NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date: 05/27/2021

Region: Fayetteville Regional Office
County: Sampson
NC Facility ID: 8200158
Inspector's Name:
Date of Last Inspection:
Compliance Code:

Facility Data

Applicant (Facility's Name): Prestage AgEnergy - Moltonville

Facility Address:
Prestage AgEnergy - Moltonville
311 Prestage Mill Lane
Clinton, NC 28328

SIC: 4911 / Electric Services
NAICS: 221119 / Other Electric Power Generation

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

Permit Applicability (this application only)

SIP: 15A NCAC 02D .0504, 02D .0516, 02D .0524, 02D .1111, and 02Q .0317 of 02D .1111
NSPS: Subpart Dc, Subpart IIII
NESHAP: Subpart JJJJJJ, Subpart ZZZZ
PSD: N/A
PSD Avoidance: N/A
NC Toxics: N/A
112(r): N/A
Other: 15A NCAC 02D .1806(d)(11); State BACT from 2007 Senate Bill 3 (SB3) and NC General Statute 62-133.8(g);

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Michael Pope Vice President (910) 596-5758 PO Box 438 Clinton, NC 28329	John Prestage Senior Vice President (910) 592-5771 PO Box 438 Clinton, NC 28329	Michael Pope Vice President (910) 596-5758 PO Box 438 Clinton, NC 28329

Application Data

Application Number: 8200158.20A
Date Received: 03/26/2020
Application Type: Greenfield Facility
Application Schedule: State

Existing Permit Data

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

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP

<No Inventory>

Review Engineer: Jeff Twisdale

Review Engineer's Signature: Jeff Twisdale **Date:** 5/27/2021

Comments / Recommendations:
Issue: 10653/R00
Permit Issue Date: 05/27/2021
Permit Expiration Date: 04/30/2029

1. Purpose of Application:

Prestage AgEnergy Operations, LLC (Prestage AgEnergy) is a biomass-to-energy facility located in Clinton, Sampson County that is currently permitted as part of the Prestage Farms – Moltonville facility (Facility ID No. 8200112). Application No. 8200158.20A was received on March 26, 2020 but was not considered complete until September 8, 2020 after receiving the information requested in several "additional information" documents. Prestage AgEnergy has requested to permit the biomass-to-energy operation under a new Title V air permit for the following equipment:

- Wood/used poultry bedding-fired boiler (72.88 million Btu per hour, ID No. ES-01) controlled by the following:

- Multicyclone (59 nine-inch diameter tubes, ID No. CD-01a)

- Dry Sorbent Injection control system (ID No. CD-04) for acid gas control, and

- Fabric filter (16,270 square feet of filter area, ID No. CD-05), for particulate matter (PM) control

The facility will be classified as Title V. The facility will avoid being major for hazardous air pollutants (HAP) requirements by properly operating and maintaining the dry sorbent injection control system, and the fabric filter for control of the boiler's emissions.

The facility provides saturated steam to an adjacent feed mill owned by Prestage Farms and sells generated electricity to Duke Energy Progress. The facility is a self-qualified cogeneration facility and is certified by the North Carolina Utility Commission as new Renewable Energy Facility in Docket No. SP-10007, Sub 0. Therefore, Prestage AgEnergy is a qualified source of Renewable Energy Credits (RECs) in the North Carolina Renewable Energy and Energy Efficiency Portfolio Standards (REPS) program that was established in 2007 session by the North Carolina General Assembly under Senate Bill 3 (SB3) that requires utilities in North Carolina with a minimum number of customers to provide for an escalating percentage of power generation to be from renewable resources. (See Section 8. below for more details).

2. Zoning Compliance:

A zoning consistency determination was issued by Sampson County Planning and Zoning Department. The completed determination dated April 8, 2020 and signed by Anita Lane, Senior Planner, stated that the proposed facility is consistent with the Sampson County Zoning Ordinance.

3. Application Chronology:

3/26/20 Raleigh Central Office (RCO) received a permit application package requesting a new permit to allow installation and operation of a control system consisting of a dry adsorbent injection system and fabric filter on the used poultry bedding-fired boiler. The application was accompanied by a check in the amount of $10,177. However, the application did not include a completed zoning consistency determination. The application was sealed by Mr. Joe Sullivan, who is a registered P.E. in North Carolina. **[PERMIT APPLICATION CLOCK OFF]**

4/8/20 A completed zoning consistency determination was received from Sampson County. **[PERMIT APPLICATION CLOCK ON]**

5/14/20 RCO sent additional info email sent requesting an update to the application to cover SB3 BACT analysis, 15A NCAC 02D .0504 applicability and 15A NCAC 02Q .0503(8). **[PERMIT APPLICATION CLOCK OFF]**

5/27/20 Received Fayetteville Regional Office (FRO) review from Mr. Greg Reeves.

7/15/20 RCO received the updated Forms and SB3 State BACT application. **[PERMIT APPLICATION CLOCK ON]**

8/28/20 RCO sent additional info email to revise SB3 BACT for NOx/SNCR and clarify the poultry litter storage areas. [**PERMIT APPLICATION CLOCK OFF]**

9/8/20 Prestage sent in revised SB3 BACT for NOx/SNCR and clarified the poultry litter storage areas. [**PERMIT APPLICATION CLOCK ON]**

11/18/20 DAQ Director's office requested an Environmental Justice summary be prepared. **[PERMIT APPLICATION CLOCK OFF]**

1/8/21 RCO submitted an Environmental Justice summary for review. [**PERMIT APPLICATION CLOCK ON]**

2/2/21 RCO sent additional info email to revise SB3 BACT for CO/VOCs with RCO being evaluated, and similarly for Hg with DSI being evaluated as well. [**PERMIT APPLICATION CLOCK OFF]**

2/8/20 Prestage sent in updated SB3 BACT for CO/VOCs and RCO and Hg/DSI. [**PERMIT APPLICATION CLOCK ON]**

2/12/20 Sent Draft permit/review to Mr. Booker Pullen, Permitting Supervisor, for review. Minor comments received 2/19/2021, and then Drafts updated and approved 2/24/2021 [**PERMIT APPLICATION CLOCK remains ON]**

2/25/20 Sent Draft permit/review to Prestage, FRO, and DAQ's Stationary Source Compliance Branch (SSCB) [**PERMIT APPLICATION CLOCK OFF]**

3/17/20 Received comments from SSCB (3/2/2021), FRO (3/8/2021) and Prestage (3/17/2021) on Draft permit/review [**PERMIT APPLICATION CLOCK ON]**

4. Process Description:

Prestage AgEnergy consists of a used poultry bedding-fired boiler with associated control devices, fuel handling and storage equipment, and electrical generators. The used poultry bedding-fired boiler (72.88 million Btu per hour, ID No. ES-01) is controlled by a multicyclone for particulate matter (PM) control, a dry sorbent injection system for acid gas control, and a fabric filter for PM control. Used poultry bedding is received at the facility and stored in an enclosed fuel hall. The fuel hall is vented to the boiler combustion air, providing control of odors from the used poultry bedding. Wood chips, shavings, and sawdust are also stored in the fuel hall. The bedding and wood are mixed as needed, then sent to a storage silo. The fuel is then conveyed from the silo to the boiler. Ash from the boiler is collected and stored for use as crop fertilizer. High pressure steam from the boiler is sent to a steam turbine driving a 975 kilowatt (kW) electrical generator. Low pressure exhaust steam from this turbine is sent to two additional steam turbines driving 250 kW and 375 kW electrical generators. Electricity from the generators is sold to the local electrical supplier. Exhaust steam from the turbines is sent to the feed mill at Prestage Farms for process heat. In the event that the amount of steam available from the boiler is not sufficient to feed the 975 kW generator, the steam is fed directly from the boiler to the two smaller generator systems through a pressure reducing valve.

5. Changes in Equipment and PE Seal Requirements:

The company proposed to add the following existing equipment to the new permit:

- Wood/Used Poultry Bedding-fired boiler (ID No. ES-01).
- Multicyclone (59 nine-inch diameter tubes, ID No. CD-01a)
- Dry Sorbent Injection control system (ID No. CD-04) for acid gas control, and
- Fabric filter (16,270 square feet of filter area, ID No. CD-05), for PM control

The Emission Sources and Control Devices are listed below:

Emission Source ID	Emission Source Description	Control System ID	Control System Description
ES-01 **NSPS Dc** **GACT** **JJJJJJ** **SB3 BACT**	Wood / Used Poultry Bedding-fired Boiler (72.88 million Btu per hour maximum heat input)	CD-01a in series with CD-04 in series with CD-05	Multicyclone fifty-nine 9 inch diameter tubes in series with Dry Sorbent Injection in series with Fabric Filter (16,270 square feet filter area)

Insignificant/Exempt Sources are listed below:

Source	Exemption Regulation	Source of TAPs?	Source of Title V Pollutants?
IES-2 Ash Handling System/ Dried Used Poultry Bedding Storage Building	02Q .0503(8)	No	Yes
IES-3 Dried Used Poultry Bedding Silo controlled by fabric filter (208 square feet filter area)	02Q .0503(8)	Yes	Yes
IES-4 Dried Used Poultry Bedding Fuel Hall	02Q .0503(8)	Yes	Yes
IES-5 Ash/Dried Used Poultry Bedding Storage Shed	02Q .0503(8)	Yes	Yes
IES-6 200 kW / 268 HP diesel-fired emergency generator [NSPS IIII, GACT ZZZZ]	02Q .0503(8)	Yes	Yes

<u>PE Seal</u>

A PE Seal was required for this application. A complete and properly sealed Form D5 was submitted with the air permit application and was signed and sealed by Mr. Joe Sullivan who is a Professional Engineer registered in North Carolina (NC Seal No. 23037). Mr. Sullivan works for a consultant company (AECOM) that prepared the air permit application and can be reached at 919.461.1237.

6. NSPS, Nonapplicable SIP regulations, NESHAP, PSD, Attainment Status, CAM, and Chemical Accident Prevention (112r) –

- **NSPS -**

  a. The used poultry bedding-fired boiler (ID No. ES-01) is subject to NSPS Subpart Dc "Small Industrial-Commercial-Institutional Steam Generating Units," specifically the requirements for particulate matter and visible emissions for biomass-fired boilers.

  b. The Emergency Generator engine (ID No. IES-6) is subject to NSPS Subpart IIII "Stationary Compression Ignition Internal Combustion Engines."

  c. The used poultry bedding-fired boiler (ID No. ES-01) is not subject to NSPS Subpart CCCC "Commercial and Industrial Solid Waste Incineration Units for Which Construction is Commenced After June 4, 2010 or for which Modification or Reconstruction is Commenced After August 7, 2013," as the used poultry bedding is considered a non-hazardous secondary material, not a waste. See Section 7 below for more details.

- 15A NCAC 02D .0521 "Control of Visible Emissions" does not apply to the boiler (ES-01) since NSPS Subpart Dc applies to the visible emissions that are limited to 20% opacity with testing required within every 12 calendar months from the previous performance test.

- 15A NCAC 02D .0516 "Sulfur Dioxide Emissions from Combustion Sources," the boiler (ES-01) and the engine (IES-6), shall not exceed 2.3 pounds per million Btu heat input.

- **NESHAP –**

  a. The used poultry bedding-fired boiler (ID No. ES-01) is subject to NESHAP Subpart JJJJJJ (6J) as a new biomass boiler. The boiler is subject to PM emission limits, source testing, initial notification, and notification of compliance status (after source testing is completed.) The initial notification was satisfied by the submittal of this permit application (8200158.20A) on March 26, 2020, and previously on November 23, 2015 with the submittal of the permit application (8200112.15B) for Prestage Farms – Moltonville. Also, the initial source test (2018-283ST) was performed on January 25, 2019 at Prestage Farms – Moltonville, and the notification of compliance status was completed on September 17, 2019 [40 CFR §63.9(b)(iii)].

  b. The Emergency Generator is subject to NESHAP Subpart ZZZZ "Stationary Reciprocating Internal Combustion Engines" and complies with this regulation by complying with the requirements of NSPS Subpart IIII.

- **PSD** – The potential emissions after controls do not exceed PSD threshold limits; therefore, this facility is not a major stationary source. The PSD minor source increment baseline tracking has been triggered for PM_{10} and NOx in Sampson County. This modification will result in an increase in 7.19 pounds per hour of NOx based on the increase over 100 tons per year of NOx that was previously limited in the Synthetic Minor permit for the Prestage Farms - Moltonville facility (Permit No. 07210R12).

- **Attainment Status –** Sampson County is in attainment.

- **Compliance Assurance Monitoring (CAM)** – CAM is applicable for any emission unit, if it has after control emissions equal to or greater than the major source threshold (§40 CFR 64.5(a)); however, CAM is not applicable yet since this permit is not a Title V permit. CAM will be evaluated during the initial Title V application that will be submitted within one year of this permit's issuance date.

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

7. CISWI Applicability and 40 CFR 241:

The used poultry bedding that is being utilized as fuel for the boiler (ID No. ES-01) is not a traditional fuel. Therefore, a determination was made as to whether this material is considered a non-hazardous secondary material when used as a fuel, or whether the material is considered a waste material under the definitions of Part 241.

On June 2, 2015, Prestage submitted to DAQ a request for a non-hazardous secondary material determination for the used poultry bedding proposed for fuel for the boiler (ID No. ES-01). The Applicability Determination No. 2636, issued on August 11, 2015, determined that the used poultry bedding is considered a non-hazardous secondary material (NHSM) within the meaning of Title 40, Part 241 of the Code of Federal Regulations (40 CFR 241). The Applicability Determination is here: https://files.nc.gov/ncdeq/Air%20Quality/permits/memos/NHSM_Determination_for_Prestage_AgEnergy.pdf

Therefore, the used poultry bedding is not considered a waste, and the boiler is NOT subject to the Commercial and Industrial Solid Waste Incineration (CISWI) rules contained in NSPS Subpart CCCC "Commercial and Industrial Solid Waste Incineration Units for Which Construction is Commenced After June 4, 2010 or for Which Modification or Reconstruction is Commenced After August 7, 2013."

8. Senate Bill 3 (SB3) BACT Analysis pursuant to NCGS 62-133.8(g) and Session Law 2007-397

This legislation requires a biomass combustion process at any new renewable energy facility that delivers electric power to an electric power supplier to meet Best Available Control Technology (BACT) even though the facility is not subject to the Prevention of Significant Deterioration (PSD) permitting program. The SB3 BACT analysis was initially submitted to DAQ on July 15, 2020.

Normally under the PSD requirements, all new or modified major stationary sources of air pollutants regulated under the Clean Air Act (CAA) must undergo a preconstruction review consistent with Section 165 of the Act prior to begin[ning] actual construction. A "major stationary source" is defined as any one of 28 named source categories which has the potential to emit 100 tons per year (tpy) or more, or any other stationary source which has the potential to emit 250 TPY or more, of any pollutant regulated under the CAA. Prestage is not one of the listed source categories with a 100 ton per year threshold; therefore, the major source threshold for this renewable energy facility is 250 tpy of any regulated pollutant. *See 40 CFR 51.166(b)(23).*

Prestage operates the used poultry bedding-fired boiler (72.88 million Btu per hour maximum heat input), fuel handling and pollution control equipment (one multicyclone, one dry sorbent injection system and one fabric filter installed on the boiler). The emission increases resulting from the operation of this existing boiler and ancillary equipment do not exceed the PSD major source thresholds for particulate matter (PM), particulate matter with an aerodynamic diameter of 10 micrometers or less (PM_{10}), nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), or volatile organic compounds (VOCs). Therefore, the PSD permitting requirements were not triggered. Prestage is classified as a minor stationary source for the purpose of the PSD permitting program.

As noted above the cogeneration boiler does not have potential emissions that exceed the PSD major source thresholds. *Note that for PSD purposes the PM10/PM2.5 emissions include the control provided by the multicyclone and the fabric filter installed on the boiler since the fabric filter and the multicyclone were required for compliance with PM limit under 15A NCAC 02D .1111 GACT Subpart JJJJJJ.* Therefore, although federal PSD permitting requirements were not triggered, a BACT analysis is still required since the facility was classified as a new renewable energy facility.

The tables below summarize the emission estimates based on DAQ approved stack testing on the boiler (ES-01). The estimates were based on an expected worst case (firing used poultry bedding).

Table 1 – Prestage Moltonville Boiler (ES-01) Testing performed February 14, 2020: **Emissions Results**

Pollutant	Test Results	Emissions Limit	Standard	Compliance
Filterable PM	0.053 lb/hr	---	---	---
	0.0010 lb/MMBtu	0.03 lb/MMBtu	60 Subpart Dc 63 Subpart JJJJJJ	Yes
Condensable PM	3.67 lb/hr	---	---	---
	0.0696 lb/MMBtu	---	---	---
Total PM	3.72 lb/hr	---	---	---
	0.071 lb/MMBtu	0.45 lb/MMBtu	02D .0504	Yes
HCl (controlled)	1.43 lb/hr	---	---	---
	6.3 TPY	10 TPY[1]	02Q .0315	Yes
Heat Input Rate	52.4 MMBtu/hr	72.88 MMBtu/hr	---	---

1. Test frequency may be reduced to once per 5 years if 3 consecutive HCl tests demonstrate HCl emissions ≤ 8 tpy. The testing was performed with (CD-04) dry sorbent injection (DSI) system with lime injection rate of 3 lb/hr.

Table 2 – Prestage Moltonville Boiler (ES-01) Testing performed May 16, 2019: **Emissions Results**

Pollutant	Test Results	Emissions Limit	Standard	Compliance
NOx	21.2 lb/hr	---	---	---
	0.411 lb/MMBtu	---	---	---
CO	14.6 lb/hr	---	---	---
	0.282 lb/MMBtu	---	---	---
HCl (uncontrolled)	3.17 lb/hr	---	---	---
	13.9 TPY	10 TPY[1]	02Q .0315	No[1]
Heat Input Rate	51.6 MMBtu/hr	72.88 MMBtu/hr	---	---

1. The testing was performed with (CD-04) dry sorbent injection (DSI) system shut off (no lime injection).

Table 3 – Prestage Moltonville Boiler (ES-01) Testing performed January 25, 2019: **Emissions Results**

Pollutant	Test Results	Emissions Limit	Standard	Compliance
Filterable PM	0.0561 lb/hr	---	---	---
	0.00102 lb/MMBtu	0.03 lb/MMBtu	60 Subpart Dc 63 Subpart JJJJJJ	Yes
Condensable PM	5.44 lb/hr	---	---	---
	0.0988 lb/MMBtu	---	---	---
Total PM	5.50 lb/hr	---	---	---
	0.0998 lb/MMBtu	0.45 lb/MMBtu	02D .0504	Yes
SO2	16.7 lb/hr 0.304 lb/MMBtu	---	---	---
	73.2 TPY	---	---	---
NOx	22.7 lb/hr 0.413 lb/MMBtu	---	---	---
	99.4 TPY	100 TPY	02Q .0315	Yes[1]
CO	22.8 lb/hr 0.416 lb/MMBtu	---	---	---
	99.9 TPY	100 TPY	02Q .0315	Yes[1]
HCl (controlled)	0.206 lb/hr	---	---	---
	0.902 TPY	10 TPY[2]	02Q .0315	Yes
Heat Input Rate	54.9 MMBtu/hr	72.88 MMBtu/hr	---	---

1. The annual potential to emit was marginally in compliance in 100 TPY threshold limit based on 8,760 hours of operation. Estimates provided for 8,040 hours of operation.
2. The testing was performed with (CD-04) dry sorbent injection (DSI) system with lime injection rate of 8 lb/hr.

The permitted heat input is 72.88 MMBtu/hr for the boiler. The boiler steam flow rate averaged 35,800 lb/hr. The calculated average testing heat input was approximately 53.0 MMBtu/hr (73% of permitted heat input). The boiler is currently limited to no more than 110% of the average operating load recorded during the most recent stack test pursuant to 40 CFR 63.11201(c) under GACT Subpart JJJJJJ. If the facility wishes to exceed this rate, they must perform a new stack test to reestablish the heat input rate. The test results were deemed acceptable for compliance, permitting, and emissions inventory uses.

The boiler typically operates at a maximum of 6.35 tons per hour of fuel (used poultry bedding) with a fuel moisture content of approximately 25% similar to wet wood. Assuming 8,760 hours of operation per year, annual criteria pollutant emissions were calculated and compared to the stack test data as appropriate and to those in the permit application to aid in the determination of the SB3 BACT limits.

Pollutant	**Factor (lb/MMBtu)**	**Actual Maximum Controlled Emissions (lb/hr)**	**Actual Maximum Controlled Emissions (tpy)**
$PM/PM_{10}/PM_{2.5}$	0.10 (controlled AP-42 factor) [a]	7.29	31.9
$PM/PM_{10}/PM_{2.5}$	*0.085 (approved controlled test data average)*	*6.19*	*27.1*
SO_2	0.025 (AP-42 Table 1.6-2)	1.82	7.98
SO_2	*0.304 (approved test data)*	*22.1*	*97.0*
NOx	0.22 (AP-42 Table 1.6-2)	16.0	70.2
NOx	*0.412 (approved test data average)*	*30.0*	*131.5*
CO	0.60 (AP-42 Table 1.6-2)	43.7	191.5
CO	*0.349 (approved test data average)*	*25.4*	*111.4*
VOC	0.017 (AP-42 Table 1.6-3)	1.24	5.43
Hg	3.50E-6 (AP-42 Table 1.6-4)	2.56E-4	1.12E-3
HCl	1.90E-2 (AP-42 Table 1.6-3)	1.38	6.06
HCl	(approved uncontrolled test data)	3.17	13.9
HCl	*(approved controlled test data average)*	*0.82*	*3.58*

[a] AP-42 Table 1.6-5 states that PM_{10} is 74% of total PM emitted from DEGF control.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT) –

A Best Available Control Technology (BACT) Determination as determined by the permitting agency on a case-by-case basis in accordance with Senate Bill 3 (SB3), and Prestage submitted the following information required for a BACT analysis for each subject pollutant:

1. **BACT Analysis for Nitrogen Oxide (NO_x) emissions** – NO_x emissions have adverse health effects and play a role in ground level ozone formation, acid rain deposition, global warming, water quality degradation, reduced visibility, and the formation of toxic air pollutants. The most abundant forms of NO_x emissions from combustion sources are nitric oxide (NO) and nitrogen dioxide (NO_2). Nitric oxide is an odorless, colorless, toxic gas.

   NO_2 is also a toxic gas, but unlike NO, it is highly corrosive with a pungent odor and a reddish-brown appearance. Over time, in the presence of oxygen, most NO is converted to NO_2. The reddish brown NO_2 gas blocks the transmission of light, reduces visibility, and creates haze. NO_x emissions also increase nitrogen loading in coastal estuaries and upset the chemical balance of nutrients used by aquatic plants and animals. Elevated nitrogen levels promote excessive plant growth, which eventually leads to oxygen depletion and reductions in fish/shellfish populations.

   During combustion, NO_x is formed through the high temperature oxidation of the diatomic nitrogen found in combustion air (thermal NO_x) and through the release of the nitrogen bound in the fuel, which ultimately reacts to forms NO_x (fuel NO_x). Most NO_x from natural gas combustion is thermal NO_x, while up to half of the NO_x from fuel oil combustion is fuel NO_x. Thermal NO_x formation is a function of the combustion temperature and the residence time of nitrogen at that temperature. NO_x production increases exponentially with increases in combustion temperature.

   a. **BACT for NOx in the Cogeneration Boiler**

      i. The following **control technologies** for NO_x emissions were evaluated:

         (A) Regenerative Selective Catalytic Reduction (RSCR) – Babcock Power Inc. has developed a new SCR system that can be installed after the final particulate matter emissions controls. This technology is post combustion add-on control technology that utilizes beds of ceramic media to raise the temperature of the flue gas after particulate control to a temperature (~450 ºF) needed for the reaction. NH_3 reacts with NO_x and reduces to form nitrogen gas (N_2) and water (H_2O). The flue gas passes through a preheated bed where it is heated from 450 ºF to 550 ºF. Burners then raise the flue gas temperature to 600 ºF before it flows across the adjacent catalyst canister, where NOx reduction occurs. The exhaust gas from the catalyst bed then heats an adjacent bed containing heat transfer media. This heated bed then becomes the preheater for the exhaust. Flow direction continues to alternate in this fashion.

         (B) Selective Catalytic Reduction (SCR) – This technology is a post combustion add-on control technology that is placed in the flue gas stream following the boiler. SCR utilizes ammonia (NH_3) that is typically drawn from a storage tank, vaporized and injected upstream of the catalyst bed. Excess NH_3 that is not reacted in the catalyst bed and emitted is referred to as ammonia slip. An important factor that affects the performance of an SCR is operating temperature. The temperature range for standard base metal catalyst is between 400-800 ºF. In order for the catalytic system to operate at an ideal operating temperature, SCR is installed after the last heat transfer surface in the boiler but prior to the particulate matter control device.

(C) <u>Selective Non-Catalytic Reduction (SNCR)</u> – This technology is a post combustion add-on control technology that injects ammonia or urea into the flue gas stream where ammonia or urea reacts with NO_x that is reduced to form N_2 and H_2O. Typically, injection nozzles are located in the upper area of the furnace and convective passes. Once injected, the urea or ammonia decomposes into NH_3 or NH_2 free radicals, reacts with NO_X molecules, and reduces to nitrogen and water.

Both ammonia and urea have been successfully employed as reagents in SNCR systems and have certain advantages and disadvantages. Ammonia is less expensive than urea and results in substantially less operating costs at comparable levels of effectiveness. Urea, however, is able to penetrate further into flue gas streams, making it more effective in larger scale burners and combustion units with high exhaust flow rates. In addition, ammonia is a toxic substance whose storage above certain quantities requires the development of a Risk Management Plan (RMP).

SNCR is considered a selective chemical process because, under a specific temperature range, the reduction reactions described above are favored over reactions with other flue gas components. Although other operating parameters such as residence time and oxygen availability can significantly affect performance, temperature remains one of the most prominent factors affecting SNCR performance.

The SNCR process requires the installation of reagent storage facilities, a system capable of metering and diluting the stock reagent into the appropriate solution, and an atomization/injection system at the appropriate locations in the combustion unit. The reagent solution is typically injected along the post-combustion section of the combustion unit. Injection sites around the unit must be optimized for reagent effectiveness and must balance residence time with flue gas stream temperature.

For ammonia, the optimum reaction temperature range is 879 to 1,100 degrees Celsius (°C) (1,615 to 2,000 °F), while optimum urea reaction temperature ranges are marginally higher at 900 to 1,150 °C (1,650 to 2,100 °F).[1] Below the SNCR operating temperature range, the NH_3/NOx reaction will not occur. The unreacted NH_3 will either be emitted as NH_3 slip or it will react with SO_3 to form ammonium salts. Above the optimal temperature range, the amount of NH_3 that oxidizes to NOx increases and NOx reduction performance deteriorates.

(D) <u>Staged Combustion (SC)</u> – This technology is combustion unit design and/or operational technique that allows for the reduction of thermal and rapid NOx formation by modifying the primary combustion zone stoichiometry and air/fuel ratio. The combustion air is provided in a staged manner to control the burn rate. The slower burning of the fuel pile resulting in pyrolysis products allowed to oxidize in lower temperature zones of the combustion unit furnace reduces the high instantaneous temperatures of the fuel bed responsible for NOx formation. Overfire Air (OFA) is a form of staged combustion where the primary combustion uses a fuel-rich mixture to complete combustion.

ii. The following control technologies for NO_x emissions were evaluated for their **technical feasibility** below:

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[1] U.S. EPA, "Air Pollution Control Technology Fact Sheet; Selective Non-catalytic Reduction", EPA-452/F-03-031, p. 2.

(A) The RSCR system typically requires the flue gas to be reheated with either natural gas or No. 2 fuel oil duct burners prior to entering the catalyst area. Reheating the air stream would have additional detrimental environmental impacts including the generation of additional NOx emissions that the RSCR would be installed to reduce. Therefore, RSCR is **not** considered to be technically feasible and will **not** be considered further.

(B) In an SCR control system, the flue gas can be laden with ash particles due to the SCR's location upstream of a particulate matter control device. These particles have the potential to poison and "blind" the SCR catalyst. Wood ash particles can be especially problematic for this type of system, and no projects implementing SCR systems on wood-fired boilers could be found during the research conducted for this analysis. Therefore, SCR is **not** considered to be technically feasible for this project and will **not** be considered further.

(C) The SNCR system is a proven technology for boilers with sufficient area in the upper, post combustion area of the steam vessel for placement of the injection nozzles. Therefore, SNCR is technically feasible for this project and will be considered further.

(D) **S**taged combustion (SC) utilized in combination with good combustion practices (GCP) is technically feasible for this project and will be considered further.

iii. Therefore, the economic, environmental, and energy impacts of SC/GCP and SNCR are further evaluated.

(A) **<u>SNCR</u>**

(1) **<u>Economic Impact</u>** - A detailed cost evaluation of SNCR is included in Table 3-3 of the application. As shown in the Table 3-4 of the application, an incremental cost effectiveness of approximately $9,500 per ton of NOx based on Prestage's estimates of uncontrolled emission rate of 0.60 lb/MMBtu to an SNCR controlled emission rate of 0.39 lb/MMBtu while noting that the DAQ approved 2019 stack tests results yielded an average actual emissions rate of 0.41 lb/MMBtu. Therefore, SNCR is considered to be cost prohibitive and will **not** be considered further.

(B) **<u>SC/GCP</u>** - No adverse economic, environmental, or energy impacts are expected from the use of SC/GCP to reduce NOx emissions.

The remaining technically feasible control technology for the proposed biomass-fired cogeneration boiler is staged combustion (SC) that will be utilized in combination with good combustion practices (GCP). The DAQ evaluated the practicality of this control technology for the existing boiler and then compared to the data for similar installations. The proposed NOx emissions limit is representative of similar package systems operating without controls, but slightly higher than the DAQ approved 2019 stack test results that yielded an average actual emissions rate of 0.41 lb/MMBtu. **Therefore, DAQ selects SC in combination with GCP with a NOx emission limit of 0.49 lb/MMBtu as BACT. Compliance with the above limit will be determined by performing a stack test over a 3-hour average.**

2. **<u>BACT Analysis for Carbon Monoxide (CO) and Volatile Organic Compound (VOC) emissions</u>** - CO is a colorless, odorless, tasteless and toxic gas produced as a by-product of incomplete combustion. CO emissions have adverse health effects and play a role in ground level ozone formation. The highest levels of CO in the outside air occur during periods of nighttime inversions when an upper layer of warm air traps CO near the ground, usually in the colder months of the year.

VOCs result from incomplete combustion as well. Unburned hydrocarbons consist of VOCs, which contribute to ground level ozone, and methane and ethane which do not produce ozone. VOCs are also significant greenhouse gases via their role in creating ozone and in prolonging the life of methane in the atmosphere. Aromatic VOC compounds such as benzene, toluene, and xylene are suspected carcinogens.

CO and VOC emissions from the cogeneration boiler are a function of oxygen availability (excess air), flame temperature, residence time at flame temperature, combustion zone design, and turbulence. CO control methods include combustion control to suppress CO formation and post-combustion control, such as regenerative catalytic oxidation, to remove the CO from the flue gas. Combustion control techniques, including increased fuel residence time and increased combustion zone temperature, minimize incomplete combustion and CO formation. However, because increases in thermal NO_x formation are related to increases in the combustion temperature and the residence time of nitrogen at that temperature, care must be exercised when using combustion control. At higher combustion temperatures and longer residence times, NO_x formation is substantially greater. Conversely, a low NO_x emission rate achieved through flame temperature control results in higher CO emissions. Thus, a balance must be established whereby the flame temperature reduction is set to achieve the lowest NO_x emission rate possible while keeping CO emission rates at acceptable levels. In North Carolina, NO_x is a more important pollutant to control because it is a precursor to ozone formation.

a. **<u>BACT for CO and VOCs in the Cogeneration Boiler</u>**

i. The following **control technologies** for CO and VOC emissions were evaluated:

(A) **<u>Good Combustion Practices (GCP)</u>** - Good combustion control practices rely on efficient operation of the boiler. Emissions of CO and VOC are minimized due to better combustion efficiency through optimum design and operation of the boiler. This includes proper air-to-fuel ratios and a boiler design that provides the sufficiently high combustion temperature, adequate residence time and mixing conditions (adequate excess air and turbulence) in the combustion zone. As a result of economic incentives as well as air pollution concerns, manufacturers have attempted to maximize the combustion efficiency of boilers.

(B) **Flares, Recuperative Thermal Oxidation, and Regenerative Thermal Oxidation**

These post-combustion control technologies are thermal oxidizers that are similar to the RCO described below; however, they involve reheating the exhaust stream to high combustion temperatures and don't utilize a catalyst bed. The required higher combustion temperatures result in thermally inefficiency and excessively high operating costs that make these control options impractical.

(C) Regenerative Catalytic Oxidation (RCO) – Regenerative catalytic oxidation is an add-on or post-combustion control used to promote the oxidation of CO to carbon dioxide (CO_2) by lowering the activation energy of the reaction. Boiler exhaust gases containing CO, VOCs and O_2 pass through a catalyst bed (typically platinum/ rhodium) and react to form CO_2 and H_2O. RCO is the only oxidation technology evaluated because it requires only moderate reheating to a minimum temperature of 450 °F.

Furthermore, RCOs can achieve a high thermal efficiency of 95% because they utilize a ceramic bed to recapture the heat of the stream exiting the combustion zone. Particulate control must be placed upstream of an RCO. Even with highly efficient PM_{10} control, there is the risk of catalyst blinding/poisoning and catalyst life guarantees are relatively short. Control efficiencies typically range from 50 to 60 percent.

ii. The following control technologies for CO and VOC emissions were evaluated for their **technical feasibility** below:

(A) GCPs are technically feasible for the control of CO and VOC emissions for this project.

(B) Thermal oxidizers typically require the flue gas to be heated with either natural gas or No. 2 fuel oil duct burners for proper destruction. Heating the air stream to a higher temperature would have additional detrimental environmental impacts including the generation of additional NOx emissions. Therefore, thermal oxidizers are **not** considered to be technically feasible and will **not** be considered further.

(C) RCOs require the installation of a PM control technology upstream since the flue gas can be laden with ash particles. These particles have the potential to poison and "blind" the catalyst and reduce control efficiency. Also, there are no known installations of a RCO controlling emissions from similar boilers. Therefore, RCOs are considered to be technically infeasible since RCOs are not a commercially demonstrated control technology for this type of project.

iii. Therefore, the economic, environmental, and energy impacts of GCP are further evaluated.

GCP - No adverse economic, environmental, or energy impacts are expected from the use of GCP to control CO and VOC emissions.

According to RBLC, the most stringent demonstrated control option for CO is 0.40 MMBtu for the small biomass-fired boilers achieved with GCP. The applicant proposed that GCP design can achieve a CO level of 0.50 lb/MMBtu. However, CO emissions testing on the boiler was approved by DAQ on August 21 and 30, 2019 and yielded an average emission rate of 0.35 lb/MMBtu. There were only two facilities in the RBLC that had a limit less than 0.50 lb/MMBtu. All the small biomass-fired boilers in the RBLC cite some version of GCP as the control technology.

According to RBLC, the most stringent control option for VOC is 0.017 MMBtu for small biomass-fired boilers achieved with GCP. The applicant estimated a VOC level of 0.017 lb/MMBtu which is equivalent to the value in AP-42. Only two facilities in the RBLC had a limit less than 0.10 lb/MMBtu. All the small biomass-fired boilers in the RBLC cite GCP as the control technology.

Therefore, DAQ selects GCP as BACT for CO emissions with an emission limit of 0.45 lb/MMBtu for the boilers. Compliance with the CO limit will be determined utilizing a performance stack testing over a 3-hour average.

Also, DAQ selects GCP as BACT for VOC emissions and does not establish a numerical emission limit because measurement of VOCs of this level for this purpose is not considered reasonable. Compliance with the VOC work practices will follow the applicable provisions for inspection and maintenance of air pollution control equipment in accordance with 15A NCAC 02D .0611.

3. **BACT Analysis for Particulate Matter (PM), Particulate Matter less than 10 micrometers in diameter (PM_{10}), and Particulate Matter less than 2.5 micrometers in diameter ($PM_{2.5}$) emissions** - Particulate emissions are the result of incomplete combustion and trace particulates and impurities in the fuel. Particulate emissions may have adverse health effects, reduce visibility, and contribute to environmental and aesthetic damage. PM_{10} and $PM_{2.5}$ have been linked to respiratory irritation, aggravated asthma, chronic bronchitis, decreased lung function, irregular heartbeat, nonfatal heart attacks, and premature death.

   a. **BACT for the Cogeneration Boiler**

      i. The following **control technologies** for PM_{10} and $PM_{2.5}$ emissions were evaluated:

         (A) Multicyclone – Cyclones are a type of mechanical collector that utilizes centrifugal force to concentrate particles of entrained dust at the interior walls of the collecting tubes. The particles then fall and are discharged from the bottom of the tube. Clean gas exits through the outlet at the collecting tubes vertical centerline. Multicyclones consisting of a number of small diameter cyclones that operate in parallel have longer residence times while their smaller diameters create greater centrifugal force that results in better separation of the dust particles.

         (B) Baghouse - A fabric filtration device (baghouse) consists of a number of filtering elements (bags) along with a bag cleaning system contained in a main shell structure incorporating dust hoppers. Fabric filters use fabric bags as filters to collect particulate matter. The particulate-laden gas enters a fabric filter compartment and

passes through a layer of particulate and filter bags. The collected particulate forms a cake on the bag, which enhances the bag's filtering efficiency.
However, excessive caking will increase the pressure drop across the fabric filter and reduce its efficiency.

The particulate removal efficiency of fabric filters is dependent upon a variety of particle and operational characteristics. Particle characteristics that affect the collection efficiency include particle size distribution, particle cohesion characteristics, and particle electrical resistivity. Operational parameters that affect fabric filter collection efficiency include air-to-cloth ratio, operating pressure loss, cleaning sequence, interval between cleanings, cleaning method, and cleaning intensity. In addition, the particle collection efficiency and size distribution can be affected by certain fabric properties (e.g., structure of fabric, fiber composition, and bag properties). Often a mechanical collector, such as a multicyclone, is used to remove larger particulate matter before the exhaust reaches the primary control device.

(C) **Electrostatic Precipitator (ESP)** - ESPs remove particles from a gas stream through the use of electrical forces. Discharge electrodes apply a negative charge to particles passing through a strong electrical field. These charged particles then migrate to a collecting electrode having an opposite, or positive, charge. Collected particles are removed from the collecting electrodes by periodic mechanical rapping. Often a mechanical collector, such as a multicyclone, is used to remove larger particulate matter before the exhaust reaches the primary control device.

ii. The following control technologies for PM_{10} and $PM_{2.5}$ emissions were evaluated for their **technical feasibility** below:

(A) Since the multicyclones are limited in controlling PM_{10} and $PM_{2.5}$ emissions, the baghouses and ESPs are the most effective control technology (achieving the same emission rate) for PM_{10} and $PM_{2.5}$ emissions. The baghouse is widely considered BACT for PM_{10} and $PM_{2.5}$ emissions while the multicyclone is eliminated from further evaluation.

The remaining technically feasible control technologies for the proposed biomass-fired cogeneration boiler is the baghouse with the multicyclone established baseline control for this analysis.

The boiler is subject to the PM limit under GACT Subpart JJJJJJ which is a Federal NESHAP guideline for BACT determinations and establishes minimum acceptable control requirements for a BACT determination. Therefore, the BACT PM limit cannot be less stringent than that GACT Subpart JJJJJJ PM limit of 0.03 lb/MMBtu.

The applicant evaluated the practicality of multicyclones and the baghouse for the boiler that resulted in a proposed $PM/PM_{10}/PM_{2.5}$ emissions rate of 0.15 pounds per million Btu (lb/MMBtu) considering that total $PM/PM_{10}/PM_{2.5}$ (filterable and condensable) emissions stack tests on the boiler approved by DAQ on August 21 and 30, 2019 yielded an average emission rate of 0.085 lb/MMBtu, and then compared to the data for similar installations. The proposed $PM/PM_{10}/PM_{2.5}$ emissions limit was representative of similar systems operating with that level of controls;

however, operation of additional control (e.g. baghouse) is required to meet the GACT Subpart JJJJJJ PM limit of 0.03 lb/MMBtu (filterable only).

Therefore, DAQ selects multicyclones in series with a baghouse and a total (condensable and filterable) PM/PM_{10}/$PM_{2.5}$ emission limit of 0.10 lb/MMBtu as BACT. Compliance with the above limit will be determined by performing a stack test over a 3-hour average. 15A NCAC 02D .0611 requires inspection and maintenance as well as recordkeeping to ensure proper operation of the multicyclones and the baghouse for compliance purposes.

4. **<u>BACT Analysis for Sulfur Dioxide (SO_2) emissions</u>** – SO_2 emissions are produced by the combustion of sulfur-containing fuels. Generally, all the sulfur compounds contained in the fuels will oxidize to SO_2. High concentrations of sulfur dioxide affect breathing and may aggravate existing respiratory and cardiovascular disease. Sensitive populations include asthmatics, individuals with bronchitis or emphysema, children, and the elderly. Sulfur dioxide is also a primary contributor to acid rain, which causes acidification of lakes and streams and can damage trees, crops, buildings, and statues.

   a. **<u>BACT for the Cogeneration Boiler</u>**

      i. The following **control technologies** for SO_2 emissions were evaluated:

      (A) **<u>Scrubber (Venturi)</u>** – A venturi scrubber is one type of wet scrubber used to remove SO_2. Flue gas enters the scrubber vertically after passing through a fan. In the scrubber, an alkaline solution such as sodium hydroxide absorbs SO_2 from the flue gas. The SO_2 reacts with the sodium hydroxide and is removed in a solution as a liquid waste. Additional scrubbing solution is added to the recirculating scrubber solution to compensate for the quantity that reacts with SO_2, and the reacted scrubbing liquor is discharged to a wastewater treatment as "blowdown."

      (B) **<u>Dry Sorbent Injection (Lime or Trona)</u>** – A reagent such as lime or Trona (sodium sesquircarbonate) is injected into the hot flue gas stream and reacts with the acid gases (i.e. SO_2, SO_3, H_2SO_4) to form a salt. The reacted sorbent is removed as particles by the downstream PM control system. The sorbent particles must be extremely fine in order to maximize the surface area of the particles for reaction, and an additional "run" of ductwork must be added to the system to allow for adequate residence time for reaction between the sorbent and SO_2.

      The venturi scrubber and dry sorbent injection (DSI) are both technically feasible control technologies for the existing biomass-fired cogeneration boiler.

      iii. Therefore, the **economic, environmental, and energy impacts** of the venturi scrubber and DSI are further evaluated.

(A) Venturi Scrubber

Although the venturi scrubber is technically feasible control technology for a biomass-fired boiler, the facility has previously operated a wet scrubber with operational difficulties including an excessive blowdown rate. The retrofit would require an extensive engineering study to design major upgrades to the air handling systems and the combined capital costs of installation and the ongoing operating cost (i.e. hauling and treating waste water offsite plus reagent costs) would be excessive. Therefore, the costs of installing the venturi scrubber are considered prohibitive, and the venturi scrubber will be eliminated from further consideration.

(B) Dry Sorbent Injection (Lime or Trona)

The DSI is technically feasible control technology for the existing biomass-fired boiler; however, the facility has already installed the DSI (lime) to reduce hydrochloric acid (HCl) emissions at a designed low lime injection rate (3 to 8 lb/hr) for the desired level of control due to the high reactivity of lime and HCl. The applicant states that the vendor (Dustex) estimates indicate that an injection rate of approximately 177 lb/hr of lime would be required to achieve an estimated 50% emission reduction efficiency. These high lime injection rates cannot be delivered to the existing DSI, and even if a new larger DSI was installed, the current boiler fan is not capable of blowing the additional lime into the flue gas, and the baghouse would also have to be replaced with a larger unit. The applicant believes the installation and operating costs of all the required upgrades would be exorbitant. Therefore, the costs of installing the DSI are considered prohibitive, and the DSI will be eliminated further consideration.

The RBLC database and other resources were reviewed, but no data was found on installations similar to the proposed small biomass-fired boilers regarding SO_2 emissions. The combustion of biomass (unadulterated wood) results in 7.98 tons per year (tpy) of SO_2 from the boiler based on an AP-42 emission factor of 0.025 lb/MMBtu while the manufacturer (Hurst) guaranteed 21.1 lb/hr based on 0.289 lb/MMBtu. Also, the SO_2 emissions testing on the boiler when burning 100% used poultry bedding that was approved by the DAQ on August 30, 2019 yielded an emission rate of 0.304 lb/MMBtu. The applicant did determine that wet scrubbers and dry sorbent injection are feasible control technologies and evaluated both, but in both cases the costs to control were excessive. In addition to those costs, there are adverse environmental issues including wastewater and by-product disposal costs with the scrubber technology.

Therefore, the NC DAQ selects an emission limit of 0.35 lb/MMBtu for the boiler when firing used poultry bedding. Compliance with the SO_2 limit will be determined by performing a stack test over a 3-hour average.

5. **BACT Analysis for Mercury (Hg) emissions** – Mercury (Hg) emissions are produced from the combustion of mercury-containing fuels (more typically with coal and to a lesser extent with wood). Generally, the majority of the mercury compounds contained in the biomass (wood) fuel will be released as Hg gas with about 10% of Hg emitted from power plants taking a particulate form. The remainder takes either an ionic or an elemental form. Ionic Hg usually binds after emission to airborne particles that carry it to earth, where it enters land and aquatic ecosystems. Elemental mercury, on the other hand, may travel the atmosphere for up to two years before converting to ionic form and precipitating down. Mercury is a highly toxic pollutant that has been linked to many health effects, including neurological and developmental problems, cancer, and endocrine disruption in fish, wildlife, and humans. The developing fetus may be particularly vulnerable to mercury. Potential effects on human health include losses of sensory or cognitive ability, delays in development, birth defects, tremors, and death.

   a. **BACT for the Cogeneration Boiler**

      i. The following control technologies for Hg emissions were evaluated and focus on secondary PM control devices including baghouse and ESP that have described above in the PM analysis section and dry sorbent injection that has been discussed some above in the SO_2 analysis section.

      Dry Sorbent Injection (Powdered Activated Carbon) – DSI is a post-combustion technology wherein a reactive carbon-based sorbent (powdered activated carbon (PAC)) is injected into the upper part of the furnace to react directly with the products of combustion that effectively and economically mitigates potential Hg emissions problems in the flue gas.

      ii. The following control technologies for Hg emissions were evaluated for their **technical feasibility** below:

         (A) DSI (PAC) - DSI (PAC) has been utilized on coal-fired utility boilers and municipal waste combustors generally in combination with baghouses and ESPs (note that the DSI have been previously eliminated for SO_2 above from this review). Also, since the concentration of Hg in biomass is expected to be much lower than in coal or municipal solid waste, the use of DSI (PAC) will have a limited ability (undemonstrated for biomass) to control Hg. In addition, the use of DSI (PAC) may also adversely impact the potential reuse of the boiler fly ash that could result in substantial environmental impacts and additional economic costs.

         The combustion of biomass (unadulterated wood) results in 1.12 E-2 tons per year of Hg from the boiler based on an AP-42 emission factor of 3.50 E-6 lb/MMBtu while the manufacturer (Hurst) guaranteed 1.09 tpy based on 3.43 E-3 lb/MMBtu. Based on the review of RBLC database and other resources and the fact that DSI (PAC) has not been demonstrated on similar biomass-fired boilers, and the level of control of Hg emissions by DSI (PAC) will be no more effective as when firing with low mercury containing biomass.

The NC DAQ concludes the use of good combustion practices (GCP) as BACT for Hg because the establishment of a numerical BACT limit at this low level (approximately 1.12 E-2 tpy) is not technically reasonable. Note that 15A NCAC 02D .0611 requires inspection and maintenance as well as recordkeeping to ensure proper operation of the multicyclones and the baghouse for compliance purposes.

Summary

The SB3 BACT analysis considered possible controls for NO_x, $PM/PM_{10}/PM_{2.5}$, SO_2, CO, VOC, and Hg above. Recommended BACT controls and emission limits/work practices for the individual pollutants are as follows:

NO_x – no additional controls, staged combustion/good combustion practices, 0.49 lb/MMBtu
$PM/PM_{10}/PM_{2.5}$ – multicyclones/ESP, 0.10 lb/MMBtu total (filterable and condensable)
SO_2 – no additional controls, when firing used poultry bedding, 0.35 lb/MMBtu
CO – no additional controls, good combustion practices, 0.45 lb/MMBtu
VOC – no additional controls, good combustion practices, no specific limitations
Hg – no additional controls, good combustion practices, no specific limitations

Pollutant	SB3 BACT	Compliance Method
NO_x	0.49 lb/MMBtu *(3-hour average)*	Staged Combustion and Good Combustion Practices Initial Testing, then additional testing once every five years thereafter by Test Method determined by DAQ approved testing protocol
SO_2	0.35 lb/MMBtu *(3-hour average)* when firing used poultry bedding	Initial Testing, then additional testing once every five years thereafter by Test Method determined by DAQ approved testing protocol
$PM/PM_{10}/PM_{2.5}$	0.10 lb/MMBtu *(filterable and condensable)* *(3-hour average)*	Initial Testing, then additional testing once every five years thereafter by Test Method determined by DAQ approved testing protocol
CO	0.45 lb/MMBtu *(3-hour average)*	Good Combustion Practices Initial Testing, then additional testing once every five years by Test Method determined by DAQ approved testing protocol
VOC	Good Combustion Practices	Compliance with applicable provisions for inspection and maintenance of air pollution control equipment in 15A NCAC 02D .0611
Hg	Good Combustion Practices	Compliance with applicable provisions for inspection and maintenance of air pollution control equipment in 15A NCAC 02D .0611

-The subsequent testing shall be conducted no later than 61 months after the previously conducted test.
-Note that NC DAQ's Director decided in April 2011 that an SB3 BACT evaluation for greenhouse gas emissions (GHGs) will not be required.
-Also note that the Compliance Methods listed above do not include the multicyclones and the baghouse control devices. BACT only sets emission limits (or in the case of pollutants where limits are not feasible or practical, work practice standards) without regard for which, if any, control devices are employed. Other sections of the permit require the use of the multicyclones and the baghouse (i.e. 02D .0611).

9. Facility-Wide Air Toxics Review:

In accordance with 15A NCAC 02Q .0702(a)(27), this facility is exempt from North Carolina (NC) Air Toxics (State-only requirement); however, the NC Division of Air Quality (DAQ) was required by NC Session Law 2012-91, House Bill 952, to perform a health risk assessment during the addition of the biomass-to-energy equipment to the Prestage Farms – Moltonville permit (07210R09) in 2017 and again (07210R12) in 2018 when the biomass-to energy equipment was updated for better operation with the current sources and control devices in the Title V application (8200158.20A). The facility completed an NC air toxics review in their previous applications and performed modeling on nine toxic air pollutants (TAPs) because emissions exceeded the Toxics Permitting Emissions Rates (TPERs) in 15A NCAC 02Q .0711. The TAP analyses from the air permit reviews from NC DAQ's Fayetteville Regional Office (FRO) dated March 15, 2017 and May 21, 2018 previously determined that an unacceptable risk to human health was not presented.

The expected emissions submitted with the 2018 application and reflected in the current 2020 application included changes in emissions of three of the toxic pollutants for which modeling was performed. These TAPs are Arsenic, Hydrochloric Acid, and Sulfuric Acid. The previously modeled emissions and the emissions projected in this application are listed below. NC DAQ used the results versus Acceptable Ambient Level (AAL) from the previous modeling and assumed a linear correlation of emissions versus % AAL to determine the new projected % AAL in the table below for each pollutant. Emissions of other toxic pollutants did not change from the previous permit applications.

Pollutant	Emissions listed in the 2016 application	2016 Modeled % AAL	Projected emissions listed in the 2018 application	2018 Projected % AAL
Arsenic	1.778 lb/yr	2.9	0.326 lb/yr	0.53
Hydrochloric Acid	1.92 lb/hr	4.3	2.26	5.1
Sulfuric Acid	10.57 lb/hr	2.1	2.67 lb/hr	0.54
	253.7 lb/day	2.7	64.1 lb/day	0.69

Based on the updated analysis from the permit review from the FRO dated May 21, 2018, the TAP emissions do not present an unacceptable risk to human health. Therefore, the NC DAQ believes that the toxic emissions from this facility will not present an unacceptable health risk.

10. Facility Emissions Review:

Emission increases and <decreases> expected as a result of this modification are as follows:

Pollutant	Expected Emissions as submitted in 2018 application	Expected Emissions as submitted in 2020 application	Expected Emission Increase (tons/yr)	Expected Emission Increase (lb/hr)
PM	84.6	27.0	<57.6>	<13.1>
PM_{10}	62.3	27.0	<35.3>	<8.06>
$PM_{2.5}$	61.2	27.0	<34.2>	<7.81>
SO_2	92.6	92.6	0.0	0.0
NOx	90.9	158.2	67.3	15.4
CO	92.0	159.4	67.4	15.4
VOC	5.43	5.43	0.0	0.0

Individual HAP (HCl)	9.91	9.91	0.0	0.0
Total HAP	15.7	15.7	0.0	0.0

-The PM emissions changes from 2018 include an update in PM control to a fabric filter from a previously permitted venturi scrubber.
-The NOx and CO emissions changes from 2018 include removal of the synthetic minor limitations (less than 100 tons per year (tpy)).
-The permit contains limitations for HAPs (HCl less than 10 tpy and Total HAP less than 25 tpy).

PSD minor source increment tracking has been triggered for PM_{10} and NOx in Sampson County. Prestage has performed stack tests on PM and NOx, and the DAQ has approved as shown below.

Pollutant	**Factor (lb/MMBtu)**	**Actual Maximum Controlled Emissions (lb/hr)**	**Actual Maximum Controlled Emissions (tpy)**
$PM/PM_{10}/PM_{2.5}$	0.10 (controlled AP-42 factor) [a]	7.29	31.9
$PM/PM_{10}/PM_{2.5}$	*0.085 (approved controlled test data average)*	*6.19*	*27.1*
NOx	0.22 (AP-42 Table 1.6-2)	16.0	70.2
NOx	*0.412 (approved test data average)*	*30.0*	*131.5*

Therefore, this modification will result in an increase in 7.19 pounds per hour of NOx based on the approved stack test results for NOx (31.5 tpy increase over 100 tons per year) that was previously limited in Prestage Farms - Moltonville's Synthetic Minor permit (07210R14).

11. Source Testing:

Source testing of the used poultry bedding-fired boiler (ID No. ES-01) is required under both NSPS Subpart Dc and GACT Subpart JJJJJJ for Filterable Particulate Matter (FPM). In addition to the FPM testing for NSPS and GACT, condensable particulate matter (CPM) emissions were also determined in order to demonstrate compliance with 02D .0504 total particulate matter emission limits.

Prestage performed total $PM/PM_{10}/PM_{2.5}$ (filterable and condensable) stack tests on the boiler that were approved by NC DAQ on August 21 and 30, 2019 and yielded an average total emission rate of 0.085 lb/MMBtu. Initial NSPS Subpart Dc and GACT Subpart JJJJJJ testing has been completed for NSPS Dc and GACT JJJJJJ while the boiler was operating under the Prestage Farms – Moltonville's permit (07210R14). and subsequent testing will follow the NSPS Dc and GACT JJJJJJ requirements.

Visible Emissions (VE) testing on the boiler (ES-01) is required under NSPS Subpart Dc every 12 months. Subsequent VE testing continues at least every 12 months as required. This time period is dependent on the results of the most recent testing.

Source testing for the SB3 BACT limits will be required for PM, NOx, CO and SO_2 initially and once every 5 years (no later than 61 months later than the previously conducted test) thereafter in order to ensure compliance will be demonstrated with these limits. Prestage has performed other stack testing on the boiler under Prestage Farms' permit for emission factor and synthetic minor compliance purposes for PM, NOx, CO, SO_2 and HCl as well over the last two years.

Since the facility has the potential to exceed the HAP major threshold (10 tons per year) for the emissions of HCl, testing was required to establish and verify emission factors for this pollutant. Prestage has tested HCl twice and demonstrated that HCl emissions were less than 8 tons per year.

Therefore, another annual stack test for HCl is required before subsequent testing is allowed to change to once every 3 years (no later than 37 months later than the previously conducted test).

12. Stipulation Review:

The following regulations are applicable to this facility:

Regulation	Affected Sources	Emission Limits or Requirements
15A NCAC 02Q .0304 and 02Q .0207	Facility-wide	Permit Renewal and Emission Inventory Requirement
15A NCAC 02D .0504	ES-01	PM ≤ 0.45 lb/million Btu
15A NCAC 02D .0516	ES-01	SO_2 ≤ 2.3 lb/million Btu
15A NCAC 02D .0524 NSPS Subpart Dc	ES-01	PM ≤ 0.03 lb/million Btu VE ≤ 20% Opacity Startup Notification Stack Test Report due within 30 days after testing Recordkeeping
15A NCAC 02D .0535	Facility-wide	Notification requirement
15A NCAC 02D .0540	Facility-wide	Control fugitive dust emissions
15A NCAC 02D .0605	ES-01	Stack Testing Requirements Filterable PM – NSPS Dc limits Filterable + Condensable PM – 02D .0504 limits HCl – Establish emission factor Stack test report due within 30 days after testing
15A NCAC 02D .0611	CD-05	Fabric Filter Requirements Annual internal inspection, I&M per manufacturer's recommendations, recordkeeping
15A NCAC 02D .0611	CD-01a	Multicyclone Requirements Annual internal inspection, I&M per manufacturer's recommendations, recordkeeping
15A NCAC 02D .0611	CD-04	Dry Sorbent Injection System Requirements Establish minimum 3-hour average injection rate during stack testing Maintain 3-hour rolling average minimum injection rate Annual inspection of injection system Periodic Inspection & Maintenance per manufacturer's recommendations Continuous monitoring of injection rate Recordkeeping

15A NCAC 02D .1111 GACT Subpart 6J	ES-01	PM ≤ 0.030 lb/million Btu Operating load ≤ 110% of load during source testing Periodic stack testing either every 3 or 5 years, depending on results of previous test Stack test results and NOCS submitted within 30 days after test completed Develop site-specific monitoring plan for CPMS systems Operate and maintain a bag leak detection system Operate oxygen trim system and maintain an optimum air-to-fuel ratio Initial boiler tune-up within 61 months after initial startup Subsequent tune-ups no later than 72 months after previous tune-up Prepare an Annual compliance certification report, and submit to DAQ only if deviation or if requested Recordkeeping Submit Stack Test report via CEDRI
15A NCAC 02Q .0503(8)	IES-6	NESHAP Subpart ZZZZ and NSPS Subpart IIII Applicable to the Emergency Generator
15A NCAC 02Q .0317 Avoidance Condition	Facility-wide	Individual HAP ≤ 10 tons/yr Total HAP ≤ 25 tons/yr I&M of emission controls per 02D .0611 conditions Stack Testing per 02D .0605 condition Monthly and 12-month Emission Records I&M Records per 02D .0611 conditions Semi-Annual Reporting of Emissions
15A NCAC 02D .1806 Avoidance Condition		Management practices for minimizing odor from poultry litter pursuant to Senate Bill 615 of 2017 Session
NCGS 62-133.8(g) Senate Bill 3 (SB3) BACT	ES-01	SB3 BACT limits pursuant to Senate Bill 3 of 2007 Session (See Section 8 above for details)

All the applicable rules above except for SB3 BACT have previously demonstrated initial and continued compliance while the equipment operated and was permitted under Prestage Farms – Moltonville's permit (07210R14).

13. Compliance History based on equipment operation at Prestage Farms - Moltonville:

10/10/17 NOV/NRE issued for exceedance of VE limits.

09/11/17 NOV issued for failure to install CPMS required by the permit.

08/14/17 NOD issued for late reporting.

12/21/16 NOV issued for operation without first obtaining a permit for poultry litter storage area.

14. Facility Comments on Draft Permit and NCDAQ's Responses

Comments on Draft Permit received March 17, 2021:
Significant comments from Prestage are addressed here. Minor typographical errors, incorrect references, insignificant activities, etc. are not addressed below, but are corrected in the permit.

- The boiler is equipped with an oxygen trim system that is set to control excess air into the boiler to an optimize oxygen ratio. Per 40 CFR 63.11223(c), the requirement for tune-ups should revert to a once per 5-year requirement. Following 40 CFR 63.11223(c), … You may delay the burner inspection and inspection of the system controlling the air-to-fuel ratio until the next scheduled unit shutdown, but you must inspect each burner and system controlling the air-to-fuel ratio at least once every 72 months.

  Response
  DAQ concurs with Prestage's request once the oxygen trim system operation was confirmed, and the associated tune-up requirements were updated in the permit accordingly.

- Please remove the specific condition for Quarterly Fuel Sampling, Analysis and Usage Report. The facility has conducted extensive testing of poultry litter proving to the satisfaction of DAQ that additional testing is no longer needed. This condition was removed from the most recent permit pursuant to that determination.

  Response
  DAQ concurs with Prestage's request after confirming that on 12/2/2019 with permit 7210R14 for Prestage Farms, DAQ's FRO permit engineer removed this condition. "The facility's Quarterly Fuel Sampling and Usage Report, dated 10/15/19, shows that, over 4 calendar quarters of fuel testing, the used poultry bedding fuel is of consistent make-up and conforms with the NHSM determination. Therefore, we are removing the NCGS 143-215.108 "Control of Sources of Air Pollution; Permits Required" stipulation from the facility's permit."

- In reference to the SB3 BACT limit for total PM/PM10/PM2.5, Prestage originally proposed a limit of 0.15 lb/MMBtu while DAQ proposed a limit of 0.10 lb/MMBtu based on similar test data. However, condensable PM emission resulting from combustion in many systems can be highly variable, and the conditions and/or fuel-related conditions contributing to condensable formation are regularly not well understood even by experts. This is especially true for boilers fueled by poultry bedding. We cannot identify with confidence changes in boiler operation that could have improved condensable PM emission during testing. Moreover, the boiler's oxygen trim system and excess air settings had already been optimized prior to both of our tests so the combustion system was operating at optimal conditions. As a result of the variability of the condensable PM emissions with filterable PM emissions already being limited to 0.03 lb/MMBtu by NSPS Dc and GACT 6J, we propose a new total PM limit of 0.13 lb/MMBtu.

  Response
  DAQ concurs with Prestage's request to adjust the SB3 total PM limit to 0.13 lb/MMBtu because of the variability of condensable PM emissions with filterable PM emissions already being limited to 0.03 lb/MMBtu by NSPS Dc and GACT 6J. Also, DAQ agrees that the facility is utilizing optimum PM control with fabric filtration and an oxygen trim system.

- In reference to the SB3 BACT limit for SO2, Prestage originally proposed no numerical limit, and the burning of used poultry bedding was similar to the burning clean cellulosic biomass linked by the NHSM determination made. However, DAQ noted that the sulfur content in the used poultry bedding would warrant a proposed limit of 0.35 lb/MMBtu based on limited test data. As a result, Prestage proposed a SB3 BACT of 0.41 lb/MMBtu based on the average sulfur content (0.27%) from the extensive used poultry bedding sampling plan on top on the initial test result (0.304 lb/MMBtu).

  Response
  DAQ concurs with Prestage's request to adjust the SB3 BACT limit for SO2 to 0.41 lb/MMBtu since the SO2 emission will be very dependent on the sulfur content in the used poultry bedding that was determined from the sampling plan data and the test data when statistically analyzed.

- In reference to the SB3 BACT limit for CO, Prestage originally proposed a SB3 BACT limit of 0.50 lb/MMBtu while DAQ proposed a limit of 0.45 based on the previously approved stack data of 0.35 lb/MMBtu. Prestage maintains that their original proposed limit (0.50 lb/MMBtu) based on the approved test data is justified since the boiler manufacturer, Hurst, made adjustments to the air between the tests while maintaining the same oxygen setpoint, but was not certain of the decrease in CO emissions during the recent test as a result of those changes except that the bedding burned during the initial test had higher moisture content.

  Response
  DAQ disagrees with Prestage's request to adjust the SB3 BACT limit for CO to 0.50 lb/MMBtu since the CO emissions will be minimized by the oxygen trim system if properly operated while maintaining a consistent fuel (used poultry bedding) with their standard processing to produce an average moisture content since the goal is to obtain the best heat content possible from this fuel in order to produce steam and generate renewable electricity. DAQ maintains that the proposed limit of 0.45 lb/MMBtu based on the previously approved stack data average of 0.35 lb/MMBtu and proper operation of the boiler's oxygen trim system as well as standard processing of the used poultry bedding in order to produce a fuel with higher heat content resulting in more renewable electricity being generated is the project's goal.

15. Conclusions, Comments, and Recommendations:

Recommend that Permit No. 10653R00 be issued to Prestage AgEnergy – Moltonville since no comments were received when the public comment period was completed on May 21, 2021.