NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date: xx, 2023

Region: Fayetteville Regional Office
County: Sampson
NC Facility ID: 8200159
Inspector's Name: N/A
Date of Last Inspection: N/A (Greenfield)
Compliance Code: N/A

Facility Data

Applicant (Facility's Name): Sapphire Renewable Natural Gas

Facility Address:
Sapphire Renewable Natural Gas
7424 Roseboro Highway
Roseboro, NC 28382

SIC: 4922/Natural Gas Transmission
NAICS: 221210/Pipeline Transportation of Natural Gas

Facility Classification: Before: N/A **After:** Title V
Fee Classification: Before: N/A **After:** Title V

Permit Applicability (this application only)

SIP: 15A NCAC 02D .0202, 02D .0516, 02D .0521, 02D .0535, 02D .0540, 02D .0611, 02D .1100, and 02D .1806, 02Q .0504, and 02Q .0711
NSPS: N/A
NESHAP: N/A
PSD: N/A
PSD Avoidance: N/A
NC Toxics: Benzene, Hydrogen Chloride, Vinyl chloride
112(r): N/A
Other: State-enforceable Only condition added to the permit for the per-and polyfluoroalkyl substances (PFAS).

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Suparna Chakladar VP - Fuel Supply & Env. Svcs. 5087 Junction Road Lockport, NY 14094	Anthony Falbo Sr. VP Operations 5087 Junction Road Lockport, NY 14094	Robert Harvey Services Director (517) 481-3170 4180 Keller Road, Suite B Holt, MI 48842

Application Data

Application Number: 8200159.22A
Date Received: 11/08/2022
Application Type: Greenfield Facility
Application Schedule: State

Existing Permit Data
Existing Permit Number: N/A
Existing Permit Issue Date: N/A
Existing Permit Expiration Date: N/A

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP

<No Inventory>

Consultant: Impact Compliance & Testing, Inc. **Contact:** Robert L. Hardy **Phone:** 517-481-3170
email: Rob.Harvey@inpactCandT.com

Review Engineer: Booker T. Pullen

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

Comments / Recommendations:
Issue: 10772R00
Permit Issue Date: xx 2023
Permit Expiration Date: March 31, 2031

1. Purpose of Application:

The purpose of Application No. 8200159.22A is to request a Title V permit for a greenfield facility that will be constructed on land that is located contiguous and adjacent to the existing Sampson County Disposal, LLC Landfill located at 7434 Roseboro Highway in Roseboro, Sampson County, North Carolina. The application was received on November 8, 2022 but was considered complete on December 14, 2022 when the toxics modeling files were received by the Air Quality Analysis Branch (AQAB).

Because this is a greenfield facility, the location was placed in the EJ database and evaluated as to whether it was located in an Environmental Justice community. After several discussions with upper management, it was decided that DAQ would send this application through a public hearing process which has a 30-day public comment period leading up to the hearing. This permit will be processed according to the procedures in 15A NCAC 02Q .0300 and will require that a Title V permit application is submitted within 12 months of beginning operation of any source that is a part of the proposed project. When the second application is submitted, the draft permit and review will go through a 30-day public notice and a 45-day EPA review prior to permit issuance.

The Responsible Official and facility contact for this application is Anthony Falbo, Senior Vice President of Operations, 5087 Junction Road, Lockport, New York, 14094.

2. Facility Description:

Sapphire RNG, LLC (Sapphire RNG) has entered into an agreement with the Sampson County Disposal Landfill (SCD) to install and operate a processing facility that will use the collected landfill gas (lfg) to produce renewable natural gas (RNG) which is a gas comprised of mostly methane that has a heating value comparable to pipeline natural gas. The RNG will be transferred to a nearby pipeline and distributed to end users as a substitute for fossil fuel derived natural gas. However, in the initial startup of the facility and the pipeline is not in place, the RNG from the facility will be compressed into specially designed mobile trailers and transported to a pipeline injection station. The SCD Landfill and the proposed Sapphire RNG facility are considered part of a single stationary source because they are both owned by GFL Environmental. Therefore, the construction and operation permit for this RNG facility is a significant modification of an existing Title V source as defined in 15A NCAC 02Q. 0500 Title V Procedures. Sapphire RNG is the owner and operator of the proposed facility and has requested that a separate Title V construction and operation permit be issued in their name and separate from the Title V permit for the Sampson County Disposal Landfill Facility. The proposed project will include an open (candlestick) flare, one thermal oxidizer, a Hydrogen Sulfide (H_2S) removal system and two Pressure Swing Adsorption Systems for processing the landfill gas into pipeline quality natural gas.

<u>Processing Facility:</u>

Gas collected by the Landfill will be transferred to Sapphire RNG via a pipeline where it initially undergoes compression and hydrogen sulfide (H_2S) removal. The landfill gas flows through vessels packed with activated carbon media. H_2S is adsorbed onto the media and converted to elemental sulfur attached to the media surface. When the media nears its adsorption capacity, the vessels are taken off-line during a scheduled shutdown (per the applicant 8 to 12 hours) and the media will be replaced. During the shutdown to replace the activated carbon media, the landfill gas will be combusted in flare at the Sampson County Disposal Landfill. All downstream processes (including the open flare) use gas from the outlet of the removal unit. Initial filtration and dewatering of the gas is also performed prior to the RNG refining process.

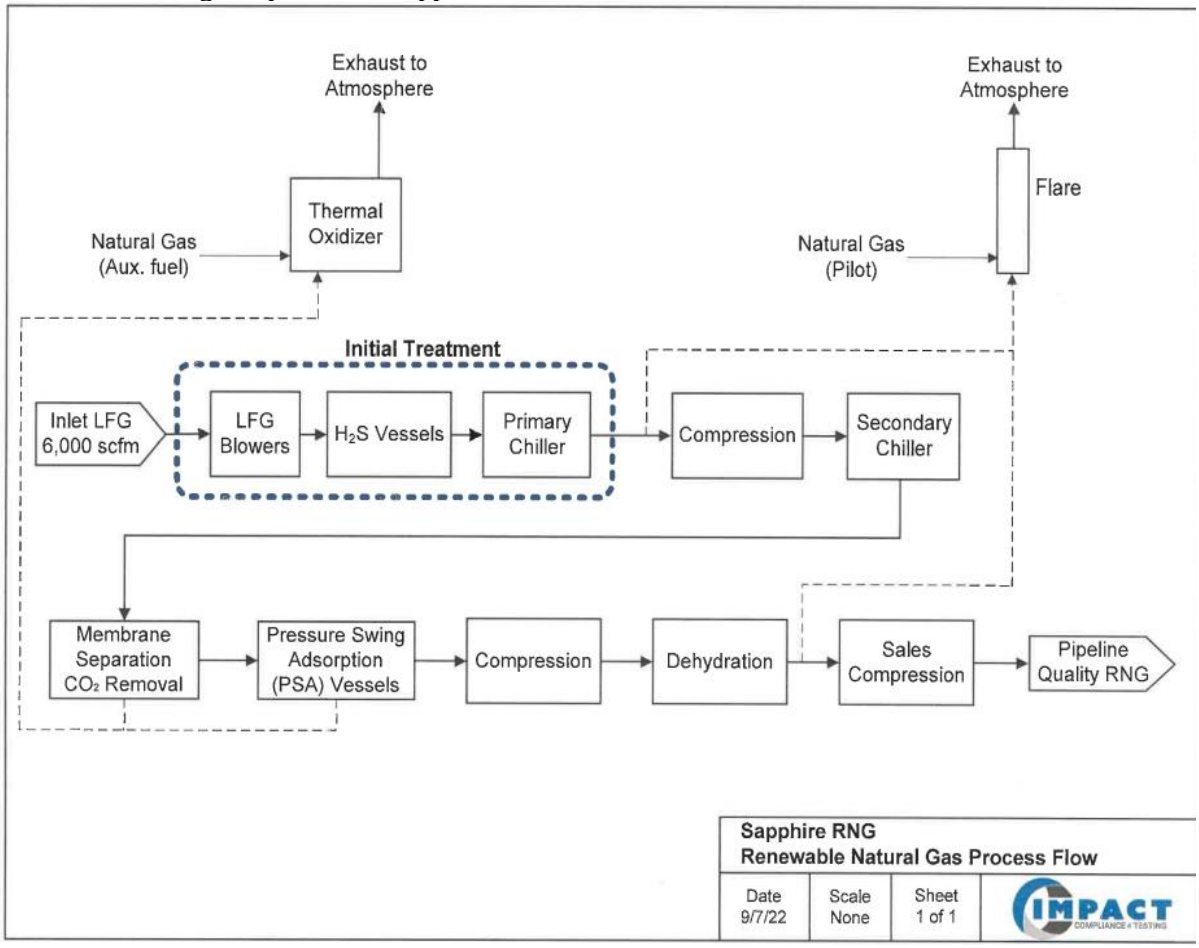
- **Gas chilling and compression:** The gas stream is chilled to remove additional moisture and compressed to high pressure for the next step (pressure swing adsorption and membrane separation). The condensate from this process will be handled in the same manner as it is currently handled at the landfill.

- **Pressure swing adsorption (PSA) and membrane process:** A Pressure swing adsorption process (PSA) is based on the phenomenon that under high pressure, gases tend to be trapped onto solid surfaces (i.e., to be "adsorbed"). The higher the pressure, the more gas is adsorbed. When the pressure is dropped, the gas is released, or desorbed.

- The PSA process is followed by non-regenerating vessels containing activated carbon that remove NMOC and some more of the remaining sulfur bearing compounds from the gas stream in preparation for the membrane separation process. In the membranes, carbon dioxide (CO_2) is separated from the methane and rejected as part of the waste gas stream (WGS) that goes to the thermal oxidizer. This process sends both CO_2 and H_2S to the thermal oxidizer.

- A final PSA process reduces oxygen (O_2) and nitrogen (N_2) levels in the RNG to target levels required by the pipeline operator.

Process Flow Diagram provided in application No. 8200159.22A



3. History/Background/Application Chronology:

History/Background

This is a greenfield facility with no previous permit.

Application Chronology

11/08/2022 Received permit application 8200159.22A.

11/15/2022 The ePayment for the application fee was received.

12/09/2022	A technical completeness request was sent to Sapphire RNG, LLG requesting modeling information. The appropriate information was received by the DAQ on 12/14/2022.
12/16/2023	Technical additional information request was sent to Sapphire RNG, LLC with question concern potential PFAS at the facility. A Response to the request was received by the DAQ on 12/22/2022.
01/19/2023	An email request was sent to the Sapphire RNG facility requesting that they submit (in writing) a detailed explanation of their requested construction activities prior to receiving an air permit.
01/20/2023	Applicability Determination # 3917 was sent to Sapphire RNG, LLC explaining the pre-construction activities that could be completed prior to the construction operation permit being issued.
01/24/2023	The DAQ requested some type of flow diagram for the facility to show the relationship between Black Creek Renewable Energy LLC, GFL, OPAL, and GFL Renewable. Received written description on 01/24/2023.
03/18/2023	Sent an additional information request for spreadsheet calculation clarifications. Information received on 3/20/2023.
04/03/2023	Draft permit and review forwarded to SSCB (Samir) for comments. Response received on 04/05/2023 with no comments.
04/03/2023	Draft permit and review were forwarded to the Fayetteville Regional Office. Comments were received on 04/06/2023 and incorporated into the draft permit.
04/18/2023	Revised draft permit and review forwarded to the Fayetteville Regional Office. Comments were received on 04/18/2023 and incorporated into the draft permit.
04/18/2023	Sent the draft permit and the engineering review to Dawn Reddix (Hearing Officer) of the Raleigh Regional Office.
05/08/2023	Sent additional information request via email regarding the change out of the H_2S activated carbon media and how long would the process take. Response 04/09/2023.
May xx 2023	Draft permit and permit review forwarded to public notice.
XX, xx, 2023	Public comment period ends. XXX comments received.
June 27, 2023	Public Hearing scheduled. Location: Clinton City Hall, 221 Lisbon Street, Clinton, NC 28328 from 5:00 pm to 9:00 pm.
XX, xx, 2023	Public Hearing ends.

4. Permitted Sources (All sources are new):

a. Sources/control devices that will be listed on the permit.

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description
ES-RNG Plant	Landfill Gas-to-Renewable Natural Gas Processing Plant (6,000 standard cubic feet per minute) consisting of: ● Compression/chiller system ● Two Pressure Swing Adsorption systems	CD-TOX CD-RNGFLARE CD-H_2S	Waste gas thermal oxidizer (3,172 standard cubic feet per minute, 20 million Btu per hour heat input) One backup open type candlestick flare (4,400 standard cubic feet per minute of landfill gas, 162 million Btu per hour heat input) Two H_2S Removal Vessels

5. Permit Modifications/Changes and TVEE Discussion:

- This is the first permit for this facility, therefore there are no changes to an existing permit.
- All permitted sources at the facility that emit criteria pollutants will be placed into the TVEE module.

6. Regulatory Review:

Sapphire RNG, LLC is subject to the following air quality regulations in addition to the General Conditions:

- 15A NCAC 02D .0202 "Registration of Air Pollution Sources"
- 15A NCAC 02D .0516 "Sulfur Dioxide Emissions from Combustion Sources"
- 15A NCAC 02D .0521 "Control of Visible Emissions"
- 15A NCAC 02D .0535 "Excess Emissions Reporting and Malfunctions"
- 15A NCAC 02D .0540 "Particulates From Fugitive Dust Emission Sources"
- 15A NCAC 02D .0605 "General Recordkeeping And Reporting Requirements"
- 15A NCAC 02D .0611 "Monitoring Emissions From TOX, H_2S Removal System, CD - RNGFLARE"
- 15A NCAC 02D .1100 "Control of Toxic Air Pollutants"
- 15A NCAC 02D .1806 "Control and Prohibition of Odorous Emissions"
- 15A NCAC 02Q .0504 "Option For Obtaining Construction and Operation Permit"
- 15A NCAC 02Q .0711 "Emission Rates Requiring a Permit"

<u>15A NCAC 02D .0202 - Registration of Air Pollution Sources</u>
Any person required to register a source of air pollution with the Division shall register the source on forms provided by the Division and shall provide the following information: (1) the name of the person, company, or corporation operating the sources; (2) the address, location, and county; (3) principal officer of the company; (4) quantities and kinds of raw materials used; (5) process flow sheets; (6) operating schedules; (7) total weights and kinds of air pollution released; (8) types and quantities of fuels used; (9) stack heights; and (10) other information considered essential in evaluating the potential of the source to cause air pollution.

15A NCAC 02D .0516 - Sulfur Dioxide Emissions from Combustion Sources
Emission of sulfur dioxide from any source of combustion discharged from any vent, stack, or chimney shall not exceed 2.3 pounds of sulfur dioxide per million BTU input. Sulfur dioxide formed by the combustion of sulfur in fuels, wastes, ores, and other substances shall be included when determining compliance with this standard. The only combustion sources at this facility will be the open-type flare (CD-RNGFLARE) and a thermal oxidizer (CD-TOX).

Gas collected by the Landfill will be transferred to Sapphire RNG where it initially undergoes compression and hydrogen sulfide (H_2S) removal; one pair of vessels in a lead-lag configuration that contain media that adsorbs H_2S and converts it to elemental sulfur. When the media nears its adsorption capacity, the vessel is taken off-line (a second vessel is placed into service), and the media replaced. All downstream processes (including the open flare) use gas from the outlet of the N28 removal unit. Initial filtration and dewatering of the gas is performed prior to the RNG refining process. Thus, the gas handled by the RNG plant equipment is treated landfill gas. Therefore, the normal operation for this facility is to route all the tail gas from the H_2S removal system to the thermal oxidizer (CD-TOX), the processed landfill gas will be converted to pipeline equivalent natural gas, and the open flare is used only as a backup control device.

Thermal Oxidizer (CD-TOX) SO_2 Emissions:
The waste gas stream is directed to the TOX for emission reduction before being released to the ambient air. The TOX consists of a burner section and upright combustion chamber (6-ft diameter by 40-ft height), similar to an enclosed flare. The TOX is designed to control up to ≈3,000 scfm of waste gas containing approximately 5.5% methane. This results in a maximum waste gas heat input of 10 million Btu per hour (mmBtu/hr). Due to the high methane recovery efficiency of the RNG process, the waste gas contains a minimal amount of methane and the TOX must be supplemented with natural gas to increase the waste gas stream to thermal oxidation temperature, generally 1,600 °F. The supplement fuel heat input required to maintain the unit for waste gas thermal oxidation is expected to be 10 mmBtu/hr, which is equivalent to a natural gas use rate of 165 scfm. The total heat input rating of the CD-TOX is 20 million Btu heat input.

TOX design flow rate ≈ 3,000 ft^3/min
Heat input rating of the TOX = 20 mmBtu/hr (10 mmBtu from tail gas and 10 mmBtu from natural gas).
Waste gas (tail gas methane flow rate) into TOX = 165 ft^3/min (waste gas @ 5.5% methane)
Supplemental fuel (natural gas) into TOX = 165 ft^3/min
The H_2S content in the inlet landfill gas = 300 ppmv (site specific value)
The H_2S content after scrubbing (adsorption) and going to the thermal oxidizer = 20 ppmv.

$$\frac{3{,}000\ ft^3}{min} \times \frac{60\ min}{hr} \times \frac{1012\ Btu}{ft^3} \times \frac{5.5}{100} \times \frac{1\ mmBtu}{1\ x\ 10^6\ Btu} = \frac{10.00\ mmBtu}{hr}\ from\ tail\ gas$$

$$\frac{165\ ft^3\ nat\ gas}{min} \times \frac{60\ min}{hr} \times \frac{1012\ Btu}{ft^3} \times \frac{1\ mmBtu}{1\ x\ 10^6\ Btu} = \frac{10.00\ mmBtu}{hr}\ from\ natural\ gas$$

The SO_2 emissions will be calculated using the waste gas and the supplemental natural gas and the assumption that all of the H_2S that is burned and released to the atmosphere will be converted to SO_2. The volumetric flow rate of the H_2S can be found using the Ideal Gas Law and the site estimated 20 ppmv of H_2S that remains in the waste gas to the TOX.

The National Institute of Standards and Technology (NIST) uses a temperature of 20 °C (293.15 K, 68 °F) and an absolute pressure of 101.325 kPa (14.696 psi, 1 atm) for standard temperature and pressure (STP). For an ideal gas (ambient air approximates an ideal gas), volume percent is the same as mole percent. Using these values, the constant for the volume that one mole of gas would occupy (molar volume) under STP would be 385 scf/lb-mole.

P = absolute pressure (1 atm)
V = volume
n = number of moles
R = ideal gas constant (0.08206 liter-atmosphere/gmole)
T = absolute temperature (20 ^{0}C + 273.15 ^{0}K = 293.15 ^{0}K)

PV = nRT

$$\frac{V}{n} = \frac{RT}{P}$$

$$\frac{V}{n} = \frac{0.08206\ liter - atm\ \times\ (20\ C\ +\ 273.15)\ K}{gmole\ -\ K} \times \frac{1}{atm} \times \frac{0.03531\ ft^3}{liter} \times \frac{453.59\ g}{lb} = \frac{385\ ft^3}{1b - mole}$$

Emission Factor for the inlet landfill gas at 300 ppmv H_2S:

$$\frac{300\ parts}{million} \times \frac{64.06\ lbs}{lbmoles} \times \frac{lbmole}{385\ ft^3} = \frac{49.92\ lbs}{million\ ft^3\ lfg}$$

Emission Factor for the landfill gas coming out of the H_2S (converted to SO_2) removal system going into the TOX at 20 ppmv H_2S:

$$\frac{20\ parts}{million} \times \frac{64.06\ lbs}{lbmoles} \times \frac{lbmole}{385\ ft^3} = \frac{3.33\ lbs\ SO2}{million\ ft^3\ of\ lfg}$$

Since the emission factors developed were on a lfg input into the facility (6,000 ft^3 per minute), the lbs of SO_2 (assuming all the H_2S to the TOX is converted to SO_2) that are emitted from the TOX are as follows. The following calculation is more conservative than using the actual design capacity of the TOX.

CD-TOX

$$\frac{6000\ ft^3}{min} \times \frac{60\ min}{hour} \times \frac{3.33\ lbs\ SO_2}{1\ x\ 10^6\ ft^3} = \frac{1.2\ lbs}{hour}$$

Flare (CD-RNGFLARE)

$$\frac{6000\ ft^3}{min} \times \frac{60\ min}{hour} \times \frac{49.92\ \ lbs\ SO_2}{1\ x\ 10^6\ ft^3} = \frac{17.97\ lbs}{hour}$$

The allowable emission rate for 02D .0516 is 2.3 lbs SO_2 per million Btu heat input.

1.2 lbs SO_2 ÷ 20 million Btu heat input of the TOX = 0.06 lbs/million Btu which is less that the allowable emission limit. [Note: the ppmv H_2S concentration could reach as much as 270 ppmv without going over the 2.3 lbs SO_2 per million Btu limit into the thermal oxidizer]

Compliance with 02D .0516 is expected as long as the H_2S removal system is operated properly.

If the landfill gas bypasses the H_2S control and is burned in the backup flare rated at 162 mmBtu per hour, compliance with 02D .0516 is expected. 17.97 lbs SO_2 ÷ 162 million Btu heat input of the TOX = 0.11 lbs/million Btu which is less that the allowable emission limit.

Open type flare (CD-RNGFLARE) SO_2 emissions:
The flare (rated at 162 mmBtu per hour) at this facility is used as a backup control device to burn the gas that is off specification (gas that can't be put into the pipeline for a particular reason) having a 97.4% methane content or landfill gas that has close to 50% methane content (if lfg by-passes untreated). Due to the high ratio of heat input to the sulfur content of these types of gases, this facility should always be in compliance with 15A NCAC 02D .0516 when the flare is being used.

15A NCAC 02D .0521 - Control of Visible Emissions
Flare (CD-RNGFLARE) and the thermal oxidizer (CD-TOX) are subject to this regulation because they both will be manufactured after July 1, 1971. Visible emissions from the flare and the thermal oxidizer are limited to a six-minute average opacity of 20% each. Visible emissions from a properly maintained and operated flare and thermal oxidizer are commonly not a concern. No monitoring, recordkeeping or reporting is required for landfill gas/natural gas combustion from these sources. Compliance is expected.

15A NCAC 02D .0535 - Excess Emissions Reporting and Malfunctions
If the source is not subject to NSPS (15A NCAC 02D .0524), NESHAPS (15A NCAC 02D .1110 or .1111), or these rules do NOT define "excess emissions," the Permittee shall report excess emissions in accordance with 15A NCAC 02D .0535 as follows: (1) Pursuant to 15A NCAC 02D .0535, if excess emissions last for more than four hours resulting from a malfunction, a breakdown of process or control equipment, or any other abnormal condition, the owner or operator shall: (a) notify the Regional Supervisor or Director of any such occurrence by 9:00 a.m. Eastern Time of the Division's next business day of becoming aware of the occurrence and provide: (i) name and location of the facility; nature and cause of the malfunction or breakdown; time when the malfunction or breakdown is first observed; expected duration; and estimated rate of emissions; (b) notify the Regional Supervisor or Director immediately when corrective measures have been accomplished; and (c) submit to the Regional Supervisor or Director within 15 days a written report as described in 15A NCAC 02D .0535(f)(3).

15A NCAC 02D .0540 - Particulates From Fugitive Dust Emission Sources
The owner or operator of a facility required to have a permit pursuant to 15A NCAC 02Q or a source subject to a requirement pursuant to 15A NCAC 02D shall not cause or allow fugitive dust emissions to cause or contribute to substantive complaints or excess visible emissions as defined in this Rule.

15A NCAC 02D .0611 – Thermal Oxidizer (CD-TOX)

1. As required by 15A NCAC 02D .0611, VOC, toxics and HAP emissions shall be controlled as described in the permitted equipment list.

a. Inspection and Maintenance Requirements: To comply with the provisions of this permit and ensure that emissions do not exceed the regulatory limits, the Permittee shall perform periodic inspections and maintenance (I&M) as recommended by the manufacturer. As a minimum, the Permittee shall perform an annual (for each 12-month period following the initial inspection) internal inspection of each primary heat exchanger and associated inlet/outlet valves to ensure structural integrity.

b. Monitoring Requirements - The Permittee shall ensure the proper performance of the thermal oxidizer (CD-TOX) by monitoring the following operational parameters:
   i. The Permittee shall properly operate, inspect and maintain the control device at all times.
   ii. The combustion zone temperature in the thermal oxidizer (CD-TOX) shall be maintained at a minimum 3-hour average of 1,400 degrees Fahrenheit during operation.
   iii. The Permittee shall continuously monitor and record the temperature in the thermal oxidizer.
   iv. These approved parameters shall apply at all times except as noted in the following:
      (A) The Permittee may re-establish any parameter and/or factor during subsequent testing. Compliance with previously approved parameters and/or factors is not required during subsequent required testing or other tests undertaken to re-establish parameters and/or factors by the Permittee.
      (B) The Permittee shall comply with applicable emission standards at all times, including during periods of testing.

c. Recordkeeping Requirements -The results of all inspections and any variance from manufacturer's recommendations or from those given in this permit (when applicable) shall be investigated with corrections made and dates of actions recorded in a logbook. Records of all maintenance activities shall be recorded in the logbook. The logbook (in written or electronic form) shall be kept on-site and made available to DAQ personnel upon request.

15A NCAC 02D .0611 – H_2S Carbon Adsorber (CD-H_2S)

1. As required by 15A NCAC 02D .0611, H_2S emissions shall be controlled as described in the permitted equipment list.

   a. Monitoring Requirements - The Permittee shall ensure the proper performance of the H_2S adsorption system by monitoring the following operational parameters:
      i. The Permittee shall monitor weekly the hydrogen sulfide concentration at the exhaust of CD-H_2S by use of a portable biogas analyzer.
      ii. At a minimum, the Permittee shall perform semi-annual calibrations of the biogas analyzer.
      iii. Establish a pressure range across the carbon adsorber vessels within 30 days after steady operation of the unit begins. Monitor on a daily basis the pressure-drop across the carbon adsorber vessels to verify they do not exceed TBD psig.

   c. Recordkeeping Requirements - The Permittee shall maintain the following records in a logbook (in written or electronic format). The records shall be kept on-site and made available to DAQ personnel upon request for:
      i. Daily carbon adsorber vessel pressure-drop measurements.
      ii. Weekly hydrogen sulfide concentration measurements at the exhaust of the carbon adsorber.
      iii. Dates and times that control device CD-H_2S is not in operation, what corrective actions were taken, when corrective actions were completed, and
      iv. Calibration results for the biogas analyzer and pressure gauge(s).
      v. Instances when the pressure drop is outside of the established pressure range.

15A NCAC 02D .1100 - Control of Toxic Air Pollutants

A facility shall not emit any of the toxic air pollutants listed in this regulation in such quantities that may cause or contribute beyond the facility's premises to any significant ambient air concentration that may adversely affect human health, except as allowed pursuant to 15A NCAC 02Q .0700. In determining these significant ambient air concentrations, the Division shall be governed by the list of acceptable ambient levels in milligrams per cubic meter at 77 ^{0}F (25 ^{0}C) and 29.92 inches (760 mm) of mercury pressure in this regulation. Modeled emission rates will be placed into the body of the permit. See Section 8 of this review below.

15A NCAC 02D .1806 - Control and Prohibition of Odorous Emissions
This regulation is State-enforceable Only. The owner or operator of a facility subject to this Rule shall not operate the facility without implementing management practices or installing and operating odor control equipment sufficient to prevent odorous emissions from the facility from causing or contributing to objectionable odors beyond the facility's boundary. There are no uncontrolled vents into the atmosphere from this facility. Compliance is anticipated.

15A NCAC 02Q .0504 - Option For Obtaining Construction and Operation Permit
Since this facility is following the permitting procedures in 15A NCAC 02Q .0300, the Permittee shall have 12 months from the date of beginning operation of the modified facility or source to file an amended application following the procedures in this Section. A permit condition will be placed in the construction and operation permit stating this requirement.

15A NCAC 02Q .0711 - Emission Rates Requiring a Permit
A permit to emit toxic air pollutants shall be required for any facility if all emission release points are unobstructed and vertically oriented whose actual rate of emissions from all sources is greater than the rates listed in this Rule. The table of TPER limits will be listed in permit.

7. NSPS, NESHAPS/MACT, PSD, 112(r), CAM:

NESHAP/MACT
There are no National Emission Standards For Hazardous Air Pollutants or Maximum Control Technology standards for this type of Industry that converts landfill gas to pipeline quality natural gas. Sapphire RNG, LLC is shielded from the following nonapplicable requirement. [15A NCAC 02Q .0512(a)(1)(B)]

40 CFR 63 Subpart HHH "National Emission Standards for Hazardous Air Pollutants From Natural Gas Transmission and Storage Facilities" is not applicable because this facility does not meet the definition of the Natural Gas Transmissions and Storage Facility source category. [40 CFR 63.1271]

The annual emissions of hazardous air pollutants (HAPs) are below the major source thresholds of 10 tpy for a single HAP and 25 tpy for total HAPs.

NSPS
There are no New Source Performance Standards for this type of industry that converts landfill gas to pipeline quality natural gas.

Sapphire RNG, LLC is shielded from the following nonapplicable requirement. [15A NCAC 02Q .0512(a)(1)(B)]

40 CFR 60 Subpart OOOOa "Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced After September 18, 2015" is not applicable because this facility does not meet the definition of the Crude Oil and Natural Gas Production source category. [40 CFR 60.5430a]

PSD

The facility's potential emissions of criteria pollutants do not exceed PSD permitting thresholds. Sampson County is located in an area that is considered attainment or non-classifiable area for all criteria pollutants. Sampson County has triggered increment tracking under PSD for PM_{10}, NOx and $PM_{2.5}$. The following calculations were done using the heat input for the open flare for CO and NOx with the emission factors for the open flare (CD-RNGFLARE) because this would be the worse-case hourly operation scenario.

Emission factor PM_{10} = 17 lbs per million cubic feet (EPA default emission factor)
Emission factor $PM_{2.5}$ = 17 lbs per million cubic feet
Emission factor NOx = 0.068 lbs per million Btu heat input (manufacturer data)

$$\frac{162\ x\ 10^6\ Btu}{hr} \times \frac{0.068\ lbs\ NOx}{10^6\ Btu} = \frac{11.02\ lbs\ NOx}{hr}$$

$$\frac{2{,}750\ ft^3}{min} \times \frac{97.4\ (CH_4)}{100} \times \frac{60\ min}{hr} \times \frac{17.0\ lbs\ PM10}{1\ x\ 10^6\ ft^3} = \frac{2.73\ lbs\ PM10}{hr}$$

$$\frac{2{,}750\ ft^3}{min} \times \frac{97.4\ (CH_4)}{100} \times \frac{60\ min}{hr} \times \frac{17.0\ lbs\ PM2.5}{1\ x\ 10^6\ ft^3} = \frac{2.73\ lbs\ PM2.5}{hr}$$

The worse-case scenario for increment from this facility is the operation of the open flare for an hour. This modification will result in an increase of 2.73 pounds per hour of PM_{10} and 11.02 pounds per hour of NOx, and 2.73 pounds per hour of $PM_{2.5}$.

Since the backup flare does not have any operation limitations, and the backup flare could possibly operate along with the thermal oxidizer during "non-normal" operation, the emissions of CO were calculated based on 8,760 hours of operation of the backup flare and the thermal oxidizer together. The result of this evaluation was that even if the two control devices operated simultaneously, the emissions of CO would still remain below the 250 ton per PSD threshold (220.8 tpy for flare + 17.53 tpy for TOX). See the facility wide emissions in Section 9 of this review.

112(r)

The facility is not subject to Section 112(r) of the Clean Air Act requirements because it does not store any of the regulated substances in quantities above the 112(r) thresholds.

CAM

A CAM plan will not be required because the facility is being processed according to the procedures in 15A NCAC 02Q .0300. The CAM plan will not be evaluated until the first renewal unless these sources are defined as large PSEUs under Part 64, CAM at the time of the 1st Time Title V permit.

8. Facility Wide Air Toxics:

The proposed facility has the potential to emit toxic air pollutants (TAPs) that are regulated by 15A NCAC 02D. 1100, Control of Toxic Air Pollutants. The collected LFG contains TAPs that are potentially transferred to the waste gas and combusted (controlled) in the TOX or the open flare each with 98% destruction efficiency. The list of default LFG constituents for municipal solid waste landfills in USEPA AP-42 Section 2.4 was compared to the TAP list in 15A NCAC 02D. 1100 to determine those compounds required to be evaluated. Additionally, hydrogen chloride was included based on the assumption that any chlorinated compounds in the lfg could form hydrogen chloride during combustion. Any TAP with a calculated emission rate that exceeds the Toxic Air Pollutant Permitting Emission Rate (TPER) in 15A NCAC 2Q.0711 was evaluated using a computer dispersion model to demonstrate that predicted off-site ground-level concentrations are less than (in compliance with) the Acceptable Ambient Levels (AAL).

Table 1: Molecular Weights and Concentrations of Toxic Air Pollutants in landfill gas (AP-42)

Constituent	Molecular Weight (AP-42)	AP-42 Concentrations LFG constituents
1,1,1-Trichloroethane (Methyl chloroform)	133.41grams/gmole	0.48 ppmv
1,1,2,2-Tetrachloroethane	167.85 grams/gmole	1.11 ppmv
1,1-Dichloroethene (Vinylidene chloride)	96.94 grams/gmole	0.20 ppmv
1,2-Dichloroethane (Ethylene dichloride)	98.96 grams/gmole	0.41 ppmv
Acrylonitrile	53.06 grams/gmole	6.33 ppmv
Benzene (no co-disposal or unknow co-disposal)	78.11 grams/gmole	1.91 ppmv
Carbon disulfide	76.13 grams/gmole	0.58 ppmv
Carbon tetrachloride	153.84 grams/gmole	0.004 ppmv
Chlorobenzene	112.56 grams/gmole	0.25 ppmv
Chloroform	119.39 grams/gmole	0.03 ppmv
Chlorine (Cl^- ion)	35.453 grams/gmole	42.0 ppmv
p-Dichlorobenzene	147.0 grams/gmole	0.21 ppmv
Dichloromethane (Methylene chloride)	84.94 grams/gmole	14.3 ppmv
Ethylene dibromide	187.88 grams/gmole	0.001 ppmv
Ethyl mercaptan (Ethanethiol)	62.13 grams/gmole	2.28 ppmv
Hydrogen sulfide	34.08 grams/gmole	35.5 ppmv
Hydrogen chloride	36.46 grams/gmole	----------
Mercury	200.61 grams/gmole	0.000292 ppmv
Methyl ethyl ketone	72.11 grams/gmole	7.09 ppmv
Methyl isobutyl ketone	100.16 grams/gmole	1.87 ppmv
Methyl mercaptan	48.11grams/gmole	2.49 ppmv
n-hexane	86.18 grams/gmole	6.57 ppmv
Perchloroethylene (Tetrachloroethene)	165.83 grams/gmole	3.73 ppmv

Toluene	92.13 grams/gmole	39.3 ppmv
Trichloroethylene (Trichloroethene)	131.40 grams/gmole	2.82 ppmv
Vinyl chloride	62.50 grams/gmole	7.34 ppmv
Xylenes	106.16 grams/gmole	12.1 ppmv

The following equation from AP-42, fifth edition, Section 2.4.4.1 "Emissions", Revised November 1998, was used to calculate the **volumetric** emission rate of individual toxic air pollutants in the landfill/methane gas.

The applicant used the maximum flow rate of landfill gas into the facility to calculate the toxic air pollutants that would come from the thermal oxidizer operated at 8760 hours per year. The applicant listed 50% methane content (Table 2.1 of the application) in the landfill gas.

$$\frac{6000\ ft^3}{min} \times \frac{60\ min}{hr} \times \frac{8760\ hrs}{yr} \times \frac{1\ m^3}{35.315\ ft^3} = \frac{89{,}299{,}165\ m^3}{yr}$$

= 89,299,165 m^3 lfg/year:

Sample calculation for vinyl chloride

$$Q_p = A \times Q_{lfg} \times \left(\frac{C_p}{1\times 10^6}\right)$$ AP-42 Section 2.4, Equation 3

Where:

Q_p = Emission rate of pollutants, m^3/yr
Q_{lfg} = landfill gas generation rate, m^3/yr (89,299,165 m^3/yr)
Q_{CH4} = methane gas rate at 50% methane content (44,649,582.5 m^3/yr)
C_p = concentration of vinyl chloride from AP-42 (7.34 ppmv)
A = multiplication factor (2.00) for 50% methane (CH_4) and 50 percent is CO_2, N_2, and other constituents)
MW = 62.50 gram/gram-mole

<u>Calculation of mass emission rate for vinyl chloride:</u>

$$Q_p = 2.0 \times \frac{44{,}649{,}582.5\ m^3}{yr} \times \frac{7.34\ parts}{1\ x\ 10^6} = \frac{656\ m^3}{yr}$$

Where:

UM_p = Uncontrolled mass emissions of pollutants, kg/yr
MW_p = Molecular weight of vinyl chloride (62.5 grams/gmole
Q_p = Emission rate of pollutant, m^3/yr (4.87 m^3/yr)
T^0 = 25^0 C (77 ^{0}F), recommended by AP-42 for landfill gas temperature if temperature is unknown

$$UM_p = \frac{656\ m^3}{yr} \times \left[\frac{62.5\ (g/gmole) \times (1\ atmosphere)}{(\frac{8.205\times10^{-5}\ m^3-atmospere}{gmol-\ ^0K}) \times \frac{1000\ g}{kg} \times (273+\ 25\ ^0C)\ ^0K}\right] \times \frac{2.205\ lbs}{kg} \times (1 - 0.98) = \frac{74.0\ lbs\ vinyl\ chloride}{yr}$$

The applicant calculated a value of 75.2 lbs per year of vinyl chloride. The annual TPER for vinyl chloride is limit is 35.1 lbs per year and the calculated emissions are greater than the TPER. This pollutant was modeled by the applicant at a value of 75.2 lbs per year.

Sample calculation for benzene:

$$Q_p = 2.0 \times \frac{44{,}649{,}582.5\ m^3}{yr} \times \frac{1.91\ parts}{1\ x\ 10^6} = \frac{170.5\ m^3}{yr}$$

Where:

Q_p = Emission rate of pollutant benzene, 170.5 m^3/yr
Q_{CH4} = 44,649,582.5 m^3/year
C_p = 1.91 ppmv (AP-42)
MW = 78.11 grams/gmole benzene
A = Multiplication factor (2.0 for 50 percent CH_4 in scrubbed landfill gas and 50 percent is CO_2, N_2, and other constituents)

$$Q_p = 2.0 \times \frac{44{,}649{,}582.5\ m^3}{yr} \times \frac{1.91\ parts}{1\ x\ 10^6} = \frac{170.5\ m^3}{yr}$$

The following equation from AP-42, fifth edition, Section 2.4.4.1 "Emissions", Revised November 1998, was used to calculate the uncontrolled mass emission rate of acrylonitrile present in the methane gas.

$$UM_p = \frac{170.5\ m^3}{year} \times \left[\frac{78.11\ g/gmole \times 1\ atmosphere}{\left(\frac{8.205 \times 10^{-5}\ m^3 - atmospere}{gmol - {}^0K}\right) \times \frac{1000\ g}{kg} \times (273 + 25\ {}^0C)\ {}^0K} \right] \times \frac{2.205\ lbs}{kg} \times (1 - 0.98) = \frac{24\ lbs\ benzene}{yr}$$

The applicant calculated a value of 24.4 lbs per year of benzene. The annual TPER limit for benzene 11.1 lbs per year and the calculated emissions are greater than the TPER. This pollutant was modeled by the applicant at a value of 24.4 lbs per year.

All of the other toxic air pollutants present in the landfill gas were calculated using a similar methodology as above and have been placed in the table, along with their respective TPER thresholds.

The calculated toxic air pollutant emissions from the Sapphire RNG Project have been summarized below and compared to TPER limits from an unobstructed stack per 15A NCAC 02Q .0711(b).

Table 5-1 Toxic Air Pollutant (TAP) Emissions Compared to TPER

Toxic Air Pollutant (TAP)[1]	Landfill Gas Concentration[2] (ppmv)	Molecular Weight	LFG Content (lb/MMcf)	Destruction Effeciency[3] (%)	Emission Factor (lb/MMcf)	Emission Rate 6,000 cfm LFG inlet (lb/hr)	(lb/day)	(lb/yr)	Toxic Permit Emission Rate (TPER) lb/hr	lb/day	lb/yr	Emissions / TPER lb/hr	lb/day	lb/yr
1,1,2,2-tetrachloroethane	1.11	167.85	0.48	98.0%	9.68E-03	3.48E-03	8.36E-02	3.05E+01			5.81E+02			5.3%
1,2-dichloroethane (ethylen	0.41	98.96	0.11	98.0%	2.11E-03	7.59E-04	1.82E-02	6.65E+00			3.51E+02			1.9%
Acrylonitrile	6.33	53.06	0.87	98.0%	1.74E-02	6.28E-03	1.51E-01	5.50E+01	1.05E+00	1.30E+00		0.6%	11.6%	
Benzene	1.91	78.11	0.39	98.0%	7.75E-03	2.79E-03	6.70E-02	2.44E+01			1.11E+01			220.8%
Carbon disulfide	0.58	76.13	0.11	98.0%	2.29E-03	8.26E-04	1.98E-02	7.23E+00		7.80E+00			0.3%	
Carbon tetrachloride	0.004	153.84	0.00	98.0%	3.20E-05	1.15E-05	2.76E-04	1.01E-01			6.18E+02			0.0%
Chlorobenzene	0.25	112.56	0.07	98.0%	1.46E-03	5.26E-04	1.26E-02	4.61E+00		9.27E+01			0.0%	
Chloroform	0.03	119.39	0.01	98.0%	1.86E-04	6.70E-05	1.61E-03	5.87E-01			3.97E+02			0.1%
Dichloromethane	14.3	84.94	3.15	98.0%	6.31E-02	2.27E-02	5.45E-01	1.99E+02	1.79E+00		2.21E+03	1.3%		9.0%
Ethyl mercaptan	2.28	62.13	0.37	98.0%	7.36E-03	2.65E-03	6.36E-02	2.32E+01	1.10E-01			2.4%		
Ethylene dibromide	0.001	187.88	0.00	98.0%	9.76E-06	3.51E-06	8.43E-05	3.08E-02			3.69E+01			0.1%
Hexane	6.57	86.17	1.47	98.0%	2.94E-02	1.06E-02	2.54E-01	9.27E+01		4.63E+01			0.5%	
Hydrogen Chloride[4]					3.98E+00	1.43E+00	3.44E+01	1.25E+04	7.40E-01			193.5%		
Hydrogen sulfide[5]			3.33	98.0%	6.66E-02	2.40E-02	5.75E-01	2.10E+02		5.10E+00			11.3%	
Mercury (total)	2.92E-04	200.61	0.00	0.0%	1.52E-04	5.48E-05	1.31E-03	4.80E-01		2.50E-02			5.3%	
Methyl ethyl ketone	7.09	72.11	1.33	98.0%	2.66E-02	9.56E-03	2.29E-01	8.38E+01	9.32E+01	1.56E+02		0.0%	0.1%	
Methyl isobutyl ketone	1.87	100.16	0.49	98.0%	9.73E-03	3.50E-03	8.41E-02	3.07E+01	3.16E+01	1.08E+02		0.0%	0.1%	
Methyl mercaptan	2.49	48.11	0.31	98.0%	6.22E-03	2.24E-03	5.38E-02	1.96E+01	5.00E-02			4.5%		
Perchloroethylene	3.73	165.83	1.61	98.0%	3.21E-02	1.16E-02	2.78E-01	1.01E+02			1.75E+04			0.6%
Toluene	39.3	92.13	9.40	98.0%	1.88E-01	6.77E-02	1.63E+00	5.93E+02	5.90E+01	1.98E+02		0.1%	0.8%	
Trichloroethylene	2.82	131.40	0.96	98.0%	1.92E-02	6.93E-03	1.66E-01	6.07E+01			5.44E+03			1.1%
Vinyl chloride	7.34	62.50	1.19	98.0%	2.38E-02	8.58E-03	2.06E-01	7.52E+01			3.51E+01			214.4%
Xylene	12.1	106.16	3.34	98.0%	6.67E-02	2.40E-02	5.77E-01	2.10E+02	6.84E+01	1.14E+02		0.0%	0.5%	

Notes
1 Toxic air pollutants; 15A NCAC 02Q.0711
2 Default concentrations from AP-42 Tables 2.4-1 and 2.4-2.
3 A flare control efficiency of 98% was used for all compounds unless otherwise noted.
4 HCl based on USEPA defalt that LFG contains 42 ppm chlorinated compounds
5 H_2S based on 20 ppm existing the sulfur removal process and 98% conversion.

In accordance with 15A NCAC 02D .1100 and in accordance with the approved application for an air toxic compliance demonstration, the following modeled permit limits shall not be exceeded. The modeling analysis was reviewed (Nancy Jones, Meteorologist, of Air Quality Analysis Branch (AQAB) on April 3, 2023. The placement of the emission sources, configuration of the emission points, and operation of the sources shall be in accordance with the submitted dispersion modeling analysis and should reflect any changes from the original analysis submittal as outlined in the AQAB review memo.

The dispersion modeling analysis was received by the Division of Air Quality on November 8, 2022 for Sapphire RNG in Roseboro, Sampson County, North Carolina. The purpose for modeling was to demonstrate compliance with guidelines specified in 15A NCAC 2D .1104 for Toxic Air Pollutants (TAPs) emitted in excess of the Toxic Permitting Emission Rates (TPERs) listed in 15A NCAC 02Q .0711. The modeling adequately demonstrates compliance, on a source-by-source basis, for all toxics modeled.

Three air toxics, benzene, hydrogen chloride and vinyl chloride, were evaluated using AERMOD (v22112) using the 2017-2018 surface data for Fayetteville/Pope AFB and upper air data for Greensboro. Five years of meteorological data were not required since all TAP impacts were less than 50 percent of the AAL.

The BPIP-Prime program (04274) and direction-specific building dimensions were not used since the buildings are more than 5L away from the stack. Receptors were placed at 50-meter intervals along the fenceline and out to 1,000 meters, and at 100-meter intervals out to 2,000 meters. The maximum modeled impacts are from the thermal oxidizer (TOX) since its impacts and emission rates are greater than the occasionally used flare. Release parameters and emission rates are attached.

Maximum Modeled Toxics Impacts for Sapphire RNG
Roseboro, Sampson County, NC

AQAB Modeled Emissions Rates

Pollutant	Averaging Period	TPER	Modeled Emission Rate	Max. Conc. (mg/m^3)	AAL (mg/m^3)	Modeled Impact % of AAL
Benzene	Annual	11.069 lbs/yr	24.4 lbs/yr	6.47E-8	1.2E-4	<1
Hydrogen Chloride	1-hour	0.74 lbs/hr	1.43 lbs/hr	1.57E-3	7E-1	<1
Vinyl Chloride	Annual	35.01 lbs/yr	75.2 lb/yr	1.99E-7	3.8E-4	<1

9. Facility Emissions Review (criteria pollutants):

Maximum operating conditions	Thermal Oxidizer	Open Flare
lfg flow to the RNG plant:	6,000 scfm	----------
Waste gas stream (WGS):	2,992 scfm	2,750 scfm
Methane content in the WGS:	5.5%	97.4%
Methane throughput:	165 scfm	2,679 scfm
Additional methane fuel:	165 scfm	----------
Heat input rate:	20.0 mmBtu/hr (HHV)	162.6 mmBtu/hr
Hours per year:	8,760 hrs/yr	used 8,760 for calcs
Maximum annual methane:	86 mmscf/yr	161 mmscf/yr
Maximum annual heat input:	175,295 mmBtu/yr	162,639 mmBtu/yr

Flare (CD-RNGFLARE) Emissions:

Calculated heat input of the open flare:

$$\frac{2{,}750\ ft^3\ CH_4}{min} \times \frac{97.4\ (methane\ content)}{100} \times \frac{60\ min}{hr} \times \frac{1{,}012\ Btu}{ft^3\ CH_4} \times \frac{mmBtu}{1{,}000{,}000\ Btu} = 162.6\ mmBtu/hr$$

Emissions factors used for flare calculations:

CO = 0.31 lbs/mmBtu (manufacturer data)
NOx = 0.068 lbs/mmBtu (manufacturer data)
PM_{10} = 17 lbs/mmcubic feet of methane

Sample calculated emissions from the open flare for CO and NOx at 8,760 hours: (the permit does not have a limit for the open flare usage even though in reality it should never operate at this rate). The flare is only used for backup when the thermal oxidizer is down, or the flare is burning unsellable gas. Normal operation is tail gas going through the thermal oxidizer.

CO Emission Factor = 0.31 lbs/mmBtu (manufacturer data)
Calculation of CO emission using 8,760 hours per year

$$\frac{2{,}750\ ft^3}{min} \times \frac{97.4\ (CH_{4\ content})}{100} \times \frac{60\ min}{hr} \times \frac{1{,}012\ Btu}{ft^3\ CH_4} \times \frac{8760\ hrs}{yr} \times \frac{0.31\ lbs\ CO}{1{,}000{,}000\ Btu} \times \frac{tons\ CO}{2000\ lbs} = \frac{220.8\ tons\ CO}{yr}$$

Calculation of CO emission using 1,000 hours per year (used by the facility in the application)

$$\frac{2{,}750\ ft^3}{min} \times \frac{97.4\ (CH_{4\ content})}{100} \times \frac{60\ min}{hr} \times \frac{1{,}012\ Btu}{ft^3\ CH_4} \times \frac{1000\ hrs}{yr} \times \frac{0.31\ lbs\ CO}{1{,}000{,}000\ Btu} \times \frac{tons\ CO}{2000\ lbs} = \frac{25.2\ tons\ CO}{yr}$$

NOx Emission Factor = 0.06 lbs/mmBtu (manufacturer data)

$$\frac{2{,}750\ ft^3}{min} \times \frac{97.4\ (CH_{4\ content})}{100} \times \frac{60\ min}{hr} \times \frac{1{,}012\ Btu}{ft^3\ CH_4} \times \frac{8760\ hrs}{yr} \times \frac{0.068\ lbs\ NOx}{1{,}000{,}000\ Btu} \times \frac{tons\ NOx}{2000\ lbs} = \frac{48.4\ tons\ NOx}{yr}$$

Sample calculated emissions from the open flare for PM_{10}:

PM_{10} Emission Factor = 17 lbs/mmft^3
Calculation based on an annual usage at 8,760 hours

$$\frac{2{,}750\ ft^3}{min} \times \frac{97.4\ (CH_4)}{100} \times \frac{60\ min}{hr} \times \frac{8760\ hrs}{yr} \times \frac{17.0\ lbs\ PM10}{1\ x\ 10^6\ ft^3} \times \frac{tons\ PM10}{2000\ lbs} = \frac{11.97\ tons\ PM10}{yr}$$

Thermal Oxidizer (CD-TOX) Emissions:

Emissions factors used for thermal oxidizer calculations:

CO = 0.20 lbs/mmBtu (manufacturer data)
NOx = 0.06 lbs/mmBtu (manufacturer data)

PM_{10} = 17 lbs/million cubic feet of methane (CH_4)
Heat input into the TOX = 20 mmBtu/hr
Methane gas flow rate into TOX = 165 ft^3/min (2,992 waste gas @ 5.5% methane)

Sample calculation of CO emissions

$$\frac{20.01\ x\ 10^6\ Btu}{hr} \times \frac{8{,}760\ hrs}{yr} \times \frac{0.20\ lbs\ CO}{10^6\ Btu} \times \frac{tons\ CO}{2000\ lbs} = \frac{17.53\ tons\ CO}{yr}$$

Sample calculation of NOx emissions

$$\frac{20.01\ x\ 10^6\ Btu}{hr} \times \frac{8{,}760\ hrs}{yr} \times \frac{0.06\ lbs\ NOx}{10^6\ Btu} \times \frac{tons\ NOx}{2000\ lbs} = \frac{5.26\ tons\ NOx}{yr}$$

Sample calculation of PM_{10}

$$\frac{330\ ft^3}{min} \times \frac{60\ min}{hr} \times \frac{8{,}760\ hrs}{yr} \times \frac{17.0\ lbs\ PM10}{1\ x\ 10^6\ ft^3} \times \frac{tons\ PM10}{2{,}000\ lbs} = \frac{1.474\ tons\ PM10}{yr}$$

In the application, the maximum operation hours for the thermal oxidizer were calculated using 8760 hours per year. However, the applicant calculated the annual usage of the flare at 1000 hours per year. In the unlikely event that the flare and the thermal oxidizer are in operation at the same time (flare burning off-specification gas and the thermal oxidizer is burning waste gas), the DAQ evaluated the total Carbon Monoxide emissions for both control devices at 8760 hours per year. This evaluation revealed that even with the operation of the thermal oxidizer and the flare at 8760 hours per year simultaneously, the emission of CO will still remain below the 250 ton per year threshold.

Air Pollutant	Thermal Oxidizer @ 8760	Open Flare @ 1000 hours	Open Flare @ 8760 hours	Totals @ 1000 hrs for flare	Total @ 8760 hrs for flare
CO emissions (tpy)	17.53 tpy	25.21 tpy	220.8 tpy	42.74 tpy	238.33 tpy
NOx emissions (tpy)_	5.26 tpy	5.53 tpy	Note 2	10.79 tpy	Note 2
PM_{10} emissions (tpy)	1.47 tpy	1.37 tpy	Note 2	2.86 tpy	Note 2
VOC emissions (tpy)	4.20 tpy	Note 1	Note 2	4.20 tpy	Note 2
SO_2 emissions (tpy)	5.25 tpy	Note 1	Note 2	5.25 tpy	Note 2
Total HAPs (tpy)	7.10 tpy	Note 1	Note 2	7.10 tpy	Note 2

Note 1:
These emissions are based on the constituents in the incoming landfill gas and are reported with the thermal oxidizer based on continuously processing 6,000 scfm of landfill gas. (In normal operation of the flare (CD-RNGFLARE), only the pilot flame would be lit because all the flow is directed to the thermal oxidizer.)

Note 2:
These values would not be large enough to change the PSD status and/or the HAP major status for the facility.

The following table was supplied by Sapphire to indicate the beneficial use of the landfill gas and the reductions of pollutants as a result of converting the landfill gas into natural gas and injecting it into the pipeline or placing the natural gas into tanker trucks versus combusting the landfill gas in the Sampson County Disposal landfill.

Air Pollutant	Flaring 6,000 SCFM LFG	6,000 SCFM RNG Plant (TPY)	TPY (reductions)
CO	294.63	42.74	(-251.89)
NOx	54.15	10.79	(-43.36)
VOC	4.2	4.20	0.00
SOx	78.5	5.25	(-73.30)
CO2	91,409.07	4,570.45	(-86,838.62)

Notes:

Flaring:

NOx emissions are based on an emission factor of 0.068 lb/mmbtu per AP-42 Industrial Flares

CO emisions are based on an emission factor of 0.37 lb/mmbtu per AP-42 Industrial Flares

VOC emissions are based on 595 ppmv of NMOC in LFG per AP-42 and 98% control at open flare

SOx emissions based on 295 ppm TRS in LFG

RNG Plant:

Emissions from submitted permit application

SOx emissions based on 20 ppm exhaust from sulfur treatment system

10. Compliance:

This is the first permit for this site and therefore no compliance inspections have been performed for this facility to date.

11. Public Notice/EPA and Affected State(s) 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. This draft copy will sent to the general public and any affected states during the 30 day notice. It will not be sent for a 45-day EPA review at this time because the draft permit is being processed using the State 02Q .0300 procedures and will require the submittal of a Title V permit application within one year of operation of the proposed source. At that time the draft permit will be sent again through a 30-day public comment period and a 45-day EPA review.

The 30-day public notice period for this application was from XXXXX 2023 through XXXXX_2023 _____public comments were received during the public comment period.

Due the nature of this facility, and the fact that it is located in an Environmental Justice Community, the Director decided that this application would also go through a public hearing process. The public hearing dates were from June 27, 2023 to _____2023.

12. Other Regulatory Considerations:

- A P.E. seal is NOT required for this permit application.
- A zoning consistency determination is required for this greenfield facility.
- A permit fee is required and was received via the electronic for this renewal application on November 15, 2022.

- PFAS:
  The public has questioned how air quality permits would "require control of air pollutants that are not classed as HAPs or TAPs but are in fact toxic" and specifically mentioned per- and polyfluoroalkyl substances, also known as PFAS. As a result, DAQ will require the following:

  (1) require disclosure of all volatile chemicals that may be used or released from Sapphire's processes, including those that are not listed as HAPs or TAPs; (2) condition the permit to prevent or control all emissions of emerging contaminants, including PFAS; and (3) require appropriate monitoring to ensure that the conditions are met during the facility's operation.

- PFAS has become a significant concern since 2017 when the public learned that GenX, a PFAS produced at the Chemours Fayetteville Works Facility, had been discovered in the Cape Fear River. Since then, Chemours-related compounds have been found in an expanding radius around the facility and as far downstream as New Hanover and Brunswick Counties. PFAS compounds are commonly used in industrial processes including the production of lithium-ion batteries and industrial PFAS air emissions can deposit these compounds into surface water or soil and eventually reach groundwater.

Questions sent to Sapphire on 12/16/2023 concerning air emissions of PFAS

a. Will your facility use any material or products in your operations that contain fluorinated chemicals? If so, please identify such materials or products and the fluorinated chemicals they contain.
b. Will your facility formulate/create products or byproducts (directly or indirectly) that contain fluorinated chemicals (across multiple media)? If so, please identify such products or byproducts and the fluorinated chemicals they contain.
c. Will your facility generate solid, liquid, or gaseous related emissions, discharges, or wastes/products containing fluorinated chemicals? If so, please identify such waste streams or materials and the fluorinated chemicals they contain.
d. Do your facility's processes or operations use equipment, material, or components that contain fluorinated chemicals (e.g., surface coating, clean room applications, solvents, lubricants, fittings, tubing, processing tools, packaging, facility infrastructure, air pollution control units)? Could these processes or operations directly or indirectly (e.g., through leaching, chemical process, heat treatment, pressurization, etc.) result in the release of fluorinated chemicals into the environment?

e. List the fluorinated chemicals identified (i.e., through testing or desktop review) above in your response under the appropriate methods/approaches? If one is not, are they on any other known US or International target lists?
    - OTM-45 (air emissions)
    - Methods 533 & 537.1 (drinking water)
    - SW-846: Method 8327 (water)
    - Draft Method 1633 (water, solids, tissue)
    - "Total PFAS" Draft Method 1621 for Adsorbable Organic Fluorine (wastewater)
    - Non targeted analytical methods
    - Qualitative approach through suspect screening

f. Are there other facilities or operations in the U.S. or internationally engaged in the same or similar activities involving fluorinated chemicals addressed in your response to the above questions? If so, please provide facility identification information? In addition, are there any ISO (International Organization for Standardization) certification requirements?
g. Do you plan to store AFFF on site, use it in fire training at the site, use it for fighting fires at the facility, or include it in a fire fighting system at the site?
h. Are other emerging contaminants (e.g., 1,4-dioxane, brome, perchlorate, 1,2,3-Trichloropropane) used in some capacity within your facility or operations?
i. Do you need technical assistance to answer the above questions?

In identifying any fluorinated chemicals or emerging contaminants in response to any of the above questions, please use CAS numbers (if available) and specify the relevant quantities of any such chemicals. If your answers to any of the above questions rely on assumptions or, if information necessary to respond to any of these questions is unavailable, please state. If any of the information requested is deemed a "trade secret" under N.C.G.S. § 66-152(3) and subject to confidential treatment under N.C.G.S. § 132-1.2(1) as required under the Public Record Act, please contact us to discuss proper designation of this information.

Sapphire Responses to Questions received by the DAQ via email on 12/22/2023.

- Question "a" answer: The RNG project (construction as well as operation) will not produce any additional fluorinated chemicals.
- Question "b" answer: The RNG project (construction as well as operation) will not produce any additional fluorinated chemicals.
- Question "c" answer: The landfill gas that feeds the RNG process contains trace quantities of fluorinated compounds. These will be presented in the RNG plant's condensate (as they are in the current condensate from landfill), present in the waste gas to the thermal oxidizer (TOx), present in the activated carbon utilized for removal of volatile organic compounds from the landfill gas and to some extent in the media used in the Sulfur Treatment System.
- The condensate will be handled with the same precautions being taken at the landfill at this time. The emissions from the TOx will be source tested to comply with applicable BACT and the solid waste generated will be disposed using best management practices after profiling of the waste.
- Question "d" answer: The RNG project (construction as well as operation) does not use and will not produce any additional fluorinated chemicals.
- Question "e" answer: Same as item "c".
- Question "f" answer: Same as item "a"
- Question "g" answer: No.
- Question "h" answer: No.
- Question "i" answer: No.

Additional responses to Questions from the DAQ.

- Sapphire has not conducted any analysis for PFAS. I don't think there is precedent for such analysis in the landfill industry so far.
- As we mentioned in our response, the inlet gas handled by the RNG plant is the same gas that is currently combusted at the landfill flares, with the exception of the gas being used beneficially for RNG and producing a reduction of ~90% in stationary source emissions.

In response to the growing concern about fluorinated chemicals, and the fact that Landfills have been identified as possible sources of polyfluorinated substances, the Department of Environmental Quality upper management has directed Permitting to place the following items or similar in the Sapphire Permit and other landfill gas-to-renewable natural gas facilities.

State-enforceable only

- An initial testing requirement of the inlet landfill gas for per- and polyfluorinated substances in the gas will be placed into permit.

  TESTING REQUIREMENT – As required by 15A NCAC 02D .0605, the Permittee shall conduct an initial performance test for per- and polyfluoroalkyl substances (PFAS) at the inlet where the landfill gas enters the facility (ES-RNG Plant).
  - The Permittee shall utilize a DAQ approved reference test method in accordance with the testing protocol submittal form.
  - The Permittee shall submit a protocol to DAQ at least 45 days prior to initial testing and shall submit a notification of initial compliance testing at least 15 days in advance of the testing. The protocol must be approved by DAQ in advance of the testing.
  - Testing shall be completed within 180 days of commencement of operation of the new equipment unless an alternate date is approved in advance by DAQ.
  - The Permittee shall submit a written report of the test results to the Regional Supervisor, DAQ, no later than 30 days following sample collection test in accordance with 15A NCAC 02D .2602(f), unless an alternative date is approved in advance by DAQ.

- Disclosure of Information Relating to Emissions of Fluorinated Chemicals
  [15A NCAC 02Q .0308(a); 15A NCAC 02Q .0309(b)]

  The Permittee shall have an ongoing duty to disclose the presence of materials containing fluorinated chemicals at the facility that have the potential to result in the emission of fluorinated chemicals to the environment. Such disclosures shall be in writing and submitted to the Regional Office Supervisor within thirty days of the Permittee becoming aware of such information unless such information has already been disclosed to DAQ by the Permittee. The disclosure shall describe the identity, quantity, and use of such material to the extent known. DAQ may require the permittee to conduct analysis or testing of fluorinated chemical emissions as necessary to properly evaluate emissions sources at the facility. As used in this condition, the term "fluorinated chemicals" includes but is not limited to per- and polyfluoroalkyl substances (PFAS).

13. Recommendations:

The permit application for Sapphire RNG, LLC located in Roseboro, Sampson County, North Carolina has been reviewed by DAQ to determine compliance with all procedures and requirements. DAQ has determined this facility is complying or will achieve compliance, as specified in the permit, with all requirements that are applicable to the affected sources. DAQ recommends the issuance of Air Permit No. 10772R00.