$400 rec'd 12/10/19

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February 26, 2020

VIA MAIL & ELECTRONIC DELIVERY

Brad Newland
Environmental Program Supervisor II
NCDEQ Division of Air Quality
127 Cardinal Drive Extension
Wilmington, North Carolina 28405

Re: Response to January 17, 2020 Additional Information Request
Align RNG, LLC – BF Grady Road
Facility ID# 3100179

Dear Mr. Newland;

This letter and accompanying documents were prepared in response to the Additional Information Request mailed to Align RNG, LLC (Align RNG) by the NCDEQ Division of Air Quality on January 17, 2020. The Additional Information Request asked that a revised permit application be submitted to demonstrate compliance with 15A NCAC 02D .0516 and that information be submitted to assess the impacts of sulfur dioxide (SO_2) emissions to the surrounding properties in the area.

A revised permit application demonstrating 15A NCAC 02D .0516 compliance through increased hydrogen sulfide removal using the iron sponge system included in the system design is provided and enclosed with this letter.

The information required to assess the impacts of SO_2 emissions in the surrounding area is provided with this response and includes the following:

- Completed Air Permit Application Form D3 (Form D3).
- BF Grady Rd General Arrangement drawing depicting and numerically labeling all proposed structures at the BF Grady Rd facility. Section 5 (Building Data) of Form D3 references the numerical labeling on the General Arrangement drawing.
- BF Grady Rd Boundary Survey depicting the property boundaries.
- BF Grady Rd Overall Site Plan providing the emission point and property boundary coordinates.
- Warsaw Feed Mill Site Plan to provide the heights and coordinates for structures located on the Warsaw Feed Mill property.[1]
- USGS Contour Map depicting the location of the BF Grady Rd facility.

[1] Note that the emission points proposed for the project are not within "5*L" of any structure at the Warsaw Feed Mill, where "L" is the lesser of building height or projected building width.

Form D3 has been completed for both the enclosed flare (EP-1) and the candlestick flare (EP-2). Under normal facility operations, biogas will be upgraded to renewable natural gas (RNG) for injection into the pipeline, and tail gas from the process will be routed to the iron sponge system for hydrogen sulfide (H_2S) removal and then to the enclosed flare (EP-1). The SO_2 emission rate from the enclosed flare under this normal operating scenario is 10.24 lbs/hr.

During each facility startup and when product gas does not meet the quality specifications defined by Piedmont Natural Gas, as further explained in the BF Grady Rd Air Quality Permit Application, product gas will be combusted in the candlestick flare (EP-2). Align RNG has conservatively estimated that operation of the candlestick flare for product gas combustion will not exceed 360 hours per year for the purposes of calculating potential emissions from these circumstances. The SO_2 emission rate from the candlestick flare during product gas combustion is significantly lower than the SO_2 emission rate from the candlestick flare during biogas combustion because H_2S is removed from the product gas during the gas upgrading process. The product gas is expected to contain less than 0.25 grain H_2S per 100 scf, resulting in very low SO_2 emissions during product gas combustion. The SO_2 emission rate during product gas combustion is estimated to be 0.03 lbs/hr using the SO_2 emission factor from AP-42 Section 1.4. Since the SO_2 emissions resulting from product gas combustion are lower than the SO_2 emissions resulting from biogas combustion, only the SO_2 emission rate for biogas combustion is listed on Form D3.

In addition to the normal operating scenario and product gas combustion in the candlestick flare, the facility may experience brief events during which biogas may be routed directly to the candlestick flare (EP-2), bypassing facility processing equipment. This occurrence is only expected to occur during initial facility startup/commissioning, infrequent and unavoidable maintenance events, and during rare, unpredictable, and emergency malfunction events.[2] It is impossible to predict when such events will occur, if ever. As such, Align RNG has conservatively assumed that operation of the candlestick flare for biogas combustion will not exceed 240 hours per year for the purposes of estimating potential emissions from these circumstances.

EPA guidance states that intermittent sources may be excluded in NAAQS compliance demonstrations for the 1-hr NO_2 and 1-hr SO_2 NAAQS[3].

> *Given the implications of the probabilistic form of the 1-hour NO2 NAAQS discussed above, we are concerned that assuming continuous operations for intermittent emissions would effectively impose an additional level of stringency beyond that intended by the level of the standard itself. As a result, we feel that it would be inappropriate to implement the 1-hour NO_2 standard in such a manner and recommend*

[2] Examples of scenarios where biogas would be routed directly to the candlestick flare include, but are not limited to: (i) damage to pipeline from an extreme weather event or other natural disaster requires purging of pipeline and (ii) processing equipment and iron sponge system are down for maintenance or otherwise not operational and the pipeline needs to be purged to relieve pressure at upstream digesters.

[3] USEPA Memorandum, *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard*, at 9-11 (Mar. 1, 2011) ("the discussion of other topics in this memo should apply equally to the 1-hour SO_2 standard").

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that compliance demonstrations for the 1-hour NO_2 NAAQS be based on emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations. EPA believes that existing modeling guidelines provide sufficient discretion for reviewing authorities to exclude certain types of intermittent emissions from compliance demonstrations for the 1-hour NO_2 standard under these circumstances.

Nevertheless, in response to NCDEQ's request, Align RNG has included the candlestick flare (EP-2) on Form D3. The SO_2 emission rate for the candlestick flare was calculated in accordance with the alternative approach included in the guidance referenced above. Specifically, the guidance states:

Another approach that may be considered in cases where there is more uncertainty regarding the applicability of this guidance would be to model impacts from intermittent emissions based on an average hourly rate, rather than the maximum hourly emission. For example, if a proposed permit includes a limit of 500 hours/year or less for an emergency generator, a modeling analysis could be based on assuming continuous operation at the average hourly rate, i.e., the maximum hourly rate times 500/8760. This approach would account for potential worst-case meteorological conditions associated with emergency generator emissions by assuming continuous operation, while use of the average hourly emission represents a simple approach to account for the probability of the emergency generator actually operating for a given hour.

Pursuant to this guidance, the SO_2 emission rate for the candlestick flare included on Form D3 is 1.21 lbs/hr, which represents the annualized average emission rate based on the maximum hourly emission rate and the aforementioned annual operating limit.[4]

Align RNG performed a preliminary air dispersion modeling analysis using EPA's AERMOD software and the model input parameters included on Form D3. The analysis included both the enclosed flare (EP-1) and the candlestick flare (EP-2) based on the operational scenarios discussed above. The results of the preliminary analysis indicate that project will comply with the 1-hr and 3-hr SO_2 NAAQS.

Should you have any questions or need additional information, please contact Ben Cauthen at 877-557-8923 ext. 303 or via email at ben.cauthen@cavanaughsolutions.com.
Thank you for your assistance.

= 1.21 lb/hr

[4] 44.13 lbs/hr * 240 hrs/yr / 8,760 hrs/yr.

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With kind regards;

William G. "Gus" Simmons, Jr., P.E.
Vice President, Director of Bioenergy
Cavanaugh & Associates, P.A.

Attachments:

Revised BF Grady Rd Air Quality Permit Application
Information to Assess SO_2 Emission Impacts

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Attachment 1

Revised BF Grady Rd Air Quality Permit Application

BF Grady Rd

Air Quality Permit Application

New Biogas Upgrading Facility for Renewable Natural Gas Production

Duplin County, North Carolina • February 26, 2020

Prepared By: Cavanaugh & Associates, P.A.
1213 Culbreth Dr.
Wilmington, NC 28405
Phone: 877-557-8923

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Prepared For: Align Renewable Natural Gas (RNG)
120 Tredegar St.
Richmond, VA 23219

align
RENEWABLE NATURAL GAS

NORTH CAROLINA PROFESSIONAL SEAL 27407 ENGINEER WILLIAM G. SIMMONS, JR.
2/24/2020

NORTH CAROLINA CORPORATE SEAL C-1273 CAVANAUGH & ASSOCIATES, PA

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List of Appendices

I. Project Overview

This air quality permit application has been prepared for a proposed biogas upgrading facility in Duplin County, North Carolina between Warsaw and the Town of Turkey. The facility, referred to as BF Grady Rd, will be owned by Align Renewable Natural Gas, LLC, a joint venture between Smithfield Foods, Inc. and Dominion Energy, Inc. The facility will receive biogas produced in anaerobic digesters at various independently owned and operated hog farms located throughout Duplin and Sampson Counties. The projected biogas production for each farm was calculated using operational data from similar anaerobic digester installations in North Carolina using hog manure as the sole feedstock. The biogas will be dried at each farm and transported through a new, low-pressure biogas pipeline to the facility. The biogas will be upgraded to renewable natural gas quality and injected into the existing Piedmont Natural Gas pipeline for offsite consumption. The non-methane constituents of the biogas, referred to as tail gas, will be scrubbed for hydrogen sulfide using an iron sponge system, then oxidized using one enclosed hybrid flare utilizing conventional natural gas from the existing natural gas pipeline as supplemental fuel. One elevated candlestick flare will be used to combust biogas on-site during facility commissioning and startup and at times when the upgrading system's operation is temporarily down for maintenance and/or repairs or unexpected emergency events. Additionally, the candlestick flare will be used to combust product gas during facility commissioning and startup, and when the product gas does not meet pipeline specifications. Detailed descriptions of each of these processes and their impact on air emissions, as well as process flow diagrams, are provided in this application. Several definitions are provided below for further clarification.

- Biogas – Gas produced in the anaerobic digesters at each hog farm. The 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, animal age, farm management practices, and other factors. The average biogas composition listed above is based on similar anaerobic digester installations in North Carolina. The maximum H_2S concentration is anticipated to be 0.35% by volume, as used in all emissions calculations.
- Gas Upgrading System (GUS) – Equipment used at the gas upgrading facility to separate methane from the other biogas constituents for subsequent injection into the existing natural gas pipeline as RNG. The selected GUS is the Guild Pressure Swing Adsorption (PSA) system. The PSA system generates two gas streams: product gas and tail gas.
- Product Gas – Gas generated by the GUS that is approximately 98-99.9% methane by volume and meets all pipeline specifications, except temperature and pressure requirements.
- Tail Gas – Waste gas separated from the product gas and generated by the GUS as part of the upgrading process. At the maximum H_2S concentration, the anticipated tail gas composition is 7.02% CH_4, 92.00% CO_2, 0.03% NH_3, and 0.95% H_2S.
- Renewable Natural Gas (RNG) – Gas that complies with all pipeline specifications established by Piedmont Natural Gas, including minimum delivery pressure. RNG differs from product gas because it has been compressed to the operating pressure of the natural gas pipeline.

A map depicting the BF Grady Rd facility's location is included on the following page.


Hudson Rd
Penny Branch Rd
Long Horn Creek Ln
1911
B F Grady Rd
1108
Existing Warsaw Feed Mill
Proposed BF Grady Rd Facility
40
Hudson St
Herring St
Turkey
24
Hwy-24
1004
McCoy Rd
Needmore Rd
Carrells Rd
Cornwallis Rd
Google Earth
©2018 Google
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II. Facility Description and Emissions Information

Align RNG proposes to construct and operate the following emission source for the BF Grady Rd biogas upgrading facility:

1. ES-1: Gas Upgrading System (GUS)

The BF Grady Rd facility will utilize the following control devices:

1. CD-1: Iron Sponge System Vessel
2. CD-2: Iron Sponge System Vessel
3. CD-3: Enclosed Hybrid Flare
4. CD-4: Elevated Candlestick Flare

The BF Grady Rd facility will have the following emission points:

1. EP-1: Enclosed Hybrid Flare Stack
2. EP-2: Elevated Candlestick Flare Stack

Normal BF Grady Rd facility operation consists of the GUS (ES-1) receiving biogas from the biogas inlet pipe and processing the biogas to produce tail gas and product gas. The product gas will be injected into the existing natural gas pipeline as RNG after being compressed to pipeline pressure using electrically powered compressors. The tail gas will be treated in an iron sponge system vessel (CD-1 or CD-2) and oxidized in the enclosed hybrid flare (CD-3). This normal operation is referred to in the emissions calculations and forms as the "Normal Operating Scenario."

The 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 (CD-4) or not receive biogas. The facility will also combust biogas in the candlestick flare during initial facility startup and commissioning. This infrequent operating scenario not associated with the "Normal Operating Scenario" of the facility is herein considered as the bypass operating scenario. The GUS bypass valve must be opened to allow biogas flow to the candlestick flare. The GUS bypass valve is normally closed. These infrequent events are conservatively estimated to occur for no more than 10 hours in a day or 240 hours in each year. 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 year, although not more than 10 hours per 24-hour day. These hourly operating assumptions are based on the operation of similar biogas upgrading facilities and the design and operation of the anaerobic digester systems. The GUS, iron sponge system vessels, and enclosed hybrid flare will not be operated when biogas is combusted in the candlestick flare.

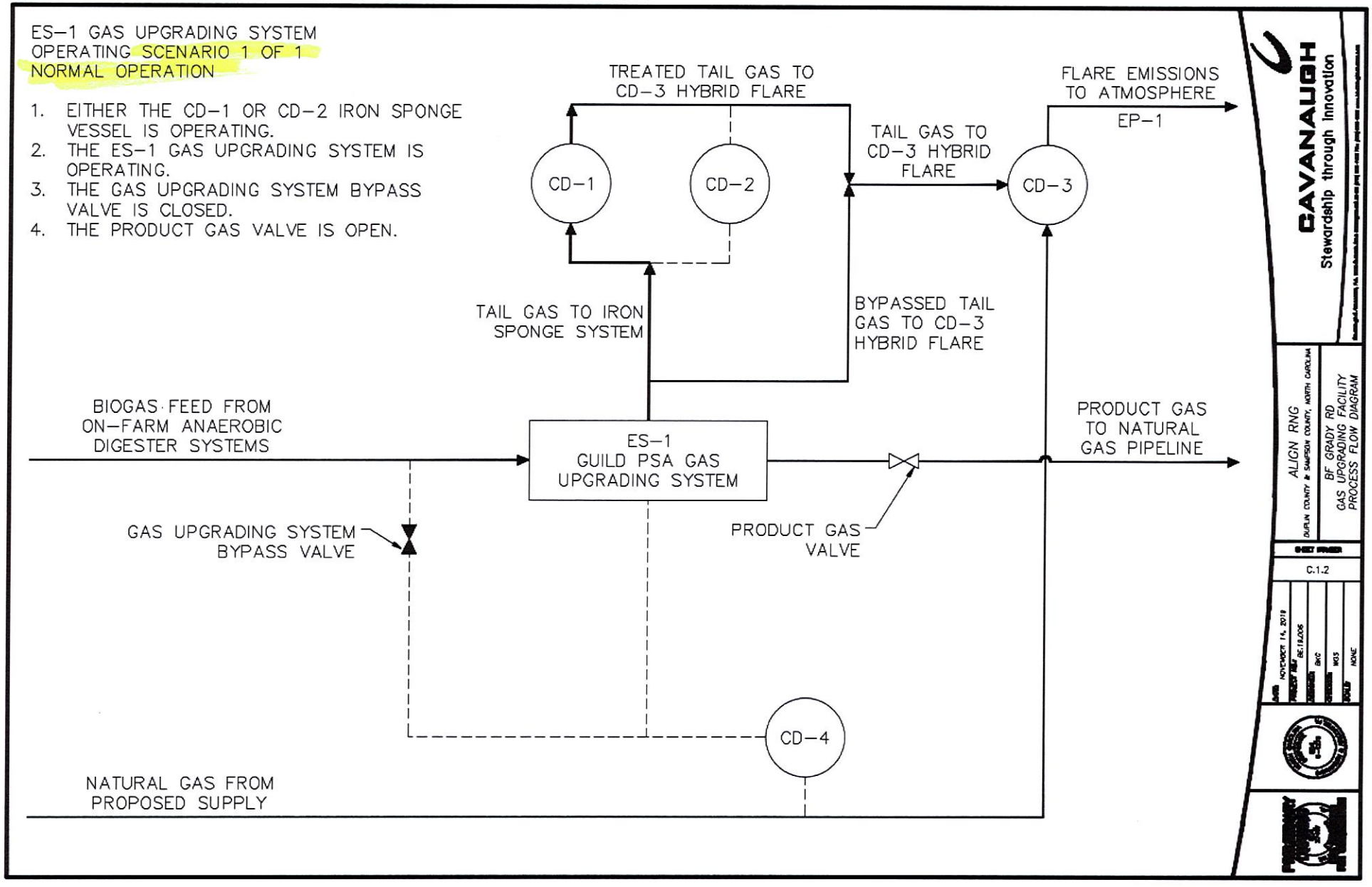
There will be brief periods of time when the product gas produced by the GUS does not meet pipeline specifications and therefore cannot be injected into the natural gas pipeline. During those times, the product gas will be combusted at the BF Grady Rd facility in the candlestick flare. Product gas will 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 each year. 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 year. 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 design and operation of the anaerobic digester systems. The GUS, iron sponge system vessels, and enclosed hybrid flare will be operated when product gas is combusted in the candlestick flare. This infrequent operating scenario as described above, not associated with the "Normal Operating Scenario" of the facility, is herein considered as the off-spec operating scenario.

The Normal Operating Scenario, off-spec operating scenario (combusting product gas), and bypass operating scenario (combusting biogas) are depicted in the process flow diagrams on the following three pages. The bypass operating scenario and the off-spec operating scenario will not occur during the Normal Operating Scenario and will only happen during infrequent but necessary and/or unavoidable equipment maintenance, facility startup, or malfunction events.

The BF Grady Rd facility will be available through remote monitoring and control 24 hours per day, but an operator will not physically be on site 24 hours per day. The facility's controls system will send alarm codes to operators when one or more parameters deviate from the acceptable operating ranges. The facility will automatically shut down if parameters exceed or fall below programmed set points. If the GUS or hybrid flare shuts down, the biogas handling equipment at each farm will automatically turn off to stop sending biogas through the pipeline to the BF Grady Rd facility.

The gas upgrading system (ES-1), iron sponge system vessels (CD-1 and CD-2), enclosed hybrid flare (CD-3), and elevated candlestick flare (CD-4) are described in greater detail in the sections that follow.


ES–1 GAS UPGRADING SYSTEM
OPERATING SCENARIO 1 OF 1
NORMAL OPERATION
1. EITHER THE CD–1 OR CD–2 IRON SPONGE VESSEL IS OPERATING.
2. THE ES–1 GAS UPGRADING SYSTEM IS OPERATING.
3. THE GAS UPGRADING SYSTEM BYPASS VALVE IS CLOSED.
4. THE PRODUCT GAS VALVE IS OPEN.
TREATED TAIL GAS TO CD–3 HYBRID FLARE
FLARE EMISSIONS TO ATMOSPHERE
EP–1
CD–1
CD–2
TAIL GAS TO CD–3 HYBRID FLARE
CD–3
TAIL GAS TO IRON SPONGE SYSTEM
BYPASSED TAIL GAS TO CD–3 HYBRID FLARE
BIOGAS FEED FROM ON–FARM ANAEROBIC DIGESTER SYSTEMS
ES–1 GUILD PSA GAS UPGRADING SYSTEM
PRODUCT GAS TO NATURAL GAS PIPELINE
GAS UPGRADING SYSTEM BYPASS VALVE
PRODUCT GAS VALVE
CD–4
NATURAL GAS FROM PROPOSED SUPPLY
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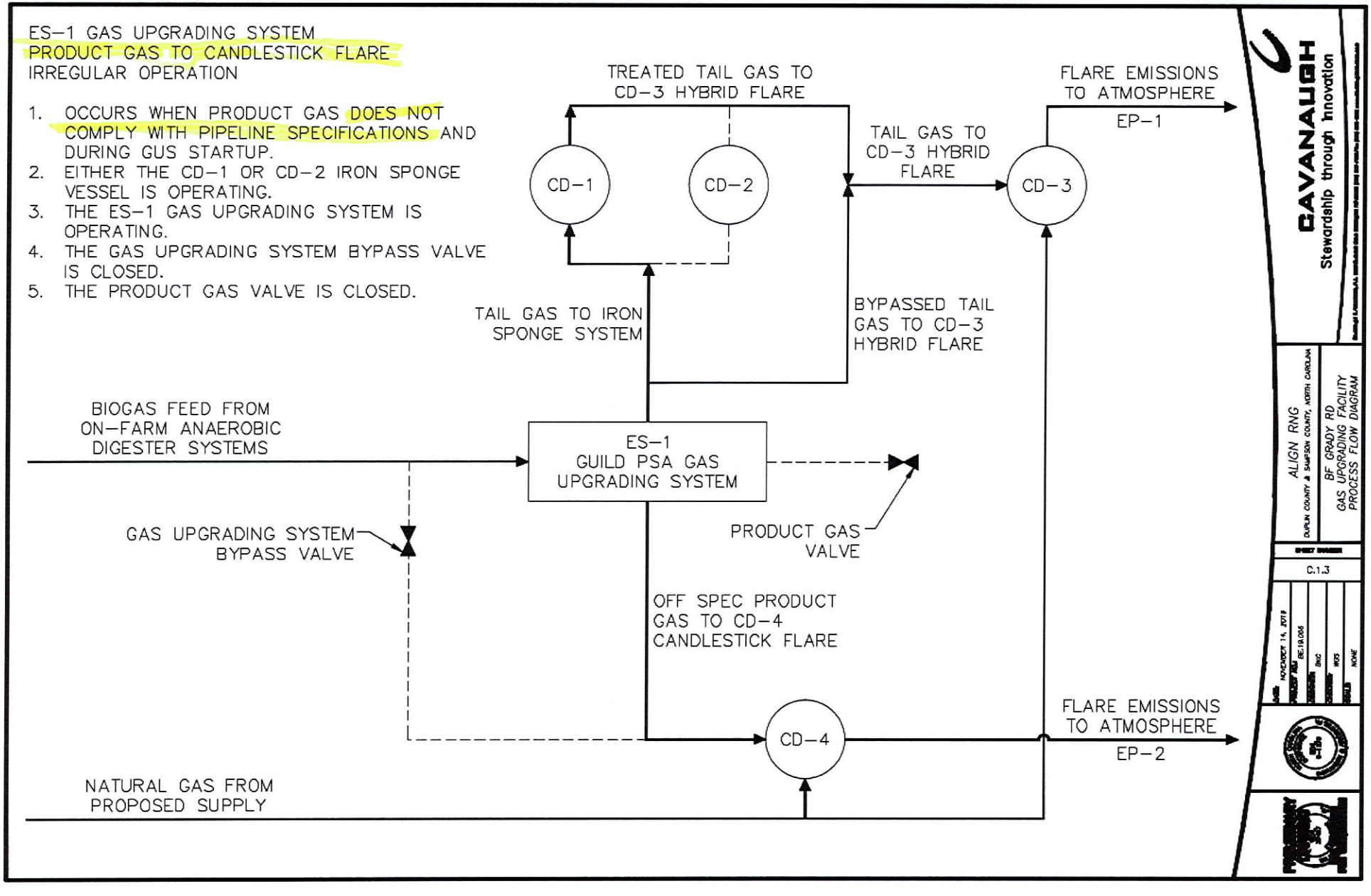
ALIGN RNG
DUPLIN COUNTY & SAMPSON COUNTY, NORTH CAROLINA
BF GRADY RD
GAS UPGRADING FACILITY
PROCESS FLOW DIAGRAM
C.1.2
NOVEMBER 14, 2019
BE.19.006
BWC
MDS
NONE

off-Spec


ES–1 GAS UPGRADING SYSTEM
PRODUCT GAS TO CANDLESTICK FLARE
IRREGULAR OPERATION
1. OCCURS WHEN PRODUCT GAS DOES NOT COMPLY WITH PIPELINE SPECIFICATIONS AND DURING GUS STARTUP.
2. EITHER THE CD–1 OR CD–2 IRON SPONGE VESSEL IS OPERATING.
3. THE ES–1 GAS UPGRADING SYSTEM IS OPERATING.
4. THE GAS UPGRADING SYSTEM BYPASS VALVE IS CLOSED.
5. THE PRODUCT GAS VALVE IS CLOSED.
TREATED TAIL GAS TO CD–3 HYBRID FLARE
FLARE EMISSIONS TO ATMOSPHERE
EP–1
CD–1
CD–2
TAIL GAS TO CD–3 HYBRID FLARE
CD–3
TAIL GAS TO IRON SPONGE SYSTEM
BYPASSED TAIL GAS TO CD–3 HYBRID FLARE
BIOGAS FEED FROM ON–FARM ANAEROBIC DIGESTER SYSTEMS
ES–1 GUILD PSA GAS UPGRADING SYSTEM
GAS UPGRADING SYSTEM BYPASS VALVE
PRODUCT GAS VALVE
OFF SPEC PRODUCT GAS TO CD–4 CANDLESTICK FLARE
CD–4
FLARE EMISSIONS TO ATMOSPHERE
EP–2
NATURAL GAS FROM PROPOSED SUPPLY
GAVANAUGH
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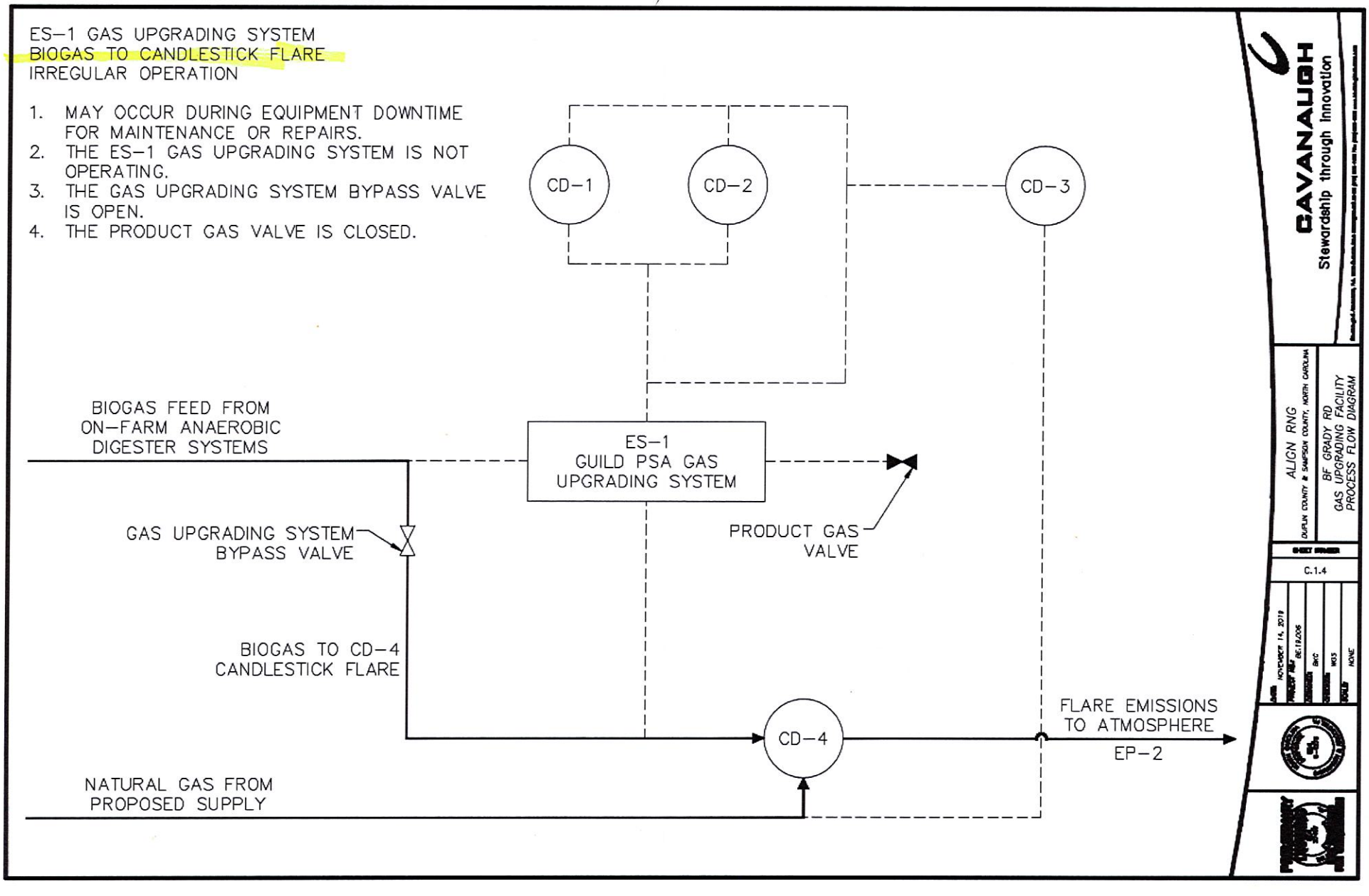
ALIGN RNG
DUPLIN COUNTY & SAMPSON COUNTY, NORTH CAROLINA
BF GRADY RD
GAS UPGRADING FACILITY
PROCESS FLOW DIAGRAM
C.1.3
NOVEMBER 14, 2019
NONE

By - Pass


ES–1 GAS UPGRADING SYSTEM
BIOGAS TO CANDLESTICK FLARE
IRREGULAR OPERATION
1. MAY OCCUR DURING EQUIPMENT DOWNTIME FOR MAINTENANCE OR REPAIRS.
2. THE ES–1 GAS UPGRADING SYSTEM IS NOT OPERATING.
3. THE GAS UPGRADING SYSTEM BYPASS VALVE IS OPEN.
4. THE PRODUCT GAS VALVE IS CLOSED.
CD–1
CD–2
CD–3
BIOGAS FEED FROM ON–FARM ANAEROBIC DIGESTER SYSTEMS
ES–1 GUILD PSA GAS UPGRADING SYSTEM
GAS UPGRADING SYSTEM BYPASS VALVE
PRODUCT GAS VALVE
BIOGAS TO CD–4 CANDLESTICK FLARE
CD–4
FLARE EMISSIONS TO ATMOSPHERE
EP–2
NATURAL GAS FROM PROPOSED SUPPLY
CAVANAUGH
Stewardship through Innovation
ALIGN RNG
DUPLIN COUNTY & SAMPSON COUNTY, NORTH CAROLINA
BF GRADY RD
GAS UPGRADING FACILITY
PROCESS FLOW DIAGRAM
C.1.4
NOVEMBER 14, 2019
RE.19.206
BWC
MKS
NONE

A. ES-1: Gas Upgrading System

Biogas will be delivered to the BF Grady Rd facility via dedicated pipeline from anaerobic digester systems located at various hog farms located in Duplin and Sampson Counties. Biogas will enter the facility through the pipeline header and will be directed to the GUS inlet feed. The GUS will separate methane, nitrogen, and oxygen from the other biogas constituents to create product gas that is approximately 99% methane by volume. The product gas will be compressed, injected into the existing natural gas pipeline, and used for downstream consumption. The biogas constituents not comprised in the product gas, referred to as tail gas, will be scrubbed for H_2S in an iron sponge system vessel (CD-1 or CD-2) and oxidized at the facility in the enclosed hybrid flare (CD-3). The elevated candlestick flare (CD-4) will not operate during the Normal Operating Scenario.

The GUS will be supplied by Guild Associates. Guild's pressure swing adsorption (PSA) system, which uses Molecular Gate adsorbent to separate biogas into product gas and tail gas, will be utilized. The Molecular Gate adsorbent does not degrade during operation and can be used for the life of the equipment, meaning the adsorbent does not need to be changed. The PSA system operates by delivering biogas to Molecular Gate adsorbent vessels under high pressure. The gases comprising the tail gas are adsorbed on the surface and in the pores of the adsorbent media while the product gas passes through the vessels. The tail gas is removed from a vessel by lowering the vessel pressure to release the tail gas constituents from the adsorbent media. In this way, the adsorbent media is regenerated and can be utilized again for the PSA process.

The maximum capacity of the GUS is 1,200 scfm of biogas. The BF Grady Rd facility's potential-to-emit (PTE) was calculated using the maximum capacity of the GUS. The biogas feed to the BF Grady Rd facility is anticipated to vary throughout the year because biogas production is dependent on ambient temperatures, among other factors. The average expected biogas feed to the GUS is 996 scfm of biogas. Manufacturer specifications from Guild Associates are provided in Appendix G for reference.

Commissioning and facility startup is expected to take 30 days. This estimation is based on the initial testing requirements of Piedmont Natural Gas and the commissioning of similar facilities. During that time, the hybrid flare will be used for tail gas oxidation and the candlestick flare will be used for biogas and product gas combustion until the facility consistently maintains acceptable operation and has passed the gas constituent testing required by Piedmont Natural Gas. Some biogas will be stored in the on-farm digesters during startup and the GUS will not be operated continuously.

B. CD-1 and CD-2: Iron Sponge System Vessels

An iron sponge system, supplied by MV Technologies (MV Tech), is proposed to be installed to remove H_2S from the tail gas stream. MV Tech's H2S Plus System will be utilized, which, for this application, will be a two vessel, fixed bed media H_2S scrubber that utilizes wood chips impregnated with iron oxide as the media, commonly referred to as iron sponge. The two media vessels will be identical. One vessel may be operated at a time or both vessels may be operated simultaneously depending on the total tail gas flow rate. Tail gas will flow through the media vessels causing hydrogen sulfide in the gas to react with the iron oxide to form iron sulfide and water. The iron sulfide can be oxidized with air to produce elemental sulfur and regenerate the iron oxide. The elemental sulfur produced by this reaction remains in the media bed and will eventually reduce the reactivity of the bed so media changeouts will be required. MV Tech has successfully installed over 70 hydrogen sulfide scrubbers in various applications.

MV Tech's technical proposal and standard drawings are provided in Appendix G. The iron sponge system vessels are capable of treating a greater tail gas flow rate than is shown in MV Tech's technical proposal. The treated flow rate reflected in the technical proposal, 240 scfm, was calculated by MV Tech using preliminary design information. We have since consulted with MV Tech and verified the vessels are sized to treat higher flow rates. The upper boundary on flow rate through the vessels is limited by the pressure drop across the vessels, which cannot become too great for the enclosed flare downstream.

During the Normal Operating Scenario, a specified percentage of the tail gas will be treated in the iron sponge system vessels while the remainder will be bypassed around the vessels. Tail gas will be generated by the GUS and then flow through one iron sponge system vessel. The vessels will be designed to reduce the H_2S concentration of the tail gas from approximately 9,500 ppm to less than 100 ppm. The H_2S concentration of the tail gas treated in the vessels will be less than 100 ppm, while the H_2S concentration of the tail gas being bypassed around the vessels will remain at 9,500 ppm. The two tail gas streams will be combined before being delivered to the enclosed flare to achieve an overall H_2S concentration of 2,200 ppm in the flared gas. The removal efficiency of the scrubber was provided by MV Tech and used for the emission calculations.

As previously described, due to the ambient temperature digester design, farm management practices, and other factors, biogas production will vary throughout the year. When the Guild PSA system is operating at its maximum capacity of 1,200 scfm of biogas, approximately 444 scfm of tail gas will be produced. When this occurs, 345 scfm of tail gas will be treated in both iron sponge system vessels while the remaining 99 scfm will be bypassed around the vessels. When the biogas production fluctuates, the treated tail gas flow rate will also change. This means the H_2S load to the enclosed flare will vary throughout the year. The tail gas stream will be supplemented with air when the tail gas flow rate is less than the minimum rated flow rate of 170 scfm for one iron sponge vessel. The minimum capacity of the Guild PSA system is 360 scfm biogas which would result in a 133 scfm tail gas flow rate, although it is not expected the GUS will operate at this low flow rate often.

Based on these varying operating conditions and tail gas flow rates, Align will operate the iron sponge system in such a manner to effectively remove the desired H2S load in the tail gas prior to it being sent to the enclosed flare in order to meet an SO2 emission rate of 2.3 lb/MMBtu. As stated above, when biogas flow rates entering the facility are high and the Guild PSA system is operating at capacity, both iron sponge vessels will be operated simultaneously to treat the resulting high tail gas flow rates. However, when the biogas flow rate into the facility is low resulting in a low tail gas flow rate out of the Guild PSA system, only one iron sponge vessel may be required to meet the 2.3 lb SO2/MMBtu emission limit.

After the iron sponge media in the CD-1 vessel is spent, tail gas flow will be diverted to the CD-2 vessel. Media changeout will occur for one vessel at a time to prevent any disruption to the operation. This alternating configuration allows the iron sponge system to remain operational at all times even during changeouts, barring a malfunction. The expected bed life for one vessel is 32 days or 68 days for the entire system of two vessels. The system has few moving parts: only one small air blower and three sump pumps, resulting in very few malfunctions.

The H_2S concentration of the tail gas will be monitored daily before and after treatment in the iron sponge vessels to determine the H_2S concentration of the tail gas being oxidized in the enclosed hybrid flare. The H_2S concentration of the treated gas is an indicator of remaining media bed life. The pressure drop across each vessel is another indicator of when media changeout should occur. Tail gas flow into the vessels will be maintained at a constant flow rate by a flow control valve which will be automatically controlled by tail gas flow meter readings. The iron sponge system will also include temperature monitoring and manual pH monitoring. When the readings from the temperature transmitters exceed the threshold temperature of 125 °F, the water recirculation system will turn on and the sump pumps will deliver water to the spray nozzle at the top of the operating vessel(s) to wet and cool the media. The pH of the media beds must be maintained above 8 to achieve maximum bed adsorption capacity. If the pH drops below 7.5, sodium carbonate, commonly referred to as soda ash, will be added to the system sump to raise the pH.

C. CD-3: Enclosed Hybrid Flare

The enclosed hybrid flare will be supplied by John Zink Hamworthy Combustion. John Zink will use its ZBRID Low-Btu Gas Flare design. John Zink's technical proposal and standard drawing for the ZBRID flare are included in Appendix G for your reference and to provide additional detail. The flare is rated for low-Btu tail gas that is composed primarily of CO_2 but also contains low amounts of CH_4 and H_2S. The design rating of the flare is 10 MMBtu/hr. The flare is designed to handle the maximum tail gas production from the GUS and the required supplemental natural gas. The flare will be equipped with automatic ignition and controls, temperature monitoring and control, and pneumatic valves to ensure the flare is operating properly. As listed in the technical proposal, the flare is rated for an overall destruction efficiency of 98% and an oxidation efficiency of 98% for sulfur containing compounds.

The enclosed hybrid flare will be used during the Normal Operating Scenario to oxidize the tail gas constituents. The hybrid flare is designed to operate at all times the GUS is operating. Due to the low heating value of the tail gas, supplemental conventional natural gas from the existing pipeline will be combusted in the flare to raise the temperature and efficiently oxidize the tail gas constituents. The required quantity of supplemental fuel to maintain the 1,400 °F to 1,800 °F operating temperature was calculated and provided by John Zink in the technical proposal. John Zink estimated 2.7 MMBtu/hr of supplemental natural gas will be required during maximum tail gas flows.

D. CD-4: Elevated Candlestick Flare

The elevated candlestick flare will be supplied by ProPump & Controls. ProPump's technical proposal is included in Appendix G. The candlestick flare will not be used during the Normal Operating Scenario. Instead, the candlestick flare will only be used for the bypass operating scenario and the off-spec operating scenario, consisting of combusting biogas or product gas respectively, all of which involve infrequent or unavoidable events. The bypass operating scenario will utilize the candlestick flare to combust biogas during initial facility startup and commissioning and when the GUS or hybrid flare are not functioning, and the on-farm digesters have reached maximum storage capacity. The off-spec operating scenario will utilize the candlestick flare to combust product gas during each facility startup and when product gas does not meet Piedmont Natural Gas pipeline specifications. The candlestick flare is designed with a heat input rating of 45 MMBtu/hr and maximum flow of 1,200 scfm of biogas. The flare will use natural gas as a pilot fuel to ensure proper combustion of biogas and product gas. The flare

is rated for an overall destruction efficiency of 98% and an oxidation efficiency of 98% for sulfur containing compounds.

E. EP-1: Enclosed Hybrid Flare Stack

Emissions from the enclosed hybrid flare stack will result from the combustion of supplemental natural gas and the oxidation of tail gas in the enclosed hybrid flare (CD-3), as described above. Emissions from the enclosed hybrid flare were calculated using the calculation sheets included in Appendix C. The emission factors used for the calculations were obtained from AP-42 Section 1.4 and AP-42 Section 13.5.

F. EP-2: Elevated Candlestick Flare Stack

Emissions from the elevated candlestick flare stack will result from the combustion of biogas or product gas in the candlestick flare (CD-4) during infrequent but unavoidable maintenance and malfunction events. Emissions from the elevated candlestick flare were calculated using the calculation sheets included in Appendix C. The emission factors used for the calculations were obtained from AP-42 Section 1.4 and AP-42 Section 13.5.

G. Fugitive Emissions

The BF Grady Rd facility will generate fugitive emissions from the following sources:

- Gas Analyzer Building
- Manual Condensate Drains
- Iron Sponge System Vessels (during media changeout)

The gas analyzer building will house gas chromatography equipment and gas analyzers used to monitor the product gas quality, including the concentrations of methane, carbon dioxide, oxygen, nitrogen, water, and hydrogen sulfide. The primary purpose of the gas analyzer equipment is to ensure the product gas complies with Piedmont Natural Gas pipeline specifications which are provided in Appendix D of this application for reference. The gas analyzer building will receive a small feed of product gas from a sample line installed on the piping downstream from the GUS. The gas feed to the analyzer building will be less than 0.2 scfm. The gas will be emitted to the atmosphere after analysis has occurred. On average, the product gas composition is expected to be 99.1% CH_4, 0.8% N_2, 0.1% CO_2, 0.03% O_2. Based on third-party product gas constituent testing at similar facilities, the product gas is not expected to contain detectable levels of VOCs. Pursuant to NCAC 02Q .0102(g)(14)(A) and NCAC 02Q .0102(g)(14)(G), since no regulated air pollutants are emitted from the gas analyzer building, fugitive emissions from the gas analyzer building were not included in the BF Grady Rd facility PTE calculations.

Manual condensate drains will be placed on the biogas collection piping delivering biogas to the BF Grady Rd facility and on the piping delivering gas to each flare. A total of three manual condensate drains will be installed at the facility. The drains will consist of a tee in the primary gas piping connected to a manual valve that can be opened to release accumulated water from the piping. The biogas delivered to the BF Grady Rd facility will have already been dried at each farm and passed through the biogas pipeline which also utilizes condensate drains. Due to this, very little condensate is expected to accumulate in the biogas condensate drain at the BF Grady Rd facility. Similarly, the gas being delivered to each flare is expected to have a low moisture content which will lead to minimal condensate accumulation. Each condensate drain valve is expected to be open for a maximum of 15 hours per year. When the drain valves are opened, accumulated water will be released from the piping. A small quantity

of gas will be released when the water is drained. An operator will be present for the entire duration of the drain valves being open and will close the valves immediately after water flow sufficiently decreases.

The approximate volume of the 8' high by 18" diameter condensate drains is 14.1 cubic feet. The drain valves will be opened for approximately 30 minutes during each draining event or 30 times per year. It is assumed a volume of gas that is four times the volume of the condensate drains will be released each time the valves are opened, so 56.4 cubic feet of gas. The total hydrogen sulfide emissions, for 56.4 cubic feet of gas at a hydrogen sulfide concentration of 3,500 ppm, will be 0.02 pounds per event. The yearly hydrogen sulfide emissions for 90 events (three condensate drains with 30 events each) will be 1.69 pounds. Due to the infrequency and irregularity of the drain valves being open and the minimal volume of gas that will be released from the drains, the fugitive emissions from the condensate drains were not included in the BF Grady Rd facility PTE calculations. The actual frequency of the drains being open, and the volume of gas released are expected to be much less than the values provided above.

H_2S TPER?

The lids will be unbolted and removed from the iron sponge system vessels to complete media changeouts. Prior to removing the lids, each vessel must be filled with water using the system sump pumps and spray nozzles. By filling the vessels with water prior to media changeouts, available gas storage space is filled, and any remaining gas will flow from the vessels to the enclosed flare. A small volume of headspace will remain in the vessels. The 13.5' high by 10' diameter vessels can have a maximum volume of 1,060 cubic feet. The vessels are designed to hold 924 cubic feet of iron sponge media. The maximum volume of headspace in each vessel will be 136 cubic feet. The tail gas remaining in the vessels prior to changeout will have been scrubbed for hydrogen sulfide and contain approximately 100 ppm hydrogen sulfide by volume. Each vessel will require up to six media changeouts per year. The yearly total volume of gas released from the vessels during changeouts will be 1,632 cubic feet (12 changeouts times 136 cubic feet). The total hydrogen sulfide emissions, for 1,632 cubic feet of gas at a hydrogen sulfide concentration of 100 ppm, will be 0.02 pounds per year or 0.001 pounds per changeout. Fugitive emissions from the iron sponge system vessels were not included in the BF Grady Rd facility PTE calculations since the quantity of hydrogen sulfide emitted during 12 changeouts per year is insignificant.

H. Emissions Summary

The BF Grady Rd facility is classified as a synthetic minor facility as defined in 15A NCAC 2Q .0503(17) as "a facility that would otherwise be required to follow the procedures of Title V (15A NCAC 2Q .0500 "Title V Procedures") except that the PTE is restricted by one or more federally enforceable physical or operational limitations.

The potential emissions for the BF Grady Rd facility are presented in the tables below. Tables 1 and 2 contain potential annual emissions for the entire facility both without and with controls and limits, respectively. The calculations include the emissions associated with occurrences when product gas and/or biogas are combusted in the candlestick flare (in accordance with the assumptions provided above), which are also provided separately in Tables 3 and 4. The potential emissions were calculated using the maximum rated capacity of the GUS (1,200 scfm of biogas) and the maximum expected hydrogen sulfide concentration for the biogas (3,500 ppm). The NCDEQ forms containing emissions information are provided in Appendix B and the BF Grady Rd emissions calculations are provided in Appendix C. Once the controls and limits are made enforceable, the values provided in Table 2 will represent the potential-to-emit for the facility.

Facility-wide Potential Annual Emissions Without Controls or Limits

The BF Grady Rd PTE without controls and limits shown in Table 1 below was calculated using the Normal Operation Emissions Calculator and the Product Gas to Candlestick Flare (PTE Calculations Only) Combustion Emissions Calculator provided in Appendix C. The emissions from EP-1 assume 8,760 hours at a maximum emission rate without hydrogen sulfide removal in the iron sponge vessels. The emissions from EP-2 assumes the candlestick flare will combust biogas for up to 240 hours per year and up to 360 hours per year of product gas.

The calculations used for the PTE without controls or limits shown in Table 1 accounts for 240 hours of biogas combustion in the candlestick flare at the maximum biogas flow rate and 360 hours of product gas combustion in the candlestick flare at the maximum product gas flow rate. The emissions calculations show 600 hours of product gas combustion because it is assumed that the enclosed flare will receive the maximum flow of tail gas for 8,760 hours per year without H_2S removal in the iron sponge vessels. This means that all H_2S processed by the GUS will be directed to the enclosed flare in the tail gas stream. Since the full quantity of H_2S entering the BF Grady Rd facility is accounted for in the emissions calculations for the enclosed flare (EP-1), the emissions resulting from H_2S oxidation by the candlestick flare should not be included separately in the calculations for PTE without controls or limits. Doing so would result in an unachievable value for the PTE SO_2 and H_2S because the calculations would show a greater quantity of H_2S being delivered to the flares than will be produced by the GUS. All biogas processed by the GUS is accounted for in the PTE without controls and limits calculations with the assumption that product gas will be injected into the existing natural gas pipeline for 8,160 hours per year and thus not combusted in the candlestick flare at the BF Grady Rd facility. The oxidation efficiencies provided by the manufacturers for the enclosed flare and candlestick flare are both 98%.

Potential Annual Emissions Without Controls and Limits			
	ES-1 EP-1	ES-1 EP-2	Facility Total
Air Pollutant Emitted	tons/yr	tons/yr	tons/yr
PM	0.14	0.01	0.14
PM_{10}	0.14	0.01	0.14
$PM_{2.5}$	0.11	0.01	0.12
SO_2	193.24	0.01	193.24
NO_x	5.70	0.84	6.54
CO	13.58	3.81	17.39
VOCs	1.45	0.07	1.53
Highest HAP	4.76E-01	2.45E-02	0.50
Total HAPs	4.97E-01	2.56E-02	0.52
Highest TAP	2.10	0.00	2.10

Table 1. BF Grady Rd Potential Annual Emissions Without Controls and Limits

Facility-wide Potential Annual Emissions With Controls and Limits

The BF Grady Rd PTE with controls and limits shown in Table 2 below was calculated using the Normal Operation Emissions Calculator, the Biogas to Candlestick Flare Combustion Emissions Calculator, and the Product Gas to Candlestick Flare Combustion Emissions Calculator provided in Appendix C. The emissions from EP-1 assume 8,760 hours at a maximum emission rate with hydrogen sulfide removal in the iron sponge vessels. The emissions from EP-2 assume 360 hours of product gas combustion and 240 hours of biogas combustion in the candlestick flare.

Potential Annual Emissions With Controls and Limits			
	ES-1 EP-1	ES-1 EP-2	Facility Total
Air Pollutant Emitted	tons/yr	tons/yr	tons/yr
PM	0.07	0.01	0.08
PM_{10}	0.07	0.01	0.08
$PM_{2.5}$	0.06	0.01	0.06
SO_2	44.78	5.30	50.08
NO_x	4.19	0.93	5.11
CO	6.67	3.88	10.56
VOCs	0.71	0.09	0.81
Highest HAP	2.34E-01	3.03E-02	0.26
Total HAPs	2.44E-01	3.16E-02	0.28
Highest TAP	0.49	0.06	0.54

Table 2. BF Grady Rd Potential Annual Emissions With Controls and Limits

Synth for just SO2

Potential Annual Emissions from Combustion of Product Gas or Biogas in Candlestick Flare During Maintenance

The PTE for product gas combustion in the candlestick flare shown in Table 3 below was calculated using the Product Gas to Candlestick Flare Combustion Emissions Calculator and the Tail Gas to Enclosed Flare (Not During Normal Operation) Emissions Calculator provided in Appendix C. The emissions from EP-1 assume 360 hours of product gas combustion with hydrogen sulfide removal in the iron sponge vessels. The emissions from EP-2 assume 360 hours of product gas combustion in the candlestick flare.

H_2S is a TAP only

not a VOC

not a HAP delisted Dec 1997

360 hrs

Potential Annual Emissions With Controls and Limits			
	ES-1 EP-1	ES-1 EP-2	Facility Total
Air Pollutant Emitted	tons/yr	tons/yr	tons/yr
PM	0.00	0.00	0.01
PM_{10}	0.00	0.00	0.01
$PM_{2.5}$	0.00	0.00	0.01
SO_2	1.84	0.00	1.85
NO_x	0.17	0.50	0.67
CO	0.27	2.29	2.56
VOCs	0.03	0.04	0.07
Highest HAP	9.61E-03	1.47E-02	0.02
Total HAPs	1.00E-02	1.54E-02	0.03
Highest TAP	1.99E-02	0.00E+00	0.02

Table 3. Potential-to-Emit for Product Gas Combustion in the Candlestick Flare

The PTE for biogas combustion in the candlestick flare shown in Table 4 below was calculated using the Biogas to Candlestick Flare Combustion Emissions Calculator provided in Appendix C. The emissions from EP-2 assume 240 hours of biogas combustion in the candlestick flare.

Potential Annual Emissions With Controls and Limits			
	ES-1 EP-1	ES-1 EP-2	Facility Total
Air Pollutant Emitted	tons/yr	tons/yr	tons/yr
PM	0.00	0.00	0.00
PM_{10}	0.00	0.00	0.00
$PM_{2.5}$	0.00	0.00	0.00
SO_2	0.00	5.29	5.29
NO_x	0.00	0.42	0.42
CO	0.00	1.59	1.59
VOCs	0.00	0.05	0.05
Highest HAP	0.00E+00	1.56E-02	0.02
Total HAPs	0.00E+00	1.63E-02	0.02
Highest TAP	0.00E+00	5.74E-02	0.06

Table 4. Potential-to-Emit for Biogas Combustion in the Candlestick Flare

III. Source Determination

The BF Grady Rd facility is a separate and distinct source, as explained further below, and thus its emissions should not be aggregated with any other sources, such as the existing Warsaw Feed Mill or the proposed on-farm anaerobic digesters.

A. Warsaw Feed Mill

The BF Grady Rd facility will be located approximately 1,000 feet from the existing Warsaw Feed Mill (Facility ID No. 3100014) operated by Murphy-Brown, LLC at 175 Old Courthouse Rd, Warsaw, NC 28398. The Warsaw Feed Mill currently operates under Air Permit No. 02897R25. In general, multiple facilities may be considered a single source if they are under the control of the same person (or persons under common control), they share a common Major Group SIC classification, and they are located on one or more contiguous or adjacent properties. In this case, the Warsaw Feed Mill is owned and operated by Murphy Brown, LLC, a subsidiary of Smithfield Foods, Inc., whereas the BF Grady Rd facility will be owned by Align Renewable Natural Gas, LLC, a joint venture between Smithfield Foods, Inc. and Dominion Energy, Inc. The facilities conduct entirely different and distinct activities that do not overlap and do not share a common industrial grouping—the Warsaw Feed Mill is primarily involved in grain processing for livestock feed production and has SIC Code 2048, whereas the BF Grady Rd facility is primarily involved in biogas collection and processing for renewable natural gas production and has SIC Code 4925. In addition, neither facility is a "support facility" for the other, since they will not share inputs or outputs. Since the Warsaw Feed Mill and BF Grady Rd facilities do not share a common industrial grouping, and the BF Grady Rd facility is not a support facility to the Warsaw Feed Mill, the BF Grady Rd facility should not be aggregated with the Warsaw Feed Mill. The Warsaw Feed Mill and BF Grady Rd facility should be considered separate sources and permitted as such. The two facilities are not a single source.

B. On-Farm Anaerobic Digester Systems

The BF Grady Rd facility and the on-farm anaerobic digester systems should not be considered part of the same stationary source for three reasons. First, the BF Grady Rd facility and related biogas handling equipment used to transfer gas to the facility from each farm will be owned by Align Renewable Natural Gas, LLC. The on-farm anaerobic digester and manure handling systems will be owned by the independent farm owners who currently own and operate the participating hog farming operations. Since Align will not own the on-farm anaerobic digester systems or the individual hog farming operations, the on-farm systems and the BF Grady Rd facility are not under control of the same person or persons under common control. Second, the on-farm anaerobic digester systems are primarily involved in manure processing for livestock production. The hog farming operations have SIC Code 0213. The BF Grady Rd facility is primarily involved in biogas collection and processing for renewable natural gas production and has SIC Code 4925. The two facilities do not share a common Major Group SIC classification or industrial grouping. Third, the BF Grady Rd facility will be located approximately 1.1 miles (straight-line distance) from the nearest on-farm anaerobic digester system; the rest are located even further away. The facilities are not located on contiguous or adjacent properties. Since the on-farm anaerobic digester systems and BF Grady Rd facilities are not contiguous or adjacent, do not share a common industrial grouping, and they are not under control of the same person (or persons under common control), the BF Grady Rd facility and the on-farm anaerobic digester systems should be considered separate sources and permitted as such.

farthest ≈ 19 mi

IV. State Regulatory Applicability

The following sections discuss NCDEQ Division of Air Quality regulatory requirements that could be reasonably applied to the BF Grady Rd facility. An applicability determination is presented for each regulatory requirement.

A. 15A NCAC 02Q .0113 – Notification in Areas Without Zoning

The BF Grady Rd facility will be located in Duplin County just outside the Warsaw ETJ district on the existing parcel with PIN 245500442354. Since Duplin County does not have a countywide zoning ordinance, the notification procedures in NCAC 02Q .0113 were completed prior to submitting this permit application. A legal notice was published in The Duplin Times on October 10, 2019 pursuant to 02Q .0113 and an affidavit and proof of publication are included in Appendix F. A sign was posted at the proposed BF Grady Rd facility location on October 11, 2019 pursuant to 02Q .0113. Pictures of the sign are included in Appendix F and were sent to Dean Carroll via email on October 14, 2019.

B. 15A NCAC 02Q .0300 – Construction and Operation Permits

The owner or operator of a new, modified, or existing facility or source shall not begin construction or operation without first obtaining a construction and operation permit pursuant to 15A NCAC 02Q .0300. This air quality permit application is being submitted for the proposed BF Grady Rd facility prior to start of construction to comply with the requirements of 02Q .0300.

C. 15A NCAC 02Q .0500 – Title V Procedures

Pursuant to 15A NCAC 2Q .0502 and 40 CFR Part 70, the BF Grady Rd facility does not fall into one of the categories subject to the Title V regulations, and therefore does not need to complete a Title V permit application. The BF Grady Rd facility does not have the potential to emit more than 100 tons per year of any regulated air pollutant, nor does any applicable standard require the facility to obtain a Title V permit.

D. 15A NCAC 02Q .0711 – Emission Rates Requiring a Permit

As previously stated, the emission points for the BF Grady Rd facility will be one enclosed hybrid flare stack (EP-1) and one elevated candlestick flare stack (EP-2). Both emission points will be unobstructed and vertically oriented. Pursuant to 02Q .0711(b), a permit to emit toxic air pollutants is required for any facility whose actual rate of hydrogen sulfide emissions from all sources is greater than 5.1 pounds per day. The rate of hydrogen sulfide emissions for the BF Grady Rd facility is 4.79 pounds per day when the maximum potential flow of biogas is combusted in the candlestick flare (CD-4) and 2.66 pounds per day when the maximum potential tail gas flow is oxidized in the hybrid flare (CD-3). Since the maximum emission rates are less than the 5.1 pounds per day limit, the BF Grady Rd facility will not require a permit to emit toxic air pollutants due to hydrogen sulfide emissions.

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

As stated in 02D .0516(a), sulfur dioxide emissions from any "source of combustion" that is discharged from any "vent, stack, or chimney" shall not exceed "2.3 pounds per million Btu input" (lb/MMBtu). The GUS that comprises the source of emissions does not involve combustion, and SO_2 will only be emitted by the flares[1] designated as control devices (CD-3 and CD-4), but DAQ has initially determined that rule

[1] See, e.g., 15A NCAC 02D .0533 (defining "stack" as "not including flares")

02D .0516(a) will apply to the facility. At DAQ's request, the facility has developed an alternative method for operating the iron sponge vessels (CD-1 and CD-2) to demonstrate continuous compliance with the 2.3 lb/MMBtu limit. Under the revised operating method, which is described in more detail above, the rate of SO_2 emissions for the BF Grady Rd facility will be 1.03 lb/MMBtu when the maximum potential flow of biogas is combusted in the candlestick flare (CD-4), and 2.08 lb/MMBtu, when the maximum potential tail gas flow is oxidized in the hybrid flare (CD-3) with 50 scfm of natural gas as assist fuel, per manufacturer specifications. Since these maximum emission rates will be less than 2.3 lb/MMBtu, the BF Grady Rd facility will comply with rule 02D .0516(a).

Annulized 1.21 lb/hr

V. Federal Regulatory Requirements

The following sections discuss federal regulatory requirements relevant to the BF Grady Rd facility.

A. New Source Performance Standards (NSPS)

The potentially relevant categories of the NSPS regulations are described below.

1. 40 CFR 60 Subpart OOOOa – Standards of Performance for Crude Oil and Natural Gas Facilities

Subpart OOOOa establishes emission standards and compliance schedules for the control of the pollutant greenhouse gases (GHG), volatile organic compounds (VOC), and sulfur dioxide (SO_2) emissions from affected facilities in the crude oil and natural gas source category that commence construction, modification, or reconstruction after September 18, 2015. The BF Grady Rd facility is not subject to this subpart because it will not process conventional natural gas obtained from a natural gas well facility (see 40 C.F.R. §§ 60.5365a, 60.5430a), but will instead receive biogas produced from the anaerobic digestion of hog manures and process the biogas to form renewable natural gas.

B. National Emission Standards for Hazardous Air Pollutants (NESHAP)

NESHAP regulations established in 40 CFR Part 61 and Part 63 regulate emission of air toxics. The BF Grady Rd facility will not emit any single HAP in excess of 10 tons per year and will not emit combined HAPs in excess of 25 tons per year and will therefore be designated as an area source of HAPs.

1. 40 CFR 63 Subpart HH – National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities

This regulation applies to certain affected facilities at major and area HAP sources. This regulation is not applicable to the BF Grady Rd facility because it is not a facility that processes, upgrades, or stores natural gas prior to the point at which natural gas enters the natural gas transmission and storage source category or is delivered to a final end user (see 40 C.F.R. §§ 63.760, 63.761).

2. 40 CFR 63 Subpart HHH – National Emissions Standards for Hazardous Air Pollutants from Natural Gas Transmission and Storage Facilities

This regulation applies to certain affected facilities at major HAP sources. This regulation is not applicable to the BF Grady Rd facility because (1) it is not a major source of HAP and (2) it is not a natural gas transmission and storage facility that transports or stores natural gas prior to entering the pipeline (see 40 C.F.R. §§ 63.1270, 1271).

C. Prevention of Significant Deterioration (PSD) and Non-Attainment New Source Review

The BF Grady Rd facility will be located in Duplin County, NC. The air quality of Duplin County is designated by the U.S. EPA as either "better than normal standards" or "attainment/unclassifiable" for all criteria pollutants (40 CFR 81.334 – North Carolina). As such, new construction or major modifications that result in significant emission increases are potentially subject to the PSD permitting regulations.

PSD applicability depends on the existing status of a facility and the net emissions increase associated with the project. The major source threshold for PSD applicability for a facility is 250 tons per year of each regulated pollutant unless the source is included on a list of 28 specifically defined industrial source categories for which the PSD "major" source threshold is 100 tons per year. Since the BF Grady Rd facility is not one of the 28 listed sources, the PSD major source threshold is 250 tons per year of any pollutant regulated by the Clean Air Act. Potential emissions of each criteria pollutant from the proposed facility will not exceed 250 tons per year, as shown in the Emissions Summary and Appendices B and C. Therefore, the facility is not subject to PSD review.

D. 40 CFR 68 – Chemical Accident Prevention Provisions

The BF Grady Rd facility is not subject to 40 CFR Part 68 because it will not store regulated substances above the threshold quantities stated in 40 C.F.R. § 68.130, and therefore does not need to submit a risk management plan.

VI. Description of Appendices

To facilitate your review of the application, an itemized breakdown of the appendices is provided below.

Appendix A. BF Grady Rd General Arrangement Drawing

Appendix B. NCDEQ Division of Air Quality Permit Application Forms

1. One (1) copy of Form A.
2. One (1) copy of Form A2/A3.
3. One (1) copy of Form B for the ES-1 Gas Upgrading System Operating Scenario 1 of 1.
4. One (1) copy of Form B9 for the ES-1 Gas Upgrading System Operating Scenario 1 of 1.
5. One (1) copy of Form C5 for the CD-1 and CD-2 Iron Sponge System Vessels.
6. One (1) copy of Form C9 for the CD-3 Enclosed Hybrid Flare.
7. One (1) copy of Form C9 for the CD-4 Elevated Candlestick Flare.
8. One (1) copy of Form D1 Facility-Wide Emissions Summary.
9. One (1) copy of Form D5 Technical Analysis to Support Permit Application.

Appendix C. BF Grady Rd Emissions Calculations

1. One (1) copy of Calculations to Support Air Quality Permit Application cover page.
2. One (1) copy of the BF Grady Rd Project Equipment List.
3. One (1) copy of the ES-1 Gas Upgrading System (GUS) Mass Balance to serve as a basis for the emissions calculations.
4. One (1) copy of BF Grady Rd Potential to Emit Summary Tables.
5. One (1) copy of BF Grady Rd Event Based Potential to Emit Summary Tables.
6. One (1) copy of the ES-1 Gas Upgrading System Normal Operation Process Flow Diagram (for reference only).
7. One (1) copy of the Normal Operation Emissions Calculator.
8. One (1) copy of the Product Gas to Candlestick Flare (PTE Calculations Only) Combustion Emissions Calculator.
9. One (1) copy of the ES-1 Gas Upgrading System Biogas to Candlestick Flare Process Flow Diagram (for reference only).
10. One (1) copy of the Biogas to Candlestick Flare Combustion Emissions Calculator.
11. One (1) copy of the ES-1 Gas Upgrading System Product Gas to Candlestick Flare Process Flow Diagram (for reference only).
12. One (1) copy of the Product Gas to Candlestick Flare Combustion Emissions Calculator.
13. One (1) copy of the Tail Gas to Enclosed Flare (Not During Normal Operation) Emissions Calculator.
14. One (1) copy of the Emission Factors for Tail Gas, Product Gas, and Biogas Combustion.
15. One (1) copy of 15A NCAC Applicability Calculations.

Appendix D. Piedmont Natural Gas Appendix F – Statement of Alternative Gas Requirements

Appendix E. Zoning Consistency Determination Request Documents

Appendix F. Documentation and Affidavit for NCAC 02Q .0113 Notification

1. One (1) copy of an affidavit and proof of publication from The Duplin Times newspaper pursuant to 15A NCAC 02Q .0113.
2. One (1) copy of pictures of the sign posted at the BF Grady Rd facility location pursuant to 15A NCAC 02Q .0113.

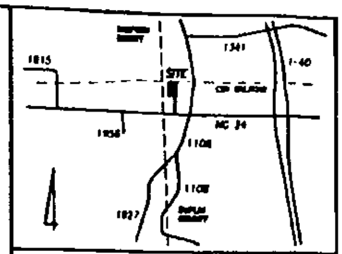
Appendix G. Equipment Details and Specifications

1. One (1) copy of Equipment Details and Specifications cover page.
2. One (1) copy of the manufacturer technical proposal for the ES-1 Gas Upgrading System as supporting information.
3. One (1) copy of the manufacturer technical proposal and arrangement drawings for the CD-1 and CD-2 Iron Sponge System Vessels as supporting information.
4. One (1) copy of the manufacturer technical proposal and arrangement drawing for the CD-3 Enclosed Hybrid Flare as supporting information.
5. One (1) copy of the manufacturer technical proposal and arrangement drawing for the CD-4 Elevated Candlestick Flare as supporting information.

Appendix A

BF Grady Rd General Arrangement Drawing

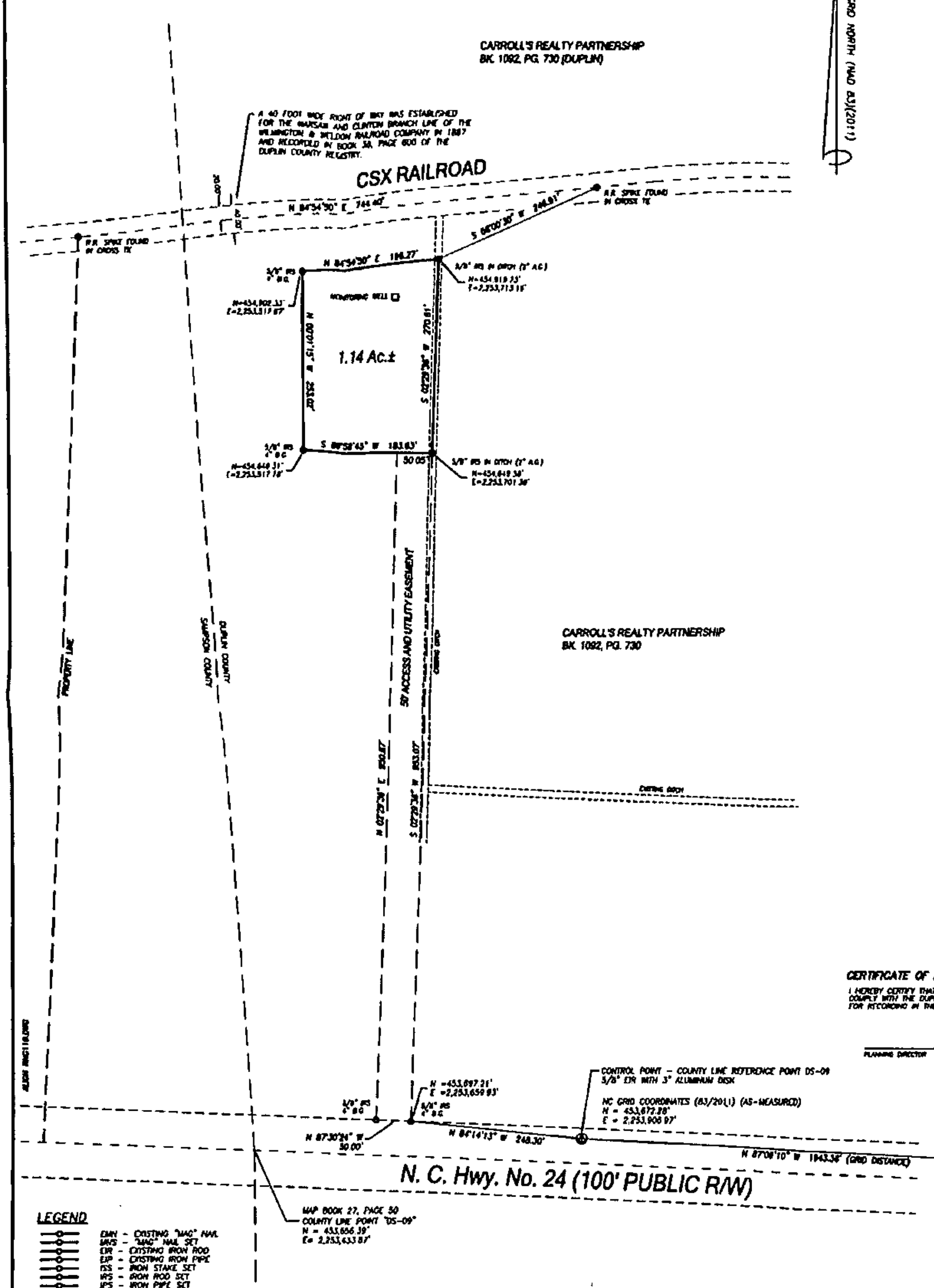
NOTES



VICINITY MAP

RECORDED REFERENCES:

BOOK 1151, PAGE 100 (SAMPSON COUNTY)
BOOK 1092, PAGE 730 (DUPLIN COUNTY)



LEGEND

EMN – EXISTING "MAG" NAIL
MNS – "MAG" NAIL SET
EIR – EXISTING IRON ROD
EIP – EXISTING IRON PIPE
ISS – IRON STAKE SET
IRS – IRON ROD SET
IPS – IRON PIPE SET
ECM – EXISTING CONCRETE MONUMENT
CMS – CONCRETE MONUMENT SET
Δ NCGS – NC GEODETIC SURVEY TRAVERSE STATION OR CONTROL POINT
A.G./B.G. – TOP OF SURVEY MARKER IS ABOVE/BELOW GROUND SURFACE

WARSAW TOWNSHIP
DUPLIN COUNTY
STATE OF NORTH CAROLINA

Brent H. Whitfield 1-31-20
BRENT H. WHITFIELD

CERTIFICATE OF SURVEY & ACCURACY:

STATE OF NORTH CAROLINA —— DUPLIN COUNTY

Brent H. Whitfield 1-31-20
BRENT H. WHITFIELD

REVIEW OFFICER'S CERTIFICATE:

STATE OF NORTH CAROLINA —— DUPLIN COUNTY

I, ______________________
REVIEW OFFICER OF DUPLIN COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

____
REVIEW OFFICER

____
DATE

CERTIFICATE OF REGISTRY:

CERTIFICATE OF APPROVAL FOR RECORDING:

I HEREBY CERTIFY THAT THE SUBDIVISION PLAT SHOWN HEREON HAS BEEN FOUND TO COMPLY WITH THE DUPLIN COUNTY SUBDIVISION ORDINANCE AND IS HEREBY APPROVED FOR RECORDING IN THE OFFICE OF THE REGISTER OF DEEDS OF DUPLIN COUNTY.

______________________ ______________________
PLANNING DIRECTOR DATE

OWNER: CARROLL'S REALTY PARTNERSHIP

MURPHY-BROWN, LLC 2822 N. C. HIGHWAY 24 WEST WARSAW, N.C. 28398 PHONE (910) 293-3434	DATE: JANUARY 28, 2020 SCALE 1" = 100'	BOUNDARY SURVEY FOR: ALIGN RNG, LLC

Appendix B

NCDEQ Division of Air Quality Permit Application Forms

DAQ WIRO

FEB 2 7 2020

RECEIVED

400 rec'd 12-10-19

FORM A

GENERAL FACILITY INFORMATION

REVISED 09/22/16 — NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate — **A**

NOTE- APPLICATION WILL NOT BE PROCESSED WITHOUT THE FOLLOWING:

☑	Local Zoning Consistency Determination (new or modification only)	☑	Appropriate Number of Copies of Application	Application Fee (please check one option below)
☑	Responsible Official/Authorized Contact Signature	☑	P.E. Seal (if required)	☐ Not Required ☐ ePayment ☑ Check Enclosed

GENERAL INFORMATION

Legal Corporate/Owner Name:	Align Renewable Natural Gas, LLC
Site Name:	BF Grady Rd
Site Address (911 Address) Line 1:	2940 NC Highway 24 (West)
Site Address Line 2:	
City: Turkey	State: North Carolina
Zip Code: 28393	County: Duplin

CONTACT INFORMATION

Responsible Official/Authorized Contact:		***Invoice Contact:***	
Name/Title:	Kraig Westerbeek / Vice President	Name/Title:	Kraig Westerbeek / Vice President
Mailing Address Line 1:	120 Tredegar St.	Mailing Address Line 1:	120 Tredegar St.
Mailing Address Line 2:		Mailing Address Line 2:	
City: Richmond State: VA Zip Code:	23219	City: Richmond State: VA Zip Code:	23219
Primary Phone No.:	910-293-5330 x 55330	Primary Phone No.:	910-293-5330 x 55330
Fax No.:		Fax No.:	
Secondary Phone No.:		Secondary Phone No.:	
Email Address:	kwesterbeek@smithfield.com	Email Address:	kwesterbeek@smithfield.com
Facility/Inspection Contact:		***Permit/Technical Contact:***	
Name/Title:	Kraig Westerbeek / Vice President	Name/Title:	Kraig Westerbeek / Vice President
Mailing Address Line 1:	120 Tredegar St.	Mailing Address Line 1:	120 Tredegar St.
Mailing Address Line 2:		Mailing Address Line 2:	
City: Richmond State: VA Zip Code:	23219	City: Richmond State: VA Zip Code:	23219
Primary Phone No.:	910-293-5330 x 55330	Primary Phone No.:	910-293-5330 x 55330
Fax No.:		Fax No.:	
Secondary Phone No.:		Secondary Phone No.:	
Email Address:	kwesterbeek@smithfield.com	Email Address:	kwesterbeek@smithfield.com

APPLICATION IS BEING MADE FOR

☑ New Non-permitted Facility/Greenfield ☐ Modification of Facility (permitted) ☐ Renewal Title V ☐ Renewal Non-Title V
☐ Name Change ☐ Ownership Change ☐ Administrative Amendment ☐ Renewal with Modification

FACILITY CLASSIFICATION AFTER APPLICATION (Check Only One)

☐ General ☐ Small ☐ Prohibitory Small ☑ Synthetic Minor ☐ Title V

FACILITY (Plant Site) INFORMATION

Describe nature of (plant site) operation(s):
The BF Grady Rd facility will receive biogas from swine farms in Duplin and Sampson Counties and upgrade the biogas to renewable natural gas (RNG) quality for injection into the existing natural gas pipeline. The facility will utilize an enclosed hybrid flare and an elevated candlestick flare for gas combustion. An iron sponge system will be used for hydrogen sulfide emissions control.

1311 1321 2819

	Facility ID No.
Primary SIC/NAICS Code: 211130 Natural Gas Extraction	Current/Previous Air Permit No. / Expiration Date:
Facility Coordinates: Latitude: 34.996706	Longitude: -78.153190

Does this application contain confidential data? ☐ YES ☑ NO ***If yes, please contact the DAQ Regional Office prior to submitting this application.*** (See Instructions)

PERSON OR FIRM THAT PREPARED APPLICATION

Person Name:	Ben Cauthen	Firm Name:	Cavanaugh & Associates, P.A.
Mailing Address Line 1:	1213 Culbreth Dr.	Mailing Address Line 2:	
City: Wilmington	State: NC	Zip Code: 28405	County: New Hanover
Phone No.: 877-557-8923	Fax No.:	Email Address:	ben.cauthen@cavanaughsolutions.com

SIGNATURE OF RESPONSIBLE OFFICIAL/AUTHORIZED CONTACT

Name (typed): Kraig Westerbeek	Title: Vice President
X Signature(Blue Ink): Kraig Westerbeek	Date: 12-6-19

Attach Additional Sheets As Necessary

FORM A (continued, page 2 of 2)
GENERAL FACILITY INFORMATION

REVISED 09/22/16 | NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate | A

SECTION AA1 - APPLICATION FOR NON-TITLE V PERMIT RENEWAL

_____ (Company Name) hereby formally requests renewal of Air Permit No. _____

There have been no modifications to the originally permitted facility or the operations therein that would require an air permit since the last permit was issued.

Is your facility subject to 40 CFR Part 68 "Prevnetion of Accidental Releases" - Section 112(r) of the Clean Air Act? ☐ YES ☐ NO

If yes, have you already submitted a Risk Manage Plan (RMP) to EPA? ☐ YES ☐ NO Date Submitted: _____

Did you attach a current emissions inventory? ☐ YES ☐ NO

If no, did you submit the inventory via AERO or by mail? ☐ Via AERO ☐ Mailed Date Mailed: _____

SECTION AA2- APPLICATION FOR TITLE V PERMIT RENEWAL

In accordance with the provisions of Title 15A 2Q .0513, the responsible official of _____ (Company Name) hereby formally requests renewal of Air Permit No. _____ (Air Permit No.) and further certifies that:

(1) The current air quality permit identifies and describes all emissions units at the above subject facility, except where such units are exempted under the North Carolina Title V regulations at 15A NCAC 2Q .0500;

(2) The current air quality permit cits all applicable requirements and provides the method or methods for determing compliance with the applicable requirements;

(3) The facility is currently in compliance, and shall continue to comply, with all applicable requiremetns. (Note: As provided under 15A NCAC 2Q .0512 compliance with the conditions of the permit shall be deemed compliance with the applicable requirements specifically identified in the permit);

(4) For applicable requirements that become effective during the term of the renewed permit that the facility shall comply on a timely basis;

(5) The facility shall fulfill applicable enhanced monitoring requirements and submit a compliance certification as required by 40 CFR Part 64.

The responsible official (signature on page 1) certifies under the penalty of law that all information and statements provided above, based on information and belief formed after reasonable inquiry, are true, accurate, and complete.

SECTION AA3- APPLICATION FOR NAME CHANGE

New Facility Name: _____

Former Facility Name: _____

An official facility name change is requested as described above for the air permit mentioned on page 1 of this form. Complete the other sections if there have been modifications to the originally premitted facility that would requie an air quality permit since the last permit was issued and if ther has been an ownership change associated with this name change.

SECTION AA4- APPLICATION FOR AN OWNERSHIP CHANGE

By this application we hereby request transfer of Air Quality Permit No. _____ from the former owner to the new owner as described below. The transfer of permit responsibility, coverage and liability shall be effective _____ (immediately or insert date.) The legal ownership of the facility described on page 1 of this form has been or will be transferred on _____ (date). There have been no modifications to the originally permitted facility that would require an air quality permit since the last permit was issued.

Signature of New (Buyer) Responsible Official/Authorized Contact (as typed on page 1):

X Signature (Blue Ink): _____

Date:

New Facility Name:

Former Facility Name:

Signature of Former (Seller) Responsible Official/Authorized Contact:

Name (typed or print):

Title:

X Signature (Blue Ink): _____

Date:

Former Legal Corporate/Owner Name:

In lieu of the seller's signature on this form, a letter may be submitted with the seller's signature indicating the ownership change

SECTION AA5- APPLICATION FOR ADMINISTRATIVE AMENDMENT

Describe the requested administrative amendment here (attach additional documents as necessary):

FORMs A2, A3

EMISSION SOURCE LISTING FOR THIS APPLICATION - A2

112r APPLICABILITY INFORMATION - A3

REVISED 09/22/16 — NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate — **A2**

EMISSION SOURCE LISTING: New, Modified, Previously Unpermitted, Replaced, Deleted

EMISSION SOURCE ID NO.	EMISSION SOURCE DESCRIPTION	CONTROL DEVICE ID NO.	CONTROL DEVICE DESCRIPTION
Equipment To Be ADDED By This Application (New, Previously Unpermitted, or Replacement)			
ES-1	Gas Upgrading System Normal Operation (Operating Scenario 1 of 1)	CD-1, CD-2, CD-3	Iron Sponge System Vessels, Enclosed Hybrid Flare
ES-1	Gas Upgrading System Irregular Operation (Biogas to Candlestick Flare)	CD-4	Elevated Candlestick Flare
ES-1	Gas Upgrading System Irregular Operation (Product Gas to Candlestick Flare)	CD-1, CD-2, CD-3, CD-4	Iron Sponge System Vessels, Enclosed Hybrid Flare, Elevated Candlestick Flare
Existing Permitted Equipment To Be MODIFIED By This Application			
Equipment To Be DELETED By This Application			

112(r) APPLICABILITY INFORMATION — A 3

Is your facility subject to 40 CFR Part 68 "Prevention of Accidental Releases" - Section 112(r) of the Federal Clean Air Act? ☐ Yes ☑ No

If No, please specify in detail how your facility avoided applicability: The BF Grady Rd facility does not store any 112(r)-subject chemicals above threshold quantities.

If your facility is Subject to 112(r), please complete the following:

A. Have you already submitted a Risk Management Plan (RMP) to EPA Pursuant to 40 CFR Part 68.10 or Part 68.150?

☐ Yes ☐ No Specify required RMP submittal date: _____ If submitted, RMP submittal date: _____

B. Are you using administrative controls to subject your facility to a lesser 112(r) program standard?

☐ Yes ☐ No If yes, please specify: _____

C. List the processes subject to 112(r) at your facility:

PROCESS DESCRIPTION	PROCESS LEVEL (1, 2, or 3)	HAZARDOUS CHEMICAL	MAXIMUM INTENDED INVENTORY (LBS)

Attach Additional Sheets As Necessary

FORM B

SPECIFIC EMISSION SOURCE INFORMATION (REQUIRED FOR ALL SOURCES)

REVISED 09/22/16 — **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** — **B**

EMISSION SOURCE DESCRIPTION: Gas Upgrading System (GUS)	EMISSION SOURCE ID NO: ES-1
	CONTROL DEVICE ID NO(S): CD-1, CD-2, CD-3
OPERATING SCENARIO 1 OF 1	EMISSION POINT (STACK) ID NO(S): EP-1

DESCRIBE IN DETAILTHE EMISSION SOURCE PROCESS (ATTACH FLOW DIAGRAM):

Biogas will be produced in anaerobic digesters at hog farms in Duplin and Sampson Counties and transferred to the BF Grady Rd facility via biogas pipeline. During normal operation, the GUS will receive biogas from the pipeline and separate it into product gas and tail gas. Product gas will be injected into the existing natural gas pipeline and tail gas will be directed to the iron sponge system vessels (CD-1 and CD-2) for hydrogen sulfide removal. The treated tail gas will then be oxidized in the enclosed hybrid flare (CD-3).

TYPE OF EMISSION SOURCE (CHECK AND COMPLETE APPROPRIATE FORM B1-B9 ON THE FOLLOWING PAGES):

- ☐ Coal,wood,oil, gas, other burner (Form B1)
- ☐ Int.combustion engine/generator (Form B2)
- ☐ Liquid storage tanks (Form B3)
- ☐ Woodworking (Form B4)
- ☐ Coating/finishing/printing (Form B5)
- ☐ Storage silos/bins (Form B6)
- ☐ Manuf. of chemicals/coatings/inks (Form B7)
- ☐ Incineration (Form B8)
- ☑ Other (Form B9)

START CONSTRUCTION DATE: 2/1/2020 (pour concrete slabs) — DATE MANUFACTURED: 2/4/2019 (equipment ready for shipment)

MANUFACTURER / MODEL NO.: TBD — EXPECTED OP. SCHEDULE: 24 HR/DAY 7 DAY/WK 49 WK/YR

IS THIS SOURCE SUBJECT TO? ☐ NSPS (SUBPARTS?):_____ ☐ NESHAP (SUBPARTS?):_____

PERCENTAGE ANNUAL THROUGHPUT (%): DEC-FEB 20% MAR-MAY 25% JUN-AUG 30% SEP-NOV 25%

CRITERIA AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

AIR POLLUTANT EMITTED	SOURCE OF EMISSION FACTOR	EXPECTED ACTUAL (AFTER CONTROLS / LIMITS) lb/hr	EXPECTED ACTUAL (AFTER CONTROLS / LIMITS) tons/yr	POTENTIAL EMISSIONS (BEFORE CONTROLS / LIMITS) lb/hr	POTENTIAL EMISSIONS (BEFORE CONTROLS / LIMITS) tons/yr	POTENTIAL EMISSIONS (AFTER CONTROLS / LIMITS) lb/hr	POTENTIAL EMISSIONS (AFTER CONTROLS / LIMITS) tons/yr
PARTICULATE MATTER (PM)	09	0.03	0.07	0.06	0.14	0.06	0.08
PARTICULATE MATTER<10 MICRONS (PM_{10})	09	0.03	0.07	0.06	0.14	0.06	0.08
PARTICULATE MATTER<2.5 MICRONS ($PM_{2.5}$)	09	0.03	0.06	0.05	0.12	0.05	0.06
SULFUR DIOXIDE (SO2)	03, 09	10.24	47.02	44.15	193.24	10.27	50.08
NITROGEN OXIDES (NOx)	03, 09	1.30	4.83	4.36	6.54	4.36	5.11
CARBON MONOXIDE (CO)	09	3.10	10.10	17.05	17.39	17.05	10.56
VOLATILE ORGANIC COMPOUNDS (VOC)	09	0.33	0.76	0.61	1.53	0.61	0.81
LEAD							
OTHER							

HAZARDOUS AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

HAZARDOUS AIR POLLUTANT	CAS NO.	SOURCE OF EMISSION FACTOR	EXPECTED ACTUAL (AFTER CONTROLS / LIMITS) lb/hr	EXPECTED ACTUAL (AFTER CONTROLS / LIMITS) tons/yr	POTENTIAL EMISSIONS (BEFORE CONTROLS / LIMITS) lb/hr	POTENTIAL EMISSIONS (BEFORE CONTROLS / LIMITS) tons/yr	POTENTIAL EMISSIONS (AFTER CONTROLS / LIMITS) lb/hr	POTENTIAL EMISSIONS (AFTER CONTROLS / LIMITS) tons/yr
Acetaldehyde (TH)	75070	09	9.17E-07	2.09E-06	1.67E-06	4.22E-06	1.67E-06	2.23E-06
Acrolein (TH)	107028	09	1.09E-06	2.48E-06	1.98E-06	5.00E-06	1.98E-06	2.64E-06
Ammonia (T)	7664417	03, 09	2.00E-01	4.70E-01	3.59E-01	9.19E-01	3.59E-01	5.00E-01
Arsenic unlisted compounds (TH)	ASC-other	09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	09	1.27E-04	2.89E-04	2.31E-04	5.83E-04	2.31E-04	3.08E-04
Benzo(a)pyrene (TH)	50328	09	7.24E-08	1.65E-07	1.32E-07	3.33E-07	1.32E-07	1.76E-07
Beryllium metal (unreacted) (TH)	7440417	09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromic acid (VI) (TH)	7738945	09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cobalt unlisted compounds (H)	COC-other	09	5.07E-06	1.16E-05	9.25E-06	2.33E-05	9.25E-06	1.23E-05
Formaldehyde (TH)	50000	09	4.52E-03	1.03E-02	8.26E-03	2.08E-02	8.26E-03	1.10E-02
Hexane, n- (TH)	110543	09	1.09E-01	2.48E-01	1.98E-01	5.00E-01	1.98E-01	2.64E-01
Lead unlisted compounds (H)	PBC-other	09	3.02E-05	6.89E-05	5.51E-05	1.39E-04	5.51E-05	7.33E-05
Manganese unlisted compounds (TH)	MNC-other	09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Napthalene (H)	91203	09	3.68E-05	8.41E-05	6.72E-05	1.69E-04	6.72E-05	8.95E-05
Nickel metal (TH)	7440020	09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Selenium compounds (H)	SEC	09	1.45E-06	3.31E-06	2.64E-06	6.67E-06	2.64E-06	3.52E-06
Toluene (TH)	108883	09	2.05E-04	4.69E-04	3.75E-04	9.45E-04	3.75E-04	4.99E-04
Total HAPs			1.14E-01	2.59E-01	2.07E-01	5.23E-01	2.07E-01	2.76E-01
Highest HAP	110543		1.09E-01	2.48E-01	1.98E-01	5.00E-01	1.98E-01	2.64E-01

Hyd. Sulfide is not a HAP

TOXIC AIR POLLUTANT EMISSIONS INFORMATION FOR THIS SOURCE

TOXIC AIR POLLUTANT	CAS NO.	SOURCE OF EMISSION FACTOR	EXPECTED ACTUAL EMISSIONS AFTER CONTROLS / LIMITATIONS		
			lb/hr	lb/day	lb/yr
Acetaldehyde (TH)	75070	09	9.17E-07	2.20E-05	4.19E-03
Acrolein (TH)	107028	09	1.09E-06	2.61E-05	4.96E-03
Ammonia (T)	7664417	03, 09	2.00E-01	4.80E+00	9.39E+02
Arsenic unlisted compounds (TH)	ASC-other	09	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	09	1.27E-04	3.04E-03	5.79E-01
Benzo(a)pyrene (TH)	50328	09	7.24E-08	1.74E-06	3.31E-04
Beryllium metal (unreacted) (TH)	7440417	09	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	09	0.00E+00	0.00E+00	0.00E+00
Soluble chromate compounds, as chromium (VI) e	7738945	09	0.00E+00	0.00E+00	0.00E+00
Formaldehyde (TH)	50000	09	4.52E-03	1.09E-01	2.07E+01
Hexane, n- (TH)	110543	09	1.09E-01	2.61E+00	4.96E+02
Hydrogen Sulfide	7783064	03	1.11E-01	2.66E+00	1.02E+03
Manganese unlisted compounds (TH)	MNC-other	09	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	09	0.00E+00	0.00E+00	0.00E+00
Nickel metal (TH)	7440020	09	0.00E+00	0.00E+00	0.00E+00
Toluene (TH)	108883	09	2.05E-04	4.92E-03	9.37E-01

Attachments: (1) emissions calculations and supporting documentation; (2) indicate all requested state and federal enforceable permit limits (e.g. hours of operation, emission rates) and describe how these are monitored and with what frequency; and (3) describe any monitoring devices, gauges, or test ports for this source.

COMPLETE THIS FORM AND COMPLETE AND ATTACH APPROPRIATE B1 THROUGH B9 FORM FOR EACH SOURCE

Attach Additional Sheets As Necessary

All TAP's are below TPER.

FORM B9
EMISSION SOURCE (OTHER)

REVISED 09/22/16 — **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** — **B9**

EMISSION SOURCE DESCRIPTION: Gas Upgrading System (GUS)	EMISSION SOURCE ID NO: ES-1
OPERATING SCENARIO: 1 OF 1	CONTROL DEVICE ID NO(S): CD-1, CD-2, CD-3
	EMISSION POINT (STACK) ID NO(S): EP-1

DESCRIBE IN DETAIL THE PROCESS (ATTACH FLOW DIAGRAM):
Biogas will be produced in anaerobic digester systems at hog farms in Duplin and Sampson Counties and tranferred to the GUS through a biogas pipeline. During normal operation, the GUS will receive biogas from the biogas pipeline collection header and generate tail gas and product gas. The product gas will be injected into the existing natural gas pipeline as RNG. The tail gas will be treated in the iron sponge system (CD-1 and CD-2) and oxidized in the enclosed hybrid flare (CD-3).

MATERIALS ENTERING PROCESS - CONTINUOUS PROCESS

TYPE	UNITS	MAX. DESIGN CAPACITY (UNIT/HR)	REQUESTED CAPACITY LIMITATION(UNIT/HR)
Biogas	scf	72,000.0	72,000.0
Natural Gas (as supplemental and pilot fuel for flare)	scf	3,050.0	3,050.0

MATERIALS ENTERING PROCESS - BATCH OPERATION

TYPE	UNITS	MAX. DESIGN CAPACITY (UNIT/BATCH)	REQUESTED CAPACITY LIMITATION (UNIT/BATCH)

MAXIMUM DESIGN (BATCHES / HOUR):	
REQUESTED LIMITATION (BATCHES / HOUR):	(BATCHES/YR):
FUEL USED: Tail Gas and Natural Gas	TOTAL MAXIMUM FIRING RATE (MILLION BTU/HR): 10.0
MAX. CAPACITY HOURLY FUEL USE: 79,250 scf/hr	REQUESTED CAPACITY ANNUAL FUEL USE: 694.23 MMscf

COMMENTS:
The values provided above for materials entering process were derived in the gas upgrading system mass balance for the maximum rated capacity of the gas upgrading system which is 1,200 scf of biogas per minute. Due to the low heating value of the tail gas, supplemental natural gas will be combusted in the flare to raise the temperature and efficiently oxidize the tail gas constituents. The total maximum firing rate listed above is equal to the rated capacity of the enclosed flare (CD-3).

Attach Additional Sheets as Necessary

FORM C5
CONTROL DEVICE (ADSORBER)

REVISED 09/22/16 | NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate | C5

AS REQUIRED BY 15A NCAC 2Q .0112, THIS FORM MUST BE SEALED BY A PROFESSIONAL ENGINEER (P.E.) LICENSED IN NORTH CAROLINA.

CONTROL DEVICE ID NO: CD-1, CD-2	CONTROLS EMISSIONS FROM WHICH EMISSION SOURCE ID NO(S): ES-1
EMISSION POINT ID NO(S): EP-1	POSITION IN SERIES OF CONTROLS NO. 1 OF 2 UNITS
OPERATING SCENARIO:	
1 OF 1	

DESCRIBE CONTROL SYSTEM: The iron sponge system will be a will be a two vessel, fixed bed media hydrogen sulfide scrubber that utilizes wood chips impregnated with iron oxide as the media, commonly referred to as iron sponge. Refer to the application, manufacturer technical proposal, and manufacturer arrangement drawings for additional details.

POLLUTANT(S) COLLECTED:	H_2S			
BEFORE CONTROL EMISSION RATE (LB/HR):	23.93			
CAPTURE EFFICIENCY:	77.7%	%	%	%
CONTROL DEVICE EFFICIENCY:	98.94%	%	%	%
CORRESPONDING EFFICIENCY:	76.8%	%	%	%
EFFICIENCY DETERMINATION CODE:	2			
TOTAL EMISSION RATE (LB/HR):	5.54			

INLET FLOW RATE (SCFM):	345			
PRESSURE DROP (IN. H_2O):	8 MIN	20 MAX	WARNING ALARM? ☐ YES	☑ NO
INLET TEMPERATURE (°F):	80 MIN	130 MAX	OUTLET TEMPERATURE (°F): 80 MIN	130 MAX
SIZE OF COMPARTMENTS (FT)	LENGTH:	WIDTH:	HEIGHT: 13.5	DIAMETER: 10

METHOD OF ADSORPTION: ☐ ONE-PASS REGENERATIVE ☑ ONE-PASS NONREGENERATIVE ☐ RECIRCULATING ☐ OTHER:

TYPE OF ADSORPTION MATERIAL: Iron Sponge | NUMBER OF COMPARTMENTS: 1

REGENERATIVE METHOD: ☑ DISCARDED ☐ CHEMICAL ☐ THERMAL (DRY HEAT) ☐ THERMAL (STEAM) ☐ OTHER:

REGENERATIVE SCHEDULE	MAX. TIME FOR DESORPTION:	LENGTH OF TIME TO MAX. SATURATION: 45 days

HOW ARE EMISSIONS CONTROLLED DURING REGENERATION? (Attach additional sheets as necessary.):

VOLATILE CONCENTRATIONS (PPMV)	ENTERING UNIT:	LEAVING UNIT: 100
RELATIVE HUMIDITY OF AIR STREAM ENTERING UNIT (%): <10		ORIENTATION OF BEDS: Vertical (gas flows top to bottom)
BREAKTHROUGH CAPACITY (LB. VAPOR/LB. ADSORBENT): 13		BREAKTHROUGH ALARM? ☐ YES ☑ NO
CYCLE TIME:		

DESCRIBE MAINTENANCE PROCEDURES:
Weekly visual inspection of the vessels and connections to detect damage or indications of gas leakage. The pH of each media bed must be monitored once weekly. If the pH is too acidic, soda ash will be added to the makeup water sump to raise the pH. The iron sponge media must be removed from the vessels after the media is spent and replaced with new media according to manufacturer specifications.

DESCRIBE ANY FIRE DETECTION DEVICES AND ANY MEANS OF FIRE SUPPRESSION:
The iron sponge beds will remain sufficiently saturated due to the production of water as a result of the iron oxide/hydrogen sulfide chemical reaction and the addition of makeup water several times per day. The air addition blower is controlled by thermocouple readout. The blower will turn off to stop adding oxygen to the vessels at the high temperature setpoint.

DESCRIBE ANY MONITORING DEVICES, GAUGES, TEST PORTS, ETC:
Temperature transmitters to monitor bed temperature on each vessel; Pressure transmitters to monitor pressure drop across each vessel; Water drain line sample ports to monitor pH on each vessel; Chemical cell H_2S monitor to monitor the H_2S concentration of the untreated and treated tail gas.

DESCRIBE HOW REGENERATION CYCLE IS INITIATED (e.g. - fixed time, ppm monitor, etc.):
The media beds have an expected life based on the anticipated tail gas flow rate and H_2S concentration. The H_2S monitor will be used to monitor the H_2S concentration of the treated tail gas. The pressure drop across the beds will be used to determine when media changeouts must occur.

ON A SEPARATE PAGE, ATTACH A DIAGRAM OF THE RELATIONSHIP OF THE CONTROL DEVICE TO ITS EMISSION SOURCE(S):

Attach Additional Sheets As Necessary

FORM C9

Flare

CONTROL DEVICE (OTHER)

REVISED 09/22/16 | **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** | **C9**

CONTROL DEVICE ID NO: CD-3	CONTROLS EMISSIONS FROM WHICH EMISSION SOURCE ID NO(S): ES-1
EMISSION POINT (STACK) ID NO(S): EP-1	POSITION IN SERIES OF CONTROLS: NO. 2 OF 2 UNITS
OPERATING SCENARIO: 1 OF 1	P.E. SEAL REQUIRED (PER 2Q .0112)? ☐ YES ☑ NO

DESCRIBE CONTROL SYSTEM:
The enclosed hybrid flare will be used during normal facility operations to oxidize the tail gas constituents. Due to the low heating value of the tail gas, supplemental natural gas will be combusted in the flare to raise the temperature and efficiently oxidize the tail gas constituents. The required quantity of supplemental fuel to maintain the 1,400 °F to 1,800 °F operating temperature was calculated and provided by the manufacturer. Refer to the application and manufacturer information for additional details.

POLLUTANT(S) COLLECTED:	H_2S			
BEFORE CONTROL EMISSION RATE (LB/HR):	5.54			
CAPTURE EFFICIENCY:	100.0%	%	%	%	%
CONTROL DEVICE EFFICIENCY:	98.0%	%	%	%	%
CORRESPONDING OVERALL EFFICIENCY:	98.0%	%	%	%	%
EFFICIENCY DETERMINATION CODE:	2			
TOTAL AFTER CONTROL EMISSION RATE (LB/HR):	0.11			

PRESSURE DROP (IN. H_2O):	20 MIN	20 MAX	BULK PARTICLE DENSITY (LB/FT^3)	
INLET TEMPERATURE (°F):	55 MIN	130 MAX	OUTLET TEMPERATURE (°F):	1,400 MIN	1,800 MAX
INLET AIR FLOW RATE (SCFM):	441.0		OUTLET AIR FLOW RATE (ACFM):	8,730.0	
INLET AIR FLOW VELOCITY (FT/SEC):	0.4		OUTLET AIR FLOW VELOCITY (FT/SEC):	8.7	
INLET MOISTURE CONTENT (%): <50			☑ FORCED AIR ☐ INDUCED AIR		
COLLECTION SURFACE AREA (FT^2): N/A			FUEL USED: Natural Gas	FUEL USAGE RATE: 50 SCFM	

DESCRIBE MAINTENANCE PROCEDURES:
Weekly visual inspection of the enclosed flare and connections to detect damage or indications of gas leakage. Inspection of any gauges and valves for deterioration. Remove and clean any filter elements or mesh strainers every three months. Inspect all thermocouple assemblies and replace at least once each year. Inspect the pilot assembly, ignition rod, electrode, and insulators for damage once every three months. Repair or replace if necessary. Verify pilot gas supply pressure and pilot ignition. Remove the arrester element for cleaning every six months. Confirm control logic is functioning properly and all input and output signals are correct.

DESCRIBE ANY AUXILIARY MATERIALS INTRODUCED INTO THE CONTROL SYSTEM:

DESCRIBE ANY MONITORING DEVICES, GAUGES, TEST PORTS, ETC:
Four thermocouple connections with type k thermocouples; Two sample ports; One sight port; Self-checking UV flame scanner. See arrangement drawing included with application.

ATTACH A DIAGRAM OF THE RELATIONSHIP OF THE CONTROL DEVICE TO ITS EMISSION SOURCE(S):
See BF Grady Rd facility process flow diagrams included with application.

COMMENTS:

Attach manufacturer's specifications, schematics, and all other drawings necessary to describe this control.

Attach Additional Sheets As Necessary

FORM C9

Flare

CONTROL DEVICE (OTHER)

REVISED 09/22/16 | **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** | **C9**

CONTROL DEVICE ID NO: CD-4	CONTROLS EMISSIONS FROM WHICH EMISSION SOURCE ID NO(S): ES-1
EMISSION POINT (STACK) ID NO(S): EP-2	POSITION IN SERIES OF CONTROLS: NO. 1 OF 1 UNITS
OPERATING SCENARIO: 1 OF 1	P.E. SEAL REQUIRED (PER 2Q .0112)? ☐ YES ☑ NO

DESCRIBE CONTROL SYSTEM:
The candlestick flare will be used to combust biogas during equipment disrepair or maintenance. The enclosed hybrid flare will not operate when the candlestick flare is used to combust biogas. The candlestick flare will also be used to combust product gas during facility startup and when product gas does not meet Piedmont Natural Gas pipeline specifications. The enclosed hybrid flare will operate normally when the candlestick flare is used to combust product gas. Refer to the application cover letter for additional detail.

POLLUTANT(S) COLLECTED:	H_2S			
BEFORE CONTROL EMISSION RATE (LB/HR):	23.93			
CAPTURE EFFICIENCY:	100.0%	%	%	%	%
CONTROL DEVICE EFFICIENCY:	98.0%	%	%	%	%
CORRESPONDING OVERALL EFFICIENCY:	98.0%	%	%	%	%
EFFICIENCY DETERMINATION CODE:	2			
TOTAL AFTER CONTROL EMISSION RATE (LB/HR):	0.48			

PRESSURE DROP (IN. H_2O): 5 MIN 10 MAX	BULK PARTICLE DENSITY (LB/FT^3)
INLET TEMPERATURE (°F): 55 MIN 140 MAX	OUTLET TEMPERATURE (°F): 200 MIN 1,200 MAX
INLET AIR FLOW RATE (SCFM): 1,200	OUTLET AIR FLOW RATE (SCFM): 1,200
INLET AIR FLOW VELOCITY (FT/SEC): 102	OUTLET AIR FLOW VELOCITY (FT/SEC): 101.9
INLET MOISTURE CONTENT (%): <10	☑ FORCED AIR ☐ INDUCED AIR
COLLECTION SURFACE AREA (FT^2): N/A	FUEL USED: Natural Gas / FUEL USAGE RATE: 50 SCFH

DESCRIBE MAINTENANCE PROCEDURES:
Weekly visual inspection of the flare and connections to detect damage or indications of gas leakage. Inspection of any gauges and valves for deterioration. Inspect the pilot assembly, ignition rod, electrode, and insulators for damage once every three months. Repair or replace if necessary. Verify pilot gas supply pressure and pilot ignition. Remove the arrester element for cleaning every six months.

DESCRIBE ANY AUXILIARY MATERIALS INTRODUCED INTO THE CONTROL SYSTEM:

DESCRIBE ANY MONITORING DEVICES, GAUGES, TEST PORTS, ETC:
One thermocouple for pilot confirmation.

ATTACH A DIAGRAM OF THE RELATIONSHIP OF THE CONTROL DEVICE TO ITS EMISSION SOURCE(S):
See BF Grady Rd facility process flow diagrams included with application.

COMMENTS: Natural gas will be used to fuel the pilot flame.

Attach manufacturer's specifications, schematics, and all other drawings necessary to describe this control.

Attach Additional Sheets As Necessary

FORM D1

FACILITY-WIDE EMISSIONS SUMMARY

REVISED 09/22/16 — NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate — D1

CRITERIA AIR POLLUTANT EMISSIONS INFORMATION - FACILITY-WIDE

AIR POLLUTANT EMITTED	EXPECTED ACTUAL EMISSIONS (AFTER CONTROLS / LIMITATIONS) tons/yr	POTENTIAL EMISSIONS (BEFORE CONTROLS / LIMITATIONS) tons/yr	POTENTIAL EMISSIONS (AFTER CONTROLS / LIMITATIONS) tons/yr
PARTICULATE MATTER (PM)	0.07	0.14	0.08
PARTICULATE MATTER < 10 MICRONS (PM_{10})	0.07	0.14	0.08
PARTICULATE MATTER < 2.5 MICRONS ($PM_{2.5}$)	0.06	0.12	0.06
SULFUR DIOXIDE (SO_2)	47.02	193.24	50.08
NITROGEN OXIDES (NOx)	4.83	6.54	5.11
CARBON MONOXIDE (CO)	10.10	17.39	10.56
VOLATILE ORGANIC COMPOUNDS (VOC)	0.76	1.53	0.81
LEAD			
GREENHOUSE GASES (GHG) (SHORT TONS)			
OTHER			

HAZARDOUS AIR POLLUTANT EMISSIONS INFORMATION - FACILITY-WIDE

HAZARDOUS AIR POLLUTANT EMITTED	CAS NO.	EXPECTED ACTUAL EMISSIONS (AFTER CONTROLS / LIMITATIONS) tons/yr	POTENTIAL EMISSIONS (BEFORE CONTROLS / LIMITATIONS) tons/yr	POTENTIAL EMISSIONS (AFTER CONTROLS / LIMITATIONS) tons/yr
Acetaldehyde (TH)	75070	2.09E-06	4.22E-06	2.23E-06
Acrolein (TH)	107028	2.48E-06	5.00E-06	2.64E-06
Ammonia (T)	7664417	4.70E-01	9.19E-01	5.00E-01
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	2.89E-04	5.83E-04	3.08E-04
Benzo(a)pyrene (TH)	50328	1.65E-07	3.33E-07	1.76E-07
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00
Chromic acid (VI) (TH)	7738945	0.00E+00	0.00E+00	0.00E+00
Cobalt unlisted compounds (H)	COC-other	1.16E-05	2.33E-05	1.23E-05
Formaldehyde (TH)	50000	1.03E-02	2.08E-02	1.10E-02
Hexane, n- (TH)	110543	2.48E-01	5.00E-01	2.64E-01
Lead unlisted compounds (H)	PBC-other	6.89E-05	1.39E-04	7.33E-05
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00
Napthalene (H)	91203	8.41E-05	1.69E-04	8.95E-05
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00
Selenium compounds (H)	SEC	3.31E-06	6.67E-06	3.52E-06
Toluene (TH)	108883	4.69E-04	9.45E-04	4.99E-04
Total HAPs		2.59E-01	5.23E-01	2.76E-01
Highest HAP	110543	2.48E-01	5.00E-01	2.64E-01

TOXIC AIR POLLUTANT EMISSIONS INFORMATION - FACILITY-WIDE

INDICATE REQUESTED ACTUAL EMISSIONS AFTER CONTROLS / LIMITATIONS. EMISSIONS ABOVE THE TOXIC PERMIT EMISSION RATE (TPER) IN 15A NCAC 2Q .0711 MAY REQUIRE AIR DISPERSION MODELING. USE NETTING FORM D2 IF NECESSARY.

TOXIC AIR POLLUTANT EMITTED	CAS NO.	lb/hr	lb/day	lb/year	Modeling Required ? Yes	Modeling Required ? No
Acetaldehyde (TH)	75070	9.17E-07	2.20E-05	4.19E-03		X
Acrolein (TH)	107028	1.09E-06	2.61E-05	4.96E-03		X
Ammonia (T)	7664417	2.00E-01	4.80E+00	9.39E+02		X
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00		X
Benzene (TH)	71432	1.27E-04	3.04E-03	5.79E-01		X
Benzo(a)pyrene (TH)	50328	7.24E-08	1.74E-06	3.31E-04		X
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00		X
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00		X
Soluble chromate compounds, as chromium (VI) equival	7738945	0.00E+00	0.00E+00	0.00E+00		X
Formaldehyde (TH)	50000	4.52E-03	1.09E-01	2.07E+01		X
Hexane, n- (TH)	110543	1.09E-01	2.61E+00	4.96E+02		X
Hydrogen Sulfide	7783064	1.11E-01	2.66E+00	1.02E+03		X
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00		X
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00		X
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00		X
Toluene (TH)	108883	2.05E-04	4.92E-03	9.37E-01		X

COMMENTS: The hourly and daily emission rates for the Expected Actual Emissions listed above were calculated for normal operation using the Normal Operation Emissions Calculator. The annual emission rates for the Expected Actual Emissions listed above were calculated for normal operation plus the expected duration of biogas and product gas combustion in the candlestick flare.

Attach Additional Sheets As Necessary

FORM D5

TECHNICAL ANALYSIS TO SUPPORT PERMIT APPLICATION

REVISED 09/22/16 **NCDEQ/Division of Air Quality - Application for Air Permit to Construct/Operate** **D5**

PROVIDE DETAILED TECHNICAL CALCULATIONS TO SUPPORT ALL EMISSION, CONTROL, AND REGULATORY DEMONSTRATIONS MADE IN THIS APPLICATION. INCLUDE A COMPREHENSIVE PROCESS FLOW DIAGRAM AS NECESSARY TO SUPPORT AND CLARIFY CALCULATIONS AND ASSUMPTIONS. ADDRESS THE FOLLOWING SPECIFIC ISSUES ON SEPARATE PAGES:

A **SPECIFIC EMISSIONS SOURCE (EMISSION INFORMATION) (FORM B and B1 through B9) -** SHOW CALCULATIONS USED, INCLUDING EMISSION FACTORS, MATERIAL BALANCES, AND/OR OTHER METHODS FROM WHICH THE POLLUTANT EMISSION RATES IN THIS APPLICATION WERE DERIVED. INCLUDE CALCULATION OF POTENTIAL BEFORE AND, WHERE APPLICABLE, AFTER CONTROLS. CLEARLY STATE ANY ASSUMPTIONS MADE AND PROVIDE ANY REFERENCES AS NEEDED TO SUPPORT MATERIAL BALANCE CALCULATIONS.

B **SPECIFIC EMISSION SOURCE (REGULATORY INFORMATION)(FORM E2 - TITLE V ONLY) -** PROVIDE AN ANALYSIS OF ANY REGULATIONS APPLICABLE TO INDIVIDUAL SOURCES AND THE FACILITY AS A WHOLE. INCLUDE A DISCUSSION OUTING METHODS (e.g. FOR TESTING AND/OR MONITORING REQUIREMENTS) FOR COMPLYING WITH APPLICABLE REGULATIONS, PARTICULARLY THOSE REGULATIONS LIMITING EMISSIONS BASED ON PROCESS RATES OR OTHER OPERATIONAL PARAMETERS. PROVIDE JUSTIFICATION FOR AVOIDANCE OF ANY FEDERAL REGULATIONS (PREVENTION OF SIGNIFICANT DETERIORATION (PSD), NEW SOURCE PERFORMANCE STANDARDS (NSPS), NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAPS), TITLE V), INCLUDING EXEMPTIONS FROM THE FEDERAL REGULATIONS WHICH WOULD OTHERWISE BE APPLICABLE TO THIS FACILITY. SUBMIT ANY REQUIRED INFORMATION TO DOCUMENT COMPLIANCE WITH ANY REGULATIONS. INCLUDE EMISSION RATES CALCULATED IN ITEM "A" ABOVE, DATES OF MANUFACTURE, CONTROL EQUIPMENT, ETC. TO SUPPORT THESE CALCULATIONS.

C **CONTROL DEVICE ANALYSIS (FORM C and C1 through C9) -** PROVIDE A TECHNICAL EVALUATION WITH SUPPORTING REFERENCES FOR ANY CONTROL EFFICIENCIES LISTED ON SECTION C FORMS, OR USED TO REDUCE EMISSION RATES IN CALCULATIONS UNDER ITEM "A" ABOVE. INCLUDE PERTINENT OPERATING PARAMETERS (e.g. OPERATING CONDITIONS, MANUFACTURING RECOMMENDATIONS, AND PARAMETERS AS APPLIED FOR IN THIS APPLICATION) CRITICAL TO ENSURING PROPER PERFORMANCE OF THE CONTROL DEVICES). INCLUDE AND LIMITATIONS OR MALFUNCTION POTENTIAL FOR THE PARTICULAR CONTROL DEVICES AS EMPLOYED AT THIS FACILITY. DETAIL PROCEDURES FOR ASSURING PROPER OPERATION OF THE CONTROL DEVICE INCLUDING MONITORING SYSTEMS AND MAINTENANCE TO BE PERFORMED.

D **PROCESS AND OPERATIONAL COMPLIANCE ANALYSIS - (FORM E3 - TITLE V ONLY)** - SHOWING HOW COMPLIANCE WILL BE ACHIEVED WHEN USING PROCESS, OPERATIONAL, OR OTHER DATA TO DEMONSTRATE COMPLIANCE. REFER TO COMPLIANCE REQUIREMENTS IN THE REGULATORY ANALYSIS IN ITEM "B" WHERE APPROPRIATE. LIST ANY CONDITIONS OR PARAMETERS THAT CAN BE MONITORED AND REPORTED TO DEMONSTRATE COMPLIANCE WITH THE APPLICABLE REGULATIONS.

E **PROFESSIONAL ENGINEERING SEAL -** PURSUANT TO 15A NCAC 2Q .0112 "APPLICATION REQUIRING A PROFESSIONAL ENGINEERING SEAL," A PROFESSIONAL ENGINEER REGISTERED IN NORTH CAROLINA SHALL BE REQUIRED TO SEAL TECHNICAL PORTIONS OF THIS APPLICATION FOR NEW SOURCES AND MODIFICATIONS OF EXISTING SOURCES. (SEE INSTRUCTIONS FOR FURTHER APPLICABILITY).

I, _____ *attest that this application for* Align RNG, LLC - BF Grady Rd _____ *has been reviewed by me and is accurate, complete and consistent with the information supplied in the engineering plans, calculations, and all other supporting documentation to the best of my knowledge. I further attest that to the best of my knowledge the proposed design has been prepared in accordance with the applicable regulations. Although certain portions of this submittal package may have been developed by other professionals, inclusion of these materials under my seal signifies that I have reviewed this material and have judged it to be consistent with the proposed design. Note: In accordance with NC General Statutes 143-215.6A and 143-215.6B, any person who knowingly makes any false statement, representation, or certification in any application shall be guilty of a Class 2 misdemeanor which may include a fine not to exceed $10,000 as well as civil penalties up to $25,000 per violation.*

(PLEASE USE BLUE INK TO COMPLETE THE FOLLOWING)

NAME:	William G. Simmons, Jr., P.E.
DATE:	February 19, 2020
COMPANY:	Cavanaugh & Associates, P.A.
ADDRESS:	1213 Culbreth Drive, Ste 312, Wilmington, NC
TELEPHONE:	(910) 392-4462
SIGNATURE:	
PAGES CERTIFIED:	A2, A3, B, B9, C5, C9, D1

(IDENTIFY ABOVE EACH PERMIT FORM AND ATTACHMENT THAT IS BEING CERTIFIED BY THIS SEAL)

PLACE NORTH CAROLINA SEAL HERE

2/19/2020

Attach Additional Sheets As Necessary

Appendix C

BF Grady Rd Emissions Calculations

Calculations to Support Air Quality Permit Application

BF Grady Rd • Duplin County, North Carolina

The following calculations and information are included as part of this air quality permit application:

1. BF Grady Rd Project Equipment List (Calculations Page 2);
2. ES-1 Gas Upgrading System (GUS) Mass Balance – Maximum Biogas Production (Calculations Page 3);
3. BF Grady Rd Potential to Emit Summary Tables (Calculations Pages 4-6);
4. BF Grady Rd Event Based Potential to Emit Summary Tables (Calculations Page 7);
5. ES-1 Gas Upgrading System Normal Operation Process Flow Diagram (for reference);
6. Normal Operation Emissions Calculator (Calculations Pages 8-10);
7. Product Gas to Candlestick Flare (PTE Calculations Only) Combustion Emissions Calculator (Calculations Pages 11-13);
8. ES-1 Gas Upgrading System Biogas to Candlestick Flare Process Flow Diagram (for reference);
9. Biogas to Candlestick Flare Combustion Emissions Calculator (Calculations Pages 14-16);
10. ES-1 Gas Upgrading System Product Gas to Candlestick Flare Process Flow Diagram (for reference);
11. Product Gas to Candlestick Flare Combustion Emissions Calculator (Calculations Pages 17-19);
12. Tail Gas to Enclosed Flare (Not During Normal Operation) Emissions Calculator (Calculations Pages 20-22);
13. Emission Factors for Tail Gas, Product Gas, and Biogas Combustion (Calculations Page 23);
14. 15A NCAC Applicability Calculations (Calculations Pages 24).

Project Equipment List

BF Grady Rd • Duplin County, North Carolina

Emission Sources				
Emission Source ID	**Emission Source**	**Manufacturer**	**Model/Type**	**Rated Capacity**
ES-1	Gas Upgrading System (GUS)	Guild Associates, Inc.	Molecular Gate PSA System	1,200 scf biogas per minute

Control Devices				
Control Device ID	**Control Device**	**Manufacturer**	**Model/Type**	**Rated Capacity**
CD-1	Iron Sponge System Vessel	MV Technologies	H2S Plus System	300 scf tail gas per minute
CD-2	Iron Sponge System Vessel	MV Technologies	H2S Plus System	300 scf tail gas per minute
CD-3	Enclosed Hybrid Flare	John Zink Hamworthy	ZBRID Low-Btu Gas Flare	10 MMBtu/hr
CD-4	Elevated Candlestick Flare	ProPump & Controls	Elevated Candlestick Flare	45 MMBtu/hr

Emission Points				
Emission Point ID	**Emission Sources**	**Control Devices**	**Fuel Type**	**Usage**
EP-1	ES-1	CD-1, CD-2, CD-3	Tail Gas, Natural Gas	Normal Operation
EP-2	ES-1	CD-4	Biogas, Product Gas, Off-Spec Product Gas, Natural Gas	Irregular Operation

or

By-Pass Scenario 240 hr

In Parallel

Off-Spec Scenario 360 hr

ES-1 Gas Upgrading System (GUS) Mass Balance - Maximum Biogas Production

Maximum Biogas Flow into GUS (scfm):	1,200
Average GUS Methane Recovery:	96.0%
GUS Uptime with Normal Operation:	93.2%

Hours of Normal Operation:	8,160
Hours of Product Gas to the Candlestick Flare:	360
Hours of Biogas to the Candlestick Flare:	240
Total Annual Hours of Operation:	8,760

Iron Sponge System Overall Efficiency:	76.8%
Hydrogen Sulfide Captured in Vessel (scfm):	3.23
Hydrogen Sulfide Captured in Vessel (lb/hr):	18.39
Hydrogen Sulfide Captured in Vessel (tons/yr):	78.34

Raw Biogas from Pipeline Header into GUS (ES-1)

Raw Biogas Constituents	Formula	Biogas Composition	Flowrate (scfm)	lb/hr	tons/yr
Methane	CH_4	65.00%	780.00	2,091.67	9,161.53
Carbon Dioxide	CO_2	34.12%	409.44	3,012.57	13,195.05
Nitrogen	N_2	0.50%	6.00	28.11	123.11
Oxygen	O_2	0.02%	0.24	1.28	5.62
Hydrogen Sulfide	H_2S	0.35%	4.20	23.93	104.81
Ammonia	NH_3	0.01%	0.12	0.34	1.50
Totals		**100.00%**	**1,200.00**	**5,157.90**	**22,591.62**

Product Gas to Natural Gas Pipeline (Offsite Consumption)

Product Gas Constituents	Formula	Product Gas Composition	Flowrate (scfm)	lb/hr	tons/yr
Methane	CH_4	99.07%	748.80	2,008.01	8,192.67
Carbon Dioxide	CO_2	0.10%	0.76	5.56	22.69
Nitrogen	N_2	0.79%	6.00	28.11	114.68
Oxygen	O_2	0.03%	0.24	1.28	5.24
Hydrogen Sulfide	H_2S	0.00%	0.00	0.00	0.00
Ammonia	NH_3	0.00%	0.00	0.00	0.00
Totals		**100.00%**	**755.80**	**2,042.96**	**8,335.27**

Tail Gas to Iron Sponge System and System Bypass (CD-1 and CD-2)

Tail Gas Constituents	Formula	Tail Gas Composition	Flowrate (scfm)	lb/hr	tons/yr
Methane	CH_4	7.02%	31.20	83.67	356.42
Carbon Dioxide	CO_2	92.00%	408.68	3,007.01	12,809.85
Nitrogen	N_2	0.00%	0.00	0.00	0.00
Oxygen	O_2	0.00%	0.00	0.00	0.00
Hydrogen Sulfide	H_2S	0.95%	4.20	23.93	101.94
Ammonia	NH_3	0.03%	0.12	0.34	1.46
Totals		**100.00%**	**444.20**	**3,114.95**	**13,269.67**

Biogas to Candlestick Flare (CD-4)

Raw Biogas Constituents	Formula	Biogas Composition	Flowrate (scfm)	lb/hr	tons/yr
Methane	CH_4	65.00%	780.00	2,091.67	251.00
Carbon Dioxide	CO_2	34.12%	409.44	3,012.57	361.51
Nitrogen	N_2	0.50%	6.00	28.11	3.37
Oxygen	O_2	0.02%	0.24	1.28	0.15
Hydrogen Sulfide	H_2S	0.35%	4.20	23.93	2.87
Ammonia	NH_3	0.01%	0.12	0.34	0.04
Totals		**100.00%**	**1,200.00**	**5,157.90**	**618.95**

Product Gas to Candlestick Flare (CD-4)

Product Gas Constituents	Formula	Product Gas Composition	Flowrate (scfm)	lb/hr	tons/yr
Methane	CH_4	99.07%	748.80	2,008.01	361.44
Carbon Dioxide	CO_2	0.10%	0.76	5.56	1.00
Nitrogen	N_2	0.79%	6.00	28.11	5.06
Oxygen	O_2	0.03%	0.24	1.28	0.23
Hydrogen Sulfide	H_2S	0.00%	0.00	0.00	0.00
Ammonia	NH_3	0.00%	0.00	0.00	0.00
Totals		**100.00%**	**755.80**	**2,042.96**	**367.73**

Tail Gas to Enclosed Hybrid Flare (CD-3)

Tail Gas Constituents	Formula	Tail Gas Composition	Flowrate (scfm)	lb/hr	tons/yr
Methane	CH_4	7.08%	31.20	83.67	356.42
Carbon Dioxide	CO_2	92.68%	408.68	3,007.01	12,809.85
Nitrogen	N_2	0.00%	0.00	0.00	0.00
Oxygen	O_2	0.00%	0.00	0.00	0.00
Hydrogen Sulfide	H_2S	0.22%	0.97	5.54	23.60
Ammonia	NH_3	0.03%	0.12	0.34	1.46
Totals		**100.00%**	**440.98**	**3,096.56**	**13,191.33**

Notes:

1) The maximum rated biogas flow of 1,200 scfm into the GUS is shown. The maximum expected biogas hydrogen sulfide concentration is shown.
2) Normal operation consists of the GUS (ES-1) processing biogas to form product gas and tail gas. The product gas will be utilized offsite and the tail gas will be scrubbed in the iron sponge vessels (CD-1 and CD-2) for hydrogen sulfide then oxidized in the enclosed flare (CD-3).
3) Product gas will be combusted in the candlestick flare (CD-4) during GUS startup, which is estimated to require one hour. Product gas will also be combusted in the candlestick flare when the gas does not comply with pipeline specifications. The product gas composition may vary. The average composition is shown.
4) Biogas may be combusted in the candlestick flare during equipment maintenance or disrepair.
5) The overall efficiency of the iron sponge system vessels is shown for the maximum biogas flow rate of 1,200 scfm.

BF Grady Rd Potential to Emit Summary Tables

Potential Annual Emissions Without Controls and Limits

Source Information		Gas Usage (scfm)				Criteria Pollutants (tons/yr)							HAPs (tons/yr)	
Emission Source	Emission Point	Tail Gas	Product Gas	Natural Gas	Biogas	PM	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC	Highest HAP	Total HAPs
ES-1 Gas Upgrading System	EP-1	444.2	0.0	50.0	0.0	0.14	0.14	0.11	193.24	5.70	13.58	1.45	0.48	0.50
ES-1 Gas Upgrading System	EP-2	0.0	755.8	0.8	0.0	0.01	0.01	0.01	0.01	0.84	3.81	0.07	0.02	0.03
Totals		**444.2**	**755.8**	**50.8**	**0.0**	**0.14**	**0.14**	**0.12**	**193.24**	**6.54**	**17.39**	**1.53**	**0.50**	**0.52**

Notes:

1. The ES-1 Gas Upgrading System potential emissions for EP-1 were calculated using the Normal Operation Emissions Calculator. The potential emissions were calculated without hydrogen sulfide removal in the iron sponge vessels and using 8,760 operating hours per year. See calculations pages 8-10.
2. The ES-1 Gas Upgrading System potential emissions for EP-2 were calculated using the Product Gas to Candlestick Flare Combustion Emissions Calculator (PTE Calculations Only).The potential emissions were calculated for 600 operating hours per year. See calculations pages 11-13.
3. The GUS Mass Balance (see calculations page 3) lists 360 hours of operation for product gas to the candlestick flare and 240 hours of operation for biogas to the candlestick flare. Combusting biogas in the candlestick flare results in equal emissions as normal operation without hydrogen sulfide removal in addition to combusting product gas in the candlestick flare. The potential emissions for combusting product gas in the candlestick flare are shown for 600 hours of operation above because totaling the emissions for 240 hours of biogas combustion and 8,760 hours of normal operation without hydrogen sulfide removal would result in unachieveable emissions. The potential to emit for the GUS and EP-1 listed above reflects all hydrogen sulfide being directed to the enclosed flare as a component of the tail gas. The same hydrogen sulfide cannot also be directed to the candlestick flare as a component of the biogas.
4. The calculations (see calculations pages 8-13) used to obtain the potential emissions listed above used the maximum rated capacity of the GUS (1,200 scfm biogas) and the maximum anticipated hydrogen sulfide concentration in the biogas (3,500 ppm).
5. See calculations page 23, Emission Factors for Tail Gas, Product Gas, and Biogas Combustion, for the emission factors used to obtain the emission rates above.

BF Grady Rd Potential to Emit Summary Tables

Control Device Efficiencies

Control Device	Control Device ID	Emission Source ID	Emission Point ID	Pollutant Collected	Overall Efficiency
Iron Sponge System Vessel	CD-1 or CD-2	ES-1	EP-1	H_2S	76.8%

Notes:
1. Two identical iron sponge system vessels will be used to remove hydrogen sulfide from the tail gas before it is oxidized in the enclosed flare. Only one vessel will be used at a time.
2. The overall efficiency was taken from manufacturer data. See Form C5 and the MV Technologies technical proposal for design specifications.

Potential Annual Emissions With Controls and Limits

Source Information		Gas Usage (scfm)				Criteria Pollutants (tons/yr)							HAPs (tons/yr)	
Emission Source	Emission Point	Tail Gas	Product Gas	Natural Gas	Biogas	PM	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC	Highest HAP	Total HAPs
ES-1 Gas Upgrading System	EP-1	444.2	0.0	50.0	0.0	0.07	0.07	0.06	44.78	4.19	6.67	0.71	0.23	0.24
ES-1 Gas Upgrading System	EP-2	0.0	755.8	0.8	0.0	0.00	0.00	0.00	0.00	0.50	2.29	0.04	0.01	0.02
ES-1 Gas Upgrading System	EP-2	0.0	0.0	0.8	1,200.0	0.00	0.00	0.00	5.29	0.42	1.59	0.05	0.02	0.02
Totals		**444.2**	**755.8**	**51.7**	**1,200.0**	**0.08**	**0.08**	**0.06**	**50.08**	**5.11**	**10.56**	**0.81**	**0.26**	**0.28**

Notes:
1. The ES-1 Gas Upgrading System potential emissions for EP-1 were calculated using the Normal Operation Emissions Calculator. The potential emissions with controls were calculated with hydrogen sulfide removal in the iron sponge vessels and using 8,760 operating hours per year. See calculations pages 8-10.
2. The ES-1 Gas Upgrading System potential emissions for EP-2 product gas combustion were calculated using the Product Gas to Candlestick Flare Combustion Emissions Calculator.The potential emissions with controls and limits were calculated for 360 operating hours per year. See calculations pages 17-19.
3. The ES-1 Gas Upgrading System potential emissions for EP-2 biogas combustion were calculated using the Biogas to Candlestick Flare Combustion Emissions Calculator.The potential emissions with controls and limits were calculated for 240 operating hours per year. See calculations pages 14-16.
4. The GUS Mass Balance (see calculations page 3) lists 360 hours of operation for product gas to the candlestick flare and 240 hours of operation for biogas to the candlestick flare.
5. The calculations (see calculations pages 8-10 and 14-19) used to obtain the potential emissions listed above used the maximum rated capacity of the GUS (1,200 scfm biogas) and the maximum anticipated hydrogen sulfide concentration in the biogas (3,500 ppm).
6. See calculations page 23, Emission Factors for Tail Gas, Product Gas, and Biogas Combustion, for the emission factors used to obtain the emission rates above.

BF Grady Rd Potential to Emit Hazardous Air Pollutants Summary Tables

Potential to Emit Before Controls and Limits

Toxic / Hazardous Air Pollutant	CAS Number	ES-1 EP-1 tons/yr	ES-1 EP-2 tons/yr	ES-1 Total tons/yr
Acetaldehyde (TH)	75070	4.02E-06	2.07E-07	4.22E-06
Acrolein (TH)	107028	4.76E-06	2.45E-07	5.00E-06
Ammonia (T)	7664417	8.75E-01	4.36E-02	9.19E-01
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	5.55E-04	2.86E-05	5.83E-04
Benzo(a)pyrene (TH)	50328	3.17E-07	1.63E-08	3.33E-07
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00
Chromic acid (VI) (TH)	7738945	0.00E+00	0.00E+00	0.00E+00
Cobalt unlisted compounds (H)	COC-other	2.22E-05	1.14E-06	2.33E-05
Formaldehyde (TH)	50000	1.98E-02	1.02E-03	2.08E-02
Hexane, n- (TH)	110543	4.76E-01	2.45E-02	5.00E-01
Lead unlisted compounds (H)	PBC-other	1.32E-04	6.81E-06	1.39E-04
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00
Napthalene (H)	91203	1.61E-04	8.31E-06	1.69E-04
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00
Selenium compounds (H)	SEC	6.34E-06	3.27E-07	6.67E-06
Toluene (TH)	108883	8.98E-04	4.63E-05	9.45E-04
Total HAPs		4.97E-01	2.56E-02	5.23E-01
Highest HAP	110543	4.76E-01	2.45E-02	5.00E-01

Potential to Emit After Controls and Limits

Toxic / Hazardous Air Pollutant	CAS Number	ES-1 EP-1 tons/yr	ES-1 EP-2 tons/yr	ES-1 Total tons/yr
Acetaldehyde (TH)	75070	1.97E-06	2.56E-07	2.23E-06
Acrolein (TH)	107028	2.34E-06	3.03E-07	2.64E-06
Ammonia (T)	7664417	4.46E-01	5.46E-02	5.00E-01
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	2.73E-04	3.53E-05	3.08E-04
Benzo(a)pyrene (TH)	50328	1.56E-07	2.02E-08	1.76E-07
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00
Chromic acid (VI) (TH)	7738945	0.00E+00	0.00E+00	0.00E+00
Cobalt unlisted compounds (H)	COC-other	1.09E-05	1.41E-06	1.23E-05
Formaldehyde (TH)	50000	9.74E-03	1.26E-03	1.10E-02
Hexane, n- (TH)	110543	2.34E-01	3.03E-02	2.64E-01
Lead unlisted compounds (H)	PBC-other	6.49E-05	8.41E-06	7.33E-05
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00
Napthalene (H)	91203	7.92E-05	1.03E-05	8.95E-05
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00
Selenium compounds (H)	SEC	3.12E-06	4.04E-07	3.52E-06
Toluene (TH)	108883	4.42E-04	5.72E-05	4.99E-04
Total HAPs		2.44E-01	3.16E-02	2.76E-01
Highest HAP	110543	2.34E-01	3.03E-02	2.64E-01

Notes:

1. The ES-1 Gas Upgrading System potential HAPs emissions for EP-1 were calculated using the Normal Operation Emissions Calculator. The potential emissions were calculated for 8,760 operating hours per year. The emission rates before controls and limits differ from the emission rates after controls and limits because the fuel input to the enclosed flare (CD-3) differs. The calculations for PTE without controls and limits use the maximum rated heat input for the flare (10 MMBtu/hr) whereas the calculations for PTE with controls and limits use the realistic maximum heat input to the flare. See calculations pages 8-10, specifically the Normal Operation Emissions Calculator Input, for the values used to obtain the EP-1 emission rates listed above.
2. The ES-1 Gas Upgrading System PTE without controls and limits for EP-2 was calculated using the Product Gas to Candlestick Flare Combustion Emissions Calculator (PTE Calculations Only).The potential emissions were calculated for 600 operating hours per year. See calculations pages 11-13.
3. The ES-1 Gas Upgrading System PTE with controls and limits for EP-2 was calculated using the Product Gas to Candlestick Flare Combustion Emissions Calculator (360 operating hours) and the Biogas to Candlestick Flare Combustion Emissions Calculator (240 operating hours). See calculations pages 14-19.
4. The calculations used to obtain the potential emissions listed above used the maximum rated capacity of the GUS (1,200 scfm biogas) and 8,760 operating hours for normal operation. The calculations for PTE without controls and limits use the maximum rated heat input for each flare: 10 MMBtu/hr for the enclosed flare (CD-3) and 45 MMBtu/hr for the candlestick flare (CD-4).

BF Grady Rd Event Based Potential to Emit Summary Tables

Potential Annual Emissions With Controls and Limits for Product Gas Combustion in the Candlestick Flare

Source Information		Gas Usage (scfm)				Criteria Pollutants (lb/hr)							HAPs (lb/hr)	
Emission Source	Emission Point	Tail Gas	Product Gas	Natural Gas	Biogas	PM	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC	Highest HAP	Total HAPs
ES-1 Gas Upgrading System	EP-1	444.2	0.0	50.00	0.0	0.03	0.03	0.03	10.24	1.30	3.10	0.33	0.11	0.11
ES-1 Gas Upgrading System	EP-2	0.0	755.8	0.8	0.0	0.03	0.03	0.02	0.03	3.06	13.95	0.27	0.09	0.09
Totals		**444.2**	**755.8**	**50.8**	**0.0**	**0.06**	**0.06**	**0.05**	**10.27**	**4.36**	**17.05**	**0.61**	**0.20**	**0.21**

Source Information		Gas Usage (scfm)				Criteria Pollutants (tons/yr)							HAPs (tons/yr)	
Emission Source	Emission Point	Tail Gas	Product Gas	Natural Gas	Biogas	PM	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC	Highest HAP	Total HAPs
ES-1 Gas Upgrading System	EP-1	444.2	0.0	50.0	0.0	0.00	0.00	0.00	1.84	0.17	0.27	0.03	0.01	0.01
ES-1 Gas Upgrading System	EP-2	0.0	755.8	0.8	0.0	0.00	0.00	0.00	0.00	0.50	2.29	0.04	0.01	0.02
Totals		**444.2**	**755.8**	**50.8**	**0.0**	**0.01**	**0.01**	**0.01**	**1.85**	**0.67**	**2.56**	**0.07**	**0.02**	**0.03**

Notes:

1. The emission rates listed above were calculated for irregular operation when product gas is combusted in the candlestick flare (CD-4) instead of being injected into the natural gas pipeline for offsite consumption. The GUS is operational in this scenario and tail gas is scrubbed for hydrogen sulfide in the iron sponge vessels before being oxidized in the enclosed flare (CD-3).
2. Product gas will be combusted in the candlestick flare during facility startup (estimated to take one hour) and during equipment disrepair, not during normal operation.
3. The calculations used to obtain the potential emissions listed above used the maximum rated capacity of the GUS (1,200 scfm biogas) and the maximum anticipated hydrogen sulfide concentration in the biogas (3,500 ppm). As listed in the GUS Mass Balance, 360 hours of operation are expected for product gas to the candlestick flare at the maximum GUS capacity.
4. The ES-1 Gas Upgrading System potential emissions for EP-1 were calculated using the Tail Gas to Enclosed Flare (Not During Normal Operation) Emissions Calculator. The potential emissions with controls were calculated with hydrogen sulfide removal in the iron sponge vessels and using 360 operating hours per year. See calculations pages 20-22.
5. The ES-1 Gas Upgrading System potential emissions for EP-2 product gas combustion were calculated using the Product Gas to Candlestick Flare Combustion Emissions Calculator.The potential emissions with controls and limits were calculated for 360 operating hours per year. See calculations pages 17-19.
6. These emission rates for product gas combustion in the candlestick flare are included in the BF Grady Rd Potential to Emit Summary Tables provided above.
7. See calculations page 23, Emission Factors for Tail Gas, Product Gas, and Biogas Combustion, for the emission factors used to obtain the emission rates above.

Potential Annual Emissions With Controls and Limits for Biogas Combustion in the Candlestick Flare

Source Information		Gas Usage (scfm)				Criteria Pollutants (lb/hr)							HAPs (lb/hr)	
Emission Source	Emission Point	Tail Gas	Product Gas	Natural Gas	Biogas	PM	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC	Highest HAP	Total HAPs
ES-1 Gas Upgrading System	EP-2	0.0	0.0	0.0	1,200.0	0.04	0.04	0.03	44.13	3.68	13.95	0.42	0.14	0.14
Totals		**0.0**	**0.0**	**0.0**	**1,200.0**	**0.04**	**0.04**	**0.03**	**44.13**	**3.68**	**13.95**	**0.42**	**0.14**	**0.14**

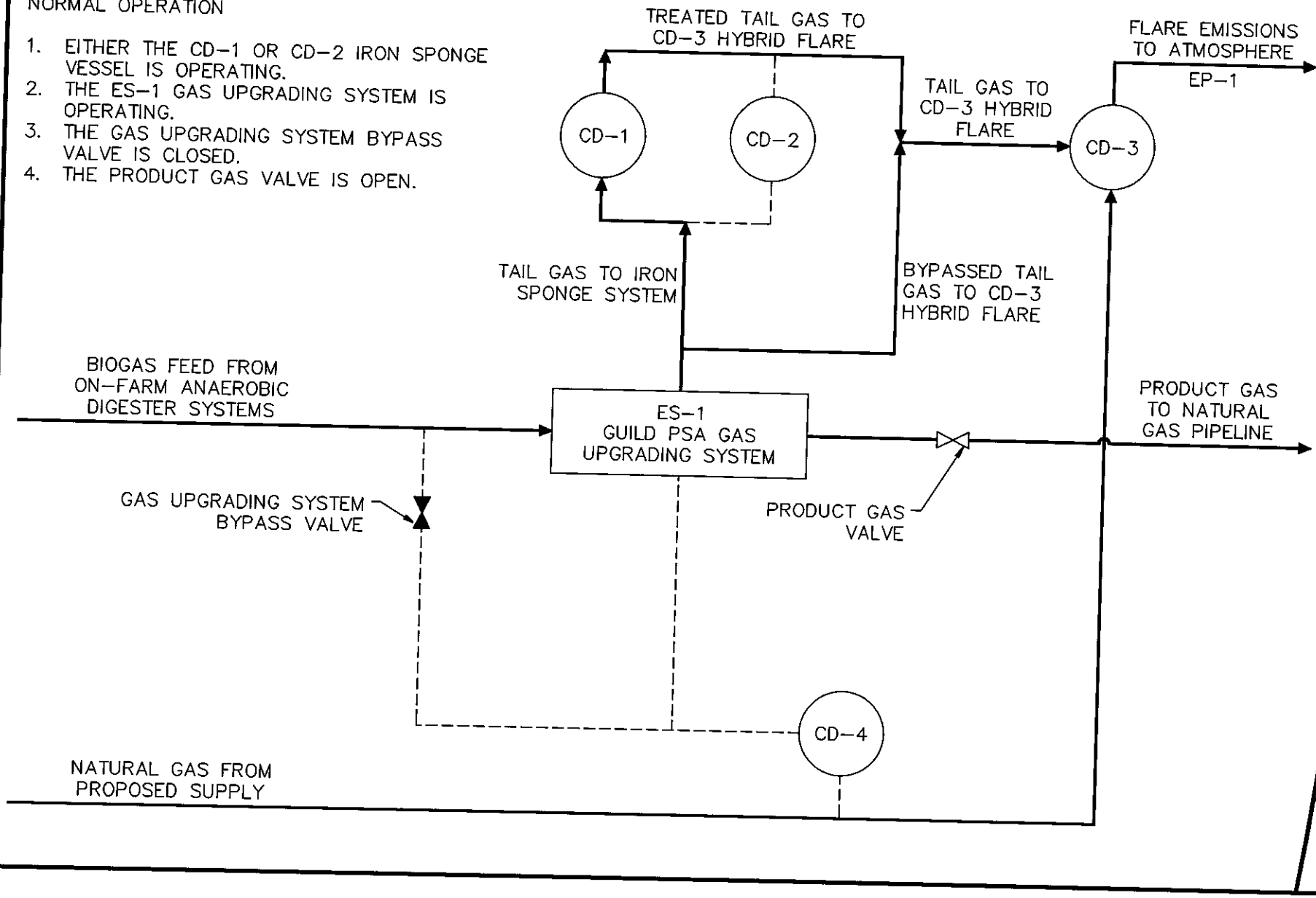
Source Information		Gas Usage (scfm)				Criteria Pollutants (tons/yr)							HAPs (tons/yr)	
Emission Source	Emission Point	Tail Gas	Product Gas	Natural Gas	Biogas	PM	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC	Highest HAP	Total HAPs
ES-1 Gas Upgrading System	EP-2	0.0	0.0	0.0	1,200.0	0.00	0.00	0.00	5.29	0.42	1.59	0.05	0.02	0.02
Totals		**0.0**	**0.0**	**0.0**	**1,200.0**	**0.00**	**0.00**	**0.00**	**5.29**	**0.42**	**1.59**	**0.05**	**0.02**	**0.02**

Notes:

1. The emission rates listed above were calculated for irregular operation when biogas is combusted in the candlestick flare (CD-4) instead of being separated into product gas and tail gas by the GUS. The GUS is not operational in this scenario and the iron sponge vessels are not used.
2. Biogas will be combusted in the candlestick flare infrequently during equipment disrepair or maintenance, not during normal operation.
3. The calculations used to obtain the potential emissions listed above used the maximum rated capacity of the GUS (1,200 scfm biogas) and the maximum anticipated hydrogen sulfide concentration in the biogas (3,500 ppm). As listed in the GUS Mass Balance, 240 hours of operation are expected for biogas to the candlestick flare at the maximum GUS capacity.
4. The ES-1 Gas Upgrading System potential emissions for EP-2 biogas combustion were calculated using the Biogas to Candlestick Flare Combustion Emissions Calculator.The potential emissions with controls and limits were calculated for 240 operating hours per year. See calculations pages 14-16.
5. These emission rates for biogas combustion in the candlestick flare are included in the BF Grady Rd Potential to Emit Summary Tables provided above.
6. See calculations page 24, Emission Factors for Tail Gas, Product Gas, and Biogas Combustion, for the emission factors used to obtain the emission rates above.

ES-1 GAS UPGRADING SYSTEM
OPERATING SCENARIO 1 OF 1
NORMAL OPERATION

1. EITHER THE CD-1 OR CD-2 IRON SPONGE VESSEL IS OPERATING.
2. THE ES-1 GAS UPGRADING SYSTEM IS OPERATING.
3. THE GAS UPGRADING SYSTEM BYPASS VALVE IS CLOSED.
4. THE PRODUCT GAS VALVE IS OPEN.



CAVANAUGH
Stewardship through innovation

ALIGN RNG
DUPLIN COUNTY & SAMPSON COUNTY, NORTH CAROLINA

BF GRADY RD
GAS UPGRADING FACILITY
PROCESS FLOW DIAGRAM

SHEET NUMBER
C.1.2

DATE NOVEMBER 14, 2019
PROJECT REF RE19.005
DESIGNED BKD
DRAWN WCS
ISSUED NONE

PRELIMINARY

Normal Operation
Emissions Calculator Input

Company Name:	Align Renewable Natural Gas, LLC
Facility Name:	BF Grady Rd
Facility ID Number:	Greenfield Facility
Permit Number:	Greenfield Facility
Facility City:	Turkey, NC
Facility County:	Duplin
Calculations Prepared By:	Ben Cauthen (Cavanaugh & Associates, P.A.)
Calculations Checked By:	Gus Simmons, P.E. (Cavanaugh & Associates, P.A.)
Calculations Prepared On:	2/4/2020
Calculations Checked On:	

Emission Source ID Number:	ES-1
Control Device ID Number:	CD-1, CD-2, CD-3
Emission Point ID Number:	EP-1
Operating Scenario:	1 of 1
Flare Maximum Heat Input (MMBtu/hr):	10.00
Date of Construction:	4/1/2020

Fuel Type:	Tail Gas and Natural Gas
Tail Gas Production (scfm):	444.20
Natural Gas Usage (scfm):	50.00
Average Fuel Heating Value (Btu/scf):	165.79
Calculated Potential Yearly Fuel Usage (MMscf):	528.39
Requested Annual Limitation (MMscf):	259.75
Actual Yearly Fuel Usage (MMscf):	241.96
Calculated Potential Yearly Fuel Usage (MMBtu):	87,600
Limited Potential Yearly Fuel Usage (MMBtu):	43,063
Actual Yearly Fuel Usage (MMBtu):	40,114
Actual Heat Input (MMBtu/hr):	4.92

Daily Hours of Operation:	24
Yearly Hours of Operation:	8,160

Maximum Tail Gas Production and Composition

Tail Gas Constituents	Formula	Tail Gas Composition	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	tons/yr	HHV (Btu/scf)
Methane	CH_4	7.02%	31.20	16.04	83.67	341.36	911.00
Carbon Dioxide	CO_2	92.00%	408.68	44.01	3,007.01	12,268.59	0.00
Nitrogen	N_2	0.00%	0.00	28.02	0.00	0.00	1.00
Oxygen	O_2	0.00%	0.00	32.00	0.00	0.00	0.00
Hydrogen Sulfide	H_2S	0.95%	4.20	34.08	23.93	97.63	587.00
Ammonia	NH_3	0.03%	0.12	17.03	0.34	1.39	359.00
Totals		**100.00%**	**444.20**	**41.94**	**3,114.95**	**12,708.98**	**69.63**

Supplemental Fuel	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	MMBtu/hr	HHV (Btu/scf)
Natural Gas	50.00	19.00	158.82	3.06	1,020.00

Notes:
1. The BF Grady Rd facility produces the lowest emissions during normal operation because hydrogen sulfide is captured in the iron sponge vessels and product gas is injected into the natural gas pipeline for offsite consumption. The candlestick flare is not used.
2. Normal operation may occur for more than 8,160 hours per year.
3. Limited potential yearly fuel usage was calculated using 8,760 operating hours per year.
4. Actual yearly fuel usage was calculated using 8,160 operating hours per year.

Normal Operation
Emissions Calculator Output - Criteria Pollutants

Criteria Air Pollutant Mass Balances

Tail Gas Constituent	MW (lb/lbmol)	Maximum Flowrate (scfm)	Maximum Molar Q (lbmol/hr)	Destruction Efficiency
Hydrogen Sulfide	34.08	4.20	0.70	98.00%
Nitrogen	28.02	0.00	0.00	98.00%
Ammonia	17.03	0.12	0.02	98.00%
Methane	16.04	31.20	5.22	98.00%

Air Pollutant Emitted	Formula	MW (lb/lbmol)
Sulfur Dioxide	SO_2	64.06
Nitric Oxide	NO	30.01
Nitrogen Dioxide	NO_2	46.01
Ammonia	NH_3	17.03
Methane	CH_4	16.04
Hydrogen Sulfide	H_2S	34.08

Hydrogen Sulfide Removal in Iron Sponge Vessel (lb/hr):	18.39
Sulfur Dioxide Emissions Reduction (lb/hr):	34.57

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)	
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
Sulfur Dioxide	10.21	41.64	44.08	193.08	10.21	44.71
Nitric Oxide	0.53	2.17	0.53	2.33	0.53	2.33
Nitrogen Dioxide	0.09	0.37	0.09	0.40	0.09	0.40
Ammonia	0.01	0.03	0.01	0.03	0.01	0.03
Methane	1.67	6.83	1.67	7.33	1.67	7.33
Hydrogen Sulfide	0.11	0.45	0.48	2.10	0.11	0.49

Criteria Air Pollutant Emissions

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/MMBtu
PM (Total)	0.03	0.06	0.03	0.14	0.03	0.07	3.14E-03
PM (Filterable)	0.01	0.02	0.01	0.05	0.01	0.03	1.21E-03
PM (Condensable)	0.02	0.04	0.02	0.08	0.02	0.04	1.93E-03
PM 2.5 (Total)	0.03	0.05	0.03	0.11	0.03	0.06	2.59E-03
PM 2.5 (Filterable)	0.01	0.01	0.01	0.03	0.01	0.01	6.64E-04
Sulfur Dioxide (SO_2)	10.24	41.72	44.12	193.24	10.24	44.78	3.62E-03
Nitrogen Oxides (NO_x)	1.30	3.90	1.30	5.70	1.30	4.19	6.80E-02
Carbon Monoxide (CO)	3.10	6.22	3.10	13.58	3.10	6.67	3.10E-01
VOCs	0.33	0.67	0.33	1.45	0.33	0.71	3.32E-02

Notes:

1. Emission rates from criteria air pollutant mass balances were added to emission rates derived from emission factors and the maximum flare heat input in MMBtu/hr listed in the calculator input.
2. Potential Emissions (Before Controls/Limits): Calculated with no controls or limitations and 8,760 operating hours per year.
3. Potential Emissions (After Controls/Limits): Iron sponge system (CD-1 and CD-2) used for hydrogen sulfide capture. Calculated using the limited yearly potential fuel usage listed in the calculator input.
4. Actual Emissions (After Controls/Limits): Iron sponge system (CD-1 and CD-2) used for hydrogen sulfide capture. Calculated using the actual yearly fuel usage listed in the calculator input.

Normal Operation
Emissions Calculator Output - HAPs and TAPs

Toxic / Hazardous Air Pollutant Emissions

		Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Toxic / Hazardous Air Pollutant	CAS Number	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	9.17E-07	3.68E-03	9.17E-07	8.03E-03	9.17E-07	3.95E-03	9.17E-08
Acrolein (TH)	107028	1.09E-06	4.36E-03	1.09E-06	9.51E-03	1.09E-06	4.68E-03	1.09E-07
Ammonia (T)	7664417	2.00E-01	8.30E+02	2.00E-01	1.75E+03	2.00E-01	8.91E+02	1.93E-02
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	1.27E-04	5.08E-01	1.27E-04	1.11E+00	1.27E-04	5.45E-01	1.27E-05
Benzo(a)pyrene (TH)	50328	7.24E-08	2.90E-04	7.24E-08	6.34E-04	7.24E-08	3.12E-04	7.24E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromic acid (VI) (TH)	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cobalt unlisted compounds (H)	COC-other	5.07E-06	2.03E-02	5.07E-06	4.44E-02	5.07E-06	2.18E-02	5.07E-07
Formaldehyde (TH)	50000	4.52E-03	1.81E+01	4.52E-03	3.96E+01	4.52E-03	1.95E+01	4.52E-04
Hexane, n- (TH)	110543	1.09E-01	4.36E+02	1.09E-01	9.51E+02	1.09E-01	4.68E+02	1.09E-02
Lead unlisted compounds (H)	PBC-other	3.02E-05	1.21E-01	3.02E-05	2.64E-01	3.02E-05	1.30E-01	3.02E-06
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Napthalene (H)	91203	3.68E-05	1.48E-01	3.68E-05	3.22E-01	3.68E-05	1.58E-01	3.68E-06
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Selenium compounds (H)	SEC	1.45E-06	5.81E-03	1.45E-06	1.27E-02	1.45E-06	6.23E-03	1.45E-07
Toluene (TH)	108883	2.05E-04	8.23E-01	2.05E-04	1.80E+00	2.05E-04	8.83E-01	2.05E-05
Total HAPs		1.14E-01	4.55E+02	1.14E-01	9.94E+02	1.14E-01	4.89E+02	1.14E-02
Highest HAP	110543	1.09E-01	4.36E+02	1.09E-01	9.51E+02	1.09E-01	4.68E+02	1.09E-02

Toxic Air Pollutant Emissions

		Expected Actual Emissions After Controls / Limitations			Emission Factor
Toxic Air Pollutant	CAS Number	lb/hr	lb/day	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	9.17E-07	2.20E-05	3.68E-03	9.17E-08
Acrolein (TH)	107028	1.09E-06	2.61E-05	4.36E-03	1.09E-07
Ammonia (T)	7664417	2.00E-01	4.80E+00	8.30E+02	1.93E-02
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	1.27E-04	3.04E-03	5.08E-01	1.27E-05
Benzo(a)pyrene (TH)	50328	7.24E-08	1.74E-06	2.90E-04	7.24E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Soluble chromate compounds, as chromium (VI) equivalent	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde (TH)	50000	4.52E-03	1.09E-01	1.81E+01	4.52E-04
Hexane, n- (TH)	110543	1.09E-01	2.61E+00	4.36E+02	1.09E-02
Hydrogen Sulfide	7783064	1.11E-01	2.66E+00	9.04E+02	
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene (TH)	108883	2.05E-04	4.92E-03	8.23E-01	2.05E-05

TAP

Product Gas to Candlestick Flare (PTE Calculations Only)
Combustion Emissions Calculator Input

Company Name:	Align Renewable Natural Gas, LLC
Facility Name:	BF Grady Rd
Facility ID Number:	Greenfield Facility
Permit Number:	Greenfield Facility
Facility City:	Turkey, NC
Facility County:	Duplin
Calculations Prepared By:	Ben Cauthen (Cavanaugh & Associates, P.A.)
Calculations Checked By:	Gus Simmons, P.E. (Cavanaugh & Associates, P.A.)
Calculations Prepared On:	2/4/2020
Calculations Checked On:	

Emission Source ID Number:	ES-1
Control Device ID Number:	CD-1, CD-2, CD-3, CD-4
Emission Point ID Number:	EP-1, EP-2
Operating Scenario:	Product Gas to Flare
Flare Maximum Heat Input (MMBtu/hr):	45.00
Date of Construction:	4/1/2020

Fuel Type:	Product Gas and Natural Gas
Product Gas Production (scfm):	755.80
Fuel Heating Value (Btu/scf):	902.70
Calculated Potential Yearly Fuel Usage (MMscf):	436.69
Requested Annual Limitation (MMscf):	27.24
Actual Yearly Fuel Usage (MMscf):	27.24
Calculated Potential Yearly Fuel Usage (MMBtu):	394,200
Limited Potential Yearly Fuel Usage (MMBtu):	24,588
Actual Yearly Fuel Usage (MMBtu):	24,588
Actual Heat Input (MMBtu/hr):	40.98

Daily Hours of Operation:	24
Yearly Hours of Operation:	600

Maximum Product Gas Production and Composition							
Product Gas Constituents	Formula	Product Gas Composition	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	tons/yr	HHV (Btu/scf)
Methane	CH_4	99.07%	748.80	16.04	2,008.01	602.40	911.00
Carbon Dioxide	CO_2	0.10%	0.76	44.01	5.56	1.67	0.00
Nitrogen	N_2	0.79%	6.00	28.02	28.11	8.43	1.00
Oxygen	O_2	0.03%	0.24	32.00	1.28	0.39	0.00
Hydrogen Sulfide	H_2S	0.00%	0.00	34.08	0.00	0.00	587.00
Ammonia	NH_3	0.00%	0.00	17.03	0.00	0.00	359.00
Totals		**100.00%**	**755.80**	**16.17**	**2,042.96**	**612.89**	**902.58**

Pilot Fuel	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	MMBtu/hr	HHV (Btu/scf)
Natural Gas	0.83	19.00	2.65	0.05	1,020.00

Notes:
1. These calculations were completed to determine the emissions from product gas combustion in the candlestick flare for 600 operating hours. The output from these calculations was used to determine the potential to emit before controls and limits for the BF Grady Rd facility.
2. Emissions from product gas combustion in the candlestick flare are greater than emissions from normal operation because product gas is combusted onsite instead of being used offsite.

Product Gas to Candlestick Flare (PTE Calculations Only)
Combustion Emissions Calculator Output - Criteria Pollutants

Criteria Air Pollutant Mass Balances

Biogas Constituent	MW (lb/lbmol)	Average Flowrate (scfm)	Average Molar Q (lbmol/hr)	Destruction Efficiency
Hydrogen Sulfide	34.08	0.00	0.00	98.00%
Nitrogen	28.02	6.00	1.00	98.00%
Ammonia	17.03	0.00	0.00	98.00%
Methane	16.04	748.80	125.19	98.00%

Air Pollutant Emitted	Formula	MW (lb/lbmol)
Sulfur Dioxide	SO_2	64.06
Nitric Oxide	NO	30.01
Nitrogen Dioxide	NO_2	46.01
Ammonia	NH_3	17.03
Methane	CH_4	16.04
Hydrogen Sulfide	H_2S	34.08

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)	
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
Sulfur Dioxide	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Oxide	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Dioxide	0.00	0.00	0.00	0.00	0.00	0.00
Ammonia	0.00	0.00	0.00	0.00	0.00	0.00
Methane	40.16	12.05	40.16	175.90	40.16	12.05
Hydrogen Sulfide	0.00	0.00	0.00	0.00	0.00	0.00

Criteria Air Pollutant Emissions

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/MMBtu
PM (Total)	0.03	0.01	0.03	0.11	0.03	0.01	5.76E-04
PM (Filterable)	0.01	0.00	0.01	0.04	0.01	0.00	2.22E-04
PM (Condensable)	0.02	0.00	0.02	0.07	0.02	0.00	3.54E-04
PM 2.5 (Total)	0.02	0.01	0.02	0.09	0.02	0.01	4.76E-04
PM 2.5 (Filterable)	0.01	0.00	0.01	0.02	0.01	0.00	1.22E-04
Sulfur Dioxide (SO_2)	0.03	0.01	0.03	0.13	0.03	0.01	6.65E-04
Nitrogen Oxides (NO_x)	3.06	0.84	3.06	13.40	3.06	0.84	6.80E-02
Carbon Monoxide (CO)	13.95	3.81	13.95	61.10	13.95	3.81	3.10E-01
VOCs	0.27	0.07	0.27	1.20	0.27	0.07	6.09E-03

Notes:

1. Emission rates from criteria air pollutant mass balances were added to emission rates derived from emission factors and the maximum flare heat input in MMBtu/hr listed in the calculator input.
2. Potential Emissions (Before Controls/Limits): Calculated with no controls or limitations and 8,760 operating hours per year.
3. Potential Emissions (After Controls/Limits): Calculated using the limited yearly potential fuel usage listed in the calculator input. Limited potential fuel usage was calculated using 600 operating hours per year.
4. Actual Emissions (After Controls/Limits): Calculated using the actual yearly fuel usage listed in the calculator input. Actual yearly fuel usage was calculated using 600 operating hours per year.

Product Gas to Candlestick Flare (PTE Calculations Only)
Combustion Emissions Calculator Output - HAPs and TAPs

Toxic / Hazardous Air Pollutant Emissions

		Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Toxic / Hazardous Air Pollutant	CAS Number	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	7.58E-07	4.14E-04	7.58E-07	6.64E-03	7.58E-07	4.14E-04	1.68E-08
Acrolein (TH)	107028	8.97E-07	4.90E-04	8.97E-07	7.86E-03	8.97E-07	4.90E-04	1.99E-08
Ammonia (T)	7664417	1.60E-01	8.72E+01	1.60E-01	1.40E+03	1.60E-01	8.72E+01	3.54E-03
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	1.05E-04	5.72E-02	1.05E-04	9.17E-01	1.05E-04	5.72E-02	2.33E-06
Benzo(a)pyrene (TH)	50328	5.98E-08	3.27E-05	5.98E-08	5.24E-04	5.98E-08	3.27E-05	1.33E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromic acid (VI) (TH)	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cobalt unlisted compounds (H)	COC-other	4.19E-06	2.29E-03	4.19E-06	3.67E-02	4.19E-06	2.29E-03	9.31E-08
Formaldehyde (TH)	50000	3.74E-03	2.04E+00	3.74E-03	3.28E+01	3.74E-03	2.04E+00	8.31E-05
Hexane, n- (TH)	110543	8.97E-02	4.90E+01	8.97E-02	7.86E+02	8.97E-02	4.90E+01	1.99E-03
Lead unlisted compounds (H)	PBC-other	2.49E-05	1.36E-02	2.49E-05	2.18E-01	2.49E-05	1.36E-02	5.54E-07
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Napthalene (H)	91203	3.04E-05	1.66E-02	3.04E-05	2.66E-01	3.04E-05	1.66E-02	6.76E-07
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Selenium compounds (H)	SEC	1.20E-06	6.54E-04	1.20E-06	1.05E-02	1.20E-06	6.54E-04	2.66E-08
Toluene (TH)	108883	1.69E-04	9.26E-02	1.69E-04	1.48E+00	1.69E-04	9.26E-02	3.77E-06
Total HAPs		9.38E-02	5.13E+01	9.38E-02	8.22E+02	9.38E-02	5.13E+01	2.08E-03
Highest HAP	110543	8.97E-02	4.90E+01	8.97E-02	7.86E+02	8.97E-02	4.90E+01	1.99E-03

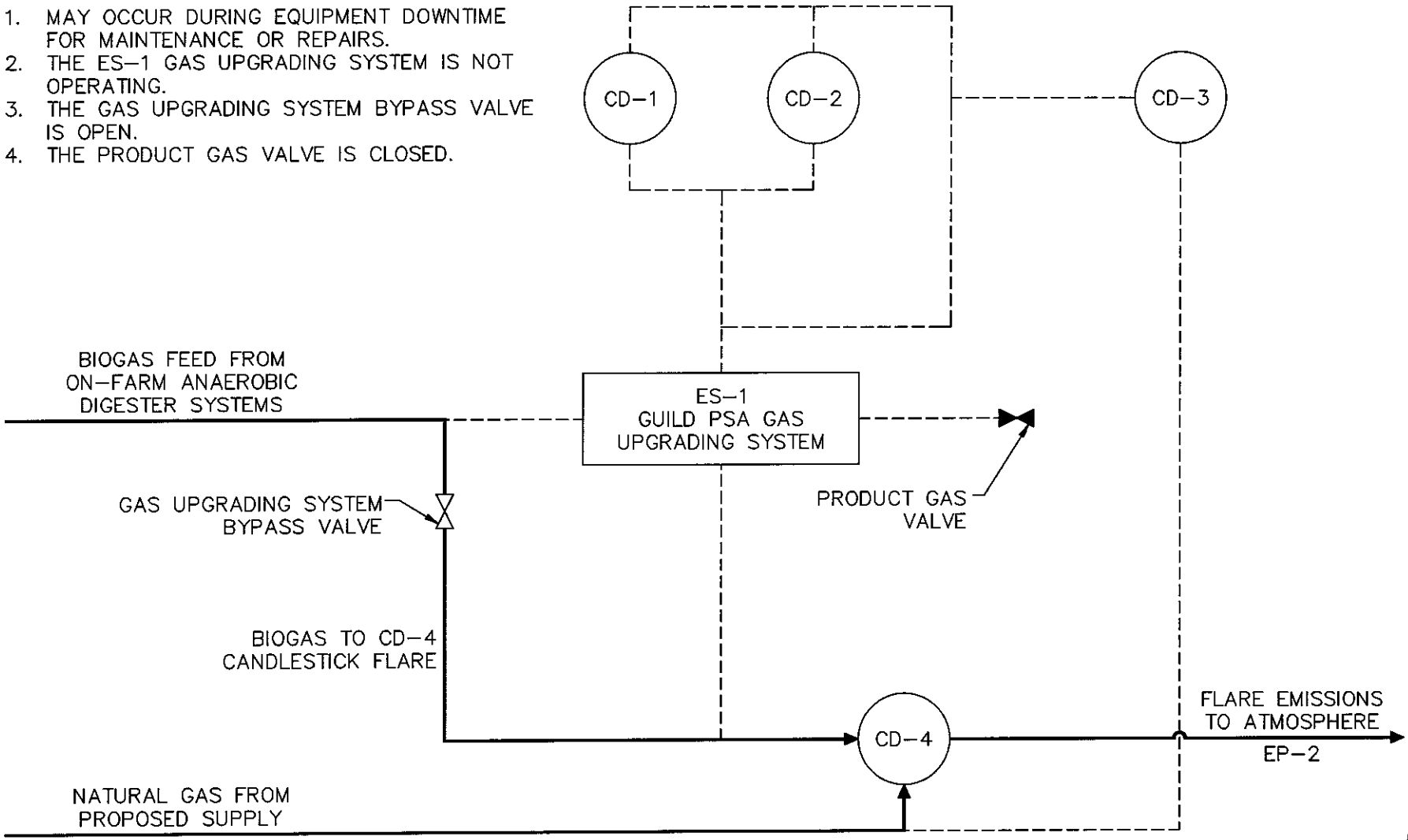
Toxic Air Pollutant Emissions

		Expected Actual Emissions After Controls / Limitations			Emission Factor
Toxic Air Pollutant	CAS Number	lb/hr	lb/day	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	7.58E-07	1.82E-05	4.14E-04	1.68E-08
Acrolein (TH)	107028	8.97E-07	2.15E-05	4.90E-04	1.99E-08
Ammonia (T)	7664417	1.60E-01	3.83E+00	8.72E+01	3.54E-03
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	1.05E-04	2.51E-03	5.72E-02	2.33E-06
Benzo(a)pyrene (TH)	50328	5.98E-08	1.44E-06	3.27E-05	1.33E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Soluble chromate compounds, as chromium (VI) equivalent	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde (TH)	50000	3.74E-03	8.97E-02	2.04E+00	8.31E-05
Hexane, n- (TH)	110543	8.97E-02	2.15E+00	4.90E+01	1.99E-03
Hydrogen Sulfide	7783064	0.00E+00	0.00E+00	0.00E+00	
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene (TH)	108883	1.69E-04	4.07E-03	9.26E-02	3.77E-06

TAP

ES–1 GAS UPGRADING SYSTEM
BIOGAS TO CANDLESTICK FLARE
IRREGULAR OPERATION

1. MAY OCCUR DURING EQUIPMENT DOWNTIME FOR MAINTENANCE OR REPAIRS.
2. THE ES–1 GAS UPGRADING SYSTEM IS NOT OPERATING.
3. THE GAS UPGRADING SYSTEM BYPASS VALVE IS OPEN.
4. THE PRODUCT GAS VALVE IS CLOSED.



CAVANAUGH
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ALIGN RNG
DUPLIN COUNTY & SAMPSON COUNTY, NORTH CAROLINA

BF GRADY RD
GAS UPGRADING FACILITY
PROCESS FLOW DIAGRAM

SHEET NUMBER
C.1.4

DATE NOVEMBER 14, 2019
PROJECT NO.: BC.19.006
DESIGNED BYC
DRAWN WCS
CHECKED NONE

Biogas to Candlestick Flare
Combustion Emissions Calculator Input

Company Name:	Align Renewable Natural Gas, LLC
Facility Name:	BF Grady Rd
Facility ID Number:	Greenfield Facility
Permit Number:	Greenfield Facility
Facility City:	Turkey, NC
Facility County:	Duplin
Calculations Prepared By:	Ben Cauthen (Cavanaugh & Associates, P.A.)
Calculations Checked By:	Gus Simmons, P.E. (Cavanaugh & Associates, P.A.)
Calculations Prepared On:	2/4/2020
Calculations Checked On:	

Emission Source ID Number:	ES-1
Control Device ID Number:	CD-4
Emission Point ID Number:	EP-2
Operating Scenario:	Biogas to Flare
Flare Maximum Heat Input (MMBtu/hr):	45.00
Date of Construction:	4/1/2020

Fuel Type:	Biogas and Natural Gas (Pilot)
Biogas Production (scfm):	1,200.00
Fuel Heating Value (Btu/scf):	594.54
Calculated Potential Yearly Fuel Usage (MMscf):	663.03
Requested Annual Limitation (MMscf):	17.29
Actual Yearly Fuel Usage (MMscf):	17.29
Calculated Potential Yearly Fuel Usage (MMBtu):	394,200
Limited Potential Yearly Fuel Usage (MMBtu):	10,281
Actual Yearly Fuel Usage (MMBtu):	10,281
Actual Heat Input (MMBtu/hr):	42.84

Daily Hours of Operation:	10
Yearly Hours of Operation:	240

Maximum Biogas Production and Composition							
Raw Biogas Constituents	Formula	Biogas Composition	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	tons/yr	HHV (Btu/scf)
Methane	CH_4	65.00%	780.00	16.04	2,091.67	251.00	911.00
Carbon Dioxide	CO_2	34.12%	409.44	44.01	3,012.57	361.51	0.00
Nitrogen	N_2	0.50%	6.00	28.02	28.11	3.37	1.00
Oxygen	O_2	0.02%	0.24	32.00	1.28	0.15	0.00
Hydrogen Sulfide	H_2S	0.35%	4.20	34.08	23.93	2.87	587.00
Ammonia	NH_3	0.01%	0.12	17.03	0.34	0.04	359.00
Totals		**100.00%**	**1,200.00**	**25.71**	**5,157.90**	**618.95**	**594.25**

Pilot Fuel	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	MMBtu/hr	HHV (Btu/scf)
Natural Gas	0.83	19.00	2.65	0.05	1,020.00

Notes:
1. The BF Grady Rd facility produces the greatest emissions during biogas combustion in the candlestick flare because the iron sponge vessels are not used for hydrogen sulfide capture.

Biogas to Candlestick Flare
Combustion Emissions Calculator Output - Criteria Pollutants

Criteria Air Pollutant Mass Balances

Biogas Constituent	MW (lb/lbmol)	Average Flowrate (scfm)	Average Molar Q (lbmol/hr)	Destruction Efficiency
Hydrogen Sulfide	34.08	4.20	0.70	98.00%
Nitrogen	28.02	6.00	1.00	98.00%
Ammonia	17.03	0.12	0.02	98.00%
Methane	16.04	780.00	130.40	98.00%

Air Pollutant Emitted	Formula	MW (lb/lbmol)
Sulfur Dioxide	SO_2	64.06
Nitric Oxide	NO	30.01
Nitrogen Dioxide	NO_2	46.01
Ammonia	NH_3	17.03
Methane	CH_4	16.04
Hydrogen Sulfide	H_2S	34.08

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)	
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
Sulfur Dioxide	44.08	5.29	44.08	193.08	44.08	5.29
Nitric Oxide	0.53	0.06	0.53	2.33	0.53	0.06
Nitrogen Dioxide	0.09	0.01	0.09	0.40	0.09	0.01
Ammonia	0.01	0.00	0.01	0.03	0.01	0.00
Methane	41.83	5.02	41.83	183.23	41.83	5.02
Hydrogen Sulfide	0.48	0.06	0.48	2.10	0.48	0.06

Criteria Air Pollutant Emissions

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/MMBtu
PM (Total)	0.04	0.00	0.04	0.17	0.04	0.00	8.75E-04
PM (Filterable)	0.02	0.00	0.02	0.07	0.02	0.00	3.36E-04
PM (Condensable)	0.02	0.00	0.02	0.11	0.02	0.00	5.38E-04
PM 2.5 (Total)	0.03	0.00	0.03	0.14	0.03	0.00	7.23E-04
PM 2.5 (Filterable)	0.01	0.00	0.01	0.04	0.01	0.00	1.85E-04
Sulfur Dioxide (SO_2)	44.13	5.29	44.13	193.28	44.13	5.29	1.01E-03
Nitrogen Oxides (NO_x)	3.68	0.42	3.68	16.12	3.68	0.42	6.80E-02
Carbon Monoxide (CO)	13.95	1.59	13.95	61.10	13.95	1.59	3.10E-01
VOCs	0.42	0.05	0.42	1.82	0.42	0.05	9.25E-03

Notes:

1. Emission rates from criteria air pollutant mass balances were added to emission rates derived from emission factors and the maximum flare heat input in MMBtu/hr listed in the calculator input.
2. Potential Emissions (Before Controls/Limits): Calculated with no controls or limitations and 8,760 operating hours per year.
3. Potential Emissions (After Controls/Limits): Calculated using the limited yearly potential fuel usage listed in the calculator input. Limited potential fuel usage was calculated using 240 operating hours per year.
4. Actual Emissions (After Controls/Limits): Calculated using the actual yearly fuel usage listed in the calculator input. Actual yearly fuel usage was calculated using 240 operating hours per year.

Biogas to Candlestick Flare
Combustion Emissions Calculator Output - HAPs and TAPs

Toxic / Hazardous Air Pollutant Emissions

		Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Toxic / Hazardous Air Pollutant	CAS Number	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	1.15E-06	2.63E-04	1.15E-06	1.01E-02	1.15E-06	2.63E-04	2.56E-08
Acrolein (TH)	107028	1.36E-06	3.11E-04	1.36E-06	1.19E-02	1.36E-06	3.11E-04	3.03E-08
Ammonia (T)	7664417	2.56E-01	5.70E+01	2.49E-01	2.18E+03	2.56E-01	5.70E+01	5.38E-03
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	1.59E-04	3.63E-02	1.59E-04	1.39E+00	1.59E-04	3.63E-02	3.53E-06
Benzo(a)pyrene (TH)	50328	9.08E-08	2.08E-05	9.08E-08	7.96E-04	9.08E-08	2.08E-05	2.02E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromic acid (VI) (TH)	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cobalt unlisted compounds (H)	COC-other	6.36E-06	1.45E-03	6.36E-06	5.57E-02	6.36E-06	1.45E-03	1.41E-07
Formaldehyde (TH)	50000	5.68E-03	1.30E+00	5.68E-03	4.97E+01	5.68E-03	1.30E+00	1.26E-04
Hexane, n- (TH)	110543	1.36E-01	3.11E+01	1.36E-01	1.19E+03	1.36E-01	3.11E+01	3.03E-03
Lead unlisted compounds (H)	PBC-other	3.78E-05	8.65E-03	3.78E-05	3.32E-01	3.78E-05	8.65E-03	8.41E-07
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Napthalene (H)	91203	4.62E-05	1.05E-02	4.62E-05	4.04E-01	4.62E-05	1.05E-02	1.03E-06
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Selenium compounds (H)	SEC	1.82E-06	4.15E-04	1.82E-06	1.59E-02	1.82E-06	4.15E-04	4.04E-08
Toluene (TH)	108883	2.57E-04	5.88E-02	2.57E-04	2.25E+00	2.57E-04	5.88E-02	5.72E-06
Total HAPs		1.42E-01	3.25E+01	1.42E-01	1.25E+03	1.42E-01	3.25E+01	3.17E-03
Highest HAP	110543	1.36E-01	3.11E+01	1.36E-01	1.19E+03	1.36E-01	3.11E+01	3.03E-03

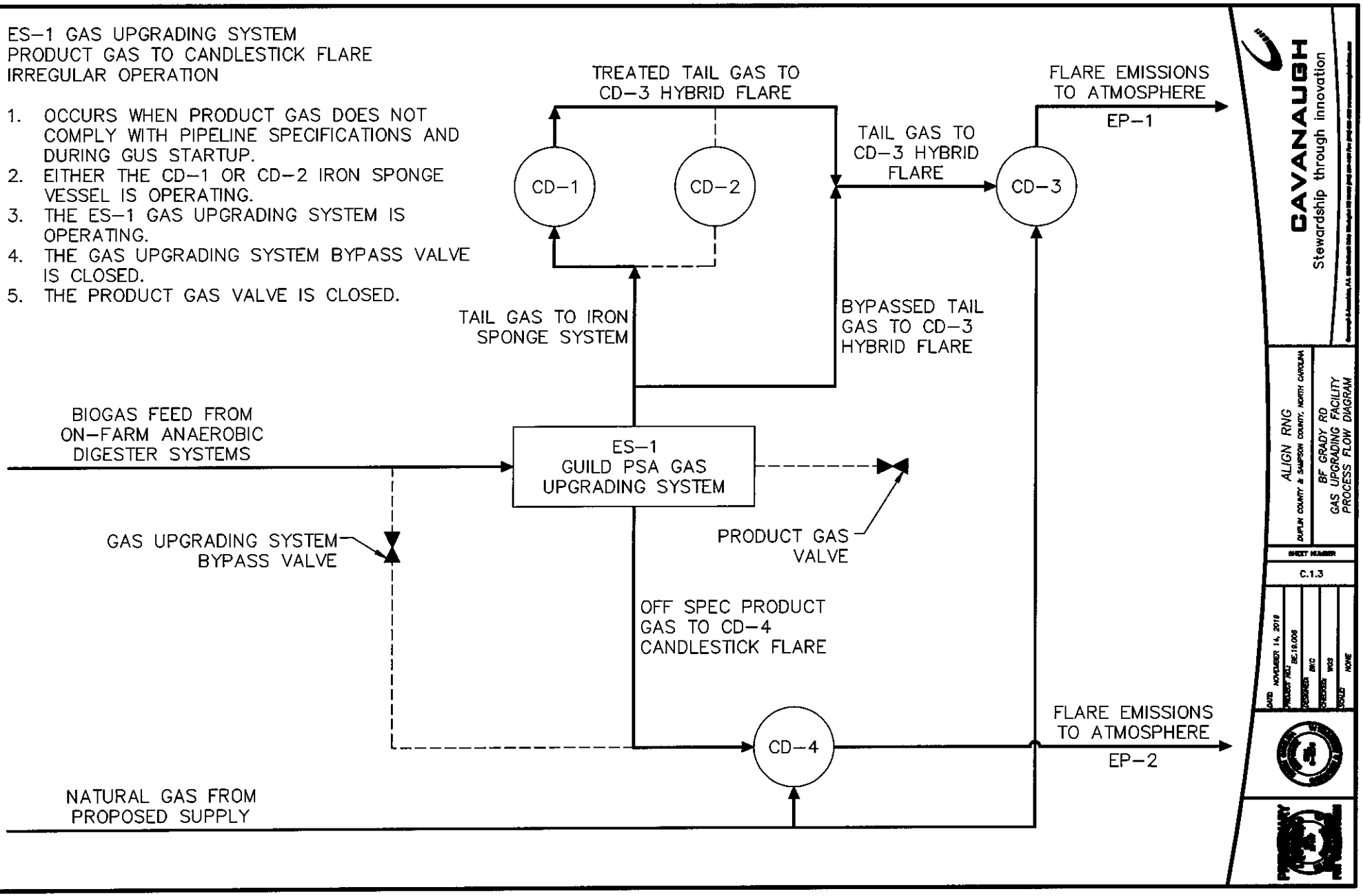
Toxic Air Pollutant Emissions

		Expected Actual Emissions After Controls / Limitations			Emission Factor
Toxic Air Pollutant	CAS Number	lb/hr	lb/day	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	1.15E-06	1.15E-05	2.63E-04	2.56E-08
Acrolein (TH)	107028	1.36E-06	1.36E-05	3.11E-04	3.03E-08
Ammonia (T)	7664417	2.56E-01	2.49E+00	5.70E+01	5.38E-03
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	1.59E-04	1.59E-03	3.63E-02	3.53E-06
Benzo(a)pyrene (TH)	50328	9.08E-08	9.08E-07	2.08E-05	2.02E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Soluble chromate compounds, as chromium (VI) equivalent	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde (TH)	50000	5.68E-03	5.68E-02	1.30E+00	1.26E-04
Hexane, n- (TH)	110543	1.36E-01	1.36E+00	3.11E+01	3.03E-03
Hydrogen Sulfide	7783064	4.79E-01	4.79E+00	1.15E+02	
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene (TH)	108883	2.57E-04	2.57E-03	5.88E-02	5.72E-06

TAP

ES–1 GAS UPGRADING SYSTEM
PRODUCT GAS TO CANDLESTICK FLARE
IRREGULAR OPERATION

1. OCCURS WHEN PRODUCT GAS DOES NOT COMPLY WITH PIPELINE SPECIFICATIONS AND DURING GUS STARTUP.
2. EITHER THE CD–1 OR CD–2 IRON SPONGE VESSEL IS OPERATING.
3. THE ES–1 GAS UPGRADING SYSTEM IS OPERATING.
4. THE GAS UPGRADING SYSTEM BYPASS VALVE IS CLOSED.
5. THE PRODUCT GAS VALVE IS CLOSED.



CAVANAUGH
Stewardship through innovation

ALIGN RNG
DUPLIN COUNTY & SAMPSON COUNTY, NORTH CAROLINA

BF GRADY RD
GAS UPGRADING FACILITY
PROCESS FLOW DIAGRAM

SHEET NUMBER
C.1.3

DATE NOVEMBER 14, 2019
PROJECT NO. BE.18.006
DESIGNED BKC
DRAWN WSS
CHKD NONE

Product Gas to Candlestick Flare
Combustion Emissions Calculator Input

Company Name:	Align Renewable Natural Gas, LLC
Facility Name:	BF Grady Rd
Facility ID Number:	Greenfield Facility
Permit Number:	Greenfield Facility
Facility City:	Turkey, NC
Facility County:	Duplin
Calculations Prepared By:	Ben Cauthen (Cavanaugh & Associates, P.A.)
Calculations Checked By:	Gus Simmons, P.E. (Cavanaugh & Associates, P.A.)
Calculations Prepared On:	2/4/2020
Calculations Checked On:	

Emission Source ID Number:	ES-1
Control Device ID Number:	CD-1, CD-2, CD-3, CD-4
Emission Point ID Number:	EP-1, EP-2
Operating Scenario:	Product Gas to Flare
Flare Maximum Heat Input (MMBtu/hr):	45.00
Date of Construction:	4/1/2020

Fuel Type:	Product Gas and Natural Gas
Product Gas Production (scfm):	755.80
Fuel Heating Value (Btu/scf):	902.70
Calculated Potential Yearly Fuel Usage (MMscf):	436.69
Requested Annual Limitation (MMscf):	16.34
Actual Yearly Fuel Usage (MMscf):	16.34
Calculated Potential Yearly Fuel Usage (MMBtu):	394,200
Limited Potential Yearly Fuel Usage (MMBtu):	14,753
Actual Yearly Fuel Usage (MMBtu):	14,753
Actual Heat Input (MMBtu/hr):	40.98

Daily Hours of Operation:	24
Yearly Hours of Operation:	360

Maximum Product Gas Production and Composition							
Product Gas Constituents	Formula	Product Gas Composition	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	tons/yr	HHV (Btu/scf)
Methane	CH_4	99.07%	748.80	16.04	2,008.01	361.44	911.00
Carbon Dioxide	CO_2	0.10%	0.76	44.01	5.56	1.00	0.00
Nitrogen	N_2	0.79%	6.00	28.02	28.11	5.06	1.00
Oxygen	O_2	0.03%	0.24	32.00	1.28	0.23	0.00
Hydrogen Sulfide	H_2S	0.00%	0.00	34.08	0.00	0.00	587.00
Ammonia	NH_3	0.00%	0.00	17.03	0.00	0.00	359.00
Totals		**100.00%**	**755.80**	**16.17**	**2,042.96**	**367.73**	**902.58**

Pilot Fuel	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	MMBtu/hr	HHV (Btu/scf)
Natural Gas	0.83	19.00	2.65	0.05	1,020.00

Notes:
1. The BF Grady Rd facility may combust product gas onsite in the candlestick flare instead of injecting it into the natural gas pipeline. When this occurs, tail gas will be scrubbed in the iron sponge vessels and oxidized in the enclosed hybrid flare.
2. Emissions from product gas combustion in the candlestick flare are greater than emissions from normal operation because product gas is combusted onsite instead of being used offsite.

Product Gas to Candlestick Flare
Combustion Emissions Calculator Output - Criteria Pollutants

Criteria Air Pollutant Mass Balances

Biogas Constituent	MW (lb/lbmol)	Average Flowrate (scfm)	Average Molar Q (lbmol/hr)	Destruction Efficiency
Hydrogen Sulfide	34.08	0.00	0.00	98.00%
Nitrogen	28.02	6.00	1.00	98.00%
Ammonia	17.03	0.00	0.00	98.00%
Methane	16.04	748.80	125.19	98.00%

Air Pollutant Emitted	Formula	MW (lb/lbmol)
Sulfur Dioxide	SO_2	64.06
Nitric Oxide	NO	30.01
Nitrogen Dioxide	NO_2	46.01
Ammonia	NH_3	17.03
Methane	CH_4	16.04
Hydrogen Sulfide	H_2S	34.08

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)	
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
Sulfur Dioxide	0.00	0.00	0.00	0.00	0.00	0.00
Nitric Oxide	0.00	0.00	0.00	0.00	0.00	0.00
Nitrogen Dioxide	0.00	0.00	0.00	0.00	0.00	0.00
Ammonia	0.00	0.00	0.00	0.00	0.00	0.00
Methane	40.16	7.23	40.16	175.90	40.16	7.23
Hydrogen Sulfide	0.00	0.00	0.00	0.00	0.00	0.00

Criteria Air Pollutant Emissions

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/MMBtu
PM (Total)	0.03	0.00	0.03	0.11	0.03	0.00	5.76E-04
PM (Filterable)	0.01	0.00	0.01	0.04	0.01	0.00	2.22E-04
PM (Condensable)	0.02	0.00	0.02	0.07	0.02	0.00	3.54E-04
PM 2.5 (Total)	0.02	0.00	0.02	0.09	0.02	0.00	4.76E-04
PM 2.5 (Filterable)	0.01	0.00	0.01	0.02	0.01	0.00	1.22E-04
Sulfur Dioxide (SO_2)	0.03	0.00	0.03	0.13	0.03	0.00	6.65E-04
Nitrogen Oxides (NO_x)	3.06	0.50	3.06	13.40	3.06	0.50	6.80E-02
Carbon Monoxide (CO)	13.95	2.29	13.95	61.10	13.95	2.29	3.10E-01
VOCs	0.27	0.04	0.27	1.20	0.27	0.04	6.09E-03

Notes:

1. Emission rates from criteria air pollutant mass balances were added to emission rates derived from emission factors and the maximum flare heat input in MMBtu/hr listed in the calculator input.
2. Potential Emissions (Before Controls/Limits): Calculated with no controls or limitations and 8,760 operating hours per year.
3. Potential Emissions (After Controls/Limits): Calculated using the limited yearly potential fuel usage listed in the calculator input. Limited potential fuel usage was calculated using 360 operating hours per year.
4. Actual Emissions (After Controls/Limits): Calculated using the actual yearly fuel usage listed in the calculator input. Actual yearly fuel usage was calculated using 360 operating hours per year.

Product Gas to Candlestick Flare
Combustion Emissions Calculator Output - HAPs and TAPs

Toxic / Hazardous Air Pollutant Emissions

		Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Toxic / Hazardous Air Pollutant	CAS Number	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	7.58E-07	2.48E-04	7.58E-07	6.64E-03	7.58E-07	2.48E-04	1.68E-08
Acrolein (TH)	107028	8.97E-07	2.94E-04	8.97E-07	7.86E-03	8.97E-07	2.94E-04	1.99E-08
Ammonia (T)	7664417	1.60E-01	5.23E+01	1.60E-01	1.40E+03	1.60E-01	5.23E+01	3.54E-03
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	1.05E-04	3.43E-02	1.05E-04	9.17E-01	1.05E-04	3.43E-02	2.33E-06
Benzo(a)pyrene (TH)	50328	5.98E-08	1.96E-05	5.98E-08	5.24E-04	5.98E-08	1.96E-05	1.33E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromic acid (VI) (TH)	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cobalt unlisted compounds (H)	COC-other	4.19E-06	1.37E-03	4.19E-06	3.67E-02	4.19E-06	1.37E-03	9.31E-08
Formaldehyde (TH)	50000	3.74E-03	1.23E+00	3.74E-03	3.28E+01	3.74E-03	1.23E+00	8.31E-05
Hexane, n- (TH)	110543	8.97E-02	2.94E+01	8.97E-02	7.86E+02	8.97E-02	2.94E+01	1.99E-03
Lead unlisted compounds (H)	PBC-other	2.49E-05	8.17E-03	2.49E-05	2.18E-01	2.49E-05	8.17E-03	5.54E-07
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Napthalene (H)	91203	3.04E-05	9.97E-03	3.04E-05	2.66E-01	3.04E-05	9.97E-03	6.76E-07
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Selenium compounds (H)	SEC	1.20E-06	3.92E-04	1.20E-06	1.05E-02	1.20E-06	3.92E-04	2.66E-08
Toluene (TH)	108883	1.69E-04	5.56E-02	1.69E-04	1.48E+00	1.69E-04	5.56E-02	3.77E-06
Total HAPs		9.38E-02	3.08E+01	9.38E-02	8.22E+02	9.38E-02	3.08E+01	2.08E-03
Highest HAP	110543	8.97E-02	2.94E+01	8.97E-02	7.86E+02	8.97E-02	2.94E+01	1.99E-03

Toxic Air Pollutant Emissions

		Expected Actual Emissions After Controls / Limitations			Emission Factor
Toxic Air Pollutant	CAS Number	lb/hr	lb/day	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	7.58E-07	1.82E-05	2.48E-04	1.68E-08
Acrolein (TH)	107028	8.97E-07	2.15E-05	2.94E-04	1.99E-08
Ammonia (T)	7664417	1.60E-01	3.83E+00	5.23E+01	3.54E-03
Arsenic unlisted compounds (TH)	ASC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (TH)	71432	1.05E-04	2.51E-03	3.43E-02	2.33E-06
Benzo(a)pyrene (TH)	50328	5.98E-08	1.44E-06	1.96E-05	1.33E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Soluble chromate compounds, as chromium (VI) equivalent	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde (TH)	50000	3.74E-03	8.97E-02	1.23E+00	8.31E-05
Hexane, n- (TH)	110543	8.97E-02	2.15E+00	2.94E+01	1.99E-03
Hydrogen Sulfide	7783064	0.00E+00	0.00E+00	0.00E+00	
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene (TH)	108883	1.69E-04	4.07E-03	5.56E-02	3.77E-06

Tail Gas to Enclosed Flare (Not During Normal Operation)
Emissions Calculator Input

Company Name:	Align Renewable Natural Gas, LLC
Facility Name:	BF Grady Rd
Facility ID Number:	Greenfield Facility
Permit Number:	Greenfield Facility
Facility City:	Turkey, NC
Facility County:	Duplin
Calculations Prepared By:	Ben Cauthen (Cavanaugh & Associates, P.A.)
Calculations Checked By:	Gus Simmons, P.E. (Cavanaugh & Associates, P.A.)
Calculations Prepared On:	2/4/2020
Calculations Checked On:	

Emission Source ID Number:	ES-1
Control Device ID Number:	CD-1, CD-2, CD-3, CD-4
Emission Point ID Number:	EP-1, EP-2
Operating Scenario:	Product Gas to Flare
Flare Maximum Heat Input (MMBtu/hr):	10.00
Date of Construction:	4/1/2020

Fuel Type:	Tail Gas and Natural Gas
Tail Gas Production (scfm):	444.20
Natural Gas Usage (scfm):	50.00
Average Fuel Heating Value (Btu/scf):	165.79
Calculated Potential Yearly Fuel Usage (MMscf):	528.39
Requested Annual Limitation (MMscf):	10.67
Actual Yearly Fuel Usage (MMscf):	10.67
Calculated Potential Yearly Fuel Usage (MMBtu):	87,600
Limited Potential Yearly Fuel Usage (MMBtu):	1,770
Actual Yearly Fuel Usage (MMBtu):	1,770
Actual Heat Input (MMBtu/hr):	4.92

Daily Hours of Operation:	24
Yearly Hours of Operation:	360

Maximum Tail Gas Production and Composition							
Tail Gas Constituents	Formula	Tail Gas Composition	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	tons/yr	HHV (Btu/scf)
Methane	CH_4	7.02%	31.20	16.04	83.67	15.06	911.00
Carbon Dioxide	CO_2	92.00%	408.68	44.01	3,007.01	541.26	0.00
Nitrogen	N_2	0.00%	0.00	28.02	0.00	0.00	1.00
Oxygen	O_2	0.00%	0.00	32.00	0.00	0.00	0.00
Hydrogen Sulfide	H_2S	0.95%	4.20	34.08	23.93	4.31	587.00
Ammonia	NH_3	0.03%	0.12	17.03	0.34	0.06	359.00
Totals		**100.00%**	**444.20**	**41.94**	**3,114.95**	**560.69**	**69.63**

Supplemental Fuel	Flowrate (scfm)	MW (lb/lbmol)	lb/hr	MMBtu/hr	HHV (Btu/scf)
Natural Gas	50.00	19.00	158.82	3.06	1,020.00

Notes:

1. The BF Grady Rd facility may combust product gas onsite in the candlestick flare instead of injecting it into the natural gas pipeline. When this occurs, tail gas will be scrubbed in the iron sponge vessels and oxidized in the enclosed hybrid flare.
2. The values listed above are used as inputs to calculate emissions from the enclosed flare during the estimated 360 hours in which product gas is combusted in the candlestick flare.

Tail Gas to Enclosed Flare (Not During Normal Operation)
Emissions Calculator Output - Criteria Pollutants

Criteria Air Pollutant Mass Balances

Tail Gas Constituent	MW (lb/lbmol)	Maximum Flowrate (scfm)	Maximum Molar Q (lbmol/hr)	Destruction Efficiency
Hydrogen Sulfide	34.08	4.20	0.70	98.00%
Nitrogen	28.02	0.00	0.00	98.00%
Ammonia	17.03	0.12	0.02	98.00%
Methane	16.04	31.20	5.22	98.00%

Air Pollutant Emitted	Formula	MW (lb/lbmol)
Sulfur Dioxide	SO_2	64.06
Nitric Oxide	NO	30.01
Nitrogen Dioxide	NO_2	46.01
Ammonia	NH_3	17.03
Methane	CH_4	16.04
Hydrogen Sulfide	H_2S	34.08

Hydrogen Sulfide Removal in Iron Sponge Vessel (lb/hr):	18.39
Sulfur Dioxide Emissions Reduction (lb/hr):	34.57

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)	
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr
Sulfur Dioxide	10.21	1.84	44.08	193.08	10.21	1.84
Nitric Oxide	0.53	0.10	0.53	2.33	0.53	0.10
Nitrogen Dioxide	0.09	0.02	0.09	0.40	0.09	0.02
Ammonia	0.01	0.00	0.01	0.03	0.01	0.00
Methane	1.67	0.30	1.67	7.33	1.67	0.30
Hydrogen Sulfide	0.11	0.02	0.48	2.10	0.11	0.02

Criteria Air Pollutant Emissions

	Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Air Pollutant Emitted	lb/hr	tons/yr	lb/hr	tons/yr	lb/hr	tons/yr	lb/MMBtu
PM (Total)	0.03	0.00	0.03	0.14	0.03	0.00	3.14E-03
PM (Filterable)	0.01	0.00	0.01	0.05	0.01	0.00	1.21E-03
PM (Condensable)	0.02	0.00	0.02	0.08	0.02	0.00	1.93E-03
PM 2.5 (Total)	0.03	0.00	0.03	0.11	0.03	0.00	2.59E-03
PM 2.5 (Filterable)	0.01	0.00	0.01	0.03	0.01	0.00	6.64E-04
Sulfur Dioxide (SO_2)	10.24	1.84	44.12	193.24	10.24	1.84	3.62E-03
Nitrogen Oxides (NO_x)	1.30	0.17	1.30	5.70	1.30	0.17	6.80E-02
Carbon Monoxide (CO)	3.10	0.27	3.10	13.58	3.10	0.27	3.10E-01
VOCs	0.33	0.03	0.33	1.45	0.33	0.03	3.32E-02

Notes:

1. Emission rates from criteria air pollutant mass balances were added to emission rates derived from emission factors and the maximum flare heat input in MMBtu/hr listed in the calculator input.
2. Potential Emissions (Before Controls/Limits): Calculated with no controls or limitations and 8,760 operating hours per year.
3. Potential Emissions (After Controls/Limits): Calculated using the limited yearly potential fuel usage listed in the calculator input. Limited potential fuel usage was calculated using 360 operating hours per year.
4. Actual Emissions (After Controls/Limits): Calculated using the actual yearly fuel usage listed in the calculator input. Actual yearly fuel usage was calculated using 360 operating hours per year.

Tail Gas to Enclosed Flare (Not During Normal Operation)
Emissions Calculator Output - HAPs and TAPs

Toxic / Hazardous Air Pollutant Emissions

		Actual Emissions (After Controls/Limits)		Potential Emissions (Before Controls/Limits)		Potential Emissions (After Controls/Limits)		Emission Factor
Toxic / Hazardous Air Pollutant	CAS Number	lb/hr	lb/yr	lb/hr	lb/yr	lb/hr	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	9.17E-07	1.62E-04	9.17E-07	8.03E-03	9.17E-07	1.62E-04	9.17E-08
Acrolein (TH)	107028	1.09E-06	1.92E-04	1.09E-06	9.51E-03	1.09E-06	1.92E-04	1.09E-07
Ammonia (T)	7664417	2.00E-01	3.66E+01	2.00E-01	1.75E+03	2.00E-01	3.66E+01	1.93E-02
Arsenic unlisted compounds (TH)	ASC-other	1.21E-05	2.13E-03	1.21E-05	1.06E-01	1.21E-05	2.13E-03	1.21E-06
Benzene (TH)	71432	1.27E-04	2.24E-02	1.27E-04	1.11E+00	1.27E-04	2.24E-02	1.27E-05
Benzo(a)pyrene (TH)	50328	7.24E-08	1.28E-05	7.24E-08	6.34E-04	7.24E-08	1.28E-05	7.24E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromic acid (VI) (TH)	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cobalt unlisted compounds (H)	COC-other	5.07E-06	8.97E-04	5.07E-06	4.44E-02	5.07E-06	8.97E-04	5.07E-07
Formaldehyde (TH)	50000	4.52E-03	8.01E-01	4.52E-03	3.96E+01	4.52E-03	8.01E-01	4.52E-04
Hexane, n- (TH)	110543	1.09E-01	1.92E+01	1.09E-01	9.51E+02	1.09E-01	1.92E+01	1.09E-02
Lead unlisted compounds (H)	PBC-other	3.02E-05	5.34E-03	3.02E-05	2.64E-01	3.02E-05	5.34E-03	3.02E-06
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Napthalene (H)	91203	3.68E-05	6.51E-03	3.68E-05	3.22E-01	3.68E-05	6.51E-03	3.68E-06
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Selenium compounds (H)	SEC	1.45E-06	2.56E-04	1.45E-06	1.27E-02	1.45E-06	2.56E-04	1.45E-07
Toluene (TH)	108883	2.05E-04	3.63E-02	2.05E-04	1.80E+00	2.05E-04	3.63E-02	2.05E-05
Total HAPs		1.14E-01	2.01E+01	1.14E-01	9.94E+02	1.14E-01	2.01E+01	1.14E-02
Highest HAP	110543	1.09E-01	1.92E+01	1.09E-01	9.51E+02	1.09E-01	1.92E+01	1.09E-02

Toxic Air Pollutant Emissions

		Expected Actual Emissions After Controls / Limitations			Emission Factor
Toxic Air Pollutant	CAS Number	lb/hr	lb/day	lb/yr	lb/MMBtu
Acetaldehyde (TH)	75070	9.17E-07	2.20E-05	1.62E-04	9.17E-08
Acrolein (TH)	107028	1.09E-06	2.61E-05	1.92E-04	1.09E-07
Ammonia (T)	7664417	2.00E-01	4.80E+00	3.66E+01	1.93E-02
Arsenic unlisted compounds (TH)	ASC-other	1.21E-05	2.90E-04	2.13E-03	1.21E-06
Benzene (TH)	71432	1.27E-04	3.04E-03	2.24E-02	1.27E-05
Benzo(a)pyrene (TH)	50328	7.24E-08	1.74E-06	1.28E-05	7.24E-09
Beryllium metal (unreacted) (TH)	7440417	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cadmium metal (elemental unreacted) (TH)	7440439	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Soluble chromate compounds, as chromium (VI) equivalent	7738945	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde (TH)	50000	4.52E-03	1.09E-01	8.01E-01	4.52E-04
Hexane, n- (TH)	110543	1.09E-01	2.61E+00	1.92E+01	1.09E-02
Hydrogen Sulfide	7783064	1.11E-01	2.66E+00	3.99E+01	
Manganese unlisted compounds (TH)	MNC-other	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury vapor (TH)	7439976	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel metal (TH)	7440020	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene (TH)	108883	2.05E-04	4.92E-03	3.63E-02	2.05E-05

Emission Factors for Tail Gas, Product Gas, and Biogas Combustion

Criteria Pollutants	
Pollutant	Uncontrolled (lb/MMscf)
PM (Total)	0.52
PM (Filterable)	0.20
PM (Condensable)	0.32
PM 2.5 (Total)	0.43
PM 2.5 (Filterable)	0.11
Sulfur Dioxide (SO_2)	0.60
VOCs	5.50
Pollutant	Uncontrolled (lb/MMBtu)
Nitrogen Oxides (NO_x)	0.07
Carbon Monoxide (CO)	0.31

HAPs / TAPs	
Pollutant	Uncontrolled (lb/MMscf)
Acetaldehyde (H,T)	1.52E-05
Acrolein (H,T)	1.80E-05
Ammonia (T)	3.20E+00
Arsenic (H,T)	2.00E-04
Benzene (H,T)	2.10E-03
Benzo(a)pyrene (H,T)	1.20E-06
Beryllium (H,T)	1.20E-05
Cadmium (H,T)	1.10E-03
Chromium (VI) (H,T)	1.40E-03
Cobalt (H)	8.40E-05
Formaldehyde (H,T)	7.50E-02
n-Hexane (H,T)	1.80E+00
Lead (H)	5.00E-04
Manganese (H,T)	3.80E-04
Mercury (H,T)	2.60E-04
Napthalene (H)	6.10E-04
Nickel (H,T)	2.10E-03
Selenium (H)	2.40E-05
Toluene (H,T)	3.40E-03

Notes:
1. Emission factors for PM, SO_2, and VOCs were obtained from AP-42 Section 1.4.
2. Emission factors for NO_x and CO were obtained from AP-42 Section 13.5.

15A NCAC Applicability Calculations

Emission Rates Requiring a Permit (15A NCAC 02Q .0711)	
Maximum H_2S Emission Rate from ES-1 Normal Operation	
Potential H_2S Emission Rate With Controls/Limits for ES-1 During Normal Operation (lb/hr):	0.11
Daily Hours of Operation for ES-1 During Normal Operation:	24
H_2S Emission Rate from EP-1 During Normal Operation (lb/day):	2.66
Maximum H_2S Emission Rate from ES-1 Biogas to Candlestick Flare	
Potential H_2S Emission Rate With Controls/Limits for ES-1 During Biogas Combustion in the Candlestick Flare (lb/hr):	0.48
Daily Hours of Operation for ES-1 During Biogas to Cadlestick Flare:	10
H_2S Emission Rate from EP-2 During Biogas to Candlestick Flare (lb/day):	4.79

Notes:

1. The potential hydrogen sulfide emission rate for ES-1 normal operation listed above was calculated using the maximum capacity of the GUS and the maximum expected biogas hydrogen sulfide concentration. The calculations included hydrogen sulfide capture in the iron sponge system vessels. See Normal Operation Emissions Calculator (calculations pages 8-10).
2. The potential hydrogen sulfide emission rate for ES-1 biogas to candlestick flare listed above was calculated using the maximum capacity of the GUS and the maximum expected biogas hydrogen sulfide concentration. The calculations included no hydrogen sulfide capture. See Biogas to Candlestick Flare Emissions Calculator (calculations pages 14-16).

Sulfur Dioxide Emissions from Combustion Sources (15A NCAC 02D .0516)	
Maximum SO_2 Emissions per MMBtu Input from ES-1 Normal Operation	
Potential SO_2 Emission Rate With Controls/Limits from ES-1 During Normal Operation (lb/hr):	10.24
Actual Heat Input for EP-1 During Normal Operation (MMBtu/hr):	4.92
SO_2 Emissions per Million Btu Input (lb/MMBtu):	2.08
Actual SO_2 Emissions per MMBtu Input from ES-1 Biogas to Candlestick Flare	
Potential SO_2 Emission Rate With Controls/Limits from ES-1 During Biogas Combustion in the Candlestick Flare (lb/hr):	44.13
Actual Heat Input for EP-2 During Biogas to Candlestick Flare (MMBtu/hr):	42.84
SO_2 Emissions per Million Btu Input (lb/MMBtu):	1.03

Notes:

1. The potential sulfur dioxide emission rate for ES-1 normal operation listed above was calculated using the maximum capacity of the GUS and the maximum expected biogas hydrogen sulfide concentration. The calculations included hydrogen sulfide capture in the iron sponge system vessels. See Normal Operation Emissions Calculator (calculations pages 8-10).
2. The potential sulfur dioxide emission rate for ES-1 biogas to candlestick flare listed above was calculated using the maximum capacity of the GUS and the maximum expected biogas hydrogen sulfide concentration. The calculations included no hydrogen sulfide capture. See Biogas to Candlestick Flare Emissions Calculator (calculations pages 14-16).

Newland, Brad

From: Abraczinskas, Michael
Sent: Monday, March 02, 2020 5:04 PM
To: Newland, Brad
Cc: Pjetraj, Michael; Carroll, Dean; Anderson, Tom
Subject: RE: Allign meeting

Brad,
I'm not sure if we're going to get into anything specific about their current application during the scheduled meeting. I think it will be more of a big picture type presentation.
Here's an excerpt from the message I sent them:

> *"...But the reason for my call was to invite you and your team to Raleigh to present your "big picture" plans on biogas facilities to DEQ. It is our understanding that additional facilities like the BF Grady/Align project may be in your plans. In anticipation of additional projects that may require various levels of permitting/interaction with our Department, we would like to better understand those plans, including but not limited to:*
> - *How many biogas upgrading stations are planned statewide. Where?*
> - *How many lagoons per upgrading station? How many miles of gathering lines?*
> - *What are the anticipated permitting requirements for all of these activities (DAQ, DWR, DWM, DEMLR)?*
> - *Has Smithfield done any analysis showing the amount of methane, H2S or other air emissions reduced from these projects? "*

Knowing that WIRO may be the office permitting more than one of these, I wanted to make sure ya'll were in the meeting for the meet/greet and info.
Thanks!
-Mike"

Mike Abraczinskas, EIT, CPM
Director, Division of Air Quality
North Carolina Department of Environmental Quality
1641 Mail Service Center 919.707.8447 (Office)
Raleigh, NC 27699-1641
Michael.Abraczinskas@ncdenr.gov

From: Newland, Brad
Sent: Monday, March 2, 2020 4:25 PM
To: Abraczinskas, Michael <michael.abraczinskas@ncdenr.gov>
Cc: Pjetraj, Michael <michael.pjetraj@ncdenr.gov>; Carroll, Dean <dean.carroll@ncdenr.gov>; Anderson, Tom <tom.anderson@ncdenr.gov>
Subject: RE: Allign meeting

Based on what's in the application it might be a good idea to have a modeling expert in the meeting. Preferably one with knowledge of flares. In particular, they are requesting to use an EPA Memo on NOx modeling and apply it to the SO2 modeling for NAAQS. They "annualize" a 44 #/hr bypass rate which is expected to only occur 240 hrs/ yr to a 1.21 #/hr rate (44/240=1.21).

Brad Newland, PE, CPM
Regional Supervisor
Division of Air Quality
North Carolina Department of Environmental Quality

910 796-7234 Ph
910 350-2004 fx
Brad.Newland@ncdenr.gov

DEQ -Wilmington Regional Office
127 Cardinal Dr Ext
Wilmington, NC 28405

From: Abraczinskas, Michael <michael.abraczinskas@ncdenr.gov>
Sent: Monday, March 02, 2020 9:41 AM
To: Newland, Brad <brad.newland@ncdenr.gov>
Cc: Pjetraj, Michael <michael.pjetraj@ncdenr.gov>
Subject: RE: Allign meeting

Might be a good meeting to attend in person. Are ya'll able to drive up?

Mike Abraczinskas, EIT, CPM
Director, Division of Air Quality
North Carolina Department of Environmental Quality
1641 Mail Service Center 919.707.8447 (Office)
Raleigh, NC 27699-1641
Michael.Abraczinskas@ncdenr.gov

From: Newland, Brad
Sent: Monday, March 2, 2020 9:03 AM
To: Abraczinskas, Michael <michael.abraczinskas@ncdenr.gov>
Subject: Allign meeting

Mike, will there be a call in number for this meeting next Fri or do you want Dean and I to drive up? If we are the only remote attendee's you can just call my number 910 796 7234.

Brad Newland, PE, CPM
Regional Supervisor

Division of Air Quality
North Carolina Department of Environmental Quality

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