NORTH CAROLINA
DIVISION OF AIR QUALITY
Application Review

Issue Date: xx

Region: Fayetteville Regional Office
County: Bladen
NC Facility ID: 0900096
Inspector's Name: Jeffrey D. Cole
Date of Last Inspection: 01/08/2020
Compliance Code: W / Violation - procedures

Facility Data	Permit Applicability (this application only)
Applicant (Facility's Name): Optima TH **Facility Address:** Optima TH 15855 Highway 87 West Tar Heel, NC 28392 **SIC:** 4925 / Gas Production/Distribution **NAICS:** 22121 / Natural Gas Distribution **Facility Classification: Before:** Permit/Registration Pending **After:** **Fee Classification: Before:** N/A **After:**	**SIP:** 02D .0516, .0521, .0535, .0540, .1100, and .1806 **NSPS:** N/A **NESHAP:** N/A **PSD:** N/A **PSD Avoidance:** N/A **NC Toxics:** 02Q .0711 **112(r):** N/A **Other:** 02Q .0207, .0304, and .0504

Contact Data

Facility Contact	Authorized Contact	Technical Contact
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Application Data

Application Number: 0900096.20A
Date Received: 08/20/2020
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>

Review Engineer: Rahul Thaker

Review Engineer's Signature: **Date:** February 25, 2021

Comments / Recommendations:
Issue 10673/R00
Permit Issue Date: xx
Permit Expiration Date: 8 years from issuance date

1. Purpose of Application

Optima TH LLC ("Optima") submitted an application to obtain an air permit in accordance with 15A NCAC 02Q .0300 "construction and operation permit" on August 20, 2020. The application deemed complete by DAQ on this date. Additional information requests were sent from the DAQ to Optima on September 3, 2020 and October 23, 2020.

A requirement in accordance with 15A NCAC 02Q .0504 will be placed into the air permit that will specify the requirement to obtain an operating permit under the Title V of the Clean Air Act (CAA).

2. Facility Description

Optima TH facility (Facility ID 0900096) is located on the property of Smithfield Fresh Meats Corp – Tar Heel facility (Facility ID 0900055), Tar Heel, Bladen County, NC. The Smithfield Fresh Meats facility is a hog slaughter, meat preparation, and rendering operation. The Optima facility receives biogas produced by Smithfield Meats' wastewater treatment plant (WWTP), including existing anaerobic digesters and associated biogas collection system. It processes biogas, removes the impurities, and separates and sells methane as a renewable natural gas to Duke Energy by transporting it via the Piedmont Natural Gas Company's pipeline.

The Optima TH facility's primary business activity is classified under the Standard Industrial Classification (SIC) code 4925 "Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or Establishments engaged in the manufacture and/or distribution of gas for sale, including mixtures of manufactured with natural gas…" under the Major Group "Electric, Gas, And Sanitary Services".

3. Application Chronology

August 20, 2020	Fayetteville Regional Office (FRO) received the application.
August 21, 2020	DAQ acknowledged the receipt of the application and considered the application complete on this date.
August 25, 2020	Raleigh Central Office (RCO) received the application from FRO.
September 3, 2020	Requested additional information on emissions calculations.
September 7, 2020	Received the requested information on emissions calculations.
October 23, 2020	Requested to complete D3 Form and provide building parameters for DAQ modeling.
November 4, 2020	Received the additional information on D3 Form and building parameters.
November 18, 2020	DAQ completed its own modeling on facility H_2S and SO_2 emissions.
December 8, 2020	Pre-public notice draft permit documents sent to central office personnel (supervisor, compliance), applicant, and regional office.
December 16, 2020	DAQ extended the un-official review period for the applicant till January 15, 2021 and requested actual SO_2 emissions information.
xx	Draft permit documents sent for public noticing.
xx	Public comment period ends.
xx	Permit issued.

4. Compliance Status

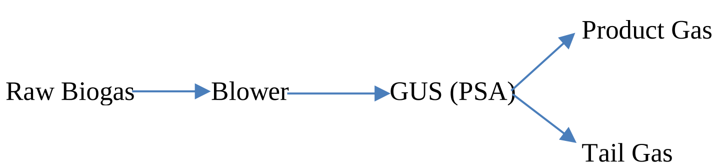
The facility has been built and in operation since December 11, 2019. Optima TH (owner/operator) has constructed and operated a major stationary source, violating both NC's "construction and operation permits" program in 15A NCAC 02Q .0300 and the Title V program in 02Q .0500 with regard to the new flare. The DAQ through Fayetteville Regional Office (FRO) issued a Notice of Violation / Notice of Recommendation for Enforcement (NOV/NRE) on June 18, 2020 for the above matter.

5. Proposed Facility

The applicant has constructed a non-emitting gas upgrading system (GUS) and an emitting candlestick (open) flare.

5.1 Overview

Optima TH filters the raw biogas from the Smithfield facility, selecting for methane to produce pipeline quality renewable gas (RNG). The separation of methane from other biogas constituents occurs using the Gas Upgrading System (GUS) which is comprised of a Guild Pressure Swing Adsorption (PSA) system.



In general, PSA processes utilize the fact that under high pressure, gases tend to be attracted to solid surfaces, or "adsorbed". The higher the pressure, the more gas is adsorbed. When the pressure is reduced, the gas is released, or desorbed. PSA processes can be used to separate gases in a mixture because different gases tend to be attracted to different solid surfaces more or less strongly. Specific adsorbent materials (e.g., zeolites, activated carbon, molecular sieves, etc.) are used as a trap, preferentially adsorbing the target gas species at high pressure. The process then swings to low pressure to desorb the adsorbed material. PSA systems usually consist of two or more adsorption vessels; while one vessel is going through adsorption, the other goes through regeneration (desorption).

The Guild[1] describes its PSA technology as "simple-to-operate technology [that] has been installed at wastewater treatment plants and commercial digesters such as hog farms and rendering plants". The technology offers the following main benefits:

- Single step removal of impurities
- All media is regenerated – no need for replacement
- H_2S completely removed from any level up to 7000 PPM

The recovered methane (RNG or "product gas") meets the requisite quality specifications prior to being injected into Piedmont Natural Gas pipeline for off-site consumption.[2] The nonmethane constituents of the biogas, referred to as "tail gas", are oxidized using the proposed candlestick flare. The candlestick flare is also used to combust unrefined biogas during times when the upgrading system's operation is temporarily down for maintenance and/or repairs or unexpected events. Additionally, the candlestick flare is used to combust the "product gas", during facility startup and when the product gas does not meet pipeline specifications. The following provides definitions of each of these gas terms:

- Biogas - Gas produced by the biological decomposition of organic wastes in the wastewater treatment plant serving the Smithfield – Tar Heel facility. The observed and anticipated average biogas composition, by volume, is as follows: 65.0% methane (CH_4), 0.5% nitrogen (N_2), 34.17% carbon dioxide (CO_2), 0.02% oxygen (O_2), 0.01% ammonia (NH_3), and 0.3% hydrogen sulfide (H_2S). The biogas composition and production will vary depending on weather conditions, facility management practices, and other factors. The average biogas composition listed above is based on historic biogas production and constituent testing provided by Smithfield to Optima TH.

- Product Gas - Gas generated by the GUS that is approximately 98-99.9% methane by volume and meets all pipeline specifications, except delivery temperature and pressure requirements of the receiving utility.

- Tail Gas - The portion of the biogas separated from the product gas and generated by the GUS as part of the biogas upgrading process, primarily composed of carbon dioxide.

- Renewable Natural Gas (RNG) - Gas that complies with all pipeline specifications established by Piedmont Natural Gas, including minimum delivery pressure and temperature requirements.

Candlestick Flare (ID No. ES-1)

The installed flare will act both as an emission source and a control device for the facility. The maximum heat input capacity of the flare is 50 million Btu per hour when using biogas, product gas, tail gas, propane, or natural gas as fuel. The flare operation will be governed by how the GUS operates and does not operate: normal operation, bypass operation, and off-spec operation. These operating scenarios are described below with the associated schematics:

Operating Scenario 1: Normal Operation

During the normal operation, the facility operation consists of the GUS receiving biogas and processing the biogas to produce tail gas and product gas. The product gas is injected into the existing natural gas pipeline as RNG after being compressed to pipeline pressure using electrically powered compressors. The tail gas is oxidized in the facility candlestick flare (ES-1), which utilizes propane or natural gas as pilot fuel. At times during normal operation, a small

[1] https://www.guildassociates.com/BiogasPur.
[2] Appendix F of the Piedmont Natural Gas Service Regulations, as approved by the North Carolina Utility Commission's January 11, 2019 Order, inter alia Docket No. G-9, Sub 698.

portion of the total biogas flow may be bypassed around the GUS and directed to the candlestick flare without methane recovery to increase the heating value of the flared gas to enhance tail gas combustion and ensure compliance with the emission standard of sulfur dioxide (SO_2). The normal operation is assumed to last 8,160 hours in any 12-months of operation.

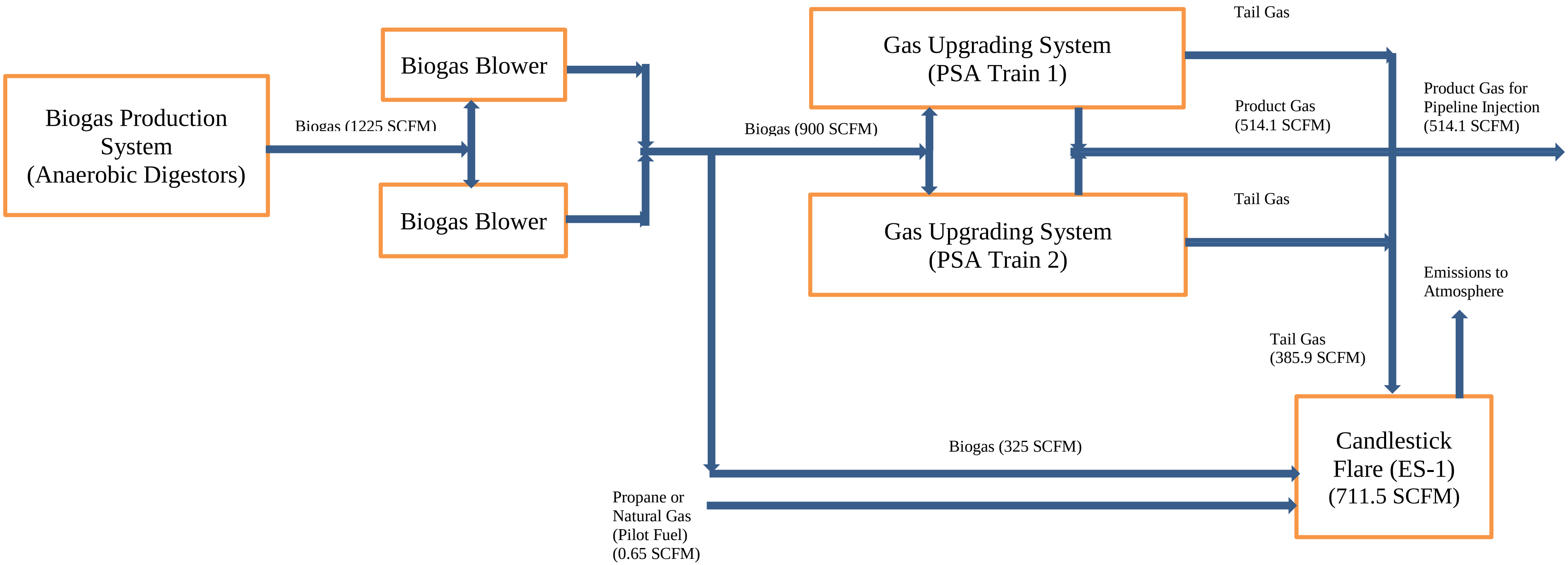
Operating Scenario 2: Bypass Operation

The Optima TH facility is designed to operate continuously, though it is expected that facility operations will be interrupted from time to time to perform necessary maintenance activities or for unpredictable events, such as extreme weather events or malfunctions of critical biogas system components. In such instances, the facility will either combust biogas in the candlestick flare or store biogas in the existing wastewater treatment facility's covered lagoon digesters for a short period of time. This infrequent operating scenario, not associated with the normal operation of the facility, is considered as "Bypass Operation." These infrequent events are conservatively estimated to occur for no more than 240 hours in any 12-months period. Therefore, the emission calculations for the facility assume combustion of the maximum flow of biogas in the candlestick flare for a total of 240 hours per 12-month period. The GUS will not be operated during Bypass Operation.

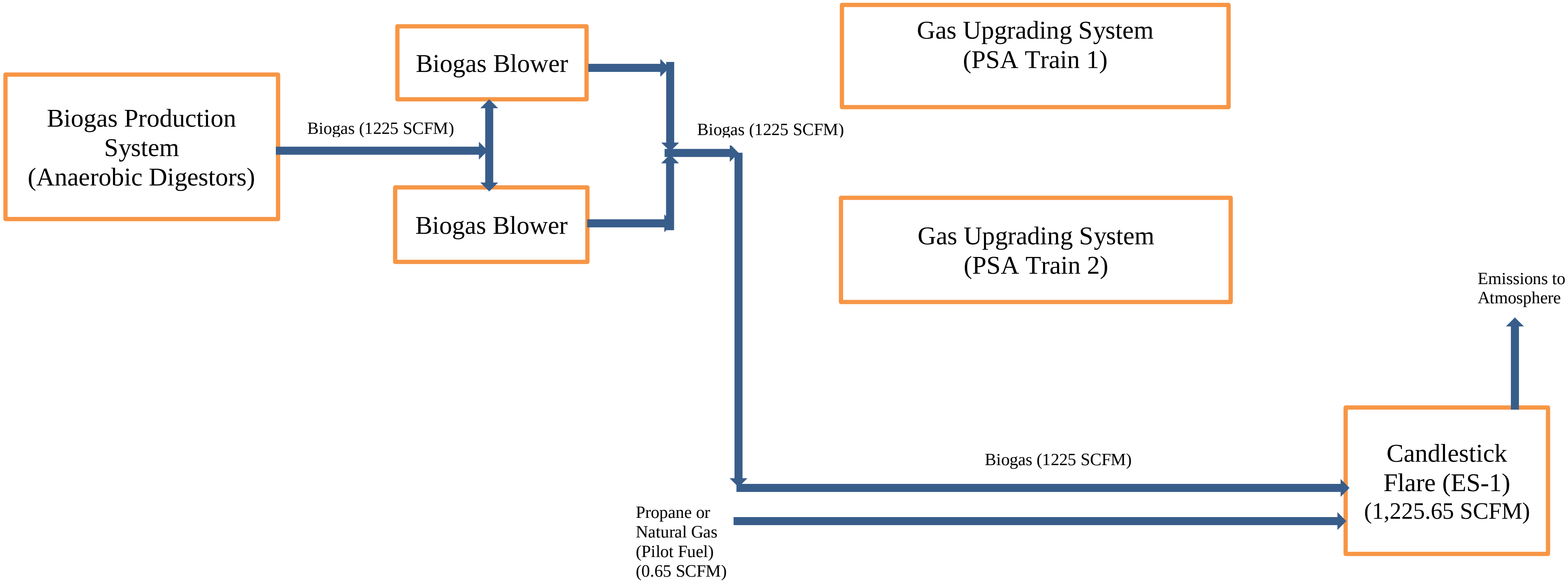
Operating Scenario 3: Off-Spec Operation

There will be brief periods of time when the product gas produced by the GUS does not meet pipeline specifications and therefore cannot be injected into the natural gas pipeline. During these times, the product gas (in addition to separated tail gas) will be combusted at the Optima TH facility in the candlestick flare. Product gas will also be combusted in the candlestick flare during GUS startup, which is anticipated to take one hour or less. These events are conservatively estimated to occur for no more than 360 hours in any 12-months period. Therefore, the emission calculations for the facility assume combustion of the maximum flow of product gas in the candlestick flare for a total of 360 hours per 12-months period. This hourly operating assumption is based on the operation of similar biogas upgrading facilities, the unfavorable economics of operating the biogas upgrading equipment without pipeline injection and RNG offtake, and the operation of the biogas.

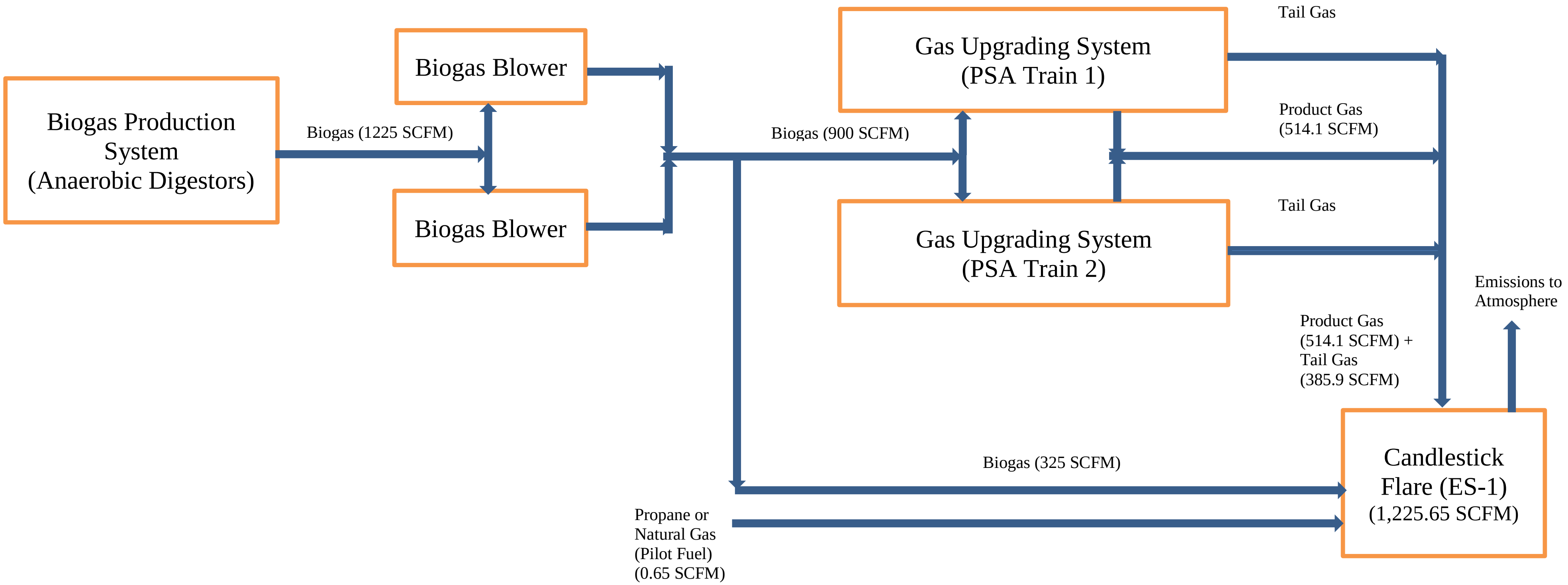
Process Flow Diagram
Operating Scenario 1: Normal Operation (8,160 hours)



Process Flow Diagram
Operating Scenario 2: Bypass Operation (240 hours)



Process Flow Diagram
Operating Scenario 3: Off-Spec Operation (360 hours)



5.2 Stationary Source Determination

As part of this application, Optima TH (ID No. 0900066) and Smithfield Fresh Meats Corp – Tar Heel (ID No. 0900055) were evaluated as to whether the two facilities constituted one single stationary source or two separate stationary sources for Clean Air Act (CAA) permitting.

If the DAQ determines that both of these facilities constituted a single stationary source in the context of CAA permitting, then, the Optima TH application cannot be processed as a separate source from the Smithfield facility. If the two facilities are determined to be a single stationary source, a PSD major modification application (satisfying all applicable requirements: BACT, source impact analysis, additional impacts, Class I, etc.) will be required for SO_2 emissions because the modification has potential SO_2 emissions greater than the PSD significance emission rate and the existing Smithfield facility is a major stationary source for PSD.

The following evaluation process is in accordance with 40 CFR §51.166(b)(5) as incorporated in NC's State Implementation Plan (SIP)-approved PSD Program (15A NCAC 02D .0530) and was used to evaluate two facilities. A three-prong test is used in accordance with the rule to answer the following questions: (i) do the two facilities belong to the same industrial grouping, (ii) are they located on one or more contiguous or adjacent properties, and (iii) are they under the control of the same person or (persons under common control)?

It should be noted that the same above process is used for determining whether a stationary source is a "major source" in §70.2 as incorporated in NC's approved State Operating Permit Program (15A NCAC 02Q .0500).

Optima TH has asserted that it is a separate stationary source from the Smithfield Fresh Meats facility and should not be deemed one single stationary source.

The following facts and information need to be considered, which is based on telephone conversations[3], email exchange[4], and review of North Carolina Utilities Commission (NCUC) docket[5]:

- Optima TH facility is located on the Smithfield facility. Smithfield has leased the portion of its Tar Heel facility land to Optima TH.

- Optima TH has constructed and is operating a gas upgrading system (GUS) and an open flare since December 11, 2019.

- Both Smithfield and Optima TH have confirmed that the Optima TH facility is located to serve only the byproducts (biogas) produced by the Smithfield facility. Both confirmed that the Optima TH facility is designed to meet only the biogas generated from the Smithfield facility. Both have confirmed that in order to process additional biogas in Optima TH facility (from other suppliers, other than Smithfield), its existing gas upgrading capacity needs to be increased. Optima TH has also confirmed that it does not purchase any biogas from other suppliers at this time and if it decides to process additional biogas from other suppliers, it will have to increase its existing capacity.

- Smithfield has stated to NCUC that "Optima TH project will allow all biogas produced from [its Tar Heel] facility to be cleaned and injected…"

- Smithfield has confirmed that it has no plans to revise its current Title V permit for its permission for biogas burning in its existing boilers (ID Nos. ES-1 through ES-3) and flaring off biogas in its existing flare (ID No. CD-1) due to Optima TH operations.

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[3] Rahul Thaker (DAQ) and Gus Simmons (Consultant for Optima TH) on 9/2 and 9/3/2020, and Rahul Thaker (DAQ) and Robert Harris (Smithfield Fresh Meats Corp – Tar Heel) on 9/3/2020.

[4] Keith Bailey (Smithfield Foods) and Rahul Thaker (DAQ), 9/18/2020.

[5] No. G-9 Sub 726 for "*Application of Optima TH, LLC for Approval to Participate in Pilot Program*", 7/12/2018, https://starw1.ncuc.net/NCUC/PSC/DocketDetails.aspx?DocketId=71b00827-9251-484d-82d6-18b22bff9a4e.

- Optima TH has currently removed the Smithfield's capability to burn biogas in the above boilers or flaring off in the above flare. Optima TH sealed off the pipes delivering biogas to Smithfield's boilers and flare (flanged off and bolted). However, Smithfield retains the authority to remove the flanged-off piping to both boilers and flare whenever it wishes.

- If Optima's GUS and flare are not operational for an extended period of time, Smithfield's flare and boilers could operate. Smithfield does not anticipate having to operate its flare. It would only be necessary if GUS and flare system are not functional. The possibility of both systems being out of commission for an extended period are low.

- Optima has the right to purchase the biogas from Smithfield and not a requirement (mandate) to purchase as per Smithfield. Same is also correct that Smithfield has the right to sell and not a mandate (requirement) to sell its biogas to Optima.

<u>Prong 1: Same Industrial Grouping</u>

In general, pollutant-emitting activities shall be considered as part of the same industrial grouping if they belong to the same two-digit SIC (Standard Industrial Classification) code.

The SIC code for the Smithfield facility is 2011 "Meat Packing Plants" under the Major Group 20 "Food And Kindred Products". The SIC code for Optima TH is 4925 "Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or Establishments engaged in the manufacture and/or distribution of gas for sale, including mixtures of manufactured with natural gas…" under the Major Group 49 "Electric, Gas, And Sanitary Services".

Optima TH has argued in the air permit application that "the [Smithfield and Optima TH] facilities conduct entirely different and distinct activities and do not share a common industrial grouping."

It appears facially to DAQ that these entities do not have the same industrial grouping. However, the DAQ also evaluated whether the Optima TH facility is a "support facility" for Smithfield's primary activity of meat products packing.

EPA has stated that "a support facility analysis is only relevant under the SIC-code determination. EPA explained that when two activities have different SIC codes, a support facility analysis may be conducted to determine whether the activities should be treated as having the same industrial grouping. The [1980 NSR rules] preamble clarifies that "support facilities" that "convey, store, or otherwise assist in the production of the principal product or group of products produced or distributed, or services rendered" should be considered under one source classification, even when the support facility has a different primary two-digit SIC code. Thus, one source classification encompasses both primary and support facilities, even when the latter includes units with a different primary two digit SIC code. See 45 FR 52696."[6]

It is clear from the NCUC docket information and the telephone conversations with both Smithfield and Optima TH that the Optima facility is located on Smithfield property solely to process and dispose of biogas generated by the Smithfield's wastewater treatment plant (WWTP). There is no other function for Optima TH for locating on the Smithfield facility, except to process the byproducts produced by the Smithfield facility by cleaning the raw biogas and producing a pipeline quality renewable natural gas for sale, and disposing of the biogas (when the GUS is not available or product gas is not meeting the pipeline quality specifications or generated biogas is exceeding the design capacity of GUS).

[6] *In the Matter of Anadarko Petroleum Corp; Frederick Compressor Station*, Order on Petition No. VIII-2010-4 at Page 16 and 17 (February 2, 2011) as referenced in the *Meadowbrook* guidance on "common control" (April 30, 2018).

However, based on the email response[7], it appears that the processing and disposal of Smithfield-generated biogas via the Optima TH facility is not the only option for Smithfield. Smithfield still has the authority and capability to flare off all generated biogas in its existing flare and/or burn in its boilers (Air Quality Permit 07221T22) as it retains the authority to remove the bolted-off flange for supplying biogas (if needed) to these emission sources. In addition, there is no mandate for Optima to purchase all biogas generated - Optima TH has only the right to purchase biogas from Smithfield. Similarly, Smithfield does not have a contractual requirement to sell all biogas to Optima - It is only an option to sell and not a mandate. This proves that Smithfield can still flare off its biogas in its flare and burn biogas in its boilers as per its Title V permit. Thus, Optima TH's operations are only incidental to Smithfield's primary activity and not a support facility for Smithfield. DAQ further believes that the Optima TH facility is not integral to the Smithfield's fresh meat production activity and its purpose is not for supporting the Smithfield's primary activity (meat production) especially in the context of CAA permitting. Therefore, DAQ believes that Optima TH is not a support facility for Smithfield; thus, Optima's pollutant emitting activities cannot be assigned the same Smithfield's SIC code (2011 "Meat Packing Plants" under the Major Group 20: Food And Kindred Products).

Prong 2: Contiguous or Adjacent

It is clear from the air permit application, statements made by both Smithfield and Optima TH during the telephonic conversations, and the NCUC docket information that the Optima TH facility is physically located on the Smithfield facility. In the air permit application, Optima TH states that it is "located approximately 900 feet from the existing Smithfield pork processing facility". Due to the fact that the Optima TH is physically located on the Smithfield property, as it leases the Smithfield facility land for its operations, the DAQ believes that these two facilities do meet the second prong of the evaluation of being "contiguous" or "adjacent".

Prong 3: Common Control

The DAQ determination on "common control" will be based upon the current EPA guidance in the *Meadowbrook* as referenced above. The guidance makes it clear that the common control determination needs to be focused on "the power or authority of one entity to dictate decisions of the other that could affect the applicability of, or compliance with, relevant air pollution regulatory requirements".

Optima TH is specifically designed to process only the maximum biogas generation of Smithfield's WWTP. From the NCUC docket and the telephone conversations, the DAQ has understood that Optima TH is to purchase all biogas generated in Smithfield's WWTP and process it in its gas upgrading system for selling renewable biogas (methane) and flare it off if it cannot sell or process in its GUS. DAQ understands that there are no other suppliers of raw biogas for the Optima TH facility. Moreover, if Optima TH decides to process additional biogas (more than the Smithfield's maximum biogas production capacity) by purchasing from non-Smithfield suppliers, it will have to first increase its gas processing capacity of the Optima TH facility.

Considering above, it appears that Smithfield dictates the amount of raw biogas available for purchase and processing by Optima TH (especially since it does not currently possess capability to burn biogas in its boilers or flaring it in its flare as the biogas supply to these equipment has been sealed off by Optima). At least facially it appears that Smithfield would have the power or authority over Optima's operations considering that the amount of supplied biogas would directly affect Optima's air emissions, applicability of permitting requirements, and its compliance with various air pollution-related requirements. However, the DAQ believes that this amounts to "influence" and not "control" as per EPA guidance. At best, this may be characterized as Smithfield providing/selling raw biogas feedstock to Optima TH for processing in its biogas processing facility through arm's length contract and during the normal course of contractual performance, air emissions occur at the Optima facility.

In addition, Smithfield has confirmed that it does not have the power or authority to start the Optima TH's biogas processing facility or start the new flare at Optima facility. Smithfield has specifically confirmed that it does not have the power or authority over Optima TH's air pollution related operations, or to determine applicability of or compliance with Optima facility's CAA requirements.

[7] Id.

Therefore, DAQ concludes that Smithfield does not “control” Optima TH in determining whether these two facilities constitute a single source.

With respect to Optima TH, it can be said that it can decline to take the delivery of biogas from Smithfield. Thus, Optima TH accepting or not accepting the biogas from Smithfield could affect the Smithfield’s compliance with its air pollution requirements in its current Title V permit. Specifically, by accepting the delivery of all biogas by Optima, Smithfield will generally be in compliance with its Title V requirements for the said existing boilers and flare as those pieces of equipment will not be emitting (as all biogas is to be consumed by Optima and not available for Smithfield boilers and flare). In addition, by not accepting the biogas, for example, during unavailability of GUS due to maintenance / repair, the raw biogas will be stored for a short period of time in the Smithfield’s WWTP’s covered digesters, Smithfield facility will still remain in compliance with its Title V permit requirements. The DAQ believes that this limited amount of control of Optima TH over Smithfield operations should not hinder Smithfield’s ability to independently comply with its Title V permit obligations. In fact, Smithfield retains the ability to operate its boilers and flare by continuing to have an air permit, and the authority to remove the flanged-off piping to deliver the biogas to its flare and boilers (if needed). Importantly, Optima TH does not have the power or authority to burn or flare off biogas in Smithfield’s boilers and flare, respectively, in accordance with Smithfield’s Title V permit. Specifically, Optima TH does not have the power or authority over Smithfield’s air pollution related operations including compliance with Smithfield’s Title V permit.

In summary, neither Smithfield nor Optima TH has “control” over the other facility’s air pollution-related requirements, specifically the decision-making authority for applicability of or compliance with the CAA matters.

Conclusions

The DAQ concludes that both Smithfield Fresh Meats Corp – Tar Heel and Optima TH belong to two different two-digit SIC codes (2011 “Meat Packing Plants” under the Major Group 20 “Food And Kindred Products” for Smithfield and 4925 “Mixed, Manufactured, or Liquefied Petroleum Gas Production and/or Establishments engaged in the manufacture and/or distribution of gas for sale, including mixtures of manufactured with natural gas…” under the Major Group 49 “Electric, Gas, And Sanitary Services” for Optima TH). Both facilities are “contiguous” or “adjacent” to each other. However, neither facility has “control” over the decisions that could affect the air permitting and compliance obligations of the other facility.

Therefore, pursuant to NC’s SIP-approved PSD Program (02D .0530), DAQ concludes that Optima TH (ID No. 0900066) and Smithfield Fresh Meats Corp – Tar Heel (ID No. 0900055) facilities are not a single stationary source and they are two separate stationary sources for CAA permitting. In addition, pursuant to NC’s approved State Operating Permitting Program (02Q .0500), DAQ concludes that Optima TH (ID No. 0900066) is a separate major source for Title V permitting from the Title V major source of Smithfield Fresh Meats Corp – Tar Heel facility (ID No. 0900055).

5.3 Facility-wide Emissions Summary

The facility-wide emissions are based upon the following design features:

- Maximum biogas production: 1,225 scfm
- Average GUS methane recovery: 87%
- GUS uptime in normal operation: 97%
- GUS design capacity: 900 scfm
- Flare maximum heat input rate: 50 million Btu/hour

Emissions rates have been based upon a mass balance approach, considering the composition (% by volume) and flow rates (cfm) of various constituent gases (H_2S, N_2, NH_3, CH_4) in biogas, product gas, and tail gas, as applicable, and the resulting formation of SO_2, NOx, ammonia, H_2S, and CH_4 (constituent of Greenhouse Gases (GHGs)), after applying the applicant-assumed destruction efficiency of 99 percent. The composition of biogas is based upon the historical data provided by Smithfield to Optima. The composition of product gas is based upon actual measurements by Optima. The composition of tail gas is simply the balance using the above biogas and product gas composition data.

The emissions estimate also accounts for emissions due to heat input provided by the new flare (i.e., products of combustion due to flaring off gases). Emissions factors for "Industrial Flares (Section 13.5, 02/18, AP-42)" have been utilized especially for NOx and CO. For the remaining criteria pollutants and air toxics pollutants, emissions factors for "Natural Gas Combustion (Section 1.4, 7/98, AP-42)" have been utilized. For GHGs, the applicant has used the applicable Global Warming Potentials (GWP) for carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), and emissions factors of these gases due to natural gas burning in Tables A-1, and C-1 and C-2 of the EPA's "Mandatory Greenhouse Gas Reporting" Rule (MRR) in 40 CFR 98, respectively.

Per the applicant, the destruction efficiency is based upon the information provided in "Industrial Wastewater Treatment" in Subpart II of Part 98, peer-reviewed paper for similar applications, and the flare design installed.

Actual emissions are based upon operating scenarios 1 through 3 described and shown above (i.e., 8,160 hours for normal operation, 240 hours for bypass operation, and 360 hours for off-spec operation) and actual yearly fuel usage.

Both potential to emit before and after control emissions are based on 8,760 hours of operation. Combusting 100 percent biogas in the flare results in the highest amount of emissions (i.e., no product gas is recovered and delivered in the pipeline for sell) for the worst-case scenario. For potential to emit before control, the maximum flare heat input rate is used while potential to emit after control accounts for limited annual fuel usage.

The following provides a facility-wide emission summary for the Optima TH facility (flare is the only emission source):

Regulated Air Pollutant	Actual Emissions, tons/yr	Potential to Emit Before Controls/Limitations, tons/yr	Potential to Emit After Controls/Limitations, tons/yr
Particulate Matter (PM)	0.10	0.17	0.17
Particulate Matter < 10 microns (PM_{10})	0.10	0.17	0.17
Particulate Matter < 2.5 microns ($PM_{2.5}$)	0.08	0.14	0.14
Sulfur Dioxide (SO_2)	170.78	170.86	170.86
Nitrogen Oxides (NO_x)	8.72	17.70	17.32
Carbon Monoxide (CO)	26.95	67.89	66.16
Volatile Organic Compounds (VOCs)	1.08	1.82	1.77
Lead	0.0000981	0.000165	0.000161
Hydrogen Sulfide (H_2S)	0.92	0.92	0.92
Greenhouse Gases (GHGs) as CO_2e	24,589	41,441	40,787
Single Largest Hazardous Air Pollutant (HAP), n-Hexane	0.353	0.595	0.580
Total HAPs	0.369	0.622	0.606

5.4 Regulatory Applicability

The flare emissions are subject to the requirements in 15A NCAC 02D .0516, .0521, .0535, .0540 and .1806, and 02Q .0207, .0504, and 02Q .0711. These requirements are discussed below:

15A NCAC 02D .0516 "Sulfur Dioxide Emissions from Combustion Sources"

Sulfur dioxide emissions from the flare are subject to the emission standard of 2.3 lb/million Btu.

The worst-case emission rate for normal operation (operating scenario 1) is 2.2 lb/million Btu/hr considering the emission rate of 38.99 lbs/hr and the associated heat input rate of 17.73 lb/million Btu.

However, the worst-case emission rate for both the bypass operation (operating scenario 2) and the off-spec operation (operating scenario 3) is 0.8 lb/million Btu, considering the emission rate of 39.01 lb/hr and the associated heat input rate of 48.72 million Btu/hr.

Since the worst-case emission rate for normal operation of 2.2 lb/million Btu is close to the emission standard of 2.3 lb/million Btu, the DAQ believes that monitoring for SO_2 emissions from the flare is justified for all scenarios to assure compliance. It should be noted that in general, it is technically infeasible to measure the actual emission rate for SO_2 (or for any other pollutant) accurately for open flares such as the proposed flare at Optima. Thus, in lieu of an actual source sampling, the DAQ proposes the following monitoring approach.

The Permittee will be required to determine the SO_2 emission rate (million Btu/hr) for the flare for all operating scenarios (normal operation, bypass operation, and off-spec operation) on a 24-hour block average basis, as below for each day the facility is in operation. If any 24-hour block average SO_2 emission rate (million Btu/hr) exceeds the above emission standard (2.3 lb/million Btu), the Permittee will be deemed to have violated this requirement.

Emission Rate Monitoring

Equation 1

SO_2 emission rate, lb/million Btu

= {SO_2 formed due to destruction of H_2S and other trace sulfur compounds in biogas and tail gas by flare} + {SO_2 formed due to combustion of fuel in flare}

= $\{[(60 * MW * P * V) / (R * T)] * \eta\} / \{HI\} + \{0.001\} + \{EF\} / \{HV\}$

Where,

MW = molecular weight of SO_2, lb/lb-mol = 64.06 lb/lb-mol
P = absolute pressure, psia = 14.7 psia (reference condition of 1 atmosphere)
V = average daily actual flow rate of H_2S in both biogas and tail gas, scfm
R = ideal gas law constant = 10.73 psia - ft3/lb-m ^{O}R
T = absolute temperature, ^{O}R = 528 ^{O}R (reference condition of 20 ^{O}C)
η = destruction efficiency of flare for H_2S, percent = 98 percent
HI = average daily actual heat input rate (biogas, tail gas, product gas[8], propane, and natural gas) for flare, million Btu/hr
EF = SO_2 emission factor for combustion of fuel in flare, lb/10^6 sft^3 = 0.60 lb/10^6 sft^3
HV = weighted average fuel heating value (biogas, tail gas, product gas[9], propane, and natural gas), based on the monthly measured or fuel-supplier's heating values for each of the fuels and actual fuel flow rate for each to flare, Btu/sft^3
0.001 = default SO_2 emission rate for trace sulfur compounds in biogas and tail gas in lb/million Btu, unless and until the facility can demonstrate, through sampling, that an alternative value is more representative

The above default SO_2 emission rate for trace sulfur compounds is based upon a similar biogas generation project, recently approved by the DAQ for Align RNG, LLC – BF Grady Road, Turkey, NC (Air Permit No. 10644R00, January 6, 2021). The subject permit for this facility includes a default SO_2 emission rate of 0.05 lb/hr for trace sulfur compounds in biogas and tail gas. Using the maximum heat input rate of 50 million Btu/hr for the proposed flare at Optima TH, the equivalent emission rate of 0.001 lb/million Btu is estimated.

The DAQ approval of 98 percent destruction efficiency (instead of applicant-assumed 99 percent) for H_2S is justified with supporting rationale in Sections 7 and 10 below and shall be used for monitoring of SO_2 emissions.

[8] For off-spec scenario only.
[9] Id.

For each of the hourly operation of flare, flow rate of H_2S as V_h (scfm) shall be determined as below in Equation 2 and the average of all calculated hourly values of the day shall be determined and input as average daily value of V (scfm) in the Equation 1 above:

Equation 2

V_h, scfm = (% by volume H_2S in biogas * amount of biogas, scfm) + (% by volume H_2S in tail gas * amount of tail gas, scfm)

For each of the hourly operation of flare, heat input for flare as HI_h (million Btu/hr) shall be determined as follows in Equation 3 and the average of all calculated hourly values for the day shall be determined and input as average daily value of HI (million Btu/hr) in the Equation 1 above:

Equation 3

HI_h, million Btu/hr = {{(biogas flow rate, scfm) * (biogas heating value (HHV), Btu/sft^3)} + {(tail gas flow rate, scfm) * (tail gas heating value (HHV), Btu/sft^3)} + {(product gas flow rate, scfm) * (product gas heating value (HHV), Btu/sft^3)}[10] + {(propane flow rate, scfm) * (propane heating value (HHV), Btu/sft^3)} + {(natural gas flow rate, scfm) * (natural gas heating value (HHV), Btu/sft^3)}} * {60 min/hr}

Monitoring

- The Permittee will be required to perform the following monitoring on an hourly basis of each day the facility is operating:
    - Measure the amount of biogas entering the GUS (scfm) using a flow monitor.
    - Measure the amount of biogas entering the flare (scfm), bypassing the GUS, using a flow meter.
    - Measure the tail gas leaving the GUS (scfm).
    - Determine the product gas leaving the GUS (scfm) using the mass balance method and the data collected for the amounts of biogas and tail gas as above.
    - Measure the amount of propane and natural gas entering the flare (scfm).
    - Measure the concentrations of both methane (% volume) and H_2S (% volume) in the biogas using a biogas analyzer (gas chromatograph).
    - Measure the methane concentration (% volume) in the product gas using a gas analyzer.
    - Determine the concentration of H_2S (% volume) in the tail gas using the biogas data for H_2S as above.
- The Permittee will be required to analyze biogas and tail gas samples once every month to determine their heating values (HHV), Btu/sft^3.
- The Permittee will be required to verify that the flare is designed and operated as below within 180 days of the issuance of an air quality permit:
    - Flare shall be designed for and operated with no visible emissions as determined by the Method 22 of Appendix A to 40 CFR 60, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours. The observation period is 2 hours and shall be used according to Method 22.

[10] Id.

- Flare shall be operated with a flame present at all times, as determined by the following method. The presence of a flare pilot flame shall be monitored using a thermocouple or any other equivalent device to detect the presence of a flame.

- Flare shall meet the following heat content and maximum tip velocity specifications as below:

  - Flare shall be used only with the net heating value of the gas being combusted being 300 Btu/scf or greater if the flare is steam-assisted or air-assisted; or with the net heating value of the gas being combusted being 200 Btu/scf or greater if the flare is non-assisted.

  - If the flare is steam-assisted or non-assisted flare, it shall be designed for and operated with an exit velocity less than 60 ft/sec with the exceptions as provided below.

  - If the flare is steam-assisted or non-assisted flare, it shall be designed for and operated with an exit velocity greater than 60 ft/sec but less than 400 ft/sec, provided the net heating value of the gas being combusted is greater than 1,000 Btu/scf.

  - Steam-assisted or non-assisted flare designed for and operated with an exit velocity less than 400 ft/sec is permitted as long as the exit velocity is less than the velocity, V_{max}, as determined below.

  - The net heating value of the gas being combusted in a flare shall be calculated using the following equation:

$$H_T = K \sum_{i=1}^{n} C_i H_i$$

where:

H_T = Net heating value of the sample, MJ/scm; where the net enthalpy per mole of offgas is based on combustion at 25 °C and 760 mm Hg, but the standard temperature for determining the volume corresponding to one mole is 20 °C;

$$K = \text{Constant, } 1.740 \times 10^{-7} \left(\frac{1}{\text{ppm}}\right) \left(\frac{\text{g mole}}{\text{scm}}\right) \left(\frac{\text{MJ}}{\text{kcal}}\right)$$

where the standard temperature for $\left(\frac{\text{g mole}}{\text{scm}}\right)$ is 20°C;

C_i = Concentration of sample component i in ppm on a wet basis, as measured for organics by Reference Method 18 and measured for hydrogen and carbon monoxide by ASTM D1946-77 or 90 (Reapproved 1994);
and

H_i = Net heat of combustion of sample component i, kcal/g mole at 25 °C and 760 mm Hg. The heats of combustion may be determined using ASTM D2382-76 or 88 or D4809-95 if published values are not available or cannot be calculated.

  - The actual exit velocity of a flare shall be determined by dividing the volumetric flowrate (in units of standard temperature and pressure), as determined by Reference Methods 2, 2A, 2C, or 2D of Appendix A to 40 CFR 60, as appropriate; by the unobstructed (free) cross sectional area of the flare tip.

  - The maximum permitted velocity, V_{max}, for the flare shall be determined by the following equation.

$\text{Log}_{10} (V_{max}) = (H_T + 28.8)/31.7$
V_{max} = Maximum permitted velocity, M/sec
28.8 = Constant
31.7 = Constant

H_T = The net heating value as determined above.

- If the flare is air-assisted flare, it shall be designed and operated with an exit velocity less than the velocity, V_{max}, as determined by the following method:

  $V_{max} = 8.706 + 0.7084\ (H_T)$
  V_{max} = Maximum permitted velocity, m/sec
  8.706 = Constant
  0.7084 = Constant
  H_T = The net heating value as determined above.

Recordkeeping and Reporting

The Permittee will be required to keep records of all monitoring activities as described above. The Permittee will be required to report the SO_2 emissions rates of flare on a 6-month basis (January-June and July-December) within 30 days of end of each of the 6-month periods, containing a summary of average SO_2 emission rates (lb/million Btu) for each day.

15A NCAC 02D .0521 "Control of Visible Emissions"

The flare has been manufactured on September 1, 2020 as per the application, after the cut-off date of July 1, 1971 in 02D .0521. Therefore, the visible emissions from the flare shall not exceed 20% opacity when averaged over a six-minute period. It is this engineer's judgement that visible emissions from biogas, tail gas or propane combustion would be low to negligible. Compliance is expected, but, it will be determined through facility inspection when the air permit is issued for the facility.

15A NCAC 02D .0535 "Excess Emissions Reporting and Malfunctions"

If excess emissions from the flare last for more than four hours and that results from a malfunction, a breakdown of process or control equipment or any other abnormal conditions, the Permittee shall

- Notify the Director or his designee 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 describe:

  i. the name and location of the facility,
  ii. the nature and cause of the malfunction or breakdown,
  iii. the time when the malfunction or breakdown is first observed,
  iv. the expected duration, and
  v. an estimated rate of emissions.

- Notify the Director or his designee immediately when the corrective measures have been accomplished.

It should be emphasized that this reporting requirement does not allow the Permittee to operate the flare in non-compliance with the applicable Environmental Management Commission Regulations, as discussed in this application review.

15A NCAC 02D .0540 "Particulates from Fugitive Dust Emission Sources"

The Permittee shall not cause or allow fugitive dust emissions to cause or contribute to substantive complaints or excess visible emissions beyond the property boundary. If substantive complaints are received or excessive fugitive dust emissions from the facility are observed beyond the property boundaries for six minutes in any one hour (using Reference Method 22 in 40 CFR, Appendix A), the owner or operator may be required to submit a fugitive dust plan as described in 2D .0540(f).

“Fugitive dust emissions” means particulate matter that does not pass through a process stack or vent and that is generated within plant property boundaries from activities such as: unloading and loading areas, process areas stockpiles, stock pile working, plant parking lots, and plant roads (including access roads and haul roads).

15A NCAC 02D .1806 “Control and Prohibition of Odorous Emissions”

The purpose of this Rule is to provide for the control and prohibition of objectionable odorous emissions.

The Permittee 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.

Compliance is expected. But it will be confirmed during routine compliance inspections after permit issuance or during any complaint investigations.

15A NCAC 02Q .0207 “Annual Emissions Reporting”

The Permittee will be required to submit an emission inventory by June 30th of each year for the previous year’s actual emissions for the pollutants listed in 02Q .0207(a).

15A NCAC 02Q .0504 “Option for Obtaining Construction and Operation Permit”

The Permittee will be required to apply for a Title V permit within one year from the date of beginning operation of the facility. As stated earlier, the facility commenced operation of a major source (Title V) on December 11, 2019. Therefore, the Permittee will be required to submit a timely and complete Title V application on or before December 11, 2020. However, after additional discussions with the Director’s office, it was decided that the permit, when issued, will require the owner/operator to submit another application, a complete Title V application under 02Q .0500 “Title V procedures” within 90 days from the issuance of this air permit, which is processed under 02Q .0300 “construction and operation permits”. Refer to Section 10 below for details.

15A NCAC 02Q .0700 “Toxics Air Pollutant Procedures”
15A NCAC 02D .1100 “Control of Toxic Air Pollutants”

The facility-wide (flare is the only emission source) emissions on a potential to emit basis for the air toxic pollutants expected to be emitted are as below:

Toxic Air Pollutant	Averaging Period	Potential Emissions	TPER	Modeling Required?
Acetaldehyde (75-07-0)	lb/hr	0.00000115	28.43	No
Acrolein (107-02-8)	lb/hr	0.00000136	0.08	No
Ammonia (7664-41-7)	lb/hr	0.245	2.84	No
Benzene (71-43-2)	lb/yr	0.824	11.069	No
Benzo(a)pyrene (50-32-8)	lb/yr	0.000471	3.044	No
Formaldehyde (50-00-0)	lb/hr	0.136	0.16	No
n-Hexane (110-54-3)	lb/day	3.26	46.3	No
Hydrogen sulfide (7783-06-4)	lb/day	5.04 9.96	5.1	No Yes
Toluene (108-88-3)	lb/day	0.00616	197.96	No
	lb/hr	0.000257	58.97	No

As can be seen in the above Table, for all pollutants expected to be emitted, the facility-wide emissions are less than the respective toxics pollutant emission rates (TPERs). Therefore, an air toxics permit application containing a modeling analysis demonstrating compliance with the applicable acceptable ambient levels (AALs) in 02D .1104 is not required for the pollutants listed. However, with the applicant-assumed destruction efficiency of 99 percent for sulfur in H_2S, it is noted that the facility-wide potential emissions of H_2S (5.04 lbs/day) are very close to the applicable

TPER (5.1 lb/day). In addition, with the DAQ-approved destruction efficiency of 98 percent (instead of applicant-proposed 99 percent) for sulfur in H_2S, the facility-wide potential emissions of H_2S (9.96 lb/day) will exceed the above TPER. Thus, the DAQ will include a requirement for controlling the toxic emissions of H_2S below the above rate pursuant 02D .1100, using the monitoring approach below and the DAQ-conducted modeling in Section 7 below:

The following monitoring approach (similar to SO_2 emissions above) will be included in the permit to ensure compliance with 02D .1100:

Emission Rate Monitoring

H_2S emission rate, lb/day

= {H_2S emitted from flare (i.e., H_2S in biogas and tail gas not destructed by flare)}

= $\{[(60 * MW * P * V) / (R * T)]\} * \{1-\eta\} * \{24\}$

Where, MW = molecular weight of H_2S, lb/lb-mol = 34.06 lb/lb-mol
P = absolute pressure, psia = 14.7 psia (reference condition of 1 atmosphere)
V = average daily actual flow rate of H_2S in both biogas and tail gas, scfm
R = ideal gas law constant = 10.73 psia - ft3/lb-m ^{O}R
T = absolute temperature, ^{O}R = 528 ^{O}R (reference condition of 20 ^{O}C)
η = destruction efficiency of flare for H_2S, percent = 98 percent (DAQ-approved)

As stated earlier, the DAQ approval of 98 percent destruction efficiency (instead of applicant-assumed 99 percent) for H_2S is justified with supporting rationale in Sections 7 and 10 below and shall be used for monitoring of H_2S emissions.

The Permittee will be required to calculate H_2S emissions on a daily basis (24-hour block average) when the flare is in operation. The measurements and calculations for both H_2S flow rates and concentrations, as included in the SO_2 requirements above, shall be used to determine daily H_2S emission rate for the flare to ensure that the H_2S TPER is not exceeded. No additional monitoring shall be required.

Recordkeeping and Reporting

The Permittee will be required to keep records of all monitoring activities as described above. The Permittee will be required to report the H_2S emissions rates (lb/day) for the flare on a 6-month basis (January-June and July-December) within 30 days of end of each of the 6-month periods.

DEQ's Environmental Justice Analysis

As per DEQ's environmental justice (EJ) criteria, evaluation will be performed for each greenfield Title facility before an air permit is to be issued. The DEQ will conduct an EJ evaluation for the Optima TH facility and prepare a separate report (if required) which will be available along with other draft permit documents for public comment on DEQ's website at https://deq.nc.gov/news/events/public-notices-hearings when the draft permit is noticed for public comments (Refer to Section 8 below).

6. NSPS, NESHAPS, PSD, Attainment Status, 112(r), CAM

NSPS

Not applicable.

NESHAP

Not applicable.

PSD

Bladen County is in attainment or unclassifiable for all promulgated National Ambient Air Quality standards (NAAQS) in accordance with §81.334. The PSD program applies to major stationary sources and major modifications in this airshed.

Based upon the facility wide emissions summary in Section 5.3 above, the Optima TH is not a major stationary source for PSD. Bladen county has triggered minor source baseline dates for both PM_{10} and SO_2. The actual emissions increases for the proposed project are 0.02 lb/hr (PM_{10}) and 38.99 lbs/hr (SO_2).

No further review is required under PSD.

<u>112(r)</u>

As per the applicant, the facility does not store any regulated toxic substances in amounts exceeding the threshold amounts in Subpart F of 40 CFR 68 "Regulated Substances for Accidental Release Prevention". Therefore, the CAA §112(n) requirements implemented through Part 68 (40 CFR) do not apply except the following.

Pursuant to §112(n)(1), as implemented in §68.1 of 40 CFR, the facility owner has "a general duty in the same manner and extent…to identify hazards which may result from such releases using appropriate hazard assessment techniques, to design and maintain a safe facility taking such steps as are necessary to prevent releases, and to minimize the consequences of accidental releases which do occur."

<u>CAM</u>

Compliance assurance monitoring (CAM) requirement under 40 CFR 64, as implemented through 02D .0614, is a Title V program requirement. When the DAQ processes the facility's Title V application (when submitted), such applicability analysis must be conducted. This application is processed pursuant to 02Q .0300 "construction and operation permits". Therefore, CAM analysis need not be performed at this time.

7. DAQ-Conducted Modeling

As discussed above in Section 5.4 above, the worst-case SO_2 emission rate for the flare (facility wide) is 2.2 lb/million Btu, just below the standard of 2.3 lb/million Btu (02D .0516). In addition, the worst-case facility wide H_2S emission rate is 0.21 lb/hr (or 5.04 lb/day), which barely meets the applicable TPER of 5.1 lb/day (02Q .0711). Both of these emissions rates account for the applicant-assumed 99 percent destruction efficiency for sulfur in H_2S, which the DAQ finds not supportable. Because the emissions of H_2S and SO_2 are close to their respective regulatory thresholds, the DAQ decided to conservatively assume a 98 percent destruction efficiency for sulfur in H_2S. The DAQ performed its own modeling for the facility wide emission rate of 0.415 lb/hr (or 9.96 lb/day) for H_2S and predicted that the impact would be less than 1 percent of the applicable Acceptable Ambient Level of 0.12 mg/m^3 in 02D .1104.

Moreover, using the unrealistic assumption of 100 percent (instead of realistic 98 percent) destruction efficiency for sulfur in H_2S and its conversion to SO_2, the DAQ conducted modeling to predict the worst-case SO_2 impact for the mass rate of 39.1 lb/hr. The following Table provides the predicted impacts against the ambient standards:

Pollutant	Averaging Period	Maximum Impact ug/m^3	NAAQS[11] or SAAQS[12] ug/m^3
SO_2	1-hour	43.50	196
	3-hour	47.78	1,300
	24-hour	14.27	365
	annual	1.89	80

[11] National Ambient Air Quality Standard.
[12] State Ambient Air Quality Standard.

Thus, the DAQ concludes that neither the emissions of H_2S nor SO_2 on a facility wide basis are expected to create any adverse health impacts beyond the property boundary. The DAQ memorandum (November 18, 2020) on its modeling is included in Appendix 1 of this application review.

8. Public Participation

The draft permit documents including permit, application review, and the DEQ's Environmental Justice (EJ) Analysis report (if required) will be noticed in a local newspaper and on the DEQ's web site for seeking public and EPA comments in accordance with 02Q .0306 and .0307. The notice will provide for a 30-day comment period for these draft documents. The DAQ will consider all public comments including any comment requesting a public hearing and any EPA comment received during this comment period, before finalizing the draft permit and the EJ analysis.

9. Stipulation Review

Not applicable. This is an unpermitted ("greenfield") facility. Thus, no existing stipulations are available for any revisions. All stipulations included in the air permit are new.

10. Conclusions, Comments, and Recommendations

- A professional engineer (PE)'s seal is not required.

  The application does include a new emission source which is also a control device (flare) to destroy hydrogen sulfide emissions. The application includes some design information including its destruction efficiency. This design data has been utilized to estimate emissions and the determination of expected compliance with various regulatory requirements (e.g., 02D .0516, 02Q .0711, etc.). The applicant's consultant (Mr. William G. Simmons) has sealed the technical portion of the application with his PE (professional engineer) license. Mr. Simmons' current PE license (27407) status is "active" as per North Carolina Board of Engineers for Engineers and Surveyors (NCBELS) web site[13].

- The new facility of Optima TH requires a local zoning consistency determination as per 02Q .0304(b)(1). Bladen County Planning Department Director (Gregory J. Elkins) has issued a Zoning Consistency Determination on 9/2/20 certifying that "I have received a copy of the air permit application (draft or final) and the proposed operation is consistent with the applicable zoning ordinances".

- The pre-public notice draft permit was emailed to the Permittee for review and comment on December 8, 2020. The DAQ provided additional time to review the draft permit till January 15, 2021 after receiving a request from the applicant attorney on December 14, 2020. The applicant's comments were received from Mr. Mark Maloney (responsible official) of Optima TH on January 15th. The following includes each of the applicant-comments and the DAQ response to each:

  Comment 1:

  "Page 2, Specific Condition 1: As previously stated, we believe the application of 15A NCAC 02D .0516 in the manner described in the draft permit to be inconsistent with the language and history of this regulation. The sulfur dioxide (SO2) emission limit in 15A NCAC 02D .0516(a) is based on SO2 emissions from any "source of combustion" that is discharged from any "vent, stack, or chimney." On its face, this rule does not seem to apply to emissions from a flare – only a vent, stack or chimney. "Stack" is defined to not include flare in the ancillary regulation 15A NCAC 02D.0533. Flares also do not fall within the ordinary meaning of a "vent" or "chimney." Optima's operation involves SO2 emissions from a gas upgrading system (GUS), that does not have combustible fuel, and that is discharged through a flare which does not seem to fall under the .0516 regulation. However, we understand DAQ's historical use of .0516 and we would like the opportunity to discuss further."

  DAQ Response:

[13] https://www.membersbase.com/ncbels/search.

The requirement in 02D .0516(a) mandates that "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."

The applicant argues that requirements in 15A NCAC 02D .0533 "Stack Height" specifically exempts flares from the definition of "stack"; thus, he believes that the DAQ cannot regulate the SO_2 emissions from the flare at the Optima TH facility under 02D .0516. The applicant further argues that the flares also do not fall within the ordinary meaning of "vent" or "chimney". Moreover the applicant appears to contend that the GUS emits SO_2 emissions instead of the candlestick flare, and it does not have any combustible fuels, implying that the GUS is not an emission source.

DAQ has deemed the candlestick flare (CD-1) on the GUS (ES-1) both an emission source and a control device for air permitting requirements. The DAQ believes that based upon the application, GUS only processes biogas and it is a non-emitting source (not a combustion source).

NC has historically treated flares as sources of combustion. NC has issued numerous Title V permits for flares, controlling emissions of municipal solid waste landfills (MSWLs). The flare permits for MSWLs include both the emission source standards such as SO_2 in 02D .0516 and the inspection and maintenance provisions as control device requirements for the landfill gas emissions. In addition, as stated previously, NC recently issued an air permit for a similar biogas generation project where the agency included the SO_2 standard in 02D .0516 as an applicable standard for the facility flares.

In summary, DAQ concludes that the candlestick flare at Optima TH is a "source of combustion", emitting SO_2 through a "vent, stack, or chimney". Finally, the DAQ believes that the entire height of the flare can be deemed a "stack" in the context of 02D .0516 even if the definition of stack in 02D .0533 explicitly states contrary. No change to the permit will be made.

Comment 2:

"Page 2, Specific Condition 3.a: Please clarify if we may provide a letter from the Engineer of Record for the project demonstrating conformance with this requirement by flowrate/area calculation?"

DAQ Response:

Condition 3a requires a demonstration for proper design and operation of the candlestick flare containing the following: no visible emissions, continuous operation of flame while operating flare, and compliance with the heat content and maximum tip velocity specifications. The Permittee is required to submit a report within 180 days of the issuance of the air quality permit 10673R00, verifying that the candlestick flare (ID No. CD-1) is designed and operated as per the requirements included in Condition 3a. Thus, the applicant needs to provide a report for such demonstration containing all above elements for proper design and operation of the flare.

Comment 3:

"Page 2, Specific Condition 3.a.iii.(A): The tail gas has a heating value of 204 Btu/scf, as stated in the permit application, based on 87% methane recovery. This is a conservative estimate (as is typical of our estimates in the calculations) as we may achieve ≥90% recovery, and may observe higher methane content (and therefore heating value, as expressed in Btu/SCF) in the biogas, at times. For normal operation we will blend tail gas, biogas, and or flare pilot fuel for oxidation of the tail gas."

DAQ Response:

It is understood that the flare will burn the combination of gases and fuels (biogas, tail gas, propane, natural gas) in normal operation and the heat content of these blended fuels will generally be higher than the specified heat content requirement.

Comment 4:

"Page 4, Specific Condition Monitoring/Recordkeeping b. Equation 1 and Equation 3: The terms "HI" and "HV" in Equation 1 should be restated to include the total of biogas, tail gas, propane and natural gas (natural gas is missing). Similarly, Equation 3 should include the natural gas flowrate and heating value for natural gas. The destruction efficiency is also prescribed in the permit to be used as "98 percent (DAQ-approved)". As noted in the attached Toxic Release Inventory (TRI) Reporting Guidance for Poultry Processing for Hydrogen Sulfide (H_2S), Revision 1 published March 15, 2017, 99% destruction efficiency for hydrogen sulfide in the flare (equal to that for methane per USEPA GHG Reporting Rule) is reasonable. We respectfully request the variable "η" be revised to include "99 percent (DAQ-approved)."

DAQ Response:

The DAQ will revise the Equations 1 and 3 to include the contribution of natural gas with regard to calculating average daily heat input rate of flare and average heat content of fuels combusted. DAQ will also revise the same equations for the off-spec scenario only, for including the contribution of product gas in determining the average daily heat input rate of flare and the average heat input rate of all fuels combusted.

Regarding the applicant's contention on reasonableness of H_2S destruction efficiency of 99 percent, it needs to be emphasized that the applicant has not provided any information on manufacturer's warranty for the proposed flare. Moreover, the EPA regulation in "Subpart II—Industrial Wastewater Treatment , 40 CFR 98 "Mandatory Greenhouse Gas Reporting (MRR)", cited by the applicant, specifies that under this Subchapter, the owner/operator is to use the "lesser of manufacturer's specified destruction efficiency and 0.99" for the biogas generated in anaerobic digesters and controlled by on-site devices such as flares. Finally, the industry guidance[14] cited by the applicant indicates the use of manufacturer guarantees or assumption of 99% destruction efficiency for hydrogen sulfide for flares, referring to the above EPA's MRR Subchapter, for estimating emissions of H_2S emissions for anaerobic treatment units.

In summary, the DAQ believes that because the applicant has not provided the reasoned justification (vendor guarantees) indicating that the destruction efficiency of 99 percent for H_2S is achievable for the proposed flare, it is not reasonable for this state agency to approve the applicant's request of this control efficiency.

Comment 5:

"Page 5, Specific Condition c.iii: We currently measure the tail gas with a flow meter, but not the product gas for each PSA. We derive product gas flow for each PSA through mass balance by measuring the biogas into the plant, and measuring the tail gas stream, deriving the product gas as the difference, since there is no other outlet or flow stream. Please confirm that product gas flow may continue to be derived via mass balance rather than adding additional, redundant flow meters."

DAQ Response:

The DAQ agrees with the applicant that it is not necessary to monitor the product gas flow rate. The DAQ further agrees that it would be appropriate to determine the product gas flow rate using a mass balance approach and the monitored data of biogas and tail gas. This change will be made to the permit.

Comment 6:

"Page 5, Specific Condition c.iv: Natural gas needs to be included."

DAQ Response:

The DAQ agrees with the applicant and will make this change to the permit.

[14] *"Toxic Release Inventory (TRI) Reporting Guidance for Poultry Processing for Hydrogen Sulfide (H2S), Revision 1"*, prepared by US Poultry & Egg Association and Woodruff & Howe Environmental Engineering, Inc., March 15, 2017.

Comment 7:

"Page 5, Specific Condition c.vii: The tail gas is moist and typically higher H2S concentrations prior to control via the flare. Such moist, higher H2S conditions are very difficult to measure this with an "online" analyzer, as the H2S is corrosive, and the moisture tends to "gum up" or facilitate corrosion of the delicate instruments. As such, we respectfully ask for this permit condition to allow the use of the raw biogas value for H2S, and through mass balance calculation, consider all H2S is directed to the control device, the flare. This is a conservative approach as some trace amount of H2S is delivered with the product gas, so this approach should over-account, by a minor amount, the mass of H2S directed to the flare."

DAQ Response:

The DAQ agrees with the applicant with regard to the technical difficulties in accurately measuring the H_2S content of the tail gas; thus, it will allow the use of biogas H_2S content data for determining the H_2S content of the tail gas as a conservative approach.

Comment 8:

"Page 7, Specific Condition 11.c: Please confirm that laboratory analysis of samples taken suffice for performing these calculations."

DAQ Response:

Specific condition 11.c. includes the requirement to obtain an air toxics permit before the facility wide actual emissions for acetaldehyde (75-07-0), acrolein (107-02-8), ammonia (7664-41-7), benzene (71-43-2), benzo(a)pyrene (50-32-8), formaldehyde (50-00-0), n-Hexane (110-54-3), hydrogen sulfide (7783-06-4), or toluene (108-88-3) exceed the respective TPERs.

The DAQ agrees with the applicant that he/she can use the laboratory sample results for various gases and pollutants for determining the facility wide emissions for the pollutants of concern.

Comment 9:

"Page 8, Specific Condition d: The destruction efficiency is also prescribed in the permit to be used as "98 percent (DAQ-approved)". As noted in the attached Toxic Release Inventory (TRI) Reporting Guidance for Poultry Processing for Hydrogen Sulfide (H2S), Revision 1 published March 15, 2017, 99% destruction efficiency for hydrogen sulfide in the flare (equal to that for methane per USEPA GHG Reporting Rule) is reasonable. We respectfully request the variable "η" be revised to include "99 percent (DAQ-approved)."

DAQ Response:

Refer to the response to the comment 4 above.

Comment 10:

"Page 8, Specific Condition g: Assuming the permit is issued prior to Jan 30, 2021, is the permittee required to provide this report for July-December 2020? All data may not be available, as we were not required to monitor it in the manner described in the permit."

DAQ Response:

The permit requirements can only be prospective. Assume the hypothetical case that the DAQ is to issue the permit for the Optima TH facility on March 1, 2021. For this assumed case, the first semi-annual report for H_2S emissions rates (lb/day) for the flare under this Condition A.11.g. will be due on July 30, 2021 for the period of March 2021 - July 2021. No change to the permit is required.

- The draft permit was emailed to the FRO for review on December 8, 2020. Jeff Cole from the regional office emailed on December 15th the comments on the application review and the draft permit. Almost all comments pertain to the formatting issues (extra space within the word or between the words, extra tab, etc.) in these documents, except the comments on (i) the consistent discussion on H_2S destruction efficiency in the application review in the context of applicant-proposed (99 percent) v. DAQ-approved (98 percent), how the emissions of H_2S vary, and their comparisons with the associated TPER, and (ii) the requirement of submittal of a complete Title V application within one year from the date of beginning operation of either the (non-emitting) GUS (ID No. ES-1) or the candlestick flare (ID No. CD-1) in the air permit. These substantive comments from the regional office have been discussed below:

  With regard to the issue of flare destruction efficiency, the DAQ will amend the application review to make the discussions on DAQ-approved 98 percent H_2S destruction efficiency consistent to avoid any ambiguity with the applicant-proposed 99 percent destruction efficiency and their effects on emissions.

  With respect to the requirement to submit a complete Title V application within one year from the date of beginning operation of either the (non-emitting) GUS (ID No. ES-1) or the candlestick flare (ID No. CD-1), it should be noted that the applicant started operating a major source for Title V on December 11, 2019. Both the CAA (§503(c)) and the implementing regulations (§70.5(a), and 02Q .0501(e) and .0504(d)) require that the applicant must submit a timely and complete application within one year from the commencement of facility operations. After additional discussions with the Director's office, it was decided that the permit, when issued, will require the owner/operator to submit another application, a complete Title V application under 02Q .0500 "Title V procedures" within 90 days from the issuance of this air permit, which is processed under 02Q .0300 "construction and operation permits". In summary, the draft permit will be modified to specify this 90 days deadline to submit a Title V application.

  Finally, all formatting issues will be taken care of as needed. However, it should be noted that the DAQ version of the documents (as sent for review to the FRO) do not show any formatting issues.

- This permit engineer recommends issuing the final permit after the completion of public comment (30-day) period.

Appendix 1
DAQ Memorandum on Modeling

DIVISION OF AIR QUALITY
November 18, 2020

MEMORANDUM

TO: Rahul Thaker, Engineer, RCO
Greg Reeves, Permit Coordinator, FRO

THRU: Tom Anderson, Supervisor, Air Quality Analysis Branch (AQAB)

FROM: Mark Yoder, Meteorologist, AQAB

SUBJECT: Toxics Dispersion Modeling Request
Optima TH, LLC
Tar Heel, Bladen County, NC, Facility ID 0900096

I have completed hydrogen sulfide (H_2S) and sulfur dioxide (SO_2) modeling for the Optima TH, LLC (Optima TH) in Tar Heel, Bladen County, North Carolina. Optima TH receives biogas produced by the wastewater treatment plant, including the existing anaerobic digesters and associated biogas collection system, serving the Smithfield Fresh Meats Corp. - Tar Heel facility. The Optima TH plant purchases and filters the biogas, selecting for methane, to produce pipeline-quality renewable natural gas (RNG). The nonmethane constituents of the biogas, referred to as "tail gas," are oxidized using one candlestick flare. The candlestick flare is also used to combust unrefined biogas during times when the upgrading system's operation is temporarily down for maintenance and/or repairs or unexpected events. Additionally, the candlestick flare is used to combust the renewable natural gas, referred to as "product gas," during facility startup and when the product gas does not meet pipeline specifications. The modeling adequately demonstrates compliance on a facility-wide basis for H_2S. Modeling results for SO_2 are detailed below.

I evaluated the facility's H_2S and SO_2 emissions using AERMOD (Version 19191) with five years (2014-2018) of surface weather data from the Lumberton Regional Airport (LBT) in Lumberton, NC and upper air meteorological data from the Piedmont - Triad International Airport in Greensboro, NC. The area, including and surrounding the site, is classified rural, based on the land use type scheme established by Auer 1978. The candlestick flare was modeled as a point source. Exit velocity and exit temperature default values from SCREEN3/AERSCREEN of 20 m/s and 1,273 K, respectively, were used for the candlestick flare. The stack diameter (1) and effective stack height (2) were calculated using the following equations:

$$D = 9.88 \times 10^{-4} \times \sqrt{HR \times (1 - HL)} \qquad (1)$$

$$h_{eff} = H_s + 4.56 \times 10^{-3} \times HR^{0.478} \qquad (2)$$

Where D is effective stack diameter, HR is the heat release rate (50 MMBTU/hr), HL is the heat loss fraction (default value of 0.55), H_{eff} is effective stack height and Hs is the stack height (26 feet). H_2S emissions corresponding to 98% and 99% destruction efficiencies were modeled. An SO_2 emissions rate corresponding to a 100% destruction efficiency was also modeled. Direction specific building dimensions, determined using the BPIP PRIME program, were used as input to the model for building wake effects. Full terrain elevations were included, as were normal regulatory defaults. Receptors were placed in ambient air beginning at the property boundary and were sufficient to establish maximum impacts.

The maximum predicted impact for H_2S is provided in the following table:

Maximum H_2S Impacts
Optima TH – Tar Heel, NC

Toxic	Averaging Period	% AAL
Hydrogen Sulfide	24-hour	<1%

The maximum predicted impact for SO_2 is provided in the following table:

Maximum SO_2 Impacts
Optima TH – Tar Heel, NC

Pollutant	Averaging Period	Maximum Impact ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Sulfur Dioxide	1-hour	43.50	196
	3-hour	47.78	1,300
	24-hour	14.27	365
	Annual	1.89	80

Modeled emissions rates and stack parameters are included in the attached tables. The modeling results demonstrate compliance assuming the source parameter and pollutant emission rates used in the analyses are correct.

cc: Michael Pjetraj
Heather Carter
Tom Anderson
Gregory Reeves
Jeffrey Cole
Mark Yoder

Optima TH - Modeled Emissions Rates

Source ID	H_2S (98% DE)	H_2S (99% DE)	SO_2 (100% DE)
	(lb/hr)	(lb/hr)	(lb/hr)
FLARE	0.415	0.21	39.1

Optima TH - Source Parameters

Source ID	Stack Release Type	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (fps)	Stack Diameter (ft)
FLARE	DEFAULT	700990.01	3846537.39	125	46.09	1831.73	65.62	4.07