DRAFT

NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date:

Region: Fayetteville Regional Office
County: Robeson
NC Facility ID: 7800166
Inspector's Name: Evangelyn Lowery-Jacobs
Date of Last Inspection: 09/11/2020
Compliance Code: W / Violation - procedures

Facility Data

Applicant (Facility's Name): North Carolina Renewable Power - Lumberton, LLC

Facility Address:
North Carolina Renewable Power - Lumberton, LLC
1866 Hestertown Rd
Lumberton, NC 28358

SIC: 4911 / Electric Services
NAICS: 221112 / Fossil Fuel Electric Power Generation

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

Permit Applicability (this application only)

SIP: 02D .0504, 02D .0515, 02D .0516, 02D .0521, 02D .0524, 02D .0530, 02D .0540, 02D .0614. 02D .1100, 02D .1111, 02Q .0317, 02Q .0400
NSPS: Subpart Db
NESHAP: GACT JJJJJJ
PSD: Yes
PSD Avoidance: N/A
NC Toxics: N/A
112(r): N/A
Other: N/A

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Carey Davis Executive Vice President (205) 403-5273 2100 Southbridge Parkway, Suite 540 Birmingham, AL 35209	Carey Davis Executive Vice President (205) 403-5273 2100 Southbridge Parkway, Suite 540 Birmingham, AL 35209	Carey Davis Executive Vice President (205) 403-5273 2100 Southbridge Parkway, Suite 540 Birmingham, AL 35209

Application Data

Application Number: 7800166.17C
Date Received: 03/29/2017
Application Type: Modification
Application Schedule: PSD

Existing Permit Data

Existing Permit Number: 05543/T28
Existing Permit Issue Date: 07/29/2021
Existing Permit Expiration Date: 08/31/2022

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP
2020	131.80	203.01	265.73	539.11	14.55	7.97	4.87 [Hydrogen chloride (hydrochlori]
2019	193.31	203.02	65.03	539.12	18.20	10.59	6.47 [Hydrogen chloride (hydrochlori]
2018	156.30	158.21	57.59	537.41	17.69	11.55	7.86 [Hydrogen chloride (hydrochlori]
2017	93.30	186.60	2.15	1262.20	19.71	11.71	7.16 [Hydrogen chloride (hydrochlori]
2016	7.57	47.93	1.28	408.17	8.91	4.77	3.21 [Hydrogen chloride (hydrochlori]

Review Engineer: Betty Gatano

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

Comments / Recommendations:
Issue 05543/T29
Permit Issue Date:
Permit Expiration Date:

Table of Contents

1.0 Introduction and Purpose of Application

1.1 Facility Description & Proposed Change

North Carolina Renewable Power – Lumberton, LLC (NCRP) currently holds Title V Permit No. 05543T28 with an expiration date of August 31, 2022 for a power plant in Lumberton, Robeson County, North Carolina (the "facility").

NCRP fires non-Commercial and Industrial Solid Waste Incineration (CISWI) subject wood,[1] poultry litter, and poultry cake in its two stoker boilers (ID Nos. ES-1A and ES-1B). The boilers produce steam used to generate electricity in the existing turbine and sold to the local utility. Condensed hot water from the steam turbine is used as the heat source for the facility's belt dryers.

The boilers are equipped with several different controls to reduce pollutant emissions. Each boiler is equipped with a selective non-catalytic reduction (SNCR) system (ID Nos. CD-1A3 and CD-1B3) to reduce emissions of nitrogen oxides (NO_X). After treatment with ammonia (NH_3) in the SNCR system, the exhaust gas is sent to multiclones (ID Nos. CD-1A2 and CD-1B2) followed by a common bagfilter (ID No. CD-1C) to reduce the particulate matter (PM) emissions. Sulfur dioxide (SO_2) and acid gas, including hydrogen chloride (HCl), will be controlled by a dry sorbent injection (DSI) system (ID No. CD-1C4)[2], which will inject either sodium sesquicarbonate (trona), sodium bicarbonate, or hydrated lime in the flue gas exhaust between the multiclones and the bagfilter. Egg shells are also added to the fuel to help control emissions of SO_2 and acid gases, although no removal efficiency is credited to the egg shells for the purpose of evaluating potential emissions.

NCRP is also permitted to operate four belt dryers (ID Nos. ES-17, ES-18, ES-19, and ES-21) and a drum dryer (ID No. ES-22). Construction on three belt dryers (ID Nos. ES-17, ES-18, and ES-19) has been completed, and the units are operational. Construction of the fourth belt dyer (ID No. ES-21) and the drum dryer has not yet begun. The belt dryers are used to reduce the moisture content of wood chips from 50% to 7% through indirect heat. Hot water from the condenser on the steam turbine serves as the sole source of heat for the belt dryers. Each belt dryer is permitted at a maximum capacity of 30 tons of wood chips per hour. The primary purpose of the belt dryers is to dry wood chips to be sold offsite as product. The drum dryer will have a natural gas-fired burner and will be controlled by a multi-cyclone (ID No. CD-6) and a regenerative thermal oxidizer (ID No. CD-7). Although the dryers can be used to dry wood chips to fuel the boilers, this situation is highly unlikely. The drum dryer will primarily be used to dry and "sanitize" wood chips for sale to customers as product, but some of the drum dryer's output will be fuel for the boilers.

<u>Background and PSD Application</u>

NCRP acquired ownership of the facility from the prior owner/operator in February 2015. On March 19, 2015, NCRP submitted an air permit application to the North Carolina Division of Air Quality (NCDAQ) to remove coal, No. 2 and No. 4 fuel oil, tire-derived fuels, pelletized paper, and fly ash briquettes from the fuel mix and to add non-CISWI poultry litter as a permitted fuel for its two boilers (ID Nos. ES-1A and ES-1B). NCDAQ issued the requested modification, Air permit No. 05543T21, on May 29, 2015 incorporating these changes. Upon issuance of the modification, the

[1] Non-CISWI subject wood means wood which is not a solid waste as defined in 40 CFR 258.2, pursuant to 40 CFR 241.2.

[2] The common bagfilter (ID No. CD-1C) and DSI system (ID No. CD-1C4) were permitted with the issuance of Air Permit No. 05543T28 on July 29, 2021.

boilers were permitted to fire only non-CISWI subject wood and poultry litter. As part of that modification, NCRP also requested facility-wide emissions limitations for carbon monoxide (CO), NO_X, and SO_2 of 250 tons per year (tpy), each, to establish the facility as a minor source under Prevention of Significant Deterioration (PSD) regulations. The emission estimates indicating that compliance with the PSD limits could be achieved were based on stack testing from a similar facility in North Carolina.

When NCRP acquired ownership of the facility, it had not operated since 2009. On July 7, 2015, the boilers were restarted firing only non-CISWI subject wood. Poultry litter was added to the fuel mix for the first time on October 16, 2015. The CO emissions from the boilers are monitored by a continuous emissions monitoring system (CEMS), and these emissions were observed to be higher than anticipated upon restart of the boilers after permit issuance. Because the cumulative CO emissions approached the 250 tpy PSD avoidance limit, the Permittee voluntarily shut down the boilers on March 7, 2016.

On June 30, 2016, NCRP entered into a Special Order by Consent (referred to as the First SOC) with NCDAQ that allowed NCRP to restart the boilers following the completion of boiler maintenance. These activities included unplugging air tube heaters, unplugging economizer tubes, repairing the soot blower, repairing leakage in the boiler penthouse, replacing missing dampers in the fuel distribution spouts, and reconfiguring the over-fire air system. The First SOC also specified CO emissions limits that would trigger NCRP to submit a compliance plan and/or enter into a second SOC. The First SOC became effective on August 1, 2016.

NCRP restarted the boilers on August 13, 2016 after conducting maintenance on the boilers pursuant to the First SOC. During the month of September 2016, CO emissions from the boilers totaled 46.2 tons per month, which triggered the Permittee to prepare a compliance plan and enter into a second SOC. Cumulative CO emissions from the facility also totaled 263.7 tpy during the month of September 2016, in excess of the PSD avoidance limitation for CO. NCRP submitted a compliance plan to NCDAQ on October 28, 2016 indicating that it intended to submit a PSD permit application for the facility.

On January 25, 2017, NCRP entered into a second SOC (referred to as the Second SOC) with NCDAQ to address noncompliance with PSD for exceeding 250 tpy of CO emissions. Among other requirements, the Second SOC required the Permittee to submit a retroactive PSD application for the 2015 modification to permit poultry litter as fuel no later than 30 days from the effective date of the second SOC. The Second SOC became effective on February 27, 2017, and the PSD application was received on March 29, 2017, which was 30 days after the effective date of the second SOC. The PSD application was deemed incomplete for PSD purposes because the required air dispersion modeling was not included in the application. The required air dispersion modeling was subsequently received on October 29, 2017, at which point the PSD application was deemed complete.

From the receipt of the complete PSD permit application, NCDAQ and NCRP have worked to draft a PSD permit for the 2015 permit modification. An outline of these activities is provided in Section 1.4 below. Throughout this time period, NCRP continued to experience maintenance issues with its boilers (ID Nos. ES-1A and ES-1B), and voluntarily shut down its boilers on November 1, 2020 due to these ongoing issues. On June 23, 2021, NCRP submitted an addendum to the PSD permit application to request authorization to conduct various maintenance, repair, and replacement activities on the boilers (ID Nos. ES-1A and ES-1B), including replacement and reconfiguration of certain component boiler parts, as further described below in Section 2.1 of this review.

This PSD permit application will be processed as a significant permit modification pursuant to 15A NCAC 02Q .0501(b)(1). The Permittee has requested the Director exercise his discretion under 15A NCAC 02Q .0521(g) to submit the draft PSD permit for public hearing prior to permit issuance.

1.2 Plant Location

The facility is located at 1866 Hestertown Road, Lumberton, North Carolina, which is in central Robeson County. The current Clean Air Act Section 107 attainment status designations for areas in the State of North Carolina are summarized in 40 CFR 81.334. Robeson is classified as better than national standards for total suspended particulates (TSP) and for SO_2. The entire State of North Carolina is designated as "unclassifiable/attainment" for carbon monoxide (CO) and ozone (1-hour standard). Robeson County is designated as "unclassifiable/ attainment" for ozone (1997 and 2008 8-hour standards) and $PM_{2.5}$ (annual and 1997 and 2006 24-hour primary and secondary standards). Robeson County is designated as "cannot be classified or better than national standards" for nitrogen dioxide (NO_2). Based on these designations, NCRP is not located in an area designated as "nonattainment" for any pollutant regulated under the National Ambient Air Quality Standards (NAAQS).

1.3 Permitting History Since Issuance of Air Permit No. 05543T21

Permit	Date	Description
05543T21	May 19, 2015	Air Permit No. 05543T21 was issued as a "Part 1" significant modification. Under this permit, coal and other materials were removed as a fuel from the boilers (ID Nos. ES-1A and ES-1B) and non-CISWI poultry litter was added. Three new biomass belt dryers (ID Nos. ES-17, ES-18, and ES-19) were also added to the permit. The Permittee also accepted several avoidance conditions to establish the facility as a minor source under PSD.
05543T22	June 12, 2015	Air Permit No. 05433T22 was issued as an administrative amendment to correct a typographical error in the permit.
05543T23	March 8, 2016	Air Permit No. 05433T23 was issued under a "reopen for cause" permit application. Cross State Air Pollution Rule (CSAPR) Requirements were added to the permit. References to the Clean Air Interstate Rules (CAIR) were moved to Section 2.5, "Permit Shield for Non-Applicable Requirements."
05543T23	August 1, 2016	SOC 2016-002 (i.e., the First SOC) became effective on August 1, 2016. The SOC addressed higher than anticipated CO emissions from the boilers after permitting them to fire non-CISWI subject wood and poultry litter. The SOC allowed the Permittee to restart boilers (ID Nos. ES-1A and ES-1B) following the completion of specified boiler maintenance.
05543T23	February 27, 2017	SOC 2017-001 (i.e., the Second SOC) became effective on February 27, 2017. The SOC was triggered because emissions of CO from the boilers exceeded limits specified in SOC 2016-

Permit	Date	Description
		002. The Permittee was required to submit a PSD application within 30 days of the effective date of the SOC.
05543T24	May 10, 2017	Air Permit No. 05433T24 was issued as a "Part 1" significant modification to add a fourth belt dryer (ID No. ES-21) and a drum dryer (ID No. ES-22) to the permit.
05543T25	September 14, 2017	Air Permit No. 05543T25 was issued. The following permit applications received during 2016 and 2017 were consolidated under this permit: • Permit Application No. 7800166.16B – The 502(b)(10) notification was received on February 26, 2016. NCRP proposed to replace its two existing multiclones (ID Nos. CD-1A2 and CD-1B2) with two new, higher efficiency multiclones with 20, 24-inch tubes, each. NCRP also replaced the fly ash drag chains and removed the bottom ash silo (ID No. ES-4). • Permit Application No. 7800166.16C – The 502(b)(10) notification was received on March 3, 2016. NCRP proposed to vent the poultry litter storage warehouse to the atmosphere rather than to the boilers (ID Nos. ES-1A and ES-1B). • Permit Application No. 7800166.16D – This application was a state-only modification and was received on April 4, 2016. The application established the SB3 BACT limit for SO_2 for non-CISWI subject wood. • Permit Application No. 7800166.16F – This application was a "Part 2" significant modification under 15A NCAC 02Q .0501(c)(2) and was received on July 12, 2016. • Permit Application No. 7800166.16G –This permit application, which was submitted as a minor modification, was for repairs to the boilers and for the modification of the existing over fire air (OFA) systems. The application included a request to delete the requirement to monitor pressure drop across baghouses (ID Nos. CD-1A and CD-1B). Because this change represented a relaxation of a monitoring requirement, this modification was deemed a significant modification. The facility subsequently submitted an amendment to the "Part 2" significant permit application (7800166.16F) requesting this change. • Permit Application No. 7800166.16H – The 502(b)(10) notification was received on October 13, 2016. NCRP proposed to add a poultry litter storage shed. • Permit Application No. 7800166.17A – This permit application was for renewal of the Title V permit and was received on January 24, 2017. • Permit Application No. 7800166.17B – This permit application was for renewal of the Acid Rain permit and was received on January 24, 2017.
05543T26	October 11, 2019	Air Permit No. 05433T26 was issued as an administrative amendment to add a condition to the permit for exemption of

Permit	Date	Description
		15A NCAC 02D .1806, Control and Prohibition of Odorous Emissions, in accordance with 15A NCAC 02D .1806(d)(11).
05543T27	April 15, 2020	Air Permit No. 05433T27 was issued. The following permit applications were consolidated under this permit: • Permit Application No. 7800166.19A – This application was received February 1, 2019 for a minor modification to add poultry cake as permitted fuel for the facility's boilers (ID Nos. ES-1A and ES-1B). • Permit Application No. 7800166.19B – This permit modification was a re-open for cause issued by NCDAQ in a letter dated February 26, 2019. The re-open for cause addressed PSD applicability for the fourth belt dryer (ID No. ES-21) at the facility. • Permit Application No. 7800166.19C – The 502(b)(10) notification was received on February 18, 2019. NCRP proposed to add a fly ash storage pile to the facility. • Permit Application No. 7800166.19D – The 502(b)(10) notification was received on May 24, 2019. NCRP proposed to add egg shells for control of SO_2 emissions from the facility's boilers (ID Nos. ES-1A and ES-1B).
05543T28	July 29, 2021	Air Permit No. 05433T28 was issued as a minor modification to replace the existing two bagfilters (ID Nos. CD-1A and CD-1B) for the two boilers with a new common bagfilter (ID No. CD-1C) and to replace the two existing dry sorbent injection systems (DSI) (ID Nos. CD-1A4 and CD-1B4) with a new common system (ID No. CD-1C4).

1.4 Application Chronology

Date	Event
March 20, 2017	Pre-application meeting between NCDAQ and NCRP occurred.
March 21, 2017	Tom Anderson of the Air Quality Analysis Branch (AQAB) of NCDAQ e-mailed personnel from US Forest Service, the Fish and Wildlife Services, and the National Park Service informing them of the project.
March 28, 2017	Jill Webster of the Fish and Wildlife Service sent an e-mail to Tom Anderson indicating that a Class I analysis was not needed.
March 29, 2017	PSD permit application received. The required air dispersion modeling was not included with the PSD application.
March 31, 2017	A permit application acknowledgment letter was issued indicating the permit application was complete for processing.
April 10, 2017	A letter was issued to NCRP indicating the application was deemed incomplete for PSD purposes in part because required air dispersion modeling was not included with the permit application.
May 5, 2017	The modeling protocol for the PSD impact analysis and the additional impact analyses including the Class I impact analyses, visibility impairment analysis, growth analysis, and soils and vegetation analysis was received.
October 29, 2017	The air dispersion modeling analysis was received, and the PSD permit application was deemed complete.

Date	Event
November 2, 2017	A copy of permit application and modeling was forwarded to US EPA Region 4.
December 18, 2017	Frank Burbach, consultant for the Permittee, submitted revised emission rates and supporting calculations for the PSD project.
January 19, 2018	Eva Land of the US EPA Region 4 provided comments on the PSD permit application. NCDAQ addressed the comments as deemed appropriate.
February 13, 2018	Betty Gatano, permitting engineer, e-mailed Frank Burbach requesting clarification of emissions that differed from emission rates submitted in the 2015 "Part 2" permit application.
March 5, 2018	Frank Burbach provided a response for the difference in emission calculations. NCDAQ agreed with the updated emissions.
March 15, 2018	Frank Burbach provided an e-mail reviewing all the emission sources at the facility, including insignificant activities. The e-mail provides that emission increases from the retroactive PSD modification were only expected from the boilers (ID Nos. ES-1A and ES-1B) and the poultry litter storage warehouse (ID No. IES-16).
March 21, 2018	NCDAQ staff participated in a phone call to discuss air dispersion modeling issues with Frank Burbach and Santosh Chandru, consultants for the Permittee.
April 25, 2018	Betty Gatano and Matt Porter of the AQAB participated in a site visit to NCRP. The need to construct a fence on the property as required for the modeling analysis for PSD was discussed with plant personnel.
May 10, 2018	Jeff Twisdale of NCDAQ issued a memorandum for the State BACT also referred to as Senate Bill 3 (SB3) BACT emission limits and control technology for lead and mercury from boilers (ID Nos. ES-1A and ES-1B) at NCRP.
June 11, 2018	4Frank Burbach submitted BACT analyses for the poultry litter storage warehouse (ID No. ES-16) and the three belt dryers (ID Nos. ES-17, ES-18, and ES-19).
June 15, 2018	NCDAQ staff participated in a phone call to discuss outstanding modeling issues with Frank Burbach and Santosh Chandru.
June 25, 2018	Santosh Chandru notified NCDAQ that construction of the property boundary fence was complete.
June 27, 2018	Matt Porter finalized a memorandum approving the PSD and NC air toxics dispersion modeling analyses for NCRP.
July 13, 2018	NCDAQ staff and NCRP staff and consultants participated in a conference call to discuss the 30-day averaging time for BACT emission limits for NOx, SO_2, and CO. NCRP contended a shorter (i.e., 24-hour) averaging period was not appropriate in this situation given fuel variability. NCDAQ agreed that a 30-day averaging time was acceptable and requested NCRP submit a detailed justification.
August 22 and 23, 2018	NCRP conducted source testing of one of the belt dryers.
November 1, 2018	NCDAQ received justification from NCRP for a 30-day averaging time for BACT emission limits for NOx, SO_2, and CO. The information was considered supplemental to the PSD permit application.
November 2, 2018	Brent Hall of the Stationary Source Compliance Branch (SSCB) approved the source testing for the belt dryers in a memorandum dated November 2, 2018.

Date	Event
November 7, 2018	A copy of the supplemental information was forwarded to US EPA Region 4.
November 20, 2018	Betty Gatano requested NCRP to revise the BACT analysis for the belt dryers based on results of the testing.
January 3, 2019	Revised BACT analysis for the belt dryers received.
Spring 2019	In phone calls in the spring of 2019, Frank Burbach indicated the Permittee had difficulty meeting the proposed BACT limits for CO and NOx.
June 26, 2019	Frank Burbach submitted revised BACT limits for CO and NOx for the boilers.
August 5, 2019	Updated air dispersion modeling was received. The revised air dispersion modeling was based on revised BACT limits for CO and NOx and updated formaldehyde emissions based on testing of the belt dryers.
September 3, 2019	Nancy Jones of the AQAB requested information about the revised air dispersion modeling.
October 28, 2019	Requested information supporting the revised air dispersion modeling was received.
October 30, 2019	Nancy Jones issued a memorandum approving the revised PSD and NC air toxics dispersion modeling analyses for NCRP.
November 27, 2019	A draft of the permit and permit review based on revised BACT and associated air dispersion modeling was forwarded internally for comments.
December 18, 2019	A draft of the permit and permit review was forwarded to the facility for comments.
May 13, 2020	Received comments from Frank Burbach and Rick Houser, technical contact for NCRP.
November 1, 2020	NCRP voluntarily shutdown the boilers (ID Nos. ES-1A and ES-1B) due to ongoing maintenance issues.
January 27, 2021	NCDAQ participated in call with NCRP and consultants regarding noncompliance issues at the facility and the PSD permit application.
February 23, 2021	NCRP submitted a request for a routine maintenance, repair and replacement (RMRR) determination for the boilers.
April 15, 2021	Fern Paterson, outside counsel for NCRP, participated in a call with NCDAQ to discuss the RMRR request.
May 5, 2021	Carey Davis, Executive Vice President for NCRP, submitted a request via e-mail to withdraw the RMRR request. The e-mail stated in part, "[per] discussions with NCDAQ, NCRP will be submitting an amendment to the PSD permit application that is currently pending (Application No. 7800166.17C) to incorporate the proposed maintenance, repair and replacement work on the [boilers] into the requested major modification under the PSD permitting program."
June 23, 2021	NCRP submitted an addendum to the PSD permit to request authorization to conduct the proposed maintenance, repair and replacement work at the boilers (ID Nos. ES-1A and ES-1B).
August 6, 2021	A second draft of the PSD permit and permit review was forwarded internally for comments.
August 10 – 20, 2021	Comments received from NCDAQ staff .
August 30, 2021	A second draft of the PSD permit and permit review was forwarded to NCRP for comments.
September 14, 2021	NCDAQ and NCRP participated in a call to discuss issues around the emissions included in the 30-day average for CEMS.

Date	Event
September 23, 2021	Received partial comments from NCRP on the draft permit and permit review. NCRP indicated comments are still being developed regarding the 30-day average for CEMS.
October 19, 2021	Received comments from NCRP for proposed requirements for BACT emission limits for NO_X and CO during startup and shutdown of the boilers.
October 26, 2021	Forwarded proposed language BACT emission limits for startup and shutdown internally.
November 3, 2021	NCDAQ staff participated in internal call to discuss proposed BACT emission limits for startup and shutdown. Forward questions from internal call to Frank Burbach and Fern Paterson that same day.
November 8 and 18, 2021	Betty Gatano and Frank Burbach exchanged phone calls and e-mails regarding questions from NCDAQ and proposed emission limits.
November 22, 2021	NCRP final draft of NCRP permit and permit review forwarded for comments. The drafts incorporated the proposed BACT emission limits for startup and shutdown as well as all comments on the drafts received to date.
November 30, 2021	Comments on final draft received
December 3, 2021	Final comments were incorporated into the drafts and the drafts were prepared for public notice.

2.0 Modified Emission Sources and Emissions Estimates

On May 29, 2015, Air Permit No. 05543T21 was issued to NCRP to allow the facility to fire only non-CISWI subject wood and poultry litter in its two stoker boilers (ID Nos. ES-1A and ES-1B). Three belt dryers (ID Nos. ES-17, ES-18, and ES-19) were also added to Air Permit No. 05543T21. The modification to the boilers and the addition of the belt dryers under Air Permit No. 05543T21 are collectively referred to as “the PSD modification” throughout the remainder of this review. Equipment, process changes, and emissions associated with this PSD modification are discussed in this section.

2.1 Emission Sources

<u>Stoker Boilers (ID Nos. ES-1A and ES-1B)</u>

The primary emission sources at the facility are two stoker boilers, rated at 215 million Btu/hr, each. The boilers are identical and are fueled with non-CISWI subject wood and poultry litter. Poultry cake was added as fuel with the issuance of Air Permit No. 05433T27 on April 15, 2020. However, the addition of poultry cake was not part of the PSD modification and will not be discussed further in this permit review. Emissions from the boilers are based on fuel blends of up to 85% poultry litter, although this level has not been achieved at the facility. A small amount of No. 2 fuel oil is used for startup. Each boiler generates approximately 115,000 pounds per hour of steam at approximately 1,150 psig.

Permit Application Addendum
Concentration of chlorine in the flue gas and ash associated with the non-CISWI poultry litter has increased the rate of degradation of the boiler components and has generally required more frequent maintenance, including more frequent startups and shutdowns associated with that maintenance. NCRP submitted an addendum to the PSD permit application on June 23, 2021 to request authorization to conduct the proposed maintenance, repair, and replacement work at the boilers (ID Nos. ES-1A and ES-1B) (the "Boiler Maintenance Project"). The purpose of this Boiler Maintenance Project is to repair and replace degraded components and to reduce maintenance and associated startup and shutdown events by using corrosion-resistant replacement materials and to increase spacing between superheater tubes to reduce plugging and allow for improved cleaning and maintenance. The activities associated with the Boiler Maintenance Project are discussed below:

- Primary and Secondary Superheater Replacements – The primary and secondary superheaters have deteriorated over time, requiring replacement of these components. The replacement superheaters will be located above the furnace nose in the same cavity space occupied by the existing superheaters. The superheater headers will be in the same location as the existing headers and will be made of the same material and thickness. The number of tubes in the replacement superheaters bundles in the front-to-back direction will not change. However, the tubes will include corrosion-resistant overlays to improve durability. Fewer pendant elements will be included in the superheater bundles in the horizontal direction to clear spacing between the tubes in the direction of the gas path.

- Economizer replacement – The replacement economizers will be in the same location as the existing economizer and will have the same design, except the tubes in the replacement economizers will be constructed of a harder and more corrosion resistant carbon steel.

- Overfire Air (OFA) System Repair – The OFA system will be repaired and restored. OFA ports on the sidewalls of each boiler will remain in place and the existing OFA fans, ductwork, dampers, and accessories will be removed and replaced in-kind. The location of nozzles in the rear and front walls of the boilers will also be optimized to allow for the adjustment of the air flow and improved air distribution of the full operating range of the boilers.

- Fuel grate repairs and replacements – Existing grate components will be disassembled to remove chains, grate, bars, and seals in order to inspect all parts. Parts still in good working order will be reused as is, and those parts that need replacing due to wear or damage will be replaced with new grate parts. In addition, the front steel support beam on Boiler B (ID No. ES-1B) is bent and will be replaced with a new beam.

- Replacement of furnace near wall screen tubes – Two rows of furnace rear wall screen tubes directly behind the superheater have deteriorated over time and will be replaced. The number of tubes will be exactly the same at forty (40). The replacement tubes will be in an in-line orientation versus the current staggered orientation to allow for improved cleaning and maintenance of the tubes.

NCRP voluntarily ceased operation of its boilers on November 1, 2020 due to ongoing maintenance issues, and the facility does not intend to restart the boilers until maintenance and redesign of the boilers are completed.

Control of the Boilers
The boilers are equipped with several different controls to reduce pollutant emissions. As previously discussed in Section 1.1, each boiler is equipped with a SNCR system (ID Nos. CD-1A3 and CD-1B3), with aqueous ammonia injection for NO_X control. The control efficiency for NO_X for the SNCR systems is estimated at 40%. After treatment with ammonia, the exhaust gas is sent to multiclones (ID Nos. CD-1A2 and CD-1B2), followed by a common bagfilter (ID No. CD-1C). The control efficiency for PM is estimated at 95%. A common DSI (ID No. CD-1C4) will be used to control SO_2 and HCl emissions from the boilers (ID Nos. ES-1A and ES-1B). Sodium bicarbonate, sodium sesquicarbonate (commonly known as trona), or hydrated lime will be used as the sorbent. The control efficiency of the sorbent injection systems is expected to be 80% to 95% for acid gases, such as HCl. Good combustion practices are used to minimize emissions of CO and volatile organic compounds (VOC). Emissions of SO_2, CO, and NO_X are monitored via CEMS.

A 502(b)(10) notification was received on May 24, 2019, allowing NCRP to add egg shells to the fuel control emissions of SO_2 and acid gases. However, the addition of egg shells was not part of the PSD permit modification, and no emission reduction efficiency associated with the egg shells is included in the emissions calculations. Therefore, the addition of egg shells will not be discussed again in this permit review.

Poultry Litter Preparation, Storage, and Conveying System (ID Nos. IES-16 and IES-20)

Poultry litter is delivered via truck to the facility. The litter is examined visually, and samples are taken to ensure it meets quality standards for moisture, heat content, and contaminant level. Rejected litter is returned to the supplier. Litter that passes the quality inspection is deposited in either the poultry litter warehouse (ID No. IES-16) or poultry litter storage shed (ID No. IES-20) for storage. Prior to feeding the boiler, the poultry litter is screened based on size, surface area, and density and blended with non-CISWI subject wood to achieve proper moisture and heat content for combustion. These sources are considered insignificant activities under 15A NCAC 02Q .0503(8). (See attachment 2 for emission calculations.)

The poultry litter storage shed (ID No. IES-20) was added as an insignificant activity under Air Permit No. 05543T25 issued on September 14, 2017 and is not part of the PSD modification. The storage shed will not be discussed further in this permit review.

Non-CISWI subject wood Preparation, Storage, and Conveying System (ID Nos. IES-8, IES-9, IES-10, and IES-11)

Wood chips are delivered via truck to the facility. The wood chips are inspected for significant signs of contamination such as a large amount of debris, plastic, or metal. Rejected wood shipments are returned to the supplier. Wood chips that pass the quality inspection are transferred to a receiving bin and conveyed to an outdoor storage pile (ID No. IES-10). Wood is mixed with poultry litter to achieve proper moisture and heat content for combustion and sent to the boilers. These sources are considered insignificant activities under 15A NCAC 02Q .0503(8). (See attachment 2 for emission calculations.)

NCRP also burns construction and demolition (C&D) wood debris in its boilers. C&D wood debris is not considered solid waste when used as fuel in a combustion unit provided the procedures specified in 40 CFR 241.4(a)(5) are followed. To that end, NCRP must obtain a written certification from C&D processing facilities that the C&D wood debris has been processed by trained operators in accordance with best management practices.

<u>Belt dryers (ID Nos. ES-17, ES-18, ES-19, and ES-21)</u>

NCRP has permitted four belt dryers, which are used to reduce the moisture content of wood chips from 50% to 7%. Each belt dryer has a maximum permitted capacity of 30 tons of wood chips per hour.

The primary purpose of the dryers is to dry wood chips to be sold offsite as product. Although the dryers can be used to dry the wood chips to feed the boilers, this situation is highly unlikely. Hot water from the condenser on the steam turbine is the sole source of heat for the dryers, and the dryers operate at a maximum temperature of 120 ^{o}F.

Three of the belt dryers (ID Nos. ES-17, ES-18, and ES-19) were permitted under Air Permit No. 05543T21 issued on May 29, 2015. The fourth belt dryer (ID No. ES-21) was permitted under Air Permit No. 05543T24 issued on May 10, 2017.The facility accepted a PSD avoidance condition to limit emissions of VOC from the fourth belt dryer to less than 40 tpy. The fourth belt dryer has not yet been constructed and is not considered to be part of the PSD modification. This belt dryer will not be discussed further in this permit review.

<u>Ancillary Equipment</u>

<u>A 19% Aqueous Ammonia Storage Tank (ID No. ES-15)</u>

A 10,000 gallon, fixed-roof storage tank stores materials used in the SNCR control system. The vessel is permitted as an ammonia storage vessel, but aqueous urea may also be used as the reagent. Additionally, 19% aqueous ammonia is not a regulated material under Section 112(r) of the Clean Air Act.

<u>Sorbent Silo (ID No. IES-13)</u>

Sodium bicarbonate or sodium sesquicarbonate (trona), which is used in the sorbent injection systems if necessary to control acid gases and SO_2, is stored in the sorbent silo. NCRP estimates a usage rate of sorbent at 657 tpy.

<u>Other Equipment</u>

The emission sources listed below were not modified but were existing emission sources at the time of the PSD modification or were added subsequent to the PSD modification.

- Diesel Fired Emergency Fire Pump (ID No. ES-1).
- Diesel Storage Tank (ID No. IES-2).
- Fire Pump Fuel Oil Storage Tank (ID No IES-3).
- Solvent Parts Cleaner (ID No. IES-4).

- Turbine Lube Oil Tank Vent (ID No. IES-5).
- Cooling Tower (ID No. IES-6).
- Bottom Ash Sifter (ID No. IES-14).

- One Fly Ash Silo with a Bin Vent Filter (ID No. IES-21).

Drum Dryer (ID No. ES-22)
The drum dryer was permitted under Air Permit No. 05543T24 issued on May 10, 2017. The drum dryer will have a natural gas-fired burner and will be controlled by a multi-cyclone and a regenerative thermal oxidizer (RTO). The drum dryer will primarily be used to dry and "sanitize" wood chips for sale to customers as product, but some of the drum dryer's output will be fuel for the boilers. The RTO limits VOC emissions from the drum dryer to less than 40 tpy. The drum dryer has not yet been constructed and is not considered to be part of the PSD modification. The drum dryer will not be discussed further in this review.

Fly Ash Storage Pile (ID No. ES-23)
The fly ash storage pile was permitted with the issuance of Air Permit No. 05433T27 on April 15, 2020 and is not part of the PSD modification. The fly ash storage pile will not be discussed further in this review.

2.2 Emissions

Emissions associated with the PSD modification are discussed in this section.

Boilers

Modifying the boilers and associated control devices and modifying the permitted fuel represent a physical change or change in the method of operation for the boiler. As such, the emissions resulting from these modifications were reviewed to determine if this project would be considered a major modification under PSD rules. NCRP assessed the applicability of PSD by performing a comparison test of baseline actual emissions (BAE) to potential emissions (PE). Calculations of the PE are provided in Attachment 2 to this document.

For the BAE, NCRP conducted a ten-year look back at emissions from the facility. This length of time is allowed per NCDAQ's definition of BAE in 15A NCAC 02D .0530, which means the following:

> *For an existing emissions unit, baseline actual emissions mean the average rate, in tons per year, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the five-year period immediately preceding the date that a complete permit application is received by the Division for a permit required under this Rule. The Director shall allow a different time period, not to exceed 10 years immediately preceding the date that a complete permit application is received by the Division, if the owner or operator demonstrates that it is more representative of normal source operation*

The facility was shut down and "mothballed for long term storage" in 2009[3] and remained shut down until July 7, 2015. NCRP calculated the BAE based on 2007 and 2008 emissions. These years

[3] See compliance inspection report from Jim Moser (06/08/2010).

represent the most recent two consecutive years of actual operation in the ten-year look back prior to submittal of the permit application (7800166.15B) to add poultry litter as fuel. BAE are provided in Table 1 below.

Prior to this modification, the facility was a PSD major source. For this modification to be considered a significant modification under PSD, the emissions increase must exceed the PSD significant emission rates (SER). Table 1 below provides the PE and BAE and shows the emission increases (PE – BAE) associated with the modification of the boilers under Air Permit No. 05443T21. As shown in the table, the emission increase exceeds the SERs for all NSR pollutants, with the exception of lead.

Table 1 –Emissions from Boilers (ID Nos. ES-1A and ES-1B)

Pollutant	Baseline Actual Emissions (tpy)	Potential Emissions (tpy)	Emission Increase (tpy)	PSD SER (tpy)	Above PSD SER
CO	5.8	1,224.21	1218.4.8	100	Yes
NO_x	70.2	320.2	249.9	40	Yes
SO_2	170.9	301.3	130.4	40	Yes
TSP/ PM	4.5	56.5	52.0	25	Yes
PM10	2.4	67.8	65.4	15	Yes
PM2.5	0.95	50.9	49.9	10	Yes
VOC	0.60	56.5	55.9	40	Yes
Lead	0.00033	0.09	0.09	0.6	No
H_2SO_4	2.24	58.4	56.2	7	Yes
CO_2e	46,117	438,825	392,708	75,000	Yes

Notes:

- PM and $PM_{2.5}$ emissions are based on vendor guarantees and an estimated control efficiency of the multiclones and the new bagfilter of 95%.
- PM_{10} emissions are based on the NSPS PM limit of 0.03 lb/million Btu in 40 CFR Part 60 Subpart Db (NSPS Subpart Db). Before control emissions were determined based on an estimated control efficiency of the multiclones and the new bagfilter of 95%.
- SO_2 emissions are based on the proposed BACT limit determined from sampling poultry litter and 80% reduction (when burning wood/litter mix) and assuming 50% furnace capture. This limit was revised in the updated emissions submitted on 12/18/2017 and is based on the facility's CEMS readings for SO_2.
- NO_X emissions are based on the proposed PSD BACT limit of 0.17 lb/ million Btu, which is the lowest numeric limit as determined from the facility's CEMS readings on a 30-day rolling average when burning wood and poultry litter. Before control emissions was determined assuming a 40% control efficiency of the SNCR for NOx.
- CO emissions are the proposed BACT limit of 0.65 lb/million Btu, which is the lowest numeric limit as determined from the facility's CEMS readings on a 30-day rolling average when burning wood and poultry litter.
- VOC emissions are based on SB3 BACT limit of 0.03 lb/ million Btu when burning wood and poultry litter.
- CO_2 equivalent (CO_2e) is defined as the sum of individual greenhouse gas pollutant emission times their global warming potential, converted to metric tons.
- Emissions above do not include the emissions from startup on No. 2 fuel.

The Boiler Maintenance Project will not change the potential emissions associated with the PSD modification. Instead, these changes will allow the facility to more consistently and reliably control emissions to meet the proposed BACT limits, as discussed in Section 4.0 below, with less downtime for boiler maintenance.

Belt Dryers (ID Nos. ES-17, ES-18, and ES-19)

These three belt dryers were added as new sources to Air Permit No 05543T21 issued on March 19, 2015 and are considered part of the PSD modification. Emissions of VOC and HAPs from the belt dryers were measured during stack testing on August 22 and 23, 2018. The test results and estimated potential emissions from these sources are provided in the table below.

Table 2 - Belt Dryer Test Results					
Pollutant	**Test Results for Four Stacks of Belt Dryer**	**Test Results for Belt Dryer**	**Annual Emission Rate**	**PSD SER (tpy)**	**Above PSD SER**
VOC	9.32 lb/hr	18.6 lb/hr	245.0 tpy	40	Yes
Formaldehyde	0.13 lb/hr	0.26 lb/hr	3.42 tpy	N/A	N/A
Methanol	0.12 lb/hr	0.24 lb/hr	3.15 tpy	N/A	N/A

Note:
- The source test report was reviewed and approved in a memorandum from Brent Hall of the SSCB on November 2, 2018.
- Only four stacks were tested during the August 2018 testing. Each belt dryer has eight stacks, so the stack test results were doubled to represent total emissions from the belt dryer.
- Annual emission rate assumes three belt dryers (eight stacks each) operating, each at 8,760 hours per year.

Poultry litter storage warehouse (ID No. IES-16)

Emission estimates from the poultry litter warehouse are provided in the Table 3 below. As shown in the table, emissions from the poultry litter are considered insignificant in accordance with 15A NCAC 02Q .0503(8).

Table 3 –Poultry Litter Storage Warehouse (ID No. IES-16)			
Pollutant	**Emission Factor**	**Emissions**	**Reference**
PM PM_{10} $PM_{2.5}$	--	0.08 tons/yr 0.012 tons/yr 0.008 tons/yr	US EPA AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995) See pages A2-14 through 16 of Attachment 2 for development of these emissions.
NO_x	184 mg/m^2-day (open field)	275.1 lb/yr 0.14 tons/yr	The emission factor is for nitrous oxide (N_2O), which is included in the family of NOx compounds. The emission factor is found on page 19 of the Iowa State report. (See table notes.) The area of flux from the poultry litter storage warehouse was assumed to be 1,858 m^2 (100 ft x 200 ft).
VOC	N/A	Negligible	The Iowa State report had no VOC data from poultry litter. The EPA indicated emissions of VOC from log piles and chip storage were non-detect, with one exception. In Table 10.6-7 limited data for VOC was measured.

Table 3 –Poultry Litter Storage Warehouse (ID No. IES-16)			
Pollutant	**Emission Factor**	**Emissions**	**Reference**
NH_3	4.2 – 9.1 g/m^2-day (open field)	0.72 lb/hr	The emission factor range is provided in Table 4 of the Iowa State report. The area of flux from the poultry litter storage warehouse was assumed to be 1,858 m^2 (100 ft x 200 ft). Typically, the higher end of the range would be used to provide a conservative estimate. However, the poultry litter is stored and handled in a partially enclosed warehouse. For this reason, the lower end of the range is a better representation of expected NH_3 emissions. The TAP permitting emission rate (TPER) for NH_3 is 0.68 lb/hr. The facility has conducted air dispersion modeling to demonstrate compliance with the NC Air Toxics. Please see Section 5.7.

Notes:
- NOx, VOC, and NH_3 emissions are estimated from "Air Quality and Emissions from Livestock and Poultry Production / Waste Management Systems." (2006) Retrieved from http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1624&context=abe_eng_pubs. This reference is called the Iowa State Report.
- Emission data for other pollutants in the Iowa State Report pertained to poultry houses, with emission factors given in terms in animal units (AU) processed. These emission factors were not applicable to the poultry litter fired at NCRP and were not used in the emission calculations above.
- The NH_3 emission factor was based on flux from uncovered fields. The poultry litter storage warehouse is an enclosed building with two large bay doors opened on one side to allow for loading and unloading poultry litter into the warehouse. Using the emission factors without adjusting for the enclosure is an overestimate of the expected emissions. Therefore, the lower end of the range was used as conservative estimate.

CEMS for CO, NO_X, and SO_2

Emissions of CO, NO_X, and SO_2 from the boilers are measured with the use of CEMS. NCDAQ issued a memorandum dated October 27, 2020 entitled "Legal Basis for Calculation & Reporting Frequencies of CEMS/COMS-affected Facilities." Based on this memorandum, NCDAQ now requires all facilities that operate a CEMS or COMS to conduct quarterly calculation of the CEMS and COMS data regardless of reporting frequency. The permit will be updated to incorporated quarterly calculations as part of this modification.

3.0 Project Regulatory Review

The emission sources associated with this PSD modification are subject to the following regulations.

- 15A NCAC 02D .0504 "Particulates from Wood Burning Indirect Heat Exchangers" – This rule applies to the boilers (ID Nos. ES-1A and ES-1B) because NCDAQ considers poultry litter to be wood for the purposes of 02D .0504. The allowable PM emission rate in pounds per million Btu (lb/MMBtu) is calculated using the following equations:

For firing non-CISWI subject wood only or non-CISWI subject wood and poultry litter Ec = $1.1698 \times Q^{-0.223}$ Where Ec = the emission limit for PM for firing wood only in lb/million Btu Q = the maximum heat input in million Btu per hour from firing wood only combusted in the source Q = (215 million Btu per hour heat input each) * 2 Q= 430 million Btu per hour. Ec = $1.1698 \times 430^{-0.223}$ **E_e = 0.30 lb/million Btu**
For fuel (aka poultry cake) only as specified in 15A NCAC 02D .0503 Ec = $1.090 \times Q^{-0.2594}$ Where Ec = the emission limit for PM for fuel wood only in lb/million Btu Q = the maximum heat input in million Btu per hour from firing wood only combusted in the source Q = (215 million Btu per hour heat input each) * 2 Q= 430 million Btu per hour. Ec = $1.090 \times 430^{-0.2594}$ **E_e = 0.23 lb/million Btu**
For firing non-CISWI subject wood, poultry litter, and poultry cake Ec = [(Ew)(Qw) + (Eo)(Qo)] /Qt. Where Ec = the emission limit for combination or combined emission sources in lb/million Btu. Ew = emission limit for wood only in lb/million Btu = 0.30 lb/million Btu Eo = emission limit for other fuels only in lb/million Btu = 0.23 lb/million Btu Qw = the actual wood heat input to the combination or combined emission sources in Btu/hr. Qo = the actual other fuels heat input to the combination or combined emission sources in Btu/hr. Qt = Qw + Qo and is the actual total heat input to combination or combined emission sources in Btu/hr. **Ec = [(0.30)(Qw) + (0.23)(Qo)]/Qt**

- <u>15A NCAC 02D .0516 "Sulfur Dioxide Emissions from Combustion Sources"</u> - The boilers (ID Nos. ES-1A and ES-1B) are subject to this rule and are limited to a sulfur dioxide emission rate of no more than 2.3 pounds SO_2 per million Btu heat input. CEMS data from the facility and emission testing conducted in December 2015 demonstrated compliance with the emission limit as shown in Table 4.

Table 4 – SO_2 Emission Factors		
Data Source	**Test Results**	**Comments**
Stack test results December 20, 2015	0.000 lb/million Btu	Based on three 1-hour runs
CEMS data from December 5 – 21, 2015	0.005 lb/million Btu	Based on 15 operating days
	0.039 lb/million Btu	Highest hourly average

The worst-case emissions measured was 0.039 pounds SO_2 per million Btu based on 30% poultry litter blend, which is much lower than the allowable emissions of 2.3 pounds SO_2 per million Btu heat input. Due to large margin of compliance, the boilers are expected to be in compliance with 02D .0516 even at higher poultry litter blends. Thus, no monitoring, reporting, or recordkeeping (MRR) is required.

- <u>15A NCAC 02D .0524 "New Source Performance Standards (NSPS)</u>" – 40 CFR Subpart Db, "New Source Standards for Industrial-Commercial-Institutional Steam Generating Units," (NSPS Subpart Db) applies to steam generating units that commence construction, modification, or reconstruction after June 19, 1984 and have a heat input capacity of greater than 100 million Btu per hour. Although the boilers (ID Nos. ES-1A and ES-1B) were constructed prior to this date, they become applicable to NSPS Subpart Db with the addition of poultry litter as fuel. In accordance with 40 CFR 60.14, a modification under NSPS is "any physical or operational change to an existing facility, which results in an increase in emission rate of any pollutant to which a standard applies..." The proposed burning of poultry litter was considered an operational change, and emissions show an increase in PM and NOx after modification to add poultry litter as a fuel for the boiler.[4] Therefore, the boilers are considered modified units and are subject to NSPS Subpart Db.

  Emissions limits under NSPS Subpart Db for units that combust coal, oil, wood, a mixture of these fuels or a mixture of these fuels with any other fuels are provided in the following table and requirements under this rule are discussed below.

Table 5 – Emission Limits under 40 CFR Part 60 Subpart Db	
Pollutant	**NSPS Emission Limit**
Particulate Matter	0.030 lb/million Btu (filterable)
Visible Emissions	20% opacity, except no more than one 6-minute period of no more than 27% opacity
SO_2	The SO_2 limits do not apply to a boiler that burns biomass fuel.
NO_X	No applicable emission limit. NCRP fires only a small amount of fuel oil at startup and is limited to no more than 500 gallons of fuel oil per year.

[4] See the permit review in support of Air Permit No. 05543T21 for more discussion of applicability to NSPS Subpart Db (05/29/2015).

Standard for Sulfur Dioxide
The SO_2 emission limit under NSPS Subpart Db is not applicable to combustion of biomass fuels, per 40 CFR 60.42b(k)(1), which states that the SO_2 emission limit is applicable only to units that "combust coal, oil, natural gas, a mixture of these fuels, or a mixture of these fuels with any other fuels."

The SO_2 emission rate of fuels (non-CISWI subject wood, poultry litter and poultry cake) used in the boilers is estimated at 0.16 lb/million Btu. This value was estimated using typical sulfur contents of wood and litter, and assuming 50% furnace capture and 80% reduction from the DSI (ID No. CD-1C4). Emission calculations for SO_2 are provided in Attachment 2.

NCRP is also permitted to fire a limited amount of No. 2 fuel oil (e.g. no more than 500 gallons per year) in the boilers during startup. The SO_2 emission rate from No. 2 fuel oil are calculated as follows:

S = Percent sulfur in fuel = 0.05%:	EPA defines low sulfur diesel fuel as having a sulfur level between 15 ppm and 500 ppm. Assume worst-case sulfur content of fuel at 500 ppm or 0.05% sulfur by weight.
SO2 emission factor = 142*S lb/10^3 gal:	Table 1.3-1 in Chapter 1.3, Fuel Oil Combustion, US EPA AP-42
Fuel Heating Value (FHV) = 140,000 Btu/gal	Default value provided in NCDAQ's "Fuel Oil Combustion Emission Calculator Revision G" (11/05/2012).

SO_2 emission rate = 142*S (lb/10^3 gal) / FHV (Btu/gal) * ($1x10^6$ Btu/million Btu)

SO_2 emission rate = 142 * 0.05 (lb/gal) / 140,000 Btu/gal * ($1x10^6$ Btu/million Btu)

SO_2 emission rate = 0.05 lb/million Btu

As specified in 40 CFR 60.42b(k)(2), units firing low sulfur fuels with a potential SO_2 emission rate of 0.32 lb/million Btu heat input or less are exempt from the SO_2 emission standard in NSPS Subpart Db. Therefore, these boilers are not subject to the SO_2 standards.

Standard for Particulate Matter and Opacity
The facility is subject to a federally enforceable PM limit of 0.030 pounds per million Btu for filterable particulate matter as required by 40 CFR 60.46b(h)(1). On and after the date on which the initial performance test is completed, NCRP cannot discharge into the atmosphere any gases that exhibit visible emissions greater than 20% opacity (6-minute average), except for one 6-minute period per hour of not more than 27% opacity, per 40 CFR 60.43b(f). The PM emission standard and opacity limit apply at all times except during periods of startup, shutdown, or malfunction, per 40 CFR 60.43b(g).

Initial compliance testing to demonstrate compliance with PM emission limit under 40 CFR 60.46b(h)(1) was conducted on December 22, 2016. NCRP fired approximately 30% poultry litter during the test. As shown in Table 6 below, compliance was demonstrated.

Table 6 – Results of PM Testing of Boilers (ID Nos. ES-1A and ES-1B)				
Pollutant	**Test Results**	**Emission Limit**	**Regulation**	**Compliance**
PM	0.011 lb/MMBtu	0.030 lb/MMBtu	40 CFR 60 Subpart Db	Yes
Note: The source test report was reviewed and approved in a memorandum from Brent Hall of the SSCB on February 20, 2017.				

The permit will require NCRP to conduct another initial compliance test for PM emissions within 180 days of first startup of the boilers after completion of the Boiler Maintenance Project, unless another date is approved by NCDAQ. NCRP will be required to conduct subsequent performance tests for PM emissions within 60 days of the date that the percentage of poultry litter firing exceeds 50%, 70% and 90% of total heat input to the boilers (ID Nos. ES-1A and ES-1B).

Because the boilers are subject to an opacity standard under 40 CFR 60.43b, NCRP is required to install, calibrate, maintain, and operate a continuous opacity monitor system (COMS) to ensure compliance with the PM emission limit.

Standard for Nitrogen Oxides (NOx)
As specified under 40 CFR 63.44b(c), the NOx standard does not apply to facilities that limit the use of "coal, oil, natural gas (or any combination of the three)" to an annual capacity factor of 10% (0.10) or less. This limit also must be included as a federally enforceable requirement in the permit. No. 2 fuel oil is used for startup, but the amount is limited to 500 gallons per year. This limit will be included as part of the PSD BACT condition. Because NCRP is limited to firing only 500 gallons of No. 2 fuel oil per year, which is much less than the 10% annual capacity factor for fossil fuels, the facility is not subject to the NO_x emission limit, per 40 CFR 60.44b(c).

- 15A NCAC 02D .0530 "Prevention of Significant Deterioration" –
  The facility was subject to PSD BACT when firing coal, No. 2 and No. 4 fuel oil, tire-derived fuels, pelletized paper, and fly ash briquettes. A separate BACT analyses was triggered when non-CISWI subject wood was added as fuel for the boilers under Air Permit No. 05543T18 issued on February 14, 2012. The coal fuel mix and the associated BACT emission limits were subsequently removed from the permit under Air Permit No. 05543T21 issued on May 29, 2015. Because NCRP continued to fire non-CISWI subject wood its boilers, the BACT emission limits for non-CISWI subject wood only remain in the permit.

  BACT Emission Limits for Burning Non-CISWI Subject Wood Only
  When the addition of non-CISWI subject wood fuel was permitted, the only pollutants above the SERS were CO and sulfuric acid mist, and PSD BACT emission limits were established for these pollutants. Previous permits required NCRP to conduct source testing to verify compliance with the PSD BACT limits for CO and sulfuric acid mists when burning non-CISWI subject wood by testing one of the boilers (ID Nos. ES-1A and ES-1B) within 180 days of burning non-CISWI subject wood exclusively in a boiler. The required stack testing was conducted during the period of December 15 – December 30, 2015, with subsequent testing performed on February 10, 2016. The results of the testing are provided in Table 7. As shown in the table, the facility tested in compliance with the PSD BACT emission limits during subsequent tests.

Table 7 – Source Testing for PSD BACT Limits for Non-CISWI Subject Wood				
Pollutant	**Test Date**	**Test Results**	**Emission Limit**	**Compliance**
CO	12/17/2015	0.23 lb/million Btu	0.45 lb/million Btu	Yes
Sulfuric Acid Mist	12/17/2015	0.72 lb/million Btu	0.011 lb/million Btu	Not Indicated: Sample thought to be contaminated
Sulfuric Acid Mist	2/10/2016	0.0004 lb/million Btu	0.011 lb/million Btu	Yes
Notes: The source test report was reviewed and approved in a memorandum from Gary Saunders of the SSCB on June 23, 2016.				

The permit will require NCRP to conduct a compliance test for CO and sulfuric acid mist within within 180 days of first startup of the boilers after completion of the Boiler Maintenance Project, unless another date is approved by NCDAQ.

No MRR is required to demonstrate compliance with the BACT limit for non-CISWI subject wood. However, the condition will remain in the permit because NCRP may fire only non-CISWI subject wood in the boilers in the future. Continued compliance is anticipated.

BACT Emission Limits for Burning Non-CISWI Subject Wood and Poultry Litter
PSD BACT emission limits for firing poultry litter and non-CISWI subject wood boilers (ID Nos. ES-1A and ES-1B) are being added under this permit application. The BACT limits and their derivation are provided in Section 4.0 below.

Increment Tracking
The Minor Source Baseline Date for a specific county is set by the date that the first complete PSD permit application for that county is submitted to the NCDAQ. This permit application (7800166.17C) represents the first PSD application for NO_X and $PM_{2.5}$ emissions in Robeson County. Therefore, this permit application triggers Minor Source Baseline dates for NO_X and $PM_{2.5}$ emissions for Robeson County. It should be noted that Minor Source Baseline dates have previously been triggered for Robeson County for SO_2 and PM_{10} emissions. The Minor Source Baseline Dates are provided in the table below.

County	Pollutant	Minor Source Baseline Date	Triggered by
Robeson	PM_{10} SO_2	03/23/79 03/23/79	Campbell Soup Campbell Soup
	$PM_{2.5}$ NO_X	10/29/2017 10/29/2017	NCRP NCRP

- <u>15A NCAC 02D .0614 "Compliance Assurance Monitoring" (CAM)</u> – CAM is applicable to any pollutant-specific emission unit, if the following three conditions are met:
  - the unit is subject to any (non-exempt: e.g. pre-November 15, 1990, Section 111 or Section 112 standard) emission limitation or standard for the applicable regulated pollutant.
  - the unit uses any control device to achieve compliance with any such emission limitation or standard.
  - the unit's precontrol potential emission rate exceeds either 100 ton per year (for criteria pollutants) or 10/25 tons per year (for HAPs).

Table 8 below provides a summary of the applicable regulations and control devices for the boilers at NCRP. As indicated in the table, the multiclones and the bagfilter are subject to CAM for PM control. No other units are subject to CAM as discussed below in the table.

Table 8 – CAM Analysis

Emission Source ID No.	Pollutant	Control Device ID No.	Applicable Emission Standard (Pollutant)	Estimated Potential Uncontrolled Emissions (tpy)	CAM Required?
Boilers (ID Nos. ES-1A and ES-1B)	PM PM_{10}	Multiclones (ID Nos. CD-1A2 and CD-1B2) Bagfilter (ID No. CD-1C).	02D .0503 02D .0530 02D .0524 02D .0530	1,356	Yes – Permit currently contains a CAM condition
	NO_X	SNCR (ID Nos. CD-1A3 and CD-1B3)	02D .0530	392	No – A CEMS is required for NO_x to ensure compliance. Per 64.2(b)(vi), sources are exempt from CAM for emission limitations for which a TV permit specifies a continuous compliance determination method, such as CEMS.
	SO_2	DSI(ID No.CD-1C4)	02D .0530	1,507	No – A CEMS is required for SO_2 to ensure compliance. Per 64.2(b)(vi), sources are exempt from CAM for emission limitations for which a TV permit specifies a continuous compliance determination method, such as CEMS.
	HCl	DSI (ID No. CD-1C4)	02Q .0317 for avoidance of 02D .1111	-~50	No – The SNCR controls are operated to ensure emissions of HCl remain below major levels.

Notes:

- Emissions as reported in Permit Application No. 78000166.17C.
- Uncontrolled emissions of HCl assume a control efficiency of the DSI of 80% for acid gases.
- Emissions above do not include startup on No. 2 fuel.

The Permittee must ensure the PM and PM_{10} emitted from the two boilers (ID Nos. ES-1A and ES-1B) are controlled by the two multiclones (ID Nos. CD-1A2 and CD-1B2) and the bagfilter (ID No. CD-1C). NCRP has elected to use COMS to measure opacity for CAM. An excursion under CAM is defined as a 3-hour block average value of opacity greater than 12%. The 3-hour block average is calculated by averaging the 30, six-minute opacity average readings in a 3-hour period. Therefore, there are eight periods of 3-hour block average in a day (midnight to midnight). When the facility cannot provide data for any 3-hour block, it is reported as monitor downtime in the quarterly/semi-annual excessive emission reports and reviewed in line with good operation and maintenance practices for the COMS. Continued compliance is anticipated.

- 15A NCAC 02D .1100 "Control of Toxic Air Pollutants" – This rule is state enforceable only. The facility controls emissions of NO_x using a non-catalytic reduction system that requires aqueous ammonia. The aqueous ammonia storage tank (ID No. ES-15) is subject to 02D .1100 for ammonia. As part of this PSD application, NCRP also conducted air dispersion modeling to demonstrate compliance with NC Air Toxics for other toxic air pollutants (TAPs) associated with the PSD modification. More detail on the air dispersion modeling and compliance with NC Air Toxics is provided below in Section 5.8.

- 15A NCAC 02D .1111 "Maximum Achievable Control Technology (MACT)" – NCRP has accepted an avoidance condition (see discussion of avoidance condition below) to be classified as an area source of HAPs. As an area source, the boilers are subject to the "NESHAP for Areas Sources: Industrial, Commercial, and Institutional Boilers," 40 CFR 63 Subpart JJJJJJ (also referred to as GACT Subpart 6J). The boilers were constructed prior to June 4, 2010 and are considered existing boilers under this rule. Additionally, the boilers fall in the biomass subcategory under the rule, which "includes any boiler that burns any biomass and is not in the coal subcategory."

  Existing biomass boilers do not have emission standards, but they do have work practice standards under GACT Subpart 6J, including biennial tune-ups and a one-time energy assessment. The compliance date for the one-time energy assessment was due by March 21, 2014, as specified in 40 CFR 63.11196(1)(3). Lumberton Energy, LLC (the former owners) completed the one-time energy assessment on April 17, 2014.

  The boilers (ID Nos. ES-1A and ES-1B) did not operate between the effective date of 40 CFR 63 Subpart JJJJJJ and the compliance date of March 21, 2014. The initial tune-up on boiler ES-1B was completed on September 18, 2015 and the initial tune-up on boiler ES-1A was completed on September 24, 2015. A biennial tune-up was required no more than 25 months after these dates. The most recent compliance inspection report indicated the most recent tune-ups were completed on August 7, 2020,[5] with the next tune-up required no later than September 7, 2022. In accordance with 40 CFR 63.11223(b)(7), if the boilers are not in operation at that time, the periodic tune-up on these boilers must be conducted within 30 days of startup. Continued compliance is anticipated.

  The Boiler Maintenance Project as described in the application addendum submitted on June 23, 2021 does not constitute reconstruction under GACT 6J. As defined in 40 CFR Part 63.2, reconstruction means, in part, "the replacement of components of an affected or a previously nonaffected source to such an extent that… [t]he fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable new source." NCRP estimates the total project cost of the Boiler Maintenance Project at $4.2 million, while the cost to replace two 12.5-Megawatt electric (MWe), poultry litter-fired boilers is estimated at $100 million. Thus, the Boiler Maintenance Project is less than 50% of the fixed capital costs, and the boilers at NCRP remain classified as existing sources under GACT Subpart 6J.

[5] See compliance inspection report from Evangelyn Lowery-Jacobs dated 09/11/2020.

- <u>15A NCAC 02Q .0317 "Avoidance Conditions</u>" – NCRP has accepted a facility-wide avoidance conditions for avoidance of 15A NCAC 02D .1111, Maximum Achievable Control Technology. The permit currently limits the emissions of any single HAP to less than 10 tons per year and to less than 25 tons per year for any combination of HAPs for to avoid becoming a major source of HAPs.

  HCl and chlorine are the largest quantity HAPs emitted from the boilers. The facility maintains emissions of these HAPs using low chlorine wood and the DSI system (ID No. CD-1C4). The control efficiency of the sorbent injection is expected to be 80% to 95% for acid gases such as HCl.

  NCRP was required to conduct a stack test within 180 days of startup of Air Permit No. 05543T21 to verify emissions of HCl and chlorine and to establish operating parameters for the sorbent injection systems, if necessary. Source testing for these limitations was conducted on December 22, 2016, and the results are presented in Table 9. Because the sorbent injection systems were not required during testing, the operating parameters have not yet been established.

  NCRP ensures compliance with 02Q .0317 by calculating monthly HAP emissions, including HCl and chlorine emissions, and submitting consecutive 12-month totals for facility-wide HAP emissions semiannually. The permit includes equations for calculation the HCl and chlorine emissions from the boilers (ID Nos. ES-1A and ES-1B). When poultry cake was permitted as fuel for the boilers under Air Permit No. 05543T27 issued on April 15, 2020, the HCl and chlorine emissions were inadvertently omitted from these equations. This oversight will be corrected as part of this current permit modification, by updating the emission equations to account for HCl and chlorine emissions from the combustion of poultry cake in the boilers.

Table 9 – Source Testing for HAP Emissions				
Pollutant	**Test Results**	**Emission Limit**	**Regulation**	**Compliance**
HCl	0.00064 lb/MMBtu	0.00663 lb/MMBtu	15A NCAC 02Q .0317 15A NCAC 02D .1111	Yes
Cl_2	<6.83E-06 lb/MMBtu	1.8E-03 lb/MMBtu	15A NCAC 02Q .0317 15A NCAC 02D .1111	Yes
<u>Notes:</u> Testing occurred on December 22, 2016 and source test report reviewed and approved in a memorandum from Brent Hall of the SSCB on February 20, 2017.				

The permit will require NCRP to conduct additional source test to verify emissions of HCl and chlorine and to establish operating parameters for the sorbent injection systems. The source testing must be conducted and test results submitted within 180 days of first startup of the boilers after completion of the Boiler Maintenance Project, unless another date is approved by NCDAQ. Additional source testing is required at 50%, 70%, and 90% poultry litter fuel mixes to ensure the HAP avoidance limits can be met over the range of poultry litter blends.

NCRP is also required to calculate annual HCl and chlorine emissions monthly, and report emissions semiannually to ensure compliance with the HAP avoidance limit. Emissions of HCl and chlorine are determined with equations using the emission factors developed via testing, the higher heating value of each fuel, and the usage of each fuel type fired in the boilers. Higher heating value and the fuel usage for the poultry cake is being added to the HCl and chlorine emission equations as part of this permit modification.

- 15A NCAC 02Q .0400 "Acid Rain Procedures" – The boilers (ID Nos. ES-1A and ES-1B) at NCRP are currently subject to the Acid Rain Program in accordance with 40 CFR 72 and 15A NCAC 02Q .0400. Even though the boilers no longer burn coal, natural-gas, or fuel-oil, (except for the small amount during startup), the boilers are still considered fossil-fuel fired boilers under the Acid Rain Program. As specified in 40 CFR 72.2, fossil fuel-fired "means the combustion of fossil fuel or any derivative of fossil fuel, alone or in combination with any other fuel, *independent of the percentage of fossil fuel consumed in any calendar year* (expressed in MMBtu)" [emphasis added]. It should be noted that this definition is not found in the PSD regulations under 40 CFR Part 51, and thus, the boilers are not considered fossil fuel-fired boilers under PSD.

  NCRP submitted application forms to renew the existing Acid Rain permit (part of current Title V permit) on January 27, 2017. Thus, the existing Acid Rain permit can be renewed for five years. The effective and expiration dates of renewed Acid Rain permit are aligned with the effective and expiration dates of the renewed Title V permit.

  As specified in 40 CFR 76.1(a), the affected units (ID Nos. ES-1A and ES-1B) are not subject to a NO_X emission limitation under 40 CFR Part 76 because they are not subject to an Acid Rain emissions limit for SO_2 under Phase I or Phase II of the Clean Air Act.

- Senate Bill 3 (Session Law 2007-397) – In accordance with NCGS 62-133.8(g) in the Renewable Energy and Energy Efficiency Portfolio Standard (REPS), a facility wishing to be categorized as a new renewable energy facility that delivers electric power to an electric power supplier must meet BACT. NCDAQ determines on a case-by-case basis the BACT for a facility that would not otherwise be required to comply with BACT pursuant to the PSD emissions program. Such BACT analyses are referred to as State BACT or SB3 BACT (for Senate Bill 3 (Session Law 2007-397)).

  SB3 BACT Emission Limits for Firing Non-CISWI Subject Wood Only
  When non-CISWI subject wood was added as fuel to the permit under Air Permit No. 05543T18 issued on February 14, 2012, PSD BACT conditions were added for CO and sulfuric acid mist (see discussion above). Other PSD regulated pollutants did not trigger PSD BACT, and a permit condition for SB3 BACT for these other pollutants was added to the permit at that time. The SB3 BACT emission limits for burning non-CISWI subject wood only in the boilers are shown in the table below.

Table 10 – SB3 BACT Emission Limits for Firing Non-CISWI Subject Wood Only

Emission Source	Pollutant	Emission Limits	Control Technology
Boilers (ID Nos. ES-1A and ES-1B)	PM/PM_{10}	0.036 lb/million Btu (both filterable and condensable) [stack test: 3-run average]	multiclone and bagfilter
	$PM_{2.5}$	0.011 lb/million Btu (both filterable and condensable [organic and inorganic including sulfuric acid mist]) [stack test: 3-run average]	multiclone and bagfilter

Table 10 – SB3 BACT Emission Limits for Firing Non-CISWI Subject Wood Only			
Emission Source	**Pollutant**	**Emission Limits**	**Control Technology**
	Sulfur dioxide	0.025 lb/million Btu [CEM: 30-day rolling average]	use of low sulfur wood
	Nitrogen oxides	0.125 lb/million Btu [CEM: 30-day rolling average]	selective non-catalytic reduction
	Volatile organic compounds	0.03 lb/million Btu [stack test: 3-run average]	good combustion control
	Mercury	5 x 10^{-6} lb/million Btu [stack test: 3-run average]	Bagfilter

NCRP demonstrated compliance with the emission limits during testing conducted December 15 – December 30, 2015, with subsequent testing performed on February 11, 2016. The results of the testing are provided in Table 11 below. As shown in the table, the facility tested in compliance with the SB3 BACT emission limits for non-CISWI subject wood during subsequent tests.

Table 11 – Source Testing for SB3 BACT Limits				
Pollutant	**Test Date**	**Test Results**	**Emission Limit**	**Compliance**
PM/PM_{10}	12/18/2015	0.035 lb/million Btu	0.036 lb/million Btu	Yes
$PM_{2.5}$	12/18/2015	0.032 lb/million Btu	0.011 lb/million Btu	No
SO_2	12/20/2015	0.000 lb/million Btu	0.025 lb/million Btu	Yes
NO_x	12/17/2015	0.107 lb/million Btu	0.125 lb/million Btu	Yes
VOC	12/17/2015	0.001 lb/million Btu	0.03 lb/million Btu	Yes
Hg	12/19/2015	1.5 x 10^{-8} lb/million Btu	5 x 10^{-6} lb/million Btu	Yes
PM/PM_{10}	2/11/2016	0.012 lb/million Btu	0.036 lb/million Btu	Yes
$PM_{2.5}$	2/11/2016	0.011 lb/million Btu	0.011 lb/million Btu	Yes
Notes: The source test report was reviewed and approved in a memorandum from Gary Saunders of the SSCB on June 23, 2016.				

The permit will require NCRP to conduct an initial performance test to demonstrate compliance with the emissions limits for the pollutants listed in Table 11 above while firing non-CISWI subject wood only in the boilers (ID Nos. ES-1A and ES-1B). The source testing must be conducted and test results submitted within 180 days of first startup of the boilers after completion of the Boiler Maintenance Project, unless another date is approved by NCDAQ.

Continuing compliance with state BACT for NO_x and SO_2 are demonstrated via CEMS. MRR requirements 15A NCAC 02D .0504 are sufficient to ensure compliance with the SB3 BACT emission limits for PM/PM_{10}, $PM_{2.5,}$ and mercury. No MRR is required for the SB3 BACT emission limit for VOC. Continued compliance is anticipated.

SB3 BACT Emission Limits for Firing Non-CISWI Subject Wood and Poultry Litter
NCRP accepted a facility-wide PSD avoidance limit as part of Air Permit No. 05543T21 issued on May 29, 2015 to remove coal, No. 2 and No. 4 fuel oil, tire-derived fuels, pelletized paper, and fly ash briquettes from the fuel mix and add non-CISWI poultry litter as a permitted fuel for its two boilers (ID Nos. ES-1A and ES-1B). This 2015 modification was not considered a major modification under PSD at that time. Thus, no PSD BACT analyses were required, and NCRP submitted SB3 BACT analyses to NCDAQ on March 19, 2015 for firing of non-CISWI subject

wood/poultry litter blends in boilers (ID Nos. ES-1A and ES-1B) for CO, VOC, NOx, SO_2, sulfuric acid mist, PM (including mercury and lead) and greenhouse gases.

Because the 2015 modification was subsequently deemed to be a major modification under PSD, NCRP conducted and submitted BACT analyses under PSD for firing non-CISWI subject wood/poultry litter blends in boilers (ID Nos. ES-1A and ES-1B) in this permit application (7800166.17C). The PSD BACT analyses included all pollutants noted above except for mercury and lead. NCDAQ determined the PSD BACT analyses presented in this permit application (7800166.17C) meet the requirements under NCGS 62-133.8(g). Thus, no SB3 BACT analyses are required for CO, VOC, NOx, SO_2, sulfuric acid, PM, and greenhouse gases for firing poultry litter and non-CISWI subject wood in the boilers.

However, SB3 BACT analyses are required for mercury and lead (which are not subject to PSD BACT for this modification) when firing poultry litter and non-CISWI subject wood in the boilers, and the analyses were submitted to NCDAQ on March 19, 2015. Jeff Twisdale of NCDAQ reviewed the SB3 BACT analysis and provided the results in a memorandum dated May 10, 2018. The SB3 BACT emission limits and control technology for mercury and lead are provided in Table 12.

Table 12 – SB3 BACT Emission Limits and Required Control Technology for Firing Poultry Litter and Non-CISWI Subject Wood

Emission Source	Pollutant	Emission Limits	Control Technology
Boilers (**ID Nos. ES-1A and ES-1B**)	Lead	2.86 5 x 10^{-5} lb/million Btu [stack test: 3-run average]	Multiclones and baghouse
	Mercury	5.0 x 10^{-6} lb/million Btu [stack test: 3-run average]	Multiclones and baghouse

The permit will require NCRP to conduct a performance test to demonstrate compliance with the emissions limits for mercury and lead while firing a minimum of 30% poultry litter blend in boilers (ID Nos. ES-1A and ES-1B). The source testing must be conducted and test results submitted within 180 days180 days of first startup of the boilers after completion of the Boiler Maintenance Project, unless another date is decided by NCDAQ. NCRP must conduct subsequent performance tests within 60 days of the date that the percentage of poultry litter firing exceeds 50%, 70% and 90% of total heat input to the boilers (ID Nos. ES-1A and ES-1B). Additionally, NCRP must follow the MRR requirements under 15A NCAC 02D .0503 for the bagfilter (ID No. CD-1C) to ensure continued compliance with the SB3 BACT limits for mercury and lead.

- 40 CFR Part 97, Subparts, AAAAA, BBBBB, and CCCCC, Cross State Air Pollution Rule [CSAPR] – The boilers at NCRP were previously subject to the 15A NCAC 02D .2400, "Clean Air Interstate Rules" (CAIR). When this rule expired on February 1, 2016, NCDAQ reopened the permit to remove references to CAIR and replace them with CSAPR. Air Permit No. 05543T23 was issued on March 28, 2016 with the CSAPR rules. Continued compliance is anticipated.

4.0 Prevention of Significant Deterioration

The PSD regulations are designed to ensure that the air quality in current attainment areas does not significantly deteriorate beyond baseline concentration levels. PSD regulations specifically apply to the construction of United States Environmental Protection Agency (US EPA)-defined Major Stationary Sources in areas designated as attainment or unclassified attainment for at least one of the criteria pollutants. North Carolina has incorporated US EPA's PSD regulations (40 CFR 51.166) into its air pollution control regulations in 15A NCAC 02D .0530.

4.1 PSD Applicability

Under PSD requirements all major new or modified stationary sources of air pollutants regulated and listed in this section of the Clean Air Act must be reviewed and approved prior to construction by the permitting authority. A major stationary source is defined as any one of 28 named source categories that has the potential to emit 100 tons per year of any regulated pollutant or any other stationary source that has the potential to emit 250 tons per year of any PSD regulated pollutant. NCRP is not in one of the 28 named source categories and is not subject to the 100-tpy threshold.
Prior to modification to add poultry litter as a fuel, the facility was considered a major source under PSD. On March 19, 2015, NCRP submitted an air permit application to NCDAQ to remove coal, No. 2 and No. 4 fuel oil, tire-derived fuels, pelletized paper, and fly ash briquettes from the fuel mix and add non-CISWI poultry litter as a permitted fuel for its two boilers (ID Nos. ES-1A and ES-1B). Air Permit 05543T21 allowing the boilers to fire only non-CISWI subject wood and poultry litter was issued on May 29, 2015. As noted in Section 1.1 above, emissions of CO when firing non-CISWI subject wood and poultry litter in the boilers after permit issuance were higher than anticipated, and facility-wide emissions exceeded 250 tpy as measured with CEMS in September 2016, while the facility was operating under the First SOC. Therefore, the 2015 modification is considered a significant modification under PSD. As such, it was necessary for NCRP to apply for and obtain a retroactive PSD permit and perform the associated BACT review and impact analysis required under the PSD program, for this modification. This retroactive PSD permit is for all NSR pollutants, excluding lead, for which the emissions increase does not exceed the SER, as shown above in Table 1.

The elements of a PSD review are as follows:

1) A BACT Determination as determined by the permitting agency on a case-by-case basis in accordance with 40 CFR 51.166(j),
2) An Air Quality Impacts Analysis including Class I and Class II analyses, and
3) An Additional Impacts Analysis including effects on soils and vegetation and impacts on local visibility in accordance with 40 CFR 51.166(o).

4.2 BACT Analysis

Under PSD regulations, the determination of the necessary emission control equipment is developed through a BACT review. The regulations define BACT as:

> An emissions limitation...based on the maximum degree of reduction for each pollutant... which would be emitted from any proposed major stationary source or major modification which the reviewing authority, on a case-by-case basis, taking into account energy, environment, and

economic impacts and other costs, determines is achievable... for control of such a pollutant. [40 CFR 51.166 (b)(12)]

The BACT requirements are intended to ensure that the control systems incorporated in the design of the proposed facility reflect the latest control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the facility. Additionally, the BACT analysis may consider the impacts of non-criteria pollutants and unregulated toxic air pollutants, if any are emitted, when making the BACT decision for regulated pollutants. Each pollutant subject to a PSD review must meet the criteria of BACT, which refers to the maximum amount of emission reduction currently possible with respect to technical application and economic, energy, and environmental considerations.

Because equipment within categories of sources varies widely, it is difficult to establish a uniform BACT determination for a particular pollutant or source. Economics, energy, and environment in combination with the unique functions of the source and engineering design, require BACT to be determined on a case-by-case basis. In most instances BACT may be defined through an emission limitation. In cases where this is impossible, BACT can be defined by the use of a particular type of control device and its achievable emission reduction efficiency. In no event can a technology be recommended that would not comply with any applicable standard of performance established pursuant to section 111 or 112 of the Clean Air Act.

The BACT analyses provided by NCRP for the proposed project were conducted in accordance with NCDAQ regulations and were consistent with the US EPA's five step "top-down" BACT process. The "top down" methodology results in the selection of the most stringent control technology in consideration of the technical feasibility and the energy, environmental, and economic impacts. Control options are first identified for each pollutant subject to BACT and evaluated for their technical feasibility. Options found to be technically feasible are ranked in order of their effectiveness and then further evaluated for their energy, economic, and environmental impacts. In the event that the most stringent control identified is selected, no further analysis of impacts is performed. If the most stringent control is ruled out based upon economic, energy, or environmental impacts, the next most stringent technology is similarly evaluated until BACT is determined.

After establishing the baseline emissions levels required to meet any applicable NSPS, NESHAPs, or SIP limitations, the "top-down" procedure followed for each pollutant subject to BACT is outlined as follows:

- Step 1: Identify of all available control options - from review of US EPA RACT/BACT/LAER Clearinghouse (RBLC), agency permits for similar sources, literature review and contacts with air pollution control system vendors.
- Step 2: Eliminate technically infeasible options - evaluation of each identified control to rule out those technologies that are not technically feasible (i.e., not available and applicable per US EPA guidance).
- Step 3: Rank remaining control technologies - "Top-down" analysis, involving ranking of control technology effectiveness.
- Step 4: Evaluate most effective controls and document results – Economic, energy, and environmental impact analyses are conducted if the "top" or most stringent control technology

is not selected to determine if an option can be ruled out based on unreasonable economic, energy or environmental impacts.
- Step 5: Select the BACT – the highest-ranked option that cannot be eliminated is selected, which includes development of an achievable emission limitation based on that technology.

4.3. References Used to Identify Control Technologies

The references and methodologies discussed in this section were used to identify control technologies considered in the BACT analyses for the boilers found in Sections 4.4 through 4.9.

RACT/BACT/LAER Clearinghouse (RBLC)
An investigation was performed to identify current regulatory BACT/LAER determinations for wood-fired boilers. When considering the BACT/LAER decisions summarized for this permit modification, it is important to note that NCRP fires wood and poultry litter in its boilers. Control technology identified in RBLC was for biomass and wood-fired boilers and may not be feasible for NCRP's boilers due to differences between poultry litter and wood.

The investigation involved a review of US EPA's RBLC, which included information on BACT and LAER decisions throughout the country. Specifically, NCDAQ performed searches of the RBLC database for the years 2008 – 2018 using the following categories:

- Combustion Units firing biomass (includes wood, wood waste, biogases, and other biomass) for utility boilers > 250 million Btu/hr (RBLC Code 11.120);
- Industrial size furnaces/boilers 100 million Btu/hr to 250 million Btu/hr (RBLC Code 12.120); and
- Commercial/Institutional size furnaces/boilers (<100 million Btu/hr) (RBLC Code 12.120).

Boilers firing fuel types other than wood, biomass, or bark were culled from the initial search results. The refined search results encompassed 56 boilers at 43 different facilities. Control technology for specific pollutants emitted from these boilers are discussed below in Sections 4.4 through 4.9.

Literature Search for Similar Sources
Literature on control technology used for biomass boilers was reviewed in the effort to identify control technologies for NCRP. The literature search included, but was not limited to, resources from US EPA and the Northeast States for Coordinated Air Use Management (NESCAUM).

NSR Permits for Similar Sources
To date only one other facility firing wood/poultry litter in its boilers has been identified with BACT limits. This facility is Fibrominn Biomass Power Plant (Fibrominn) in Benson, Minnesota. The biomass power plant at Fibrominn consists of one boiler, fueled principally with poultry litter. Vegetative biomass may also be burned. The facility generates an average of 50 MW of electricity for export and has a peak electrical export capacity of 55 MW. Construction began in 2005 and the plant began operating in 2007. The facility has since ceased operation and was demolished in August 2019.

Unlike the boilers at NCRP, which were originally designed to burn coal, the boiler at Fibrominn was designed specifically to burn poultry litter as its main source of fuel. Consequently, the BACT limits developed for Fibrominn may not be achievable for NCRP, which has older boilers that were retrofitted to fire wood and poultry litter. The Fibrominn BACT limits are provided in the table below and will be considered in the BACT analyses for NCRP below as appropriate.

Table 13 – BACT Limits for Fibrominn

Pollutant	BACT Emission Limit	Selected Control Technology
CO	0.24 lb/MMBtu (CEMS: 24-hr daily average)	Good combustion technology
NO_X	0.16 lb/MMBtu (CEMS: 30-day rolling average)	Selective non-catalytic reduction
SO_2	0.07 lb/MMBtu or 80% control, whichever is least stringent (CEMS: 24-hour daily geometric mean concentration or reduction percentage)	Spray Dryer Absorber (SDA)
PM	0.020 lb/MMBtu (stack test: 3-1 hour run average)	Baghouse/SDA
PM10	Limit to be proposed after completing of initial stack test	Baghouse/SDA

Notes:
BACT emission limits and selected control technologies were obtained from Air Permit No. 15100038- 001 IS issued to Fibrominn LLC on 10/23/02, retrieved from https://www.pca.state.mn.us/sites/default/files/15100038-001-aqpermit.pdf

4.4. Carbon Monoxide and Volatile Organic Compound BACT

4.4.1 Identify Control Technologies

The most common method identified from the RBLC search to control emissions of CO and/or VOC from wood fired boilers was good combustion practices, which included the use of over-fire air (OFA). "No controls" was the second most noted method. Other methods include catalytic oxidation, regenerative thermal oxidation, and proper boiler design,

Based on the review of RBLC, relevant literature, and knowledge of the industry as discussed in Section 4.3.1 above, the following control technologies were considered in the BACT analyses for CO and VOC emissions from the wood/poultry litter-fired boilers:

- Catalytic Oxidation,
- Thermal Oxidation, and
- Good operation practices.

<u>Catalytic Oxidation</u>
Catalytic oxidation is a post-combustion control that oxidizes CO to carbon dioxide (CO_2) and causes destruction of VOCs in the presence of a catalyst. An acceptable flue gas temperature range for catalyst operation is 450 ^{o}F to 1100 ^{o}F. The oxidation process takes place spontaneously, without requiring any additional reactants in the flue gas stream. The catalyst serves to lower the activation energy necessary for complete oxidation of the incomplete combustion products. Catalytic oxidation has been used to control CO and VOC on combustion turbines firing natural gas. Oxidation catalysts are susceptible to deactivation due to impurities present in the exhaust gas stream. Arsenic, iron,

sodium, phosphorus, and silica will act as catalyst poisons causing a reduction in the catalyst activity and pollutant removal efficiencies. Oxidation catalysts are also subject to masking and/or blinding by fly ash contained in the exhaust gas stream of a biomass fired boiler. Because of the potential for oxidation catalyst fouling and/or deactivation, the catalyst must be located downstream of the control device for PM. Therefore, a supplemental burner will be necessary to reheat the flue gas to requisite temperatures. Additionally, the systems can be sensitive to the VOC inlet stream flow conditions and can contribute to deactivation.

Thermal Oxidization

Thermal oxidation causes the destruction of CO and VOC through a separate combustion process. The process destroys CO by passing the gas stream through a high temperature region. It consists of a combustion chamber, a burner, and heat/exchanger/shell that preheats the incoming air. Thermal oxidizers are usually operated between 1500 ^{o}F and 1800 ^{o}F to achieve an 85% reduction in CO. The thermal oxidizer components are subject to fouling by PM. Therefore, the thermal oxidizer must be located downstream of the PM control device. Additionally, a thermal oxidizer requires a source of supplemental heat, to raise the exhaust stream to the required oxidation temperature.

Good Combustion Practices

Good combustion practices are based on proper boiler design and proper operation of the boiler. Good combustion practices mean operation of the boiler at high combustion efficiency thereby reducing products of incomplete combustions. They include sufficiently high combustion temperatures, adequate residence time, adequate excess air, and adequate turbulence to ensure sufficient mixing and available oxygen for efficiency combustion. Reducing emissions of CO and VOCs can be accomplished by increasing the air available for combustion and/or combustion temperature, with taking care to avoid increase in NOx emissions.

Good combustion practices can also include the use of OFA. OFA air is injected into the active flame zone to provide turbulence needed to completely mix the to ensure good combustion.[6] If there is a lack of OFA, large quantities of CO and other combustibles can travel through the system unreacted and out of the stack.[7]

Fibrominn used good combustion practices to control carbon monoxide and VOC from its boiler, prior to shut down and demolition of the Benson, Minnesota facility in August 2019.

4.4.2 Eliminate Technically Infeasible Options

Catalytic Oxidation

Catalytic oxidation requires detailed knowledge of the influent stream. The composition of the poultry litter is expected to vary, so the presence of compounds that could potentially act as catalyst poisons is unknown. Therefore, it is considered technically infeasible to use catalytic oxidation as the control technology for CO and VOC from the wood / poultry-litter fired boilers.

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6 Combustion Air. Retrieved on 08/26/2021 from https://www.sciencedirect.com/topics/engineering/combustion-air

7 Three Ways to Optimize Solid Fuel Combustion. Retrieved on 08/26/2021 from https://www.hurstboiler.com/biomass_boiler_systems/three-ways-to-optimize-solid-fuel-combustion

<u>Thermal Oxidation</u>
Thermal oxidation has primarily been applied to industrial exhaust streams to reduce VOC and HAP emissions. The conversion of CO into CO_2 is a by-product of the process. Thermal oxidation is primarily applicable only to gas streams with high levels of CO, VOCs and HAPs, such as chemical processing facilities. Due to the expected concentration of CO from the boilers, this control is considered infeasible because the CO emission rate is not expected to improve from the add-on thermal oxidation process.

4.4.3 Rank Remaining Control Technologies by Effectiveness

NCRP determined that good combustion practices are the only demonstrated and technically feasible control measure for CO and VOC reduction for the wood/poultry litter-fired boilers. Good combustion practices have shown to provide control efficiencies up to 50% of CO and VOC emissions.

4.4.4 Evaluate Technically Feasible Control Options

NCRP currently uses good combustion practices, including OFA, at its facility. There are no additional costs or significant collateral environmental issues that would eliminate good combustion practices as BACT.

4.4.5 Select BACT for CO and VOC Emissions

NCRP proposes good combustion practices as the selected BACT for CO emissions from the wood/poultry litter-fired boilers. NCRP proposes a BACT emission limit of 0.65 lb of CO /million Btu on a 30-day rolling average from each boiler when combusting a mix of wood and poultry litter, during normal operations. The BACT limit represents the lowest numerical value that can be achieved on a 30-day rolling average when combusting wood and poultry litter as fuel. Compliance with the CO emission limit will be determined using a CEMS certified in accordance with Performance Specifications 4 and 6, Appendix A, 40 CFR Part 60.
Because emissions during startup and shutdown are highly variable for certain parameters including CO emissions, NCRP proposes separate BACT emission limits for CO during these events. The proposed BACT emission limits are as follows:

Pollutants	BACT Emission Limit	Averaging Period
CO	208.8 lb/hr (startup and shutdown when one boiler is idle)	3-hour rolling average as measured via CEMS
	526.2 lb/hr (startup and shutdown when both boilers are operating)	3-hour rolling average as measured via CEMS

The BACT limit represents the highest numerical value observed during a startup event occurring in July 2017, as measured with CEMS. These values were also used in the air dispersion modeling that demonstrated compliance with the Class II Area Significant Impact Level (SIL) for CO, as discussed in detail below in Section 5.1. Compliance during startup and shutdown will be achieved on a 3-hour rolling average when combusting wood and poultry litter as fuel. Compliance with the CO emission limit will be determined using a CEMS certified in accordance with Performance Specifications 4

and 6, Appendix A, 40 CFR Part 60. NCRP proposes good combustion practices to minimize emissions as the selected BACT for CO during startup and shutdown events.
NCRP also proposes good combustion practices as the selected BACT for VOC emissions from the wood/poultry litter-fired boilers. NCRP proposes a BACT emission limit of 0.03 lb of VOC /million Btu boiler when combusting a mix of wood and poultry litter, and this limit is the same as the BACT limit for burning non-CISWI subject wood only. Compliance with the good combustion practices for VOC emissions will be determined by following the requirements under GACT Subparts 6J, which includes biennial tune-ups for the boilers and a one-time energy assessment.

NCDAQ concurs with NCRP's proposed BACT and emission limits for VOC and CO emissions from the wood/poultry litter-fired boilers.

4.5 Nitrogen Oxides BACT

4.5.1 Identify Control Technologies

The most common method identified from the RBLC search to control emissions of NO_X from wood fired boilers was selective non-catalytic reduction (SNCR). Selective catalytic reduction (SCR) was the second most noted method. Other methods include flue gas recirculation, good combustion practices, "no controls," regenerative thermal oxidation, and proper boiler design.

Based on the review of RBLC, relevant literature, and knowledge of the industry as discussed in Section 4.3.1 above, the following control technologies were considered in the BACT analysis for NO_x emissions from the wood/poultry litter-fired boilers:
- Selective catalytic reduction,
- Regenerative selective catalytic reduction (RSCR),
- Selective non-catalytic reduction, and
- Flue gas recirculation (FGR)

<u>SCR</u>
SCR is a post-combustion control technology that involves a catalyst bed installed upstream of the PM control device, between the boiler economizer and combustion preheater. The temperature range of flue gas at this point is between 650 ^{o}F and 750 ^{o}F. Ammonia is injected into the flue gas stream and catalytically reduces the NOx to molecular nitrogen and water. Emission reduction of 70-90% can be achieved from this technology.

<u>RSCR</u>
RSCR is a specific type of SCR capable of achieving a NOx removal efficiency of greater than 80%. It is called regenerative SCR because this technology has a highly efficient direct heat transfer that results in an overall heat recovery of greater than 95%. The "hot-side" of the SCR is a conventional SCR system (described above) that is located prior to the air heater and upstream of the PM control device where the flue exhaust stream is the optimum temperature range of 650 ^{o}F to 700 ^{o}F. The "cold side" of the RSCR is located downstream of the PM control device. The flue gas temperature at this location is lower than the required temperature range for optimum catalytic reduction in the "hot-side" SCR system, so a natural gas or oil-fired duct burner is used to provide supplemental heat to increase temperature to the appropriate range. Prior to the flue gas entering the RSCR, ammonia is injected to ensure it is well mixed with the flue gas. Then the flue gas enters the RSCR and passes upward through a ceramic bed that has been heated by the duct burner. The hot ceramic bed

increases the temperature of the flue gas to a maximum of 650 °F prior to passing through the catalyst bed.

SNCR

SNCR is the NOx control measure commonly used for biomass boilers. SNCR is a post combustion control technology that involves ammonia or urea injection but not the presence of a catalyst. SNCR, like SCR, involves the reaction of NOx with ammonia by which NOx is converted to molecular nitrogen and oxygen. Without the use of a catalyst, the NOx reduction reaction temperature must be tightly controlled between 1600 °F and 1800 °F for optimum efficiency. Below 1600 °F, ammonia will not fully react, resulting in unreacted ammonia that is emitted to the atmosphere (referred to as ammonia slip). If the temperature is above 2200 °F, the ammonia will be oxidized resulting in an increased level of NOx emissions.

Fibrominn used SNCR to control NOx emissions from its boiler prior to shut down and demolition of the Benson, Minnesota facility in August 2019.

FGR

FGR technology is based on reducing thermal NO_X formation by introducing inert flue gas, which reduces oxygen concentration and absorbs heat, thereby reducing peak flame temperatures. FGR involves extracting a portion of the flue gas from the economizer or air heater outlet and reintroducing it into the furnace through a separate duct and hot gas fan to the combustion air duct that feeds burners (i.e., the windbox). The recirculated flue gas is mixed with the combustion air to reduce peak flame temperature thereby suppressing NO_X formation. FGR is most effective for natural gas and low nitrogen-containing fuels because it reduces thermal NO_X.

4.5.2 Eliminate Technically Infeasible Options

SCR and RSCR

SCR is not an option on wood/poultry litter-fired units due to the high levels of catalyst poisons and particulates present in the ash. The alkaline nature of wood ash due to high content of soluble potassium or sodium has been known to deactivate the SCR catalyst by poisoning and fouling. The potassium or sodium ions resembles the ammonia ion and may block access to the active sites on the catalyst causing deactivation or catalyst poisoning. Similarly, RSCR is also considered technically infeasible because it also relies on the use of a catalyst.

The use of RSCR and SCR can also form undesired side products such as isocyanic acid, nitrous oxide, ammonia, hydrogen cyanide and others under certain unfavorable conditions.[8] This characteristic makes these control options technically infeasible for controlling NOx emission from the NCRP boilers.

4.5.3 Rank Remaining Control Technologies by Effectiveness

The remaining technically feasible options are FGR and SNCR. These control technologies were ranked from the most stringent to the least stringent, as shown in the table below.

[8] NESCAUM (2008). *Controlling Emissions from Wood Boilers (DRAFT)* Retrieved from http://www.nescaum.org/

Control Technology	Approximate Control Efficiency (%)
SNCR	30 – 50%[9] 40–75% (for wood-fired stoker boilers) [10]
FGR	10 – 30% [11]

4.5.4 Evaluate Technically Feasible Control Options

NCRP has selected SNCR as the BACT for NOx emissions from the wood/poultry litter-fired boilers. Because the Permittee has selected the top-option for BACT, detailed economic, energy, and environmental information on the lower efficient option (i.e., FGR) is not required.

4.5.5 Select BACT for NOx

NCRP proposes SNCR as the selected BACT for NOx emissions from the wood/poultry litter-fired boilers. NCRP proposes a BACT limit of 0.17 lb of NOx /million Btu on a 30-day rolling average from each boiler when combusting a mix of wood and poultry litter as fuel, during normal operations. The BACT limit represents the lowest numerical value that can be achieved on a 30-day rolling average when combusting wood and poultry litter as fuel. Compliance with the NOx emission limit will be determined using a CEMS that meets the requirements of 40 CFR Part 75, except that unbiased values may be used.

Because emissions during startup and shutdown are highly variable for certain parameters including NO_X emissions, NCRP proposes separate BACT emission limits for NO_X during these events. The proposed BACT emission limits are as follows:

Pollutants	BACT Emission Limit	Averaging Period
NO_X	11.2 lb/hr (startup and shutdown when one boiler is idle)	3-hour rolling average as measured via CEMS
	39.2 lb/hr (startup and shutdown when both boilers are operating)	3-hour rolling average as measured via CEMS

The BACT limit represents the highest numerical value observed during a startup event occurring in July 2017, as measured with CEMs. These values were also used in the air dispersion modeling that demonstrated compliance with the Class II Area SIL for NO_X, as discussed in detail below in Section 5.1. Compliance during startup and shutdown will be achieved on a 3-hour rolling average when combusting wood and poultry litter as fuel. Compliance with the NOx emission limit will be determined using a CEMS that meets the requirements of 40 CFR Part 75, except that unbiased values may be used. NCRP proposes good combustion practices to minimize emissions as the selected BACT for NO_X during startup and shutdown events.

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[9] US EPA. EPA-452/F-030-031. *Air Pollution Control Technology Fact Sheet* -SNCR. Retrieved from https://www3.epa.gov/ttncatc1/cica/files/fsncr.pdf
[10] US EPA (2016) *EPA Air Pollution Control Cost Manual: Chapter 1 – SNCR.* Retrieved from https://www.epa.gov/sites/production/files/2017-12/documents/sncrcostmanualchapter7thedition20162017revisions.pdf
[11] US EPA (1999) EPA 456/F-99-006R. *Nitrogen Oxides (NOx): Why and How They Are Controlled*. Retrieved from https://www3.epa.gov/ttncatc1/dir1/fnoxdoc.pdf

NCDAQ concurs with NCRP's proposed BACT and emission limits for NOx from the wood/poultry litter-fired boilers.

4.6 Sulfur Dioxide BACT

4.6.1 Identify Control Technologies

The most common method identified from the RBLC search to control emissions of SO_2 from wood fired boilers was dry sorbent injection. The use of low sulfur fuel, including low sulfur fuel oil during startup, was the second most noted method. Other methods include good combustion practices and "no controls."

Based on the review of RBLC, relevant literature, and knowledge of the industry as discussed in Section 4.3.1 above, the following control technologies were considered in the BACT analysis for SO_2 from the wood/poultry litter-fired boilers:

- Dry flue gas desulfurization (FGD),
- Wet flue gas desulfurization, and
- Inherently low sulfur fuel

<u>Dry FGD</u>
Dry FGD is an established technology with removal efficiency of SO_2 in the range of 90%. Types of dry FGD control systems include spray dryer absorbers, circulating dry scrubbers, and DSI systems.

In a spray dryer absorber (SDA) control system, the combustion process exhaust stream passes through the spray dryer absorber upstream of a PM control device. An alkaline slurry (typically lime) is injected in the spray dryer absorber using rotary atomizer of fluid nozzles. The liquid sulfite/sulfate salts that form from the reaction of the alkaline slurry with SO_2 are dried by heat contained in the exhaust stream. Fabric filters are used on the PM control device, and the alkaline reagent may further react with the SO_2 that passes through the filter cake.

Circulating dryer scrubber technology uses flue gas, ash, and lime sorbent to form a fluidized bed in an absorber vessel. Water is added to the circulating dry scrubber absorber vessel to enhance the lime and SO_2 absorption reactions. Byproducts leave the absorber in the dry form with the flue gas for subsequent removal by the downstream PM control device.

A DSI system pneumatically injects a powdered sorbent directly into the furnace, the economizer, or the downstream ductwork. DSI systems typically use calcium or sodium based alkaline reagents. A DSI system requires no slurry equipment or reactor vessel because the sorbent is stored and injected dry into the flue duct where it reacts with the SO_2. The sulfite/sulfate salt reaction products are then removed using control equipment for PM. Newer DSI applications have achieved greater than 90% control efficiencies.

Fibrominn used a wet limestone in a SDA (considered a semi-dry technology) to control emissions of SO_2 prior to shut down and demolition of the Benson, Minnesota facility in August 2019.

Wet FGD
In a wet FGD system, the flue gas passes through a recirculating alkaline slurry that absorbs and neutralizes the SO_2. Most wet FGD systems use limestone or lime as the alkali source. The performance of a wet FGD system varies with individual unit design. However, removal efficiencies in the range of 98% are achievable. In the wet scrubbing process, the flue gas is contacted with an alkaline solution of slurry (typically lime or limestone) in an absorber. The temperature of the flue gas is reduced to its adiabatic saturation temperature and the SO_2 is removed from the flue gas by absorption and reaction with the alkaline medium. Resulting waste product is a slurry containing both reacted and unreacted alkaline materials. There are numerous design variations of wet scrubbers with wet limestone systems being the most common process used. Generally, for lower sulfur fuel, it is more difficult to achieve the higher percent sulfur removal rates. The range of SO_2 reduction efficiency at wet scrubber installations is higher than that for dry scrubbing.

Inherently Low Fuel
Wood is an inherently low sulfur fuel. Because SO_2 is generated during the combustion process as result of the thermal combustion of the sulfur contained in the fuel, the combustion of low sulfur fuel produces lower SO_2 emissions.

4.6.2 Eliminate Technically Infeasible Options

Wet FGD
Due to location and area restrictions at the facility, a wet FGD system would be required to be installed upstream of the baghouse used to remove PM. For this reason, wet FGD is not feasible as it is not recommended to introduce moisture into baghouse filters.

Inherently Low Fuel
Using inherently low sulfur fuel (wood) is not technically feasible because the fuel mixture will be up to 85% poultry litter. (Sulfur in poultry litter at NCRP has been measured to be as high as 1.3 percent by weight.[12]) Low sulfur wood would not significantly impact the SO_2 emissions because most of the sulfur will come from the poultry litter. Additionally, the precise composition of the poultry litter is variable, so the concentrations of sulfur in the mixture will also be variable.

4.6.3 Rank Remaining Control Technologies by Effectiveness

Dry FGD (i.e., DSI) is the only remaining control option that is technically feasible. Dry FGD may achieve removal of SO_2 up to 90% depending upon the concentration of the SO_2 in the flue gas.

4.6.4 Evaluate Technically Feasible Control Options

Depending on the type and size, dry FGD systems are considered to have high capital costs and variable operations and maintenance costs. Total costs range greatly from $500 to $4000 per ton of pollutant removed for a facility of this size. However, this range is not expected to be cost prohibitive.

[12] E-mail from Frank Burbach to Betty Gatano dated 08/25/2021.

4.6.5 Select BACT for Sulfur Dioxide

NCRP proposes a DSI system as BACT for SO_2 emissions from the wood/poultry litter-fired boilers. Based on the anticipated sulfur content of the fuel and a DSI control efficiency of 80% (consistent with the BACT determination for Fibrominn), NCRP proposes a BACT limit of 0.16 lb of SO_2 /million Btu, on a 30-day rolling average when combusting a mix of wood and poultry litter as fuel. Compliance with the SO_2 emission limit will be determined using a CEMS that meets the requirements of 40 CFR Part 75, except that unbiased values may be used.

NCDAQ concurs with NCRP's proposed BACT and emission limit for SO_2 emissions from the wood/poultry litter-fired boilers.

4.7. Sulfuric Acid Mist BACT

4.7.1 Identify Control Technologies

NCDAQ performed a search of the US EPA's RBLC as discussed above in Section 4.3.1. Four facilities with emission limits on sulfuric acid mist were contained in the search and all four facilities used some type of DSI system to control sulfuric acid mist.

4.7.2 Evaluation of Control Options

The amount of sulfuric acid mist formed depends on the amount of sulfur trioxide (SO_3) and water vapor present and the temperature of the flue gas. Because SO_3 forms from SO_2, the control of sulfuric acid mist correlates directly with SO_2 removal. The control technologies proposed to minimize SO_2 apply for H_2SO_4 mist as well. Please refer to Section 4.6 for the evaluation of control options for SO_2.

4.7.3 Select BACT for Sulfuric Acid Mist

NCRP proposes a DSI system as BACT for sulfuric acid mist emissions from the wood/poultry litter-fired boilers. The BACT emission limit for H_2SO_4 mist is 0.027 lb/million Btu. This value was developed based on emission modeling and testing at the facility.

NCDAQ concurs with NCRP's proposed BACT and emission limit for sulfuric acid mist from the wood/poultry litter-fired boilers.

4.8. Particulate Matter BACT

4.8.1 Identify Control Technologies

The most common technology identified from the RBLC search to control PM emissions from wood fired boilers was a dry electrostatic precipitator (ESP). Fabric filter/bag house was the second most common control technology, with wet electrostatic precipitator (WESP) being the only other control technology noted. Cyclones were noted only in combination with other control methods such as baghouses or ESPs.

Based on the review of RBLC, relevant literature, and knowledge of the industry as discussed in Section 4.3.1 above, the following control technologies were considered in the BACT analysis for PM emissions from the wood/poultry litter-fired boilers:

- Cyclone
- Settling Chamber
- Baghouse
- ESP and WESP, and
- Wet Scrubber

Cyclone

Cyclones are referred to as "precleaners" because they are typically used to reduce inlet loading of PM to a downstream treatment device and are often used in series. Cyclones use inertia to remove particles from the gas stream, primarily PM with diameters greater than 10 microns. The cyclone imparts centrifugal force on the gas stream, forcing particles toward the cyclone walls. Particles are collected at bottom of the cyclone tubes as the gas stream exists the top of the tube for further treatment.

Multiclones or multicyclones consist of multiple small-diameter tubes in parallel, each of which acts like a small cyclone. This configuration combines the high efficiency of a small diameter with the ability to treat large gas volumes.

Settling Chamber

Like the cyclone, a settling chamber is considered a precleaner used to remove primarily larger PM greater than 10 microns in diameter from the gas stream. This technology uses gravity to collect the particles prior to further treatment of the gas stream. Air enters through the upper side of the chamber and travels laterally through the chamber to exit at the opposite upper side. As the gas stream travels from one side of the chamber to the other, larger particles fall out of the air stream via gravity. Control efficiencies vary greatly depending on the size of the chamber, the residence time of the gas stream, and the composition of the PM in the gas.

Baghouse

A baghouse contains sets of fabric filters used to capture primarily $PM_{2.5}$ and PM_{10}. Control efficiency for baghouses is typically in the range of 99 to 99.9%. Moisture and corrosives content are the most significant limits to the technology and should be considered during the design phase. Additionally, it is recommended that larger particles (>10 microns) be removed (typically with cyclones) prior to treatment with fabric filters.

ESP

ESPs use electrical forces to move particles onto collector plates where they are either "rapped" off by mechanical means in a dry ESP or washed off typically with water in a WESP. Operating efficiencies are in the range of 90 to 99.95% removal. ESPs in general are not well suited for use in processes that are highly variable because they are sensitive to fluctuations in gas stream conditions.

Wet Scrubber

Wet scrubbers for PM control may be constructed in a wide variety of styles (e.g., spray chamber, venturi type, packed-bed, etc.) but all use the same general operational theory of water droplets capturing PM in a gas stream. Depending on the style of scrubber, PM control efficiencies range from 50 to 99.9%.

4.8.2 Eliminate Technically Infeasible Options

Settling Chamber

A settling chamber would require a large amount of available space for construction that is not currently available onsite. Additionally, the settling chamber is a precleaner technology, like a cyclone, and will require additional PM treatment. For these reasons, a settling chamber is not feasible at this facility.

ESP

ESPs are not well suited for highly variable gas stream conditions such as those expected to be at NCRP due to the variability of the poultry litter fuel stream. Additionally, ESPs require a significant footprint for construction, which is not currently available at the facility. For these reasons, ESP is eliminated as a technically feasible control technology.

Wet Scrubber

Wet scrubbers create solid waste and wastewater that will need to be treated and disposed of. Due to the location and size restrictions at this facility, the installation of such wastewater treatment system is not feasible. Offsite disposal may also be prohibitively high in cost.

4.8.3 Rank Remaining Control Technologies by Effectiveness

Cyclones alone and cyclones in combination with a fabric filter were the only remaining technically feasible options for control of PM emissions. These control technologies were ranked from the most stringent to the least stringent, as shown in the table below.

Control Technology	Approximate Control Efficiency (%)
Multiclones and fabric filter	99 to 99.9% [13]
Single Cyclone	30 – 90% for PM_{10} 0 – 40% for $PM_{2.5}$ [14]

4.8.4 Evaluate Technically Feasible Control Options

NCRP has selected multiclones and a fabric filter as the BACT for PM emissions from the wood/poultry litter-fired boilers. These controls are currently being used at the facility. Therefore, no additional impacts are associated with the installation and operation of these control technologies. Because the Permittee has selected the top-option for BACT, detailed economic, energy, and environmental information on the lower efficient option (simple cyclone) is not required.

4.8.5 Select BACT for PM Emissions

As stated above, NCRP proposes the use of multiclones in series with a baghouse system as BACT for PM emissions from the wood/poultry litter-fired boilers. Assuming a control efficiency of 95% for this control system, NCRP proposes BACT emission limits of 0.03 lb/ million Btu for filterable

[13] US EPA. EPA-452/F-03-025. *Air Pollution Control Technology Fact Sheet* – Pulse Jet Cleaned Type. Retrieved from https://www3.epa.gov/ttncatc1/cica/files/ff-pulse.pdf

[14] US EPA. EPA-452/F-03-005. *Air Pollution Control Technology Fact Sheet* -Cyclones. Retrieved from https://www3.epa.gov/ttncatc1/cica/files/fcyclon.pdf

PM, 0.036 lb/million Btu for condensible and filterable PM, and 0.027 lb/million Btu for filterable and condensible $PM_{2.5}$. Compliance with the BACT emission limits for PM, PM_{10}, and $PM_{2.5}$ will be demonstrated via initial and periodic performance testing. Compliance will be ensured by following the monitoring and recordkeeping requirement for the bagfilter (ID No. CD-1C) for compliance with 15A NCAC 02D .0503.

NCDAQ concurs with NCRP's proposed BACT and emission limit for PM emissions from the wood/poultry litter-fired boilers.

4.9. Greenhouse Gas BACT

4.9.1 Identify Control Technologies

NCDAQ performed a search of the US EPA's RBLC as described in Section 4.3.1. Good combustion practices were the most common control method. The only other noted method was "No controls."

Based on the review of RBLC, relevant literature, and knowledge of the industry as discussed in Section 4.3.1 above, the following control technologies were considered in the BACT analysis for greenhouse gases (GHG) from the wood/poultry litter-fired boilers:

- Carbon capture and storage (CCS) and
- Lower-emitting processes and practices, consisting of:
    - Boiler design
    - Lower-emitting fuels
    - Good combustion practices

<u>CCS</u>
CCS is an add-on technology that consists of removing CO_2 from the gas stream, transporting it to a sequestering site, and injecting it into geological storage structure. Currently, there are no full-scale storage sites available as the technology is still in the experimental stage of development.

<u>Lower-emitting Processes and Practices</u>
CO_2 emissions from boilers can be decreased by controlling several factors such as boiler design, fuel type, and good combustion practices. These factors can be adjusted to improve the boiler's efficiency, thereby reducing the amount of fuel used to provide the steam.

4.9.2 Eliminate Technically Infeasible Options

CCS is considered technically infeasible because no full-scale storage sites are available as the technology is still in the experimental stage of development. Boiler design is not feasible as the boilers are existing. The use of lower-emitting fuels, although feasible, is not appropriate as the business of NCRP is to burn biomass for energy generation. These control options will not be considered further.

4.9.3 Rank Remaining Control Technologies by Effectiveness

The only technically remaining feasible option is good combustion practices.

4.9.4 Evaluate Technically Feasible Control Options

Good combustion practices will improve boiler efficiency, thereby reducing and maintaining optimal CO_2 emissions. There are no additional costs or significant collateral environmental issues that would eliminate good combustion practices as BACT.

4.9.5 Select BACT for GHG

NCRP proposes good combustion practices as the selected BACT to minimize GHG emissions from the wood/poultry litter-fired boilers. The proposed BACT emission limit for GHG emissions is an annual emission limit of 438,825 tons of CO_2e per year.

NCDAQ concurs with NCRP's proposed BACT and emission limit for GHG emissions from the wood/poultry litter-fired boilers.

4.10. BACT for Poultry Litter Storage Warehouse (ID No. IES-16)

No poultry litter handling operations were included in the RBLC. NCDAQ surveyed other facilities firing poultry litter across North Carolina to identify controls used for handling poultry litter. NCDAQ also reviewed controls used at Fibrominn. None of the North Carolina facilities had controls other than housing the poultry litter in a warehouse or bunker. Fibrominn required all poultry litter to be processed, handled, and stored indoors in a building that exhausted to the boiler. The controls at Fibrominn on the poultry litter storage warehouse were implemented for odor control.

4.10.1 Emissions

The PSD pollutant emissions from the warehouse are expected to be minimal and will consist of particulate matter (PM, PM10, and PM2.5), VOC, and GHGs in the form of nitrous oxide (N_2O). Particulate matter emissions have been estimated using AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles, Table 13.2.4-1 (Crushed limestone), and Chapter 11.9 Western Surface Coal Mining, Table 11.9-1 (bulldozing -overburden). The N_2O emissions were estimated using emission factors presented in a document published in 2006 by Iowa State University entitled "Air Quality and Emissions from Livestock and Poultry Production/Waste Management Systems."[15] No data is available for VOC emissions from poultry litter, but as indicated in the Iowa State Report, VOC emissions are expected to be negligible. Emissions from the poultry litter storage warehouse were provided previously in Table 2.

4.10.2. BACT for Particulate Matter

The PM emissions from the warehouse are expected to be low, primarily because the warehouse shields the storage pile and material handling activities from wind. Based on engineering emissions estimates, the warehouse will reduce PM emissions that would have occurred had the litter been stored outdoors by more than 90%. The remaining PM emissions are too low to warrant the cost of add-on controls. Therefore, NCRP proposes, as a work practice standard, that the storage and

15 N_2O, VOC, and NH_3 emissions are estimated from "Air Quality and Emissions from Livestock and Poultry Production / Waste Management Systems." (2006) Retrieved from http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1624&context=abe_eng_pubs.

handling of the litter in the warehouse be deemed as BACT for particulate emissions from the poultry litter storage warehouse. NCDAQ concurs with NCRP's proposed BACT.

4.10.3. BACT for Volatile Organic Compounds

As mentioned in the previous section, VOC emissions from the poultry litter warehouse are expected to be negligible. Add-on controls would be cost prohibitive, and there are no known work practice standards for reducing VOC emissions from poultry litter storage. Therefore, NCRP proposes "no controls" be deemed as BACT for VOC emissions from the poultry litter storage warehouse. NCDAQ concurs with "no controls" for VOC emissions as BACT.

4.10.4. BACT for Nitrous Oxide

Nitrous oxide is regulated as a GHG. Because the project was subject to PSD for GHG emissions, a BACT analysis of nitrous oxide is required. As shown above in Table 2, the N_2O emissions are expected to be only 0.13 ton/yr. Due to the low emission rate, add-on controls would not be feasible and would be cost prohibitive. Therefore, NCRP proposes "no controls" as BACT for the N_2O emissions from the poultry litter storage warehouse. NCDAQ concurs with "no controls" for N_2O emissions as BACT.

4.11. BACT for Belt Dryers (ID Nos. ES-17, ES-18, and ES-19)

4.4.11.1 Identify Control Technologies

Based on the review of RBLC, relevant literature, and knowledge of the industry as discussed in Section 4.3.1 above, the following control technologies to reduce emissions of VOCs were considered in the BACT analyses for belt dryers:

- Thermal oxidation (TO) and regenerative thermal oxidation (RTO),
- Catalytic oxidizers, and
- Good operation practices.

4.4.11.2 Eliminate Technically Infeasible Options

TO and RTO

Emissions of VOC and HAPs from the belt dryers were measured during stack testing on August 22 and 23, 2018. One belt dryer was tested with a throughput of approximately 30 tons/hour. VOC concentrations during the testing were low, ranging from 8.25 to 9.60 lb/hr (or about 2 – 3 ppmv). Exhaust from each stack averaged approximately 138,000 acfm during testing,[16] with a total across all three stacks estimated at 1,100,000 acfm. Despite the low concentrations, overall emissions from the belt dryer were high due to the large air flow from the stacks.

Neither a TO nor a RTO would be technically feasible control technologies for the belt dryers due to the low concentrations of VOC in the exhaust. According to US EPA's "Air Pollution Control Technology Fact Sheet for Thermal Incinerators," "thermal incinerators [oxidizers] perform best at concentrations around 1500 to 3000 ppmv."[17] RTO is more appropriate for lower concentration gas

[16] E-mail from Brent . Hall to Betty Gatano, dated November 21, 2018.

[17] US EPA, EPA-452/F-03-022, *Air Pollution Control Technology Fact Sheet, Thermal Incinerator,* https://www3.epa.gov/ttncatc1/dir1/fthermal.pdf

streams (1000 ppm or less) than is TO. RTO can be effective at inlet loadings as low as 100 ppmv or less, but extremely low concentrations (less than 100 ppmv) are associated with much higher cost, according to US EPA's "Air Pollution Control Technology Fact Sheet for Regenerative Thermal Incinerators."[18]

Catalytic Oxidation

Catalytic oxidation can control emissions streams with extremely low VOC concentration, which is the range of VOC concentration from the belt dryers. As reported in the US EPA's "Air Pollution Control Technology Fact Sheet for Catalytic Incinerators," typical gas flow rates for packaged catalytic incinerators range from 700 to 50,000 scfm. The much larger air flow from the belt dryers would not be appropriate for a catalytic oxidizer,[19] making this control technology infeasible.

Good Operating Practices

There are no work practice standards that would have any appreciable effect on the emissions from the belt dryers.

4.4.11.3 Select BACT for Belt Dryers

None of the proposed add-on technologies are feasible for the belt dryers due to the low VOC concentrations and large air volume of the exhaust streams. There are no work practice standards that would have any appreciable effect on the emissions from the belt dryers. Therefore, NCRP proposes that "no controls" be deemed as BACT for these emission units. NCRP will operate the belt dryers in accordance with manufacturer's specifications. NCDAQ concurs with "no controls" for VOC emissions as BACT for the belt dryers.

4.12 Proposed BACT

Based on the BACT analyses for the PSD project discussed in Sections 4.4 through 4.11 above, NCDAQ has determined the technology and limitations presented in the following table are BACT for these sources. The BACT permit condition for boilers (ID Nos. ES-1A and 1B) is provided in Attachment 1 to this permit review.

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[18] US EPA, EPA-452/F-03-021, *Air Pollution Control Technology Fact Sheet, Regenerative Thermal Incinerator,* https://www3.epa.gov/ttncatc1/dir1/fregen.pdf

[19] US EPA, EPA-452/F-03-018, *Air Pollution Control Technology Fact Sheet, Regenerative Thermal Incinerator,* https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1008OGZ.PDF

Table 14 – BACT Emission Limits			
BACT Emission Limits for Firing Non-CISWI Subject Wood and Poultry Litter in the Boilers			
Pollutants	**Control Technology or Work Practice**	**BACT Emission Limit**	**Averaging Period**
CO	Good combustion practices	0.65 lb/MMBtu per boiler	30-day rolling average as measured via CEMS
		208.8 lb/hr (startup and shutdown when one boiler is idle)	3-hour rolling average as measured via CEMS
		526.2 lb/hr (startup and shutdown when both boilers are operating)	3-hour rolling average as measured via CEMS
VOC	Good combustion practices	0.03 lb/MMBtu per boiler	3-hour average as measured via stack test
NO_X	Selective non-catalytic reduction	0.17 lb/MMBtu per boiler	30-day rolling average as measured via CEMS
		11.2 lb/hr (startup and shutdown when one boiler is idle)	3-hour rolling average as measured via CEMS
		39.2 lb/hr (startup and shutdown when both boilers are operating)	3-hour rolling average as measured via CEMS
SO_2	Dry sorbent injection	0.16 lb/MMBtu per boiler	30-day rolling average as measured via CEMS
H_2SO_4 mist (SAM)	Dry sorbent injection	0.027 lb/MMBtu per boiler	3-hour average as measured via stack test
PM (filterable only)	Multiclone and baghouse	0.030 lb/MMBtu per boiler	3-hour average as measured via stack test
PM_{10} (filterable and condensible)	Multiclone and baghouse	0.036 lb/MMBtu per boiler	3-hour average as measured via stack test
$PM_{2.5}$ (SAM, filterable, and condensible)	Multiclone and baghouse	0.027 lb/MMBtu per boiler	3-hour average as measured via stack test
CO_2e	Good combustion practices	438,825 tons/yr	Rolling 12-month average

BACT for Poultry Litter Storage Warehouse		
Pollutant	**BACT Emission Limit**	**Control Technology or Work Practice**
$PM/PM_{10}/PM_{2.5}$	--	Work practice standard - storage and handling of the poultry litter in the warehouse
NOx	--	No controls
VOC	--	No controls
BACT for Belt Dryers		
Pollutant	**BACT Emission Limit**	**Control Technology or Work Practice**
VOC	--	No controls

As noted above in Table 14 and as discussed in Sections 4.4 through 4.6, NCRP proposes a 30-day rolling average for the BACT emissions limits of CO, NOx, and SO_2 rather than a shorter averaging period (i.e., 24-hour) during normal operations. (As noted in Table 14 and discussed in Sections 4.4.5 and 4.5.5 above, NCRP proposes separate BACT emission limits for CO and NO_X during startup and shutdown events.) The longer averaging period is justified for these pollutants due to fuel variability. The wood and poultry litter used for fuel in the boilers at NCRP are sourced from different vendors. In the case of poultry litter, the material is obtained from different farms with varying chicken feeds and operating conditions. The poultry litter characteristics also vary considerably in moisture, energy, and sulfur content, leading to fluctuations in CO, NOx, and SO_2. The wood characteristics, such as moisture and bark content, are also variable, leading to fluctuations in CO and NOx.

NCRP controls NOx and SO_2 emissions via add-on controls, consisting of ammonia and sorbent injection, respectively. CO emissions are controlled by good operating practices entailing control of air introduced into the boilers. Due to the lag time between 1) detection of excess emissions by the CEMS; 2) the adjustment ammonia/sorbent injection rate or excess air flow; and 3) the reduction in emissions, NCRP cannot consistently meet the BACT emission limits on a short-term basis during normal operations. A 30-day rolling average allows plant personnel sufficient time to adjust boiler operations and/or control devices to minimize emissions in response to variations in the fuel. As further justification, NCRP provided hourly data during July 1 and 4, 2018 demonstrating the variability in emissions and fuel (heat input (MMBtu)).

NCDAQ concurs with the proposed averaging period for CO, NOx, and SO_2 emissions and deems a 30-day averaging period for BACT acceptable for these pollutants during normal operations.

5.0 PSD Air Quality Impact Analysis

The PSD impact analyses described in this section were conducted by NCRP in accordance with current PSD directives and modeling guidance. References are made to the US EPA, Draft October 1990, New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting, which will herein be referred to as the NSR Workshop Manual. [20]

Initial air dispersion modeling for PSD and NC Air Toxics was submitted on October 29, 2017. Matt Porter of the AQAB reviewed and approved this air dispersion modeling in a memorandum dated June 27, 2018. Additional air dispersion modeling for NOx and CO based on revised BACT emission limits and formaldehyde based on source testing of the belt dryers was submitted on August 5, 2019. Nancy Jones of the AQAB reviewed and approved the updated air dispersion modeling in a memorandum dated October 30, 2019. Discussion below on the air quality impact analyses for this project references both memoranda, as appropriate.

5.1 Class II Area Significant Impact Air Quality Modeling Analysis

A significant impact analysis was conducted for the pollutants shown in Table 1 above that require PSD analyses and that have established Class II Area Significant Impact Levels (SIL). Of the pollutants in Table 1, sulfuric acid mist was not included in the Class II Area SIL analysis because no

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[20] US EPA. *NSR Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting* (Draft October 1990). Retrieved from https://www.epa.gov/sites/production/files/2015-07/documents/1990wman.pdf

SIL or NAAQS exist for this pollutant. VOC is an ozone precursor and is evaluated under the ozone analysis in Section 5.2 below. The modeling results for the other pollutants (SO_2, CO, PM, PM_{10}, $PM_{2.5}$, and NO_2) were compared to the applicable Class II Area SIL as defined in the NSR Workshop Manual, NCDAQ memoranda,[21] and EPA guidance to determine if a full impact air quality analysis would be required for that pollutant.

The air dispersion modeling was based on project emission increases for applicable PSD pollutants. Emissions were modeled using three following boiler operating scenarios:

- Scenario 1 – This scenario represents the startup of only one boiler. If one boiler is in operation, startup means the boiler is producing 30,000 pounds of steam per hour or less. As defined by permit, startup ends when the boiler exceeds 30,000 pounds per hour when only one boiler is in operation.

- Scenario 2 – This scenario represents one boiler producing 30,000 pounds of steam per hour and the other boiler in startup. If both boilers are in operation, startup ends when the steam load on each boiler exceeds 30,000 pounds per hour

- Scenario 3 – This scenario represents both boilers operating at full load, producing at least 30,000 pounds per hour of steam each.

Tables 15, 16 and 17 below show modeled project impacts for each operating scenario compared to Class II Area SILs for each pollutant and averaging period. The NO_2 and CO results were based on revised air dispersion modeling submitted on August 5, 2019 and are designated as such in the tables below. As shown, all modeled impacts from each operating scenario were below all applicable Class II Area SILs. Therefore, project emission impacts are not expected to cause or contribute to a violation of PSD Increments or NAAQS, and thus, no full impact analysis is required.

[21] NCDAQ. *North Carolina PSD Modeling Guidance.* (January 6, 2012). Retrieved from https://files.nc.gov/ncdeq/Air%20Quality/permits/mets/psd_guidance.pdf

Table 15A. Class II Significant Impact Results Operating under Scenario 1 ($\mu g/m^3$) (Air Dispersion Modeling Submitted October 29, 2017)				
Pollutant	**Averaging Period**	**Project Maximum Model Impact**	**Class II SIL**	**% of Class II SIL**
SO_2	1-hour	1.33	10	13%
	3-hour	1.07	25	4%
	24-hour	0.431	5	9%
	Annual	0.0593	1	6%
PM_{10}	24-hour	0.344	5	7%
	Annual	0.0443	1	4%
$PM_{2.5}$	24-hour	0.263	1.2	22%
	Annual	0.0299	0.2	15%
Table 15B. Class II Significant Impact Results Operating under Scenario 1 ($\mu g/m^3$) (Revised Air Dispersion Modeling Submitted August 5, 2019)				
Pollutant	**Averaging Period**	**Project Maximum Model Impact**	**Class II SIL**	**% of Class II SIL**
CO	1-hour	229.9	2000	11%
	8-hour	90.6	500	18%
NO_2	1-hour	5.96	10	60%
	Annual	0.263	1	26%

Notes:
Scenario 1 represented startup of only one boiler. If one boiler is in operation, startup means the boiler is producing 30,000 pounds of steam per hour or less. As defined by permit, startup ends when the boiler exceeds 30,000 pounds per hour when only one boiler is in operation.

Table 16A. Class II Significant Impact Results Operating under Scenario 2 ($\mu g/m^3$) (Air Dispersion Modeling Submitted October 29, 2017)				
Pollutant	**Averaging Period**	**Project Maximum Model Impact**	**Class II SIL**	**% of Class II SIL**
SO_2	1-hour	0.976	10	10%
	3-hour	0.845	25	3%
	24-hour	0.327	5	7%
	Annual	0.0445	1	4%
PM_{10}	24-hour	0.953	5	19%
	Annual	0.130	1	13%
$PM_{2.5}$	24-hour	0.718	1.2	60%
	Annual	0.0836	0.2	42%
Table 16B. Class II Significant Impact Results Operating under Scenario 2 ($\mu g/m^3$) (Revised Air Dispersion Modeling Submitted August 5, 2019)				
Pollutant	**Averaging Period**	**Project Maximum Model Impact**	**Class II SIL**	**% of Class II SIL**
CO	1-hour	179.0	2,000	9%
	8-hour	136.6	500	27%
NO_2	1-hour	8.48	10	85%
	Annual	0.60	1	60%

Notes:
Scenario 2 represented one boiler producing 30,000 pounds of steam per hour and the other boiler in startup. If both boilers are in operation, startup ends when the steam load on each boiler exceeds 30,000 pounds per hour

Table 17A. Class II Significant Impact Results under Scenario 3 (µg/m^3) (Air Dispersion Modeling Submitted October 29, 2017)				
Pollutant	**Averaging Period**	**Project Maximum Model Impact**	**Class II SIL**	**% of Class II SIL**
SO_2	1-hour	8.28	10	83%
	3-hour	0.365	25	37%
	24-hour	7.27	5	73%
	Annual	6.84	1	27%
PM_{10}	24-hour	1.25	5	25%
	Annual	0.161	1	16%
$PM_{2.5}$	24-hour	0.950	1.2	79%
	Annual	0.105	0.2	53%
Table 17B. Class II Significant Impact Results under Scenario 3 (µg/m^3) (Revised Air Dispersion Modeling Submitted August 5, 2019)				
Pollutant	**Averaging Period**	**Project Maximum Model Impact**	**Class II SIL**	**% of Class II SIL**
CO	1-hour	78.30	2,000	4 %
	8-hour	57.27	500	11 %
NO_2	1-hour	9.50	10	95 %
	Annual	0.66	1	66 %

Notes:
Scenario 3 represents a full load, where both boilers operating are producing at least 30,000 pounds of steam per hour.

5.2 Class II Area Tier 1 Screening Analysis for Ozone Precursors

A Tier 1 screening analysis was conducted to evaluate project precursor emissions impacts on secondary formation of ozone in Class II areas. The screening analysis was based on methodologies taken from EPA's draft Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier I Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program (December 2, 2016). MERPs are defined as the screening emission level (tpy) above which project precursor emissions would conservatively be expected to have a significant impact on secondary $PM_{2.5}$ or ozone formation. A MERP value is developed for each precursor pollutant from photochemical ozone modeling of a hypothetical source and a "critical air quality threshold." The MERPs guidance relies on EPA's 2016 draft SILs for ozone as the critical air quality threshold to develop conservative ozone MERPs values. Consistent with EPA's SILs guidance, the critical air quality threshold for ozone is 1 ppb.

NO_X and VOC project emissions were evaluated based on an ozone MERPs value developed from a representative hypothetical source located in Horry, SC (Source #10 from Eastern U.S. Region, as shown in MERPs Appendix Table A-1). The source-derived NO_X and VOC MERPs for 8-hour ozone are 243 tpy and 15,151 tpy, respectively. As shown below, additive impacts from NOx and VOC precursor emissions are 104 % of the SIL:

Increase NOx Emissions from Project = 249.9 tpy
Percent of SIL = 249.9 tpy increase NOx/243 tpy MERPs NOx = 102% of the SIL
Ozone concentration due to increased NOx emissions = 1 ppb * % of SIL = 1 ppb* 1.02 = 1.02 ppb ozone

Increased VOC Emissions from Project = 56.5 tpy from boilers + 245 tpy from the belt dryers (ID Nos. ES-17, ES-18, and ES-19) = 301 tpy
Percent of SIL = 301 tpy increase VOC/15,151 tpy MERPs VOC) = 2% of the SIL
Ozone concentration due to increased VOC emissions = 1 ppb*% of SIL = 1 ppb * 0.02 = 0.02 ppb ozone

Because the additive impacts from NO_X and VOC precursor emissions are 104 % of the SIL (102% due to NO_X plus 2% due to VOC), a cumulative ozone impact analysis was required. The impact from the project of 1.04 ppb ozone from the MERPs analysis was added to the 63 ppb ozone design value for the nearest monitor in Cumberland County, North Carolina for a total of 64.04 ppb of ozone. This value is below the 8-hour ozone NAAQS of 70 ppb. Therefore, the project is not expected to cause or contribute to a violation of the 8-hour ozone NAAQS.

5.3 Class II Area Analysis of $PM_{2.5}$ Precursors NO_X and SO_2

Per EPA's guidance, the NOx and SO_2 precursor impacts to both daily and annual average PM2.5 were considered together to determine if the project sources' air quality impact on PM2.5 would exceed the PM2.5 SILs. MERP values were developed from a representative hypothetical source located in Horry, SC (Source #10 from Eastern U.S. Region, as shown in MERPs Appendix Table A-1). As shown in Table 18 below, the project emissions increases are well below the MERP values for both averaging periods.

Table 18. Secondary $PM_{2.5}$ from Facility Emission Increases and MERPs

Pollutant	Facility Increase (tpy)	Averaging Period	MERPs (tpy)
NO_x	250	24-hour	8,591
		Annual	40,968
SO_2	130	24-hour	2,763
		Annual	15,516

<u>Additive Secondary Impact on Daily PM2.5 (i.e., 24-hour averaging period):</u>
(250 tpy increase NO_x/8,591 tpy MERPs NO_x) + (130 tpy increase SO_2/2,763 tpy MERPs SO_2) = 7.6 % of the SIL

<u>Additive Secondary Impact on Annual PM2.5 (i.e., annual averaging period):</u>
(250 tpy increase NO_x/40,968 tpy MERPs NO_x) + (130 tpy increase SO_2/415,516 tpy MERPs SO_2) = 1.4 % of the SIL

5.4 Class II Area Analysis of Primary and Secondary $PM_{2.5}$

Primary $PM_{2.5}$[22] was modeled and compared to the SIL in the October 27, 2017 analysis that was reviewed in a June 26, 2018 memo. Table 19 shows the summed impacts of both primary and secondary $PM_{2.5}$ and compares the totals to the SILs. The summed impact is below the SILs for each averaging period, showing that the emissions of primary and secondary $PM_{2.5}$ will not cause or contribute to a violation of the $PM_{2.5}$ NAAQS for either averaging period.

[22] Primary $PM_{2.5}$ is emitted directly from the source. Secondary $PM_{2.5}$ is formed in the atmosphere after the pollutant is emitted.

Table 19. Class II Area Total $PM_{2.5}$ Impact			
Averaging Period	**Primary % of SIL**	**Secondary % of SIL**	**Total % of SIL**
24-hour $PM_{2.5}$	79.1	7.6	86.7
Annual $PM_{2.5}$	55.	1.4	56.4

5.5 Class II Area Full Impact Air Quality Modeling Analysis

Except for ozone as discussed above in Section 5.2, a Class II Area NAAQS full impact analysis was not conducted given that all project emissions impacts modeled below the SILs.

5.6 Class I Area Significant Impact Air Quality Modeling Analysis

Federal Land Managers (FLMs) were notified of the PSD project following the pre-application meeting held on March 20, 2017 at NCDEQ Headquarters in Raleigh. Notification of the PSD project was transmitted via email from NCDAQ on March 21, 2017 to representatives of the U.S. Fish and Wildlife Service (FWS), U.S. Forest Service (FS), and the National Park Service (NPS). Response from these agencies indicated a Class I Area air Quality analysis would not be required.

5.7 Class I Increment/Air Quality Related Values (AQRV) Regional Haze Impact and Deposition Analyses

The PSD modification includes significant emissions of visibility-impairing pollutants such as NO_X, SO_2, H_2SO_4, $PM_{2.5}$, and PM_{10}. Therefore, analysis of project impacts on Class I Area Air Quality Related Values (AQRVs) was required.

FLMs were notified of the PSD project following the pre-application meeting held on March 20, 2017 at NCDEQ Headquarters in Raleigh. Notification of the PSD project was transmitted via email from NCDAQ on March 21, 2017 to representatives of the U.S. FWS, U.S. FS, and the NPS. The FWS and FS both responded via email and indicated that they were not anticipating significant project impacts to AQRVs, and therefore, would not be requesting an AQRV modeling analysis.

5.8 Non-Regulated Pollutant Impact Analysis (North Carolina TAPs and TSP)

TAP Emissions
The air toxics dispersion modeling analysis was conducted to evaluate ambient impacts from facility-wide TAP emissions from the project that were estimated to exceed the TPERs specified in 15A NCAC 02Q .0711. The modeling of maximum-allowable TAPs emissions adequately demonstrates compliance with Acceptable Ambient Levels (AALs) outlined in 15A NCAC 02D .1104, on a source-by-source basis, for ammonia, arsenic, benzene, benzo(a)pyrene, beryllium, cadmium, chlorine, ethylene dibromide, hydrogen chloride, non-specific chromium VI, sulfuric acid, and vinyl chloride. The modeling establishes maximum-allowable emission limits for each TAP on a source-by-source basis. The modeled impacts from facility-wide TAPs emissions as a percentage of AALs are presented in Table 20.

TAP emissions modeled for the proposed project are the result of facility-wide emissions from combustion of non-CISWI subject wood and poultry litter in the Stoker boilers, and fuel oil combustion in the dryer and fire-water pump engine. A total of three point sources were modeled using 1 lb/hr unitized emission rates. Modeled TAPs emissions and impacts were derived assuming 8,760 hours per year facility operations.

AERMOD (version 16216r) using five years (2012-2016) of Lumberton Municipal Airport meteorological data (surface) and Greensboro vertical profile data (upper air) were used to evaluate impacts in both simple and complex terrain. Direction-specific building downwash parameters, calculated using EPA's BPIP-PRIME program (04274), were used as input to AERMOD to determine building downwash effects on plume rise and effects on entrainment of stack emissions into the cavity and turbulent wake zones downwind of existing buildings. The building downwash analysis included 11 buildings in all. Receptors were modeled around the facility's property line at 25-meter and 100-meter intervals. Fine gridded receptors spaced every 100 meters were modeled in all directions out to approximately 3,000 meters from the property line. Coarse gridded receptors spaced every 500 meters were modeled from 3,000 meters to 6,000 meters. Building, source, and receptor elevations and receptor dividing streamline heights were calculated from 1-arc-second resolution USGS NED terrain data using the AERMOD terrain pre-processor AERMAP (version 11103). All model buildings, sources, and receptors were geo-located within the Universal Transverse Mercator (UTM) Zone 17 coordinate system based on the North American Datum of 1983 (NAD83).

Table 20. Maximum Modeled Impacts from Potential Emissions NCRP - Lumberton, NC

Pollutant	Averaging Period	Maximum Modeled Impacts % of AAL
Ammonia	1-hour	0.1 %
Arsenic	Annual	5.3 %
Benzene	Annual	15.6 %
Benzo(a)pyrene	Annual	0.05 %
Beryllium	Annual	0.1 %
Cadmium	Annual	0.2 %
Chlorine	24-hour	0.2 %
Ethylene Dibromide	Annual	0.1 %
Hydrogen Chloride	1-hour	0.2 %
Non-specific Chromium VI	Annual	3.9 %
Sulfuric Acid	1-hour	5.7 %
	24-hour	9.3 %
Vinyl Chloride	Annual	0.02 %

The boilers at NCRP are subject to GACT Subpart 6J. Such emission sources are exempt from NC Air Toxics in accordance with 15A NCAC 02Q .0702(a)(27)(B). Although NCRP elected to include the boilers in the facility-wide air dispersion modeling conducted to demonstrate compliance with 15A NCAC 02D .1100, a NC Air Toxics condition for the boilers will not be included in the permit because of this exemption.

Ammonia emissions from the poultry litter storage warehouse were not included in the air dispersion modeling. Given the large margin of compliance with the AAL for ammonia (only 0.1 % of the AAL), the small amount of ammonia emitted from the poultry litter storage warehouse (11% of the modeled emissions), and the fact that the poultry litter storage warehouse is located more toward the middle of the facility, only a minimal impact from the warehouse is expected. No additional air dispersion modeling is required for this emission source.

Source testing of the belt dryers conducted in August 2018 indicated emissions of formaldehyde from these dryers were above its TPER. The revised air dispersion modeling submitted on August 5, 2019 included a compliance demonstration for this TAP.

AERMOD (v18081), using five years (2013-2017) of surface meteorological data from Lumberton and upper air meteorological data from Greensboro was used to evaluate impacts in both simple and elevated terrain. Direction specific building dimensions, determined using EPA's GEP-BPIP Prime program (04274), were used as input to the model for building wake effect determination. Receptors were placed along the property boundary at 100-meter intervals except to the south and southwest where they were spaced at 25-meter intervals because they were within 100 meters of the stack. A 100-meter spacing was used out to 3 kilometers (km) and a 500-meter spacing out to 6 km. The modeling adequately demonstrates compliance with the AAL for formaldehyde provided in 15A NCAC 02D. 1104, on a source-by-source basis. The results are provided in Table 21 below.

Table 21. Maximum Modeled Impacts from Potential Emissions NCRP - Lumberton, NC				
Pollutant	**Averaging Period**	**Max. Conc. (mg/m^3)**	**AAL (mg/m^3)**	**% of AAL**
Formaldehyde	1-hr	0.032	0.15	21 %

NCRP was issued Air Permit No. 05433T28 on July 29, 2021 to replace the existing two bagfilters and DSIs with new control devices and to replace the common stack. The new control devices will not result in any changes to the expected emissions (i.e., same control efficiencies from the new bagfilter and DSI) from the boilers. The new bagfilter will also operate with the same air flow rate and temperature as the existing bagfilters. The new stack, which is being replaced due to age and condition, will have identical parameters (i.e., stack height, diameter, and location). Therefore, no additional air dispersion modeling to demonstrate compliance with NC Air Toxics is required, and the air dispersion modeling conducted in support of the PSD permit application discussed above remains valid.

TSP Emissions
Total suspended particulate (TSP) project emissions were estimated above the SER of 25 tpy as specified under 40 CFR 51.166(b)(23). While the TSP NAAQS was revised in 1987 to narrow focus and regulation of PM_{10}, North Carolina State Ambient Air Quality Standards (SAAQS) currently still require evaluation of both PM10 and TSP separately in accordance with 15A NCAC 02D .0403. As such, NCRP modeled facility-wide TSP project emissions using AERMOD and the same model setup as the TAPs modeling analyses to show project impacts were below the 24-hour (5 $\mu g/m^3$) and annual (1 $\mu g/m^3$) TSP SILs, and thereby demonstrate compliance with the 24-hour (150 $\mu g/m^3$) and annual (75 $\mu g/m^3$) TSP SAAQS. Table 22 shows the results of the modeling analyses and that the modified facility-wide emissions impacts will not cause or contribute to a violation of the TSP SAAQS. Maximum TSP modeled impacts were taken from the full load operating scenario.

Table 22. Class II TSP SAAQS Significant Impact Analysis Results (µg/m^3)			
Pollutant	**Averaging Period**	**Modeled Concentration**	**SAAQS SIL**
TSP	24-hour	0.99	5
	Annual	0.13	1

5.9 Additional Impact Analysis

Additional impact analyses were conducted for ozone, growth, soils and vegetation, and visibility impairment.

5.9.1 Ozone Impact Analysis

VOC emissions increase of 301 tpy and NO_X emissions increase of of 249.9 tpy from the project exceed the ozone SER of 40 tpy applicable to both VOCs and NO_X as specified in 40 CFR Part 51.166(b)(23)(i). Therefore, project VOC and NO_X emissions impacts on ambient ozone levels were analyzed and assessed using the MERPs screening approach. MERPs screening for secondary ozone formation is discussed above in Section 5.2 and shows project impacts do not cause or contribute to a violation of the 8-hour Ozone NAAQS.

5.9.2 Growth Impacts

A growth analysis examines potential emissions from secondary sources associated with the proposed project. While these activities are not directly involved in process operation, the emissions involve those that can reasonably be expected to occur. The growth analysis includes the projection of the associated industrial, commercial and residential source emissions that will occur in the area due to modification of the source. Secondary emissions do not include emissions from mobile sources and sources that do not impact the same general area as the source under review. No secondary growth is proposed for the project.

5.9.3 Soils and Vegetation

The project impacts on soils and vegetation were analyzed by comparing the maximum modeled concentrations to secondary NAAQS and screening thresholds recommended in EPA's "A Screening Procedure for Impacts of Air Pollution Sources on Plants, Soils and Animals" (EPA-450/2-81-078). The modeled concentrations from the Class II significant impact analysis were well below the secondary NAAQS and screening thresholds. Therefore, little or no significant impacts are anticipated from the project to soils and/or vegetation.

5.9.4 Class II Visibility Impairment Analysis

The Class II visibility analysis was not required given the project emissions do not include significant amounts of visibility-impairing pollutants such as NO_X, SO_2, $PM_{2.5}$, or PM_{10}. Additionally, the project is not located within 10 km of an area protected from visibility impairment. And further, all

Class II significant impact analyses were below respective SILs for all PSD pollutants under evaluation. Therefore, NCDAQ did not require the Class II Visibility Impairment Analysis.

6.0 Other Issues

6.1 Compliance

NCDAQ has reviewed the compliance status of NCRP. Evangelyn Lowery-Jacobs of FRO conducted a compliance inspection at facility on September 11, 2020, prior to the shutdown of the boilers due to ongoing maintenance issues in November 2020. The Permittee appeared to be operating in compliance during the inspection, with the exception of CO emission exceedances as addressed in the Second SOC.

A signed Title V Compliance Certification (Form E5) indicating that the facility was not in compliance with all applicable requirements was included in the permit application. The Permittee and NCDAQ have entered into a Special Order of Consent, SOC 2017-001, with an effective date of February 27, 2017, to address noncompliance with 15A NCAC 02D .0530. The SOC provides a schedule of compliance allowing the Permittee to operate until such time as the Permittee has returned to compliance with 15A NCAC 02D .0530. The SOC 2017-001 will expire upon issuance of the PSD permit to NCRP and the date the PSD permit becomes final and enforceable after all periods to appeal the issuance of the permit have expired and after all penalties accrued under SOC 2017-001 have been paid in full.

The Permittee has had the following compliance issues within the past five years:

- On June 29, 2016, NCRP was issued a Notice of Violation/Notice of Recommendation for Enforcement (NOV/NRE) for exceeding SB3 limits for $PM_{2.5}$, SO_2, and NO_x; for having excessive COMS downtime in violation of NSPS Subpart Db, and for failing to conduct source testing within 180 days of startup of the boilers.
- On August 1, 2016, SOC 2016-002 was issued to address violations cited in the NOV/NRE on June 29, 2016. The order also addressed issues relating to CO emissions. NCRP paid $9,000 as an upfront penalty for these violations under the SOC. NCRP also paid an additional $6,000 on January 31, 2017 in stipulated penalties for violating the terms of the SOC.
- On September 12, 2016, NCRP was issued a Notice of Deficiency for failure to submit a Notice of Compliance Status within 120 days of initial tune-up of the boilers.
- On October 28, 2016, the facility submitted a “Compliance Plan” as required by SOC 2016-002. The Plan stated that the facility intends to submit a PSD application.
- On November 16, 2016, the facility was issued a NOV/NRE for exceeding the PSD avoidance limit for CO emissions.
- On February 27, 2017, SOC 2017-001 was issued to address exceedances of the PSD avoidance limit for CO emissions. The facility was required to submit a PSD permit application within 30 days of issuance of the SOC. NCRP paid $15,000 as an upfront penalty for these violations under the SOC. NCRP also paid an additional $12,000 on August 2, 2017 in stipulated penalties for violating the terms of the SOC.
- On March 13, 2017, a NOV/NRE was issued for exceeding SB3 limits for NO_x and for having excessive COMS downtime in violation of NSPS Subpart Db during the second half of 2016. The Permittee also experienced three (3) exceedances of the PSD avoidance limit for CO (250 tons per twelve-month rolling total).

- On June 30, 2017, a NOV was issued to the Permittee for numerous monitoring and recordkeeping violations observed during the compliance inspection on June 8, 2017 and subsequent record review on June 13, 2017.
- A civil penalty in the amount of $11,555, including costs, was assessed on July 25, 2017 for exceeding SB3 limits for NO_X and for having excessive COMS downtime in violation of NSPS Subpart Db. The penalty was paid in full on September 8, 2017.
- On November 27, 2018, NCRP was issued a NOV/NRE for exceeding SB3 limits for NOx.
- On February 28, 2019, a civil penalty was assessed in the amount of $8,596, including costs, for the violations cited in the NOV/NRE dated November 27, 2018. The civil penalty was paid in full on April 5, 2019.
- On April 16, 2020, a NOV/NRE was issued for CEMS downtime as reported by the facility on the semi-annual monitoring report for the fourth quarter of 2019. On September 18, 2020, a civil penalty was assessed in the amount of $3,449, including costs, for these violations. The civil penalty was paid in full on October 20, 2020.
- On December 9, 2020, a NOV/NRE was issued for excess emissions from the continuous opacity monitor (COMs) during first, second, and third quarters of 2020. On April 26, 2021, a civil penalty was assessed in the amount of $10,407, including costs, for these violations. The civil penalty was paid in full on May 24, 2021.

6.2 Zoning Requirements

A local zoning consistency determination is required per 15A NCAC 02Q .0304(b) for this modification. A copy of the zoning consistency determination dated March 3, 2015 from the City of Lumberton, Planning and Inspections Department, was provided in the PSD permit application. This determination was associated with the air permit application to remove coal, No. 2 and No. 4 fuel oil, tire-derived fuels, pelletized paper, and fly ash briquettes from the fuel mix and add non-CISWI poultry litter as a permitted fuel for the two boilers (ID Nos. ES-1A and ES-1B) at NCRP. NCDAQ issued Air Permit no. 05543T21 on May 29, 2015 incorporating these changes. This determination subsumes the retroactive PSD permitting action in this permit application (7800166.17C).

6.3 Professional Engineer’s Seal

A Professional Engineer's seal was included with the initial application (7800166.17C) received March 29, 2017. Lisa Manning, a Professional Engineer who is currently registered in the State of North Carolina, sealed the application for the portions containing the engineering plans, calculations, and all supporting documentation.

A Professional Engineer's seal was also included with the addendum to the permit application received June 23, 2021. Frank Burbach, a Professional Engineer who is currently registered in the State of North Carolina, sealed the application for the portions containing the engineering plans, calculations, and all supporting documentation.

6.4 Application Fee

An application fee in the amount of $14,475.00 was received with the permit application on March 29, 2017.

6.5 Public Participation Requirements

In accordance with 40 CFR 51.166(q), public participation, the reviewing authority (NCDAQ) shall meet the following:

1) Make a preliminary determination whether construction should be approved, approved with conditions, or disapproved.

   This document satisfies this requirement providing a preliminary determination that construction should be approved consistent with the permit conditions described herein.

2) Make available in at least one location in each region in which the proposed source would be constructed a copy of all materials the applicant submitted, a copy of the preliminary determination, and a copy or summary of other materials, if any, considered in making the preliminary determination.

   This preliminary determination, application, and draft permit will be made available in the Fayetteville Regional Office and in the Raleigh Central Office, with the addresses provided below.

   Fayetteville Regional Office
   Systel Building
   225 Green Street, Suite 714
   Fayetteville, NC 28301

   Raleigh Central Office
   217 West Jones Street
   Raleigh, NC 27603

   In addition, the preliminary determination and draft permit will be made available on NCDAQ public notice webpage.

3) Notify the public, by advertisement in a newspaper of general circulation in each region in which the proposed source would be constructed, of the application, the preliminary determination, the degree of increment consumption that is expected from the source or modification, and of the opportunity for comment at a public hearing as well as written public comment.

   NCDAQ prepared a public notice that will be published in a newspaper of general circulation in the region. A public hearing will be held for this permit application.

4) Send a copy of the notice of public comment to the applicant, the Administrator and to officials and agencies having cognizance over the location where the proposed construction would occur as follows: Any other State or local air pollution control agencies, the chief executives of the city and county where the source would be located; any comprehensive regional land use planning agency, and any State, Federal Land Manager, or Indian Governing body whose lands may be affected by emissions from the source or modification.

   NCDAQ will send the public notice to the Robeson County Manager at 701 N. Elm Street Lumberton, North Carolina 28358 and the Lumberton City Manager at 500 North Cedar Street, Lumberton NC 28358

5) Provide opportunity for a public hearing for interested persons to appear and submit written or oral comments on the air quality impact of the source, alternatives to it, the control technology required, and other appropriate considerations.

   NCDAQ's public notice provides contact information to allow interested persons to submit comments. A public hearing will be held for this permit application.

7.0 Conclusion

Based on the application submitted and the review of this proposal, NCDAQ is making a preliminary determination that the project can be approved and a revised permit issued. After consideration of all comments, a final determination will be made.

Attachment 1

Permit Condition for BACT for NCRP

5. 15A NCAC 02D .0530: PREVENTION OF SIGNIFICANT DETERIORATION

When burning non-CISWI subject wood and poultry litter

a. For PSD purposes, the following "Best Available Control Technology" (BACT) permit limitations shall not be exceeded for these boilers **(ID Nos. ES-1A and ES-1B)** when firing non-CISWI subject wood and poultry litter:

Pollutants	Control Technology or Work Practice	BACT Emission Limit	Averaging Period
Carbon monoxide	Good combustion practices	0.65 lb/million Btu per boiler	30-day rolling average as measured via CEMS
		208.8 lb/hr (startup and shutdown when one boiler is idle)	3-hour rolling average as measured via CEMS
		526.2 lb/hr (startup and shutdown when both boilers are operating)	3-hour rolling average as measured via CEMS
Volatile organic compounds	Good combustion practices	0.03 lb/million Btu per boiler	3-hour average as measured via stack test
Nitrogen oxides	Selective non-catalytic reduction	0.17 lb/million Btu per boiler	30-day rolling average as measured via CEMS
		11.2 lb/hr (startup and shutdown when one boiler is idle)	3-hour rolling average as measured via CEMS
		39.2 lb/hr (startup and shutdown when both boilers are operating)	3-hour rolling average as measured via CEMS
Sulfur dioxide	Dry sorbent injection	0.16 lb/million Btu per boiler	30-day rolling average as measured via CEMS
Sulfuric acid (H_2SO_4) mist (SAM)	Dry sorbent injection	0.027 lb/ million Btu per boiler	3-hour average as measured via stack test
Particulate matter (filterable only)	Multiclone and baghouse	0.030 lb/ million Btu per boiler	3-hour average as measured via stack test
PM_{10} (filterable and condensible)	Multiclone and baghouse	0.036 lb/ million Btu per boiler	3-hour average as measured via stack test
$PM_{2.5}$ (SAM, filterable, and condensible)	Multiclone and baghouse	0.027 lb/ million Btu per boiler	3-hour average as measured via stack test

Pollutants	Control Technology or Work Practice	BACT Emission Limit	Averaging Period
CO_2e	Good combustion practices	438,825 tons/yr	Rolling 12-month average

Testing [15A NCAC 02Q .0508(f)]

b. If emissions testing is required, the testing shall be performed in accordance with General Condition JJ. If the results of this test are above any limit given in Section 2.1 A.5.a above, the Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530.

c. Under the provisions of NCGS 143-215.108, the Permittee shall demonstrate compliance with the emissions limits for sulfuric acid mist and PM, PM_{10}, and $PM_{2.5}$ in Section 2.1 A.5.a above, by conducting a performance test while firing a minimum of 30 percent poultry litter blend in the boilers **(ID Nos. ES-1A and ES-1B)**. Testing shall be conducted accordance with a testing protocol approved by the DAQ. Unless another date is approved in advance by the DAQ, the source testing shall be conducted and test results submitted within 180 days of startup of the boilers **(ID Nos. ES-1A and ES-1B)** after completion of the boiler maintenance and replacement activities specified in the addendum to permit application no. 7800166.17C submitted on June 23, 2021. If the source test is not conducted or if the results of this test are above any limit given in Section 2.1 A.5.a above, the Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530.

d. Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall conduct subsequent performance tests for compliance with emissions limits for sulfuric acid mist and PM, PM_{10}, and $PM_{2.5}$ in Section 2.1 A.5.a above within 60 days of the date that the percentage of poultry litter firing exceeds 50 percent, 70 percent, and 90 percent of total heat input to the boilers **(ID Nos. ES-1A and ES-1B).** If the source tests are not conducted or if the results of the tests are above any limit given in Section 2.1 A.5.a above, the Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530.

Monitoring/Recordkeeping for CO, NO_X, and SO_2 [15A NCAC 02Q .0508 (f)]

e. For the purposes of determining compliance with the BACT emission limits in Section 2.1 A.5.a above, the following definitions for startup and shutdown apply:
   i. If one boiler is in operation, startup shall end when that boiler exceeds 30,000 lb/hr steam load or 12 hours, whichever is less.
   ii. If both boilers are in operation, startup ends when the steam load on each boiler exceeds 30,000 lb/hr or 12 hours, whichever is less.
   iii. If one boiler is in operation, shutdown shall begin when that boiler falls below 30,000 lb/hr steam load and shall not exceed 12 hours.
   iv. If both boilers are in operation, shutdown begins when the steam load on either boiler drops below 30,000 lb/hr and shall not exceed 12 hours.

f. To ensure compliance with the CO emission limit in Section 2.1 A.5.a above, the Permittee shall install and certify a continuous emissions monitoring system (CEMS) to measure CO emissions from boilers **(ID Nos. ES-1A and ES-1B)**. The CO CEMS shall be installed on the common stack and certified in accordance with Performance Specifications 4 and 6, Appendix A, 40 CFR Part 60. The CO CEMS shall meet the ongoing QA/QC requirements specified in Procedure 1, Appendix F, 40 CFR Part 60.
   i. Except for monitor malfunctions, associated repairs, and required quality assurance or control activities (including, as applicable, calibration checks and cylinder gas audits), monitor shall continuously collect data at all times that the affected source is operating.
   ii. The CO CEMS data shall be reduced as specified in 40 CFR 60.13(h)(2).
   iii. Whenever hourly CO emission data is missing, the Permittee shall substitute for each hour of data missing with the greater of either (A) or (B):

(A) the average of the hourly pollutant emission rates recorded by the CEMS of the hour before and the hour after the missing data period; or

(B) the maximum hourly pollutant emission rate of the past 720 operating hours.

iv The 30-day rolling average of CO emissions shall be calculated by summing all the valid hourly averages in the 30-day period, excluding startup or shutdown, with missing data filled in as specified in 2.1 A.5.f.iii above, then dividing the sum by the number of hours that the emission unit is operating. The missing data substitution procedure shall be used whenever the emission unit is operating and the CEMS is not providing valid hourly emission data.

v. The 3-hr rolling average of CO emissions for startup or shutdown shall be calculated by summing all the valid hourly averages for each 3-hr period during startup or shutdown, with missing data filled in as specified in 2.1 A.5.f.iii above, then dividing the sum by three. The missing data substitution procedure shall be used whenever the emission unit is operating and the CEMS is not providing valid hourly emission data. When the startup or shutdown event does not have enough hours to calculate the 3-hr rolling average (i.e. when the startup or shutdown event is less than 3 hours), the 3-hr rolling average shall be calculated by looking back the required additional hours from the previous startup or shutdown event.

The Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530 if these requirements are not met or if CO emissions exceed the limits in Sections 2.1 A.5.a.

g. To ensure compliance with the SO_2 emission limit in Section 2.1 A.5.a above, the Permittee shall monitor SO_2 emissions from boilers **(ID Nos. ES-1A and ES-1B)** using CEMS that meet the requirements of 40 CFR Part 75, except that unbiased values may be used. The 30-day rolling average of SO_2 emissions shall be calculated by summing all the valid hourly averages in the 30-day period with missing data filled in accordance with 40 CFR Part 75, then dividing the sum by the number of hours that the emission unit is operating. The missing data substitution procedure shall be used whenever the emission unit is operating and the CEMS is not providing valid hourly emission data. The Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530 if these requirements are not met or the 30-day rolling average of SO_2 emissions exceeds the limit in Sections 2.1 A.5.a.

h. To ensure compliance with the NO_X emission limits in Section 2.1 A.5.a above, the Permittee shall monitor NO_X emissions from boilers **(ID Nos. ES-1A and ES-1B)** using CEMS that meet the requirements of 40 CFR Part 75, except that unbiased values may be used. The CEMS data shall be averaged as follows:

i. The 30-day rolling average of NO_X emissions shall be calculated by summing all the valid hourly averages in the 30-day period with missing data filled in accordance with 40 CFR Part 75, then dividing the sum by the number of hours that the emission unit is operating. The missing data substitution procedure shall be used whenever the emission unit is operating and the CEMS is not providing valid hourly emission data.

ii. The 3-hr rolling average of NO_X emissions for startup or shutdown shall be calculated by summing all the valid hourly averages for each 3-hr period during startup or shutdown, with missing data filled in 40 CFR Part 75, then dividing the sum by three. The missing data substitution procedure shall be used whenever the emission unit is operating and the CEMS is not providing valid hourly emission data. When the startup or shutdown event does not have enough hours to calculate the 3-hr rolling average (i.e. when the startup or shutdown event is less than 3 hours), the 3-hr rolling average shall be calculated by looking back the required additional hours from the previous startup or shutdown event.

The Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530 if these requirements are not met or the NO_X emissions exceed the limits in Sections 2.1 A.5.a.

i. For the CO, NO_X, and SO_2 CEMS required in Sections 2.1 A.5.f, g, and h above, the monitor downtime shall not exceed 5.0 percent of the operating time in a calendar quarter and shall be calculated using the following equation:

$$\%MD = \left(\frac{\text{Total Monitor Downtime}}{\text{Total Source Operating Time}}\right) \times 100$$

Where:

"%MD" means Percent Monitor downtown for the calendar quarter.
"Total Monitor Downtime" means the the number of hours in a calendar quarter where an emission source was operating but data from the associated CEMS are invalid, not available, and/or filled with the missing data procedure.
"Total Source Operating Time" means the number of hours in a calendar quarter where the emission source associated with the CEMS was operating.
"Calendar Quarter" means the three-month period b7etween January and March, April and June, July and September, and October and December

The Permittee shall be deemed in noncompliance if these monitoring requirements are not met.

j The Permittee shall monitor volumetric flow from the boilers **(ID Nos. ES-1A and ES-1B)** using a flow monitor that meets the requirements of 40 CFR Part 75, except that unbiased data may be used (missing data shall be filled in accordance with 40 CFR Part 75). The flow monitor shall not exceed 5.0 percent monitor downtime as specified in section 2.1 A.5.i. above. If the volumetric flow meter does not comply with these requirements, the Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530.

Monitoring/Recordkeeping for VOC [15A NCAC 02Q .0508 (f)]

k. To ensure compliance with VOC emission limit in Section 2.1 A.5. a. above, the Permittee shall follow the monitoring and recordkeeping requirements in Section 2.1 A.7.h through k below for 40 CFR Part 63 Subpart JJJJJJ. The Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530 if these requirements are not met.

Monitoring/Recordkeeping for Sulfuric Acid Mist [15A NCAC 02Q .0508 (f)]

l. No monitoring or recordkeeping shall be required for emissions of sulfuric acid mist from boilers (**ID Nos. ES-1A and ES-1B**).

Monitoring/Recordkeeping for PM, PM_{10}, and $PM_{2.5}$ [15A NCAC 02Q .0508 (f)]

m. To ensure compliance with PM, PM_{10}, and $PM_{2.5}$ emission limits in Section 2.1 A.5 a above, the Permittee shall follow the monitoring and recordkeeping requirements in Section 2.1 A.1.e and f above. The Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530 if the bagfilter is not inspected and maintained or if the associated records are not maintained.

Monitoring/Recordkeeping for GHG [15A NCAC 02Q .0508 (f)}

n. The Permittee shall use current AP-42 emission factors and fuel usage to determine GHG emissions (as CO_2e) from the boilers **(ID Nos. ES-1A and ES-1B)** on a monthly basis, or as otherwise approved by NC DAQ. The Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530 if the emissions of GHG are not recorded on a monthly basis or if the emissions of GHG exceed the limits in Section 2.1 A.5.a above.

Other Monitoring/Recordkeeping Requirements [15A NCAC 02Q .0508 (f)]

o. At all times, including periods of startup, shutdown, and malfunction, the Permittee shall, to the extent practicable, maintain and operate all emission sources including associated control devices in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.

p. In order to ensure compliance with startup scenarios used in the PSD modeling, the Permittee shall fire no more than 500 gallons of No. 2 fuel oil in the boilers **(ID Nos. ES-1A and ES-1B)** during a consecutive 12-month period. The Permittee shall only fire No. 2 fuel oil during periods of start-up of the boilers and shall generate no electricity while firing No. 2 fuel oil in the boilers. The Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530 if these requirements are not met.

q. The Permittee shall record the following in logbook (written or electronic) in reference to No. 2 fuel oil usage:
   i. The date and time of each startup when No. 2 fuel oil was fired in the boilers.
   ii. The amount in gallons of No. 2 fuel oil used during startup.

   The Permittee shall be deemed in noncompliance with 15A NCAC 02D .0530 if the records are not maintained or the fuel usage exceeds the limit in Section 2.1 A.5.p above.

Reporting [15A NCAC 02Q .0508 (f)]

r. The Permittee shall submit a summary report of monitoring and recordkeeping activities given in Section 2.1 A.5.f through q above, postmarked on or before January 30 of each calendar year for the preceding six-month period between July and December and July 30 of each calendar year for the preceding six-month period between January and June. The report shall include:
   i. The monthly GHG emissions (CO_2e basis) for the previous 17 months on a facility-wide basis. The emissions must be calculated for each of the 12-month periods over the previous 17 months.
   ii. The monthly fuel usage of No. 2 fuel oil fired in the boilers **(ID Nos. ES-1A and ES-1B)** and the total fuel usage over the previous 12-month period.
   iii. An excess emissions and continuous monitoring system performance summary report. The report shall use the form and content set forth in 40 CFR 60.7(d).
   iv. All instances of deviations from the requirements of this permit must be clearly identified.

s. Reporting requirements for PM emissions from the boilers (**ID Nos. ES-1A and ES-1B**) in Section 2.1 A.1.h above shall be sufficient to ensure compliance with PM, PM_{10}, and $PM_{2.5}$ BACT limits.

t. No reporting is required for emissions of VOC or sulfuric acid mist.

Attachment 2

Emission Calculations

Facility-Wide Potential Emissions

Facility-Wide Potential Emissions (PTE) Summary

Pollutant	Hourly Potential (lb/hr)																
	Boilers (ES-1A, ES-1B)	Starter Fuel (ES-1A, ES-1B)	Emergency Fire Pump (ES-1)	Drum Dryer (ES-22)	Parts Cleaner (IES-4)	Cooling Towers (IES-6)	Truck Dump 1 (IES-8)	Truck Dump 2 (IES-9)	Fuel Piles (IES-10)	Fuel Handling (IES-11)	Roads (IES-12)	Sorbent Silo (IES-13)	Poultry Litter Warehouse (IES-16)	Belt Dryers (ES-17, ES-18, ES-19, ES-21)	Fly Ash Silo 1 (IES-21)	Fly Ash Silo 2 (IES-22)	Fly Ash Drying Operations
CO	279.50	15.36	1.95	2.77	-	-	-	-	-	-	-	-	-	-	-	-	-
NOx	73.10	73.71	2.25	3.29	-	-	-	-	-	-	-	-	-	-	-	-	-
SO2	68.80	0.65	0.70	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-
PM	12.90	10.14	0.11	1.39	-	0.34	0.04	0.04	0.99	0.39	0.34	0.18	0.88	-	Negligible	0.00003	42.88
PM10	15.48	10.14	0.11	1.39	-	0.34	0.02	0.02	0.50	0.18	0.04	0.10	0.00	-	Negligible	0.00001	16.87
PM2.5	11.61	10.14	0.11	1.39	-	0.34	0.00	0.00	0.07	0.03	0.01	0.01	0.00	-	Negligible	0.00000	4.61
VOC	12.90	0.61	0.21	3.30	0.80	-	-	-	-	-	-	-	-	77.35	-	-	-
Lead	1.23E-02	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highest Individual HAP (HCl)	2.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total HAP	4.29	0.45	0.00	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-

Pollutant	Annual Potential Emissions (tons/year)																	
	Boilers (ES-1A, ES-1B)	Starter Fuel (ES-1A, ES-1B)	Emergency Fire Pump (ES-1)	Drum Dryer (ES-22)	Parts Cleaner (IES-4)	Cooling Towers (IES-6)	Truck Dump 1 (IES-8)	Truck Dump 2 (IES-9)	Fuel Piles (IES-10)	Fuel Handling (IES-11)	Roads (IES-12)	Sorbent Silo (IES-13)	Poultry Litter Warehouse (IES-16)	Belt Dryers (ES-17, ES-18, ES-19, ES-21)	Fly Ash Drying Operations	Fly Ash Silo 1 (IES-21)	Fly Ash Silo 2 (IES-22)	Facility-Wide
CO	1,224.21	6.73	0.49	12.12	-	-	-	-	-	-	-	-	-	-	-	-		1,243.54
NOx	320.18	32.29	0.56	14.43	-	-	-	-	-	-	-	-	-	-	-	-		367.46
SO2	301.34	0.29	0.17	0.17	-	-	-	-	-	-	-	-	-	-	-	-		301.98
PM	56.50	4.44	0.03	6.07	-	1.48	0.10	0.10	4.34	1.71	1.11	0.00	0.08	-	35.28	Negligible	1.18E-04	111.23
PM10	67.80	4.44	0.03	6.07	-	1.48	0.05	0.05	2.17	0.81	0.15	0.00	0.01	-	14.30	Negligible	5.59E-05	97.35
PM2.5	50.85	4.44	0.03	6.07	-	1.48	0.01	0.01	0.33	0.12	0.02	0.00	0.01	-	4.16	Negligible	5.59E-06	67.51
VOC	56.50	0.27	0.21	14.45	0.80	-	-	-	-	-	-	-	-	293.09	-	-	-	365.33
Lead	0.05	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06
Highest Individual HAP (HCl)	10.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.00
Total HAP	16.32	0.19	0.00	0.62	-	-	-	-	-	-	-	-	-	-	-	-	-	17.14

Boiler Potential Emissions Calculation - Criteria Pollutants

Input Capacity per Boiler:	215 MMBtu/hr
Number of Boilers:	2
Total Boiler Capacity:	430 MMBtu/hr
Max Annual Operation:	8,760 hours

Wood/Poultry Litter/Poultry Cake Mix Combustion (Expected mix: 15% wood, 85% poultry litter and cake)

		PRE-CONTROL EMISSION RATES						POST-CONTROL EMISSION RATES			
Pollutant Category	Pollutant	(lb/MMBtu)	(lb/hr)	(tpy)	Pre-Control Emission Factor Source	Control	Control Efficiency	(lb/MMBtu)	(lb/hr)	(tpy)	Comments
Criteria Pollutant	CO	0.65	279.50	1,224.2	Same as post-control emissions	Good Combustion	N/A	0.65	279.50	1,224.2	Based on BACT CO limit of 0.65 lb/MMBtu (when burning wood/litter and cake mix)
Criteria Pollutant	NOx	0.28	121.83	533.6	Back calculated from post-combustion lb/MMBtu emission factor and control efficieny	SNCR	40%	0.17	73.10	320.2	Based on proposed SB3 BACT NOx limit of 0.17 lb/MMBtu (when burning wood/litter and cake mix)
Criteria Pollutant	SO_2	0.80	344.00	1,506.7	Estimated using typical sulfur contents of wood and litter, and assuming 50% furnace capture.	Low Sulfur Wood/ Litter and Cake Mix	80%	0.16	68.80	301.3	Based on BACT SO2 limit of 80% Reduction (when burning wood/litter and cake mix). Also limited by modeling.
Criteria Pollutant	VOC	0.03	12.90	56.5	Same as post-control emissions	Good Combustion	N/A	0.03	12.90	56.5	No change is requested to the existing SB3 BACT VOC limit
Criteria Pollutant	PM (filterable)	0.60	258.00	1,130.0	Back calculated from post-combustion lb/MMBtu emission factor and control efficieny	Cyclone + Baghouse	95%	0.03	12.90	56.5	Based on NSPS PM limit of 0.03 lb/MMBtu
Criteria Pollutant	PM_{10} (filterable + condensable)	0.72	309.60	1,356.0		Cyclone + Baghouse	95%	0.036	15.48	67.8	Based on BACT limit and vendor guarantee
Criteria Pollutant	$PM_{2.5}$ (filterable + condensable)	0.54	232.20	1,017.0		Cyclone + Baghouse	95%	0.027	11.61	50.9	Proposed new BACT limit. Also, limited by modeling.
Greenhouse Gas Pollutant	CO2e	233.00	100,188	438,825	Same as post-control emissions	Good Combustion	N/A	233.00	100,188	438,825	Factors from EPA Greenhouse Gas Mandatory Reporting Rule, Tables C-1 and C-2. See Notes 1 and 2.

Notes:

1. Fuel oil usage has been excluded from the GHG emission calculation as the factors for each pollutant are lower than the factors for wood, litter and cake.
2. Greenhouse gas emissions were calculated using the following emission factors from EPA's Mandatory Reporting Rule, Tables C-1 and C-2:

Wood ("Biomass Fuels - solid: wood and wood residuals")

CO_2	93.80 kg/MMBtu
CH_4	7.2E-03 kg/MMBtu
N_2O	3.6E-03 kg/MMBtu

Litter and Cake ("Biomass fuels - solid: solid byproducts")

CO_2	105.51 kg/MMBtu
CH_4	3.2E-02 kg/MMBtu
N_2O	4.2E-03 kg/MMBtu

The factors above were converted to CO_2e using the following global warming potentials from Table A-1 of the MRR:

CO_2	1
CH_4	25
N_2O	298

The developed factor is converted from kg to lb and weighted based on 15% wood and 85% litter and cake being fired in the boiler.

Emission Factors of HAPs and Air Toxics From Wood and Poultry Litter and Cake Combustion

Wood Combustion

Emission factors HAPs and Air Toxics from wood biomass combustion in the boiler are selected from the following sources, in order of hierarchy:

1. Boiler and air pollution control device (APCD) vendor guarantees for HCl and NH3.
2. EPA AP-42 Chapter 1.6 – Wood Residue Combustion in Boilers (9/03)
3. May 2010 Emission test data for Coastal Carolina Clean Power, LLC's Kenansville, NC Facility (CCCP Kenansville) for chlorine, manganese, formaldehyde, acetaldehyde, acrolein, styrene, benzene, and toluene. CCCP Kenansville is a sister facility

Poultry Litter and Cake and Wood Biomass Combined

Emission factors from Coastal Carolina Clean Power, LLC (Kenansville, NC). Test runs from May 2013, July 2013, and July 2014.

Metal HAP Baghouse Control Efficiency: 80%
(not used for Hg)

Poultry Litter and Cake + Biomass Combustion	CC May 2013 (ES-1A)	CC July 2013 (ES-1B)	CC July 2014 (ES-1B)
Poultry Litter (including bedding)%	67%	Not specified	25%
Biomass%	33%	Not specified	75%
Heat Input Rate During Tests	186 MMBtu/hr	183 MMBtu/hr	180 MMBtu/hr

100% Wood Biomass Combustion

Pollutant Category	Pollutant	CAS	Emission Factors (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)
HAP	HCl	7647-01-0	0.00663	Vendor Guarantee. Use of low chlorine content wood.	2.85E+00	10.00
VHAP	Acetaldehyde	75-07-0	8.13E-05	CCCP Kenansville May 2010 Test Data	3.50E-02	0.15
VHAP	Acetophenone		3.20E-09	AP-42 Chapter 1.6	1.38E-06	6.03E-06
VHAP	Acrolein	107-02-8	1.49E-04	CCCP Kenansville May 2010 Test Data	6.41E-02	0.28
VHAP	Benzene	71-43-2	6.58E-05	CCCP Kenansville May 2010 Test Data	2.83E-02	0.12
VHAP	bis(2-Ethylhexyl)phthalate	117-81-7	4.70E-08	AP-42 Chapter 1.6	2.02E-05	8.85E-05
VHAP	Bromomethane	74-83-9	1.50E-05	AP-42 Chapter 1.6	6.45E-03	0.03
VHAP	Carbon Tetrachloride	56-23-5	4.50E-05	AP-42 Chapter 1.6	1.94E-02	0.08
VHAP	Chlorine	7782-50-5	0.0018	CCCP Kenansville May 2010 Test Data	7.74E-01	3.39
VHAP	Chlorobenzene	108-90-7	3.30E-05	AP-42 Chapter 1.6	1.42E-02	0.06
VHAP	Chloroform	67-66-3	2.80E-05	AP-42 Chapter 1.6	1.20E-02	0.05
VHAP	Chloromethane	74-87-3	2.30E-05	AP-42 Chapter 1.6	9.89E-03	0.04
VHAP	Cumene	98-82-8	N/A	AP-42 Chapter 1.6		
VHAP	Di-n-butylphthalate	84-74-2	N/A	AP-42 Chapter 1.6		
VHAP	2,4-Dinitrophenol	51-28-5	1.80E-07	AP-42 Chapter 1.6	7.74E-05	3.39E-04
VHAP	2,4-Dinitrotoluene	121-14-2	N/A	AP-42 Chapter 1.6		
VHAP	1,4-Dichlorobenzene	106-46-7	N/A	AP-42 Chapter 1.6		
VHAP	1,2-Dichloroethane	107-06-2	2.90E-05	AP-42 Chapter 1.6	1.25E-02	0.05
VHAP	1,2-Dichloropropane	78-87-5	3.30E-05	AP-42 Chapter 1.6	1.42E-02	0.06
VHAP	Ethylbenzene	100-41-4	3.10E-05	AP-42 Chapter 1.6	1.33E-02	0.06
VHAP	Formaldehyde	50-00-0	2.19E-04	CCCP Kenansville May 2010 Test Data	9.42E-02	0.41
VHAP	n-Hexane	110-54-3	N/A	AP-42 Chapter 1.6		
VHAP	Methanol	67-56-1	N/A	AP-42 Chapter 1.6		
VHAP	Methyl Isobutyl Ketone	108-10-1	N/A	AP-42 Chapter 1.6		
VHAP	Methylene Chloride	75-09-2	2.90E-04	AP-42 Chapter 1.6	1.25E-01	0.55
VHAP	Naphthalene	91-20-3	9.70E-05	AP-42 Chapter 1.6	4.17E-02	0.18
VHAP	4-Nitrophenol	100-02-7	1.10E-07	AP-42 Chapter 1.6	4.73E-05	2.07E-04
VHAP	Pentachlorophenol	87-86-5	5.10E-08	AP-42 Chapter 1.6	2.19E-05	9.61E-05
VHAP	Phenol	108-95-2	5.10E-05	AP-42 Chapter 1.6	2.19E-02	0.10
VHAP	Propionaldehyde	123-38-6	6.10E-05	AP-42 Chapter 1.6	2.62E-02	0.11
VHAP	Styrene	100-42-5	4.64E-05	CCCP Kenansville May 2010 Test Data	2.00E-02	0.09
VHAP	Toluene	108-88-3	4.34E-05	CCCP Kenansville May 2010 Test Data	1.87E-02	0.08
VHAP	Tetrachloroethene	127-18-4	3.80E-05	AP-42 Chapter 1.6	1.63E-02	0.07
VHAP	1,1,1-Trichloroethane	71-55-6	3.10E-05	AP-42 Chapter 1.6	1.33E-02	0.06
VHAP	Trichloroethylene	79-01-6	3.00E-05	AP-42 Chapter 1.6	1.29E-02	0.06

Stack Test Emission Factors / Maximum Emissions from Poultry Litter and Cake + Biomass Combustion / Potential Emissions

Pollutant	CC May 2013 (ES-1A) lb/MMBtu	CC May 2013 (ES-1A) lb/hr	CC May 2013 (ES-1A) Final lb/MMBtu	CC July 2013 (ES-1B) lb/MMBtu	CC July 2013 (ES-1B) lb/hr	CC July 2013 (ES-1B) Final lb/MMBtu	CC July 2014 (ES-1B) lb/MMBtu	CC July 2014 (ES-1B) lb/hr	CC July 2014 (ES-1B) Final lb/MMBtu	Litter/Wood Mix Emission Factor Used in Calcs (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)
HCl	Not used. NESHAP limit used instead.									0.0063	MACT avoidance	2.71	10.00	Biomass	2.85	10.00
Acetaldehyde														Biomass	3.50E-02	0.15
Acetophenone														Biomass	1.38E-06	6.03E-06
Acrolein														Biomass	6.41E-02	0.28
Benzene														Biomass	2.83E-02	0.12
bis(2-Ethylhexyl)phthalate														Biomass	2.02E-05	8.85E-05
Bromomethane														Biomass	6.45E-03	0.03
Carbon Tetrachloride														Biomass	1.94E-02	0.08
Chlorine		0.0176	9.46E-05		0.0135	7.38E-05		0.00987	5.48E-05	0.0000946	Max emission rate from CC stack tests.[1]	0.04	0.18	Biomass	7.74E-01	3.39
Chlorobenzene														Biomass	1.42E-02	0.06
Chloroform														Biomass	1.20E-02	0.05
Chloromethane														Biomass	9.89E-03	0.04
Cumene																
Di-n-butylphthalate																
2,4-Dinitrophenol														Biomass	7.74E-05	3.39E-04
2,4-Dinitrotoluene																
1,4-Dichlorobenzene																
1,2-Dichloroethane														Biomass	1.25E-02	0.05
1,2-Dichloropropane														Biomass	1.42E-02	0.06
Ethylbenzene														Biomass	1.33E-02	0.06
Formaldehyde														Biomass	9.42E-02	0.41
n-Hexane																
Methanol																
Methyl Isobutyl Ketone																
Methylene Chloride														Biomass	1.25E-01	0.55
Naphthalene														Biomass	4.17E-02	0.18
4-Nitrophenol														Biomass	4.73E-05	2.07E-04
Pentachlorophenol														Biomass	2.19E-05	9.61E-05
Phenol														Biomass	2.19E-02	0.10
Propionaldehyde														Biomass	2.62E-02	0.11
Styrene														Biomass	2.00E-02	0.09
Toluene														Biomass	1.87E-02	0.08
Tetrachloroethene														Biomass	1.63E-02	0.07
1,1,1-Trichloroethane														Biomass	1.33E-02	0.06
Trichloroethylene														Biomass	1.29E-02	0.06

Emission Factors of HAPs and Air Toxics From Wood and Poultry Litter and Cake Combustion

Wood Combustion

Emission factors HAPs and Air Toxics from wood biomass combustion in the boiler are selected from the following sources, in order of hierarchy:

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2. EPA AP-42 Chapter 1.6 – Wood Residue Combustion in Boilers (9/03)
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Poultry Litter and Cake and Wood Biomass Combined

Emission factors from Coastal Carolina Clean Power, LLC (Kenansville, NC). Test runs from May 2013, July 2013, and July 2014.

Metal HAP Baghouse Control Efficiency: 80%
(not used for Hg)

Poultry Litter and Cake + Biomass Combustion	CC May 2013 (ES-1A)	CC July 2013 (ES-1B)	CC July 2014 (ES-1B)
Poultry Litter (including bedding)%	67%	Not specified	25%
Biomass%	33%	Not specified	75%
Heat Input Rate During Tests	186 MMBtu/hr	183 MMBtu/hr	180 MMBtu/hr

			100% Wood Biomass Combustion				Stack Test Emission Factors									Maximum Emissions from Poultry Litter and Cake + Biomass Combustion				Potential Emissions		
Pollutant Category	Pollutant	CAS	Emission Factors (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)	lb/MMBtu	lb/hr	Final lb/MMBtu	lb/MMBtu	lb/hr	Final lb/MMBtu	lb/MMBtu	lb/hr	Final lb/MMBtu	Litter/Wood Mix Emission Factor Used in Calcs (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)
VHAP	2,4,6-Trichlorophenol	88-06-2	2.20E-08	AP-42 Chapter 1.6	9.46E-06	4.14E-05														Biomass	9.46E-06	4.14E-05
VHAP	Vinyl Chloride	75-01-4	1.80E-05	AP-42 Chapter 1.6	7.74E-03	0.03														Biomass	7.74E-03	0.03
VHAP	Xylenes	1330-20-7	2.50E-05	AP-42 Chapter 1.6	1.08E-02	0.05														Biomass	1.08E-02	0.05
VHAP	HF	7664-39-3	N/A	AP-42 Chapter 1.6																		
Metal HAP	Antimony	7440-36-0	1.58E-06	AP-42 Chapter 1.6 & Baghouse Control Efficiency	6.79E-04	0.003														Biomass	6.79E-04	0.003
Metal HAP	Arsenic	7440-38-2	4.40E-06	AP-42 Chapter 1.6 & Baghouse Control Efficiency	1.89E-03	0.008		4.45E-03	2.39E-05							2.39E-05	Max emission rate from CC stack tests.	0.01	0.05	Poultry Litter + Biomass	1.03E-02	0.05
Metal HAP	Beryllium	7440-41-7	2.20E-07	AP-42 Chapter 1.6 & Baghouse Control Efficiency	9.46E-05	4.14E-04		1.60E-04	8.60E-07							8.60E-07	Max emission rate from CC stack tests.	0.00	0.00	Poultry Litter + Biomass	3.70E-04	0.002
Metal HAP	Cadmium	7440-43-9	8.20E-07	AP-42 Chapter 1.6 & Baghouse Control Efficiency	3.53E-04	0.002		4.24E-04	2.28E-06							2.28E-06	Max emission rate from CC stack tests.	0.00	0.00	Poultry Litter + Biomass	9.80E-04	0.004
Metal HAP	Chromium (Total)	7440-47-3	4.20E-06	AP-42 Chapter 1.6 & Baghouse Control Efficiency	1.81E-03	0.008		2.14E-03	1.15E-05							1.15E-05	Max emission rate from CC stack tests.	0.00	0.02	Poultry Litter + Biomass	4.95E-03	0.02
Metal HAP	Chromium (Hexavalent)	18540-29-9	7.00E-07	AP-42 Chapter 1.6 & Baghouse Control Efficiency	3.01E-04	0.001														Biomass	3.01E-04	0.001
Metal HAP	Cobalt	7440-48-4	1.30E-06	AP-42 Chapter 1.6 & Baghouse Control Efficiency	5.59E-04	0.002														Biomass	5.59E-04	0.002
Metal HAP	Lead	7439-92-1	9.60E-06	AP-42 Chapter 1.6 & Baghouse Control Efficiency	4.13E-03	0.02	2.86E-05	5.32E-03	2.86E-05							2.86E-05	Max emission rate from CC stack tests.	0.01	0.05	Poultry Litter + Biomass	1.23E-02	0.05
Metal HAP	Manganese	7439-96-5	1.16E-05	CCCP Kenansville May 2010 Test Data	4.99E-03	0.02		1.41E-02	7.58E-05							7.58E-05	Max emission rate from CC stack tests.	0.03	0.14	Poultry Litter + Biomass	3.26E-02	0.14
Metal HAP	Mercury	7439-97-6	3.50E-06	AP-42 Chapter 1.6	1.51E-03	0.007		2.06E-04	1.11E-06							1.11E-06	Max emission rate from CC stack tests.	0.00	0.00	Biomass	1.51E-03	0.007
Metal HAP	Nickel	7440-02-0	6.60E-06	AP-42 Chapter 1.6 & Baghouse Control Efficiency	2.84E-03	0.01		3.16E-03	1.70E-05							1.70E-05	Max emission rate from CC stack tests.	0.01	0.03	Poultry Litter + Biomass	7.31E-03	0.03
Metal HAP	Selenium	7782-49-2	5.60E-07	AP-42 Chapter 1.6 & Baghouse Control Efficiency	2.41E-04	0.001	2.41E-07	2.15E-03	2.41E-07							2.41E-07	Max emission rate from CC stack tests.	0.00	0.00	Biomass	2.41E-04	0.001
POM	Acenaphthene	POM	9.10E-07	AP-42 Chapter 1.6	3.91E-04	0.002														Biomass	3.91E-04	0.002
POM	Acenaphthylene	POM	5.00E-06	AP-42 Chapter 1.6	2.15E-03	0.009														Biomass	2.15E-03	0.009
POM	Anthracene	POM	3.00E-06	AP-42 Chapter 1.6	1.29E-03	0.006														Biomass	1.29E-03	0.006
POM	Benzo(a)anthracene	POM	6.50E-08	AP-42 Chapter 1.6	2.80E-05	1.22E-04														Biomass	2.80E-05	1.22E-04
POM	Benzo(a)pyrene	50-32-8	2.60E-06	AP-42 Chapter 1.6	1.12E-03	0.005														Biomass	1.12E-03	0.005
POM	Benzo(b)fluoranthene	POM	1.00E-07	AP-42 Chapter 1.6	4.30E-05	1.88E-04														Biomass	4.30E-05	1.88E-04
POM	Benzo(e)pyrene	POM	2.60E-09	AP-42 Chapter 1.6	1.12E-06	4.90E-06														Biomass	1.12E-06	4.90E-06
POM	Benzo(g,h,i)perylene	POM	9.30E-08	AP-42 Chapter 1.6	4.00E-05	1.75E-04														Biomass	4.00E-05	1.75E-04
POM	Benzo(j,k)fluoranthene	POM	1.60E-07	AP-42 Chapter 1.6	6.88E-05	3.01E-04														Biomass	6.88E-05	3.01E-04
POM	Benzo(k)fluoranthene	POM	3.60E-08	AP-42 Chapter 1.6	1.55E-05	6.78E-05														Biomass	1.55E-05	6.78E-05
POM	2-Chloronaphthalene	POM	2.40E-09	AP-42 Chapter 1.6	1.03E-06	4.52E-06														Biomass	1.03E-06	4.52E-06

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			100% Wood Biomass Combustion				Stack Test Emission Factors									Maximum Emissions from Poultry Litter and Cake + Biomass Combustion				Potential Emissions		
Pollutant Category	Pollutant	CAS	Emission Factors (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)	lb/MMBtu	lb/hr	Final lb/MMBtu	lb/MMBtu	lb/hr	Final lb/MMBtu	lb/MMBtu	lb/hr	Final lb/MMBtu	Litter/Wood Mix Emission Factor Used in Calcs (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)
POM	Chrysene	POM	3.80E-08	AP-42 Chapter 1.6	1.63E-05	7.16E-05														Biomass	1.63E-05	7.16E-05
POM	Dibenzo(a,h)anthracene	POM	9.10E-09	AP-42 Chapter 1.6	3.91E-06	1.71E-05														Biomass	3.91E-06	1.71E-05
POM	Fluoranthene	POM	1.60E-06	AP-42 Chapter 1.6	6.88E-04	0.003														Biomass	6.88E-04	0.003
POM	Fluorene	POM	3.40E-06	AP-42 Chapter 1.6	1.46E-03	0.006														Biomass	1.46E-03	0.006
POM	Indeno(1,2,3,c,d)pyrene	POM	8.70E-08	AP-42 Chapter 1.6	3.74E-05	1.64E-04														Biomass	3.74E-05	1.64E-04
POM	Monochlorobiphenyl	POM	2.20E-10	AP-42 Chapter 1.6	9.46E-08	4.14E-07														Biomass	9.46E-08	4.14E-07
POM	2-Methylnaphthalene	POM	1.60E-07	AP-42 Chapter 1.6	6.88E-05	3.01E-04														Biomass	6.88E-05	3.01E-04
POM	Phenanthrene	POM	7.00E-06	AP-42 Chapter 1.6	3.01E-03	0.01														Biomass	3.01E-03	0.01
POM	Pyrene	POM	3.70E-06	AP-42 Chapter 1.6	1.59E-03	0.007														Biomass	1.59E-03	0.007
POM	Perylene	POM	5.20E-10	AP-42 Chapter 1.6	2.24E-07	9.79E-07														Biomass	2.24E-07	9.79E-07
Total PAH (POM)	Total PAH (POM)	TotalPAH(POM)	2.80E-05	AP-42 Chapter 1.6	1.20E-02	0.05														Biomass	1.20E-02	0.05
DBF	Heptachlorodibenzo-p-furans	DBF	2.40E-10	AP-42 Chapter 1.6	1.03E-07	4.52E-07														Biomass	1.03E-07	4.52E-07
DBF	Hexachlorodibenzo-p-furans	DBF	2.80E-10	AP-42 Chapter 1.6	1.20E-07	5.27E-07														Biomass	1.20E-07	5.27E-07
DBF	Octachlorodibenzo-p-furans	DBF	8.80E-11	AP-42 Chapter 1.6	3.78E-08	1.66E-07														Biomass	3.78E-08	1.66E-07
DBF	Pentachlorodibenzo-p-furans	DBF	4.20E-10	AP-42 Chapter 1.6	1.81E-07	7.91E-07														Biomass	1.81E-07	7.91E-07
DBF	2,3,7,8-Tetrachlorodibenzo-p-furans	DBF	9.00E-11	AP-42 Chapter 1.6	3.87E-08	1.70E-07														Biomass	3.87E-08	1.70E-07
DBF	Tetrachlorodibenzo-p-furans	DBF	7.50E-10	AP-42 Chapter 1.6	3.23E-07	1.41E-06														Biomass	3.23E-07	1.41E-06
DBD	Heptachlorodibenzo-p-dioxins	DBD	2.00E-09	AP-42 Chapter 1.6	8.60E-07	3.77E-06														Biomass	8.60E-07	3.77E-06
DBD	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxins	DBD	3.18E-11	NCDENR Memo (6/11)	1.37E-08	5.99E-08														Biomass	1.37E-08	5.99E-08
DBD	Octachlorodibenzo-p-dioxins	DBD	6.60E-08	AP-42 Chapter 1.6	2.84E-05	1.24E-04														Biomass	2.84E-05	1.24E-04
DBD	Pentachlorodibenzo-p-dioxins	DBD	1.50E-09	AP-42 Chapter 1.6	6.45E-07	2.83E-06														Biomass	6.45E-07	2.83E-06
DBD	2,3,7,8-Tetrachlorodibenzo-p-dioxin	DBD	8.60E-12	AP-42 Chapter 1.6	3.70E-09	1.62E-08														Biomass	3.70E-09	1.62E-08
DBD	Tetrachlorodibenzo-p-dioxins	DBD	4.70E-10	AP-42 Chapter 1.6	2.02E-07	8.85E-07														Biomass	2.02E-07	8.85E-07
PCB	Decachlorobiphenyl	PCB	2.70E-10	AP-42 Chapter 1.6	1.16E-07	5.09E-07														Biomass	1.16E-07	5.09E-07
PCB	Dichlorobiphenyl	PCB	7.40E-10	AP-42 Chapter 1.6	3.18E-07	1.39E-06														Biomass	3.18E-07	1.39E-06
PCB	Heptachlorobiphenyl	PCB	6.60E-11	AP-42 Chapter 1.6	2.84E-08	1.24E-07														Biomass	2.84E-08	1.24E-07
PCB	Hexachlorobiphenyl	PCB	5.50E-10	AP-42 Chapter 1.6	2.37E-07	1.04E-06														Biomass	2.37E-07	1.04E-06
PCB	Pentachlorobiphenyl	PCB	1.20E-09	AP-42 Chapter 1.6	5.16E-07	2.26E-06														Biomass	5.16E-07	2.26E-06
PCB	Trichlorobiphenyl	PCB	2.60E-09	AP-42 Chapter 1.6	1.12E-06	4.90E-06														Biomass	1.12E-06	4.90E-06
PCB	Tetrachlorobiphenyl	PCB	2.50E-09	AP-42 Chapter 1.6	1.08E-06	4.71E-06														Biomass	1.08E-06	4.71E-06
Total PCB	Total PCB	1336-36-3	7.93E-09	AP-42 Chapter 1.6	3.41E-06	1.49E-05														Biomass	3.41E-06	1.49E-05
HAP	1,3 Butadiene	106-99-0	N/A	AP-42 Chapter 1.6																		
Total HAP	Total HAP		9.99E-03		4.29E+00	16.32													10.48	Biomass	4.29E+00	16.32
TAP	Acetone	67-64-1	1.90E-04	AP-42 Chapter 1.6	8.17E-02	0.36														Biomass	8.17E-02	0.36
TAP	Benzaldehyde	100-52-7	8.50E-07	AP-42 Chapter 1.6	3.66E-04	0.002														Biomass	3.66E-04	0.002
TAP	Benzoic Acid	65-85-0	4.70E-08	AP-42 Chapter 1.6	2.02E-05	8.85E-05														Biomass	2.02E-05	8.85E-05
TAP	bis(2-chloroisopropyl)ether	108-60-1	N/A	AP-42 Chapter 1.6																		
TAP	Bromodichloromethane	75-27-4	N/A	AP-42 Chapter 1.6																		
TAP	Butylbenzylphthalate	85-68-7	N/A	AP-42 Chapter 1.6																		
TAP	n-butyraldehyde	123-72-8	N/A	AP-42 Chapter 1.6																		
TAP	Carbazole	86-74-8	1.80E-06	AP-42 Chapter 1.6	7.74E-04	0.003														Biomass	7.74E-04	0.003
TAP	Carbon disulfide	75-15-0	N/A	AP-42 Chapter 1.6																		
TAP	Carene-3	13466-78-9	N/A	AP-42 Chapter 1.6																		
TAP	2-Chlorophenol	95-57-8	2.40E-08	AP-42 Chapter 1.6	1.03E-05	4.52E-05														Biomass	1.03E-05	4.52E-05
TAP	Crotonaldehyde	123-73-9	9.90E-06	AP-42 Chapter 1.6	4.26E-03	0.02														Biomass	4.26E-03	0.02
TAP	Cymene-p	99-87-6	N/A	AP-42 Chapter 1.6																		
TAP	1,2-Dibromoethane	106-93-4	5.50E-05	AP-42 Chapter 1.6	2.37E-02	0.10														Biomass	2.37E-02	0.10
TAP	1,2-Dichloroethene	540-59-0	N/A	AP-42 Chapter 1.6																		
TAP	Diethylphthalate	84-66-2	N/A	AP-42 Chapter 1.6																		
TAP	2,5-Dimethyl benzaldehyde	5779-94-2	N/A	AP-42 Chapter 1.6																		

Emission Factors of HAPs and Air Toxics From Wood and Poultry Litter and Cake Combustion

Wood Combustion

Emission factors HAPs and Air Toxics from wood biomass combustion in the boiler are selected from the following sources, in order of hierarchy:

1. Boiler and air pollution control device (APCD) vendor guarantees for HCl and NH3.
2. EPA AP-42 Chapter 1.6 – Wood Residue Combustion in Boilers (9/03)
3. May 2010 Emission test data for Coastal Carolina Clean Power, LLC's Kenansville, NC Facility (CCCP Kenansville) for chlorine, manganese, formaldehyde, acetaldehyde, acrolein, styrene, benzene, and toluene. CCCP Kenansville is a sister facility

Poultry Litter and Cake and Wood Biomass Combined

Emission factors from Coastal Carolina Clean Power, LLC (Kenansville, NC). Test runs from May 2013, July 2013, and July 2014.

Metal HAP Baghouse Control Efficiency: 80%
(not used for Hg)

Poultry Litter and Cake + Biomass Combustion

	CC May 2013 (ES-1A)	CC July 2013 (ES-1B)	CC July 2014 (ES-1B)
Poultry Litter (including bedding)%	67%	Not specified	25%
Biomass%	33%	Not specified	75%
Heat Input Rate During Tests	186 MMBtu/hr	183 MMBtu/hr	180 MMBtu/hr

			100% Wood Biomass Combustion				Stack Test Emission Factors									Maximum Emissions from Poultry Litter and Cake + Biomass Combustion				Potential Emissions		
Pollutant Category	Pollutant	CAS	Emission Factors (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)	lb/MMBtu	lb/hr	Final lb/MMBtu	lb/MMBtu	lb/hr	Final lb/MMBtu	lb/MMBtu	lb/hr	Final lb/MMBtu	Litter/Wood Mix Emission Factor Used in Calcs (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)
TAP	4,6-Dinitro-2-methylphenol	534-52-1	N/A	AP-42 Chapter 1.6																		
TAP	Di-n-octyl phthalate	117-84-0	N/A	AP-42 Chapter 1.6																		
TAP	Ethanol	64-17-5	N/A	AP-42 Chapter 1.6																		
TAP	Hexachlorobenzene	118-74-1	N/A	AP-42 Chapter 1.6																		
TAP	Hexanal	66-25-1	7.00E-06	AP-42 Chapter 1.6	3.01E-03	0.01														Biomass	3.01E-03	0.01
TAP	Isobutyraldehyde	78-84-2	1.20E-05	AP-42 Chapter 1.6	5.16E-03	0.02														Biomass	5.16E-03	0.02
TAP	Isopropanol	67-63-0	N/A	AP-42 Chapter 1.6																		
TAP	Isovaleraldehyde	590-86-3	N/A	AP-42 Chapter 1.6																		
TAP	MEK	78-93-3	5.40E-06	AP-42 Chapter 1.6	2.32E-03	0.01														Biomass	2.32E-03	0.01
TAP	Methane	74-82-8	2.10E-02	AP-42 Chapter 1.6	9.03E+00	39.55														Biomass	9.03E+00	39.55
TAP	2-Nitrophenol	88-75-5	2.40E-07	AP-42 Chapter 1.6	1.03E-04	4.52E-04														Biomass	1.03E-04	4.52E-04
TAP	alpha-Pinene	80-56-8	N/A	AP-42 Chapter 1.6																		
TAP	beta-Pinene	127-91-3	N/A	AP-42 Chapter 1.6																		
TAP	Pentanal	110-62-3	N/A	AP-42 Chapter 1.6																		
TAP	Propanal	123-38-6	3.20E-06	AP-42 Chapter 1.6	1.38E-03	0.006														Biomass	1.38E-03	0.006
TAP	alpha-Terpineol	98-55-5	N/A	AP-42 Chapter 1.6																		
TAP	m,p,o-Tolualdehyde	various	N/A	AP-42 Chapter 1.6																		
TAP	m,p-Tolualdehyde	various	1.10E-05	AP-42 Chapter 1.6	4.73E-03	0.02														Biomass	4.73E-03	0.02
TAP	o-Tolualdehyde	529-20-4	7.20E-06	AP-42 Chapter 1.6	3.10E-03	0.01														Biomass	3.10E-03	0.01
TAP	1,2,4-Trichlorobenzene	120-82-1	N/A	AP-42 Chapter 1.6																		
TAP	1,1,2-Trichloroethane	79-00-5	N/A	AP-42 Chapter 1.6																		
TAP	Trichloroethene	79-01-6	3.00E-05	AP-42 Chapter 1.6	1.29E-02	0.06														Biomass	1.29E-02	0.06
TAP	Trichlorofluoromethane	75-69-4	4.10E-05	AP-42 Chapter 1.6	1.76E-02	0.08														Biomass	1.76E-02	0.08
TAP	Valeraldehyde	110-62-3	N/A	AP-42 Chapter 1.6																		
Trace Element TAP	Barium	7440-39-3	1.70E-04	AP-42 Chapter 1.6	7.31E-02	0.32														Biomass	7.31E-02	0.32
Trace Element TAP	Copper	7440-50-8	4.90E-05	AP-42 Chapter 1.6	2.11E-02	0.09														Biomass	2.11E-02	0.09
Trace Element TAP	Iron	7439-89-6	9.90E-04	AP-42 Chapter 1.6	4.26E-01	1.86														Biomass	4.26E-01	1.86
Trace Element TAP	Molybdenum	7439-98-7	2.10E-06	AP-42 Chapter 1.6	9.03E-04	0.004														Biomass	9.03E-04	0.004
Trace Element TAP	Phosphorus	7723-14-0	2.70E-05	AP-42 Chapter 1.6	1.16E-02	0.05														Biomass	1.16E-02	0.05
Trace Element TAP	Potassium	7440-09-7	3.90E-02	AP-42 Chapter 1.6	1.68E+01	73.45														Biomass	1.68E+01	73.45
Trace Element TAP	Silver	7440-22-4	1.70E-03	AP-42 Chapter 1.6	7.31E-01	3.20														Biomass	7.31E-01	3.20
Trace Element TAP	Sodium	7440-23-5	3.60E-04	AP-42 Chapter 1.6	1.55E-01	0.68														Biomass	1.55E-01	0.68
Trace Element TAP	Strontium	7440-24-6	1.00E-05	AP-42 Chapter 1.6	4.30E-03	0.02														Biomass	4.30E-03	0.02
Trace Element TAP	Thallium	7440-28-0	N/A	AP-42 Chapter 1.6																		
Trace Element TAP	Tin	7440-31-5	2.30E-05	AP-42 Chapter 1.6	9.89E-03	0.04														Biomass	9.89E-03	0.04

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Poultry Litter and Cake and Wood Biomass Combined
Emission factors from Coastal Carolina Clean Power, LLC (Kenansville, NC). Test runs from May 2013, July 2013, and July 2014.

Metal HAP Baghouse Control Efficiency: 80%
(not used for Hg)

							Poultry Litter and Cake + Biomass Combustion															
							CC May 2013 (ES-1A)			CC July 2013 (ES-1B)			CC July 2014 (ES-1B)									
						Poultry Litter (including bedding)%	67%			Not specified			25%									
						Biomass%	33%			Not specified			75%									
						Heat Input Rate During Tests	186	MMBtu/hr		183	MMBtu/hr		180	MMBtu/hr								
			100% Wood Biomass Combustion				Stack Test Emission Factors									Maximum Emissions from Poultry Litter and Cake + Biomass Combustion				Potential Emissions		
Pollutant Category	Pollutant	CAS	Emission Factors (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)	lb/MMBtu	lb/hr	Final lb/MMBtu	lb/MMBtu	lb/hr	Final lb/MMBtu	lb/MMBtu	lb/hr	Final lb/MMBtu	Litter/Wood Mix Emission Factor Used in Calcs (lb/MMBtu)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)
Trace Element TAP	Titanium	7440-32-6	2.00E-05	AP-42 Chapter 1.6	8.60E-03	0.04														Biomass	8.60E-03	0.04
Trace Element TAP	Vanadium	7440-62-2	9.80E-07	AP-42 Chapter 1.6	4.21E-04	0.002														Biomass	4.21E-04	0.002
Trace Element TAP	Yttrium	7440-65-5	3.00E-07	AP-42 Chapter 1.6	1.29E-04	5.65E-04														Biomass	1.29E-04	5.65E-04
Trace Element TAP	Zinc	7440-66-6	4.20E-04	AP-42 Chapter 1.6	1.81E-01	0.79														Biomass	1.81E-01	0.79
TAP	Chloride	16887-00-6	N/A	AP-42 Chapter 1.6																		
TAP	Flouride	16984-48-8	N/A	AP-42 Chapter 1.6																		
TAP	Propylene	115-07-1	N/A	AP-42 Chapter 1.6																		
TAP	Ammonia slip	7664-41-7	1.60E-02	Vendor Guarantee.	6.88E+00	30.13														Biomass	6.88E+00	30.13
TAP	Sulfuric acid mist	7664-93-9	0.011	Vendor Guarantee. Use of low sulfur content wood.	4.73E+00	20.72										0.031	Vendor Guarantee. Proper fuel Mix.	13.33	58.39	Poultry Litter + Biomass	1.33E+01	58.39

ABBREVIATIONS:
POM = Polycylic Organic Matter
DBF = Dibenzofurans
DBD = Dibenzodioxins
PCB = Polychlorinated biphenyls

Notes
1. Chlorine emissions from 100% wood combustion are higher than litter and cake/wood mix. Therefore, wood only combustion factor used.

Starter Fuel Potential Emissions Calculation

No. 2 fuel oil will be used as starter fuel of the boiler.
The fuel oil usage will be limited to 10% of the annual capacity of the boiler (for avoidance of NOx limit under NSPS Db).

The fuel oil usage limit is calculated as follows:

Boiler Max Heat Input	430	MMBtu/hr
Max Annual Op Hrs =	8760	hr/yr

Boiler Annual Capacity = Boiler Max Heat Input (MMBtu/hr) x Max Annual Op Hrs (hr/yr)
Boiler Annual Capacity = 3,766,800 MMBtu/yr

10% of Boiler Annual Capacity = Boiler Annual Capacity x 10%
10% of Boiler Annual Capacity = 376,680 MMBtu/yr

No. 2 Fuel Oil Heat Content = 140.0 MMBtu/Mgal
No. 2 Fuel Oil Usage Limit = 10% of Boiler Annual Capacity / No. 2 Fuel Oil Heat Content
No. 2 Fuel Oil Usage Limit = 2,690.6 Mgal/yr (Per NSPS Db at 10% Boiler Annual Capacity)

Maximum Fuel Sulfur: 0.0015 S by weight (ULSD)

CRITERIA POLLUTANTS
For all pollutants listed below, emissions are based on AP-42 Chapter 1.3 (05/2010):

Pollutant	Emission Factor	Units	Convert to lb/hr[1]	Starter Fuel PTE[2] (tons/yr)
NOx	24.0	lb/Mgal	73.7	32.29
CO	5.0	lb/Mgal	15.4	6.73
PM (filterable+condensable)	3.3	lb/Mgal	10.1	4.44
SO_2	0.21	lb/Mgal	0.7	0.29
VOC	0.2	lb/Mgal	0.6	0.27

Starter Fuel Potential Emissions Calculation

HAP/TAPs

For all pollutants listed below, emissions are based on AP-42 Chapter 1.3 (05/2010).

Pollutant	Emission Factor (lb/Mgal)	Convert[1] to lb/hr	Starter Fuel PTE[2] (tons/yr)	HAP or TAP?
Benzene	2.14E-04	6.57E-04	2.88E-04	HAP
Ethylbenzene	6.36E-05	1.95E-04	8.56E-05	HAP
Toluene	6.20E-03	1.90E-02	8.34E-03	HAP
Formaldehyde	3.30E-02	1.01E-01	4.44E-02	HAP
Naphthalene	1.13E-03	3.47E-03	1.52E-03	HAP
1,1,1-Trichloroethane	2.36E-04	7.25E-04	3.17E-04	HAP
Xylenes	1.09E-04	3.35E-04	1.47E-04	HAP
Acenaphthylene	2.53E-07	7.77E-07	3.40E-07	HAP
Acenaphthene	2.11E-05	6.48E-05	2.84E-05	HAP
Fluorene	4.47E-06	1.37E-05	6.01E-06	HAP
Phenanthrene	1.05E-05	3.23E-05	1.41E-05	HAP
Anthracene	1.22E-06	3.75E-06	1.64E-06	HAP
Fluoranthene	4.84E-06	1.49E-05	6.51E-06	HAP
Pyrene	4.25E-06	1.31E-05	5.72E-06	HAP
Benzo(a)anthracene	4.01E-06	1.23E-05	5.39E-06	HAP
Chrysene	2.38E-06	7.31E-06	3.20E-06	HAP
Benzo(b)fluoranthene	1.48E-06	4.55E-06	1.99E-06	HAP
Benzo(k)fluoranthene	1.48E-06	4.55E-06	1.99E-06	HAP
Indeno(1,2,3,c,d)pyrene	2.14E-06	6.57E-06	2.88E-06	HAP
Dibenzo(a,h)anthracene	1.67E-06	5.13E-06	2.25E-06	HAP
Benzo(g,h,i)perylene	2.26E-06	6.94E-06	3.04E-06	HAP
Octachlorodibenzo-p-dioxins	3.10E-09	9.52E-09	4.17E-09	HAP
Antimony	5.25E-03	1.61E-02	7.06E-03	HAP
Arsenic	1.32E-03	4.05E-03	1.78E-03	HAP
Barium	2.57E-03	7.89E-03	3.46E-03	TAP
Beryllium	2.78E-05	8.54E-05	3.74E-05	HAP
Cadmium	3.98E-04	1.22E-03	5.35E-04	HAP
Chromium (total)	1.09E-03	3.36E-03	1.47E-03	HAP
Cobalt	6.02E-03	1.85E-02	8.10E-03	HAP
Manganese	3.00E-03	9.21E-03	4.04E-03	HAP
Mercury	1.13E-04	3.47E-04	1.52E-04	HAP
Nickel	8.45E-02	2.60E-01	1.14E-01	HAP
Selenium	6.83E-04	2.10E-03	9.19E-04	HAP
Vanadium	3.18E-02	9.77E-02	4.28E-02	TAP
Lead	1.51E-03	4.64E-03	2.03E-03	HAP
Chloride	3.47E-01	1.07E+00	4.67E-01	TAP
Copper	1.76E-03	5.41E-03	2.37E-03	TAP
Flouride	3.73E-02	1.15E-01	5.02E-02	TAP
Phosphorus	9.46E-03	2.91E-02	1.27E-02	TAP
Zinc	2.91E-02	8.94E-02	3.91E-02	TAP

Notes:

1. To convert to lb/hr, the following equations are used (for example):

Benzene EF (lb/hr) = Benzene EF (lb/Mgal) x Boiler Max Heat Input (MMBtu/hr) ÷ Heat Content of No. 2 Fuel Oil (MMBtu/Mgal)

2. PTE is calculated as follows:

Benzene PTE (tons/yr) = Benzene EF (lb/Mgal) x No. 2 Fuel Oil Annual Usage Limit (Mgal/yr) ÷ 2,000 (lb/ton)

Fly Ash Silo 2 (IES-22) Potential Emission Calculatioin

	Design Maximum Flow Rate (acfm)[1]	Outlet Particulate Grain Loading (grain/scf)	PM Emissions (lb/hr)	PM_{10} Emissions (lb/hr)	$PM_{2.5}$ Emissions (lb/hr)	PM Annual Emissions (tons/yr)	PM_{10} Annual Emissions (tons/yr)	$PM_{2.5}$ Annual Emissions (tons/yr)
IES-22 - Fly Ash Silo 1	0.63	0.005	2.70E-05	1.28E-05	1.28E-06	1.18E-04	5.59E-05	5.59E-06

AP-42 Section 13.2.4 Aggregate Handling and Storage Piles, Aerodynamic Particle Size Multiplier for Equation 1

k Values	
Total Suspended Particulate	0.74
PM10	0.35
PM2.5	0.035

[1]Volumetric flow rate (acfm) = 4,200 lb/hr baghouse fly ash X ft3/111.12 lb X hr/60 min = 0.63 acfm
Estimated dry density of fly ash = 1.01 to 1.78 g/cm3. Using 1.78 g/cm3 = 111.12 lb/ft3
Reference for dry density of fly ash - "Physical, chemical, and geotechnical properties of coal fly ash: A global review"

[2]Lb/hr = [(scf/hr) * (grains/scf)] / (7000 grains/lb)

[3]Annual emissions (TPY) based on 8760 hours per year operation. TPY = (lb/hr) * (8760/2000)

[4]PM_{10} calculation uses particle size multiplier based on AP-42, Section 13.2.4; lb/hr (PM_{10}) = lb/hr (TSP) * (k PM_{10}/k TSP)

[5]$PM_{2.5}$ calculation uses particle size multiplier based on AP-42, Section 13.2.4; lb/hr ($PM_{2.5}$) = lb/hr (TSP) * (k $PM_{2.5}$/k TSP)

Belt Dryer Potential Emissions (ES-17, ES-18, ES-19, ES-21)

VOC and HAP Emission factors to calculate emissions from belt dryers taken from the from the Compliance Air Emissions Test Report (dated Oct 10, 2018)

Belt Dryer Stack Test - Operating Data

	Lbs.	Cu/Ft	Feet	Lbs. / Hr.	Tons / Hr.
Dryer Bed width			21		
A. Dryer Bed Depth stack 1			0.25		
B. Dryer Bed Depth stacks 2,3,4			0.375		
800 RPM belt speed @ min			4.72		
A. Wood Chips	718.6	24.78		43,117.2	21.6
B. Wood Chips	1,077.9	37.17		64,675.8	32.3
Wet Wood Chip weight / cu/ft	29				

VOC Emission Results from Oct 2018 Stack Test

Stack Number	1	3	6	8	Total (for 8 stacks)	
VOC Emission Rates (lb/hr)	2.20	2.27	2.54	2.31		
Feed Rate (ton/hr)	21.6	32.3	32.3	32.3		
VOC Emission Factor (lb/ton)	0.102	0.070	0.079	0.072		
Estimated VOC Emission Rate (lb/hr) @ 30 ton/hr Feed Rate	3.056	2.108	2.359	2.146	19.3	lb/hr
			Potential Annual Emissions (lb/hr) =		77.3	lb/hr (ES-17, ES-18, ES-19, ES-22)
			Potential VOC Emissions =		84.7	tons/yr (per belt dryer)
			Potential VOC emissions from 3 belt dryers =		254.1	tons/yr (ES-17, ES-18, ES-19)

Notes:
1) Each belt dryer has eight stacks, and NC DAQ allowed testing of only four stacks. The test results were then doubled to represent emissions from the entire belt dryer.
2) Annual emissions were based on operation of 8,760 hours oer year.

The facility will be taking a 39 tpy VOC limit for the 4th belt dryer ES-21

Estimated potential VOC emissions from all 4 belt dryers = 293.1 tpy
(254.1 tpy VOC from ES-17, 18, 19 + 39 tpy VOC from ES-21)

Formaldehyde emissions rates for modeling: 1.04 lb/hr (From 4 belt dryers)

(Note that formaldehyde was not detected during the 2018 belt dryer stack test. However, for modeling purposes, they are assumed to be emitted at the detection limit for the pollutant) 4.56 tons/yr

Notes:
HAPs were non-detect during stack test.
Estimated total pollutant emission rate (tpy) = Emissions (lb/hr) X 8760 hr/yr / 2000 lb/ton

Fly Ash Drying Operations

Truck Filling & Unloading

Data Inputs / **Reference**

Max Hourly Throughput:	1.5 ton/hr	Capacity of pug mill
Potential annual usage:	13,140 ton/yr	Scaled up short-term usage to potential based on 8,760 hr/yr
Number of Drops:	2	Drop into truck and drop onto ground
$Emission\ Factor\ (\frac{lb}{ton}) = k(0.0032)\frac{(\frac{U}{5})^{1.3}}{(\frac{M}{2})^{1.4}}$		US EPA AP-42, Chapter 13.2.4, Equation 1.
k, particle size multiplier:	0.74 (PM) 0.35 (PM_{10}) 0.053 ($PM_{2.5}$)	US EPA AP-42, Chapter 13.2.4
U, mean wind speed:	6.24 mph	NOAA wind speed data for 2018.
M, material moisture content:	4.8%	US EPA AP-42, Chapter 13.2.4. The actual moisture content will range between 10 and 30 percent; however, the maximum of the range provided for use in Equation 1 was conservatively used.

Emission Calculations	Emission Factor		Usage		Drops		Conversion		Annual Emissions
PM	9.27E-04 lb/ton	x	13,140 ton/yr	x	2 drops	÷	2000 lb/ton	=	**1.22E-02 ton/yr**
PM_{10}	4.38E-04 lb/ton	x	13,140 ton/yr	x	2 drops	÷	2000 lb/ton	=	**5.76E-03 ton/yr**
$PM_{2.5}$	6.64E-05 lb/ton	x	13,140 ton/yr	x	2 drops	÷	2000 lb/ton	=	**8.72E-04 ton/yr**

Wind Erosion

Data Inputs / **Reference**

Average Pile Size:	0.045 acres	Estimate
$Emission\ Factor\left(\frac{lb}{(day)(acre)}\right) = 1.7\left(\frac{s}{1.5}\right)\left(\frac{365-p}{235}\right)\left(\frac{f}{15}\right)$		Air & Waste Management Association's Air Pollution Engineering Manual (1992), Chapter 4, Equation 5.
s, silt content of material:	81 %	US EPA AP-42, Chapter 13.2.4, Table 13.2.4-1, mean value.
p, number of days with >0.01 in. precipitation per year:	110 days	US EPA AP-42, Chapter 13.2.2, Figure 13.2.2-1.
f, percentage of time wind speed >12 mph at the mean pile height:	87 %	NOAA wind speed data for 2018.
k, particle size multiplier:	1 (PM) 0.5 (PM_{10}) 0.2 ($PM_{2.5}$)	US EPA AP-42, Chapter 13.2.4.

Emission Calculations	Emission Factor		Usage		Surface Area		Conversion		Annual Emissions
PM	578.6 lb/(day)(acre)	x	365 days	x	0.05 acres	÷	2000 lb/ton	=	**4.76 ton/yr**
PM_{10}	289.3 lb/(day)(acre)	x	365 days	x	0.05 acres	÷	2000 lb/ton	=	**2.38 ton/yr**
$PM_{2.5}$	115.7 lb/(day)(acre)	x	365 days	x	0.05 acres	÷	2000 lb/ton	=	**0.95 ton/yr**

Bulldozing/Truck Loading

Data Inputs / **Reference**

Loading Time:	0.75 hr	Estimate - loading one truck takes 30-45 minutes.
Shipments per Year:	1,460 shipments	Estimate - 2 to 4 shipments daily. Scaled up to 365 days per year.
$PM\ Emission\ Factor\left(\frac{lb}{hr}\right) = \frac{5.7(s)^{1.2}}{(M)^{1.3}}$		US EPA AP-42, Chapter 11.9, Table 11.9-1.
$PM_{15}\ Emission\ Factor\left(\frac{lb}{hr}\right) = \frac{1.0(s)^{1.5}}{(M)^{1.4}}$		US EPA AP-42, Chapter 11.9, Table 11.9-1.
s, silt content of material:	81 %	US EPA AP-42, Chapter 13.2.4, Table 13.2.4-1, mean value.
M, moisture content:	10 %	Desired moisture content.
Scaling Factors (applied to PM_{15}):	0.75 (PM_{10}) 0.105 ($PM_{2.5}$)	US EPA AP-42, Chapter 11.9, Table 11.9-1.

Emission Calculations	Emission Factor		Loading Time		Conversion		Annual Emissions
PM	55.7 lb/hr	x	1,095 hr/yr	÷	2000 lb/ton	=	**30.51 ton/yr**
PM_{10}	21.8 lb/hr	x	1,095 hr/yr	÷	2000 lb/ton	=	**11.92 ton/yr**
$PM_{2.5}$	5.9 lb/hr	x	1,095 hr/yr	÷	2000 lb/ton	=	**3.20 ton/yr**

Fly Ash Drying Operations

Truck Filling & Unloading

Total Emissions

Criteria Pollutants	Hourly PTE (lb/hr)	Annual PTE (tpy)
PM	42.9	35.3
PM_{10}	16.9	14.3
$PM_{2.5}$	4.6	4.2

HAP	Weight Fraction	Hourly PTE (lb/hr)	Annual PTE (tpy)
Antimony	2E-09	8.58E-08	7.06E-08
Arsenic	8.5E-08	3.65E-06	3.00E-06
Beryllium	1E-10	4.29E-09	3.53E-09
Cadmium	1.9E-10	8.15E-09	6.70E-09
Chromium	1E-09	4.29E-08	3.53E-08
Lead	4E-09	1.72E-07	1.41E-07
Manganese	2.48E-07	1.06E-05	8.75E-06
Nickel	7E-09	3.00E-07	2.47E-07
Selenium	8E-09	3.43E-07	2.82E-07
Total HAP	3.55E-07	1.52E-05	1.25E-05

Poultry Litter Storage Warehouse (IES-16) Potential Emission Calculations

0.74	PM K Value	AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995)
0.35	PM_{10} K Value	AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995)
0.053	$PM_{2.5}$ K Value	AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995)
1	U - Average Wind Speed (mph)	Estimated as wind speed inside warehouse
23.85	M - Poultry Litter Moisture Content (%)	Lowest estimated poultry litter moisture content
44.76	Maximum Hourly Production Rate (tons/hr)	Taken from poultry litter sampling data from 2012
392,087	Maximum Annual Production Rate (TPY)	Taken from poultry litter sampling data from 2012

Material Handling Emissions:

Emission Source ID No.	Source Description	Max Hourly Throughput (tons/hr)	Max Annual Throughput (TPY)	PM Emission Factor (lb/ton)[1]	PM_{10} Emission Factor (lb/ton)[1]	$PM_{2.5}$ Emission Factor (lb/ton)[1,4]	Hourly PM Emissions (lb/hr)[2]	Controlled Annual PM Emissions (TPY)[3]	Hourly PM_{10} Emissions (lb/hr)[2]	Controlled Annual PM_{10} Emissions (TPY)[3]	Hourly $PM_{2.5}$ Emissions (lb/hr)[2]	Controlled Annual $PM_{2.5}$ Emissions (TPY)[3]
IES-16	Transfer Point - Truck Dumps on Ground	44.8	392,087	9.09E-06	4.30E-06	6.36E-07	4.07E-04	1.78E-03	1.92E-04	8.43E-04	2.85E-05	1.25E-04
IES-16	Transfer Point - Existing Cogar Reclaimer moves litter from ground to Belt Conveyor C-1D	44.8	392,087	9.09E-06	4.30E-06	6.36E-07	4.07E-04	1.78E-03	1.92E-04	8.43E-04	2.85E-05	1.25E-04
IES-16	Transfer Point - Belt Conveyor to Disc Screen	44.8	392,087	9.09E-06	4.30E-06	6.36E-07	4.07E-04	1.78E-03	1.92E-04	8.43E-04	2.85E-05	1.25E-04
IES-16	Transfer Point - Disc Screen to Conveyor	44.8	392,087	9.09E-06	4.30E-06	6.36E-07	4.07E-04	1.78E-03	1.92E-04	8.43E-04	2.85E-05	1.25E-04
	Transfer Point - Conveyor to Boiler House Fuel Bin	44.8	392,087	9.09E-06	4.30E-06	6.36E-07	4.07E-04	1.78E-03	1.92E-04	8.43E-04	2.85E-05	1.25E-04
						Total	0.002	0.009	0.001	0.004	0.000	0.001

[1] Emission factors calculated utilizing AP-42 Section 13.2.4 calculation: $EF = K*0.0032*(U/5)^{1.3}/(M/2)^{1.4}$

[2] Hourly emissions calculated utilizing maximum hourly throughput

[3] Annual emissions calculated utilizing maximum annual throughput

[4] $PM_{2.5}$ calculation uses particle size multiplier from AP-42 Section 13.2.4 (approximately 7% of PM is $PM_{2.5}$)

Maximum Hourly Production Rate (tons/hr) = (430 MMBtu/hr*10^6 Btu/MMBtu*85%) /(4083 Btu/lb*2000 lb/ton) = 44.76 tons/hr

Conservatively estimated poultry litter burning capacity to be 85% of boiler capacity

Poultry Litter Storage Warehouse (IES-16) Potential Emission Calculations

Emissions from Wind Erosions:

Emission Source ID No.	Emission Source Description	Pile Area (acres)	Pile Length (ft)	Pile Width (ft)	Height of Storage Pile (ft)	Pile Surface Area[1] (m^2)	PM (lb/hr)	PM (tpy)	PM_{10} (lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (lb/hr)	$PM_{2.5}$ (tpy)
IES-16	Poultry Litter Storage Pile	0.75	340	100	25	3926.48	0.860	0.00	0.000	0.00	0.000	0.00
						Total	**0.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Calculated Emission Factors[2,3]

PM (g/m2-day)	PM10 (g/m2-day)	PM2.5 (g/m2-day)
0.00	0.00	0.00

1. Surface area of piles calculated as half cylinders $S = 0.5 * 2\pi hL + 2\pi h^2$

Where:

h = the average of the pile height and 1/2 of the width

b = 1/2 width

c = height

As the two piles are connected at the center, the surface area of one half circle (the end of the half cylinder) has been subtracted from each.

2. EPA Report 451/R-93-001, "Models for Estimating Air Emissions Rates from Superfund Remedial Actions"

EF = 1.9 x (s/15) x ((365-p)/235) x (f/15) (Equation 7-9)

Where:

EF = emission factor (g/m^2-day)

p = number of days in a year with at least 0.254 mm (0.01 in) of precipitation

p = 110 days per AP-42 Figure 13.2.2-1

s = surface material silt content (%)

s = 7.5 % per AP-42 Table 13.2.4-1; value for overburden

f = fraction of time wind >5.4 m/s at mean pile height

f = 00 per Table 7-3, Default Values for Estimating PM Emissions from Other Area Sources

3. PM Fractions (AP-42, Section 13.2.5-3)

Particle Size	k
PM30	1
PM10	0.5
PM2.5	0.075

<u>Poultry Litter Storage Warehouse (IES-16) Potential Emission Calculations</u>

Emissions from Front-End Loader/Dozer Operations

Material Silt Content (s) [1]	1.6	%
Material Moisture Content (M)	23.85	%
Number of Dozers	1	
Annual Operating Hours	8760	
Particle size scaling factor, PM_{10}	0.75	
Particle size scaling factor, $PM_{2.5}$	0.105	

<u>Emission Factor Equations</u>[2]

PM (TSP ≤ 30 um) [3]

EF_{PM} (lb/hr/dozer) = $(5.7*(s)^{1.2})/(M)^{1.3}$

≤ 15 um[4]

EF_{PM15} (lb/hr/dozer) = $(1.0*(s)^{1.5})/(M)^{1.4}$

Emission Source ID No.	Source Description	Emission Factor, EF (lb/hr/dozer)			PM (lb/hr)	PM_{10} (lb/hr)	$PM_{2.5}$ (lb/hr)	Controlled PM (tpy)	Controlled PM_{10} (tpy)	Controlled $PM_{2.5}$ (tpy)
		PM	PM_{10}	$PM_{2.5}$						
IES-16	Front-End Loader/Dozer Operations	0.16	0.02	0.02	0.02	0.00	0.00	0.07	0.01	0.01

[1]Source: AP-42, Chapter 13.2.4 Aggregate Handling and Storage Piles, Table 13.2.4-1 (Crushed limestone)

[2]Source: AP-42, Chapter 11.9 Western Surface Coal Mining, Table 11.9-1 (bulldozing - overburden)

[3]Multiply the TSP predictive equation by the $PM_{2.5}$ scaling factor to determine the $PM_{2.5}$ emission factor

[4]Multiply the PM_{15} predictive equation by the PM_{10} scaling factor to determine the PM_{10} emission factor

Poultry Litter Storage Warehouse (IES-16) Potential Emission Calculations

Emissions of NO_x			
N2O flux rates for land application of poultry and swine manure	61.3 to 184	mg NOx/m2-d	The range is for the entire year. The highest end of the range was used as a conservative estimate.
	3.80E-05	lb NOx/ft2-day	Iowa State University (2006)[1]
Area of poultry litter warehouse	100 ft by 200 ft		Conservative estimate of size of warehouse/poultry litter shed.
	20,000	ft2	
Hours of operation	365	days/yr	--
N2O emissions	E = 3.8E-5 lb NO_x/ft^2-yr * 20,000 ft^2 * 365 days		
	277.40	lb/yr NOx	
	0.14	tons/yr NOx	
	0.03	lb/hr	
Emissions of NH3			
NH3 flux rates from storage of poultry litter	4.2 to 9.1	g NH/m2-d	Typically, the higher end of the range would be used to provide a conservative estimate. However, the poultry litter delivered to the site has been dried and screened. It has been observed to be similar to wood chips and has very little detectible odor. For this reason, the lower end of the range is a better representation of expected ammonia emissions.
	6.40E-04	lb NH3/ft2-d	Iowa State University (2006)
Area of poultry litter warehouse	100 ft by 200 ft		Conservative estimate of size of warehouse/poultry litter shed.
	20,000	ft2	
Hours of operation	24	hrs/day	--
NH3 emissions	E = 6.4E-4 lb NH3/ft^2-d * 20,000 ft^2 / 24 hr/day		
	0.53	lb/hr	
	2.34	tpy	

[1] Air Quality and Emissions from Livestock and Poultry Production / Waste Management Systems. (2006) Retrieved from http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1624&context=abe_eng_pubs

Emergency Fire Pump Engine Potential Emissions Calculation

The emergency fire pump engine will be used for emergency fire purposes only.
Scheduled maintainence/testing will be limited to 9 hours per year (45 minutes/month).
Potential emissions are estimated based on maximum operation of 500 hours per year.

Engine Power in hp	340	hp
Fuel Type:	Diesel	
Maximum Fuel Sulfur:	0.0015%	S by weight
Max Operating Hours:	500	hr/yr

The engine meets NSPS Subpart IIII emissions standards for NOx/NMHC, CO, and PM (Model year 2009+).
For other pollutants, emissions are based on AP-42 Section 3.3 (10/96):

Pollutant	CAS	Emission Factor	Units	Convert to lb/hr	Fire Pump PTE (tons/yr)
NOx+NMHC		3.0	gr/hp-hr	2.2	0.56
CO		2.6	gr/hp-hr	1.9	0.49
PM		0.15	gr/hp-hr	0.1	0.03
SO_2		2.05E-03	lb/hp-hr	0.7	0.17
VOC		2.51E-03	lb/hp-hr	0.9	0.21
Benzene	71-43-2	9.33E-04	lb/MMBtu	2.22E-03	5.55E-04
Toluene	108-88-3	4.09E-04	lb/MMBtu	9.73E-04	2.43E-04
Xylenes	1330-20-7	2.85E-04	lb/MMBtu	6.78E-04	1.70E-04
Propylene	115-07-1	2.58E-03	lb/MMBtu	6.14E-03	1.54E-03
1,3 Butadiene	106-99-0	3.91E-05	lb/MMBtu	9.31E-05	2.33E-05
Formaldehyde	50-00-0	1.18E-03	lb/MMBtu	2.81E-03	7.02E-04
Acetaldehyde	75-07-0	7.67E-04	lb/MMBtu	1.83E-03	4.56E-04
Acrolein	107-02-8	9.25E-05	lb/MMBtu	2.20E-04	5.50E-05
Naphthalene	91-20-3	8.48E-05	lb/MMBtu	2.02E-04	5.05E-05
Acenaphthylene	POM	5.06E-06	lb/MMBtu	1.20E-05	3.01E-06
Acenaphthene	POM	1.42E-06	lb/MMBtu	3.38E-06	8.45E-07
Fluorene	POM	2.92E-05	lb/MMBtu	6.95E-05	1.74E-05
Phenanthrene	POM	2.94E-05	lb/MMBtu	7.00E-05	1.75E-05
Anthracene	POM	1.87E-06	lb/MMBtu	4.45E-06	1.11E-06
Fluoranthene	POM	7.61E-06	lb/MMBtu	1.81E-05	4.53E-06
Pyrene	POM	4.78E-06	lb/MMBtu	1.14E-05	2.84E-06
Benzo(a)anthracene	POM	1.68E-06	lb/MMBtu	4.00E-06	1.00E-06
Chrysene	POM	3.53E-07	lb/MMBtu	8.40E-07	2.10E-07
Benzo(b)fluoranthene	POM	9.91E-08	lb/MMBtu	2.36E-07	5.90E-08
Benzo(k)fluoranthene	POM	1.55E-07	lb/MMBtu	3.69E-07	9.22E-08
Benzo(a)pyrene	50-32-8	1.88E-07	lb/MMBtu	4.47E-07	1.12E-07
Indeno(1,2,3,c,d)pyrene	POM	3.75E-07	lb/MMBtu	8.93E-07	2.23E-07
Dibenzo(a,h)anthracene	POM	5.83E-07	lb/MMBtu	1.39E-06	3.47E-07
Benzo(g,h,i)perylene	POM	4.89E-07	lb/MMBtu	1.16E-06	2.91E-07

Notes:
1. PM_{10} and $PM_{2.5}$ are assumed to be equal to the NSPS PM emission rate.
2. To convert from lb/MMBtu to lb/hp-hr, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used.

Drum Dryer System Potential Emissions Calculation - Criteria Pollutants
Evaporation & Natural Gas Combustion

Emission factors for criteria pollutants from natural gas combustion and evaporation for the drum dryer equipped with low NOx burners are selected from EPA AP-42 Chapter 10.6.2 – Particleboard there is no value provided in that chapter.

Evaporation

Max. Annual Wood Capacity	289080	tons wood/yr	(33 tons/hr * 8760 hr/yr = 289,080 tons/yr)

Combustion

Total Dryer Burner Capacity	66.2	MMBtu/hr
Total RTO Capacity	1	MMBtu/hr
Total System Capacity	67.2	MMBtu/hr
Max. Operating Hours	8760	hr/yr
Natural Gas Heat Content	1020	Btu/scf

				UNCONTROLLED EMISSION RATES			CONTROLLED EMISSION RATES			
Pollutant Category	Pollutant	Emission Factors	Emission Factor Units	Emissions (lb/hr)	Emissions (tpy)	Control Efficiency[1,2,3]	Emissions (lb/hr)	Emissions (tpy)	Emission Factor Source[4]	Comment
Criteria Pollutant	CO	0.082	lb/MMBtu	5.53	24.24	50%	2.77	12.12	EPA AP-42 Chapter 1.4 – Natural Gas Combustion in Boilers	Used AP-42 Chapter 1.4 CO, NOx, and SO_2 emission factors; AP-42 Chapter 10.6.2 does not list emission factors for these pollutants.
Criteria Pollutant	NO_x	0.049	lb/MMBtu	3.29	14.43	0%	3.29	14.43	EPA AP-42 Chapter 1.4 – Natural Gas Combustion in Boilers	
Criteria Pollutant	SO_2	0.001	lb/MMBtu	0.04	0.17	0%	0.04	0.17	EPA AP-42 Chapter 1.4 – Natural Gas Combustion in Boilers	
Criteria Pollutant	VOC	2.0	lb/ODT	66.00	289.08	95%	3.30	14.45	EPA AP-42 Chapter 10.6.2 – Particleboard Manufacturing	Emission factors based on "Rotary dryer, direct natural gas-fired, softwood" in AP-42 Chapter 10.6.2
Criteria Pollutant	PM	0.42	lb/ODT	13.86	60.71	90%	1.39	6.07	EPA AP-42 Chapter 10.6.2 – Particleboard Manufacturing	
Criteria Pollutant	PM_{10}	0.42	lb/ODT	13.86	60.71	90%	1.39	6.07	EPA AP-42 Chapter 10.6.2 – Particleboard Manufacturing	
Criteria Pollutant	$PM_{2.5}$	0.42	lb/ODT	13.86	60.71	90%	1.39	6.07	EPA AP-42 Chapter 10.6.2 – Particleboard Manufacturing	

Notes:
1. Drum dryer VOC, PM, and CO emissions controlled by a multiclone and a 1 MMBtu/hr, natural gas-fired RTO.
2. RTO VOC control efficiency taken to be ≥95% per https://www3.epa.gov/ttnchie1/mkb/documents/fregen.pdf. RTO CO control efficiency taken from vendor email.
3. It is assumed that the combined control efficiency of the multiclone and RTO is 90% on PM, PM_{10}, and $PM_{2.5}$ emissions.
4. AP-42 emission factors are only provided for PM. Assumed filterable PM_{10} and $PM_{2.5}$ emission factors are the same as the filterable PM.
5. CO, NO_x, SO_2 emissions due to evaporation are not determined in Chapter 10.6.2. Therefore, AP-42 Chapter 1.4 emission factors are used for these pollutants.

Drum Dryer System Potential Emissions Calculation - Criteria Pollutants

Evaporation & Natural Gas Combustion

Emission factors for criteria pollutants from natural gas combustion and evaporation for the drum dryer equipped with low NOx burners are selected from EPA AP-42 Chapter 10.6.2 – Particleboard there is no value provided in that chapter.

Evaporation

Max. Annual Wood Capacity	289080	tons wood/yr	(33 tons/hr * 8760 hr/yr = 289,080 tons/yr)

Combustion

Total Dryer Burner Capacity	66.2	MMBtu/hr
Total RTO Capacity	1	MMBtu/hr
Total System Capacity	67.2	MMBtu/hr
Max. Operating Hours	8760	hr/yr
Natural Gas Heat Content	1020	Btu/scf

				UNCONTROLLED EMISSION RATES			CONTROLLED EMISSION RATES			
Pollutant Category	Pollutant	Emission Factors	Emission Factor Units	Emissions (lb/hr)	Emissions (tpy)	Control Efficiency[1,2,3]	Emissions (lb/hr)	Emissions (tpy)	Emission Factor Source[4]	Comment
Criteria Pollutant	CO	0.082	lb/MMBtu	5.53	24.24	50%	2.77	12.12	EPA AP-42 Chapter 1.4 – Natural Gas Combustion in Boilers	Used AP-42 Chapter 1.4 CO, NOx, and SO_2 emission factors; AP-42 Chapter 10.6.2 does not list emission factors for these pollutants.
Criteria Pollutant	NO_x	0.049	lb/MMBtu	3.29	14.43	0%	3.29	14.43	EPA AP-42 Chapter 1.4 – Natural Gas Combustion in Boilers	
Criteria Pollutant	SO_2	0.001	lb/MMBtu	0.04	0.17	0%	0.04	0.17	EPA AP-42 Chapter 1.4 – Natural Gas Combustion in Boilers	
Criteria Pollutant	VOC	2.0	lb/ODT	66.00	289.08	95%	3.30	14.45	EPA AP-42 Chapter 10.6.2 – Particleboard Manufacturing	Emission factors based on "Rotary dryer, direct natural gas-fired, softwood" in AP-42 Chapter 10.6.2
Criteria Pollutant	PM	0.42	lb/ODT	13.86	60.71	90%	1.39	6.07	EPA AP-42 Chapter 10.6.2 – Particleboard Manufacturing	
Criteria Pollutant	PM_{10}	0.42	lb/ODT	13.86	60.71	90%	1.39	6.07	EPA AP-42 Chapter 10.6.2 – Particleboard Manufacturing	
Criteria Pollutant	$PM_{2.5}$	0.42	lb/ODT	13.86	60.71	90%	1.39	6.07	EPA AP-42 Chapter 10.6.2 – Particleboard Manufacturing	

Notes:

1. Drum dryer VOC, PM, and CO emissions controlled by a multiclone and a 1 MMBtu/hr, natural gas-fired RTO.
2. RTO VOC control efficiency taken to be ≥95% per https://www3.epa.gov/ttnchie1/mkb/documents/fregen.pdf. RTO CO control efficiency taken from vendor email.
3. It is assumed that the combined control efficiency of the multiclone and RTO is 90% on PM, PM_{10}, and $PM_{2.5}$ emissions.
4. AP-42 emission factors are only provided for PM. Assumed filterable PM_{10} and $PM_{2.5}$ emission factors are the same as the filterable PM.
5. CO, NO_x, SO_2 emissions due to evaporation are not determined in Chapter 10.6.2. Therefore, AP-42 Chapter 1.4 emission factors are used for these pollutants.

Parts Cleaner (IES-4) Potential Emission Calculations

Calculation Parameters:

Dimensions:	2.5 ft	Estimated
	4 ft	Estimated
	10 ft2	Estimated
VOC Emission Factor[1]	0.08 lb/hr/ft2	
Hours of Operation	2000 hr/yr	(Estimated)

	VOC Emissions (lb/hr)	VOC Emissions (tons/yr)
IES-4 Solvent Parts Cleaner	0.80	0.80

Notes:

1. VOC emission factor (lb/hr/ft2) taken from AP-42, Vol. I, Ch 2.6: Solvent Degreasing, Table 4.6-2.
2. Annual Emissions (tons/yr) = x (lb/hr) * 2000 (hr/yr) / 2000 (lb/ton)

Cooling Towers (IES-6) Potential Emission Calculations

Calculation Parameters:

Recirculation Rate	11,250 gal/min	(Estimated from rates for other power plants)
	675,000 gal/hr	
Drift	0.0006 %	(Estimated from rates for other power plants)
Density of Water	8.34 lb/gal	
TDS Concentration	10,000 ppm	(Estimated)

	PM Emissions (lb/hr)	PM_{10} Emissions (lb/hr)	$PM_{2.5}$ Emissions (lb/hr)	PM Annual Emissions (tons/yr)	PM_{10} Annual Emissions (tons/yr)	$PM_{2.5}$ Annual Emissions (tons/yr)
IES-6 Cooling Tower	3.38E-01	3.38E-01	3.38E-01	1.48	1.48	1.48

Notes:

1. Annual Emissions (tons/yr) = x (lb/hr) * 8760 (hr/yr) / 2000 (lb/ton)
2. Assume PM_{10} and $PM_{2.5}$ emissions are similar to PM emission estimates.

Truck Dumps (IES-8 & -9) Potential Emission Calculations

0.74	PM K Value	AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995)
0.35	PM_{10} K Value	AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995)
0.053	$PM_{2.5}$ K Value	AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995)
7.6	U - Average Wind Speed (mph)	National Climatic Data Center - average wind speed for Raleigh, NC
10	M - Wood Moisture Content (%)	Lowest estimated wood moisture content
96	Maximum Hourly Production Rate (tons/hr)	Estimate for Proposed Operational Parameters
445709	Maximum Annual Production Rate (TPY)	Estimate for Proposed Operational Parameters
		(Based on maximum hourly boiler firing rates (42.4 tph) @ 8760 hours plus throughput needed to fill stockpiles

Emission Source ID No.	Source Description	Max Hourly Throughput (tons/hr)	Max Annual Throughput (TPY)	PM Emission Factor (lb/ton)[2]	PM_{10} Emission Factor (lb/ton)[2]	$PM_{2.5}$ Emission Factor (lb/ton)[2]	Hourly PM Emissions (lb/hr)[3]	Annual PM Emissions (TPY)[4]	Hourly PM_{10} Emissions (lb/hr)[3]	Annual PM_{10} Emissions (TPY)[4]	Hourly $PM_{2.5}$ Emissions (lb/hr)[3]	Annual $PM_{2.5}$ Emissions (TPY)[4]
IES-8	Truck Dumper No. 1	96	445709	0.000428766	0.000202795	3.07089E-05	0.041	0.096	0.019	0.045	0.003	0.007
IES-9	Truck Dumper No. 2	96	445709	0.000428766	0.000202795	3.07089E-05	0.041	0.096	0.019	0.045	0.003	0.007

Fuel Piles (IES-10) Potential Emission Calculations

Emission Source ID No.	Emission Source Description	Pile Area (acres)	Pile Length (ft)	Pile Width (ft)	Height of Storage Pile (ft)	Pile Surface Area[1] (m^2)	PM (lb/hr)	PM (tpy)	PM_{10} (lb/hr)	PM_{10} (tpy)	$PM_{2.5}$ (lb/hr)	$PM_{2.5}$ (tpy)
EIS-10	Fuel Storage Pile (North Pile Area)	0.75	340	100	25	3926.48	0.496	2.17	0.248	1.09	0.037	0.16
EIS-10	Fuel Storage Pile (South Pile Area)	0.7	340	100	25	3926.48	0.496	2.17	0.248	1.09	0.037	0.16
						Total	0.99	4.34	0.50	2.17	0.07	0.33

Calculated Emission Factors[2,3]

PM (g/m2-day)	PM10 (g/m2-day)	PM2.5 (g/m2-day)
1.37	0.69	0.10

1. Surface area of piles calculated as half cylinders $S = 0.5 * 2\pi hL + 2\pi h^2$

Where:

h = the average of the pile height and 1/2 of the width

b = 1/2 width

c = height

As the two piles are connected at the center, the surface area of one half circle (the end of the half cylinder) has been subtracted from each.

2. EPA Report 451/R-93-001, "Models for Estimating Air Emissions Rates from Superfund Remedial Actions"

EF = 1.9 x (s/15) x ((365-p)/235) x (f/15) (Equation 7-9)

Where:

EF = emission factor (g/m^2-day)

p = number of days in a year with at least 0.254 mm (0.01 in) of precipitation

p = 110 days per AP-42 Figure 13.2.2-1

s = surface material silt content (%)

s = 7.5 % per AP-42 Table 13.2.4-1; value for overburden

f = fraction of time wind >5.4 m/s at mean pile height

f = 20 per Table 7-3, Default Values for Estimating PM Emissions from Other Area Sources

3. PM Fractions (AP-42, Section 13.2.5-3)

Particle Size	k
PM30	1
PM10	0.5
PM2.5	0.075

Material Handling - Transfer Operations (IES-11) Potential Emission Calculations

0.74	PM K Value	AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995)
0.35	PM_{10} K Value	AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995)
0.053	$PM_{2.5}$ K Value	AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles (January 1995)
7.5	U - Average Wind Speed (mph)	National Climatic Data Center - average wind speed for Raleigh, NC
10	M - Wood Moisture Content (%)	Lowest estimated wood moisture content
44	Maximum Hourly Production Rate (tons/hr)	Estimate for Proposed Operational Parameters
385440	Maximum Annual Production Rate (TPY)	Estimate for Proposed Operational Parameters

Emission Source ID No.	Source Description	Max Hourly Throughput (tons/hr)	Max Annual Throughput (TPY)	PM Emission Factor (lb/ton)[1]	PM_{10} Emission Factor (lb/ton)[1]	$PM_{2.5}$ Emission Factor (lb/ton)[1,4]	Hourly PM Emissions (lb/hr)[2]	Annual PM Emissions (TPY)[3]	Hourly PM_{10} Emissions (lb/hr)[2]	Annual PM_{10} Emissions (TPY)[3]	Hourly $PM_{2.5}$ Emissions (lb/hr)[2]	Annual $PM_{2.5}$ Emissions (TPY)[3]
IES-11	Transfer Point - Truck Dumper Hopper to Screen Supply Conveyor	44.0	385440	4.21E-04	1.99E-04	2.95E-05	1.85E-02	8.12E-02	8.77E-03	3.84E-02	1.30E-03	5.69E-03
IES-11	Transfer Point - Screen Supply Conveyor to Disc Screen	44.0	385440	4.21E-04	1.99E-04	2.95E-05	1.85E-02	8.12E-02	8.77E-03	3.84E-02	1.30E-03	5.69E-03
IES-11	Transfer Point - Disc Screen to Screen Accepts Conveyor	44.0	385440	4.21E-04	1.99E-04	2.95E-05	1.85E-02	8.12E-02	8.77E-03	3.84E-02	1.30E-03	5.69E-03
IES-11	Transfer Point - Screen Accepts Conveyor to Wood Fuel Transfer Conveyor	44.0	385440	4.21E-04	1.99E-04	2.95E-05	1.85E-02	8.12E-02	8.77E-03	3.84E-02	1.30E-03	5.69E-03
IES-11	Transfer Point - Wood Fuel Transfer Conveyor to Storage Pile	44.0	385440	4.21E-04	1.99E-04	2.95E-05	1.85E-02	8.12E-02	8.77E-03	3.84E-02	1.30E-03	5.69E-03
IES-11	Transfer Point - Wood Fuel Transfer Conveyor to Top Distribution Conveyor	44.0	385440	4.21E-04	1.99E-04	2.95E-05	1.85E-02	8.12E-02	8.77E-03	3.84E-02	1.30E-03	5.69E-03
IES-11	Transfer Point - Top Distribution Conveyor to Reclaim Pile A1	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Top Distribution Conveyor to Reclaim Pile A2	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Top Distribution Conveyor to Reclaim Pile B1	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Top Distribution Conveyor to Reclaim Pile B2	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Reclaim Pile A1 to Boiler A Reclaim Slat No. 1	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Reclaim Pile A2 to Boiler A Reclaim Slat No. 2	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Reclaim Pile B1 to Boiler A Reclaim Slat No. 1	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Reclaim Pile B2 to Boiler A Reclaim Slat No. 2	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Reclaim Slat No. 1 to Boiler A Cross Chain Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Reclaim Slat No. 2 to Boiler A Cross Chain Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler B Reclaim Slat No. 1 to Boiler B Cross Chain Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler B Reclaim Slat No. 2 to Boiler B Cross Chain Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Cross Chain Conveyor to Secondary Screen A Feed Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler B Cross Chain Conveyor to Secondary Screen B Feed Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Secondary Screen A Feed Conveyor to Boiler A Secondary Screen	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Secondary Screen B Feed Conveyor to Boiler B Secondary Screen	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Secondary Screen A Feed Conveyor to Boiler A Feed Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Secondary Screen B Feed Conveyor to Boiler B Feed Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Overfeed Bucket Elevator to Boiler A Overfeed Return Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Overfeed Return Conveyor to Boiler A Bin Feed Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Feed Conveyor to Boiler A Bin Feed Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler B Overfeed Bucket Elevator to Boiler B Overfeed Return Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler B Overfeed Return Conveyor to Boiler B Bin Feed Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler B Feed Conveyor to Boiler B Bin Feed Conveyor	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Bin Feed Conveyor to Fuel Bin 3A	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Bin Feed Conveyor to Fuel Bin 2A	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Bin Feed Conveyor to Fuel Bin 1A	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Bin Feed Conveyor to Fuel Bin 3B	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Bin Feed Conveyor to Fuel Bin 2B	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
IES-11	Transfer Point - Boiler A Bin Feed Conveyor to Fuel Bin 1B	22.0	192720	4.21E-04	1.99E-04	2.95E-05	9.27E-03	4.06E-02	4.39E-03	1.92E-02	6.49E-04	2.84E-03
						Total	0.39	1.71	0.18	0.81	0.03	0.12

[1] Emission factors calculated utilizing AP-42 Section 13.2.4 calculation: $EF = K*0.0032*(U/5)^{1.3}/(M/2)^{1.4}$

[2] Hourly emissions calculated utilizing maximum hourly throughput

[3] Annual emissions calculated utilizing maximum annual throughput

[4] $PM_{2.5}$ calculation uses particle size multiplier from AP-42 Section 13.2.4 (approximately 7% of PM is $PM_{2.5}$)

Material Handling - Transfer Operations (IES-11) Potential Emission Calculations

Fuel Material Handling - Emission Estimates

Source ID N IES-11
Front-End Loader/Dozer Operations

Material Silt Content (s)[1]	1.6	%
Material Moisture Content (M)	10	%
Number of Dozers	1	
Annual Operating Hours	8760	
Particle size scaling factor, PM_{10}	0.75	
Particle size scaling factor, $PM_{2.5}$	0.105	

Emission Factor Equations[2]

PM (TSP $\leq$ 30 um)[3]

EF_{PM} (lb/hr/dozer) = $(5.7*(s)^{1.2})/(M)^{1.3}$

$\leq$ 15 um[4]

EF_{PM15} (lb/hr/dozer) = $(1.0*(s)^{1.5})/(M)^{1.4}$

Source ID No.	Source Description	Emission Factor, EF (lb/hr/dozer) PM	PM_{10}	$PM_{2.5}$	PM (lb/hr)	PM_{10} (lb/hr)	$PM_{2.5}$ (lb/hr)	PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
IES-11	Front-End Loader/Dozer Operations	0.50	0.06	0.05	0.50	0.06	0.05	2.20	0.26	0.23

[1]Source: AP-42, Chapter 13.2.4 Aggregate Handling and Storage Piles, Table 13.2.4-1 (Crushed limestone)
[2]Source: AP-42, Chapter 11.9 Western Surface Coal Mining, Table 11.9-1 (bulldozing - overburden)
[3]Multiply the TSP predictive equation by the $PM_{2.5}$ scaling factor to determine the $PM_{2.5}$ emission factor
[4]Multiply the PM_{15} predictive equation by the PM_{10} scaling factor to determine the PM_{10} emission factor

Roads (IES-12) Potential Emission Calculations

Traffic Details

	Average Weight (tons)	Number of Trucks per Year	Segments Traveled		
			A	B	C
Chip Trucks	27.5	12,000	2	1	0
Cars	1	9,100	2	0	1

Segment	Paved/Unpaved	Length (miles)	VMT	Average Weight (tons)	Emission Factors (lb/VMT)			Emissions					
								PM		PM_{10}		$PM_{2.5}$	
					PM	PM_{10}	$PM_{2.5}$	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
A	Paved	0.1	4,220	16.1	0.1174	0.0235	0.0058	0.06	0.23	0.01	0.05	0.003	0.01
B	Unpaved	0.5	6,000	27.5	0.4119	0.0467	0.0047	0.28	0.86	0.03	0.10	0.003	0.01
C	Paved	0.6	5,460	1	0.0069	0.0014	0.0003	0.004	0.02	0.001	0.003	0.0002	0.001
							Total:	0.34	1.11	0.04	0.15	0.01	0.02

1. Paved Roads (AP-42 Section 13.2.1)

Hourly Emissions

$E = k\,(sL)^{0.91}(W)^{1.02}$ (Equation 1)

where:

E = particulate emission factor (having units matching the units of k)

k = particulate size multiplier for particle size range and units of interest

sL = road surface silt loading (grams per square meter - g/m^2)

sL = 0.6 for Ubiquitous Baseline ADT <500 (Table 13.2.1-3)

W = average weight (tons) of the vehicles traveling the road

Constants (AP-42, Section 13.2.1)

Particle Size	k (lb/VMT)
PM30	0.011
PM10	0.0022
PM2.5	0.00054

Annual Emissions

$E_{ext} = E\,(1\text{-}P/4N)$ (Equation 2)

where:

E_{ext} = annual emission factor (lb/VMT)

E = emission factor from Equation 1

P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation

P = 110 days per Figure 13.2.2-1

N = number of hours in the averaging period

N = 365 days per year

2. Unpaved Roads (AP-42 Section 13.2.2)

Hourly Emissions

$E = k\,(s/12)^a(W/3)^b$ (Equation 1a)

where:

E = size-specific emission factor (lb/VMT)

s = surface material silt content (%)

s = 8.4 % per AP-42 Table 13.2.2-1

W = mean vehicle weight (tons)

Constants (AP-42 Section 13.2.2, Table 13.2.2-2; values for industrial roads)

Particle Size	k (lb/VMT)	a	b
PM30	4.9	0.7	0.45
PM10	1.5	0.9	0.45
PM2.5	0.15	0.9	0.45

Annual Emissions

$E_{ext} = E\,[(365\text{-}P)/365]$ (Equation 2)

where:

E_{ext} = annual size-specific emission factor extrapolated for natural mitigation (lb/VMT)

E = emission factor from Equation 1a

P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation

P = 110 days per Figure 13.2.2-1


NCRP
Segment C
Segment B
Segment A