projected through CY2040. The LFG generation rate was projected to be 1,000 cfm (or 525,600,000 cfm or 14,883,335 m^3/yr) using LandGEM. Emission rate projections were made using pollutant concentrations from the October 2008 Draft of AP-42.

Chlorine Emissions From The Combustion of Landfill Gas In The Flare:
The following example calculation is for the emission of hydrogen chloride (HCl) created from the combustion of the chlorine compounds in the landfill gas-fired flare. The best methods to estimate emission are mass balance methods using site specific data on total chloride [expressed in ppmv as the chloride ion (Cl$^-$)]. [AP-42, Section 2.4.4.2 – Controlled Emissions]

- Maximum Flare Flow Rate = 1,000 ft^3/minute (or 28.32 m^3/min = 1,699.2 m^3/hour)
- Methane is only 50% of this gas stream (849.6 m^3/hour)
- Q$_{Cl^-}$ = Emission rate of chloride ions, m^3/hour
- C$_{Cl^-}$ = Concentration of chloride ions (74.0 ppmv, AP-42 default value)
- Multiplication factor for 50% methane concentration in landfill gas = 2.0
- Molecular weight of chloride ions = 35.45 g/mole

$$Q_{Cl^-} = 2.0 \times Q_{CH_4} \times \left(\frac{C_{Cl^-}}{1 \times 10^6}\right) \text{ (AP-42, Equation 3)}$$

$$Q_{Cl^-} = 2.0 \times 849.6 \frac{m^3}{hour} \times \left(\frac{74.0 \text{ parts}}{1 \times 10^6}\right) = 0.126 \frac{m^3}{hour}$$

The mass of the pre-combustion chloride ions present in the methane were found using Equation 4 of AP-42, Section 2.4.4.2:

$$UM_{Cl^-} = 0.126 \frac{m^3}{hour} \times \left[\frac{35.45 \text{ g/gmol} \times 1 \text{ atm}}{8.205 \times 10^{-5} \frac{m^3 - atm}{gmol - K} \times 1000 \frac{g}{kg} \times (273 + 25°C) \text{ K}} \right] \times 2.205 \frac{lb}{kg}$$

$$UM_{Cl^-} = 0.403 \frac{lb \; Cl^-}{hour} \quad \text{(chlorine)}$$

To calculate the HCl generated from the chloride ions, Equation 10 of Section 2.4-8 was used.

$$HCl_{emissions} = UM_{Cl^-} \times \frac{\eta_{col}}{100} \times 1.03 \times \frac{\eta_{cnt}}{100}$$

Where:
UM_{cl} = Uncontrolled mass emission of Cl^- ions (0.403 lb Cl^- ions/hour)
η_{col} = Collection efficiency of the landfill gas collection system, percent*
η_{cnt} = Control efficiency of the landfill gas control flares*
* To calculate worst-case HCl emissions, the facility assumes that 100% of the generated Cl^- ions are collected and converted to HCl.

$$HCl_{emissions} = 0.403 \frac{lb \; Cl^-}{hour} \times \frac{100}{100} \times 1.03 \times \frac{100}{100} = 0.415 \frac{lb \; HCl}{hour} \text{ or 1.82 tons/year}$$

Toxic Air (Formaldehyde) Emissions from Engine:
Emission rate calculations for the LFG-fired engine was calculated in similar fashion, using a flow rate of 19,592 scfh (326.53 scfm) which is the maximum flow rate listed in the permit application, and a gas temperature of 60°F (15.6°C) which is the temperature of the gas entering the engine after having been treated.

The emissions of other toxic air pollutants were calculated using a 95% control efficiency from landfill gas combustion in the engine which is the low end of the given range in AP-42.

The uncontrolled volume emissions from the landfill's surface were also calculated using the same methods in AP-42 Equations 3 and 4 above, assuming the previously mentioned LFG generation rates from LandGEM.

Formaldehyde emissions from LFG-fired engines have recently been found to be more significant than previously thought. The facility calculated formaldehyde emissions from the engine using an emission factor developed by DAQ in 2016, of 1.107 x 10^{-3} pounds of formaldehyde per brake horsepower hour.

Example:

$$1,468 \text{ hp} \times \frac{1.107 \text{ x } 10^{-3} \text{ lb}}{hp - hr} = 1.63 \frac{lb \text{ formaldehyde}}{hour} \text{ or } \left(\frac{7.14 \text{ tons formaldehyde}}{year} \right)$$

This makes the facility a minor source of HAPs for an individual hazardous air pollutant.

Toxic Air Pollutants from the Landfill:
The toxic air pollutants were calculated using AP-42 emissions factors for municipal solid waste landfills. The mass emissions of toxic air pollutants constituents found in landfill gas were calculated for each area based on the maximum methane generation rates and average sampled constituent concentrations of toxic air pollutants as determined by EPA.

The total maximum landfill gas generation rate for the Robeson County Landfill was used to calculate the worse-case toxic air pollutant emissions over the life of the landfill. LandGEM 3.02 was used to calculate future emissions from the landfill. The Landfill Gas Emissions Model (LandGEM) is an automated estimation tool with a Microsoft Excel interface that can be used to estimate emission rates for total landfill gas, methane, carbon dioxide, nonmethane organic compounds, and individual air pollutants. from municipal solid waste landfills. The software uses the pollutant concentrations in landfill gas (ppmv), molecular weights of pollutants, the time duration of waste in-place and the annualized waste placement of the landfill to calculate emissions from the landfill.

This landfill began operation in 1998 and is scheduled to close in the year of 2040. Total maximum landfill gas flow rate that will be generated by the landfill through the closure year was calculated by the LandGEM software and is equal to 16,030,003 m³/year.

The following equation from AP-42, fifth edition, Section 2.4.4.1 "Emissions", Revised November 1998, is used to calculate the individual toxic air pollutant flow rates (m³/yr) as a part of the landfill gas/methane generation from the landfill using Equation 3.

$Q_p = Q_{CH4}$ x C_p/C_{CH4} x $(1$ x $10^6)$ **Equation 3**

Where:
Q_p = Emission rate of pollutants, m³/yr
Q_{CH4} = 8,015,001 m³/year (50% of the total landfill gas amount through year 2040)
C_p = concentration of pollutant in landfill gas (from Table 2.4-1, "Default Concentration for Landfill gas constituents", Section 2.4.5

C_{CH4} = 50% of landfill gas is methane (0.50)

The following equation from AP-42, fifth edition, Section 2.4.4.1 "Emissions", Revised November 1998, is used to calculate the uncontrolled emission of individual toxic air pollutants present in landfill gas.

$$UM_p = Q_p \left[\frac{MWs \times 1\, atmosphere}{(8.205 \times 10^{-5}\, m^3 - atmospere/gmol - {}^0K)(1000g/kg)(273 + T\ {}^0K)} \right]$$

Where:
UM_p = Uncontrolled mass emissions of pollutants, kg/yr
MW_p = Molecular weight of pollutant, g/mol
Q_p = Emission rate of pollutant, m³/yr
T^0 = Temperature of the landfill gas at this site (default = 25 ºC)
2.0   = factor for 50% methane content in landfill gas

The following equation is an example calculation for the mass emissions flow rate (m³/yr) of <u>vinyl chloride</u> including the control from the voluntary gas collection and control system with flare. It was calculated based on the maximum landfill gas created in the landfill and the maximum amount of landfill gas that goes into the flare.

$$Q_p = 2.0 \times Q_{CH_4} \left(\frac{C_p}{1 \times 10^6} \right)$$

Where: Q_{CH4} = {maximum amount of landfill gas that goes into the flare x 50% (methane)}
Cp (vinyl chloride) = 1.42 ppmv

$$Q_{vinyl\ chloride} = 2.0 \times \frac{8,015,001\ m^3}{year} \times \left(\frac{1.42\ parts}{1 \times 10^6} \right) = \frac{23.0\ m^3}{year}$$

Finding the mass emissions from the landfill flare and the fugitive emissions from the landfill (not captured by the gas collection system).

$$UM_p = Q_p \left[\frac{MWs \times 1 \ atmosphere}{(8.205 \times 10^{-5} \ m^3 - atmospere/\ gmol - {}^0K)(1000g\ /kg)(273 + T\ {}^0K)} \right]$$

Where:

UM_p	= Uncontrolled mass emissions of vinyl chloride, lb/yr
MW_p	= Molecular weight of pollutant, (62.50 g/mol)
Q_p	= Emission rate of vinyl chloride, (117.14 m³/yr)
T^0	= 25 degrees C (default value)

$$UM_{vinyl\ chl} = 23.0 \ \text{m}^3 \ \frac{vinyl\ chl}{year} \times \left[\frac{62.50 \ g/gmole \times 1 \ atmosphere}{(\frac{8.205 \ \times 10^{-5} \ m3 - atmospere}{gmol - {}^0K}) \times \frac{1000 \ g}{kg} \times (273 + 25 \ {}^0C) \ {}^0K} \right] x \frac{2.205 \ lbs}{kg}$$

= 129.6 lbs/year (applicant calculated 134.7 lbs/year)

The gas collection and control system capture efficiency = 75% of landfill gas generated and 25% of the emissions are emitted into the atmosphere uncontrolled (fugitive).

Flare destruction efficiency = 98%

$$CM_P = \left[\frac{129.6 \ \text{lbs vinyl chloride}}{year} \times \left(1 - \frac{75}{100}\right) \right] + \left[\frac{129.6 \ lbs\ vinyl\ chloride}{year} \times \frac{75}{100} \times \left(1 - \frac{98.0}{100}\right) \right]$$

The first term of the equation is equal to the surface emissions and the second term of the equation are the emissions from the flare.

Surface emissions = 32.4 lbs/year
Flare emissions = 1.94 lbs/year
Total Emissions = 34.3 lbs/year after using the voluntary gas collection and control system (GCCS).

The applicant listed a value of 134.7 lbs/yr for modeling from the landfill as if the voluntary GCCS was not being used. Both the controlled value and the uncontrolled value are above the TPER for vinyl chloride. Therefore, the worse-case value will be modeled by the DAQ for compliance with the National Ambient Air Quality Standards (without control). The other air toxic emission rates listed in Table 4 below were calculated in like manner.

Table 4: The projected toxic emissions through CY2040 with comparison to their respective TPERs from 02Q .0711(a):

Toxic Air Pollutant	Averaging Period	Landfill Surface Emissions	Flare Emissions	LFG-fired Engine Emissions	Total	TPER	Modeling Required?
1,1,1-Trichloroethane (methyl chloroform)	lb/day	0.13	2.38 x 10⁻³	2.01 x 10⁻³	0.13	250	No
	lb/hr	5.46 x 10⁻³	9.93 x 10⁻⁵	8.37 x 10⁻⁵	5.64 x 10⁻³	64	No
1,1,2,2-Tetrechloroethane	lb/yr	132.58	2.41	2.03	137.02	430	No
1,1-Dichloroethene (vinylidene chloride)	lb/day	6.27 x 10⁻²	1.14 x 10⁻³	9.62 x 10⁻⁴	6.48 x 10⁻²	2.5	No
1,2-Dibromoethane (ethylene dibromide)	lb/yr	1.33	2.42 x 10⁻²	2.04 x 10⁻²	1.37	27	No
1,2-Dicholoroethane (ethylene dichloride)	lb/yr	23.23	0.42	0.36	24.01	260	No
1,3-Butadiene	lb/yr	13.26	0.24	0.20	13.70	11	**YES**
1,4-Dioxane	lb/day	2.95 x 10⁻³	5.37 x 10⁻⁵	4.53 x 10⁻⁵	3.05 x 10⁻³	12	No

2-Butanone (MEK)	lb/day	1.17	2.13×10^{-2}	1.79×10^{-2}	1.21	78	No
	lb/hr	4.87×10^{-2}	8.86×10^{-4}	7.47×10^{-4}	5.03×10^{-2}	22.4	No
4-Methyl-2-pentanone (MIBK)	lb/day	0.36	6.50×10^{-3}	5.48×10^{-3}	0.37	52	No
	lb/hr	1.49×10^{-2}	2.71×10^{-4}	2.28×10^{-4}	1.54×10^{-2}	7.6	No
Acetaldehyde	lb/hr	5.75×10^{-4}	1.04×10^{-5}	8.81×10^{-6}	5.94×10^{-4}	6.8	No
Benzene	lb/yr	284.5	5.03	4.24	293.77	8.1	**YES**
Benzyl chloride	lb/hr	3.86×10^{-4}	7.02×10^{-6}	5.92×10^{-6}	3.99×10^{-4}	0.13	No
Carbon disulfide	lb/day	4.53×10^{-2}	8.23×10^{-4}	6.94×10^{-4}	4.68×10^{-2}	3.9	No
Carbon tetrachloride	lb/yr	1.81	3.30×10^{-2}	2.78×10^{-2}	1.87	460	No
Chlorobenzene	lb/day	0.22	4.01×10^{-3}	3.38×10^{-3}	0.23	46	No
p-Dichlorobenzene	lb/hr	2.33×10^{-2}	4.23×10^{-4}	3.57×10^{-4}	2.41×10^{-2}	16.8	No
Dichloromethane (methylene chloride)	lb/yr	771.16	14.02	11.82	797.00	1600	No
	lb/hr	8.80×10^{-2}	1.60×10^{-3}	1.35×10^{-3}	9.10×10^{-2}	0.39	No
Ethyl acetate	lb/hr	2.79×10^{-2}	5.08×10^{-4}	4.28×10^{-4}	2.88×10^{-2}	36	No
Ethyl mercaptan	lb/hr	2.07×10^{-3}	3.77×10^{-5}	3.18×10^{-5}	2.14×10^{-3}	0.025	No
Formaldehyde	lb/hr	5.92×10^{-5}	1.08×10^{-6}	1.63	1.63	0.04	**YES**
n-Hexane	lb/day	1.08	1.96×10^{-2}	1.66×10^{-2}	1.12	23	No
Hydrogen Chloride	lb/hr	0.00	0.42	0.08	0.50*	0.18	**YES**
Hydrogen Sulfide	lb/day	4.41	8.02×10^{-2}	6.76×10^{-2}	4.56	1.7	**YES**
Mercury vapor	lb/day	6.25×10^{-5}	6.14×10^{-5}	1.92×10^{-4}	3.16×10^{-4}	0.013	No
Mercury (alkyl)	lb/day	2.99×10^{-6}	5.60×10^{-8}	4.57×10^{-8}	3.09×10^{-6}	0.0013	No
Methanethiol (methyl mercaptan)	lb/hr	1.11×10^{-2}	2.02×10^{-4}	1.70×10^{-4}	1.15×10^{-2}	0.013	No
Styrene	lb/hr	7.21×10^{-3}	1.31×10^{-4}	1.11×10^{-4}	7.45×10^{-3}	2.7	No
Tetrachloroethylene (Perchloroethylene)	lb/yr	497.01	9.04	7.62	513.67	13000	No
Toluene	lb/day	10.99	0.20	0.17	11.36	98	No
	lb/hr	0.46	8.33×10^{-3}	7.02×10^{-3}	0.48	14.4	No
Trichloroethylene	lb/yr	160.62	2.92	2.46	166.00	4000	No
Trichloromethane (Chloroform)	lb/yr	12.48	0.23	0.19	12.90	290	No
Vinyl chloride	lb/yr	134.7	9.9	2.01	146.61	26	**YES**
Xylene	lb/day	3.96	7.20×10^{-2}	6.07×10^{-2}	4.09	57	No
	lb/hr	0.17	3.00×10^{-3}	2.53×10^{-3}	0.18	16.4	No

* Adjustment for only one engine. When the application was initially submitted, both engines were operating.

As stated earlier in this review, the volume emissions from the Robeson County landfill have never been evaluated for toxics. This evaluation is based on assumed LFG generation rates through the closing year 2040. Since the landfill is not required by regulation to operate the GCCS, the volume emissions are assumed to be 100% uncontrolled from the landfill. However, because HCl is created in the combustion process, emissions from the flare and the engine are included as part of the modeling evaluation. Because the Robeson County Landfill is subject to 40 CFR Subpart M, the facility requested that DAQ perform the dispersion modeling analysis in accordance with 15A NCAC 02Q .0702(a)(27) for 1,3-butadiene, benzene, formaldehyde, hydrogen chloride, hydrogen sulfide, and vinyl chloride since these emission rates exceed their respective TPERs.

Dispersion modeling was conducted by the DAQ in the following manner: The model assumed 100% uncontrolled emissions from the landfill because the GCCS is not required to be operated by regulation. For a worse-case scenario, the flare and the engine were also modeled for the toxic air pollutants that are emitted by the combustion of landfill gas, especially HCL which is created by combustion.

Mr. Mark Yoder, AQAB, performed the modeling demonstration (memo dated April 20, 2022) and determined that the model was sufficient to show compliance with the AAL. For this evaluation, none of the toxic air pollutants evaluated exceed either their respective TPER or AAL. Therefore, the DAQ has determined that there is not an unacceptable risk to human health resulting from this modification.

AERMOD (version 21112) using five years (2014-2018) of surface from the Lumberton Regional Airport and upper air meteorological data (ADJ U*) compiled from the Piedmont-Triad International Airport was used to evaluate impacts in both simple and complex terrain. The five toxics were modeled from one area source and one point source. Modeled area and point source release parameters are provided in the attached Table 2. Modeled TAP emissions are shown in the attached Table 3. Direction-specific building downwash parameters, calculated using EPA's BPIP-PRIME program (04274), were used as input to AERMOD to determine building downwash effects on plume rise and effects on entrainment of stack emissions into the cavity and turbulent wake zones downwind of existing buildings. Receptors were modeled around the facility's property line at 25-meter intervals. Nested receptor grids were modeled off property according to the following radial extents and corresponding receptor spacings, respectively: 50 m spacing out to 500 m, 100 m spacing out to 1 km, 250 m spacing out to 2.5 km, and 500 m spacing out to 5 km. Source and receptor elevations and receptor dividing streamline heights were calculated from USGS NED terrain data using the AERMOD terrain pre-processor AERMAP.

The following impacts result from this modeling demonstration for the single engine:

Pollutant	Averaging Period	Modeled Landfill Volume Emission Rates	Flare Emission Rates	LFG-fired Engine Emission Rates	AAL ($\mu g/m^3$)	% AAL
1,3-Butadiene	lb/yr	13.6 lbs/yr	------------	--------------	0.44	<0.1%
Benzene	lb/yr	284.5 lbs/yr	5.0 lbs/yr	4.1 lbs/yr	0.12	4.9%
Formaldehyde	lb/hr	-------	--------	1.63 lbs/hour	150	53.1%
Hydrogen Sulfide	lb/day	4.53 lbs/day	--------	-------------	120	0.1%
Vinyl Chloride	lb/yr	134.7 lbs/yr	2.4 lbs/yr	1.9 lbs/yr	0.38	0.7%

The permit will not contain 15A NCAC 02D .1100 or 02Q .0711 conditions since the facility is subject to NESHAP regulation (Subpart M for asbestos) that exempts it from toxics permitting pursuant to 15A NCAC 02Q .0702(a)(27).

10. Emissions Review

The total emission rates for the facility include maximum emission rates for the flare, LFG-fired engines, and landfill surface without collection since the GCCS is not required to operate. [This is an unrealistic scenario that provides and absolute worst-case for the facility (if the flare is operating, the emissions from the landfill will only be 25%; the GCCS will have a 75% collection efficiency, 25% emissions from the landfill, and flare will destruct LFG at 98% control efficiency).]

MSW Landfill Emissions:
Landfill volume emissions were calculated using the maximum landfill gas generation rate of 566,094,200 ft^3/yr (16,030,003 m^3/yr) through the year 2040 for phases 1, 2, 3, and 4 as calculated using LandGEM, and AP-42 Chapter 2.4, 2008 Draft. VOC emissions are 99.7% of NMOC. The GCCS is not required to operate, however for these purposes, post collection potential emissions were calculated by applying a nominal collection efficiency of 75%.

Example:

- CY2040 LFG generation rate from LandGEM = 16,030,003 m^3/year (or 1,830 m^3/hour)
- Methane is 50% of this gas stream (915 m^3/hour)
- Q_{NMOC} = Emission rate of NMOCs, m^3/hour

- C_{NMOC} = Concentration of NMOCs (176 ppmv, 2021 Tier 2 sample)
- Multiplication factor for 50% methane concentration in landfill gas = 2.0
- Molecular weight of NMOC (as n-hexane) = 86.18 g/gmol

$$Q_{NMOC} = 2.0 \times Q_{CH_4} \times \left(\frac{C_{NMOC}}{1\times10^6}\right) \text{ (AP-42, Equation 3)}$$

$$Q_{NMOC} = 2.0 \times 915 \, \frac{m^3}{hour} \times \left(\frac{176 \text{ parts}}{1\times10^6}\right) = 0.322 \, \frac{m^3}{hour}$$

The uncontrolled mass emission rate of NMOC (UM_{NMOC}) was found using Equation 4 of AP-42, Section 2.4.4.2.

$$UM_{NMOC} = 0.322 \, \frac{m^3}{hour} \times \left[\frac{86.18 \text{ g/gmol} \times 1 \text{ atm}}{8.205 \times 10^{-5} \, \frac{m^3 - atm}{gmol - K} \times 1000 \, \frac{g}{kg} \times (273 + 25°C) \text{ K}}\right] \times 2.205 \, \frac{lb}{kg}$$

$$UM_{NMOC} = 2.50 \, \frac{lb \text{ NMOC}}{hour} = 11.00 \, \frac{tons \text{ NMOC}}{year}$$

To calculate the VOC component of the landfill's uncontrolled surface emissions, AP-42 states in note "b" of Table 2.4-1 that VOC emissions are 99.7 wt.% of the NMOC emission rate, therefore:

$$UM_{VOC} = 0.997 \times 11.00 \, \frac{tons \text{ NMOC}}{year} = 10.9 \, \frac{tons \text{ VOC}}{year}$$

Volume emission of VOC from the landfill surface were calculated using AP-42 Section 2.4-6 Equation 5 (calculation of surface emissions and flare emissions):

$$CM_P = \left[UM_P \times \left(1 - \frac{\eta_{col}}{100}\right)\right] + \left[UM_P \times \frac{\eta_{col}}{100} \times \left(1 - \frac{\eta_{cnt}}{100}\right)\right]$$

Where:
CM_P = Controlled mass emissions of pollutant
UM_P = Uncontrolled mass emission of pollutant
η_{col} = Collection efficiency of the landfill gas collection system, percent (assumed 75%)
η_{cn} = Control efficiency of the landfill gas control flare (assume 98%)

$$CM_P = \left[\frac{10.9 \text{ tons VOCs}}{year} \times \left(1 - \frac{75}{100}\right)\right] + \left[\frac{10.9 \text{ tons VOCs}}{year} \times \frac{75}{100} \times \left(1 - \frac{98.0}{100}\right)\right] = \frac{2.96 \text{ tons VOCs}}{year}$$

The first term of the equation is equal to the surface emissions and the second term of the equation are the emissions from the flare.

Surface emissions = 2.73 tons/year
Flare emissions = 0.16

Flare emissions for other pollutants:
Total SO_2 emissions were estimated using default concentrations for reduced sulfur the methodology in AP-42 Chapter 2.4. NMOC and VOC emissions for the flare are based on the flare's maximum capacity, regardless of NMOC generation rate from the landfill, and were calculated using the same methods in AP-42 and 97.7% control efficiency [2008 Draft AP-42 Table 2.4-3]. The facility assumes that the LFG has a moisture content of 3.6% and that it consists of 50% methane.

Particulate, NOx, and CO emissions were calculated using the following emission factors from the 2008 Draft of AP-42, Table 2.4-4:

PM: 15 lb PM/10^6 dry ft^3 CH$_4$
NOx: 39 lb PM/10^6 dry ft^3 CH$_4$
CO: 46 lb PM/10^6 dry ft^3 CH$_4$

Flare throughput:

$$\frac{1{,}000 \text{ ft}^3}{\text{minute}} \times \frac{60 \text{ minutes}}{\text{hour}} \times \frac{8{,}760 \text{ hours}}{\text{year}} \times \frac{(100-(3.6 \text{ moisture}))}{100} \times \frac{50\% \text{ CH}_4}{100} = \frac{253{,}339{,}200 \text{ dry ft}^3 \text{ CH}_4}{\text{year}}$$

Examples:

$$\frac{253{,}339{,}200 \text{ dry ft}^3 \text{ CH}_4}{\text{year}} \times \frac{15 \text{ lb PM}}{10^6 \text{ ft}^3 \text{ CH}_4} \times \frac{1 \text{ ton}}{2000 \text{ lb}} = 1.90 \frac{\text{tons PM}}{\text{year}}$$

$$\frac{253{,}339{,}200 \text{ dry ft}^3 \text{ CH}_4}{\text{year}} \times \frac{39 \text{ lb NOx}}{10^6 \text{ ft}^3 \text{ CH}_4} \times \frac{1 \text{ ton}}{2000 \text{ lb}} = 4.94 \frac{\text{tons NOx}}{\text{year}}$$

$$\frac{253{,}339{,}200 \text{ dry ft}^3 \text{ CH}_4}{\text{year}} \times \frac{46 \text{ lb CO}}{10^6 \text{ ft}^3 \text{ CH}_4} \times \frac{1 \text{ ton}}{2000 \text{ lb}} = 5.83 \frac{\text{tons CO}}{\text{year}}$$

All particulate emissions from the combustion of landfill gas are considered as PM$_{2.5}$.

To calculate potential SO$_2$ emissions, AP-42 Chapter 2.4 was used along with information submitted by the facility in the application:

- Maximum Flare Flow Rate = 1,000 ft^3/minute (or 28.32 m^3/min = 1,699.2 m^3/hour)
- Methane is only 50% of this gas stream (849.6 m^3/hour)
- Q_S = Emission rate of reduced sulfur compounds, m^3/hour
- C_S = Concentration of reduced sulfur compounds (33 ppmv, AP-42)

- Multiplication factor for 50% methane concentration in landfill gas = 2.0
- Molecular weight of sulfur = 32.06 g/mole

$$Q_S = 2.0 \times Q_{CH_4} \times \left(\frac{C_S}{1\times10^6}\right) \text{ (AP-42, Equation 3)}$$

$$Q_S = 2.0 \times 849.6 \frac{m^3}{hour} \times \left(\frac{33 \text{ parts}}{1\times10^6}\right) = 0.056 \frac{m^3}{hour}$$

The mass of the pre-combustion sulfur present in the methane was found using Equation 4 of AP-42, Section 2.4.4.2.:

$$UM_s = 0.056 \frac{m^3}{hour} \times \left[\frac{32.06 \text{ g/gmol} \times 1 \text{ atm}}{8.205 \times 10^{-5} \frac{m^3 - atm}{gmol - K} \times 1000 \frac{g}{kg} \times (273 + 25°C) \text{ K}}\right] \times 2.205 \frac{\text{pounds}}{kg}$$

$$UM_s = 0.162 \frac{\text{pounds Sulfur}}{hour}$$

To calculate SO$_2$ emitted from the combustion of sulfur, Equation 10 of Section 2.4-8 was used.

$$SO_2 \text{ emitted} = UM_s \times \frac{\eta_{col}}{100} \times 2.0$$

Where:

UM_S	= Uncontrolled mass emission rate of sulfur compounds (0.162 lb sulfur/hour)
η_{col}	= Collection efficiency of the landfill gas collection system, percent (assumed 100% for these purposes)
2.0	= Ratio of the molecular weight of SO_2 to the molecular weight of Sulfur

$$SO_2 \text{ emitted} = 0.162 \frac{lb}{hour} \times \frac{100}{100} \times 2.0 \times 8,760 \frac{hours}{year} \times \frac{1 \text{ ton}}{2,000 \text{ lb}} = 1.42 \frac{\text{tons } SO_2}{year}$$

<u>LFG-Fired Engine Emissions:</u>
Emission rates for the LFG-fired engine was calculated in the same fashion as those of the flare, but using manufacturer emission factors, and NSPS JJJJ limits for PM, NOx, CO, and VOC.

Particulate, NOx, CO and VOC emissions were calculated using the following emission factors:

PM: 0.1 g/hp-hr (manufacturer emission factor)
NOx: 2.0 g/hp-hr (NSPS JJJJ limit)
CO: 5.0 g/hp-hr (NSPS JJJJ limit)
VOC: 1.0 g/hp-hr (NSPS JJJJ limit)

Examples:

PM:

$$1,468 \text{ hp } \times \frac{0.1 \text{ g PM}}{hp-hr} \times \frac{8,760 \text{ hours}}{year} \times \frac{1 \text{ kg}}{1,000 \text{ g}} \times \frac{2.205 \text{ lb}}{kg} \times \frac{ton}{2,000 \text{ lb}} = 1.42 \frac{\text{tons PM}}{year}$$

All particulate emissions from the combustion of landfill gas are considered as $PM_{2.5}$.

NOx:

$$1,468 \text{ hp } \times \frac{2.0 \text{ g NOx}}{hp-hr} \times \frac{8,760 \text{ hours}}{year} \times \frac{1 \text{ kg}}{1,000 \text{ g}} \times \frac{2.205 \text{ lb}}{kg} \times \frac{ton}{2,000 \text{ lb}} = 28.36 \frac{\text{tons NOx}}{year}$$

CO:

$$1,468 \text{ hp } \times \frac{5.0 \text{ g CO}}{hp-hr} \times \frac{8,760 \text{ hours}}{year} \times \frac{1 \text{ kg}}{1,000 \text{ g}} \times \frac{2.205 \text{ lb}}{kg} \times \frac{ton}{2,000 \text{ lb}} = 70.89 \frac{\text{tons CO}}{year}$$

VOC:

$$1,468 \text{ hp } \times \frac{1.0 \text{ g VOC}}{hp-hr} \times \frac{8,760 \text{ hours}}{year} \times \frac{1 \text{ kg}}{1,000 \text{ g}} \times \frac{2.205 \text{ lb}}{kg} \times \frac{ton}{2,000 \text{ lb}} = 14.18 \frac{\text{tons VOC}}{year}$$

To calculate potential SO_2 emissions, AP-42 Chapter 2.4 was used along with information submitted by the facility in the application:

- Maximum Landfill gas Flow Rate into the engine = 19,592 ft^3/hour (554.78 m^3/hour)
- Methane is only 50% of this gas stream (277.39 m^3/hour)
- Q_S = Emission rate of reduced sulfur compounds, m^3/hour
- C_S = Concentration of reduced sulfur compounds (33 ppmv, AP-42)
- Multiplication factor for 50% methane concentration in landfill gas = 2.0
- Molecular weight of sulfur = 32.06 g/mole

$$Q_S = 2.0 \times Q_{CH_4} \times \left(\frac{C_S}{1 \times 10^6}\right) \text{ (AP-42, Equation 3)}$$

$$Q_S = 2.0 \times 277.39 \frac{m^3}{hour} \times \left(\frac{33 \text{ parts}}{1 \times 10^6}\right) = 0.0183 \frac{m^3}{hour}$$

The mass of the pre-combustion sulfur present in the methane was found using Equation 4 of AP-42, Section 2.4.4.2.:

$$UM_s = 0.0183 \frac{m^3}{hour} \times \left[\frac{32.06 \text{ g/gmol} \times 1 \text{ atm}}{8.205 \times 10^{-5} \frac{m^3 - atm}{gmol - K} \times 1000 \frac{g}{kg} \times (273 + 15.6°C) \text{ K}}\right] \times 2.205 \frac{pounds}{kg}$$

$$UM_s = 0.053 \frac{pounds}{hour}$$

To calculate SO_2 emitted from the combustion of sulfur, Equation 10 of Section 2.4-8 was used.

$$SO_2 \text{ emitted} = UM_s \times \frac{\eta_{col}}{100} \times 2.0$$

Where:
UM_S = Uncontrolled mass emission rate of sulfur compounds (0.053 lb sulfur/hour)
η_{col} = Collection efficiency of the landfill gas collection system, percent
        (assumed 100% for these purposes)
2.0   = Ratio of the molecular weight of SO_2 to the molecular weight of Sulfur

$$SO_2 \text{ emitted} = 0.053 \frac{lb}{hour} \times \frac{100}{100} \times 2.0 \times 8,760 \frac{hours}{year} \times \frac{1 \text{ ton}}{2,000 \text{ lb}} = 0.46 \frac{tons \; SO_2}{year}$$

For the engine, emissions = 0.46 tons SO_2/year

Emergency Generator Emissions:
The potential emissions from the facility's 125 kW diesel-fired emergency generator were calculated using emission factors from AP-42, Table 3.3-1. Operation hours for emergency engines are assumed to be a maximum of 500 hours per year in keeping with EPA guidance.

PM: 2.20×10^{-3} lb/hp-hr (all particulate matter emitted is assumed to be as $PM_{2.5}$)
SO_2: 2.05×10^{-3} lb/hp-hr
NOx: 0.031 lb/hp-hr
CO: 6.68×10^{-3} lb/hp-hr
VOC: 2.51×10^{-3} lb/hp-hr (sum of crankcase and exhaust TOC)

Examples:

PM:

$$125 \text{ kW} \times \frac{1.34 \text{ hp}}{1 \text{ kW}} \times \frac{2.20 \times 10^{-3} \text{ lb PM}}{hp - hr} \times \frac{500 \text{ hours}}{year} \times \frac{ton}{2,000 \text{ lb}} = 0.09 \frac{tons \; PM}{year}$$

SO_2:

$$125 \text{ kW} \times \frac{1.34 \text{ hp}}{1 \text{ kW}} \times \frac{2.05 \times 10^{-3} \text{ lb SO}_2}{hp - hr} \times \frac{500 \text{ hours}}{year} \times \frac{ton}{2,000 \text{ lb}} = 0.09 \frac{tons \; SO_2}{year}$$

NOx:

$$125 \text{ kW} \times \frac{1.34 \text{ hp}}{1 \text{ kW}} \times \frac{0.031 \text{ lb NOx}}{\text{hp} - \text{hr}} \times \frac{500 \text{ hours}}{\text{year}} \times \frac{\text{ton}}{2,000 \text{ lb}} = 1.30 \frac{\text{tons NOx}}{\text{year}}$$

CO:

$$125 \text{ kW} \times \frac{1.34 \text{ hp}}{1 \text{ kW}} \times \frac{6.68 \times 10^{-3} \text{ lb CO}}{\text{hp} - \text{hr}} \times \frac{500 \text{ hours}}{\text{year}} \times \frac{\text{ton}}{2,000 \text{ lb}} = 0.28 \frac{\text{tons CO}}{\text{year}}$$

VOC:

$$125 \text{ kW} \times \frac{1.34 \text{ hp}}{1 \text{ kW}} \times \frac{2.51 \times 10^{-3} \text{ lb VOC}}{\text{hp} - \text{hr}} \times \frac{500 \text{ hours}}{\text{year}} \times \frac{\text{ton}}{2,000 \text{ lb}} = 0.11 \frac{\text{tons VOC}}{\text{year}}$$

Pollutant	Landfill Emissions tons/yr	Flare Emissions tons/yr	LFG-Fired Engine Emissions tons/yr	Emergency Generator Emissions tons/yr	Totals tons/yr
PM (TSP)	0.00	1.90	1.42	0.09	3.41
PM_{10}	0.00	1.90	1.42	0.09	3.41
$PM_{2.5}$	0.00	1.90	1.42	0.09	3.41
SO_2	0.00	1.42	0.46	0.09	1.97
NOx	0.00	4.94	28.36	1.30	34.6
CO	0.00	5.83	70.89	0.28	77.0
VOC	2.73 using control system	0.16	14.18	0.11	17.18

Actual emissions as reported on past AQEIs can be seen on page one of this review.

11. Statement of Compliance

The latest compliance inspection was conducted by Jeff Cole, FRO, on June 9, 2021. The facility was found to be operating in apparent compliance at that time.

In the past five years, the facility has received one Notice of Deficiency on February 18, 2019, for a late report. The report was received by the FRO, and the deficiency was resolved.

12. Public Notice Review

A notice of the DRAFT Title V Permit shall be made pursuant to 15A NCAC 02Q .0521. The notice will provide for a 30-day comment period, with an opportunity for a public hearing. Consistent with 15A NCAC 02Q .0525, the EPA will have a concurrent 45-day review period. Copies of the public notice shall be sent to persons on the Title V mailing list and EPA. Pursuant to 15A NCAC 02Q .0522, a copy of each permit application, each proposed permit and each final permit shall be provided to EPA.

The 30-day public notice period was from MONTH XX, 20XX through MONTH XX, 20XX.

The EPA 45-day review period was from MONTH XX, 20XX through MONTH XX, 20XX.

[Number of] comments were received during the public notice period and the EPA review period.

13. Comments and Recommendations

The 1st-Time Title V permit application for the Robeson County Landfill located in Saint Pauls, Robeson County, NC has been reviewed by DAQ to determine compliance with all procedures and requirements. DAQ has determined that this facility is complying or will achieve compliance, as specified in the permit, with all requirements that are applicable to the affected sources. The DAQ recommends the issuance of Air Permit No. 09771T06.