

ENVIVA PELLETS HAMLET, LLC 2016
P/N 10365
RICHMOND COUNTY



PAT MCCRORY
Governor

DONALD R. VAN DER VAART
Secretary

SHEILA C. HOLMAN
Director

March 29, 2016

Mr. Norb Hintz
Senior Vice President and Chief Engineer
Enviva Pellets Hamlet, LLC
7200 Wisconsin Avenue, Suite 1000
Bethesda, Maryland 20814

Dear Mr. Hintz:

SUBJECT: Air Quality Permit No. 10365R00
Facility ID: 7700096
Enviva Pellets Hamlet, LLC
Hamlet, North Carolina
Richmond County
PSD Status: Major
Fee Class: Title V

In accordance with your completed Air Quality Permit Application for a PSD modification for a Greenfield facility received January 20, 2015 we are forwarding herewith Air Quality Permit No. 10365R00 to Enviva Pellets Hamlet, LLC, Highway 117, Hamlet, North Carolina, authorizing the construction and operation, of the emission source(s) and associated air pollution control device(s) specified herein. Additionally, any emissions activities determined from your Air Quality Permit Application as being insignificant per 15A North Carolina Administrative Code 2Q .0503(8) have been listed for informational purposes as an "ATTACHMENT."

As the designated responsible official it is your responsibility to review, understand, and abide by all of the terms and conditions of the attached permit. It is also your responsibility to ensure that any person who operates any emission source and associated air pollution control device subject to any term or condition of the attached permit reviews, understands, and abides by the condition(s) of the attached permit that are applicable to that particular emission source.

The Permittee shall file a Title V Air Quality Permit Application pursuant to 15A NCAC 02Q .0504 on or before 12 months after commencing operation.

If any parts, requirements, or limitations contained in this Air Quality Permit are unacceptable to you, you have the right to request a formal adjudicatory hearing within 30 days following receipt of this permit, identifying the specific issues to be contested. This hearing request must be in the form of a written petition, conforming to NCGS (North Carolina General Statutes) 150B-23, and filed with both the Office of Administrative Hearings, 6714 Mail Service Center, Raleigh, North Carolina 27699-6714 and the Division of Air Quality, Permitting Section, 1641 Mail Service Center, Raleigh, North Carolina 27699-1641. The form for requesting a formal adjudicatory hearing may be obtained upon request from the Office of Administrative Hearings. Please note that this permit will be stayed in its entirety upon receipt of the request for a hearing. Unless a request for a hearing is made pursuant to NCGS 150B-23, this Air Quality Permit shall be final and binding 30 days after issuance.

You may request modification of your Air Quality Permit through informal means pursuant to NCGS 150B-22. This request must be submitted in writing to the Director and must identify the specific provisions or issues for which the modification is sought. Please note that this Air Quality Permit will become final and binding regardless of a request for informal modification unless a request for a hearing is also made under NCGS 150B-23.

The construction of new air pollution emission source(s) and associated air pollution control device(s), or modifications to the emission source(s) and air pollution control device(s) described in this permit must be covered under an Air Quality Permit issued by the Division of Air Quality prior to construction unless the Permittee has fulfilled the requirements of GS 143-215-108A(b) and received written approval from the Director of the Division of Air Quality to commence construction. Failure to receive an Air Quality Permit or written approval prior to commencing construction is a violation of GS 143-215.108A and may subject the Permittee to civil or criminal penalties as described in GS 143-215.114A and 143-215.114B.

For PSD increment tracking purposes in Richmond County, NO_x (as NO₂) emissions are increased by 50.27 pounds per hour, PM-10 emissions are increased by 23.10 pounds per hour, and PM-2.5 emissions are increased by 13.18 pounds per hour.

This Air Quality Permit shall be effective from March 29, 2016 until February 28, 2021, is nontransferable to future owners and operators, and shall be subject to the conditions and limitations as specified therein. Should you have any questions concerning this matter, please contact Kevin Godwin at (919) 707-8480.

Sincerely yours,



William D. Willets, P.E., Chief, Permitting Section
Division of Air Quality, NCDENR

- c: EPA Region 4
Steven Vozzo, Supervisor, Fayetteville Regional Office
Shannon Vogel, Stationary Source Compliance Branch
Central Files
Connie Horne (Cover letter only)

ATTACHMENT

Insignificant Activities per 15A NCAC 02Q .0503(8)

Emission Source ID No.	Emission Source Description
IES-GWHS	Green wood handling and sizing operations
IES-DWHS	Dried wood handling and sizing operations
IES-TK-1	Diesel fuel storage tank (up to 2,500 gallons capacity)
IES-TK-2	Diesel fuel storage tank (up to 1,000 gallons capacity)
IES-TK-3	Diesel fuel storage tank (up to 2,500 gallons capacity)
IES-GWSP-1 and IES-GWSP-2	Green wood storage piles
IES-DEBARK-1	De-barker
IES-GWFB	Green wood fuel bin

1. Because an activity is insignificant does not mean that the activity is exempted from an applicable requirement or that the owner or operator of the source is exempted from demonstrating compliance with any applicable requirement.
2. When applicable, emissions from stationary source activities identified above shall be included in determining compliance with the permit requirements for toxic air pollutants under 15A NCAC 02D .1100 "Control of Toxic Air Pollutants" or 02Q .0711 "Emission Rates Requiring a Permit".
3. For additional information regarding the applicability of GACT see the DAQ page titled "The Regulatory Guide for Insignificant Activities/Permits Exempt Activities". The link to this site is as follows: <http://daq.state.nc.us/permits/insig/>



State of North Carolina
Department of Environmental Quality
Division of Air Quality

AIR QUALITY PERMIT

Permit No.	Replaces Permit No.(s)	Effective Date	Expiration Date
10365R00	N/A	March 29, 2016	February 28, 2021

Until such time as this permit expires or is modified or revoked, the below named Permittee is permitted to construct and operate the emission source(s) and associated air pollution control device(s) specified herein, in accordance with the terms, conditions, and limitations within this permit. This permit is issued under the provisions of Article 21B of Chapter 143, General Statutes of North Carolina as amended, and Title 15A North Carolina Administrative Codes (15A NCAC), Subchapters 2D and 2Q, and other applicable Laws.

Pursuant to Title 15A NCAC, Subchapter 2Q, the Permittee shall not construct, operate, or modify any emission source(s) or air pollution control device(s) without having first submitted a complete Air Quality Permit Application to the permitting authority and received an Air Quality Permit, except as provided in this permit.

Permittee: **Enviva Pellets Hamlet, LLC**
Facility ID: 7700096

Facility Site Location: 1125 North NC Highway 177
City, County, State, Zip: Hamlet, Richmond County, North Carolina, 28341

Mailing Address: 7200 Wisconsin Avenue
City, State, Zip: Bethesda, Maryland 20814

Application Number: 7700096.14A
Complete Application Date: January 20, 2015

Primary SIC Code: 2499
**Division of Air Quality,
Regional Office Address:** Fayetteville Regional Office
System Building
225 Green Street, Suite 714
Fayetteville, North Carolina, 28301

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SECTION 1- PERMITTED EMISSION SOURCE (S) AND ASSOCIATED AIR POLLUTION CONTROL DEVICE (S) AND APPURTENANCES

The following table contains a summary of all permitted emission sources and associated air pollution control devices and appurtenances:

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description
ES-CHIP-1 PSD	Log chipping	N/A	N/A
ES-GHM-1 and ES-GHM-2 PSD	Green wood hammermills	CD-GHM-CYC1 and CD-GHM-CYC2	Two simple cyclones (54 inches in diameter each)
ES-BARKHOG PSD	Bark hog	N/A	N/A
ES-DRYER PSD 2D .1112 Case-by-case MACT	Wood-fired direct heat drying system (250.4 million Btu per hour heat input)	CD-DC1, CD-DC2, CD-DC3, CD-DC4, and CD-WESP	Four simple cyclones (132 inches in diameter each) in series with one wet electrostatic precipitator (29,904 square feet of collector plate area)
ES-HM-1 through ES-HM-8 PSD 2D .1112 Case-by-case MACT	Eight (8) hammermills	CD-HM-CYC-1 through CD-HM-CYC-8, and CD-HM-BF1 through CD-HM-BF8	Eight (8) simple cyclones (96 inches in diameter each) in series with eight (8) bagfilters (2,168 square feet of filter area each)
ES-HMA & ES-PFB PSD 2D .1112 Case-by-case MACT	Hammermill area and Pellets fines bin	CD-PFB-BV	One bagfilter (1,520 square feet of filter area)
ES-PMFS PSD	Pellet mill feed silo	CD-PMFS-BV	One bin vent filter (377 square feet of filter area)
ES-PSTB PSD	Pellet sampling transfer bin	CD-DC-BV3	One bin vent filter (377 square feet of filter area)

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description
ES-CLR-1 through ES-CLR-6 PSD 2D .1112 Case-by-case MACT	Six (6) pellet coolers	CD-CLR-1 through CD-CLR-6	Six (6) simple cyclones (54 inches in diameter) installed one each on the coolers
ES-FPH, ES-PB-1 through ES-PB-8, ES-PL-1 and ES-PL-3 PSD	Finished product handling, eight (8) pellet load-out bins, and three (3) pellet mill loadouts	CD-FPH-BF	One bagfilter (4,842 square feet of filter area)
ES-DWH PSD	Dried and sized wood handling	CD-DC-BV1 and CD-DC-BV2	Two bin vent filters (377 square feet of filter area each)
ES-GN PSD MACT Subpart ZZZZ NSPS Subpart III	Diesel-fired emergency generator (250 brake horsepower)	N/A	N/A
ES-FWP PSD MACT Subpart ZZZZ NSPS Subpart III	Diesel-fired fire emergency water pump (250 brake horsepower)	N/A	N/A

SECTION 2 - SPECIFIC LIMITATIONS AND CONDITIONS

2.1- Emission Source(s) and Control Devices(s) Specific Limitations and Conditions

The emission source(s) and associated air pollution control device(s) and appurtenances listed below are subject to the following specific terms, conditions, and limitations, including the testing, monitoring, recordkeeping, and reporting requirements as specified herein:

- A. Log Chipping (ID No. ES-CHIP-1), Bark Hog (ID No. ES-BARKHOG), Wood-fired direct heat drying system (ID No. ES-DRYER), Hammermills (ID Nos. ES-GHM-1 and GHM-2, ES-HM-1 through HM-8), Hammermill Area Filter (ID No. ES-HMA), Pellet Mill Feed Silo (ID No. ES-**

PMFS), Pellet Sampling and Transfer Bin (ID No. ES-PSTB), Pellet Coolers (ID Nos. ES-CLR-1 through CLR-6), Pellets Fines Bin (ID No. ES-PFB), Finished Product Handling (ID No. ES-FPH), Pellet Load-out Bins (ID Nos. ES-PB-1 through PB-8), and Pellet Mill Load-out (ID No. ES-PL-1 through PL-3), Dried and Sized Wood Handling (ID No. ES-DWH)

The following table provides a summary of limits and standards for the emission source(s) described above:

Regulated Pollutant	Limits/Standards	Applicable Regulation
Particulate matter	$E = 4.10 \times P^{0.67}$ for $P < 30$ tph $E = 55 \times P^{0.11} - 40$ for $P \geq 30$ tph where, E = allowable emission rate (lb/hr) P = process weight rate (tph)	15A NCAC 02D .0515
Sulfur dioxide	2.3 pounds per million Btu	15A NCAC 02D .0516
Visible emissions	20 percent opacity when averaged over a 6-minute period	15A NCAC 02D .0521
HAPS	See Section 2.1 A.4.	15A NCAC 02D .1112 [§ 112(g) Case-by-case MACT]
PM/PM-10/PM-2.5, NOx VOC CO GHG	BACT Limits, See Section 2.2 A.2.	15A NCAC 02D .0530

1. 15A NCAC 02D .0515: PARTICULATES FROM MISCELLANEOUS INDUSTRIAL PROCESSES

a. Emissions of particulate matter from these sources shall not exceed an allowable emission rate as calculated by the following equation: [15A NCAC 02D .0515(a)]

$$E = 4.10 \times P^{0.67} \quad \text{for } P < 30 \text{ tph}$$

$$E = 55 \times P^{0.11} - 40 \quad \text{for } P \geq 30 \text{ tph}$$

Where E = allowable emission rate in pounds per hour
 P = process weight in tons per hour

Liquid and gaseous fuels and combustion air are not considered as part of the process weight.

Testing [15A NCAC 02Q .0308(a)]

b. Under the provisions of NCGS 143-215.108, the Permittee shall test the wet electrostatic precipitator (ID No. CD-WESP) for total suspended particulate (TSP) in accordance with a testing protocol approved by the DAQ. Testing shall be completed and the results submitted within 180 days of commencement of operation unless an alternate date is approved by the DAQ.

Monitoring/Recordkeeping [15A NCAC 02Q .0308(a)]

- c. The Permittee shall maintain production records such that the process rates "P" in tons per hour, as specified by the formulas contained above (or the formulas contained in 15A NCAC 2D .0515) can be derived, and shall make these records available to a DAQ authorized representative upon request.
- d. Particulate matter emissions from the wood-fired dryer (ID No. ES-DRYER) shall be controlled by four (4) cyclones (ID Nos. CD-DC-1 through DC-4) in series with one wet electrostatic precipitator (ID No. CD-WESP). Particulate matter emissions from the hammermills (ID Nos. ES-GHM-1 and 2, ES-HM-1 through 8) shall be controlled by cyclones and bagfilters (ID Nos. CD-GMH-CYC1 and CD-GMH-CYC2, CD-HM-CYC-1 through 8, and CD-HM-BF-1 through 8). Particulate matter emissions from the hammermill area (ID No. ES-HMA) and the pellets fines bin (ID No. ES-PFB) shall be controlled by a bin vent filter (ID No. CD-PFB-BV). Particulate matter emissions from the pellet mill feed silo (ID No. ES-PMFS) shall be controlled by a bin vent filter (ID No. CD-PMFS-BV). Particulate matter emissions from the pellet sampling and transfer bin (ID No. ES-PSTB) shall be controlled by a bin vent filter (ID No. CD-DC-BV3). Particulate matter emissions from the pellet coolers (ID Nos. ES-CLR-1 through 6) shall be controlled by cyclones (ID Nos. CD-CLR-1 through 6). Particulate matter emissions from finished product handling (ID No. ES-FPH), pellet mill load-out bins (ID Nos. ES-PB-1 through 8), and pellet mill load-out (ID No. ES-PL-1 through 3) shall be controlled by a bagfilter (ID No. CD-FPH-BF). Particulate matter emissions from the dried and sized wood handling (ID No. ES-DWH) shall be controlled by two bin vent filters (ID Nos. CD-DC-BV1 and BV2).

For bagfilters, bin vent filters, and cyclones:

To assure compliance, the Permittee shall perform inspections and maintenance as recommended by the manufacturer. In addition to the manufacturer's inspection and maintenance recommendations, or if there are no manufacturer's inspection and maintenance recommendations, as a minimum, the inspection and maintenance requirement shall include the following:

- i. a monthly visual inspection of the system ductwork and material collection unit for leaks.
- ii. an annual (for each 12 month period following the initial inspection) internal inspection of the bagfilters' structural integrity.

For WESP:

To assure compliance, the Permittee shall perform inspections and maintenance as recommended by the manufacturer. In addition to the manufacturer's inspection and maintenance recommendations, or if there are no manufacturer's inspection and maintenance recommendations, as a minimum, the inspection and maintenance requirement shall include the following:

The Permittee shall establish the minimum primary voltage and minimum current within the first 30 days following the commencement of operation of the dryer. To assure compliance and effective operation of the wet electrostatic precipitator, the Permittee shall monitor and record the primary voltage and minimum current through the precipitator for each day of the calendar year period that the dryer system is operated. The Permittee shall be allowed three (3) days of absent observations per semi-annual period.

- e. The results of inspection and maintenance shall be maintained in a log (written or electronic format) on-site and made available to an authorized representative upon request. The log shall record the following:
 - i. the date and time of each recorded action;
 - ii. the results of each inspection;
 - iii. the results of any maintenance performed; and
 - iv. any variance from manufacturer's recommendations, if any, and corrections made.

Reporting

- f. The Permittee shall submit the results of any maintenance performed on the WESP, cyclones, bagfilters, and bin vent filters within 30 days of a written request by the DAQ.

2. 15A NCAC 02D .0516: SULFUR DIOXIDE EMISSIONS FROM COMBUSTION SOURCES

- a. Emissions of sulfur dioxide from these sources shall not exceed 2.3 pounds per million Btu heat input. Sulfur dioxide formed by the combustion of sulfur in fuels, wastes, ores, and other substances shall be included when determining compliance with this standard. [15A NCAC 2D .0516]

Testing [15A NCAC 02Q .0308(a)]

- b. If emissions testing is required, the testing shall be performed in accordance with General Condition JJ found in Section 3.

Monitoring/Recordkeeping/Reporting [15A NCAC 02Q .0308(a)]

- c. No monitoring/recordkeeping/reporting is required for sulfur dioxide emissions from firing biomass in the dryer system.

3. 15A NCAC 02D .0521: CONTROL OF VISIBLE EMISSIONS

- a. Visible emissions from these sources shall not be more than 20 percent opacity when averaged over a six-minute period. However, six-minute averaging periods may exceed 20 percent not more than once in any hour and not more than four times in any 24-hour period. In no event shall the six-minute average exceed 87 percent opacity. [15A NCAC 02D .0521 (d)]

Testing [15A NCAC 02Q .0308(a)]

- b. If emissions testing is required, the testing shall be performed in accordance with General Condition JJ.

Monitoring [15A NCAC 02Q .0308(a)]

- c. To assure compliance, once a month the Permittee shall observe the emission points of this source for any visible emissions above normal. The monthly observation must be made for each month of the calendar year period to ensure compliance with this requirement. The Permittee shall establish "normal" for the source in the first 30 days following the effective date of the permit. If visible emissions from this source are observed to be above normal, the Permittee shall either:
 - i. take appropriate action to correct the above-normal emissions as soon as practicable and within the monitoring period and record the action taken as provided in the recordkeeping requirements below, or
 - ii. demonstrate that the percent opacity from the emission points of the emission source in accordance with 15A NCAC 2D .2610 (Method 9) for 12 minutes is below the limit given in Section 2.1 A.3. a. above.

Recordkeeping [15A NCAC 02Q .0308(a)]

- d. The results of the monitoring shall be maintained in a log (written or electronic format) on-site and made available to an authorized representative upon request. The log shall record the following:
 - i. the date and time of each recorded action;
 - ii. the results of each observation and/or test noting those sources with emissions that were observed to be in noncompliance along with any corrective actions taken to reduce visible emissions; and
 - iii. the results of any corrective actions performed.

Reporting [15A NCAC 02Q .0308(a)]

- e. No reporting is required.

4. **15A NCAC 02D .1112 National Emissions Standards for Hazardous Air Pollutants, 112(g) Case-by-Case Maximum Achievable Control Technology** – For the wood pellet mill dryer (ID No. ES-DRYER), the Permittee shall use a low HAP emitting dryer design not requiring add-on control.

Testing [15A NCAC 02D .0530]

- a. Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall establish emission factors by conducting an initial performance test on the dryer system for formaldehyde, methanol, acetaldehyde, and propionaldehyde utilizing EPA reference methods, as in effect on the date of permit issuance, contained in 40 CFR 60, Appendix A, or 40 CFR 63 AND in accordance with a testing protocol (using testing protocol submittal form) approved by the Division of Air Quality. The sum of the above HAPs will be multiplied by a correction factor of 1.04 to determine total HAPs for the dryer system.

Initial testing shall be completed and the results submitted within 180 days of commencement of operation unless an alternate date is approved by the DAQ.

- b. **Monitoring/Recordkeeping/Reporting** [15A NCAC 02Q .0308(a)]
No monitoring, recordkeeping, or reporting is required.

B. Emergency Generator (ID No. ES-GN) and Fire Water Pump (ID No. ES-FWP)

The following table provides a summary of limits and/or standards for the emission source(s) described above.

Regulated Pollutant	Limits/Standards	Applicable Regulation
Sulfur dioxide	2.3 pounds per million Btu heat input	15A NCAC 02D .0516
Visible emissions	20 percent opacity	15A NCAC 02D .0521
Hazardous air pollutants (HAP)	National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE) No additional requirements per 63.6590(c)	15A NCAC 02D .1111 (40 CFR 63, Subpart ZZZZ)
NMHC and NO _x , CO, PM	0.20 g/kW for PM; 3.5 g/kW for CO; and 4 g/kW for NO _x + NMHC	15A NCAC 02D .0524 (40 CFR 60, Subpart IIII)

1. **15A NCAC 02D .0516: SULFUR DIOXIDE EMISSIONS FROM COMBUSTION SOURCES**

- a. Emissions of sulfur dioxide from these sources shall not exceed 2.3 pounds per million Btu heat input. Sulfur dioxide formed by the combustion of sulfur in fuels, wastes, ores, and other substances shall be included when determining compliance with this standard. [15A NCAC 02D .0516]

Testing [15A NCAC 02Q .0308(a)]

- b. If emissions testing is required, the testing shall be performed in accordance with 15A NCAC 02D .2600.

Monitoring/Recordkeeping/Reporting [15A NCAC 02Q .0308(a)]

- c. No monitoring/recordkeeping/reporting is required for sulfur dioxide emissions from the firing of diesel fuel in these sources.

2. **15A NCAC 02D .0521: CONTROL OF VISIBLE EMISSIONS**

- a. Visible emissions from these sources shall not be more than 20 percent opacity when averaged over a six-minute period. However, six-minute averaging periods may exceed 20 percent not more than once in any hour and not more than four times in any 24-hour period. In no event shall the six-minute average exceed 87 percent opacity. [15A NCAC 02D .0521(d)]

Testing [15A NCAC 02Q .0308(a)]

- b. If emissions testing is required, the testing shall be performed in accordance with 15A NCAC 02D .2600.

Monitoring [15A NCAC 02Q .0308(a)]

- c. To assure compliance, once a month the Permittee shall observe the emission points of these sources for any visible emissions above normal. The monthly observation must be made for each month of the calendar year period to ensure compliance with this requirement. The Permittee shall establish 'normal' for the sources in the first 30 days following commencement of operation. If visible emissions from these sources are observed to be above normal, the Permittee shall either:
 - i. take appropriate action to correct the above-normal emissions as soon as practicable and within the monitoring period and record the action taken as provided in the recordkeeping requirements below, or
 - ii. demonstrate that the percent opacity from the emission points of the emission source in accordance with 15A NCAC 02D .2601 (Method 9) for 12 minutes is below the limit given in Section 2.1 F.2. a. above.

Recordkeeping [15A NCAC 02Q .0308(a)]

- d. The results of the monitoring shall be maintained in a log (written or electronic format) on-site and made available to an authorized representative upon request. The log shall record the following:
 - i. the date and time of each recorded action;
 - ii. the results of each observation and/or test noting those sources with emissions that were observed to be in noncompliance along with any corrective actions taken to reduce visible emissions; and
 - iii. the results of any corrective actions performed.

Reporting [15A NCAC 02Q .0308(a)]

- e. No reporting is required.

3. 15A NCAC 02D .0524 NEW SOURCE PERFORMANCE STANDARDS [40 CFR 60 Subpart III]

- a. The provisions of this subpart are applicable to manufacturer, owners, and operators of stationary compression ignition (CI), reciprocating internal combustion engines (RICE). The Permittee shall comply with all applicable provisions, including the requirements for emission standards, notification, testing, reporting, recordkeeping, and monitoring, contained in Environmental Management Commission Standard 15A NCAC 02D .0524 "New Source Performance Standards (NSPS)" as promulgated in 40 CFR Part 60 Subpart III, including Subpart A "General Provisions."

Emission Standards

Emergency and Fire Pump Engines

- b. Pursuant to 40 CFR §60.4205(b), owners and operators must comply with the following emission standards:

Pollutant	Emission Limit (g/kW-hr)	Emission Limit (g/bhp-hr)
CO	3.5	2.6
PM	0.2	0.15
NMHC + NO _x	4.0	3.0

Monitoring [15A NCAC 02Q .0308(a)]

- c. The Permittee shall operate the stationary ICE of emergency generators according to the requirements in paragraphs (f)(1) through (3) of §60.4211. In order for the engine to be considered an emergency stationary ICE under this Subpart, any operation other than emergency operation, maintenance and testing, emergency demand response, and operation in nonemergency situations for 50 hours per year,

as described in paragraphs (f)(1) through (3) of §60.4211, is prohibited. If the Permittee does not operate the engine according to the requirements in paragraphs (f)(1) through (3) of §60.4211, the engine will not be considered an emergency engine under this Subpart and shall meet all requirements for non-emergency engines.

- i. There is no time limit on the use of emergency stationary ICE in emergency situations.
- ii. The Permittee may operate the emergency stationary ICE for any combination of the purposes specified in paragraphs (f)(2)(i) through (iii) of §60.4211 for a maximum of 100 hours per calendar year. Any operation for non-emergency situations as allowed by paragraph (f)(3) of §60.4211 counts as part of the 100 hours per calendar year allowed by this paragraph (f)(2).
 - (A) Emergency stationary ICE may be operated for maintenance checks and readiness testing, provided that the tests are recommended by federal, state or local government, the manufacturer, the vendor, the regional transmission organization or equivalent balancing authority and transmission operator, or the insurance company associated with the engine. The Permittee may petition the Administrator for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the Permittee maintains records indicating that federal, state, or local standards require maintenance and testing of emergency ICE beyond 100 hours per calendar year.
 - (B) Emergency stationary ICE may be operated for emergency demand response for periods in which the Reliability Coordinator under the North American Electric Reliability Corporation (NERC) Reliability Standard EOP-002-3, Capacity and Energy Emergencies (incorporated by reference, see § 60.17), or other authorized entity as determined by the Reliability Coordinator, has declared an Energy Emergency Alert Level 2 as defined in the NERC Reliability Standard EOP-002-3.
 - (C) Emergency stationary ICE may be operated for periods where there is a deviation of voltage or frequency of 5 percent or greater below standard voltage or frequency.
- iii. Emergency stationary ICE may be operated for up to 50 hours per calendar year in non-emergency situations. The 50 hours of operation in non-emergency situations are counted as part of the 100 hours per calendar year for maintenance and testing and emergency demand response provided in paragraph (f)(2) of this section. Except as provided in paragraph (f)(3)(i) of §60.4211, the 50 hours per calendar year for non-emergency situations cannot be used for peak shaving or non-emergency demand response, or to generate income for a facility to an electric grid or otherwise supply power as part of a financial arrangement with another entity.
 - (A) The 50 hours per year for non-emergency situations can be used to supply power as part of a financial arrangement with another entity if all of the following conditions are met:
 - (AA) The engine is dispatched by the local balancing authority or local transmission and distribution system operator.
 - (BB) The dispatch is intended to mitigate local transmission and/or distribution limitations so as to avert potential voltage collapse or line overloads that could lead to the interruption of power supply in a local area or region.
 - (CC) The dispatch follows reliability; emergency operation or similar protocols that follow specific NERC, regional, state, public utility commission or local standards or guidelines.
 - (DD) The power is provided only to the facility itself or to support the local transmission and distribution system.
 - (EE) The owner or operator identifies and records the entity that dispatches the engine and the specific NERC, regional, state, public utility commission or local standards or guidelines that are being followed for dispatching the engine. The local balancing authority or local transmission and distribution system operator may keep these records on behalf of the engine owner or operator.

[§60.4211(f)]

- d. Pursuant to 40 CFR §60.4206, owners and operators must operate and maintain the stationary RICE according to the manufacturer’s written instructions or procedures developed by the owner or operator that are approved by the engine manufacturer, over the entire life of the engine.

Fuel Requirements for Owners and Operators

- e. Pursuant to 40 CFR §60.4207, owners and operators must use fuel with a maximum sulfur content of 15 ppmw and a cetane index of at least 40.
- f. Pursuant to 40 CFR §60.4209(a), the owner or operator must install a non-resettable hour meter prior to start-up of the engines.

Recordkeeping [15A NCAC 02Q .0308(a)]

- g. Starting with the emergency engine model year 2011, if the emergency engine does not meet the standards applicable to non-emergency engines in the applicable model year, the Permittee shall keep records of the operation of the engine in emergency and non-emergency service that are recorded through the non-resettable hour meter. The Permittee shall record the time of operation of the engine and the reason the engine was in operation during that time. [§60.4214(b)]

4. 15A NCAC 02D .1111: MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY (40 CFR 63 Subpart ZZZZ)

- a. Pursuant to §63.6580, Subpart ZZZZ establishes national emission limitations and operating limitations for hazardous air pollutants (HAP) emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations.
- b. Pursuant to §63.6590(c), a new emergency stationary RICE with a site rating of less than or equal to 500 horsepower located at a major source must meet the requirements of 40 CFR Part 60, Subpart III, for compression ignition engines. No further requirements apply for such engines under this part.

2.2- Multiple Emission Source(s) Specific Limitations and Conditions

A. Facility-wide Emission Sources

The following table provides a summary of limits and standards for the emission source(s) describe above:

Regulated Pollutant	Limits/Standards	Applicable Regulation
Fugitive dust	Minimize fugitive dust beyond property boundary	15A NCAC 02D .0540
PM/PM-10/PM-2.5, NOx, CO, VOC, and GHG	BACT Limits	15A NCAC 02D .0530

1. Fugitive Dust Control Requirement [15A NCAC 02D .0540] - STATE ENFORCEABLE ONLY

As required by 15A NCAC 2D .0540 "Particulates from Fugitive Dust Emission Sources," the Permittee shall not cause or allow fugitive dust emissions to cause or contribute to substantive complaints or excess visible emissions beyond the property boundary. If substantive complaints or excessive fugitive dust emissions from the facility are observed beyond the property boundaries for six minutes in any one hour (using Reference Method 22 in 40 CFR, Appendix A), the owner or operator may be required to submit a fugitive dust plan as described in 02D .0540(f).

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

2. 15A NCAC 02D .0530: PREVENTION OF SIGNIFICANT DETERIORATION

- a. The Permittee shall comply with all applicable provisions, including the notification, testing, reporting, recordkeeping, and monitoring requirements in accordance with 15A NCAC 02D .0530, "Prevention of Significant Deterioration of Air Quality" as promulgated in 40 CFR 51.166. [15A NCAC 02D .0530]
- b. The following emission limits shall not be exceeded except during periods of start-up, shut-down, or malfunction. [15A NCAC 02D .0530]:

Unit	Pollutant	BACT Limit*	Units	Averaging Period	Technology
Dryer system	NOx	0.20	lb/MMBtu	3-hour	Good Combustion Practices/low NOx burners
	PM PM10/2.5	0.105 (filterable only)	lb/ODT	3-hour	Cyclones/WESP
	CO	0.21	lb/MMBtu	3-hour	Process Design
	VOC** GHG	1.07 229,828	lb/ODT tpy (CO ₂ e)	3-hour Annual	Process Design Good Operating Practices
Green Wood Hammermills	PM/PM10/2.5	0.022/0.0057/0.0007 (filterable only)	gr/dscf	3-hour	Cyclones
	VOC**	0.27	lb/ODT	3-hour	Good operating and maintenance procedures
Dry Hammermills	PM/PM10/2.5	0.004/0.004/0.000014 (filterable only)	gr/dscf	3-hour	Cyclones & Bagfilter
	VOC**	0.24	lb/ODT	3-hour	Process Design
Pellet Mill Feed Silo	PM/PM10/2.5	0.004 (filterable only)	gr/dscf	3-hour	Bin vent filter
Hammermill Area and Pellet Mill Fines Bin	PM/PM10/2.5	0.004 (filterable only)	gr/dscf	3-hour	Bin vent filter
Pellet Sampling and Transfer bin	PM/PM10/2.5	0.004 (filterable only)	gr/dscf	3-hour	Bin vent filter
Dried and Sized Wood Handling	PM/PM10/2.5	0.004 (filterable only)	gr/dscf	3-hour	Bin vent filter
Final Product Handling	PM/PM10/2.5	0.004/0.004/0.000014 (filterable only)	gr/dscf	3-hour	Bagfilter
Pellet Coolers	PM/PM10/2.5	0.022/0.0057/0.0007 (filterable only)	gr/dscf	3-hour	Cyclones
	VOC**	0.85	lb/ODT	3-hour	Process Design
Log Bark Hog	VOC	N/A	N/A	N/A	Fugitive

Unit	Pollutant	BACT Limit*	Units	Averaging Period	Technology
Chipper	VOC	N/A	N/A	N/A	Fugitive
Green Wood Handling	PM/PM10/2.5	N/A	N/A	N/A	Inherent Moisture content
Storage Piles	PM/PM10/2.5	N/A	N/A	N/A	Inherent Moisture content Fugitive
	VOC	N/A	N/A	N/A	
Road Dust	PM/PM10/2.5	N/A	N/A	N/A	Paving & Water Spray
Emergency engines	CO	2.6	g/bhp-hr		Design and Good operating practices NSPS Certification
	NMHC+NOx	3.0	g/bhp-hr		
	PM	0.15 (filterable only)	g/bhp-hr		
Storage tanks	VOC	Good Operation Practices	N/A	N/A	Good operating practices

* BACT emission limits shall apply at all times except the following: Emissions resulting from start-up, shutdown or malfunction above those given in the table above are permitted provided that optimal operational practices are adhered to and periods of excess emissions are minimized.

** The VOC limit is expressed as alpha pinene basis per the procedures in EPA OTM 26.

Testing [15A NCAC 02D .0530]

- c. Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall demonstrate compliance with the BACT emission limits by conducting performance test on the dryer system, the pellet coolers, and the greenwood hammermills as specified below utilizing EPA reference methods, as in effect on the date of permit issuance, contained in 40 CFR 60, Appendix A, 40 CFR 63, and/or OTM 26 AND in accordance with a testing protocol (using testing protocol submittal form) approved by the Division of Air Quality, as follows:

Unit	Pollutant	Testing
Dryer system	NOx	Annually
	PM/PM10/PM2.5	Annually
	VOC	Initial Only
	CO	Initial Only
One Pellet cooler	VOC	Initial Only
One Green wood hammermill	VOC	Initial Only

Initial testing shall be completed and the results submitted within 180 days of commencement of operation unless an alternate date is approved by the DAQ.

If the results of two consecutive NOx and/or PM/PM10/PM2.5 compliance tests are less than 80% of the above BACT limit, future testing shall be required once per five years (within 60 months of the previous test date). If the results of either test for either pollutant exceed 80% of the standard, then annual testing shall resume for the respective pollutant until two consecutive tests per pollutant are less than 80% of the above listed BACT limit.

Monitoring/Recordkeeping/Reporting [15ANCAC 02Q .0308(a)]

- d. The Permittee shall not process more than 537,625 oven-dried tons (ODT) of pellets per year. The Permittee shall not process more than 75% softwood on a 12-month rolling average basis. The process rate and hardwood/softwood mix shall be recorded in a monthly log kept on site. Calculations and the total amount of NOx, filterable PM, CO, and VOC emissions shall be recorded monthly in a log (written or electronic format) kept on site and made available to DAQ personnel upon request.

- e. For the dryer system, GHG (CO₂e) emissions shall be calculated on a monthly basis and compliance demonstrated using the applicable Part 98 emission factors. Compliance shall be documented on a 12 month rolling basis.
- f. No reporting is required.
- g. REPORTING REQUIREMENT – Within 30 days of beginning commercial operation, the Permittee shall notify, in writing, the Regional Office of the date the facility began commercial operation. Pursuant to 15A NCAC 2Q .0500 the Permittee shall have one year from the date of beginning commercial operation to submit a complete Title V application to the Regional Supervisor.

SECTION 3 - GENERAL CONDITIONS

1. REPORTS, TEST DATA, MONITORING DATA, NOTIFICATIONS, AND REQUESTS FOR RENEWAL shall be submitted to:

Steven Vozzo
Regional Air Quality Supervisor
North Carolina Division of Air Quality
Fayetteville Regional Office
Systel Building
225 Green Street, Suite 714
Fayetteville, NC 28301-5043
(910) 433-3300

2. PERMIT RENEWAL REQUIREMENT - The Permittee, at least 90 days prior to the expiration date of this permit, shall request permit renewal by letter in accordance with 15A NCAC 02Q .0304(d) and (f). Pursuant to 15A NCAC 2Q .0203(i), no permit application fee is required for renewal of an existing air permit. The renewal request should be submitted to the Regional Supervisor, DAQ.
3. ANNUAL FEE PAYMENT - Pursuant to 15A NCAC 02Q .0203(a), the Permittee shall pay the annual permit fee within 30 days of being billed by the DAQ. Failure to pay the fee in a timely manner will cause the DAQ to initiate action to revoke the permit.
4. ANNUAL EMISSION INVENTORY REQUIREMENTS – The Permittee shall report by June 30 of each year the actual emissions of each air pollutant listed in 15A NCAC 02Q .0207(a) from each emission source within the facility during the previous calendar year. The report shall be in or on such form as may be established by the Director. The accuracy of the report shall be certified by the responsible official of the facility.
5. EQUIPMENT RELOCATION - A new air permit shall be obtained by the Permittee prior to establishing, building, erecting, using, or operating the emission sources or air cleaning equipment at a site or location not specified in this permit.

6. This permit is subject to revocation or modification by the DAQ upon a determination that information contained in the application or presented in the support thereof is incorrect, conditions under which this permit was granted have changed, or violations of conditions contained in this permit have occurred. The facility shall be properly operated and maintained at all times in a manner that will effect an overall reduction in air pollution. Unless otherwise specified by this permit, no emission source may be operated without the concurrent operation of its associated air cleaning device(s) and appurtenances.
7. REPORTING REQUIREMENT - Any of the following that would result in previously unpermitted, new, or increased emissions must be reported to the Regional Supervisor, DAQ:
 - a. changes in the information submitted in the application regarding facility emissions;
 - b. changes that modify equipment or processes of existing permitted facilities; or
 - c. changes in the quantity or quality of materials processed.

If appropriate, modifications to the permit may then be made by the DAQ to reflect any necessary changes in the permit conditions. In no case are any new or increased emissions allowed that will cause a violation of the emission limitations specified herein.

8. This permit is nontransferable by the Permittee. Future owners and operators must obtain a new air permit from the DAQ.
9. This issuance of this permit in no way absolves the Permittee of liability for any potential civil penalties which may be assessed for violations of State law which have occurred prior to the effective date of this permit.
10. This permit does not relieve the Permittee of the responsibility of complying with all applicable requirements of any Federal, State, or Local water quality or land quality control authority.
11. Reports on the operation and maintenance of the facility shall be submitted by the Permittee to the Regional Supervisor, DAQ at such intervals and in such form and detail as may be required by the DAQ. Information required in such reports may include, but is not limited to, process weight rates, firing rates, hours of operation, and preventive maintenance schedules.
12. A violation of any term or condition of this permit shall subject the Permittee to enforcement pursuant to G.S. 143-215.114A, 143-215.114B, and 143-215.114C, including assessment of civil and/or criminal penalties.
13. Pursuant to North Carolina General Statute 143-215.3(a)(2), no person shall refuse entry or access to any authorized representative of the DAQ who requests entry or access for purposes of inspection, and who presents appropriate credentials, nor shall any person obstruct, hamper, or interfere with any such representative while in the process of carrying out his official duties. Refusal of entry or access may constitute grounds for permit revocation and assessment of civil penalties.
14. The Permittee must comply with any applicable Federal, State, or Local requirements governing the handling, disposal, or incineration of hazardous, solid, or medical wastes, including the Resource Conservation and Recovery Act (RCRA) administered by the Division of Waste Management.
15. PERMIT RETENTION REQUIREMENT - The Permittee shall retain a current copy of the air permit at the site. The Permittee must make available to personnel of the DAQ, upon request, the current copy of the air permit for the site.

16. CLEAN AIR ACT SECTION 112(r) REQUIREMENTS - Pursuant to 40 CFR Part 68 "Accidental Release Prevention Requirements: Risk Management Programs Under the Clean Air Act, Section 112(r)," if the Permittee is required to develop and register a risk management plan pursuant to Section 112(r) of the Federal Clean Air Act, then the Permittee is required to register this plan in accordance with 40 CFR Part 68.

17. PREVENTION OF ACCIDENTAL RELEASES - GENERAL DUTY - Pursuant to Title I Part A Section 112(r)(1) of the Clean Air Act "Hazardous Air Pollutants - Prevention of Accidental Releases - Purpose and General Duty," although a risk management plan may not be required, if the Permittee produces, processes, handles, or stores any amount of a listed hazardous substance, the Permittee has a general duty to take such steps as are necessary to prevent the accidental release of such substance and to minimize the consequences of any release. This condition is federally-enforceable only.

Permit issued this the 29th day of March, 2016

NORTH CAROLINA ENVIRONMENTAL MANAGEMENT COMMISSION



William D. Willets, P.E., Chief, Permitting Section
Division of Air Quality, NCDENR
By Authority of the Environmental Management Commission

Air Permit No. 10365R00

**PSD Final Determination (Including Preliminary
Determination)**

Permit Issue Date: March 29, 2016

Region: Fayetteville Regional Office
County: Richmond
NC Facility ID: 7700096
Inspector's Name:
Date of Last Inspection:
Compliance Code:

Facility Data	Permit Applicability (this application only)
<p>Applicant (Facility's Name): Enviva Pellets Hamlet, LLC Facility Address: Enviva Pellets Hamlet, LLC Highway 177 Hamlet, NC 28345</p> <p>SIC: 2499 / Wood Products, Nec NAICS: 321999 / All Other Miscellaneous Wood Product Manufacturing</p> <p>Facility Classification: Before: N/A After: Title V Fee Classification: Before: N/A After: Title V</p>	<p>SIP: 15A NCAC 02D .0515, .0516, and .0521 NSPS: Subpart IIII NESHAP: Subpart ZZZZ, 112(g) PSD: For VOC, CO, NOx, PM/PM10/2.5, and GHG PSD Avoidance: N/A NC Toxics: 15A NCAC 02D .1100 112(r): N/A Other: N/A</p>

Contact Data			Application Data
Facility Contact	Authorized Contact	Technical Contact	<p>Application Number: 7700096.14A Date Received: 01/15/2014 Application Type: Greenfield Facility Application Schedule: PSD</p> <p style="text-align: center;">Existing Permit Data</p> <p>Existing Permit Number: N/A Existing Permit Issue Date: N/A Existing Permit Expiration Date: N/A</p>
Joe Harrell Corporate EH&S Manager (252) 209-6032 142 NC Route 561 East Ahoskie, NC 27910	Norb Hintz Vice President Engineering (301) 657-5567 7200 Wisconsin Avenue Bethesda, MD 20814	Joe Harrell Corporate EH&S Manager (252) 209-6032 142 NC Route 561 East Ahoskie, NC 27910	

Total Actual emissions in TONS/YEAR:							
CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP

<No Inventory>

<p>Review Engineer: Kevin Godwin</p> <p>Review Engineer's Signature: <i>Kevin T. Godwin</i> Date: 3-29-16</p>	<p style="text-align: center;">Comments / Recommendations:</p> <p>Issue: 10365R00 Permit Issue Date: 03/29/2016 Permit Expiration Date: 02/28/2021</p>
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This document is intended to be a summary document of the Permits Section's response to any public or EPA comments regarding the Issuance of the Air Quality Permit. A more complete record of the full review by the NCDAQ can be found in the preliminary review (Attachment A) along with applications and other documentation in materials retained by the NCDAQ in the normal course of its review process. To provide a temporal perspective to the comprehensive review process, the following chronology is provided highlighting some, but not all, of the significant events.

CHRONOLOGY

January 15, 2014	Enviva Pellets Hamlet, LLC submitted to the North Carolina Division of Air Quality (NCDAQ) a Prevention of Significant Deterioration (PSD) permit application (7700096.14A) to construct and operate a wood pellets manufacturing plant in Richmond County.
February 20, 2014	Additional information was requested by the NCDAQ. Information received on March 22, 2014.
January 2014	The DAQ was asked by the applicant to place Application No. 7700096.14A on hold until a revised application was submitted.
January 20, 2015	A revised application including toxic and additional impact review was received and consolidated with the original application.
October 19, 2015	The public comment period for the Preliminary Determination and draft permit ended.
October 2015	Public comments were received from the general public, Southern Law Environmental Law Center and Dogwood Alliance.
March 2016	Final PSD review was processed.
March 2016	Permit was signed and issued.

SECTION 1.0

Project Name: Enviva Pellets Hamlet, LLC		
Review Engineer: Kevin Godwin		
PSD Application Processing Checklist		
Activity	Complete Date	Responsible Party/Comment(s)
1. Pre-Application Requirements		
Pre-Application Meeting	12-16-14	Management/AQAB/Engineer/Applicant: William Willets/Tom Anderson/Kevin Godwin/Michael Doniger
Contact FLM via email • Include pre-application checklist • Determine interest or noninterest • Request evaluation protocols and thresholds (if necessary)	06-03-15	AQAB: Alex Zarnowski
2. Initial Distribution		
Acknowledgement letter (application is administratively complete)	01-27-15	Office Assistant: Kathy Hash
Send letter and application to EPA Region 4	01-20-15	Engineer/Office Assistant: Kathy Hash
Send copy of application to regional office	01-20-15	Engineer/Office Assistant: Kathy Hash
Send copy of application to modeling staff (if necessary)	01-20-15	Engineer/Office Assistant: Kathy Hash
Send hard copy of letter and "complimentary" copy of application to the Federal Land Manager	N/A	Engineer/Office Assistant: N/A
3. PSD Requirements		
Send PSD completeness determination within 30 days of receipt (Hard copy letter with Permitting Chief's signature)	03-09-15	Engineer: Kevin Godwin
Prepare preliminary determination	09-01-15	Engineer: Kevin Godwin

Prepare draft permit ¹	09-01-15	Engineer: Kevin Godwin
Perform modeling (if necessary)	06-03-15	AQAB: Alex Zarnowski
Send copy of preliminary determination and draft permit to Regional office via email prior to notice	09-01-15	Engineer: Kevin Godwin
4. Public Notice		
Prepare public notice	09-16-15	Engineer/Office Assistant: Kevin Godwin/Kathy Hash
Email public notice to local newspaper, local government official(s), affected state(s), unaffected state(s), local programs, interested persons	09-16-15	Engineer/Office Assistant: Kevin Godwin/Kathy hash
Email public notice, along with draft permit & preliminary determination to the applicant, the EPA, regional office, and the FLM (if requested)	09-16-15	Engineer/Office Assistant:
Post the public notice, along with draft permit & preliminary determination on the DAQ website	09-17-15	Engineer/Office Assistant:
Activity	Complete Date	Responsible Party/Comment(s)
5. Public Hearing (if required)		
Prepare public hearing notice	N/A	Engineer/Office Assistant:
Email public hearing notice to local newspaper, local government official(s), affected state(s), unaffected state(s), local programs, and interested persons	N/A	Engineer/Office Assistant:
Email public hearing notice, along with draft permit & preliminary determination to the applicant, the EPA, regional office, and the FLM (if requested)	N/A	Engineer/Office Assistant:
Post the public hearing notice, along with draft permit & preliminary determination on the DAQ website	N/A	Engineer/Office Assistant:
Director shall issue a "Recommendation for Issuance" letter in response to the hearing officer's report	N/A	Engineer/Director
6. Permit Issuance		
Review public comments – No obligation to provide written response but must consider every comment as part of the final determination	12-28-15	Engineer: Kevin Godwin
Final Determination	03-29-16	Engineer: Kevin Godwin
Final Permit	03-29-16	Engineer: Kevin Godwin
7. Distribution of Final Permit		
Copy to Source		Engineer/Office Assistant:
Copy to Regional Office		Engineer/Office Assistant:
Copy to EPA Region 4		Engineer/Office Assistant:
Copy to FLM (if requested)		Engineer/Office Assistant:
Post to DAQ website		Engineer/Office Assistant:
Ensure copy of all materials are sent to Central Files		Engineer/Office Assistant:

SECTION 2.0

The Major New Source Review Branch of the DAQ Permits Section evaluated the application for compliance with the "Prevention of Significant Deterioration" (PSD) requirements and other DAQ air quality regulations. The findings were assembled in a Preliminary Determination (Attachment A).

A notice of the opportunity for public comment concerning the Preliminary Determination appeared in the "Richmond County Daily Journal newspaper". The Public Notice stated that interested persons had thirty days in which to review the PSD application, Preliminary Determination and Draft Permit at specified locations and to submit written comments or to request in writing a public hearing. This period began on September 18, 2015 and ended on October 19, 2015.

NCDAQ received approximately 300 duplicative comments statewide requesting a public hearing. NCDAQ Director made the decision not to hold a public hearing as there were very few commenters (less than 10) within a 25-mile radius of the proposed facility.

NCDAQ received comments on the draft permit and review from Southern Environmental Law Center (SELC) dated October 19, 2015. NCDAQ asked the applicant to provide input on SELC comments. On December 28, 2015, NCDAQ received a response from the applicant (see attached Michael J. Doniger, Enviva, December 23, 2015). Where the Division of Air Quality agreed with the applicant, the information from the application and responses to comments were included in the DAQ responses to comments.

SELC Comment #1

- a. DEQ failed to conduct a proper BACT analysis and set appropriate limits for greenhouse gas emissions.
 - i. DEQ paradoxically identified the use of biomass fuel alone as the control technology for the use of biomass fuel.

The Draft Permit inappropriately lists the "use of biomass fuel" as the sole control technology for the use of biomass fuel in the Enviva dryer system. Yet the burning of biomass does nothing to control greenhouse gas emissions from the burning of biomass. DEQ's circular reasoning cannot suffice as the basis for a proper BACT limit.

Tellingly, the Draft Permit's BACT limit on annual greenhouse gas emissions (230,000 tons per year) is *higher* than the estimate of *uncontrolled* emissions (229,828 tons per year), confirming that the use of biomass fuels does not control or reduce emissions from burning biomass. An emissions rate that exceeds the estimate of uncontrolled emissions cannot constitute the "maximum degree of reduction . . . achievable" required by BACT.

Finally, although the Preliminary Determination for the Draft Permit identifies numerous energy efficiency options that could improve fuel efficiency and lower the facility's carbon intensity, DEQ did not formalize these as requirements in the Draft Permit itself or lower the greenhouse gas emission limit based on this potential. The result is ambiguity and a proposed permit limit that does not reflect the reduction potential of measures that even DEQ determined were technically feasible and cost-effective.

DAQ Response:

The application (Section 4.4.4) for this project and the Engineering review (Section IV.L) for the BACT for GHGs followed the appropriate procedures and guidance for evaluating and choosing BACT. The energy efficiency options (Table 4.2 in the application) constitute best operational practices which was chosen as BACT. The DAQ will change the verbiage in the description of BACT in the permit from "Use of Biomass Fuel" to "Good Operating Practices".

The value of 230,000 tons per year CO_{2e} that was placed into the permit is a roundup (to the nearest 1000) from 229,828 tons per year CO_{2e}. The DAQ will place the unrounded number into the permit.

- ii. DEQ deliberately declined to consider alternative fuels that would dramatically reduce greenhouse gas emissions.

Despite DEQ’s admission that Enviva itself identified “firing of lower carbon fuel” in its dryer as a “technically feasible option” for reducing greenhouse gas emissions, DEQ declined to consider any fuel other than biomass in its BACT analysis. DEQ thus failed to meet the Clean Air Act’s basic requirement to consider alternatives and “clean fuels” as part of the BACT analysis.

The only support that DEQ attempts to offer for its failure to consider lower-carbon fuels is that “EPA has recognized [biomass] as a GHG beneficial fuel due to its renewable nature.” This blanket statement avoids the case-by-case analysis and “careful and detailed look” necessary to determine a BACT limit that is “tailor-made” for this Enviva facility, and cannot justify omitting the analysis required under BACT. First, in the recently published Clean Power Plan, EPA acknowledges that biomass is not inherently carbon-neutral. EPA recognizes that that it is not scientifically valid to assume that all biogenic feedstocks are ‘carbon neutral’ and that the net biogenic CO2 atmospheric contribution of different biogenic feedstocks generally depends on various factors related to feedstock characteristics, production, processing and combustion practices, and, in some cases, what would happen to that feedstock and the related biogenic emissions if not used for energy production.

As a result, the Clean Power Plan requires states that attempt to use biomass for compliance to “describe the types of biomass that are being proposed for use under the state plan and how those proposed feedstocks or feedstock categories should be considered as ‘qualified biomass,’” which is defined as “a biomass feedstock that is demonstrated as a method to control increases of CO2 levels in the atmosphere.” States that propose to rely on qualified biomass must also show that any carbon reductions are “quantifiable, verifiable, enforceable, non-duplicative and permanent.” Without demonstrating that particular biomass projects will curb carbon levels in the atmosphere, states cannot blindly rely on biomass as a carbon reduction measure.

Furthermore, study after study has shown that biomass actually increases carbon emissions as compared to traditional fossil fuels. When burned to generate thermal energy, as would be the case with the facility’s wood-fired dryer, biomass emits more than *twice* the amount of carbon that natural gas emits per unit of heat produced. The following chart, excerpted from a report by the Manomet Center for Conservation Sciences, shows the high carbon intensity of biomass as compared to other fuels:

Exhibit 6-6: Carbon Emission Factors by Technology*
Kilograms per Unit of Energy**

Scenarios	Biomass	Coal	Oil (#6)	Oil (#2)	Natural Gas
Utility-Scale Electric	Kilograms/MWh				
Fuel Prod & Transport	7	9			34
Fuel Combustion	399	270			102
Total	406	279			136
Thermal	Kilograms/MMBtu				
Fuel Prod & Transport	1		6	6	6
Fuel Combustion	35		27	25	17
Total	36		33	31	23
CHP	Kilograms/MMBtu				
Fuel Prod & Transport	1		7	6	6
Fuel combustion	35		29	27	18
Total	36		35	33	24

* As discussed below, emissions factors for pellets are characterized relative to the thermal technology using green chips which is shown in the table.

** Sources and calculation for these data are described in the text.

Biomass combustion also emits far more carbon than other low and zero emission technologies available in North Carolina, such as solar and wind power.

DEQ did not attempt to compare the reduction potential of various fuels or rank the effectiveness of these technologies. Instead, it relied on exactly the sort of impermissible “conclusory statements that the measures and emissions limits selected constitute ‘appropriate’ BACT requirements,” that have been rejected as inadequate, with “little to no analysis to support that determination and no representation that the requirements reflect the ‘best’ options or ‘greatest reduction in emissions achievable.’” Without a full life-cycle analysis of reduction potential, DEQ cannot assert that biomass is a clean fuel or summarily dismiss other lower-emission technologies.

Moreover, DEQ imposes no requirement on Enviva to ensure that these elevated biomass emissions are offset through forest regrowth and carbon uptake. Because the permit does not require the emissions from Enviva’s smokestacks to be recaptured in the near term, the increases in greenhouse gas emissions from burning biomass will go unchecked. Moreover, the elevated carbon levels generated by biomass combustion, compared to alternative low- and zero-emission fuel sources, would persist for decades before forest replenishment can begin to abate these excess emissions.

DAQ Response:

The application (Section 4.4.4) for this project and the Engineering review (Section IV.L) for the BACT for GHGs followed the appropriate procedures and guidance for evaluating and choosing BACT. Alternative fuels were discussed in the application (Section 4.4.4) and the engineering review. A discussion of the information from the EPA guidance document “GHG BACT Guidance for Biogenic Energy Production (page 13) was included which clearly states that the list of control options establishing BACT does not need to include “clean fuels” such as natural gas if this option results in redefining the project (biomass-fired wood pellets manufacturing plant). Also, the biomass produced at the facility as a by-product would likely have to be landfilled if not burned onsite. In a landfill, this by-product material would decompose and release CO₂ and methane without capturing the Btu value.

- iii. DEQ lacks clear authority to consider off-site sequestration to offset emissions in a BACT analysis.

DEQ’s summary rejection of lower-carbon fuels appears to be based on the unwritten, un-mandated assumption that Enviva’s emissions will be offset through off-site reforestation and sequestration. Not only is there no basis for this assumption or requirement for Enviva to engage in off-site sequestration, there is no clear authority in section 165 or 169 of the Clean Air Act for DEQ to consider such off-site efforts.

DAQ Response:

There are no sequestration storage sites established in North Carolina and the DAQ does not have the authority to require facilities to replant trees.

According to the Enviva facility, they hold certifications and will continue to hold certifications from the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) and the Programme for the Endorsement of Forest Certifications (PEFC). Enviva requires that all suppliers adhere to state-developed “Best Management Practices” in their activities to protect water quality and sensitive ecosystems. Also, Enviva is implementing an industry leading “track and trace” system to further ensure that all fiber resources come from responsible harvests.

SELC Comment #2:

- b. DEQ failed to select BACT for particulate matter.
 - i. DEQ did not limit condensable PM10 or PM2.5 as required.

Under federal rules, permit limits for coarse particulate matter (“PM10”) and fine particulate matter (“PM2.5”) must include the condensable PM10 and PM2.5 fraction emitted by a source. The Draft Permit does not set a limit on condensable particulate matter and must be revised to do so.

DAQ Response:

Enviva's BACT analysis in Section 4.4.2 of the application did include control of condensable particulate matter. The wet ESP is listed as BACT for the Dryer System and controls "filterable" and "condensable" particulate matter. As discussed in the application, the wet ESP will control some portion of the condensable particulate, but the degree of control is not well characterized. As a result of this uncertainty 100% of the uncontrolled condensable emissions were included in the dispersion modeling analysis. The condensable portion of PM/PM10/PM_{2.5} was calculated using an AP-42 (Section 1.6) emission factor of 0.17 lbs/mmBtu heat input from wood firing in the rotary dryer. The modeling analysis showed compliance with all applicable regulations.

- ii. DEQ likely underestimated particulate matter emissions.

The proposed facility's dryer system employs a wood-fired burner of 250.4 million Btu/hr. The permitted emissions rate is 0.105 lb of filterable particulate matter ("PM"), PM10, and PM2.5 per ton of pellets processed. At the hourly pellet production rate identified in the permit review document of 71.71 tons per hour, this emission rate equals 7.529 pounds of filterable PM per hour. Divided by the burner capacity of 250.4 million Btu, this translates to a rate of 0.03 pounds per million Btu. However, while the Draft Permit contains an annual production limit of 537,625 tons of pellets per year, there is no enforceable hourly pellet production limit in the permit. Because allowable emissions are tied to pellet production rates, the actual hourly PM, PM10, and PM2.5 emissions could be higher than those calculated above, if the hourly pellet production rate exceeds 71.71 tons per hour. The permitted emission rates should be expressed as independent rates that are not contingent on hourly pellet production rates.

DAQ Response:

The maximum hourly pellet production rate identified in the application as 71.71 tons per hour is also the maximum design production rate of the equipment. This maximum hourly value was used in the calculation of the annual production limit. As such, the annual production rate limit of 537,625 oven-dried tons of pellets (based on 7497.2 hours of operation per year) already limits production to less than 8760 hours per year. Therefore, a short term limit is not necessary.

$$\left\{ \frac{537,625 \text{ tons pellets}}{\text{year}} \times \frac{\text{hour}}{71.71 \text{ tons pellets}} = \frac{7497.2 \text{ hours}}{\text{year}} \right\}$$

- iii. DEQ's air quality modeling for PM likely underestimates impacts.

Presumably, the air quality modeling conducted in support of the permit assumed the facility would have a PM10/PM2.5 emissions rate of 0.03 pounds per million Btu. But if the actual operating rate is higher than that rate, due to the absence of hourly limits described above, the modeled results cannot be considered representative.

Further, it is not clear whether the air quality modeling included both filterable and condensable PM2.5, as required by EPA's current guidance for PM2.5 modeling, or whether it assessed filterable PM2.5 alone. Finally, it is not clear whether DEQ assessed secondary impacts of other precursor pollutants in the formation of PM. Given the large amounts of VOCs the facility is permitted to emit, and given the potential role of VOCs in the formation of secondary PM, the modeling for this facility should have been conducted in the most conservative manner possible. This does not appear to have been the case. For instance, it is not clear which monitors were used to provide background data, or why particular monitors were chosen. The permit review states that the Cumberland County monitor was used to provide background concentrations of PM10 and PM2.5, but also that the Duplin County monitor was used to provide background concentrations of PM2.5. The reasons for using the Duplin monitor are not immediately clear, since it is located approximately 100 miles east of the facility site, and there are three other air quality monitoring sites measuring PM2.5 (Candor, Blackstone, and Owen School, the monitor in Cumberland County) within 30 to 50 miles from Hamlet.

DAQ Response:

The PM modeling was completed as part of the Application fully addressed all PM impacts. The DEQ approved the protocol beforehand and Enviva utilized short term emissions based on the maximum design production rate and included both filterable and condensable PM. The modeling conservatively assume the maximum hourly emission rate for total PM, continuously, for every hour of the year. The modeled impacts (source + background) for the facility are demonstrated to be well below the National Ambient Air Quality Standards (NAAQS) design values. The Cumberland County monitor, which is a conservative estimate of background for the more rural Hamlet site, is roughly 50% of the 24-hour and 74% of the annual PM2.5 NAAQS. The project utilizing the conservative total PM2.5 (filterable and condensable) emissions methodology had impacts of 13% and 8% of the 24-hour and annual PM2.5 NAAQS, respectively, and the actual impact will likely be much lower.

Secondary PM formation was evaluated as described in Section 5.18 of the Application. Secondary PM is formed by the primary emission of NO_x and SO₂. Secondary PM formation was determined to be negligible, and, in accordance with the modeling protocol and EPA guidance, was not included in the modeling analysis or PM2.5 emissions summary.

Any reference in DEQs draft materials to the Duplin County monitor is a typographical error and should be corrected to show that Fayetteville/Cumberland County was used for PM10 and PM2.5 background concentrations.

iv. DEQ's PM emission rate does not reflect BACT.

The PM emission rate of 0.03 pounds per million Btu is approximately double that considered to be achievable in coal plant permits using similar technology. For instance, a document submitted to DEQ by Duke Energy discusses that company's intent to achieve a limit of 0.015 pounds per million metric Btu filterable PM10 for a coal plant using a wet electrostatic precipitator system. The document discusses a number of facilities and includes discussion of permits that constrain both filterable and condensable PM2.5/PM10 to be lower than 0.03 pounds per million Btu. A rate of 0.03 pounds per million Btu that includes both filterable and condensable PM2.5/PM10 may not actually be BACT; this rate is certainly not BACT if it only includes filterable PM2.5/PM10.

The applicant should be compelled to perform a real BACT analysis, and the permit should be revised to include enforceable emission rates that include both filterable and condensable PM2.5/PM10 and that do not depend on pellet production rates. The modeling should also be conducted to choose conservative background PM/PM2.5/PM10 concentrations and to model total PM/ PM2.5/PM10 and secondary condensable PM/PM2.5/PM10 formation.

It is especially important that DEQ correct all of these errors, given the high existing PM2.5 concentrations in the area and the significant quantities of PM2.5 that the proposed facility will add. EPA's Air Now site for North Carolina shows that large areas of the state, including the Hamlet region, have a status of "moderate" air quality for PM2.5 for a significant part of the year. Thus existing PM concentrations are already high enough to affect sensitive populations, such as people with pre-existing respiratory conditions. Since the Enviva facility is likely to significantly increase particulate matter pollution in the region, it is important that the emission controls be as effective as possible.

The air quality modeling, whether or not it included condensable PM2.5, found fairly significant impacts from the Enviva facility. The facility's emissions will more than double the concentration of PM10 in the area on a 24-hour basis and will consume 99% of the region's PM10 increment, limiting future industrial growth in the region: With facility impacts, the modeling shows the area will be at 63% and 82% of the 24-hour and annual PM2.5 NAAQS, respectively.

DAQ Response:

The combustion process for an indirect fired boiler burning coal used to produce steam and a direct-fired dryer used to dry wood for pellet production is not an appropriate comparison. Not only are there significant differences in the combustion process for burning pulverized coal versus wood, but as a result of direct drying, the Wet ESP controls both the furnace combustion gases as well as the dryer gas stream. The

dryer at this facility is not subject to NSPS Subpart Dc, but the NSPS limit for indirect-fired boilers was used to derive an equivalent limit of 0.105 lbs/ODT. As stated earlier, the wet ESP will control some portion of the condensable particulate, but the degree of control is not well characterized.

SELC Comment #3

c. DEQ's BACT analysis for VOCs is inadequate.

The wood pellet production process is a significant source of VOCs. VOCs are implicated in tropospheric ozone formation, and some may play a role as greenhouse gases, though the chemistry is complex and not well understood. Some VOCs are also regulated as hazardous air pollutants ("HAPs") due to their toxic or carcinogenic effects. As discussed in a recent edition of Biomass Magazine, controlling VOCs is a well-recognized priority in the pellet manufacturing industry, and use of regenerative thermal oxidation or regenerative catalytic oxidation-two technologies considered in the proposed facility's BACT analysis and rejected on the basis of being too expensive-is widespread.

In fact, the technology that was chosen as BACT at the proposed facility is no technology at all. Following a discussion of the various options, the permit review document abruptly states that for the dryer, "[t]he applicant proposes a BACT limit of 1.07 lb VOC/ODT ["oven dry ton"] on an annual average basis based on good operating and maintenance procedures. NCDAQ agrees with the applicant's proposed BACT." The same conclusion is reached for the pellet cooler, which is assigned an emission rate of 0.85 lb VOC/ODT. Combined, these rates are more than 10 times higher than the 0.08 lb/ODT rate that would be achieved with add-on controls. Different types of wood emit different amounts of VOCs when pelletized. Part of the "good operating" procedures as a means to control VOCs, and a condition in the permit, is the requirement that the facility not process more than 75% softwood, meaning that at least 25% of the facility's feedstock must be hardwood. This permit condition ensures that the facility will be compelled to source wood from native hardwood forests, even if adequate wood from pine plantations is available. This will significantly increase the environmental footprint of the facility.

A comparison with other large pellet facilities shows how inadequate the overall BACT process for the Hamlet facility has been. Enviva has recently purchased the former Green Circle Bio Energy facility in Cottdale, Florida. A comparison to that facility's permit is revealing. The Cottdale plant processes more than 95% yellow pine and is subject to no requirement to include hardwood. It is a larger facility than the Hamlet plant, with three pelletizing lines that are constrained by the permit to produce no more than 610,000 tons per year, a 13% greater capacity than the 537,625 ton-per-year limit at the Hamlet facility. Although it is larger, the dryer capacity is the same (two 125-million-metric Btu/hr dryers). The Cottdale facility uses a regenerative thermal oxidizer to reduce VOC emissions; as a consequence, its permit specifies an emission limit of 243 tons per year, just 40% of the emissions at the Hamlet facility, despite its larger capacity. The limit for VOCs in the Draft Permit therefore does not represent BACT, and must be revised.

DAQ Response:

It is well documented that the use of soft wood at a pelletizing facility will have higher VOC emissions than the use of hardwoods at a pelletizing facility. The Enviva facility in Hamlet, North Carolina will use up to 25 percent hardwood in its pelletizing process and includes an innovative dryer design as discussed in Section 3.1.5 of the Application. As a result of the dryer design and the usage of up to 25% hardwood, many of the VOCs that are emitted from dryers at facilities with higher softwood usage will not occur at the Hamlet facility. The RTO technology (increase in greenhouse gas, CO and NOx) was discussed in Section 4.4.3 of the application as part of the BACT analysis but was eliminated because it was cost prohibitive. With a lower VOC emission rate based on the design of the dryers and the hardwood/soft wood ratio at the Hamlet facility, the \$/ton of VOCs was cost prohibitive.

SECTION 3.0

ADMINISTRATIVE CORRECTIONS IN THE FINAL REVIEW

- I. Corrected the typographical error for the numerical value in the cost analysis for the Wet ESP. The value of \$43,234 per ton of PM removed was corrected to \$3,234 per ton of PM removed in section IV. C. 2. of this final review.
- II. The value of 230,000 tons per year CO_{2e} that was placed into the draft permit is a roundup (to the nearest 1000) from 229,828 tons per year CO_{2e}. The DAQ will place the unrounded number into the permit.

SECTION 4.0

FINAL DETERMINATION

Based on the application submitted and the review of this proposal, the NCDAQ made the preliminary determination available for comment. The comment period expired on October 19, 2015.

NCDAQ recommends issuance of Permit No. 10365R00 with the administrative changes listed above.

ATTACHMENT A – PRELIMINARY REVIEW

I. Introduction and Purpose of Application

- A. Enviva Pellets Hamlet, LLC is planning to construct and operate a wood pellets manufacturing plant in Richmond County. The proposed plant is designed to produce up to 537,625 oven-dried tons (ODT) of wood pellets per year utilizing up to 75% softwood on a 12-month rolling total basis.
- B. The proposed plant will include the following emission sources:
 1. Green wood handling and sizing operations;
 2. Green wood fuel storage bin;
 3. Log de-barker, bark hog, and log chipper;
 4. Two (2) green wood hammermills controlled by two (2) cyclones;
 5. Eight (8) dry wood hammermills controlled by eight cyclones and eight bagfilters;
 6. Hammermill area emissions and pellets fines bin controlled by a bagfilter;
 7. A pellet mill feed silo controlled by a bin vent filter;
 8. Twelve (12) wood pellet presses and six (6) pellet coolers controlled by simple cyclones;
 9. One 250.4 million Btu per hour green wood direct-fired dryer system controlled by four simple cyclones in series with a wet electrostatic precipitator (WESP);
 10. Finished product storage and loading controlled by a bagfilter;
 11. Pellet sampling transfer bin controlled by a bin vent filter;
 12. Dried and sized wood handling operations controlled by a bin vent filter;
 13. Three (3) diesel storage tanks;
 14. Diesel-fired emergency generator and fire water pump.
- C. The facility-wide potential to emit will be greater than Prevention of Significant Deterioration (PSD) major stationary source level for VOC. The PSD significance levels will be exceeded for PM, PM-10, PM-2.5, CO, NO_x, and GHG. Therefore, PSD review is required for these regulated NSR pollutants.

II. Regulatory Summary – Specific Emission Source Limitations

- A. 15A NCAC 02D .0515 “Particulates from Miscellaneous Industrial Processes” – This regulation establishes an allowable emission rate for particulate matter from any stack, vent, or outlet resulting from any industrial process for which no other emission control standards are applicable. This regulation applies to Total Suspended Particulate (TSP) or PM less than 100 micrometers (µm). The allowable emission rate is calculated using the following equation:

$$E = 4.10 \times P^{0.67} \quad \text{for } P < 30 \text{ tph}$$

$$E = 55 \times P^{0.11} - 40 \quad \text{for } P \geq 30 \text{ tph}$$

where, E = allowable emission rate (lb/hr)
P = process weight rate (tph)

According to the application, the most significant source of PM emissions is the dryer system operating at 71.71 ODT/hr. The allowable emission rate is calculated to be 48 lb/hr. Maximum PM emission rate estimate is provided by the dryer vendor. The maximum hourly emission rate is 12 lb/hr. Therefore, compliance is indicated.

DAQ Cyclone Design Evaluation spreadsheet is used to verify proper design to yield expected control device efficiencies.

The wet electrostatic precipitator (WESP) removes particles from a gas stream through the use of electrical forces. Discharge electrodes apply a negative charge to particles passing through a strong electrical field. These charged particles then migrate to a collecting electrode having an opposite, or positive, charge. Collected particles are removed from the collecting electrodes by washing using a mild hydroxide solution to prevent buildup of resinous materials present in the dryer exhaust. According to the application, the WESP possesses 29,904 square feet of collection plate area and can handle a maximum air flow of 230,000 acfm.

Control Device Monitoring

For cyclones:

To assure compliance, the Permittee shall perform inspections and maintenance as recommended by the manufacturer. In addition to the manufacturer's inspection and maintenance recommendations, or if there are no manufacturer's inspection and maintenance recommendations, as a minimum, the inspection and maintenance requirement shall include the following:

- i. a monthly visual inspection of the system ductwork and material collection unit for leaks.

For WESP:

To assure compliance, the Permittee shall perform inspections and maintenance as recommended by the manufacturer. In addition to the manufacturer's inspection and maintenance recommendations, or if there are no manufacturer's inspection and maintenance recommendations, as a minimum, the inspection and maintenance requirement shall include the following:

The Permittee shall establish the minimum primary voltage and minimum current within the first 30 days following operation of the dryer. To assure compliance and effective operation of the wet electrostatic precipitator, the Permittee shall monitor and record the primary voltage and current through the precipitator daily. The daily observation must be made for each day of the calendar year period. The Permittee shall be allowed three (3) days of absent observations per semi-annual period.

Because the application relies on vendor guaranteed emission factors and does not include estimated control efficiency, WESP performance testing will be required to establish control efficiency within 180 days of commencement of operation.

- B. 15A NCAC 02D .0516 "Sulfur Dioxide Emissions from Combustion Sources" – Under this regulation, sulfur dioxide emissions from combustion sources cannot exceed 2.3 lb/million Btu heat input. Wood is fired in the dryer and low sulfur diesel is combusted in the two emergency engines. Diesel is the worst case fuel. Firing diesel fuel (0.5% sulfur by weight) will not cause this limit to be exceeded. Therefore, compliance is indicated.

- C. 15A NCAC 02D .0521 “Control of Visible Emissions” – This regulation establishes a visible emission standard for sources based on the manufacture date. For sources manufactured after July 1, 1971, the standard is 20% opacity when averaged over a 6-minute period. The Permittee will be required to establish ‘normal’ visible emissions from these sources within the first 30-days of the permit effective date. In order to demonstrate compliance, the Permittee will be required to observe actual visible emissions on a monthly basis for comparison to ‘normal’. If emissions are observed outside of ‘normal’, the Permittee shall take corrective action. Recordkeeping and reporting are required. Because all emission sources are designed to be well controlled, compliance with this standard is expected.

III. Regulatory Review – Multiple Emission Source Limitations

- A. 15A NCAC 02D .0524 “New Source Performance Standards (NSPS), Subpart IIII” – This regulation applies to owners or operators of compression ignition (CI) reciprocating internal combustion engines (RICE) manufactured after April 1, 2006 that are not fire pump engines, and fire pump engines manufactured after July 1, 2006. Both the 250 hp emergency generator and the 250 hp fire pump engine are subject to the requirements of this regulation.

Under NSPS Subpart IIII, owners or operators of emergency generators manufactured in 2007 or later with a maximum engine power greater than or equal to 50 hp are required to comply with the emission limits referenced in 40 CFR §60.4205(b). These limits are as follows: 0.20 g/kW for PM; 3.5 g/kW for CO; and 4 g/kW for NO_x + nonmethane hydrocarbons (NMHC).

Under NSPS Subpart IIII, owners or operators of fire pump engines manufactured after July 1, 2006 must comply with the emission limits in Table 4 of the subpart. The limits are as follows: 0.20 g/kW for PM; 3.5 g/kW for CO; and 4 g/kW for NO_x + NMHC.

As stated in the application, Enviva will comply with these limits by operating the engines as instructed in the manufacturer’s operating manual in accordance with 40 CFR 60.4211(a), and purchasing an engine certified to meet the referenced emission limits in accordance with 40 CFR 60.4211(b). The engines will be equipped with a non-resettable hour meter in accordance with 40 CFR 60.4209(a). Emergency and readiness testing will be limited to 100 hours per year.

In addition, both engines are required to comply with fuel requirements in 40 CFR 60.4207, which limit sulfur content to a maximum of 15 ppm and a cetane index of at least 40.

- B. 15A NCAC 02D .1111 “Maximum Achievable Control Technology, Subpart ZZZZ” – 40 CFR Part 63 applies to RICE located at a major or area source of hazardous air pollutants (HAP). Pursuant to 40 CFR §63.6590(c) (amended January 30, 2013), a new stationary RICE located at a major source must meet the requirements of this part by meeting the requirements of 40 CFR Part 60 Subpart IIII for compression ignition engines. No further requirements apply to such engines under this part.
- C. 15A NCAC 02D .1112 “112(g) Case-by-Case Maximum Achievable Control Technology” – Potential hazardous air pollutant (HAP) emissions from the proposed facility exceed the major source threshold (i.e. 10 tons per year any single HAP or 25 tons per year combined HAP). Section 112(g) of the Clean Air Act requires that any new stationary source that is not a regulated “source category” for which a NESHAP has not been established must control emissions to the levels that reflect “maximum achievable control technology (MACT). Wood pellet manufacturing plants are not a regulated source category. Therefore, the proposed plant will trigger 112(g).

Pursuant to Section 112(d)(3), MACT for new sources is the maximum degree of reduction in emissions that is deemed achievable and shall not be less stringent than the emission control that is achieved in practice by the best controlled similar source, as determined by the Administrator. The application identifies three (3) pellet facilities utilizing controls to reduce VOC/HAP emissions. Enviva believes the proposed dryer planned for construction at the Hamlet facility represents an inherently lower emitting dryer that is substantially different from any dryer currently in operation equipped with RTO control.

The proposed rotary dryer is single pass and designed to minimize VOC/HAP emissions. One factor to minimize VOC/HAP emissions is to minimize the temperature of the wood within the dryer. Key design differences are discussed below:

- 1) Carefully managed dryer temperature, retention time, gas mixing space, and moisture content of wood to minimize smoldering and combustion. The dryer will use an improved flighting system to segregate particles for appropriate paced drying and reduce air leakage.
- 2) Utilize a high humidity environment to minimize temperature more effectively.
- 3) Engineered mixing of dryer flue gas with furnace hot gases using an improved recycle bustle and two (2) turbulators to ensure thorough mixing.

The vendor guarantees a VOC emission factor of 0.95 lb/ODT as propane.

Based on these design differences, Enviva is requesting the pellet mill dryer at its Hamlet, NC facility to be placed in a subcategory separate from other pellet mill dryers controlled by RTO. Section 112 of the Clean Air Act provides that EPA "may distinguish among classes, types, and sized of sources within a category or subcategory." Additionally, "The EPA maintains that, normally, any basis for subcategorization must be related to an effect on HAP emissions that is due to the difference in class, type, or size of the units." *Id.* at 489,493.

NCDAQ believes the Enviva pellet mill dryer is designed to minimize HAP emissions to an extent not requiring add-on control. The dryer design is sufficiently different from other dryers in the industry to qualify to be subcategorized as a "low HAP emitting dryer not using add-on control." NCDAQ will require initial testing to develop a HAP emission factor.

Metal HAP emissions will be adequately controlled by cyclones in series with a wet ESP.

Other minor HAP sources include green wood hammermills, dry hammermills and hammermill area, twelve pellet presses and six pellet coolers. According to the application, there are currently no pellet mills utilizing HAP control technologies on these types of sources.

D. Compliance Assurance Monitoring (CAM)

This initial permit (revision R00) is a non-Title V permit and CAM will be addressed at the time the Title V permit is developed.

E. 15A NCAC 02D .0530 "Prevention of Significant Deterioration"

Congress first established the New Source Review (NSR) program as part of the 1977 Clean Air Act Amendments and modified the program in the 1990 Amendments. The NSR program requires pre-construction review prior to beginning actual construction. The basic goal of NSR is to ensure that the air quality in clean (i.e. attainment) areas does not significantly deteriorate while maintaining a margin for future industrial growth. The NSR regulations focus on industrial facilities, both new and modified, that create large increases in the emission of certain pollutants. PSD permits are a type of NSR permitting requirement for new major sources or sources making a major modification in an attainment area.

Pursuant to the Federal Register notice on February 23, 1982, North Carolina (NC) has full authority from the EPA to implement the PSD regulations in the State effective May 25, 1982. NC's State Implementation Plan (SIP)-approved PSD regulations have been codified in 15A NCAC 2D .0530, which implement the requirements of 40 CFR 51.166. The Code of Federal Regulations (CFR) in 15A NCAC 2D .0530 are incorporated by reference unless a specific reference states otherwise.

Under PSD requirements, all major new or modified stationary sources of air pollutants as defined in Section 169 of the Federal Clean Air Act (CAA) must be reviewed and permitted prior to construction by the EPA or the permitting authority, as applicable, in accordance with Section 165 of CAA. A "major stationary source" is defined as any one of 28 named source categories, which emits or has a potential to emit 100 tons per year of any regulated pollutant, or any other stationary source, which emits or has the potential to emit 250 tons per year of any PSD regulated pollutant. The lumber mill industry (SIC Code 2421) is not one of the 28 named source categories. However, the Enviva facility has the potential to emit

greater than 250 tpy of a regulated NSR pollutant, and is therefore is a PSD major stationary source as defined in 40 CFR 51.166(b)(1)(i)(b).

The following table provides a summary of facility-wide potential emissions for PSD Applicability:

Emission Unit Description	TSP (tpy)	PM-10 (tpy)	PM-2.5 (tpy)	VOC (tpy)	NOx (tpy)	CO (tpy)	SO ₂ (tpy)	Lead (tpy)	H ₂ SO ₄ (tpy)	Total HAP (tpy)	GHG as CO ₂ e (tpy)
Dryer system	51.55	51.55	51.55	288.25	219.35	230.45	27.42	-	-	71.35	229,828
Hammermills	18.02	18.02	0.31	34.37	-	-	-	-	-	2.58	-
Pellet mill feed silo	0.37	0.37	0.37	-	-	-	-	-	-	-	-
Pellet sampling transfer bin	0.15	0.15	0.15	-	-	-	-	-	-	-	-
Pellet mill fines Bin/Hammermill area	1.47	1.47	1.47	-	-	-	-	-	-	-	-
Pellet presses & coolers	74.33	19.36	2.37	227.64	-	-	-	-	-	5.93	-
Log bark hog	-	-	-	0.37	-	-	-	-	-	0.08	-
Log chipping	-	-	-	1.25	-	-	-	-	-	0.27	-
Green wood hammermills	24.78	6.45	0.79	50.53	-	-	-	-	-	2.83	-
Finished product handling/pellet Load-out	1.28	1.16	0.02	-	-	-	-	-	-	-	-
Paved roads	1.47	0.29	0.07	-	-	-	-	-	-	-	-
Dried wood handling	0.30	0.30	0.30	-	-	-	-	-	-	-	-
Green wood sizing & handling	0.016	0.008	0.001	-	-	-	-	-	-	-	-
Green wood storage piles	4.01	2.00	0.30	-	-	-	-	-	-	-	-
Diesel storage tanks	-	-	-	4.00E-03	-	-	-	-	-	-	-
Emergency generator	0.02	0.02	0.02	0.41	0.41	0.36	0.0002	-	-	1.69E-03	67
Fire water pump	0.02	0.02	0.02	0.41	0.41	0.36	0.0002	-	-	1.69E-03	67
Total	177.78	101.18	57.74	606	220.17	231.17	27.42	-	-	82.89	229,961

In accordance with the PSD requirements pursuant to 15A NCAC 2D .0530, Enviva performed the following reviews and analyses for PM-10/2.5, VOC, NOx, CO, and GHG emissions associated with the project:

- BACT determination (See Section IV);
- Air Quality Impact Analysis (See Section V); and
- Additional Impacts Analysis including effects on soils, vegetation, visibility, and Class I areas (See Section VII).

F. 15A NCAC 02Q .0500 "Title V Permitting"

This is a Greenfield facility and is being processed under the state construction and operating permit program initially. Within one year after commencement of facility operation, the Permittee will be required to submit a complete Title V application.

IV. BACT

A. Introduction

For each pollutant subject to a PSD review a Best Available Control Technology (BACT) review is required. The Clean Air Act defines BACT as:

The term "best available control technology" means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall application of "best available control technology" result in emissions of any pollutant which will exceed the emissions allowed by any applicable standard established pursuant to section 111 or 112 of this Act. Emissions from any source utilizing clean fuels, or any other means, to comply with this paragraph shall not be allowed to increase above levels that would have been required under this paragraph as it existed prior to enactment of the federal Clean Air Act Amendments of 1990.

The BACT requirement is intended to ensure that the control systems incorporated in the design of the proposed source 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. Given the variation between emission sources, facility configuration, local airsheds, and other case-by-case considerations, Congress determined that it was impossible to establish a single BACT determination for a particular pollutant or source. Economics, energy, and environmental impact are mandated in the CAA to be considered in the determination of case-by-case BACT for specific emission sources. In most instances, BACT may be defined through an emission limitation. In cases where this is impracticable, BACT can be defined by the use of a particular type of control device, work practice, or fuel type. In no event can a technology be recommended which would not comply with any applicable standard of performance under CAA §§111 (NSPS) or 112(HAPs).

The U.S. EPA developed guidance referred to as "Top down BACT" for PSD applicants to use. However, NC DAQ does not strictly adhere to EPA's top-down guidance. Rather, NCDAQ implements BACT in accordance with the statutory and regulatory language. As such, NCDAQ's BACT conclusions may differ from those of the EPA.

B. Proposed BACT Limits

BACT is determined on a case-by-case basis taking into account energy, environmental, and economic impacts and other costs. The table below provides a summary of the NCDAQ proposed BACT limits that will be sent to public notice.

Unit	Pollutant	BACT Limit*	Units	Averaging Period	Technology
Wood-fired dryer	NOx	0.20	lb/MMBtu	3-hour	Good Combustion Practices/low NOx burners
	PM/PM10/2.5	0.105 (filterable)	lb/ODT	3-hour	Cyclones/WESP
	VOC**	1.07	lb/ODT	3-hour	Process Design
	CO	0.21	lb/MMBtu	3-hour	Process Design
	GHG	229,828	tpy CO2e	Annual	Good Operating Practices
Green wood hammermills	PM/PM10/2.5	0.022/0.0057/ 0.0007 (filterable)	gr/cf	3-hour	Cyclones
	VOC**		lb/ODT	3-hour	

Unit	Pollutant	BACT Limit*	Units	Averaging Period	Technology
		0.27			Good operating & maintenance procedures
Dry hammermills	PM/PM10/2.5	0.004/0.004/ 0.000014 (filterable)	gr/dscf	3-hour	Cyclones & bagfilters
	VOC	0.24	lb/ODT	3-hour	Process Design
Pellet mill feed silo	PM/PM10/2.5	0.004 (filterable)	gr/dscf	3-hour	Bin vent filter
Hammermill area and Pellet mill fines bin	PM/PM10/2.5	0.004 (filterable)	gr/dscf	3-hour	Bin vent filter
Pellet sampling transfer bin	PM/PM10/2.5	0.004 (filterable)	gr/dscf	3-hour	Bin vent filter
Dried and sized wood handling	PM/PM10/2.5	0.004 (filterable)	gr/dscf	3-hour	Bin vent filter
Final product handling	PM/PM10/2.5	0.004/0.004/ 0.000014 (filterable)	gr/cf	3-hour	Bagfilter
Pellet coolers	PM/PM10/2.5	0.022/0.0057/ 0.0007 (filterable)	gr/cf	3-hour	Cyclones
	VOC**	0.85	lb/ODT	3-hour	Process design
Log bark hog, chipper, and storage tanks	VOC	N/A	N/A	-	Fugitive – uncontrolled
Green wood handling	PM/PM10/2.5	N/A	N/A	-	Inherent moisture
Storage piles	PMPM10/2.5	N/A	N/A	-	Inherent moisture
	VOC				Fugitive – uncontrolled
Road dust	PM/PM10/2.5	N/A	N/A	-	Paving & water spray
Emergency engine, fire water pump, and backup chipper	NMHC+NOx	3.0	g/bhp-hr	3-hour	Design and Good operating practices NSPS Certification
	CO	2.6	g/bhp-hr	3-hour	
	PM (filterable only)	0.15	g/bhp-hr	3-hour	
Storage tanks	VOC	N/A	N/A	-	Good operating practices

*BACT emission limits shall apply at all times except the following: Emissions resulting from start-up, shutdown or malfunction above those given in the table above are permitted provided that optimal operational practices are adhered to and periods of excess emissions are minimized.

**The VOC limit is expressed as alpha pinene basis per the procedures in EPA OTM 26.

C. Dryer System (ID No. ES-DRYER)

The rotary dryer uses direct contact heat provided by a 250.4 million Btu/hour wood burner system. The dryer will process 71.71 ODT/hour. The following table taken from the application provides a summary of criteria pollutant emissions:

Pollutant	Baseline Uncontrolled Emission Factors	Proposed BACT Emission Factor	Baseline Emissions (tpy)	Total Controlled Potential Emissions (tpy)
CO ¹	0.210 lb/MMBtu	0.210 lb/MMBtu	230.5	230.5
NOx ²	0.200 lb/MMBtu	0.200 lb/MMBtu	219.4	219.4
SO ₂ ³	0.025 lb/MMBtu	N/A	27.4	27.4
VOC ⁴	1.07 lb/ODT	1.07 lb/ODT	288	288

Total PM-10 ⁵	2.092 lb/ODT	0.105 lb/ODT (filterable) [which is equivalent to 0.030 lb/MMBTUJ]	580.9	51.5
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Notes:

- 1 CO emissions are based on stack testing conducted at Ahoskie, NC facility on June 7, 2012 with a conservative safety margin.
- 2 NO_x and filterable PM-10 emissions based on vendor guarantee (TSI, 7/15/14).
- 3 SO₂ emissions calculated based on AP-42, Section 1.6 factor.
- 4 VOC emission factor based vendor guarantee of 0.95 lb/ODT as propane converted to alpha-pinene and Enviva Wiggins October 2013 Stack Test Data as Total VOC.
- 5 Dryer vendor provided estimates for filterable PM-10. AP-42, Section 1.6 was used to calculate the condensable fraction.

The pollutants emitted from the dryer that are subject to BACT review are NO_x, TSP/PM-10/PM-2.5, VOC, and CO.

1. BACT for NO_x – The applicant includes three potentially applicable NO_x control technologies as follows:
 - Conventional Selective Catalytic Reduction (SCR), Regenerative Selective Catalytic Reduction (RSCR); SCR involves the injection of ammonia (NH₃) into the flue gas stream ahead of a catalyst bed. On the catalyst surface, ammonia reacts with NO_x contained within the air to form nitrogen gas (N₂) and water (H₂O), and
 - Selective Non-Catalytic Reduction (SNCR); SNCR describes a process by which NO_x is reduced to molecular nitrogen (N₂) and water (H₂O) by injecting an ammonia or urea (CO(NH₂)₂) spray into the post-combustion area of the unit. Typically, injection nozzles are located in the upper area of the furnace and convective passes. Once injected, the urea or ammonia decomposes into NH₃ or NH₂ free radicals, reacts with NO_x molecules, and reduces to nitrogen and water.

The three technologies mentioned above are considered technically feasible.

RSCR (0.068 lb/million Btu NO_x):

Economic Impacts:

Capital and operating costs are based on vendor quotes, OAQPS Manual, and past permitting experience. Other cost impacts are estimated using EPA cost methodologies. As shown in Table D-4 of the application, the cost effectiveness of operation of RSCR is approximately \$13,132 per ton. When considering other similar operations, the cost is prohibitive. RSCR is eliminated from further consideration.

Energy Impacts:

Energy requirements for a RSCR system consist primarily of the power needed for the fan and fan power to overcome catalyst pressure. It is estimated that the energy impact associated with it is approximately 4.19 x 10⁶ KWH/year.

Environmental Impacts:

There are no major adverse environmental impacts.

SCR (0.068 lb/million Btu NO_x)

Economic Impacts:

As shown in Tables D-2 and D-4 of the application, SCR can achieve an annual average NO_x level of 0.068 lb/million Btu at approximately \$22,164 per ton of NO_x reduction. When considering other similar operations, this is cost prohibitive. SCR is eliminated from further consideration.

Energy Impacts:

Energy requirements for an SCR system primarily consist of the power needed for ammonia injection. It is estimated that the energy impact associated with SCR control is approximately 2.51×10^7 KWH/year.

Environmental Impacts:

There are no major adverse environmental impacts.

SNCR (0.150 lb/million Btu NO_x)

An SNCR control of 0.150 lb/million Btu was determined based on discussions with a vendor.

Economic Impacts:

As shown in Tables D-3 and D-4 of the application, the SNCR can achieve a NO_x level of 0.150 lb/million Btu at approximately \$3,176 per ton of NO_x reduction. This is not considered cost effective given the negligible impact of the dryer on air quality. The maximum modeled one-hour average concentration for nitrogen dioxide is 101.0 ug/m³, which is approximately 54% of the NAAQS. The maximum dryer contribution is 17.2 ug/m³ at the maximum receptor. SNCR is eliminated from further consideration.

Energy Impacts:

Energy requirements for an SNCR system primarily consist of the power needed for ammonia injection. It is estimated that the energy impact associated with the SNCR control is approximately 1.92×10^4 KWH/year.

Environmental Impacts:

There are no major adverse environmental impacts.

The baseline emission rate proposed by the dryer vendor is 0.20 lb/million Btu. The applicant proposes a BACT limit of 0.20 lb/million Btu based on good combustion practices and use of low NO_x burners. NCDAQ agrees with the applicant's proposed BACT.

2. BACT for Particulate matter (TSP/PM-10/PM-2.5) – The applicant includes three potentially applicable PM control technologies as follows:

- Bagfilter; use fabric bags as filters to collect particulate matter. Particle characteristics that affect the collection efficiency include particle size distribution, particle cohesion characteristics, and particle electrical resistivity.
- Electrostatic Precipitator (ESP); ESPs remove particles from a gas stream through the use of electrical forces. Discharge electrodes apply a negative charge to particles passing through a strong electrical field. These charged particles then migrate to a collecting electrode having an opposite, or positive, charge. Collected particles are removed from the collecting electrodes by periodic mechanical rapping, and
- Wet Electrostatic Precipitator (WESP); WESPs versus dry ESPs are utilized in the forest products industries for control of emissions from similar dryer sources because dry ESPs cannot reliably operate due to resin buildup on collection electrodes.

Exhaust leaving the process is sufficiently laden with moisture and resinous compounds that condensation in the bagfilter unit frequently occurs. Use of a bagfilter is technically infeasible due to the condensation of resinous compounds leading to blinding of the filters. Dry ESP are not designed to operate under conditions in which the gas stream contains water vapor or resinous compounds. Due to the moist gas stream, it would be expected to see particulate agglomeration on the dry ESP. The dry ESP is technically infeasible. Therefore, the bagfilter and dry ESP are eliminated from consideration in the BACT analysis.

For the remaining technically feasible control technology, according to the applicant, the cost effectiveness of achieving the most stringent control option of 0.105 lb filterable PM/ODT using WESP control is \$3,234 per ton. The applicant proposes a BACT limit of 0.105 lb filterable PM/ODT based on utilization of cyclones followed by WESP. NCDAQ agrees with the applicant's proposed BACT.

3. BACT for VOC and CO – The applicant includes the following potentially applicable VOC control technologies:

- Process design;
- Regenerative Thermal Oxidation (RTO); preheated, partially oxidized gases enter a combustion chamber where they are heated by auxiliary fuel (natural gas) combustion to a final oxidation temperature typically between 760 to 820 °C (1400 to 1500 °F) and maintained at this temperature to achieve maximum VOC destruction,
- Regenerative Catalytic Oxidation (RCO); operates in the same fashion as an RTO, but it requires only moderate reheating to the operating range of the catalyst, approximately 450 °F. Particulate control must be placed upstream of an RCO.
- Thermal Catalytic Oxidation (TCO); operates much in the same fashion as an RCO,
- Packed-bed Catalytic Wet Scrubber; this technology is reportedly able to reduce overall VOC emissions by approximately 30 percent, and
- Bio-oxidation/Bio-filtration; VOCs are oxidized using living micro-organisms on a media bed where microbes consume and metabolize the excess organic pollutants, converting them into CO₂ and water, much like a traditional oxidation process.

Only RCO and TCO are suitable to control CO.

Packed-bed catalytic wet scrubber: According to the applicant, this technology is still in early start-up mode of operation at its first full-scale demonstration. As stated in the application, until the technology can be demonstrated to operate reliably with an established VOC control efficiency over an extended period, it is not considered to be feasible. Therefore, it is eliminated from further consideration in the BACT analysis.

Bio-oxidation/Bio-filtration: The effectiveness of this technology remains in question. The use of this technology has not been demonstrated in practice at a pellet manufacturing facility. Therefore, it is eliminated from further consideration in the BACT analysis.

Regenerative Catalytic Oxidation/Thermal Catalytic Oxidation: According to the applicant, there are no wood pellet manufacturing facilities using RCO/TCO and operation of an RCO/TCO downstream of drying operations utilizing WESP are prone to corrosion and catalyst fouling due to deposition of entrained salts and high operating temperatures. Therefore, RCO/TCO is eliminated from further consideration in the BACT analysis.

Regenerative Thermal Oxidation (0.107 lb VOC/ODT and 0.042 lb CO/MMBtu): This control technology had been demonstrated to be technically feasible.

Economic Impact: Capital and operating costs are based on vendor quotes, OAQPS Manual, and past permitting experience. Other cost impacts are estimated using EPA cost methodologies. The economic life of the RTO is 10 years as supplied by the vendor. As shown in Table D-8 of the application, the cost effectiveness of operation of the RTO is approximately \$7,245 per ton VOC. When considering other similar operations, the cost is prohibitive. Operation of the unit will have negligible impact on ozone formation as this region is considered "NOx limited."

As shown in Table D-9, the CO cost effectiveness of operation of the RTO is approximately \$10,194 per ton CO. This is considered cost prohibitive.

Energy Impact: The additional energy required to operate the RTO is approximately 5.2 x 10⁶ KWH/year.

Environmental Impact: There are adverse environmental impacts from operation of an RTO. NOx emissions will increase which can lead to increased formation of ozone in NOx limited regions, and GHGs will increase as by-products of natural gas used for supplemental fuel and actual VOC destruction.

Process Design (1.07 lb VOC/ODT and 0.21 lb CO/MMBtu): There are no adverse economic, energy, or environmental impacts associated with designing the plant to utilize at least 25% hardwood and incorporating a low temperature drying system. Use of hardwood is used to establish baseline emissions.

The applicant proposes a BACT limit of 1.07 lb VOC/ODT and 0.21 lb CO/MMBtu utilizing at least 25% hardwood and good operating and maintenance procedures. NCDAQ agrees with the applicant's proposed BACT.

Testing

4. Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall demonstrate compliance with the BACT emission limits by conducting performance test on the dryer system utilizing EPA reference methods, as in effect on the date of permit issuance, contained in 40 CFR 60, Appendix A, 40 CFR 63, and/or OTM 26 AND in accordance with a testing protocol (using testing protocol submittal form) approved by the Division of Air Quality, as follows:

Unit	Pollutant	BACT Limit	Units	Averaging Period	Testing
Dryer system	NOx	0.20	lb/MMBtu	3-hour	Annually
	Filterable PM	0.105	lb/ODT	3-hour	Annually
	VOC	1.07	lb/ODT	3-hour	Initial Only
	CO	0.21	lb/MMBtu	3-hour	Initial Only

Initial testing shall be completed and the results submitted within 180 days of commencement of operation unless an alternate date is approved by the DAQ.

Monitoring/Recordkeeping

5. The Permittee shall not process more than 537,625 ODT of pellets per year. The Permittee shall not process more than 75% softwood on a 12-month rolling basis. The process rate and hardwood/softwood mix shall be recorded in a monthly log. The log (written or electronic format) shall be maintained on-site and made available to an authorized representative upon request.
- D. **Green Wood Hammermills (ID Nos. ES-GHM-1 and GHM-2)** : VOC emissions are released during the green wood hammermill process due the heat generated by mechanical milling the green wood. The VOC emission factor of 0.24 lb/ODT was developed from Enviva Amory October 2013 Stack Testing with a throughput of 60% softwood. Potential VOC emissions are estimated to be 34.37 tpy.

1. BACT for VOC – The applicant proposes the following potentially applicable VOC control technologies:

- Process design;
- Regenerative Thermal Oxidation (RTO);
- Regenerative Catalytic Oxidation (RCO);
- Thermal Catalytic Oxidation (TCO);
- Packed-bed Catalytic Wet Scrubber; and
- Bio-oxidation/Bio-filtration

Packed-bed wet scrubber: According to the applicant, this technology is still in early start-up mode of operation at its first full-scale demonstration. Until the technology can be demonstrated to operate reliably with an established VOC control efficiency over an extended period, it is not considered to be feasible. Therefore, it is eliminated from further consideration in the BACT analysis.

Bio-oxidation/Bio-filtration: The effectiveness of this technology remains in question. The use of this technology has not been demonstrated in practice at a pellet manufacturing facility. Therefore, it is eliminated from further consideration in the BACT analysis.

Regenerative Thermal Oxidation designed for 90% control (0.027 lb VOC/ODT): This control technology had been demonstrated to be technically feasible.

Economic Impact: Capital and operating costs are based on vendor quotes, and OAQPS Manual. Other cost impacts are estimated using EPA cost methodologies. The economic life of the RTO is 10 years as supplied by the vendor. As shown in Table D-16 of the application, the cost effectiveness of operation of the RTO is approximately \$12,358 per ton. This is considered cost prohibitive.

Energy Impact: The additional energy required to operate the RTO is approximately 1.23×10^6 KWH/year.

Environmental Impact: There are adverse environmental impacts from operation of an RTO. NO_x emissions will increase which can lead to increased formation of ozone in NO_x limited regions, and GHGs will increase as by-products of natural gas used for supplemental fuel and actual VOC destruction.

Regenerative Catalytic Oxidation designed for 90% control (0.027 lb VOC/ODT): This control technology had been demonstrated to be technically feasible.

Economic Impact: Capital and operating costs are based on vendor quotes, and OAQPS Manual. Other cost impacts are estimated using EPA cost methodologies. As shown in Table D-16 of the application, the cost effectiveness of operation of the RCO is approximately \$13,058 per ton. This is considered cost prohibitive.

Energy Impact: The additional energy required to operate the RCO is approximately 3.52×10^5 KWH/year.

Environmental Impact: There are adverse environmental impacts from operation of an RTO. NO_x emissions will increase which can lead to increased formation of ozone in NO_x limited regions, and GHGs will increase as by-products of natural gas used for supplemental fuel and actual VOC destruction.

The applicant proposes a BACT limit of 0.27 lb VOC/ODT based on good operating and maintenance procedures. NCDAQ agrees with the applicant's proposed BACT.

Testing

2. Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall demonstrate compliance with the BACT emission limits by conducting performance test on one of the green wood hammermills utilizing EPA reference methods, as in effect on the date of permit issuance, contained in 40 CFR 60, Appendix A, 40 CFR 63, and/or OTM 26 AND in accordance with a testing protocol (using testing protocol submittal form) approved by the Division of Air Quality. Testing shall be conducted within 180 days of commencing operation.
3. BACT for PM – The applicant proposes the following potentially applicable PM control technologies:
 - cyclones,
 - bagfilters and bin vent filters,
 - electrostatic precipitator (ESP)

Bagfilters/bin vent filters/Electrostatic precipitator: The gas stream exiting from the green wood hammermills has a high moisture content. Moisture can cause a filtration system to become plugged. Therefore filtration control is not considered technically feasible. ESPs are also not a technically feasible control option due to the high moisture content of the gas stream.

Cyclone (0.022 gr/dscf PM, 0.0057 gr/dscf PM10, 0.0007 gr/dscf PM2.5): This control technology has been demonstrated to be technically feasible.

Economic Impact: Capital and operating costs are based on vendor quotes, OAQPS Manual, and past permitting experience. As shown in Tables D-13a, b, and c of the application, the cost effectiveness of operation of cyclones is \$1,454/ton PM, \$5,611/ton PM10, and \$221,435/ton PM2.5.

Energy Impact: The additional energy required to operate the cyclones is about 2.85×10^5 KWH/yr.

Environmental Impact: There are no adverse impacts from operation of cyclones.

The applicant proposes a BACT limit of 0.022 gr/dscf PM, 0.0057 gr/dscf PM10, and 0.0007 gr/dscf PM2.5 using cyclone control. NCDAQ agrees with the applicant's proposed BACT.

E. Dry Hammermills (ID Nos. ES-HM-1 through HM-8), Hammermill Area Bagfilter (ID No.ES-HMA), Pellet Mill Feed Silo (ID No. ES-PMFS), Pellet Fines Bin (ID No. ES-PFB), Dry Wood Handling (ID No. ES-PB and ES-PL), Finished Product Handling (ID No.ES-FPH)

1. Particulate Matter (TSP/PM-10/PM-2.5) -The applicant proposes utilizing bagfilters or bin vent filters for the above mentioned sources. According to the applicant, the filters are capable of achieving the lowest emission rates for filterable PM.
2. The applicant proposes a TSP/PM-10/PM-2.5 BACT limit for the green wood hammermills, hammermill area, pellet mill feed silo, pellet fines bin, and dry wood handling based on an outlet grain loading factor of 0.004 gr/cf.
3. The applicant proposes a TSP/PM-10/PM-2.5 BACT limit for the dry hammermills and finished product handling of 0.004/0.004/0.000014 gr/cf.

F. Dry Hammermills (ID Nos. ES-HM-1 through HM-8)

In addition to PM emissions, some VOC are emitted from the dry hammermills.

1. BACT for VOC – The applicant proposes the following potentially applicable control technologies:
 - Regenerative Thermal Oxidation (RTO);
 - Regenerative Catalytic Oxidation (RCO);
 - Thermal Catalytic Oxidation (TCO);
 - Packed-Bed Catalytic Wet Scrubber; and
 - Bio-oxidation/Bio-filtration.

Packed-bed wet scrubber: According to the applicant, this technology is still in early start-up mode of operation at its first full-scale demonstration. As stated in the application, until the technology can be demonstrated to operate reliably with an established VOC control efficiency over an extended period, it is not considered to be feasible. Therefore, it is eliminated from further consideration in the BACT analysis.

Bio-oxidation/Bio-filtration: The effectiveness of this technology remains in question. The use of this technology has not been demonstrated in practice at a pellet manufacturing facility. Therefore, it is eliminated from further consideration in the BACT analysis.

Regenerative Thermal Oxidation designed for 90% control (0.024 lb VOC/ODT): This control technology had been demonstrated to be technically feasible.

Economic Impact: Capital and operating costs are based on vendor quotes, and OAQPS Manual. Other cost impacts are estimated using EPA cost methodologies. The economic life of the RTO is 10 years as supplied by the vendor. As shown in Table D-16 of the application, the cost effectiveness of operation of the RTO is approximately \$52,643 per ton. This is considered cost prohibitive.

Energy Impact: The additional energy required to operate the RTO is approximately 4.4×10^6 KWH/year.

Environmental Impact: There are adverse environmental impacts from operation of an RTO. NO_x emissions will increase which can lead to increased formation of ozone in NO_x limited regions, and GHGs will increase as by-products of natural gas used for supplemental fuel and actual VOC destruction.

Regenerative Catalytic Oxidation designed for 90% control (0.024 lb VOC/ODT): This control technology had been demonstrated to be technically feasible.

Economic Impact: Capital and operating costs are based on vendor quotes, and OAQPS Manual. Other cost impacts are estimated using EPA cost methodologies. As shown in Table D-20 of the application, the cost effectiveness of operation of the RCO is approximately \$41,981 per ton VOC. This is considered cost prohibitive.

Energy Impact: The additional energy required to operate the RCO is approximately 1.41×10^6 KWH/year.

Environmental Impact: There are adverse environmental impacts from operation of an RCO. NO_x emissions will increase which can lead to increased formation of ozone in NO_x limited regions, and GHGs will increase as by-products of natural gas used for supplemental fuel and actual VOC destruction.

The applicant proposes a BACT limit of 0.24 lb VOC/ODT based on good operating and maintenance procedures. NCDAQ agrees with the applicant's proposed BACT.

G. Pellet Coolers (ID Nos. ES-CLR-1 through CLR-6)

The pellet presses discharge formed pellets through one of six pellet coolers. Cooling air is passed through the pellets. The pellets contain a small amount of wood fines which become entrained in the cooling air. The VOC emission factor of 0.85 lb/ODT was developed from Enviva Wiggins October 2013 Stack Test with a throughput of 62.5% softwood. Potential emissions from the presses and coolers is estimated to be 227.64 tpy.

1. BACT for Particulate matter (TSP/PM-10/PM-2.5 – The applicant proposes three potentially applicable PM control technologies as follows:
 - Cyclones;
 - Bagfilter; and
 - Electrostatic Precipitator (ESP).

Electrostatic Precipitator: Bagfilters and ESP are both technically feasible. However, because bagfilters can be designed to be as efficient as ESP, only bagfilter control is considered in the analysis.

Bagfilter designed for 97% control efficiency:

Economic Impact: Capital and operating costs are based on vendor quotes, OAQPS Manual, and past permitting experience. As shown in Table D-24a, b, and c of the application, the cost effectiveness of operation of a bagfilter compared with the use of cyclones has an incremental cost effectiveness of \$19,278/ton PM, \$74,221/ton PM-10, and \$608,882/ton PM-2.5. This is considered cost prohibitive.

Energy Impact: The additional energy required to operate the bagfilter is approximately 8.56×10^5 KWH/year

Environmental Impact:

There are no adverse environmental impacts from operation of bagfilters.

Cyclone designed for 90% control efficiency:

Economic Impact: Capital and operating costs are based on vendor quotes, OAQPS Manual, and past permitting experience. As shown in Table D-24a, b, and c of the application, the cost effectiveness of the cyclones is \$175/ton PM, \$677/ton PM-10, and \$5,515/ton PM-2.5. This is not considered cost prohibitive.

Energy Impact: The additional energy required to operate the cyclones is approximately 8.56×10^5 KWH/year.

Environmental Impact:

There are no adverse environmental impacts from the operation of cyclones.

The applicant proposes a BACT limit of 0.022 gr PM/cf, 0.0057 gr PM-10/cf, and 0.0007 gr PM-2.5/cf based on utilization of cyclones. NCDAQ agrees with the applicant's proposed BACT.

2. BACT for VOC – The applicant proposes the following potentially applicable control technologies:
 - Regenerative Thermal Oxidation (RTO);
 - Regenerative Catalytic Oxidation (RCO);
 - Thermal Catalytic Oxidation (TCO);
 - Packed-Bed Catalytic Wet Scrubber; and
 - Bio-oxidation/Bio-filtration.

Packed-bed wet scrubber: According to the applicant, this technology is still in early start-up mode of operation at its first full-scale demonstration. As stated in the application, until the technology can be demonstrated to operate reliably with an established VOC control efficiency over an extended period, it is not considered to be feasible. Therefore, it is eliminated from further consideration in the BACT analysis.

Bio-oxidation/Bio-filtration: The effectiveness of this technology remains in question. The use of this technology has not been demonstrated in practice at a pellet manufacturing facility. Therefore, it is eliminated from further consideration in the BACT analysis.

Regenerative Thermal Oxidation designed for 90% control (0.08 lb VOC/ODT): This control technology had been demonstrated to be technically feasible.

Economic Impact: Capital and operating costs are based on vendor quotes, and OAQPS Manual. Other cost impacts are estimated using EPA cost methodologies. The economic life of the RTO is 10 years as supplied by the vendor. As shown in Table D-27 of the application, the cost effectiveness of operation of the RTO is approximately \$12,767 per ton. This is considered cost prohibitive.

Energy Impact: The additional energy required to operate the RTO is approximately 3.09×10^6 KWH/year.

Environmental Impact: There are adverse environmental impacts from operation of an RTO. NO_x emissions will increase which can lead to increased formation of ozone in NO_x limited regions, and GHGs will increase as by-products of natural gas used for supplemental fuel and actual VOC destruction.

Regenerative Catalytic Oxidation designed for 90% control (0.08 lb VOC/ODT): This control technology had been demonstrated to be technically feasible.

Economic Impact: Capital and operating costs are based on vendor quotes, and OAQPS Manual. Other cost impacts are estimated using EPA cost methodologies. As shown in Table D-27 of the application, the cost effectiveness of operation of the RCO is approximately \$11,889 per ton. This is considered cost prohibitive.

Energy Impact: The additional energy required to operate the RCO is approximately 1.06×10^6 KWH/year.

Environmental Impact: There are adverse environmental impacts from operation of an RCO. NO_x emissions will increase which can lead to increased formation of ozone in NO_x limited regions, and GHGs will increase as by-products of natural gas used for supplemental fuel and actual VOC destruction.

The applicant proposes a BACT limit of 0.85 lb VOC/ODT on an annual average basis based on good operating and maintenance procedures. NCDAQ agrees with the applicant's proposed BACT.

Testing

3. Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall demonstrate compliance with the BACT emission limits by conducting performance test on one of the pellet coolers utilizing EPA reference methods, as in effect on the date of permit issuance, contained in 40 CFR 60, Appendix A, 40 CFR 63, and/or OTM 26 AND in accordance with a testing protocol (using testing protocol submittal form) approved by the Division of Air Quality. Testing shall be conducted within 180 days of commencing operation.

- H. Log Bark Hog/Log Chipping/Diesel Storage Tanks (ID Nos. ES-BARKHOG, ES-CHIP-1)
 VOC emissions from these sources are considered fugitive and add on controls are not practicable. According to the applicant, there are no known good operating practices that would reduce emissions. Therefore, no VOC control is proposed.
- I. Green Wood Handling and Storage Pile (ID Nos. (IES-GWHS and IES-GWSP)
 PM emissions from the storage pile and handling are considered fugitive. According to the applicant, PM emissions are negligible due to the high moisture content. Use of water spray or chemical suppressants is unnecessary and would result in increases in emissions at the dryers due to combustion of additional fuel to remove the additional moisture.

VOC will also be emitted. According to the applicant, there are no practicable methods for VOC reduction.

- J. Road Dust
 The applicant proposes paved roads be used for raw material delivery, pellet load-out, and employee traffic. PM emissions will be fugitive. To minimize fugitive PM, the applicant proposes to water areas of paved roads as needed. This technique will reduce emissions by an estimated 90% and is proposed as BACT for paved roads. NCDAQ agrees with the applicant's proposed BACT.
- K. Emergency Fire Pump & Emergency Generator (ID Nos. ES-FWP and ES-GN)
 A diesel-fired fire pump and emergency generator are proposed for this facility. According to the applicant, the engines will be certified to meet the provisions of NSPS Subpart III. The engines will use fuel with a maximum sulfur content of 0.0015 weight percent (15 ppmw).

BACT for these engines will be the applicable NSPS and MACT standards. The table below summarizes the proposed BACT limits:

	CO	PM-10/2.5	NMHC + NO _x	GHG
BACT	3.5 g/kW-hr	0.20 g/kW-hr	4.0 g/kW-hr	GCP

Other than for use during emergency service, the engines are limited to a maximum of 100 hours per year of operation for maintenance and readiness testing under the NSPS. The applicant will install non-resettable hour meters to monitor and record monthly engine operation.

Add-on controls are impractical given the intermittent operation. The applicant proposes good combustion practices, as recommended by the manufacturer. NCDAQ agrees with the applicant's proposed BACT.

- L. Greenhouse Gasses (CO₂, CH₄, N₂O)
 Using DAQ spreadsheets, the applicant estimates CO₂e emissions from this proposed plant to be 229,828 tons per year. Because there will be a significant emissions increase of GHG from the wood-fired dryer, a BACT analysis is being conducted. CO, CH₄, and N₂O are anticipated from wood combustion, thus a BACT review must be conducted for CO₂e.

1. BACT for GHG – The applicant proposes the following potentially applicable control technologies:
 - Carbon capture and storage (CCS);
 - Selection of lowest carbon fuel;
 - Installation of energy efficient options
 - Fuel switching – According to GHG BACT Guidance, fuel switching is only applicable to coal-fired and oil-fired boilers.

Carbon capture and storage: As stated in the application CCS is technically infeasible for the following reasons;

- a. In post combustion CO₂ capture, flue gas is exhausted at atmospheric pressure and a lower concentration relative to pre-combustion capture. Post combustion CO₂ capture is problematic because to the low pressure and dilute concentration means a high volume of gas needs to be treated. Additional challenges stem from impurities in the flue gas that tend to negatively affect

- the ability to absorb CO₂, and the compression of CO₂ would require a substantial auxiliary power load, resulting in additional fuel consumption.
- b. The availability of a mechanism to permanently sequester the captured gas is not present. There is no existing nearby pipeline for CO₂ transport. Also, since the availability and proximity of adequate storage in geologic formations is unknown, sequestration is not a technically feasible option.

CCS as a combined technology is not considered technically feasible as BACT for reducing CO₂ emissions. Therefore, CCS is eliminated as a potential control option.

Selection of lowest carbon fuel: According to the application, firing of lower carbon fuel is a technically feasible option. However, the applicant's intent is to continue to use biomass as EPA has recognized it as a GHG beneficial fuel due to its renewable nature. Therefore, this option is eliminated as a potential control option.

Installation of Energy Efficient Options: Operating practices can increase energy efficiency and are a potential control option for improving fuel efficiency, thus providing a benefit relative to GHG emissions. Efficiency options for the wood-fired dryer are similar to those provided in the October 2010 EPA whitepaper for boilers and include:

- Burner design efficiency,
- Dryer maintenance,
- Dryer process control,
- Reduction in flue gas quantities,
- Reduction/minimization of excess air,
- Heat/Flue gas recovery, and
- Use of thermal oxidizers employing heat recovery

Each of the energy efficiency options is technically feasible except the use of regenerative thermal oxidizers (RTO). As discussed earlier in this report, RTO technology will increase NO_x emissions, is not cost effective, and is technically infeasible for the dryer.

Installation of energy efficient options is the only remaining technically feasible option for minimizing CO₂e emissions. No adverse energy, environmental, or economic impacts are associated with energy efficient operating practices.

BACT will consist of a combination of best operating practices that implement energy efficient measures.

V. Air Quality Impact Analysis

The PSD modeling analysis described in this section was conducted in accordance with current PSD directives and modeling guidance. References are made to the Draft October 1990 EPA New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting which will herein be referred to as the NSR Workshop Manual. A summary of the modeling results is presented in the last topic, PSD Air Quality Modeling Results Summary. A detailed description of the modeling and modeling methodology is described below.

Enviva Pellets Hamlet, LLC (Enviva) plans to construct and operate a wood pellet manufacturing plant in Richmond County near Hamlet, NC. Operations are expected to occur 24 hours per day, 7 days per week and 52 weeks per year. A facility-wide pollutant analysis was accomplished and documented in Appendix B, Table B-1 of the Enviva permit application. Six pollutants were declared to exceed their PSD Significant Emission Rate (SER) and thus require a PSD analysis.

In addition, GHG emissions are above the EPA suggested threshold of 75,000 TPY (as CO₂e) for triggering PSD review; and as a result, PSD analysis was completed for GHG. These emission rates are provided in the table below.

Table 1. Pollutant Netting Analysis.

Pollutant	Annual Emission Rate (tons/yr)	Significant Emission Rate (tons/yr)	PSD Review Required?
NO ₂	220.17	40	Yes
PM ₁₀	101.18	15	Yes
PM _{2.5}	57.74	15	Yes
TSP*	177.78	25*	Yes*
SO ₂	27.42	40	No
CO	231.17	100	Yes
VOC's	606	40	Yes
GHG	229,961	75,000	Yes

*N.C. requirement only.

An air quality preliminary impact analysis was conducted for the pollutants exceeding the corresponding SER. The modeling results were then compared to applicable Significant Impact Levels (SILs) as defined in the NSR Workshop Manual to determine if a full impact air quality analysis would be required for that pollutant.

The Enviva facility will be located near Hamlet, NC, in Richmond County. The facility area is in the southern piedmont region with gently rolling terrain and is generally agricultural, industrial, and forest land. For modeling purposes, the area, including and surrounding the site, is classified rural, based on the land use type scheme established by Auer 1978.

Enviva evaluated the pollutants' significant emissions using the EPA AERMOD model and five years (2008-2012) of National Weather Service (NWS) surface (Maxton) and upper air (Greensboro) meteorological data. Full terrain elevations were included, as were normal regulatory defaults. Sufficient receptors were placed in ambient air beginning at the fenceline to establish maximum impacts. Emission rates for this specific project were used and the maximum impacts were then compared to the SIL. Since the results showed impacts above the SILs for PM₁₀, PM_{2.5}, and NO₂, further modeling was required for those pollutants. The SIL results are shown in Table 2.

Table 2. Class II Significant Impact Results (ug/m³).

Pollutant	Averaging Period	Facility maximum Impact	Class II Significant Impact Level	Significant Impact Distance (km)
PM ₁₀	annual	4.4	1	3.0
	24-hour	35	5	3.0
PM _{2.5}	annual	1.0	.3	3.0
	24-hour	6.6	1.2	3.0
NO ₂	annual	2.3	1	0.75
	1-hour	78.1	10	5.5
CO	8-hour	40.4	500	n/a
	1-hour	97.2	2,000	n/a

Class II Area Full Impact Air Quality Modeling Analysis

A Class II Area NAAQS and PSD increment analysis was performed for PM₁₀, PM_{2.5}, and NO₂ to include offsite source emissions and background concentrations (NAAQS). Enviva used AERMOD with the modeling methodology as described above. Off-site source inventories for both increment and NAAQS modeling were obtained from NCDAQ and then refined by Enviva using the NCDAQ approved "Q/D=20" guideline. For the NO₂ NAAQS analysis, 10 offsite sources (from four different facilities) were used; the same sources were also used for the increment analysis. These sources, along with their emission rates, are provided in the attachments. For the PM₁₀ and PM_{2.5} NAAQS and increment analyses, 7 additional offsite sources (all from the same facility) were included.

Enviva used an appropriate array of receptors beginning at the declared fenceline and extending outward to 30 kilometers. PM₁₀ and PM_{2.5} background concentrations were obtained from the Cumberland County PM₁₀ monitoring station. The Cumberland County monitor was used for PM_{2.5} background concentrations. NO₂ background concentrations were obtained from a monitor located in Paulding County, GA since it was judged to be most representative of the rural NO₂ background concentrations for the Richmond County region. The modeling results are shown in Table 3 and indicate compliance with the NAAQS for PM₁₀, PM_{2.5}, and NO₂.

Table 3. Class II Area NAAQS Modeling Results.

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (ug/m ³)	Background Concentration (ug/m ³)	Total Impact (ug/m ³)	NAAQS (ug/m ³)	% NAAQS
PM ₁₀	24-hour	29.7	25.00	54.7	150	37
PM _{2.5}	24-hour	4.6	17.3	21.9	35	63
	annual	1.0	8.87	9.87	12	82
NO ₂	1-hour	68.9	32.10	101.0	188	54
	annual	2.1	5.30	7.4	100	7

In the CLASS II increment analysis, Enviva used the same onsite sources, fenceline, and receptors as in the NAAQS analysis. The emission rates modeled are provided in the attachments. The Class II Area increment modeling results are shown in Table 4 and indicate compliance with the Class II Area increments.

Table 4. Class II area PSD increment modeling results.

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (ug/m ³)	PSD Increment (ug/m ³)	% Increment
PM ₁₀	24-hour	29.67	30	99
	annual	4.40	17	26
PM _{2.5}	24-hour	7.5	9	83
	annual	1.3	4	33
NO ₂	annual	2.4	25	10

Non Regulated Pollutant Impact Analysis (North Carolina Toxics)

Enviva also modeled TSP and fourteen toxics using AERMOD with the same receptor array and meteorology as used in the NAAQS analysis. A list of the facility sources and emission rates used are attached to this document. All pollutants demonstrated compliance on a source-by-source basis with the NC's AAQS or Acceptable Ambient Level (AAL). The maximum concentrations as shown in Table 5 occurred along the fenceline.

Table 5. Non-regulated pollutants modeling results.

Pollutant	Averaging Period	Max Facility Impact (µg/m3)	AAL (µg/m3)	Percent of AAL
TSP	annual	12.6	75	17%
	24-hr	87.4	150	58%
Arsenic	annual	9.3E-06	2.3E-04	4%
Benzo(a)pyrene	annual	1.5E-05	3.3E-02	<1%
Cadmium	annual	1.7E-06	5.5E-03	<1%
Chlorine	1-hour	2.2E-08	900	<1%
	24-hour	6.6E-02	37.5	<1%
Formaldehyde	1-hour	9.1	150	6%
Hexachlor.dioxin	annual	9.3E-06	7.6E-05	12%
Vinyl chloride	annual	1.1E-04	0.38	<1%

Additional Impacts Analysis

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

Growth Impacts

Enviva is expected to employ approximately 80 full-time people, most of which are expected to come from the existing local population. Therefore, this project is not expected to cause a significant increase in growth in the area.

Soils and Vegetation

The facility is located in the southern piedmont area of North Carolina. The local geography is gently rolling terrain with a mix of forests, agricultural crops, and herbaceous vegetation. By way of the NAAQS analyses of this submission, Enviva demonstrated that the impacts were below the established standards – both the primary and secondary NAAQS. The impacts were also below EPA established thresholds for soil and vegetation effects (described in detail in Section 6.3 and Table 6-1 of the modeling report). Thus, the Enviva project is not expected to cause any detrimental impacts to soils or vegetation in the area.

CLASS II Visibility Impairment Analysis

A Class II visibility impairment analysis was not conducted since there are not any visibility sensitive areas with the Class II Significant Impact Area.

Class I Area - Additional Requirements

There are five Federal Class I Areas within 300 km of the Enviva project – Swanquarter NWR, James River Face Wilderness, Linville Gorge Wilderness Area, Shining Rock Wilderness Area, and Cape Romain National Wildlife Refuge. The Federal Land Manager for each of those areas was contacted and none of them required any analysis; therefore, no analysis was conducted by the applicant.

CLASS 1 SIL Analysis

AERMOD was also used to estimate impacts for the Class 1 SIL analysis. Even though the distance to the closest Class 1 area, Cape Romain NWR, exceeds 50 km, the threshold distance at which a long-range transport model is typically used, receptors were conservatively placed at 50 km from the Enviva facility. NO₂, PM_{2.5}, and PM₁₀ all modeled below the EPA-established, CLASS 1 SILs, and thus no CLASS 1 increment modeling was required. Table 6 provides the results of SIL modeling.

Table 6. Class 1 Significant Impact Results (ug/m³)

Pollutant	Averaging Period	Max. Impact at 50 km	EPA SIL	% SIL
NO ₂	Annual	0.011	0.1	12
PM ₁₀	24-hr	0.088	0.32	27
	Annual	0.003	0.20	1.5
PM _{2.5}	24-hr	0.049	0.07	70
	Annual	0.002	0.06	3

PSD Air Quality Modeling Result Summary

Based on the PSD air quality ambient impact analysis performed the proposed Enviva Pellets Hamlet, LLC facility will not cause or contribute to any violation of the Class 1 NAAQS, PSD increments, Class 1 Increments, or any FLM AQRVs.

VII. Permit Stipulations

A copy of the proposed DRAFT permit is included as Appendix A to this review.

VIII. Other

- A. Public Notice Requirements – 40 CFR 51.166(q) requires that the permitting agency make available to the public a preliminary determination on the proposed project, including all materials considered in making this determination. With respect to this preliminary determination the NCDAQ:
- i) Will make available in the NCDAQ Fayetteville Regional Office and the NCDAQ Central Office in Raleigh, NC all materials submitted, a copy of the preliminary determination, and all other information submitted and considered.
 - ii) Will publish a public notice, by advertisement in a local paper including the preliminary decision and the opportunity for public comment.
 - iii) Send a copy of the public notice to:
 - i. The applicant
 - ii. EPA Region IV for comment
 - iii. Officials having cognizance over the location of the location of the project as follows:
 - VII. Any affected state/local air agency – No other state or local agencies are expected to be affected by this project.
 - VIII. Chief Executives of the city and county in which the proposed project is to be located. Notices will be sent to the City Manager for the City of Hamlet.
 - IX. Federal Land Manager – As noted above, the FLM for the closest Class I area did not request any analysis to be performed.
- B. See Appendix C of this review for copies of the required notifications and public notices.
- C. Other Regulatory Requirements
- An application fee of \$13,837.00 is required and was received by DAQ.
 - The appropriate number of application copies was received on January 20, 2015.
 - The application included the Reduction and Recycling Form (A4).
 - A Professional Engineer’s Seal was included in the application (ref. M. Dale Overcash, P.E. Seal No. 12627).

- Receipt of the request for a zoning consistency determination was acknowledged by James Armstrong, Richmond County Planning Department on January 7, 2014.
- IBEAM Emission Source Module (ESM) update was verified on August 3, 2015.
- According to the application, the facility does not handle any of the substances subject to 112(r).
- The application was signed by Mr. Norb Hintz, Senior Vice President and Chief Engineer on January 14, 2015.

APPENDIX A
DRAFT PERMIT

APPENDIX B
PUBLIC NOTICE

APPENDIX C

LISTING OF ENTITIES AND ASSOCIATED MATERIALS

NEWSPAPER	Ms. Mary Hayes Richmond County Daily Journal 105 East Washington Street Rockingham, NC 28379 (910) 997-3111 mhayes@civistasmedia.com	Public Notice
OFFICIALS	Mr. Marcus Abernathy Manager, City of Hamlet 201 West Main Street Hamlet, NC 28345 (910) 582-2651	Public Notice
SOURCE	Mr. Norb Hintz Senior Vice President and Chief Engineer Enviva Pellets Hamlet, LLC 7200 Wisconsin Avenue, Suite 1000 Bethesda, MD 20814 (703) 380-9957	Preliminary Determination, Draft Permit & Public Notice
EPA	Ms. Heather Ceron Air Permits Section U.S. EPA Region 4 Sam Nunn Atlanta Federal Building 61 Forsyth Street, S.W. Atlanta, Georgia 30303-3104 (404) 562-9185 Preliminary Determination, Draft Permit, and Public Notice, via electronic mail to: ceron.heather@epa.gov with cc to lorinda.sheppard@epa.gov	Preliminary Determination, Draft Permit & Public Notice
FLM	Ms. Jill Webster Branch of Air Quality 7333 W. Jefferson Avenue, Suite 375 Lakewood, CO 80235-2017 (303) 914-3804	None
FAYETTEVILLE REGIONAL OFFICE	Mr. Steven Vozzo NC DAQ Air Quality Regional Supervisor Systel Building 225 Green Street, Suite 714 Fayetteville, NC 28301 (910) 433-3361	Preliminary Determination, Draft Permit & Public Notice

Comprehensive Application Report for 7700096.14A
 Enviva Pellets Hamlet, LLC - Hamlet (7700096)

03/29/2016

Richmond County

General Information: Permit/Latest Revision: 10365/ R00

Permit code: PSD Received: 01/15/2014 Completeness Due: 01/21/2014 Clock Start: 01/21/2014 Calculated Issue Due: 02/02/2015
 Application type: Greenfield Facility
 Engineer/Rev. location: Kevin Godwin/RCO
 Regional Contact: Gregory Reeves
 Facility location: Fayetteville Regional Office
 Facility classification: Title V
 Clock is ON Application is COMPLETE
 Status is : Issued

Fee Information

Initial amount: \$13827.00 Date received: 01/15/2014 Amount Due: 0.00 \$ Add. Amt Rcv'd: 10.00 Date Rcv'd: 02/02/2015
 Fund type: Location rec'd: RCO
 Deposit Slip #: 2333 Location deposited: RCO

Contact Information

Type	Name	Address	City	State	ZIP	Telephone
Authorized	Norb Hintz, Vice President Engineering	7200 Wisconsin Avenue	Bethesda, MD		20814	(301) 657-5567
Technical/Permit	Joe Harrell, Corporate EHS Manager	142 NC Route 561 East	Ahoskie, NC		27910	(252) 209-6032

Acceptance Criteria

<u>Received?</u>	<u>Acceptance Criteria Description</u>
No	Application fee
Yes	Appropriate number of apps submitted
Yes	Zoning Addressed
Yes	Source recycling/reduction form
Yes	Authorized signature
Yes	PE Seal
Yes	Application contains toxic modification(s)

Completeness Criteria

<u>Received?</u>	<u>Complete Item Description</u>
Yes	Reqd app forms submitted & completed
Yes	Supporting materials/calcs received
Yes	PE seal if 15A NCAC 2Q.0112
Yes	Modeling protocol acceptable
Yes	Confirmation of pollutants modeled

Comprehensive Application Report for 7700096.14A
Enviva Pellets Hamlet, LLC - Hamlet (7700096)
Richmond County

03/29/2016

Application Events						
<u>Event</u>	<u>Start</u>	<u>Due</u>	<u>Complete</u>	<u>Comments</u>	<u>Staff</u>	
TV - Acknowledgment/Incomplete add info re	01/15/2014	02/14/2014	01/21/2014	Need \$10	cjhorne	
Technical additional information request	02/20/2014	03/22/2014	03/22/2014		kgodwin	
Additional application received/consolidated	01/20/2015		01/20/2015		kgodwin	
Completeness Letter Sent	01/20/2015	02/14/2014	03/09/2015		kgodwin	
Regional technical review received in RCO	01/20/2015		02/12/2015		kgodwin	
Toxic/Additional Impact Review received for	01/20/2015		06/03/2015		kgodwin	
Regional technical review completed/mailed	01/20/2015	02/19/2015	02/11/2015		kgodwin	
Public notice published	09/18/2015		10/18/2015	Richmond Daily Journal	kmhash	
Draft to coordinator/supervisor for review	01/08/2016		03/28/2016		kgodwin	
Permit to coordinator/supervisor for signature	03/29/2016		03/29/2016		kgodwin	
Permit issued	03/29/2016		03/29/2016		kmhash	

Comprehensive Application Report for 7700096.14A
 Enviva Pellets Hamlet, LLC - Hamlet (7700096)

03/29/2016

Richmond County

<u>Outcome Information</u>		Permit/Revision:	10365/R00
Class before:	Unknown	Revision Issue Date:	03/29/2016
2Q .0711:	No	Accumulated process days (includes public notice periods): 773	
NSPS:	Yes	Public notice/hearing/add info after 80 days:	
PSD/NSR Avoid:	No	Manager's discretion:	
PSD/NSR Status After:	Major	Appealed? No	
Multi-site permit:	No	<u>Current Permit Information:</u>	
Quarry permit:	No	Issue	Effective
2Q .0705 Last MACT/Toxics:	NO	03/29/2016	03/29/2016
New Source RACT/LAER:	NO	Expiration	02/28/2021
RACT/LAER Added Fee:	NO	Revision #	R00
2Q .0702 (a)(18) - Toxics/Combustion Source(s) After 07/10/10:	NO		

<u>Regulations Pertaining to this Permit</u>		
<u>Reference Rule</u>	<u>Regulation Description</u>	
2D .0515	Particulates Miscellaneous Industrial Processes	
2D .0516	Sulfur Dioxide Emissions Combustion Sources	
2D .0521	Control of Visible Emissions	

<u>Audit Information Pertaining to this Application</u>			
<u>Column Name</u>	<u>Date Changed</u>	<u>Old Value</u>	<u>New Value</u>
permit_No	01/16/2014		10365
reg_Cont	01/21/2014	3183 (James Moser)	5120 (Gregory Reeves)
			<u>Editor</u>
			Connie Horne
			James Moser

Enviva
Response



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December 23, 2015

Via Electronic and First Class Mail

Kevin Godwin
Division of Air Quality
1641 Mail Service Center
Raleigh, North Carolina 27699-1641
kevin.godwin@ncdenr.gov

Re: Response to Comments Submitted by the Southern Environmental Law Center on Draft Enviva Pellets Hamlet, LLC, Prevention of Significant Deterioration Permit, #10365R00

Dear Mr. Godwin:

Per your request, Enviva Pellets Hamlet, LLC (Enviva) has prepared the following response to comments made by the Southern Environmental Law Center (SELC) on draft air permit #10365R00 (the Draft Permit) published by the Division of Air Quality of the Department of Environmental Quality (DEQ) for a wood pellet manufacturing plant proposed by Enviva in Richmond County, NC.

Basis of the Draft Permit

As a general matter, SELC alleges in its comments that the "Draft Permit issued by DEQ fails to comply with existing laws." As discussed in detail below, Enviva completely disagrees with this statement. Enviva engaged Trinity Consultants, a nationally recognized engineering firm that specializes in air permitting, to develop the application for the Draft Permit (the Application). Furthermore, Enviva personnel and environmental counsel carefully provided oversight to Trinity's work. Enviva strongly believes that DEQ issued the Draft Permit based on a sound application developed by Trinity and in full compliance with all applicable air quality statutes, rules and regulations.

Responses to SELC Comments ^{SELC} #1 (a)(i), (a)(ii) & (a)(iii)

Below are Enviva's responses to each of the statements (in bold) made by SELC regarding the Draft Permit determination.

- I. **DEQ failed to conduct a proper BACT analysis and set appropriate limits for greenhouse gas emissions.**

Enviva Response

A. DEQ paradoxically identified the use of biomass fuel alone as the control technology for the use of biomass fuel.

SELC's comment is partially correct as the Draft Permit lists "use of biomass fuel" under the control technology column for dryer system greenhouse gas (GHG) emissions in the table contained in Condition 2.2.A.2.b. However, contrary to SELC's comments, "use of biomass fuel" is not included in the Draft Permit as the "sole control technology for the use of biomass rule." Rather, Enviva's Best Available Control Technology (BACT) analysis carefully followed EPA's guidance documents and, as fully described in section 4.4.4 of the Application, installation of specified energy efficiency options (see Table 4.2 in the Application) that together constitute best operating practices were chosen as BACT to minimize emissions.

SELC also comments that the Draft Permit's BACT limit on annual GHG emissions (230,000 tons per year) is higher than the estimate of uncontrolled emissions (229,828 tons per year) for the dryer. The difference in these figures simply results from rounding to the nearest 1,000 tons. Due to the nature of the number (6 significant digits), Enviva's view is that the proposed value is reasonable.

To eliminate any confusion, Enviva recommends DEQ change "Use of Biomass Fuel" to "Good Operating Practices" in the Technology column of the table in Condition 2.2.A.2.b for the dryer system's GHG emissions.

B. DEQ deliberately declined to consider alternative fuels that would dramatically reduce greenhouse gas emissions.

SELC's comment is not correct. Alternative fuels, and specifically natural gas, were considered in the BACT analysis in section 4.4.4 of the Application. While EPA's GHG BACT Guidance for Biogenic Energy Production (page 13, italicized below) clearly states that the list of control options does not need to include "clean fuel" options, Enviva did voluntarily evaluate, and thereafter eliminate, the use of natural gas in the BACT analysis.

The [Clean Air Act] includes 'clean fuels' in the definition of BACT. While clean fuels that would reduce GHG emissions should be considered, EPA has recognized that the initial list of control options for a BACT analysis does not need to include 'clean fuel' options that would fundamentally redefine the source. Such options include those that would require a permit applicant to switch to a primary fuel type (e.g., coal, natural gas, or biomass) other than the type of fuel that an applicant proposes to use for its primary combustion process.¹

The analysis was completed using emission factors found in EPA's GHG Mandatory Reporting Rule (40 CFR Part 98). When compared to biomass (largely a byproduct of the pelleting process that would be readily available at the facility), natural gas was deemed to be cost prohibitive. Of further note if the biomass produced as a by-product of the pelleting process were not consumed on-site, it would create a solid waste disposal issue that would likely have to be landfilled. In a landfill this material would then decompose releasing both CO₂ and methane to the atmosphere without ever capturing its BTU value.

¹ <http://www.epa.gov/sites/production/files/2015-12/documents/bioenergyguidance.pdf>

Enviva App response

iii C. DEQ lacks clear authority to consider off-site sequestration to offset emissions in a BACT analysis.

SELC is correct. Off-site sequestration is not required to be considered in the facility's BACT analysis. However, as stated in the Application, Enviva is dedicated to improving the environmental profile of energy generation while promoting sustainable forestry (resulting in sequestration) in the southeastern United States. Enviva holds certifications and will continue to hold certifications from the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) and the Programme for the Endorsement of Forest Certifications (PEFC). Enviva requires that all suppliers adhere to state-developed "Best Management Practices" (BMPs) in their activities to protect water quality and sensitive ecosystems. In addition, Enviva is implementing an industry leading "track and trace" system to further ensure that all fiber resources come from responsible harvests. Enviva pays particular attention to land use change, use and effectiveness of BMPs, wetlands, biodiversity and certification status. All of this combined ensures that Enviva's forestry activities contribute to healthy forests both today and in the future.

ii SELC comment #2 (b)(c) (b)(ii) (b)(iii) II. DEQ failed to select BACT for particulate matter.

A. DEQ did not limit condensable PM10 or PM2.5 as required.

SELC's comment is not correct. Enviva's BACT analysis in section 4.4.2 of the Application included control of **condensable particulate matter**. The wet electrostatic precipitator ("WESP") required by the Draft Permit controls "filterable" and "condensable" PM. The Draft Permit requires that Enviva comply with a very stringent "filterable" PM limit of 0.105 lb/ODT. As discussed in the Application, the WESP will also control some portion of "condensable" PM, however, the degree to which "condensable" PM is controlled by a WESP is not well characterized and therefore cannot be estimated with confidence. As a result Enviva conservatively assumed 100% of the uncontrolled "condensable" PM in the air dispersion modeling analysis which showed compliance with all applicable regulations.

B. DEQ likely underestimated particulate matter emissions.

SELC comments that there is no enforceable hourly pellet limit in the permit. The maximum hourly pellet production rate identified in the Application is 71.71 tons per hour which is also the maximum design production rate. As a result no short term production rate permit limit is required.

Furthermore, under the annual production limit contained in the Draft Permit, the facility would not be able to operate continuously at the maximum design production rate without exceeding the annual production limit.

C. DEQ's air quality modeling for PM likely underestimates impacts.

SELC's comment is not correct. The PM modeling completed as part of the Application fully addressed all PM impacts and the facility will operate in compliance with all ambient air quality requirements. Based on a protocol reviewed and approved by DEQ beforehand, Enviva utilized short term emissions based on the maximum design production rate and included both filterable and condensable PM. The modeling conservatively assumed the maximum hourly emission rate for total PM, continuously, for every hour of the year.

The modeled impacts (source + background) for the facility are demonstrated to be well below the National

Enviva Response

Ambient Air Quality Standards (NAAQS) design values. The Cumberland County monitor, which is a conservative estimate of background for the more rural Hamlet site, is roughly 50% of the 24-hour and 74% of the annual PM_{2.5} NAAQS. The project, utilizing the conservative total PM_{2.5} (filterable and condensable) emissions methodology above had impacts of 13% and 8% of the 24-hour and annual PM_{2.5} NAAQS, respectively, and the actual impact will likely be much lower.

Contrary to SELC's comments, secondary PM formation was evaluated as described in section 5.18 of the Application. Secondary PM is formed by the primary emissions of NO_x and SO₂. Secondary PM formation was determined to be negligible, and, in accordance with the modeling protocol and EPA guidance, was not included in the modeling analysis or PM_{2.5} emissions summary.

SELC also questioned the selection of the specific PM₁₀ and PM_{2.5} ambient background monitors for use in modeling. Any reference in DEQ's draft materials to the Duplin County monitor is a typographical error and should be corrected to show that Fayetteville/Cumberland County was used for PM₁₀ and PM_{2.5} background concentrations.

✓ D. DEQ's PM emission rate does not reflect BACT.

★ SELC's comment compares emissions from a coal-fired boiler to a wood-fired dryer. These are not similar technologies and it would be inappropriate to make such a comparison in a BACT analysis.

A coal-fired power plant burns coal and indirectly heats water to produce steam and, ultimately, create electricity. In contrast the Enviva facility will burn wood with the resulting heat used to directly dry wood for pellet production. Not only are there significant differences in combusting pulverized coal versus wood, but as a result of direct drying, the WESP controls both the furnace combustion gases as well as the dryer gas stream.

The PM emission rate of 0.03 pounds per million Btu is a stringent PM limit matching the limit required New Source Performance Standard (NSPS) Subpart Dc and more stringent than the limit required under NSPS Subpart Db for new affected sources. As discussed in section 4.4.2 of the Application, Enviva utilized the more stringent NSPS Subpart Dc limit and derived an equivalent limit, in lb/ODT, which is expressed as a function of the maximum design production limit. While Enviva is not operating a biomass boiler subject to NSPS Subpart Db or NSPS Subpart Dc, but rather a direct-fired dryer, Enviva considers meeting the NSPS Subpart Dc limit a stringent and appropriate standard for PM and voluntarily matched this limit.

SELC comment #3 III. DEQ's BACT analysis for VOCs is inadequate.

SELC's comment is not correct. As SELC noted, Enviva included an RTO as a technically feasible control option in section 4.4.3 of the Application as part of the required BACT analysis and eliminated the RTO as cost prohibitive due to the specific characteristics of this facility. In particular Enviva's has elected both to install process equipment technology that includes an innovative dryer design and to utilize at least 25% hardwood feedstock as raw material. The dryer design is discussed in detail in section 3.1.5 of the Application. As a result of this design and as compared to other facilities, many VOCs are never generated from the dryer and are reduced at the source rather than being emitted and then subsequently controlled. Furthermore, it is well documented that the use of hardwood results in significantly lower VOC emissions when compared to emissions from a traditional softwood facility.

Enviva

Conclusion

In summary, based on Enviva's review of the Draft Permit, it was developed in strict compliance with EPA and NC DEQ PSD permitting requirements, including a proper and comprehensive top down BACT analysis. As a result, Enviva believes that the Draft Permit issued by DEQ for Enviva's proposed Richmond County facility complies with all applicable air quality statutes, rules and regulations and should be finalized.

Sincerely,



Michael J. Doniger
Director, Corporate Development

Cc: Dale Overcash, Trinity Consultants
Steve Steigerwald, Enviva
Joe Harrell, Enviva
Alan McConnell, Esq. Kilpatrick Townsend

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October 19, 2015

Via Electronic and U.S. Mail

Kevin Godwin
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Re: Comments on Enviva Pellets Hamlet, LLC, Prevention of Significant
Deterioration Permit, 10365R00

Dear Mr. Godwin:

On behalf of the Dogwood Alliance, Clean Air Carolina, Natural Resources Defense Council, Partnership for Policy Integrity, and itself, the Southern Environmental Law Center respectfully submits these comments on the draft air permit (“Draft Permit”) published by the Division of Air Quality of the Department of Environmental Quality (“DEQ”) for the wood pellet manufacturing plant proposed by Enviva Pellets Hamlet, LLC (“Enviva”).

The Draft Permit issued by DEQ fails to comply with existing laws—and must therefore be rescinded and revised—because it fails to set appropriate limits for a number of pollutants that would be emitted by the proposed facility’s wood-fired pellet dryer. First, the only technology that the Draft Permit lists for the control of greenhouse gas emissions due to the use of biomass fuel in the dryer is the use of biomass fuel. It is nonsensical for the only control technology for a major pollution source to be the source of the pollution itself. DEQ also expressly declined to consider alternative, lower-emission fuel sources in its determination of the best available control technology (“BACT”) for greenhouse gases. Second, the BACT analysis for particulate matter is inadequate and the permitted emission rate does not reflect the lowest rate realistically achievable with the technology selected. Third, the BACT analysis for volatile organic compounds (“VOC”) is inadequate and the approach selected does not include technology commonly used in the pellet manufacturing industry to reduce VOC emissions.

The Southern Environmental Law Center (“SELC”) is a non-profit environmental organization dedicated to the protection of natural resources, communities, and special places in a six-state region of the Southeast. SELC works in all three branches of government to help create, implement, and enforce the laws and policies that govern how our environment is protected.

The Partnership for Policy Integrity is a non-profit organization that uses science, legal action, and strategic communications to promote sound energy policy.

Dogwood Alliance mobilizes diverse voices to protect Southern forests and communities from destructive industrial logging through community action, holding decision-makers accountable, catalyzing large-scale conservation, and advancing a 21st-century society that values forests for the many ways they sustain life. Dogwood Alliance represents approximately 6,000 members in North Carolina.

Clean Air Carolina is a nonprofit organization working to ensure cleaner air quality for all North Carolinians through education and advocacy and by working with our partners to reduce sources of pollution.

The Natural Resources Defense Council is an international nonprofit environmental organization with more than 8,500 North Carolina members and online activists. Since 1970, its lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment.

DEQ submitted the Draft Permit for public comment on September 18, and confirmed that the comment deadline is October 19. These comments are therefore timely. The commenters request that DEQ promptly send an electronic copy of any final permit for the Enviva wood pellet plant to the SELC representatives listed in the signature block at the end of these comments.

Permitting Background

The proposed Enviva wood pellet plant would be located in Hamlet, North Carolina, in Richmond County. The plant is designed to produce 537,625 oven-dried tons of wood pellets per year.¹ It would emit nearly 230,000 tons of carbon dioxide equivalents annually—far more than the 75,000 tons-per-year threshold that the U.S. Environmental Protection Agency (“EPA”) has determined to be “significant.”² The facility would also emit significant quantities of volatile organic compounds, particle pollution, carbon monoxide, and nitrogen oxides.³ The primary source of these emissions is the proposed plant's green-wood-fired dryer system, which is rated at 250.4 million British thermal units per hour (“Btu/hr”).⁴

Legal Background

Under the federal Clean Air Act and North Carolina's Air Pollution Control Act, any new major source of pollution must use the “best available control technology” to reduce pollutants

¹ N.C. Division of Air Quality, Draft Air Permit Review Including Preliminary Determination for Enviva Pellets Hamlet, LLC at 1 (Sept. 18, 2015) (“Preliminary Determination”).

² *Id.* at 19; 40 C.F.R. § 52.21(b)(49)(iv)(b).

³ Preliminary Determination at 2.

⁴ *Id.*

that it emits in significant quantities.⁵ BACT is defined as “the maximum degree of reduction . . . which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable”⁶

When determining BACT, the agency must consider “production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques”⁷

The purpose of BACT is to “minimize emissions of regulated pollutants.”⁸ BACT “ensure[s] that the most current and stringent pollution control technologies and emission limits are required before the source is built.”⁹ BACT requires a rigorous analysis to determine the maximum reduction achievable of a given pollutant:

any BACT analysis calls for a searching review of industry practices and control options, a careful ranking of alternatives, and a final choice able to stand as first and best. *If reviewing authorities let slip their rigorous look at “all” appropriate technologies, if the target ever eases from the “maximum degree of reduction” available to something less or more convenient, the result may be somewhat protective, may be superior to some pollution control elsewhere, but it will not be BACT.*¹⁰

“[T]he BACT definition requires permit issuers to ‘proceed[] on a case-by-case basis, taking a careful and detailed look, attentive to the technology or methods appropriate for the particular facility, [] to seek the result tailor-made for that facility and that pollutant.’”¹¹

If a permit imposes an emissions ceiling that does not reflect the “maximum degree” of pollution reduction, “the permit issuer is obliged to adequately explain its rationale for selecting a less stringent emissions limit.”¹² That rationale must be based on “energy, environmental, and economic impacts and other costs” that caused the agency to select something less than the “maximum degree” of pollution reduction.¹³ It is insufficient to make mere “conclusory statements that the measures and emissions limits selected constitute ‘appropriate’ BACT

⁵ 40 C.F.R. § 51.166(j)(2); 15A N.C. Admin. Code 02D .0530(g) (requiring compliance with 40 C.F.R. § 51.166(j)).

⁶ 42 U.S.C. § 7479(3).

⁷ *Id.*; 40 C.F.R. § 51.166(b)(12); 15A N.C. Admin. Code 02D .0530(b).

⁸ *In re Prairie State Generating Co.*, 13 E.A.D. 1, 10 (EAB 2006).

⁹ *United States v. Pac. Gas & Elec.*, 776 F. Supp. 2d 1007, 1013 (N.D. Cal. 2011).

¹⁰ *N. Mich. Univ. Ripley Heating Plant*, No. 08-02, 2009 WL 443976, at *10, 17 (EAB Feb. 18, 2009) (emphasis added).

¹¹ *Desert Rock Energy Co.*, No. 08-03–08-06, 2009 WL 3126170, at *28 (EAB Sept. 24, 2009) (quoting *N. Mich. Univ. Ripley Heating Plant*, 2009 WL 443976, at *8).

¹² *Newmont Nev. Energy Inv., LLC*, No. 05-04, 2005 WL 4905114, at *11 (EAB Dec. 21, 2005).

¹³ 42 U.S.C. § 7479(3); 40 C.F.R. § 51.166(b)(12); 15A N.C. Admin. Code 02D .0530(b).

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requirements with little to no analysis to support that determination and no representation that the requirements reflect the 'best' options or 'greatest reduction in emissions achievable.'"¹⁴

For decades, EPA and other permitting authorities have followed a clear "top-down" process to determine BACT and establish emissions limits in accordance with the Clean Air Act's requirements, as set out in EPA's Draft 1990 New Source Review Manual. This analysis has five steps: 1) identify all pollution control options with a "practical potential for application" to the facility; 2) eliminate technically infeasible options, based on physical, chemical, or engineering difficulties that preclude their successful use at the particular facility; 3) rank the remaining control technologies by their effectiveness at controlling emissions; 4) compare the energy, economic, and environmental impacts of each control alternative, beginning with the most effective, to determine whether those impacts render use of the measure inappropriate; and 5) establish BACT as the most effective control option that is not eliminated in step 4.

Even if an agency does not follow the recommended top-down approach, a valid BACT determination must "reflect[] a level of detail in the BACT analysis comparable to the methodology in the NSR Manual."¹⁵ "[A] final BACT determination which still fails to reflect adequate consideration of the factors that would have been relevant using a 'top-down' type of analysis shall be considered deficient."¹⁶

Other sections of the Clean Air Act similarly demand that the permitting authority consider alternatives to a proposed major source of air pollution, such as the proposed Enviva plant.¹⁷

I. DEQ failed to conduct a proper BACT analysis and set appropriate limits for greenhouse gas emissions.

(4) A. DEQ paradoxically identified the use of biomass fuel alone as the control technology for the use of biomass fuel.

The Draft Permit inappropriately lists the "use of biomass fuel" as the sole control technology for the use of biomass fuel in the Enviva dryer system.¹⁸ Yet the burning of biomass does nothing to control greenhouse gas emissions from the burning of biomass. DEQ's circular reasoning cannot suffice as the basis for a proper BACT limit.

Tellingly, the Draft Permit's BACT limit on annual greenhouse gas emissions (230,000 tons per year) is *higher* than the estimate of *uncontrolled* emissions (229,828 tons per year),

¹⁴ *In re ConocoPhillips Co.*, 13 E.A.D. 768, 793 (EAB 2008).

¹⁵ *General Motors, Inc.*, 10 E.A.D. 360, 366 (EAB 2002).

¹⁶ See *Plumbers & Steamfitters, Local 52 v. Ala. Dep't of Env'tl. Mgmt.*, 647 So. 2d 793, 795 (Ala. Civ. App. 1994) (quoting a December 1, 1987, EPA memorandum).

¹⁷ See 42 U.S.C. § 7475(a)(2).

¹⁸ Draft Permit at 12.

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confirming that the use of biomass fuels does not control or reduce emissions from burning biomass.¹⁹ An emissions rate that exceeds the estimate of uncontrolled emissions cannot constitute the “maximum degree of reduction . . . achievable” required by BACT.

Finally, although the Preliminary Determination for the Draft Permit identifies numerous energy efficiency options that could improve fuel efficiency and lower the facility’s carbon intensity,²⁰ DEQ did not formalize these as requirements in the Draft Permit itself or lower the greenhouse gas emission limit based on this potential. The result is ambiguity and a proposed permit limit that does not reflect the reduction potential of measures that even DEQ determined were technically feasible and cost-effective.²¹

(11) **B. DEQ deliberately declined to consider alternative fuels that would dramatically reduce greenhouse gas emissions.**

Despite DEQ’s admission that Enviva itself identified “firing of lower carbon fuel” in its dryer as a “technically feasible option” for reducing greenhouse gas emissions, DEQ declined to consider any fuel other than biomass in its BACT analysis.²² DEQ thus failed to meet the Clean Air Act’s basic requirement to consider alternatives and “clean fuels” as part of the BACT analysis.²³

The only support that DEQ attempts to offer for its failure to consider lower-carbon fuels is that “EPA has recognized [biomass] as a GHG beneficial fuel due to its renewable nature.”²⁴ This blanket statement avoids the case-by-case analysis and “careful and detailed look” necessary to determine a BACT limit that is “tailor-made” for this Enviva facility,²⁵ and cannot justify omitting the analysis required under BACT.

First, in the recently published Clean Power Plan, EPA acknowledges that biomass is not inherently carbon-neutral. EPA recognizes that

that it is not scientifically valid to assume that all biogenic feedstocks are ‘carbon neutral’ and that the net biogenic CO₂ atmospheric contribution of different biogenic feedstocks generally depends on various factors related to feedstock characteristics, production, processing and combustion practices, and, in some cases, what would happen to that feedstock and the related biogenic emissions if not used for energy production.²⁶

¹⁹ Preliminary Determination at 5, 7.

²⁰ *Id.* at 18.

²¹ *Id.*

²² *Id.*

²³ 42 U.S.C. §§ 7475(a)(2), 7479(3); 40 C.F.R. § 51.166(b)(12); 15A N.C. Admin. Code 02D .0530(b).

²⁴ Preliminary Determination at 18.

²⁵ See *Desert Rock Energy Co.*, 2009 WL 3126170, at *28

²⁶ EPA, Prepublication Version of the Clean Power Plan at 1160 (Aug. 3, 2015) (emphasis added).

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As a result, the Clean Power Plan requires states that attempt to use biomass for compliance to “describe the types of biomass that are being proposed for use under the state plan and how those proposed feedstocks or feedstock categories should be considered as ‘qualified biomass,’” which is defined as “a biomass feedstock that is demonstrated as a method to control increases of CO₂ levels in the atmosphere.”²⁷ States that propose to rely on qualified biomass must also show that any carbon reductions are “quantifiable, verifiable, enforceable, non-duplicative and permanent.”²⁸ Without demonstrating that particular biomass projects will curb carbon levels in the atmosphere, states cannot blindly rely on biomass as a carbon reduction measure.

Furthermore, study after study has shown that biomass actually increases carbon emissions as compared to traditional fossil fuels. When burned to generate thermal energy, as would be the case with the facility’s wood-fired dryer, biomass emits more than *twice* the amount of carbon that natural gas emits per unit of heat produced.²⁹ The following chart, excerpted from a report by the Manomet Center for Conservation Sciences,³⁰ shows the high carbon intensity of biomass as compared to other fuels:

²⁷ *Id.* at 1165, 1552 (emphasis added).

²⁸ *Id.* at 1168.

²⁹ See Manomet Center for Conservation Sciences, *Biomass Sustainability and Carbon Policy Study* at 103 (June 2010), attached as Ex. 1. Biomass that is burned to generate electricity emits even more carbon than coal, and over three times as much carbon as natural gas. *Id.*; see also Biomass Energy Resource Center et al., *Biomass Supply and Carbon Accounting for Southeastern Forests* at 63 tbl.25 (Feb. 2012), attached as Ex. 2 (similarly showing that carbon dioxide emissions from wood power plants dwarf emissions from coal and natural gas power plants).

³⁰ See Manomet Center for Conservation Sciences, *Biomass Sustainability and Carbon Policy Study* at 103 (June 2010).

SELAC

**Exhibit 6-6: Carbon Emission Factors by Technology*
 Kilograms per Unit of Energy****

Scenarios	Biomass	Coal	Oil (#6)	Oil (#2)	Natural Gas
Utility-Scale Electric					
Kilograms/MWh					
Fuel Prod & Transport	7	9			34
Fuel Combustion	399	270			102
Total	406	279			136
Thermal					
Kilograms/MMBtu					
Fuel Prod & Transport	1		6	6	6
Fuel Combustion	35		27	25	17
Total	36		33	31	23
CHP					
Kilograms/MMBtu					
Fuel Prod & Transport	1		7	6	6
Fuel Combustion	35		29	27	18
Total	36		35	33	24

** As discussed below, emissions factors for pellets are characterized relative to the thermal technology using green chips which is shown in this table.*

*** Sources and calculations for these data are described in the text.*

Biomass combustion also emits far more carbon than other low and zero emission technologies available in North Carolina, such as solar and wind power.

DEQ did not attempt to compare the reduction potential of various fuels or rank the effectiveness of these technologies. Instead, it relied on exactly the sort of impermissible “conclusory statements that the measures and emissions limits selected constitute ‘appropriate’ BACT requirements,” that have been rejected as inadequate, with “little to no analysis to support that determination and no representation that the requirements reflect the ‘best’ options or ‘greatest reduction in emissions achievable.’”³¹ Without a full life-cycle analysis of reduction potential, DEQ cannot assert that biomass is a clean fuel or summarily dismiss other lower-emission technologies.³²

Moreover, DEQ imposes no requirement on Enviva to ensure that these elevated biomass emissions are offset through forest regrowth and carbon uptake. Because the permit does not require the emissions from Enviva’s smokestacks to be recaptured in the near term, the increases in greenhouse gas emissions from burning biomass will go unchecked. Moreover, the elevated

³¹ See *ConocoPhillips Co.*, 13 E.A.D. at 793.

³² Numerous commenters, including SELC, have explained the need for a case-by-case life-cycle analysis of biomass emissions in greater detail in their comments criticizing EPA’s 2011 proposed guidance for treatment of carbon emissions in air permits. See Comments of Clean Air Task Force, *et al.*, EPA-HQ-OAR-2011-0083-0350 (May 5, 2011), attached as Ex. 3.

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carbon levels generated by biomass combustion, compared to alternative low- and zero-emission fuel sources, would persist for decades before forest replenishment can begin to abate these excess emissions.

(11) **C. DEQ lacks clear authority to consider off-site sequestration to offset emissions in a BACT analysis.**

DEQ's summary rejection of lower-carbon fuels appears to be based on the unwritten, un-mandated assumption that Enviva's emissions will be offset through off-site reforestation and sequestration. Not only is there no basis for this assumption or requirement for Enviva to engage in off-site sequestration, there is no clear authority in section 165 or 169 of the Clean Air Act for DEQ to consider such off-site efforts.³³

SELC Comment #2
2
II. DEQ failed to select BACT for particulate matter.

(1) **A. DEQ did not limit condensable PM₁₀ or PM_{2.5} as required.**

Under federal rules, permit limits for coarse particulate matter ("PM₁₀") and fine particulate matter ("PM_{2.5}") must include the condensable PM₁₀ and PM_{2.5} fraction emitted by a source.³⁴ The Draft Permit does not set a limit on condensable particulate matter,³⁵ and must be revised to do so.

(10) **B. DEQ likely underestimated particulate matter emissions.**

The proposed facility's dryer system employs a wood-fired burner of 250.4 million Btu/hr.³⁶ The permitted emissions rate is 0.105 lb of filterable particulate matter ("PM"), PM₁₀, and PM_{2.5} per ton of pellets processed.³⁷ At the hourly pellet production rate identified in the permit review document of 71.71 tons per hour,³⁸ this emission rate equals 7.529 pounds of filterable PM per hour. Divided by the burner capacity of 250.4 million Btu, this translates to a rate of 0.03 pounds per million Btu.³⁹ However, while the Draft Permit contains an annual production limit of 537,625 tons of pellets per year,⁴⁰ there is no enforceable hourly pellet production limit in the permit. Because allowable emissions are tied to pellet production rates, the actual hourly PM, PM₁₀, and PM_{2.5} emissions could be higher than those calculated above, if the hourly pellet production rate exceeds 71.71 tons per hour. The permitted emission rates

³³ See 42 U.S.C. §§ 7475, 7479(3) (defining BACT as "the maximum degree of reduction of each pollutant . . . emitted from or which results from any major emitting facility" (emphasis added)).

³⁴ 40 C.F.R. §§ 51.166(b)(49)(i), 52.21(b)(50)(i).

³⁵ Draft Permit at 12.

³⁶ *Id.* at 3.

³⁷ *Id.* at 12.

³⁸ See Preliminary Determination at 8.

³⁹ *Id.*

⁴⁰ Draft Permit at 13.

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should be expressed as independent rates that are not contingent on hourly pellet production rates.

(iii) **C. DEQ's air quality modeling for PM likely underestimates impacts.**

Presumably, the air quality modeling conducted in support of the permit assumed the facility would have a PM₁₀/PM_{2.5} emissions rate of 0.03 pounds per million Btu. But if the actual operating rate is higher than that rate, due to the absence of hourly limits described above, the modeled results cannot be considered representative.

Further, it is not clear whether the air quality modeling included both filterable and condensable PM_{2.5}, as required by EPA's current guidance for PM_{2.5} modeling,⁴¹ or whether it assessed filterable PM_{2.5} alone.

Finally, it is not clear whether DEQ assessed secondary impacts of other precursor pollutants in the formation of PM. Given the large amounts of VOCs the facility is permitted to emit, and given the potential role of VOCs in the formation of secondary PM, the modeling for this facility should have been conducted in the most conservative manner possible. This does not appear to have been the case. For instance, it is not clear which monitors were used to provide background data, or why particular monitors were chosen. The permit review states that the Cumberland County monitor was used to provide background concentrations of PM₁₀ and PM_{2.5}, but also that the Duplin County monitor was used to provide background concentrations of PM_{2.5}.⁴² The reasons for using the Duplin monitor are not immediately clear, since it is located approximately 100 miles east of the facility site, and there are three other air quality monitoring sites measuring PM_{2.5} (Candor, Blackstone, and Owen School, the monitor in Cumberland County) within 30 to 50 miles from Hamlet.⁴³

(iv) **D. DEQ's PM emission rate does not reflect BACT.**

The PM emission rate of 0.03 pounds per million Btu is approximately double that considered to be achievable in coal plant permits using similar technology. For instance, a document submitted to DEQ by Duke Energy discusses that company's intent to achieve a limit of 0.015 pounds per million metric Btu filterable PM₁₀ for a coal plant using a wet electrostatic precipitator system.⁴⁴ The document discusses a number of facilities and includes discussion of permits that constrain both filterable and condensable PM_{2.5}/PM₁₀ to be lower than 0.03 pounds per million Btu. A rate of 0.03 pounds per million Btu that includes both filterable and

⁴¹ EPA, Guidance for PM_{2.5} Permit Modeling (May 20, 2014), available at http://www3.epa.gov/scram001/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf.

⁴² Preliminary Determination at 20.

⁴³ DEQ, NC Ambient Air Monitors, https://www.google.com/maps/d/viewer?mid=zJ_D8n5-ybOO.kGcRoL4sWaZg (last visited Oct. 19, 2015).

⁴⁴ Duke Power Cliffside Units 6 & 7 Permit Application, PM₁₀ Emission Limits for New Coal Boilers, available at http://daq.state.nc.us/permits/psd/docs/cliffside/PM10_BACT_Limits_for_Cliffside_New_Gen.pdf.

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condensable $PM_{2.5}/PM_{10}$ may not actually be BACT; this rate is certainly not BACT if it only includes filterable $PM_{2.5}/PM_{10}$.

The applicant should be compelled to perform a real BACT analysis, and the permit should be revised to include enforceable emission rates that include both filterable and condensable $PM_{2.5}/PM_{10}$ and that do not depend on pellet production rates. The modeling should also be conducted to choose conservative background $PM/PM_{2.5}/PM_{10}$ concentrations and to model total $PM/PM_{2.5}/PM_{10}$ and secondary condensable $PM/PM_{2.5}/PM_{10}$ formation.

It is especially important that DEQ correct all of these errors, given the high existing $PM_{2.5}$ concentrations in the area and the significant quantities of $PM_{2.5}$ that the proposed facility will add. EPA's AirNow site for North Carolina shows that large areas of the state, including the Hamlet region, have a status of "moderate" air quality for $PM_{2.5}$ for a significant part of the year.⁴⁵ Thus existing PM concentrations are already high enough to affect sensitive populations, such as people with pre-existing respiratory conditions.⁴⁶ Since the Enviva facility is likely to significantly increase particulate matter pollution in the region, it is important that the emission controls be as effective as possible.

The air quality modeling, whether or not it included condensable $PM_{2.5}$, found fairly significant impacts from the Enviva facility. The facility's emissions will more than double the concentration of PM_{10} in the area on a 24-hour basis⁴⁷ and will consume 99% of the region's PM_{10} increment, limiting future industrial growth in the region.⁴⁸ With facility impacts, the modeling shows the area will be at 63% and 82% of the 24-hour and annual $PM_{2.5}$ NAAQS, respectively.⁴⁹

SELC
comment #3
C

III. DEQ's BACT analysis for VOCs is inadequate.

The wood pellet production process is a significant source of VOCs. VOCs are implicated in tropospheric ozone formation, and some may play a role as greenhouse gases, though the chemistry is complex and not well understood. Some VOCs are also regulated as hazardous air pollutants ("HAPs") due to their toxic or carcinogenic effects. As discussed in a recent edition of Biomass Magazine,⁵⁰ controlling VOCs is a well-recognized priority in the pellet manufacturing industry, and use of regenerative thermal oxidation or regenerative catalytic

⁴⁵ Air quality maps for July 2015, for instance, may be viewed at <http://airnow.gov/index.cfm?action=airnow.mapsarchivecalendar&maptype=pm25peak&domainid=14&calyear=2015&calmonth=7> (last visited Oct. 19, 2015).

⁴⁶ AirNow, Air Quality Index Basics, <http://www.airnow.gov/index.cfm?action=aqibasics.aqi#mod> (last visited Oct. 19, 2015).

⁴⁷ Preliminary Determination at 20 tbl.3.

⁴⁸ *Id.* at 21 tbl.4.

⁴⁹ *Id.* at 20 tbl.3.

⁵⁰ Malcolm Swanson, *Pellet Plant VOCs: Best Practices in Control*, Biomass Magazine (Feb. 27, 2015), available at <http://biomassmagazine.com/articles/11579/pellet-plant-vocs-best-practices-in-control>.

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oxidation—two technologies considered in the proposed facility’s BACT analysis and rejected on the basis of being too expensive—is widespread.

In fact, the technology that was chosen as BACT at the proposed facility is no technology at all. Following a discussion of the various options, the permit review document abruptly states that for the dryer, “[t]he applicant proposes a BACT limit of 1.07 lb VOC/ODT [“oven dry ton”] on an annual average basis based on good operating and maintenance procedures. NCDAQ agrees with the applicant’s proposed BACT.”⁵¹ The same conclusion is reached for the pellet cooler, which is assigned an emission rate of 0.85 lb VOC/ODT. Combined, these rates are more than 10 times higher than the 0.08 lb/ODT rate that would be achieved with add-on controls.

Different types of wood emit different amounts of VOCs when pelletized. Part of the “good operating” procedures as a means to control VOCs, and a condition in the permit, is the requirement that the facility not process more than 75% softwood, meaning that at least 25% of the facility’s feedstock must be hardwood.⁵² This permit condition ensures that the facility will be compelled to source wood from native hardwood forests, even if adequate wood from pine plantations is available. This will significantly increase the environmental footprint of the facility.

A comparison with other large pellet facilities shows how inadequate the overall BACT process for the Hamlet facility has been. Enviva has recently purchased the former Green Circle Bio Energy facility in Cottondale, Florida. A comparison to that facility’s permit⁵³ is revealing. The Cottondale plant processes more than 95% yellow pine and is subject to no requirement to include hardwood. It is a larger facility than the Hamlet plant, with three pelletizing lines that are constrained by the permit to produce no more than 610,000 tons per year, a 13% greater capacity than the 537,625 ton-per-year limit at the Hamlet facility. Although it is larger, the dryer capacity is the same (two 125-million-metric Btu/hr dryers). The Cottondale facility uses a regenerative thermal oxidizer to reduce VOC emissions; as a consequence, its permit specifies an emission limit of 243 tons per year, just 40% of the emissions at the Hamlet facility, despite its larger capacity. The limit for VOCs in the Draft Permit therefore does not represent BACT, and must be revised.⁵⁴

⁵¹ Preliminary Determination at 11.

⁵² Draft Permit at 12.

⁵³ Final Permit for Green Circle Bio Energy, No. 0630058-013-AV; Revision to Title V Air Operation Permit No. 0630058-005-AV (July 9, 2013), *available at* <http://webapps.dep.state.fl.us/DarmAircom/public/showPIFacInformationAction.action?armsFacilityId=8601>.

⁵⁴ In the course of investigating Enviva’s operations, we compared the Hamlet permit with the permit for the Enviva facility in Ahoskie. We note that, while the Ahoskie permit specifies an emission rate for VOCs from the dryer, it does not specify a rate from the pellet cooler. Since emissions from the dryer and the cooler at the Hamlet facility are similar, the lack of an emissions cap for the cooler at the Ahoskie facility seems a serious omission. We also note that the Ahoskie facility was permitted as a minor source and was not required to go through PSD permitting. If the emissions from the cooler at the Ahoskie plant are comparable to the emissions from the dryer, the facility is emitting more than 250 tons of VOCs and should be regulated as a major source under PSD.

Kevin Godwin
Division of Air Quality
October 19, 2015
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SELC

Conclusion

For all of these reasons, DEQ should rescind the Draft Permit, conduct a proper BACT analysis, and revise the Draft Permit to include appropriate greenhouse gas, particle pollution, and VOC limits that reflect the maximum degree of reductions achievable through lower-carbon fuels and other measures.

Respectfully submitted,



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David Carr
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601 West Rosemary Street, Suite 220
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*On behalf of Dogwood Alliance, Clean Air
Carolina, Natural Resources Defense Council, and
Partnership for Policy Integrity*

MDB/lap
Enclosures
Cc (via email only):
Heather Ceron, Air Permits Section Chief, EPA Region 4

Zoning Consistency Determination

Received
JAN 15 2014
Air Permits Section
RECEIVED JAN 07 2015

Facility Name Enviva Pellets Hamlet, LLC
Facility Street Address US Highway 117 (Street Number TBD)
Facility City Hamlet
Description of Process Wood pellet manufacturing facility
SIC Code/NAICS SIC - 2499 ; NAICS - 321999
Facility Contact Joe Harrell
Phone Number (252) 209-6032
Mailing Address 142 NC Route 561 East
Mailing City, State Zip Ahoskie, NC 27910

Based on the information given above:

- I have received a copy of the air permit application (draft or final) AND...
- There are no applicable zoning and subdivision ordinances for this facility at this time
- The proposed operation IS consistent with applicable zoning and subdivision ordinances
- The proposed operation IS NOT consistent with applicable zoning and subdivision ordinances (please include a copy of the rules in the package sent to the air quality office)
- The determination is pending further information and can not be made at this time
- Other: _____

Agency Richmond County Planning
Name of Designated Official James Armstrong
Title of Designated Official Director of Planning & GIS Services.
Signature James Armstrong
Date 1/7/14

Please forward to the mailing address listed above and the air quality office at the appropriate address as checked on the back of this form.



January 14, 2014

Dr. Donald R. van der Vaart, P.E.
Chief Air Permits Section
North Carolina Division of Air Quality
217 West Jones Street
Raleigh, NC 27603

Received

JAN 15 2014

Air Permits Section

Re: PSD Pre-construction Permit Application
Enviva Pellets Hamlet, LLC
Hamlet, NC

Dear Dr. Van der Vaart:

On behalf of Enviva Pellets Hamlet, LLC, please find attached six copies of a PSD pre-construction permit application for a proposed pellet manufacturing facility to be located near Hamlet, NC. The enclosed application addresses the PSD requirements for VOC, NOx, PM, PM₁₀ and PM_{2.5}, preconstruction MACT for HAPs under CAA Section 112(g), the state SIP requirements, and the state only air toxic requirements. This application was developed in accordance with the current DAQ pre-construction regulations and other DAQ pre-construction application guidance.

If you have any questions regarding this application, please feel free to contact me at (919) 462-9693.

Sincerely,

Dale Overcash, P.E.
Principal Consultant

Cc: Mr. Michael Doniger, Enviva
Mr. Joe Harrell, Enviva
Mr. Alan McConnell, Kilpatrick Townsend

Enviva Development Holdings, LLC
 7200 Wisconsin Ave.
 Suite 1000
 Bethesda, MD 20814
 USA

Citibank, N.A.
 One Penn's Way
 New Castle, DE 19720
 62-20/311

No. 000004029

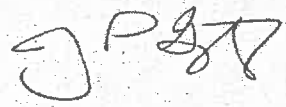
CHECK DATE
 1/9/2014

PAY THIS AMOUNT
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Security Features Included Details on Back

PAY Thirteen thousand eight hundred twenty-seven and xx / 100 Dollars

TO THE ORDER OF
 NC Dept of Environmental & Natural Res
 Division of Air Quality
 2728 Capital Blvd
 Raleigh, NC 27604
 USA



 AUTHORIZED SIGNATURE

⑈0000004029⑈ ⑆031100209⑆ 38872568⑈

VENDOR: NCDENR Enviva Development Holdings, LLC CHECK: 000004029 DATE: 1/9/2014
 REMIT TO: NC Dept of Environmental & Natural Res COMMENT:

INVOICE	DATE	VOUCHER	COMMENT	AMOUNT	DISCOUNT	NET AMOUNT
JAN072014	1/7/2014	0000000071		13,827.00	0.00	13,827.00
TOTALS:				13,827.00	0.00	13,827.00

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APPENDIX B - EMISSIONS CALCULATIONS

APPENDIX C - TAP MODELING SUPPORT

APPENDIX D - ELECTRONIC MODELING FILES

APPENDIX E - ZONING CONSISTENCY DETERMINATION

Received

JAN 15 2014

Air Permits Section

ENVIVA PELLETS HAMLET, LLC • RICHMOND COUNTY, NORTH CAROLINA

PSD AIR QUALITY CONSTRUCTION AND OPERATING PERMIT APPLICATION

Prepared By:

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January 2014

Project 133401.0069

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Consultants

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1. INTRODUCTION

Enviva Pellets Hamlet, LLC (Enviva) is planning to construct and operate a wood pellets manufacturing plant in Richmond County, NC. The proposed wood pellets plant is designed to produce up to 575,000 oven-dried tons (ODT) per year of wood pellets utilizing up to 75% softwood on a 12-month rolling total basis. The proposed plant consists of log chipper, green wood hammermill, bark hog, 175.3 MMBtu/hr dryer, hammermills, pellet presses and coolers, production loading operations and other ancillary activities described in detail in Section 2.0. Construction of the facility is anticipated to begin in 2014.

Enviva manufactures wood pellets for use as a renewable fuel for energy generation and industrial customers. Enviva's customers use wood pellets in place of coal, significantly reducing emissions of pollutants such as carbon dioxide, mercury, arsenic and lead. The company is dedicated to improving the environmental profile of energy generation while promoting sustainable forestry in the southeastern United States. Enviva holds certifications from the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) and the Programme for the Endorsement of Forest Certifications (PEFC). Enviva requires that all suppliers adhere to state-developed "Best Management Practices" (BMPs) in their activities to protect water quality and sensitive ecosystems. In addition, Enviva is implementing an industry leading "track and trace" system to further ensure that all fiber resources come from responsible harvests. We pay particular attention to: land use change, use and effectiveness of BMPs, wetlands, biodiversity and certification status. All of this combined ensures that Enviva's forestry activities contribute to healthy forests both today and in the future.

1.1. REGULATORY APPLICABILITY

This document comprises an air quality construction and operating permit application for the project. The proposed project triggers PSD review as a new major source of volatile organic compounds (VOCs), and with potential emissions from the project exceeding the PSD Significant Emission Rates (SERs) for nitrogen oxides (NO_x), and particulate matter (PM, also called total suspended particulate [TSP]), particulate matter less than 10 or 2.5 microns in aerodynamic diameter (PM₁₀ and PM_{2.5}). For each pollutant that is major and exceeds PSD SER, an evaluation of Best Available Control Technology (BACT) to reduce emissions is provided.

Air quality modeling analyses are required for criteria pollutants subject to PSD review, as well as modeling for certain toxic air pollutants (TAPs) in accordance with relevant North Carolina Division of Air Quality's (NC DAQ's) regulations. This application conforms to all permitting requirements and demonstrates that the proposed facility will operate in accordance with those requirements. It should be noted that the project will not cause or contribute to violations of the National and State Ambient Air Quality Standards (NAAQS and SAAQS) and PSD Increments, will not result in adverse impacts to federally protected Class I areas, and will utilize Best Available Control Technology (BACT) for each compound subject to PSD review. In addition to the major regulatory requirements highlighted above, this permitting action will trigger several other state requirements addressed in this application.

1.2. BACT DETERMINATION

Enviva performed BACT analyses for each of the PSD-regulated pollutants and emission units subject to PSD review following the "top-down" approach required by U.S. EPA. The top-down

process begins by ranking all potentially relevant control technologies in descending order of control effectiveness. The most stringent or "top" control option is identified as BACT unless the applicant demonstrates, and the permitting authority in its informed opinion agrees, that energy, environmental, and/or economic impacts justify the conclusion that the most stringent control option does not meet the definition of BACT. Where the top option is not determined to be BACT, the next most stringent alternative is evaluated in the same manner. This process continues until BACT is determined. BACT evaluations are provided in Section 4 of this report.

1.3. AIR QUALITY ANALYSIS

The air dispersion modeling and other air quality analyses required under PSD are provided in Section 5 of this report. Following NCDAQ policy, Trinity Consultants (Trinity), on behalf of Enviva, submitted a dispersion modeling protocol describing the proposed methodologies and data resources for the project.¹ The protocol included a description of the proposed facility, an overview of the required PSD and State-only modeling analyses, and a description of the methodology proposed to be used in those modeling analyses. The analyses discussed included evaluations of National Ambient Air Quality Standards (NAAQS), PSD Increment, additional impacts analyses for visibility and non-air quality impacts, as well as the ambient impact assessment of toxic air pollutant (TAP) emissions. The protocol was approved by NCDAQ, with limited comments on January 6, 2014.²

The modeling analyses demonstrate that the project will not cause or contribute to an exceedance of any National Ambient Air Quality Standards (NAAQS) or Class II PSD Increment requirements. An additional impacts analysis is also included in Section 5.

1.4. APPLICATION ORGANIZATION

Six copies of the application have been provided along with the \$13,837 permit application processing fee. This application is comprised of the following:

- Section 1 provides an Executive Summary,
- Section 2 provides a project description and discusses air emissions,
- Section 3 discusses regulatory applicability,
- Section 4 summarizes the BACT analysis,
- Section 5 summarizes the air dispersion modeling analysis,
- Appendix A contains air permit application forms,
- Appendix B presents air emissions calculations,
- Appendix C contains the required local zoning consistency determination,
- Appendix D contains BACT tables,
- Appendix E contains modeling plots,
- Appendix F contains PSD modeling flowchart,
- Appendix G contains the regional source inventory, and
- Appendix H contains the electronic modeling files.

¹ Letter from Jonathan Hill (Trinity) to Mark Cuilla (NCDAQ) dated December 17, 2013.

² Letter from Tom Anderson (NCDAQ) to Jonathan Hill (Trinity) dated January 6, 2014.

the 1990s, the number of people in the world who are under 15 years of age is expected to increase from 1.1 billion to 1.5 billion.

There are a number of reasons why the world's population is growing so rapidly. One of the main reasons is that the number of children born to each woman has increased. This is due to a number of factors, including the fact that women are now having children at a younger age, and that there are more children surviving to adulthood.

Another reason why the world's population is growing so rapidly is that the number of people who are surviving to old age has increased. This is due to a number of factors, including the fact that people are now living longer, and that there are more people surviving to old age.

There are a number of other factors that are contributing to the world's population growth, including the fact that there are more people surviving to old age, and that there are more people surviving to old age.

The world's population is growing so rapidly that it is expected to reach 8 billion by the year 2025. This is a significant increase from the 5 billion people who lived in the world in 1987.

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2. PROCESS DESCRIPTION AND AIR EMISSIONS

The proposed wood pellets plant is designed to produce up to 575,000 oven-dried tons (ODT) per year of wood pellets utilizing up to 75% softwood on a 12-month rolling total basis. This section discusses the Hamlet Plant's pelletizing process and associated air emissions for the proposed plant, which consists of the following:

- Green wood handling and sizing operations;
- Green wood fuel storage bin;
- Log debarker;
- Log bark hog;
- Log chipper;
- Two (2) green wood hammermills;
- Portable chipper;
- Eight (8) dry wood hammermills controlled by eight cyclones and three fabric filtration systems;
- Hammermill area emissions controlled by a hammermill fabric filter;
- A pellet mill feed silo controlled by bin vent filter;
- Twelve (12) wood pellet presses and six (6) pellet coolers controlled via cyclones;
- One 175.3 MMBtu/hr green wood direct-fired dryer system with pollution control equipment consisting of a three simple cyclones and wet electrostatic precipitator (WESP) for particulate matter abatement;
- Finished product storage and loading controlled by a fabric filter;
- Pellet fines bin controlled via a bin vent filter;
- Dried wood handling operations;
- Three (3) diesel storage tanks;
- Emergency electric generator; and
- Fire water pump.

Detailed air emissions calculations are presented for each source discussed in this section in Appendix B. A process flow diagram is presented in Figure 2-1.

2.1. GREEN WOOD HANDLING AND SIZING, FUEL STORAGE BIN, AND STORAGE PILES

“Green” (i.e., wet) wood will be delivered to the facility via trucks as either pre-chipped wood or unchipped low grade wood fiber; tops, limbs, and logs from commercial thinning for on-site chipping. Pre-chipped wood will be screened and oversized chips will undergo additional chipping. Unchipped wood will be debarked and chipped to specification for drying in the on-site electric-powered debarker (IES-DEBARK-1), chipper (ES-CHIP-1), and two green wood hammermills (ES-GHM-1, ES-GHM-2) as required. Chipped wood for drying is conveyed to a chipped wood storage pile while bark is conveyed to a bark fuel storage pile (IES-GWFB).

Green wood and bark contains a high moisture content approaching 50 percent by weight. Therefore, green wood handling and sizing, fuel storage bin, and storage piles have negligible emissions and are included on the insignificant activities list. Representative drop point emission calculations using AP-42 Section 13.2.3 for Aggregate Handling are attached in Appendix B for green wood handling and sizing to demonstrate that these emissions are negligible.

Fugitive particulate emissions from chipped wood storage piles are quantified in Appendix B. Emission factors were developed based on surface area of the piles in accordance with U.S. EPA guidance for active storage pile fugitive emissions.³ These factors provide estimates of PM emissions due to wind erosion at the surface of each storage pile based on the annual frequency of high wind speeds (> 12 mph).

In addition to particulate matter emission, volatile organic compounds are also emitted from the storage pile. Emission factors were obtained from a National Council for Air and Stream Improvement (NCASI) document provided by SC DHEC for the calculation of fugitive VOC emissions from woody biomass storage piles. Emission factors ranged from 1.6 to 3.6 lb VOC as carbon/acre-day. Enviva chose to employ the maximum emission factor to be conservative. Emission factors are provided in pounds of carbon per surface area of the pile. Detailed calculations are included in Appendix B.

2.2. DEBARKING, CHIPPING, GREEN WOOD HAMMERMILLING, PORTABLE CHIPPER, AND BARK HOG

Bark is removed from unchipped wood prior to chipping in rotary drum debarkers. There are no current AP-42 emission factors or other emission factors available for debarkers, and visual observation of these units in operation at other Enviva plants indicate that emissions are negligible due to the high moisture content of bark and the wind break provided by the drums.

Emission estimates for the chipper and bark hog are based on limited emission factors available for wood chipping. As shown in the attached emissions calculations (Appendix B), VOC emissions from these sources are calculated using emission factors from AP-42 Section 10.6.3 emission factors for hardwood chipping emissions. Methanol emissions are also calculated using factors from AP-42, Sections 10.6.3 and 10.6.4. Particulate matter (PM) emissions will be negligible from

³ U.S. EPA *Control of Open Fugitive Dust Sources*, Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988.

the green wood chipper (ES-CHIP-1) because the exhaust is directed downward towards the ground.

VOC emission estimates for the green wood hammermills (ES-GHM-1 and 2) are based on AP-42 Section 10.6.2 emission factors. PM emissions from the green wood hammermills will be combined into a single stack and controlled via a cyclone. Particulate emissions from the green wood hammermills are based on air flow rate and a cyclone outlet particulate matter grain loading factor of 0.020 gr/ft³.

In addition to the main chipper (ES-CHIP-1), a portable green wood chipper (ES-CHIP-2) may be used at the site periodically. This chipper may either be a rental unit or a unit owned by Enviva and may either be electric-powered or a diesel-fired unit of up to 1,300 brake horsepower. Only emissions from engine combustion were included in Appendix B, since chipping emissions have already been accounted for by the main chipper and the portable chipper will only be used periodically. Per vendor specifications, criteria emissions factors are consistent with NSPS Subpart IIII Tier 2 engines. Hazardous air pollutant (HAP) emission factors are obtained from AP-42 Section 3.3.

2.3. WOOD DRYER (ES-DRYER)

Green wood is conveyed to a single rotary dryer system. Direct contact heat is provided to the system via a 175.3 MMBtu/hr total heat input burner system using bark and wood chips as fuel. Air emissions are controlled by three identical simple cyclones to capture bulk particulate matter. Emissions from each of the cyclones are combined into a common duct and are routed to the wet electrostatic precipitator (WESP) for additional particulate, metal HAP, and hydrogen chloride removal.

Criteria pollutant emissions are calculated using a combination of AP-42 emission factors and existing stack testing results from Enviva's Ahoskie facility. The reader should refer to detailed footnotes in Appendix B for details of the origin of each factor.

HAP and TAP emissions were calculated from combustion of wood in the dryer using AP-42 Section 1.6 and control of metal HAP emissions via the WESP. In addition to HAP and TAP emissions from combustion of wood in the dryer, HAPs and TAPs are also released during the drying of wood. Emission factors for green, direct wood-fired softwood were obtained from AP-42, Section 10.6.2. To account for hardwood HAP and TAP emissions, factors were conservatively calculated by taking the AP-42 HAP factors for 100% softwood (green) and multiplying by the ratio of the total listed VOC emission factors for hardwood and softwood (0.24 / 4.7).

2.4. DRIED AND SIZED WOOD HANDLING (IES-DWH)

Dried materials are transferred from the dryer via conveyors to screening operations that remove smaller size wood particles prior to transfer into hammermills for further size reduction prior to pelletization. Smaller particles passing through the screens are diverted to the hammermill discharge conveyor, while oversized wood is diverted to the hammermills. Dust generated from transfer operations around the screening operation is diverted to the hammermill area filtration system, which is described in the following subsection. There are several other transfer points comprising an insignificant emission source designated as "IES-DWH", dried and sized wood

handling, located between the dryer and hammermills that are completely enclosed with no emissions.

2.5. HAMMERMILLS (ES-HM-1 THROUGH 8)

Prior to pelletization, dried materials are reduced to the appropriate size needed for pelletization using eight hammermills operating in parallel. A conveyor system receives the ground wood from the hammermills and sends it to the pellet mill feed silo.

Particulate emissions from each of the eight hammermills are controlled using cyclones, which are subsequently controlled by fabric filters. The first three cyclones are directed to hammermill filter HM-BF1. The second three cyclones are directed to hammermill filter HM-BF2. The last two cyclones are directed to hammermill filter HM-BF-3. Appendix B summarizes the emissions from each hammermill bagfilter system. Particulate matter emissions from each bagfilter are calculated using a manufacturer guaranteed grain loading factor for the wood particulates and the maximum nominal stack flow rate.

VOC, HAP, and TAP emissions are calculated using AP-42 factors, adjusted to account for the ratio of emissions as shown in Appendix B.

2.6. HAMMERMILL AREA EMISSIONS (ES-HMA)

An induced draft fan is used to transfer dust generated from a number of enclosed transfer/handling sources around the hammermill to one of the three hammermill bagfilters (CD-HM-BF3). The sources controlled by this bagfilter include, but are not limited to, the following:

- Emissions from the seventh and eighth hammermill;
- Hammermills infeed and distribution transfer;
- Pellet cooler transfer (particulate emissions from pellet cooler cyclones large enough to drop out of entrainment) & pellet screening;
- Hammermill pre-screen feeder emissions; and
- Pellet screen fines cyclone.

Emissions from this bagfilter are calculated assuming a manufacturer guaranteed grain loading factor for the wood particulates and the maximum nominal stack flow rate.

2.7. PELLETT MILL FEED SILO (ES-PMFS) AND PELLETT MILL FINES BIN (ES-PFB)

Sized wood from the hammermills is transported on a set of conveyors to the pellet mill feed silo prior to pelletization. Particulate emissions from the pellet mill feed silo bin vent filter are calculated assuming a manufacturer guaranteed grain loading factor and the maximum nominal stack flow rate.

Fine pellet material from the hammermill pollution control system and screening operation is collected in the pellet fines bin which is controlled by a bin vent baghouse. Particulate emissions from the baghouse are calculated assuming a manufacturer guaranteed grain loading factor and the maximum nominal stack flow rate.

2.8. PELLET PRESS SYSTEM PELLET COOLERS (ES-CLR-1 THROUGH 6)

Dried ground wood is mechanically compacted in the presence of water in several screw presses in the Pellet Press System. Exhaust from the Pellet Press and Pellet Presses conveyors are vented to through the cooler aspiration cyclones and then to the atmosphere. No chemical binding agents are needed for pelletization.

Formed pellets are discharged into one of six pellet coolers. Cooling air is passed through the pellets. At this point, the pellets contain a small amount of wood fines, which are swept out with the cooling air and are controlled utilizing six cyclones operating in parallel prior to discharge to the atmosphere.

Particulate matter emissions from each cyclone are calculated assuming a maximum grain loading factor for the wood particulates and the maximum nominal stack flow rate. VOC, HAP, and TAP emissions are calculated like the hammermills using AP-42 factors. Please see Appendix B for a detailed discussion.

2.9. FINISHED PRODUCT HANDLING AND LOADOUT

Final product is conveyed to rail loadout pellet bins (ES-PB) that feed railcar loadout operations (ES-PL), or, alternately can also load trucks if needed. Emissions from the Pellet Loadout Bins are controlled by a bagfilter. Pellet Loadout is accomplished by gravity feed of the pellets through a covered chute to reduce emissions. Emissions to the atmosphere from conveyance from the Pellet Loadout Bins are minimal because dried wood fines have been removed in the pellet screener, and a slight negative pressure is maintained in the loadout building as a fire prevention measure to prevent any buildup of dust on surfaces within the building. Slight negative pressure is produced via an induced draft fan that exhausts to the same bagfilter (CD-FPH) that controls minor dust emissions from loading of the Pellet Loadout Bins.

Particulate emissions from finished product handling and loadout are calculated assuming a manufacturer guaranteed grain loading factor and the maximum nominal stack flow rate for the bagfilter.

2.10. EMERGENCY GENERATOR, FIRE WATER PUMP, AND FUEL OIL STORAGE TANKS

The plant will utilize a 250 brake horsepower emergency generator for emergency operations and a 250 brake horsepower fire water pump engine. All engines will combust diesel fuel. Aside from maintenance and readiness testing, the generator and fire water pump engines will only be utilized for emergency operations. Diesel for the emergency generator will be stored in a storage tank of up to 2,500 gallons capacity and diesel for the fire water pump will be stored in a storage tank of up to 1,000 gallons capacity. There will also be a storage tank of up to 2,500 gallons that is used for fueling mobile equipment at the site. Emissions from all fuel oil storage tanks are insignificant and these units are categorically exempt from construction permitting requirements.

the 1990s, the number of people in the world who are under 15 years of age is expected to increase from 1.1 billion to 1.5 billion.

There are a number of reasons why the world's population is growing so rapidly. One of the main reasons is that the number of children born to each woman has increased. This is due to a number of factors, including improved medical care, better nutrition, and a higher birth rate.

Another reason why the world's population is growing so rapidly is that the number of people who are surviving to old age has increased. This is due to a number of factors, including improved medical care, better nutrition, and a higher life expectancy.

There are a number of other reasons why the world's population is growing so rapidly. One of the main reasons is that the number of people who are migrating to other parts of the world has increased. This is due to a number of factors, including economic opportunities, political instability, and environmental factors.

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3. REGULATORY APPLICABILITY ANALYSIS

This section summarizes the applicability and requirements of key federal and state regulations.

3.1. FEDERAL REGULATIONS

3.1.1. Prevention of Significant Deterioration (PSD), 40 CFR Part 51.166

North Carolina implements the federal PSD requirements of 40 CFR 51.166 under North Carolina Regulation 15A NCAC 2D .0530. Under the PSD regulations, a major stationary source for PSD is defined as any source in one of the 28 named source categories with the potential to emit 100 tpy or more of any regulated pollutant, or any source not in one of the 28 named source categories with the potential to emit 250 tpy or more of any regulated pollutant other than GHGs.⁴ Neither wood pellet production nor operation of associated combustion sources qualifies the facility for classification in one of the 28 listed source categories.

Federal PSD requirements for GHGs have been implemented in North Carolina under 15A NCAC 2D .0544, which essentially adopts the U.S. EPA's "GHG Tailoring Rule." The GHG Tailoring Rule establishes emission rates triggering PSD review for GHGs with the major source threshold being 100,000 tpy of CO₂ equivalent (CO_{2e}) and a significant emission rate of 75,000 tpy CO_{2e}. As shown in Appendix B, Table B-1 the proposed project does not trigger PSD review for CO_{2e}, since the biomass deferral rule is still in effect in North Carolina.

As shown in Appendix B, Table B-1, the proposed project constitutes a major stationary source of VOC. In addition, the facility triggers PSD review by virtue of exceeding the significant emission rates (SERs) for NO_x, PM, PM₁₀, PM_{2.5}, and VOC. Therefore, Enviva is submitting this PSD construction and operating permit application in accordance with federal and state PSD requirements.

It should be noted that estimates of potential VOC emissions from the wood dryer, hammermills and pellet cooler aspiration systems are based on conservative EPA estimation methodologies that likely overestimated potential emissions. As mentioned in previous discussions with the NC DAQ, Enviva is in the process of obtaining additional information that will lead to improved emissions characterization. Enviva will be providing this information to the NC DAQ once reliable information has been obtained.

3.1.2. Title V Operating Permit Program, 40 CFR Part 70

40 CFR Part 70 establishes the federal Title V operating permit program. North Carolina has incorporated the provisions of this federal program in its Title V operating permit program under 15A NCAC 2Q .0500. The major source thresholds with respect to the North Carolina Title V operating permit program regulations are 10 tons per year of a single HAP, 25 tpy of any combination of HAP, 100 tpy of certain other regulated pollutants, and 100,000 tons of GHGs per year (expressed as CO_{2e}).

⁴40 CFR §52.21(b)(1)(i)

The site will be a major Title V source for criteria and hazardous air pollutants as shown in Appendix B, Tables B-1 and B-2. Enviva is requesting that the procedures of 15A NCAC 2Q .0504 be applied to this project allowing issuance of a construction and operating permit under 15A NCAC 2D .0300. Enviva will thereafter submit a permit application for a Title V permit within one year after commencement of operation.

3.1.3. New Source Performance Standards, 40 CFR Part 60 (15A NCAC 2D .0524 New Source Performance Standards)

New Source Performance Standards (NSPS), located in 40 CFR Part 60 and implemented in North Carolina Regulation 15A NCAC 2D .0524, require certain categories of new, modified, or reconstructed sources to control emissions to specified levels. Three potentially applicable NSPS are addressed below. Moreover, any source subject to an NSPS is also subject to the general provisions of NSPS Subpart A, unless specifically excluded.

3.1.3.1. NSPS Subpart IIII

NSPS Subpart IIII applies to owners or operators of compression ignition (CI) internal combustion engines (ICE) manufactured after April 1, 2006 that are not fire pump engines, and fire pump engines manufactured after July 1, 2006. As noted in Section 2, the plant will have a 250 hp emergency generator and a 250 hp emergency fire pump. The emergency generator and fire pump are subject to the provisions of NSPS Subpart IIII.

Under NSPS Subpart IIII, owners and operators of emergency generators manufactured in CY 2007 or later with a maximum engine power greater than or equal to 50 hp are required to comply with the emission limits referenced in 40 CFR §60.4205(b). These limits are as follows: 0.20 g/kW for PM, 3.5 g/kW for CO, and 4 g/kW for NO_x + nonmethane hydrocarbons (NMHC).

Enviva will comply with the emission limits by operating the emergency generator and fire water pump as instructed in the manufacturer's operating manual in accordance with 40 CFR §60.4211(a), and purchasing an engine certified to meet the referenced emission limits in accordance with 40 CFR §60.4211(c). The engine will be equipped with a non-resettable hour meter in accordance with 40 CFR §60.4209(a). Emergency and readiness testing of the unit will be limited to 100 hours per year.

In accordance with NSPS Subpart IIII, owners and operators of fire pump engines manufactured after July 1, 2006 must comply with the emission limits in Table 4 of NSPS Subpart IIII, which are organized based on the size of the unit. These limits are as follows: 0.20 g/kW for PM, 3.5 g/kW for CO, and 4 g/kW for NO_x + nonmethane hydrocarbons (NMHC).

Enviva will comply with these emission limits by operating the fire pump as instructed in the manufacturer's operating manual in accordance with 40 CFR §60.4211(a), and purchasing an engine certified to meet the referenced emission limits in accordance with 40 CFR §60.4211(b). The engine will be equipped with a non-resettable hour meter in accordance with 40 CFR §60.4209(a). Emergency and readiness testing of the unit will be limited to 100 hours per year.

Both the proposed emergency generator and fire pump will be required to comply with the fuel requirements in 40 CFR §60.4175.3, which limit sulfur to a maximum of 15 ppmw and a cetane index of at least 40.

3.1.3.2. NSPS Subpart Kb

NSPS Subpart Kb, *Standards of Performance for Volatile Organic Liquid Storage Vessels*, regulates storage vessels with a capacity greater than 75 cubic meters (m³) (19,813 gallons) that are used to store volatile organic liquids for which construction, reconstruction, or modification is commenced after July 23, 1984.⁵

Diesel fuel oil storage tank capacities are well below the NSPS Subpart Kb storage capacity threshold of 19,813 gallons.

3.1.3.3. NSPS Subpart Db

The proposed plant will utilize direct fired drying of chipped wood and, therefore, will not trigger the NSPS Subpart Db (Industrial-Commercial-Institutional Steam Generating Units) regulations.

3.1.4. National Emission Standards for Hazardous Air Pollutants for Regulated Source Categories, 40 CFR Part 63 (15A NCAC 2D .1111 Maximum Achievable Control Technology)

National Emission Standards for Hazardous Air Pollutants (NESHAP) are listed in 40 CFR Part 63 and implemented via North Carolina regulation 15A NCAC 2D .1111. One potentially applicable NESHAP is addressed below.

3.1.4.1. 40 CFR Part 63 Subpart ZZZZ

40 CFR 63 Subpart ZZZZ applies to reciprocating internal combustion engines (RICE) located at a major or area source of HAP emissions. Emergency power and limited use units are subject to requirements under 40 CFR 63.6590(b)(i) and 40 CFR 63.6590(b)(ii). Emergency stationary RICE are defined in 40 CFR 63.6675 as any stationary RICE that operates in an emergency situation. These situations include engines used for power generation when power from the local utility is interrupted, or when engines are used to pump water in the case of fire or flood.

The proposed emergency generator and the emergency fire pump at the site will be classified as emergency stationary RICE under the NESHAP and will comply with the requirements listed under this subpart by complying with NSPS IIII.

3.1.5. National Emissions Standards for Hazardous Air Pollutants, Case-by-Case MACT for New and Reconstructed Major Stationary Sources, 40 CFR Part 63, Subpart B (15A NCAC 2D .1112 112(g) Case-by-Case Maximum Achievable Control Technology)

3.1.5.1. Statutory Background and Applicability to Project

Potential HAP emissions from the proposed facility will exceed the major stationary source threshold. Section 112(g) of the Clean Air Act requires that any new stationary source that is not a regulated "source category" for which a NESHAP has been established must control

⁵ 40 CFR 60.110b(a)

emissions to levels that reflect "maximum achievable control technology" (MACT). Wood Pellet Manufacturing Plants are not a regulated source category; therefore, the project triggers 112(g) requirements.

Section 112(d)(3) describes MACT for new sources as follows:

The maximum degree of reduction in emissions that is deemed achievable for new sources in a category or subcategory shall not be less stringent than the emission control that is achieved in practice by the best controlled similar source, as determined by the Administrator.

3.1.5.2. Overview of Other Wood Pellet Manufacturing Plants

Enviva is aware of only three (3) of the approximately 140 wood pellet manufacturing facilities in the U.S. that utilize controls on wood drying operations to reduce VOC and HAP emissions. There are no facilities in the U.S. that currently control sources of HAP emissions other than the dryer at pellet manufacturing facilities (e.g., dry wood hammermills, pellet presses, etc.).⁶ A brief description of the three facilities using controls is provided below with key process information summarized below:

1. Georgia Biomass, located in Waycross, GA, employs a regenerative thermal oxidizer (RTO) on two 47 oven dried ton per hour (ODT/hr) single-pass rotary drying kilns. The facility utilizes 100% softwood for pellet production, drying wood chips from 50% to 10% moisture. The inlet peak temperatures of dryer air contacting the wood pellets is at least 950 °F with a dryer outlet temperature of greater than 300 °F.
2. Florida Green Circle, located in Jackson County, FL, operates an RTO on two 35 ODT/hr (nominal) single-pass drying kilns. The facility utilizes 100% softwood for pellet production, drying chips from a nominal 50% moisture to 9% moisture. The inlet peak temperatures of dryer air contacting the wood pellets is approximately 950 °F with a dryer outlet temperature of greater than 300 °F.
3. German Pellets Texas, located in Woodville, TX, operates an RTO on two 36 ODT/hr (nominal) single-pass rotary kilns. The facility utilizes 100% softwood for pellet production, drying green wood sawdust from 56% moisture to approximately 11% moisture. The peak inlet temperature is at least 900°F with an outlet temperature of approximately 340 °F.

3.1.5.3. Proposed Enviva Hamlet Drying System

Enviva's proposed plant will utilize a single-pass rotary drying system manufactured by either Buettner or Dieffenbacher. Both employ drying techniques that not only serve to improve product quality, but also result in reduced emissions compared to their competitors. Each system is discussed below.

Buettner's single-pass drying system utilizes low-temperature. The inlet air temperature is carefully controlled and depends on wood material infeed moisture. At the highest specified

⁶ 2013 US and Canada Pellet Mill Map at the International Biomass Conference & Expo by BBI International.

infeed moisture the inlet air temperature is at approximately 780 °F with less than a 50 °F variability across the inlet diameter. At lower material infeed moisture the inlet air temperature is maintained at much lower levels. The drying system includes a cascading temperature control to monitor the drying temperature during the drying process at the point when the wood surface water is evaporated. At that point the drying heat is in direct contact with the wood and precise drying is critical. Not only are inlet temperatures lower than other dryers in wood products applications, but outlet dryer temperatures are typically much lower at approximately 220 °F. By contrast, Enviva's competitors, such as the ones that at the three pellet plants discussed above, utilize drying systems that maintain more laminar air flow regimes that rely more heavily on radiant heat transfer. Enviva's systems utilize a combination of radiant heat transfer at the dryer infeed and contact heat transfer towards the dryer drum outlet. In combination with optimum material distribution over the entire drum diameter and avoidance of hot air laminar flows, gentle and balanced drying is achieved.

Dieffenbacher's furnace and single-pass drying system design includes design features that will result in reduced emissions from the drying system. The Dieffenbacher drying system utilizes inlet and outlet drying air temperatures of approximately, 842 and 230 degrees F, which improves the energy efficiency of the system and lowers emissions. The lower dryer outlet temperature coupled with high overall system energy efficiency design reduces the amount of fuel required in the heat energy system which effectively lowers emissions. Dieffenbacher also utilizes more metal internals within its drum than other competitors. This larger metal surface area allows for more gentle drying using more radiant heat transfer. The distribution and redistribution of product within the dryer, at the inlet and every ten feet down the length of the dryer, keeps the product uniformly exposed to the heat during the drying process. This uniform exposure allows the product to dry with very little variation with less over-dried product. The redistribution of the material every ten feet also allows for the smaller material to move through the dryer at a faster rate that keeps this material from being over dried.

3.1.5.4. Variables Impacting Organic HAP Emissions from Wood Drying

The primary variables impacting VOC emissions from drying are as follows:

1. Wood particle size – The degree to which wood is milled prior to drying can drastically increase wood surface area. Smaller particle sizes have higher surface area and are easier to dry.
2. Temperature – Inlet and outlet temperatures (as well as temperature along the entire dryer drum) significantly impact VOC and HAP emissions. VOC and HAP emissions increase with increased drying temperature.
3. Outlet moisture content of wood – VOC emissions are highly dependent upon outlet moisture content of the wood being dried. Based on a review of a variety of forest products industries, it has been observed that VOC emissions are a *highly non-linear function* of final moisture content such that variability of moisture content by only a few percent are believed to have a considerable impact on VOC emissions. It is believed that HAP emissions also trend with outlet moisture content.

3.1.5.5. Distinguishing Characteristics of the Proposed Drying System

There are notable differences between Enviva's proposed drying process/technology and its competitors using RTOs with respect to each of the three factors that impact HAP emissions. Each factor is discussed below.

1. Wood chip size – Enviva will be reducing the size of wood chips fed to its drying system to one quarter inch to three eighths inch as measured by a square sieve. Detailed information regarding Green Circle's and Georgia Biomass' chip sizes is not known; however, German Pellets utilizes sawdust in its process, which is much finer and has a far greater surface area
2. Temperature – Enviva's systems utilize a considerably lower temperature drying regime along the entire drum length than its competitors. Information regarding drying temperatures is provided in Section 3.1.5.2.
3. Outlet moisture content – Enviva will be drying wood to only 15% or higher moisture, which allows its product to be pelletized without any steaming or "conditioning" of the wood in the pelletizers. This is a higher moisture content than its competitors, which dry to lower levels that impact the properties of the wood and thereafter require steaming to manufacture on-specification product.

3.1.5.6. Proposed MACT for Drying System

Enviva's drying and high-moisture pelletization process reduces uncontrolled emissions to levels significantly below that of its competitors that have installed RTO controls. These differences justify the classification of Enviva's process drying and pelletization process as a separate subcategory, not dependent upon use of RTO control technology to reduce VOC/HAP emissions.

The Boiler NESHAP for major stationary sources is just one example of numerous NESHAP regulations promulgated by EPA that have established subcategories for regulated process units. For biomass combustion boilers alone, EPA established seven (7) different subcategories under the Boiler NESHAP with highly variable emission standards, many of which are established at levels so high that pollution controls will be unnecessary to achieve compliance.

Accordingly, Enviva proposes to minimize HAP emissions consistent with CAA Section 112(d)(2)(A) and (D), which provide for establishing MACT based on the use of lower emitting materials (i.e., limitation on softwood) and process design, respectively. No numerical emission rate limits are proposed.

Minor metal and inorganic HAP emissions associated with combustion of wood fuel in the dryer furnace system will be well-controlled using the pellet manufacturing industry standard of a wet electrostatic precipitator (WESP) proposed for the project. Other EPA standards such as the Plywood and Composite Wood Products (PCWP) NESHAP have recognized that combustion emissions from direct-fired drying operations are well-controlled with a WESP. Therefore, Enviva is not proposing any separate emission or operational standards for metal and inorganic HAP emissions from wood combustion in the dryer furnace system.

3.1.5.7. MACT for Other Process Sources

Other sources of HAP emissions are as follows:

- Green wood hammermill with cyclone control,
- Portable chipper (combustion emissions),
- Eight (8) hammermills and hammermill area handling operations controlled using bagfilters, and
- Twelve wood pellet presses and six (6) pellet coolers controlled using cyclones.

There are currently no pellet mills that are utilizing organic HAP pollution control technologies on these types of sources. Trace PM-matrixed HAP will be well controlled by best available control technology (BACT), as discussed in Section 4. In addition to the use of PM control technologies, Enviva proposes to minimize organic HAP emissions by maintaining the equipment in accordance with manufacturer's specifications and/or standard industry practices.

3.2. NORTH CAROLINA REGULATIONS

For the sources that are included for review in this application package, the North Carolina State Implementation Plan (SIP) rules and regulations have been evaluated for applicability. Applicable rules are identified below.

3.2.1. 15A NCAC 02D .0515 Particulates from Miscellaneous Industrial Processes

Particulate emissions from all emissions sources subject to permitting, including the wood pellet dryer are regulated under 15A NCAC 2D .0515. This regulation limits the particulate emissions based on process throughput using the equation $E = 4.10 \times P^{0.67}$, for process rates (P) less than 30 tons per hour (ton/hr) and $E = 55 \times P^{0.11-40}$ for process rates greater than 30 tons per hour.

All emissions from particulate matter sources at the proposed facility are either negligible or well-controlled. The most significant emission unit at the site, the process dryer operating a 71.71 ODT/hr, has an emission limit of 48 lb/hr. Maximum emissions from the dryer are approximately 8 lb/hr, well below the standard.

3.2.2. 15A NCAC 02D .0516 Sulfur Dioxide Emissions from Combustion Sources

Under this regulation, emissions of sulfur dioxide from combustion sources cannot exceed 2.3 pounds of sulfur dioxide per million Btu input. Wood is fired in the dryer and low sulfur diesel is combusted in the two emergency engines, resulting in operation well below regulatory limits.

3.2.3. 15A NCAC 02D .0521 Control of Visible Emissions

Under this regulation, for sources manufactured after July 1, 1971, visible emissions cannot be more than 20 percent opacity when averaged over a six-minute period. However, six-minute averaging periods may exceed 20 percent opacity under the following conditions:

- No six-minute period exceeds 87 percent opacity,
- No more than one six-minute period exceeds 20 percent opacity in any hour, and
- No more than four six-minute periods exceed 20 percent opacity in any 24-hour period.

This rule applies to all processes that may have a visible emission, including the dryer, other particulate matter emissions sources controlled by cyclone and/or baghouse, and the diesel-fired engines.

3.2.4. 15A NCAC 02Q .0700 Toxic Air Pollutant Procedures

This regulation requires that certain new and modified sources of toxic air pollutants with emissions exceeding specified de minimis values apply for an air toxics permit. Facility-wide emissions of several compounds emitted from the site exceed the permitting de minimis level. A comparison of emissions to de minimis values are summarized in Appendix B, Table B-3. Air dispersion modeling results for compounds triggering permitting is discussed in Section 5 of this application.

3.2.5. 15A NCAC 2D .1100 - Control of Toxic Air Pollutant Emissions

A toxic air pollutant (TAP) permit application shall include an evaluation of the TAP emissions from facility sources, excluding exempt sources listed under 15A NCAC 2Q .0702(a)(18). This regulation outlines the procedures that must be followed if modeling is required under 15A NCAC 2Q .0700. Air dispersion modeling results for compounds triggering permitting is discussed in Section 5 of this application.

4. BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

4.1. BACT DEFINITION

The requirement to conduct a BACT analysis is set forth in the PSD regulations [40 CFR 52.21(j)(2)]:

(j) Control Technology Review.

(2) A new major stationary source shall apply best available control technology for each regulated NSR pollutant that it would have the potential to emit in significant amounts.

BACT is defined in the PSD regulations [40 CFR 52.21(b)(12)] as:

...an emissions limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61.

[primary BACT definition]

If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results.

[allowance for secondary BACT standard under certain conditions]

The primary BACT definition can be best understood by breaking it apart into its separate components.

4.1.1. Emission Limitation

an emissions limitation

First and foremost, BACT is an emission limit. While BACT is prefaced upon the application of technologies to achieve that limit, the final result of BACT is a limit. In general, this limit would be an emission rate limit of a pollutant (i.e., lb/MMBtu).⁷ However, it should be noted that the

⁷ Emission limits can be broadly differentiated as "rate-based" or "mass-based." For a boiler, a rate-based limit would typically be in units of lb/MMBtu (mass emissions per heat input). In contrast, a typical mass-based limit would be in units of lb/hr (mass emissions per time).

definition of BACT specifically allows use of a work practice standard where emissions are not easily measured or enforceable.⁸

4.1.2. Case-by-Case Basis

a case-by-case basis, taking into account energy, environmental and economic impacts and other costs

Unlike many of the Clean Air Act programs, the PSD program's BACT evaluation is case-by-case. As noted by EPA,

The case-by-case analysis is far more complex than merely pointing to a lower emissions limit or higher control efficiency elsewhere in a permit or a permit application. The BACT determination must take into account all of the factors affecting the facility The BACT analysis, therefore, involves judgment and balancing.

To assist applicants and regulators with the case-by-case process, in 1987 EPA issued a memorandum that implemented certain program initiatives to improve the effectiveness of the PSD program within the confines of existing regulations and state implementation plans. Among the initiatives was a "top-down" approach for determining BACT. The top-down process requires that all available control technologies be ranked in descending order of control effectiveness. The most stringent or "top" control option is the default BACT emission limit unless the applicant demonstrates, and the permitting authority in its informed opinion agrees, that energy, environmental, and/or economic impacts justify the conclusion that the most stringent control option is not achievable in that case. Upon elimination of the most stringent control option based upon energy, environmental, and/or economic considerations, the next most stringent alternative is evaluated in the same manner. This process continues until BACT is selected.

The five steps in a top-down BACT evaluation can be summarized as follows:

- Step 1. Identify all possible control technologies
- Step 2. Eliminate technically infeasible options
- Step 3. Rank the technically feasible control technologies based upon emission reduction potential
- Step 4. Evaluate ranked controls based on energy, environmental, and/or economic considerations
- Step 5. Select BACT

As discussed in Section 4.1.1, the BACT limit is an emissions limitation or work practice standard and does not require the installation of any specific control device.

4.1.3. Achievable

based on the maximum degree of reduction [that NC DAQ]... determines is achievable ... through application of production processes or available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques

⁸ 40 CFR §52.21(b)(12).

BACT is to be set at the lowest value that is achievable. However, there is an important distinction between emission rates achieved at a specific time on a specific unit, and an emission limitation that a unit must be able to meet continuously over its operating life. As discussed by the D.C. Circuit Court of Appeals

In National Lime Ass'n v. EPA, 627 F.2d 416, 431 n.46 (D.C. Cir. 1980), we said that where a statute requires that a standard be "achievable," it must be achievable "under most adverse circumstances which can reasonably be expected to recur."⁹

EPA has reached a similar conclusion in prior determinations for PSD permits.

Agency guidance and our prior decisions recognize a distinction between, on the one hand, measured 'emissions rates,' which are necessarily data obtained from a particular facility at a specific time, and on the other hand, the 'emissions limitation' determined to be BACT and set forth in the permit, which the facility is required to continuously meet throughout the facility's life. Stated simply, if there is uncontrollable fluctuation or variability in the measured emission rate, then the lowest measured emission rate will necessarily be more stringent than the "emissions limitation" that is "achievable" for that pollution control method over the life of the facility. Accordingly, because the "emissions limitation" is applicable for the facility's life, it is wholly appropriate for the permit issuer to consider, as part of the BACT analysis, the extent to which the available data demonstrate whether the emissions rate at issue has been achieved by other facilities over a long term.¹⁰

Thus, BACT must be set at the lowest feasible emission rate recognizing that the facility must be in compliance with that limit for the lifetime of the facility on a continuous basis. While individual unit performance can be instructive in evaluating what BACT might be, any actual performance data must be viewed carefully, as rarely such data be adequate to truly assess the performance that a unit will achieve during its entire operating life. While statistical variability of actual performance can be used to infer what is "achievable," such testing requires a detailed test plan akin to what teams in EPA use to develop MACT standards over a several year period, and is far beyond what is reasonable to expect of an individual source. In contrast to limited snapshots of actual performance data, emission limits from similar sources can reasonably be used to infer what is "achievable."¹¹

To assist in meeting the BACT limit, the source must consider production processes or available methods, systems or techniques, as long as those considerations do not redefine the source.

With regards to "achievable," we have become aware of a medium density fiberboard (MDF) mill in central North Carolina where an RTO that was controlling a wood drying operation was

⁹ As quoted in *Sierra Club v. EPA* (97-1686).

¹⁰ EPA Environmental Appeals Board decision, *In re: Newmont Nevada Energy Investment L.L.C.* PSD Appeal No. 05-04, decided December 21, 2005. Environmental Administrative Decisions Volume 12, Page 442.

¹¹ Emission limits must be used with care in assessing what is "achievable." Limits established for facilities which were never built are unreliable, as they have never been demonstrated and that company never took a significant liability in having to meet that limit. Similarly, permitted units which have not yet commenced construction must also be viewed with care for similar reasons.

corroding to the extent that the rebuilds and maintenance required to keep it operating became extremely exorbitant. The RTO operated for approximately 10 years and the RTO had nearly been completely rebuilt within this short period of time. In the application to remove the RTO, the applicant provided information that questioned the technical infeasibility of operating an RTO for its operations.

While Enviva's pellet manufacturing operation is not a MDF operation, the drying process and design are similar. Corrosion and significant, well established, operation and maintenance issues associated with RTOs installed on wood products facilities are a major concern to Enviva. If a control device must be repaired so frequently that it is essentially rebuilt over a 10 year period, Enviva concludes that the control device is neither technically feasible nor able to meet a BACT limit over a long term period.

As such, Enviva does not think a BACT limit based on operation of a RTO is achievable over the life of the operating facility.

4.1.4. Floor

Emissions [shall not] exceed ...[40 CFR Parts 60 and 61]

The least stringent emission rate allowable for BACT is any applicable limit under either New Source Performance Standards (NSPS – Part 60) or National Emission Standards for Hazardous Air Pollutants (NESHAP – Part 61). While Clean Air Act section 112(b)(6) precludes use of Part 63 NESHAPs from establishing the floor, such standards are considered informative, representing maximum achievable control technology. State SIP limitations must also be considered when determining the floor.

4.2. BACT REQUIREMENT

The BACT requirement applies to each new or modified emission unit from which there are emissions increases of pollutants subject to PSD review. The proposed plant is subject to PSD permitting as described in Section 3. The compounds subject to PSD review and for which a BACT analysis is required are:

- Nitrogen oxides (NO_x),
- Particulate matter (PM/PM₁₀/PM_{2.5}), and
- Volatile organic compounds (VOC).

The following table summarizes the emission units and pollutants which are considered in this BACT analysis:

TABLE 4-1. BACT SOURCES

Source Description	NO_x (tpy)	PM/ PM₁₀/ PM_{2.5} (tpy)	VOC (tpy)
Dryer System	x	x	x
Green Wood Hammermills		x	x
Hammermills/ Hammermill Area		x	x
Pellet Presses and Coolers		x	x
Pellet Mill Feed Silo		x	
Pellet Mill Fines Bin		x	
Finished Product Handling/ Pellet Loadout Bins/ Pellet Loadout Areas		x	
Log Bark Hog			x
Log Chipping			x
Storage Piles		x	x
Green Wood Handling		x	
Roads		x	
Emergency Generator	x	x	x
Fire Water Pump	x	x	x
Backup Chipper	x	x	x

Note that the same control techniques that reduce PM also reduce filterable PM₁₀ and PM_{2.5}. The PM₁₀ BACT analysis will satisfy BACT for PM and PM_{2.5}. In the prepared BACT analyses, references to PM₁₀ are also relevant to PM and PM_{2.5} and neither PM nor PM_{2.5} are explicitly addressed separately.

4.3. BACT ASSESMENT METHODOLOGY

The following sections provide detail on the BACT assessment methodology utilized in preparing the BACT analysis for the proposed emission units. As previously noted, the minimum control efficiency to be considered in a BACT assessment must result in an emission rate less than or equal to any applicable NSPS or Part 61 NESHAP emission rate for the source. Although the definition of BACT only extends to Part 61 NESHAPs and Section 112(b)(6) of the Clean Air Act precludes use of Part 63 NESHAPs from establishing BACT, for purposes of this application, applicable Part 63 NESHAPs will also conservatively be assumed to establish the BACT floor.

4.3.1. Identification of Potential Control Technologies

Potentially applicable emission control technologies were identified for each compound in this analysis using information from the following resources:

- RBLC (RACT/BACT/LAER Clearinghouse) database located on EPA's Technology Transfer Network in the EPA electronic bulletin board system,
- Various EPA reports on emissions control technologies,
- Various air pollution control technology vendors,
- Pending permit applications and issued permits for similar facilities, and
- Compilation of Air Pollution Emission Factors (AP-42) published by EPA.

It should be noted that the RBLC only includes one determination for a wood pellet mill, determination VA-0298. This project was permitted a number of years ago using an conceptual "wood-fired RTO" technology for VOC control, but the plant was never constructed because, according to the VA Department of Environmental Quality, the project was unable to obtain financing.

4.3.2. Economic Feasibility Calculation Process

Economic analyses were performed to compare total costs (capital and annual) for potential control technologies. Capital costs include the initial cost of the components intrinsic to the complete control system. Annual operating costs include the financial requirements to operate the control system on an annual basis and include overhead, maintenance, outages, raw materials, and utilities.

The capital cost estimating technique used is based on a factored method of determining direct and indirect installation costs. That is, installation costs are expressed as a function of known equipment costs. This method is consistent with the latest EPA OAQPS guidance manual on estimating control technology costs.¹²

Total Purchased Equipment Cost represents the delivered cost of the control equipment, auxiliary equipment, and instrumentation. Auxiliary equipment consists of all the structural, mechanical, and electrical components required for the efficient operation of the device. Auxiliary equipment costs are estimated as a straight percentage of the equipment cost. Direct installation costs consist of direct expenditures for materials and labor for site preparation, foundations, structural steel, erection, piping, electrical, painting and facilities. Indirect installation costs include engineering and supervision of contractors, construction and field expenses, construction fees, and contingencies. Other indirect costs include equipment startup, performance testing, working capital, and interest during construction.

Annual costs are comprised of direct and indirect operating costs. Direct annual costs include labor, maintenance, replacement parts, raw materials, utilities, and waste disposal. Indirect operating costs include plant overhead, taxes, insurance, general administration, and capital charges. Replacement part costs, such as the cost of replacement catalysts, were included where applicable, while raw material costs were estimated based upon the unit cost and annual consumption. With the exception of overhead, indirect operating costs were calculated as a percentage of the total capital costs. The indirect capital costs were based on a capital recovery factor (CRF) defined as:

¹² EPA, *OAQPS Control Cost Manual*, 6th edition, EPA 452/B-02-001, July 2002.
http://www.epa.gov/ttn/catc/dir1/c_allchs.pdf

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

where i is the annual interest rate and n is the equipment life in years. The equipment life is based on the normal life of the control equipment and varies on an equipment type basis.¹³

Detailed cost analyses calculations are presented in Appendix D.

4.3.3. PSD Impact Analysis of Control Alternatives

As discussed above, the economic, environmental, and energy impacts of technically feasible BACT options were evaluated according to the top-down BACT process. The first step involves a technical feasibility analysis of all potential control options, and the next step involves an evaluation of the economic impacts of feasible control alternatives with primary consideration of the cost effectiveness (dollars per ton of compound removed) for each option. The economic analysis is typically based on vendor quotes and/or established EPA cost estimating procedures. An environmental impact analysis was then performed to determine whether any adverse "non-air" impacts were associated with an alternative. The last analysis involved calculating energy impacts, or increased energy requirements, associated with each option.

4.4. DRYER SYSTEM

Enviva plans to utilize a rotary drying kiln to reduce wood moisture content. Direct contact heat will be provided to the system via a 175.3 MMBtu/hr burner system. Air emissions will be controlled by three simple cyclones and then a wet electrostatic precipitator (WESP) operating in series. The pollutants emitted from the dryer that are subject to BACT review are NO_x , TSP/PM₁₀/PM_{2.5}, and VOC. The control technology assessment for each compound subject to PSD review is provided below.

4.4.1. Nitrogen Oxides (NO_x)

The formation of NO_x is determined by the interaction of chemical and physical processes occurring within the flame zone of the furnace of the proposed boiler. There are two principal forms of NO_x , "thermal" NO_x and "fuel" NO_x . Thermal NO_x formation is the result of oxidation of atmospheric nitrogen contained in the inlet gas in the high-temperature, post-flame region of the combustion zone. The major factors influencing thermal NO_x formation are temperature, concentrations of combustion gases (primarily nitrogen and oxygen) in the inlet air and residence time within the combustion zone. Fuel NO_x is formed by the oxidation of fuel-bound nitrogen. NO_x formation can be controlled by adjusting the combustion process and/or installing post-combustion controls.

4.4.1.1. Identify Control Technologies

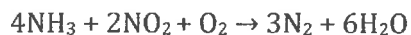
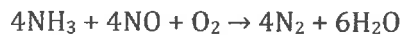
A summary of results from the RBLC is provided in Table D-1.

¹³ EPA, *OAQPS Control Cost Manual*, 6th edition, Section 2, Chapter 1, page 1-52.
http://www.epa.gov/ttn/catc/dir1/c_allchs.pdf

Potentially applicable NO_x control technologies are:

- Conventional Selective Catalytic Reduction (SCR),
- Regenerative Selective Catalytic Reduction (RSCR), and
- Selective Non-Catalytic Reduction (SNCR).

Conventional Selective Catalytic Reduction and Regenerative Selective Catalytic Reduction Technologies: Conventional Selective Catalytic Reduction (SCR) is a post combustion NO_x add-on control device that is placed in the flue gas stream following the boiler. SCR involves the injection of ammonia (NH₃) into the flue gas stream ahead of a catalyst bed. On the catalyst surface, ammonia reacts with NO_x contained within the air to form nitrogen gas (N₂) and water (H₂O) in accordance with the following chemical equations:



The catalyst's active surface is usually either a noble metal (platinum), base metal (titanium or vanadium), or a zeolite-based material. Metal-based catalysts are usually applied as a coating over a metal or ceramic substrate. Zeolite catalysts are typically a homogenous material that forms both the active surface and the substrate. The geometric configuration of the catalyst body is designed for maximum surface area and minimum obstruction of the flue gas flow path in order to achieve maximum conversion efficiency and minimum back pressure. The most common configuration is a "honeycomb" design. In a typical ammonia injection system, ammonia is drawn from a storage tank, vaporized and injected upstream of the catalyst bed. Excess ammonia that is not reacted in the catalyst bed and emitted is referred to as ammonia slip. An important factor that affects the performance of an SCR is operating temperature. The temperature range for standard base metal catalyst is between 400-800°F.

The flue gas in conventional SCR systems in wood-fired systems prior to final particulate matter controls contain alkali metals such as sodium, potassium and zinc and trace heavy metals that poison and "blind" the SCR catalyst. It is believed that there are no conventional SCR systems operating after wood-fired combustion systems in the U.S. There are a few systems reportedly operating in Europe utilizing such systems; however, these are specialized systems operating on power plants utilizing bubbling fluidized bed and circulating fluidized bed boilers and these systems reportedly require unusually high maintenance.

Babcock Power Inc. developed a new SCR system that can be installed after final particulate matter emissions controls. This relatively new technology, called Regenerative Selective Catalytic Reduction or "RSCR" utilizes beds of ceramic media to raise the temperature of the flue gas after particulate control, to a temperature needed for reaction. The main advantage of an RSCR system is that it operates in a cleaner environment providing improved catalyst performance and high thermal efficiency. In the RSCR, the gas passes through a preheated bed where it is heated from the temperature of the exhaust exiting the final PM control device (approximately 170 °F). Burners raise the flue gas temperature to 470 °F before it flows across the adjacent catalyst canister, where NO_x reduction occurs. The exhaust gas from the catalyst bed then heats an adjacent bed containing heat transfer media. This heated bed then becomes the preheater for the exhaust. Flow direction continues to alternate in this fashion.

Selective Non-Catalytic Reduction: Selective Non-Catalytic Reduction (SNCR) describes a process by which NO_x is reduced to molecular nitrogen (N₂) and water (H₂O) by injecting an ammonia or urea (CO(NH₂)₂) spray into the post-combustion area of the unit. Typically, injection nozzles are located in the upper area of the furnace and convective passes. Once injected, the urea or ammonia decomposes into NH₃ or NH₂ free radicals, reacts with NO_x molecules, and reduces to nitrogen and water. The ammonia and urea reduction equations are provided below. These reactions are endothermic and use the heat of the burners as energy to drive the reduction reaction:



Both ammonia and urea have been successfully employed as reagents in SNCR systems and have certain advantages and disadvantages. Ammonia is less expensive than urea and results in substantially less operating costs at comparable levels of effectiveness. Urea, however, is able to penetrate further into flue gas streams, making it more effective in larger scale burners and combustion units with high exhaust flow rates.

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

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

For ammonia, the optimum reaction temperature range is approximately 880 to 1,100 degrees Celsius (°C) (1,615 to 2,000 °F). Below the SNCR operating temperature range, the NH₃/NO_x reaction will not occur. The unreacted NH₃ will either be emitted as NH₃ slip or it will react with SO₃ to form ammonium salts. Above the optimal temperature range, the amount of NH₃ that oxidizes to NO_x increases and NO_x reduction performance deteriorates.

4.4.1.2. Eliminate Technically Infeasible Options

Conventional SCR and Regenerative SCR: As discussed in the previous section, there are substantial technical concerns about poisoning/blinding of catalysts utilized within a conventional SCR system and our research indicates that there are no such systems operating on source similar to the wood-fired dryer burner system anywhere in the world. RSCR has not been demonstrated on a wood chip dryer in the past. Potential impacts of salts carry over from the WESP needed for particulate matter control may poison catalyst and, furthermore, the low temperature of the exhaust from the WESP (~170 °F) makes reheat necessary for appropriate catalyst operating temperature impracticable. Thus, both conventional SCR and RSCR are considered undemonstrated/technically infeasible technologies for wood dryers.

Despite questionable technical feasibility of SCR and RSCR, this analysis has nonetheless assumed for the purposes of this economic analysis that a SCR and RSCR system are technically feasible.

4.4.1.3. Rank Remaining Control Technologies by Effectiveness

There are three NO_x control technologies that have been considered technically feasible for the boilers – RSCR, conventional SCR, and SNCR.

4.4.1.4. Evaluate Most Effective Control Option (Impacts Analysis)

4.4.1.4.1 RSCR (0.077 lb/MMBtu NO_x)

Economic Impacts

A detailed cost evaluation of RSCR is included in Table D-1. As shown in Table D-4, a cost effectiveness of approximately \$13,328 per ton of NO_x was estimated. This cost is considered prohibitive, and RSCR is therefore eliminated from further consideration in the BACT evaluation.

Energy Impacts

Energy requirements for a RSCR system consist primarily of the power needed for the fan and fan power to overcome catalyst pressure. It is estimated that the energy impact associated with it is approximately 2.80×10^6 KWH/yr.

Environmental Impacts

There are no major adverse environmental impacts.

4.4.1.4.2 SCR (0.077 lb/MMBtu NO_x)

Economic Impacts

As presented in Tables D-2 and D-5, SCR can achieve an annual average NO_x level of 0.077 lb/MMBtu at approximately \$19,601/ton of NO_x reduction. This cost is considered prohibitive, and SCR is therefore eliminated from further consideration in the BACT evaluation.

Energy Impacts

Energy requirements for an SCR system primarily consist of the power needed for ammonia injection. It is estimated that the energy impact associated with SCR control is approximately 2.54×10^4 KWH/yr.

Environmental Impacts

There are no major adverse environmental impacts.

4.4.1.4.3 SNCR (0.114 lb/MMBtu)

After discussions between Enviva and a major SNCR vendor, an SNCR control option of 0.114 lb/MMBtu was determined to be the lowest achievable emission rate due to inherent limitations on the effectiveness of this control device in the proposed burner system.

Economic Impacts

As shown in Tables D-3 and D-4, the SNCR can achieve a NO_x level of 0.114 lb/MMBtu at approximately \$2,730/ton of NO_x reduction. This cost is not considered cost effective given the negligible impact of the dryer on air quality. As discussed in Section 5, the maximum modeled one-hour average concentration for nitrogen dioxide (NO₂) is only 95.7 µg/m³ (including a background of 32.1 µg/m³), which is approximately 51% of the NAAQS (188 µg/m³). The maximum dryer contribution is only 7.7 µg/m³ at the maximum receptor.

Energy Impacts

Energy requirements for an SNCR system primarily consist of the power needed for ammonia injection. It is estimated that the energy impact associated with SNCR control is approximately 2.8 x 10⁴ KWH/yr.

Environmental Impacts

There are no major adverse environmental impacts.

4.4.1.5. Select BACT

The baseline emission rate proposed by the dryer vendor of 0.228 lb/MMBtu utilizing good combustion practices and optimal burner design is proposed as BACT.

4.4.2. Particulate Matter (TSP/PM₁₀/PM_{2.5})

Particulate matter (TSP/PM₁₀) is emitted as both filterable and condensable particulate matter. Enviva has designed the rotary dryer system with three identical simple cyclones, considered the baseline level of control, for particulate matter removal.

4.4.2.1. Identify Control Technologies

Potentially applicable TSP/PM₁₀ add-on control technologies (in addition to the base simple cyclones) are:

- Baghouse,
- Electrostatic Precipitator (ESP), and
- Wet Electrostatic Precipitator (WESP).

Baghouse: A fabric filtration device (baghouse) consists of a number of filtering elements (bags) along with a bag cleaning system contained in a main shell structure incorporating dust hoppers. Fabric filters use fabric bags as filters to collect particulate matter. The particulate-laden gas enters a fabric filter compartment and passes through a layer of particulate and filter bags. The collected particulate forms a cake on the bag, which enhances the bag's filtering efficiency. However, excessive caking will increase the pressure drop across the fabric filter and reduce its efficiency. A phenomenon known as "blinding" occurs when cake builds up to the point that air can no longer pass through the baghouse during normal operation or the baghouse becomes clogged with wet and/or resinous compounds.

The particulate removal efficiency of fabric filters is dependent upon a variety of particle and operational characteristics. Particle characteristics that affect the collection efficiency include particle size distribution, particle cohesion characteristics, and particle electrical resistivity. Operational parameters that affect fabric filter collection efficiency include air-to-cloth ratio,

operating pressure loss, cleaning sequence, interval between cleanings, cleaning method, and cleaning intensity. In addition, the particle collection efficiency and size distribution can be affected by certain fabric properties (e.g., structure of fabric, fiber composition, and bag properties).

Electrostatic Precipitator: Electrostatic precipitators (ESPs) remove particles from a gas stream through the use of electrical forces. Discharge electrodes apply a negative charge to particles passing through a strong electrical field. These charged particles then migrate to a collecting electrode having an opposite, or positive, charge. Collected particles are removed from the collecting electrodes by periodic mechanical rapping.

Wet Electrostatic Precipitator: WESPs remove particles from a gas stream through the use of electrical forces. Discharge electrodes apply a negative charge to particles passing through a strong electrical field. These charged particles then migrate to a collecting electrode having an opposite, or positive, charge. Collected particles are removed from the collecting electrodes by washing utilizing a mild hydroxide solution to prevent buildup of resinous materials present in the dryer exhaust. Wet ESPs versus dry ESPs are utilized in the forest products industries for control of emissions from similar dryer sources because dry ESPs cannot reliably operate due to resin buildup on collection electrodes.

4.4.2.2. Eliminate Technically Infeasible Options

Although an effective form of particulate control in many applications, use of a baghouse is technically infeasible due to condensation of resinous compounds on the baghouse leading to blinding. Wood chip dryers are optimized for thermal efficiency to recirculate as much air as possible through the system without leading to excess moisture and condensation problems within the drying system. However, as the exhaust leaves the process it is sufficiently laden with moisture and resinous compounds that condensation in a baghouse frequently occurs.

Dry ESPs are also not designed to operate under conditions in which the gas stream contains water vapor or other moist/sticky elements. Because of the nature of the moist, sticky exhaust stream, it would be expected to see particulate agglomeration on dry ESPs. Therefore the baghouse and dry ESP are technically infeasible to control PM. Consequently, baghouse and dry ESP control are eliminated from further consideration in the BACT analysis.

4.4.2.3. Rank Remaining Control Technologies by Effectiveness

There is only one feasible control technology for the rotary dryer, a WESP.

4.4.2.4. Evaluate Most Effective Control Option (Impacts Analysis)

Tables D-5 and D-6 indicate that the cost effectiveness of achieving the most stringent control option of 0.073 lb/ODT using WESP control is \$2,370 cost per ton. Given that PM_{2.5} modeling results for the project is near the allowable increment, this cost effectiveness is considered reasonable.

There are numerous sources utilizing this method of control on forest products dryers, so energy impacts are not considered adverse. Wastewater is pretreated prior to discharge to the local wastewater treatment plant, so there will be no adverse environmental impacts.

4.4.2.5. Select BACT

Since the baghouse and dry ESP were deemed technically infeasible, the plant will utilize cyclones followed by a WESP to minimize total PM emissions. Although WESPs control filterable and condensable PM, the degree to which condensable PM is controlled is not well characterized and cannot be estimated with confidence. Since WESP control efficiency for filterable PM in a wood-fired application is well-characterized, but condensable PM is not, Enviva proposes a filterable PM limit of approximately 0.073 lb/ODT, which is equivalent to the non-applicable NSPS limit of 0.03 lb/MMBtu. It should be noted that for conservatism, condensable PM from the dryer included in air dispersion modeling was based on conservative AP-42 factors.

4.4.3. Volatile Organic Compounds (VOC)

VOC emissions from a wood pellet mill result almost entirely from the wood drying process. Enviva will design the pellet milling equipment to utilize at least 25 percent hardwood. Hardwood species emit less VOC than the more common softwood species and it is anticipated that the plant would emit less VOC than a traditional softwood mill. It should be noted that wood chip drying systems such as the one proposed recirculate approximately 50-60 percent of dryer air into the combustion makeup air for the burner to optimize thermal efficiency and achieve partial VOC destruction.

A variety of forest products industries have attempted to utilize VOC oxidation abatement equipment. Use of such controls has been fraught with operational difficulties requiring regular, significant capital investments to replace various equipment in the oxidation system. The following analysis ignores these additional costs; however, the useful economic life of oxidation controls has been assumed to be 10 years. Ten years is conservatively long because experience with the forest products industry has shown that the major components of these systems are typically replaced at an even more frequent schedule. Due to corrosion the entire cost of an oxidation systems utilized in the forest products industry will typically be incurred more frequently than every 10 years.

4.4.3.1. Identify Control Technologies

VOC emissions from the wood dryer can be controlled by process design and/or VOC add-on oxidation technologies. Based upon a search of RBLC results and commercially demonstrated technology, only the following control technologies were considered in this evaluation:

- Process design,
- Regenerative thermal oxidation (RTO),
- Regenerative catalytic oxidation (RCO),
- Thermal Catalytic Oxidation (TCO),
- Packed-Bed Catalytic Wet Scrubber, and
- Bio-oxidation / Bio-filtration.

PROCESS DESIGN: Enviva will design the pellet milling equipment to utilize at least 25 percent hardwood species and will install an inherently low emitted low temperature dryer system.

REGENERATIVE THERMAL OXIDATION: RTOs use high-density media such as a ceramic-packed bed still hot from a previous cycle to preheat an incoming VOC-laden waste gas stream. The preheated, partially oxidized gases then enter a combustion chamber where they are heated by

auxiliary fuel (natural gas) combustion to a final oxidation temperature typically between 760 to 820 °C (1400 to 1500 °F) and maintained at this temperature to achieve maximum VOC destruction. The purified, hot gases exit this chamber and are directed to one or more different ceramic-packed beds cooled by an earlier cycle. Heat from the purified gases is absorbed by these beds before the gases are exhausted to the atmosphere. The reheated packed-bed then begins a new cycle by heating a new incoming waste gas stream.

REGENERATIVE CATALYTIC OXIDATION: Regenerative catalytic oxidation (RCO) technology is widely used in the reduction of VOC emissions. It operates in the same fashion as an RTO, but it requires only moderate reheating to the operating range of the catalyst, approximately 450 °F. Furthermore, RCOs can achieve a high thermal efficiency of 95% because they utilize a ceramic bed to recapture the heat of the stream exiting the combustion zone. Particulate control must be placed upstream of an RCO.

THERMAL CATALYTIC OXIDATION: Operating much in the same fashion as an RCO, thermal catalytic oxidation (TCO), passes heated gases through a catalyst without the regenerative properties attributed by the ceramic bed used to recapture heat.

PACKED-BED CATALYTIC WET SCRUBBER: This technology is reportedly able to reduce overall VOC emissions by approximately 30 percent.

BIO-OXIDATION / BIO-FILTRATION: Bio-filtration offers an alternative to costly thermal or catalytic units. It is an air pollution control technology – offering upwards of 80% or more control efficiency – in which VOCs are oxidized using living micro-organisms on a media bed (sometimes referred to a “bioreactor”). A fan is typically used to collect or draw contaminated air from a building or process. If the air is not properly conditioned (heat, humidity, solids), then pre-treatment may be a necessary step to obtain optimum gas stream conditions before introducing it into the bioreactor. As the emissions flow through the bed media, the pollutants are absorbed by moisture on the bed media and come into contact with the microbes. The microbes consume and metabolize the excess organic pollutants, converting them into CO₂ and water, much like a traditional oxidation process.

“Mesophilic” microbes are typically used in these systems. Mesophilic microbes can survive and metabolize VOC materials at conditions up to 110°F to 120°F. One company is attempting to develop a commercial-scale technology that employs “thermophilic” microbes, but that technology has only been demonstrated on a single pilot scale installation that has a similar – but not exactly the same – exhaust stream profile as Enviva. Thermophilic microbes live and metabolize VOC at higher operating temperatures (~160°F).

4.4.3.2. Eliminate Technically Infeasible Options

While there are a number of combustion techniques that can be used to control VOC, the following technologies are not practical for VOC control at the Enviva plant:

- Packed Bed Catalytic Scrubber, and
- Bio-oxidation / Bio-filtration,
- Regenerative catalytic oxidation (RCO), and
- Thermal Catalytic Oxidation (TCO).

PACKED BED WET SCRUBBER: This technology is still within a startup mode of operation at its first full-scale demonstration in Moncure, NC. Until the technology can be demonstrated to operate reliably with an established VOC control efficiency over an extended period of time, this technology is not considered to be a feasible control technology.

BIO-OXIDATION / BIO-FILTRATION: In the case of the bio-oxidation or bio-filtration, many questions still remain regarding the technology's efficacy to remove VOC and HAP emissions at the Enviva plant.

To our knowledge, use of this technology has not been demonstrated in practice at a pellet manufacturing facility. Due to the undemonstrated nature of this technology at a pellet manufacturing facility, it has been eliminated from further consideration in this BACT analysis.

REGENERATIVE CATALYTIC OXIDATION: There are no wood pellet manufacturing facilities using RCOs and operation of RCOs downstream of drying operations utilizing WESPs for particulate control, which will be used at this facility, are prone to major corrosion and catalyst fouling due to deposition of entrained salts and high operating temperatures. Due to operational problems and the undemonstrated nature of use of an RCO after a WESP in the wood pellets manufacturing industry, use of RCO control is rejected from further consideration.

4.4.3.3. Rank Remaining Control Technologies by Effectiveness

After eliminating the technically infeasible control options, Enviva has determined the following options remain and has ranked them in order of greatest to least control of VOC emissions:

- Regenerative thermal oxidation (RTO).

4.4.3.4. Evaluate Most Effective Control Option (Impacts Analysis)

4.4.3.4.1 Regenerative Thermal Oxidation (0.359 lb/ODT VOC)

Economic Impacts

Results of the economic impacts evaluation for operation of the RTO are presented in Tables D-7 and D-8. Capital and operating costs are based on vendor quotes, OAQPS Manual, and past permitting experience. Other cost impacts were estimated using EPA cost methodologies. Table D-7 presents a breakout of costs used in the economic impacts evaluation.

Capital Costs for the RTO were provided to Enviva by GEOENERGY. Economic Life of the RTO of 10 years was also supplied by the vendor, which is also consistent with Trinity experience.

As shown in Tables D-8, the cost-effectiveness of operation of the RTO is approximately \$2,026/ton VOC, which is considered cost prohibitive, particularly when considering that operation of the unit will have negligible impact to ozone formation in this rural region of the state, which is "NOx limited."

Please also refer back to the MDF plant in central NC that was previously mentioned above in Section 4.1.3. In that application, their cost effectiveness for a RTO based on actual costs and operating data was \$5,283/ton. Enviva requests that DAQ consider the above referenced RTO cost data in its review of our application, not only for this drying operation, but also for the other VOC sources at our pellet manufacturing facility

Energy Impacts

The additional energy required to operate the RTO is about 5.2×10^6 KWH/yr.

Environmental Impacts

There are adverse impacts from the operation of an RTO in the form of increased emissions of criteria pollutants, particularly NO_x which can lead to increased formation of ozone in NO_x -limited regions like Richmond County, and GHGs emitted as by-products of natural gas used for supplemental fuel.

4.4.3.4.2 Process Design (3.59 lb/ODT VOC)

There are no adverse economic, energy, or environmental impacts associated with designing the process to utilize at least 25% hardwood and incorporating a low temperature drying system. Use of hardwood has been used to establish baseline emissions and results in a VOC reduction compared to a traditional softwood mill.

4.4.3.5. Select BACT

Because RTO abatement technology is deemed to be cost prohibitive, the plant will utilize process design to minimize total VOC emissions to 3.59 lb/ODT on an annual average basis. As discussed in the associated emission calculations, this emission rate is based on the weighted uncontrolled AP-42 emission factors for wood chip drying at 75 and 25 percent softwood and hardwood usage on an annualized basis, respectively. An alternative proposed BACT of 4.7 lb/ODT is proposed on a short-term basis when operating using 100 percent softwood. This variability is needed because during certain periods of production, the facility will typically be drying exclusively softwood.

4.5. GREEN WOOD HAMMERMILLS

The green wood hammermills discharge a small amount of wood fines, which are controlled utilizing a high efficiency cyclones prior to discharge to the atmosphere. The control technology assessment for each compound emitted and subject to PSD review is provided below.

4.5.1. Particulate Matter (TSP/PM₁₀)

Particulate matter (TSP/PM₁₀/PM_{2.5}) is emitted as both filterable and condensable particulate matter. As stated earlier, Enviva has designed the green wood hammermills to be controlled by one high efficiency cyclone prior to discharge to the atmosphere. However in order to effectively evaluate all options, baseline emissions are based on no control of particulate matter.

4.5.1.1. Identify Control Technologies

Potentially applicable PM add-on control technologies are:

- Cyclones,
- Baghouse, and
- Electrostatic Precipitator (ESP).

Cyclone/ Multiclone: Cyclone separators, which can be arranged in series as a multiclone, remove solids from the air stream by application of centrifugal force. Typically, the particle-laden gas enters the top of the cyclone tangentially to the barrel, which causes the gas to spin inside the device. Because of the shape of the device, the gas turns and forms a vortex in the center of the device as it moves upward to the exit duct. The particles are removed by centrifugal force, which drives them to the wall of the collector where they fall to the bottom due to gravity. Cyclones are efficient in removing larger, denser particles but are not as effective for fine particle removal (less than 10 μm diameter).

Baghouse: A fabric filtration device (baghouse) consists of a number of filtering elements (bags) along with a bag cleaning system contained in a main shell structure incorporating dust hoppers. Fabric filters use fabric bags as filters to collect particulate matter. The particulate-laden gas enters a fabric filter compartment and passes through a layer of particulate and filter bags. The collected particulate forms a cake on the bag, which enhances the bag's filtering efficiency. However, excessive caking will increase the pressure drop across the fabric filter and reduce its efficiency.

Electrostatic Precipitator: Electrostatic precipitators (ESPs) remove particles from a gas stream through the use of electrical forces. Discharge electrodes apply a negative charge to particles passing through a strong electrical field. These charged particles then migrate to a collecting electrode having an opposite, or positive, charge. Collected particles are removed from the collecting electrodes by periodic mechanical rapping.

4.5.1.2. Eliminate Technically Infeasible Options

Baghouses and ESPs are both technically feasible. However, since baghouses can generally be designed to be as efficient as ESPs and are the technology of choice for these green wood hammermills, only baghouse control was considered in the analysis. Evaluation of only baghouse controls was considered logical to allow for a side-by-side comparison of the cyclone to baghouse control options evaluated in the BACT evaluation.

4.5.1.3. Rank Remaining Control Technologies by Effectiveness

After eliminating technically infeasible control options, Enviva has determined the following options remain and has ranked them in order of greatest to least control of particulate matter emissions:

- Baghouse designed for 97% control efficiency for PM.
- Cyclone designed for 90% control efficiency for PM.

4.5.1.4. Evaluate Most Effective Control Option (Impacts Analysis)

4.5.1.4.1 Baghouse (0.0075 gr/cf TSP, 0.00053 g/cf PM_{10} , 0.00006 gr/cf $\text{PM}_{2.5}$)

Economic Impacts

Results of the economic impacts evaluation for operation of the baghouse on the green wood hammermills are presented in Tables D-13a, b and c. Three separate tables present the cost impacts evaluations for PM, PM_{10} , and $\text{PM}_{2.5}$ particle size fractions. Capital and operating costs are based on vendor quotes, OAQPS Manual, and past permitting experience

As shown in Tables D-12a, b, and c the cost-effectiveness of operation of the a baghouse compared with the design of using cyclones has an incremental cost effectiveness of \$30,732/ton PM, \$423,474 /ton PM₁₀, and \$3,841,514/ton PM_{2.5} which is considered cost prohibitive.

Energy Impacts

The additional energy required to operate the baghouse is about 2.6×10^5 KWH/yr.

Environmental Impacts

There are no adverse impacts from the operation of baghouse.

4.5.1.4.2 Cyclone (0.025 gr/cf TSP, 0.0018 g/cf PM₁₀, 0.0002 gr/cf PM_{2.5})

Economic Impacts

Results of the economic impacts evaluation for operation of the cyclone on the green wood hammermills are presented in Tables D-12a, b and c. Three separate tables evaluate the cost effectiveness for PM, PM₁₀, and PM_{2.5}. Capital and operating costs were based on vendor quotes, OAQPS Manual, and past permitting experience

As shown in Tables D-12a, b, and c the cost-effectiveness of operation of the cyclone is \$119/ton PM, \$1,646/ton PM₁₀, and \$14,813/ton PM_{2.5} which is not considered cost prohibitive.

Energy Impacts

The additional energy required to operate the cyclone is about 2.6×10^5 KWH/yr.

Environmental Impacts

There are no adverse impacts from the operation of cyclones as BACT.

4.5.1.5. Select BACT

Cyclones are selected as BACT and the proposed BACT emission rate for the green wood hammermills cyclone is 0.025 gr PM/cf, 0.0018 gr PM₁₀/cf, and 0.0002 gr PM_{2.5}/cf; levels considered near the lowest levels reliably achieved via cyclone control.¹⁴

4.5.2. Volatile Organic Compounds (VOC)

VOC emissions are released during the hammermill process due to the heat generated by mechanical milling of the dried wood.

4.5.2.1. Identify Control Technologies

VOC emissions can be controlled by VOC add-on oxidation technologies. Based upon a search of RBLC results and commercially demonstrated technology, the following control technologies were considered in this evaluation:

- Regenerative thermal oxidation (RTO),
- Regenerative catalytic oxidation (RCO),

¹⁴ Air & Waste Management Association, Table 4 - Cyclone and Fabric Filter Performance, "Air Pollution Control Manual," 2000.

- Thermal Catalytic Oxidation (TCO),
- Packed-Bed Catalytic Wet Scrubber, and
- Bio-oxidation / Bio-filtration.

REGENERATIVE THERMAL OXIDATION: RTOs use high-density media such as a ceramic-packed bed still hot from a previous cycle to preheat an incoming VOC-laden waste gas stream. The preheated, partially oxidized gases then enter a combustion chamber where they are heated by auxiliary fuel (natural gas) combustion to a final oxidation temperature typically between 760 to 820 °C (1400 to 1500 °F) and maintained at this temperature to achieve maximum VOC destruction. The purified, hot gases exit this chamber and are directed to one or more different ceramic-packed beds cooled by an earlier cycle. Heat from the purified gases is absorbed by these beds before the gases are exhausted to the atmosphere. The reheated packed-bed then begins a new cycle by heating a new incoming waste gas stream.

REGENERATIVE CATALYTIC OXIDATION: Regenerative catalytic oxidation (RCO) technology is widely used in the reduction of VOC emissions. It operates in the same fashion as the RTO, but it requires only moderate reheating to the operating range of the catalyst, approximately 450 °F. Furthermore, RCOs can achieve a high thermal efficiency of 95% because they utilize a ceramic bed to recapture the heat of the stream exiting the combustion zone. Particulate control must be placed upstream of an RCO.

THERMAL CATALYTIC OXIDATION: Operating much in the same fashion as an RCO, thermal catalytic oxidation (TCO), passes heated gases through a catalyst without the regenerative properties attributed by the ceramic bed used to recapture heat.

PACKED-BED CATALYTIC WET SCRUBBER: This technology is reportedly able to reduce overall VOC emissions by approximately 30 percent.

BIO-OXIDATION / BIO-FILTRATION: Bio-filtration offers an alternative to thermal or catalytic units. It is an air pollution control technology – offering upwards of 80% or more control efficiency – in which VOCs are oxidized using living micro-organisms on a media bed (sometimes referred to a “bioreactor”). A fan is typically used to collect or draw contaminated air from a building or process. If the air is not properly conditioned (heat, humidity, solids), then pre-treatment may be a necessary step to obtain optimum gas stream conditions before introducing it into the bioreactor. As the emissions flow through the bed media, the pollutants are absorbed by moisture on the bed media and come into contact with the microbes. The microbes consume and metabolize the excess organic pollutants, converting them into CO₂ and water, much like a traditional oxidation process.

“Mesophilic” microbes are typically used in these systems. Mesophilic microbes can survive and metabolize VOC materials at conditions up to 110°F to 120°F.

4.5.2.2. *Eliminate Technically Infeasible Options*

As indicated in the previous subsection, there are a variety of combustion techniques that can be used to control VOC. However, the following technologies are not practical for VOC control at the Enviva plant:

- Packed Bed Catalytic Scrubber, and
- Bio-oxidation / Bio-filtration,
- Thermal Catalytic Oxidation (TCO).

PACKED BED WET SCRUBBER: This technology is still in startup mode of operation at its first full-scale demonstration in Moncure, NC. Until the technology can be demonstrated to operate reliably with an established VOC control efficiency over an extended period of time, this technology is not considered to be a feasible control technology.

BIO-OXIDATION / BIO-FILTRATION: In the case of bio-oxidation or bio-filtration, many questions still remain on the technology's efficacy to remove VOC and HAP emissions at the Enviva plant.

To our knowledge, use of this technology has not been demonstrated in practice at a pellet manufacturing facility. Due to the undemonstrated nature of this technology at a pellet manufacturing facility, it has been eliminated from further consideration in this BACT analysis.

4.5.2.3. Rank Remaining Control Technologies by Effectiveness

After eliminating technically infeasible control options, Enviva has determined the following options remain and has ranked them in order of greatest to least control of VOC emissions:

- Regenerative thermal oxidation (RTO) designed for 90% control
- Regenerative catalytic oxidation (RCO) designed for 90% control

4.5.2.4. Evaluate Most Effective Control Option (Impacts Analysis)

4.5.2.4.1 Regenerative Thermal Oxidation (0.11 lb/ODT VOC)

Economic Impacts

Results of the economic impacts evaluation for operation of the RTO are presented in Tables D-13 and D-15. Capital and operating costs are based on vendor quotes, OAQPS Manual, and incremental baghouse capital and annual operating cost. Other cost impacts were estimated using EPA cost methodologies. Table D-13 presents a breakout of costs used in the economic impacts evaluation.

As shown in Tables D-15, the cost-effectiveness of operation of the RTO is approximately \$2,385/ton VOC, which is considered cost prohibitive.

Energy Impacts

The additional energy required to operate the RTO is about 1.13×10^6 KWH/yr.

Environmental Impacts

There are adverse impacts from the operation of an RTO in the form of increased emissions of criteria pollutants, particularly NO_x and GHGs emitted as by-products of natural gas used for supplemental fuel.

4.5.2.4.2 Regenerative Catalytic Oxidation (0.11 lb/ODT VOC)

Economic Impacts

Results of the economic impacts evaluation for operation of the RCO are presented in Tables D-14 and D-15. Capital and operating costs are based on vendor quotes, OAQPS Manual, and incremental baghouse capital and annual operating cost. Other cost impacts were estimated using EPA cost methodologies. Table D-14 presents a breakout of costs used in the economic impacts evaluation. A

As shown in Tables D-15, the cost-effectiveness of operation of the RCO is approximately \$2,666/ton VOC, which is considered cost prohibitive.

Energy Impacts

The additional energy required to operate the RCO is about 3.24×10^5 KWH/yr.

Environmental Impacts

There are adverse impacts from the operation of an RCO in the form of increased emissions of criteria pollutants, particularly NO_x, and GHGs emitted as by-products of natural gas used for supplemental fuel.

4.5.2.5. Select BACT

Since the RTO and RCO abatement technology were deemed cost prohibitive, the plant will utilize good operating and maintenance procedures to achieve the proposed BACT of 1.10 lb/ODT.

4.6. HAMMERMILLS/ HAMMERMILL AREA BAGHOUSE/ PELLET MILL FEED SILO/ PELLET MILL FINES BIN/ FINISHED PRODUCT HANDLING

4.6.1. Particulate Matter (TSP/PM₁₀)

TSP/PM₁₀/PM_{2.5} emissions from the hammermills, hammermills area, pellet mill feed silo, pellet mill fines bin, and finished product handling sources will be controlled with fabric filtration or bin vent filtration systems. These filters are capable of achieving the lowest achievable emission rates of potentially applicable particulate matter control devices for filterable PM. The proposed BACT is based on an outlet grain loading factor of 0.003 gr/cf, which approaches the lowest emission levels reliably achieved using fabric filter control.

4.6.2. Volatile Organic Compounds (VOC)

In addition to particulate emissions, some VOC emissions will be emitted from the hammermills.

4.6.2.1. Identify Control Technologies

VOC emissions can be controlled by VOC add-on oxidation technologies. Based upon a search of RBLC results and commercially demonstrated technology, only the following control technologies were considered in this evaluation:

- Regenerative thermal oxidation (RTO),
- Regenerative catalytic oxidation (RCO),

- Thermal Catalytic Oxidation (TCO),
- Packed-Bed Catalytic Wet Scrubber, and
- Bio-oxidation / Bio-filtration.

REGENERATIVE THERMAL OXIDATION: RTOs use high-density media such as a ceramic-packed bed still hot from a previous cycle to preheat an incoming VOC-laden waste gas stream. The preheated, partially oxidized gases then enter a combustion chamber where they are heated by auxiliary fuel (natural gas) combustion to a final oxidation temperature typically between 760 to 820 °C (1400 to 1500 °F) and maintained at this temperature to achieve maximum VOC destruction. The purified, hot gases exit this chamber and are directed to one or more different ceramic-packed beds cooled by an earlier cycle. Heat from the purified gases is absorbed by these beds before the gases are exhausted to the atmosphere. The reheated packed-bed then begins a new cycle by heating a new incoming waste gas stream.

REGENERATIVE CATALYTIC OXIDATION: Regenerative catalytic oxidation (RCO) technology is widely used in the reduction of VOC emissions. It operates in the same fashion as the RTO, but it requires only moderate reheating to the operating range of the catalyst, approximately 450 °F. Furthermore, RCOs can achieve a high thermal efficiency of 95% because they utilize a ceramic bed to recapture the heat of the stream exiting the combustion zone. Particulate control must be placed upstream of an RCO.

THERMAL CATALYTIC OXIDATION: Operating much in the same fashion as an RCO, thermal catalytic oxidation (TCO), passes heated gases through a catalyst without the regenerative properties attributed by the ceramic bed used to recapture heat.

PACKED-BED CATALYTIC WET SCRUBBER: This technology is reportedly able to reduce overall VOC emissions by approximately 30 percent.

BIO-OXIDATION / BIO-FILTRATION: Bio-filtration offers an alternative to thermal or catalytic units. It is an air pollution control technology – offering upwards of 80% or more control efficiency – in which VOCs are oxidized using living micro-organisms on a media bed (sometimes referred to a “bioreactor”). A fan is typically used to collect or draw contaminated air from a building or process. If the air is not properly conditioned (heat, humidity, solids), then pre-treatment may be a necessary step to obtain optimum gas stream conditions before introducing it into the bioreactor. As the emissions flow through the bed media, the pollutants are absorbed by moisture on the bed media and come into contact with the microbes. The microbes consume and metabolize the excess organic pollutants, converting them into CO₂ and water, much like a traditional oxidation process.

“Mesophilic” microbes are typically used in these systems. Mesophilic microbes can survive and metabolize VOC materials at conditions up to 110°F to 120°F.

4.6.2.2. *Eliminate Technically Infeasible Options*

As indicated in the previous subsection, there are a variety of combustion techniques that can be used to control VOC. However, the following technologies are not practical for VOC control at the Enviva plant:

- Packed Bed Catalytic Scrubber, and
- Bio-oxidation / Bio-filtration,

- Thermal Catalytic Oxidation (TCO).

PACKED BED WET SCRUBBER: This technology is still in startup mode of operation at its first full-scale demonstration in Moncure, NC. Until the technology can be demonstrated to operate reliably with an established VOC control efficiency over an extended period of time, this technology is not considered to be a clearly feasible control technology.

BIO-OXIDATION / BIO-FILTRATION: In the case of the bio-oxidation or bio-filtration, many questions still remain on the technology's efficacy to remove VOC and HAP emissions at the Enviva plant.

To our knowledge, use of this technology has not been demonstrated in practice at a pellet manufacturing facility. Due to the undemonstrated nature of this technology at a pellet manufacturing facility, it has been eliminated from further consideration in this BACT analysis.

4.6.2.3. Rank Remaining Control Technologies by Effectiveness

After eliminating the technically infeasible control options, Enviva has determined the following options remain and has ranked them in order of greatest to least control of VOC emissions:

- Regenerative thermal oxidation (RTO) designed for 90% control efficiency with additional PM control (baghouse).
- Regenerative catalytic oxidation (RCO) designed for 90% control efficiency with upgraded PM control (baghouse).

4.6.2.4. Evaluate Most Effective Control Option (Impacts Analysis)

4.6.2.4.1 Regenerative Thermal Oxidation (0.071 lb/ODT VOC)

Economic Impacts

Results of the economic impacts evaluation for operation of the RTO are presented in Tables D-17 and D-19. Capital and operating costs were based on vendor quotes and OAQPS Manual. Other cost impacts were estimated using EPA cost methodologies. Table D-17 presents a breakout of costs used in the economic impacts evaluation. A detailed discussion of key cost estimates is provided in the following text.

As shown in Tables D-19, the cost-effectiveness of operation of the RTO is approximately \$8,634/ton VOC, which is considered cost prohibitive.

Energy Impacts

The additional energy required to operate the RTO is about 4.6×10^6 KWH/yr.

Environmental Impacts

There are adverse impacts from the operation of an RTO in the form of increased emissions of criteria pollutants and GHGs emitted as by-products of natural gas used for supplemental fuel.

4.6.2.4.2 Regenerative Catalytic Oxidation (0.071 lb/ODT VOC)

Economic Impacts

Results of the economic impacts evaluation for operation of the RCO are presented in Tables D-18 and D-19. Capital and operating costs are based on vendor quotes and OAQPS Manual. Other

cost impacts were estimated using EPA cost methodologies. Table D-18 presents a breakout of costs used in the economic impacts evaluation.

As shown in Table D-19, the cost-effectiveness of operation of the RCO is approximately \$7,251/ton VOC, which is considered cost prohibitive.

Energy Impacts

The additional energy required to operate the RCO is about 1.47×10^6 KWH/yr.

Environmental Impacts

There are adverse impacts from the operation of an RCO in the form of increased emissions of criteria pollutants, particularly NO_x, and GHGs emitted as by-products of natural gas used for supplemental fuel.

4.6.2.5. Select BACT

Since the RTO and RCO abatement technologies were deemed cost prohibitive, the plant will utilize good operating and maintenance procedures to achieve the proposed BACT of 0.710 lb/ODT on an annual average basis. This emission rate is based on the weighted uncontrolled AP-42 emission factors for wood chip drying at 75 and 25 percent softwood and hardwood usage on an annualized basis, respectively. An alternative proposed BACT of 0.931 lb/ODT is proposed on a short-term basis when operating using 100 percent softwood. This variability is needed because during certain periods of production, the facility will be drying exclusively softwood.

4.7. PELLET COOLERS

The pellet presses discharge formed pellets through one of six pellet coolers. Cooling air is passed through the pellets. At this point, the pellets contain a small amount of wood fines, which are swept out with the cooling air and are controlled utilizing six high efficiency cyclones operating in parallel (one for every cooler) prior to discharge to the atmosphere. The control technology assessment for each compound subject to PSD review is provided below.

4.7.1. Particulate Matter (TSP/PM₁₀)

Particulate matter (TSP/PM₁₀/PM_{2.5}) is emitted as both filterable and condensable particulate matter. As stated earlier, Enviva has designed the pellet coolers to have one high efficiency cyclone operating per pellet cooler prior to discharge to the atmosphere. However in order to effectively evaluate all options, baseline emissions are based on no control of particulate matter.

4.7.1.1. Identify Control Technologies

Potentially applicable PM add-on control technologies are:

- Cyclones,
- Baghouse, and
- Electrostatic Precipitator (ESP).

Cyclone/ Multiclone: Cyclone separators, which can be arranged in series as a multiclone, remove solids from the air stream by application of centrifugal force. Typically, the particle-

laden gas enters the top of the cyclone tangentially to the barrel, which causes the gas to spin inside the device. Because of the shape of the device, the gas turns and forms a vortex in the center of the device as it moves upward to the exit duct. The particles are removed by centrifugal force, which drives them to the wall of the collector where they fall to the bottom due to gravity. Cyclones are efficient in removing larger, denser particles but are not as effective for fine particle removal (less than 10 µm diameter).

Baghouse: A fabric filtration device (baghouse) consists of a number of filtering elements (bags) along with a bag cleaning system contained in a main shell structure incorporating dust hoppers. Fabric filters use fabric bags as filters to collect particulate matter. The particulate-laden gas enters a fabric filter compartment and passes through a layer of particulate and filter bags. The collected particulate forms a cake on the bag, which enhances the bag's filtering efficiency. However, excessive caking will increase the pressure drop across the fabric filter and reduce its efficiency.

Electrostatic Precipitator: Electrostatic precipitators (ESPs) remove particles from a gas stream through the use of electrical forces. Discharge electrodes apply a negative charge to particles passing through a strong electrical field. These charged particles then migrate to a collecting electrode having an opposite, or positive, charge. Collected particles are removed from the collecting electrodes by periodic mechanical rapping.

4.7.1.2. Eliminate Technically Infeasible Options

Baghouses and ESPs are both technically feasible. However, since baghouses can generally be designed to be as efficient as ESPs, only baghouse control was considered in the analysis. Evaluation of baghouse controls was considered logical to allow for a side-by-side comparison of the cyclone to baghouse control options evaluated in the BACT evaluation.

4.7.1.3. Rank Remaining Control Technologies by Effectiveness

After eliminating the technically infeasible control options, Enviva has determined the following options remain and has ranked them in order of greatest to least control of particulate matter emissions:

- Baghouse designed for 97% control efficiency for PM.
- Cyclone designed for 90% control efficiency for PM.

4.7.1.4. Evaluate Most Effective Control Option (Impacts Analysis)

4.7.1.4.1 Baghouse (0.006 gr/cf TSP, 0.0011 g/cf PM₁₀, 0.00012 gr/cf PM_{2.5})

Economic Impacts

Results of the economic impacts evaluation for operation of the baghouse on the pellet coolers are presented in Tables D-23a, b and c. Three separate tables present the cost impacts evaluations for PM, PM₁₀, and PM_{2.5} particle size fractions. Capital and operating costs were based on vendor quotes, OAQPS Manual, and past permitting experience

As shown in Tables D-23a, b, and c the cost-effectiveness of operation of the a baghouse compared with the use of using cyclones has an incremental cost effectiveness of \$15,147/ton PM, \$88,358 /ton PM₁₀, and \$757,353/ton PM_{2.5} which is considered cost prohibitive.

Energy Impacts

The additional energy required to operate the baghouse about 1.2×10^6 KWH/yr.

Environmental Impacts

There are no adverse impacts from the operation of baghouse.

4.7.1.4.2 Cyclones (0.020 gr/cf TSP, 0.0035 g/cf PM₁₀, 0.0004 gr/cf PM_{2.5})

Economic Impacts

Results of the economic impacts evaluation for operation of the cyclones on the pellet coolers are presented in Tables D-23a, b and c. Three separate tables evaluate the cost effectiveness for PM, PM₁₀, and PM_{2.5}. Capital and operating costs were based on vendor quotes, the OAQPS Manual, and past permitting experience

As shown in Tables D-23a, b, and c the cost-effectiveness of operation of the cyclones is \$177/ton PM, \$1,009 /ton PM₁₀, and \$8,832/ton PM_{2.5} which is not considered cost prohibitive.

Energy Impacts

The additional energy required to operate the cyclones is about 1.2×10^6 KWH/yr.

Environmental Impacts

There are no adverse impacts from the operation of cyclones as BACT.

4.7.1.5. Select BACT

The proposed BACT emission rate for the pellet cooler cyclones is 0.020 gr PM/cf, 0.0035 gr PM₁₀/cf, and 0.0004 gr PM_{2.5}/cf. These levels are considered near the lowest levels reliably achieved via cyclone control.¹⁵

4.7.2. Volatile Organic Compounds (VOC)

VOC emissions are released during the pelletization and cooling process due to the heat generated by mechanical compression during compression.

4.7.2.1. Identify Control Technologies

VOC emissions can be controlled by VOC add-on oxidation technologies. Based upon a search of RBLC results and commercially demonstrated technology, only the following control technologies were considered in this evaluation:

- Regenerative thermal oxidation (RTO),
- Regenerative catalytic oxidation (RCO),
- Thermal Catalytic Oxidation (TCO),
- Packed-Bed Catalytic Wet Scrubber, and
- Bio-oxidation / Bio-filtration.

¹⁵ Air & Waste Management Association, Table 4 - Cyclone and Fabric Filter Performance, "Air Pollution Control Manual," 2000.

REGENERATIVE THERMAL OXIDATION: RTOs use high-density media such as a ceramic-packed bed still hot from a previous cycle to preheat an incoming VOC-laden waste gas stream. The preheated, partially oxidized gases then enter a combustion chamber where they are heated by auxiliary fuel (natural gas) combustion to a final oxidation temperature typically between 760 to 820 °C (1400 to 1500 °F) and maintained at this temperature to achieve maximum VOC destruction. The purified, hot gases exit this chamber and are directed to one or more different ceramic-packed beds cooled by an earlier cycle. Heat from the purified gases is absorbed by these beds before the gases are exhausted to the atmosphere. The reheated packed-bed then begins a new cycle by heating a new incoming waste gas stream.

REGENERATIVE CATALYTIC OXIDATION: Regenerative catalytic oxidation (RCO) technology is widely used in the reduction of VOC emissions. It operates in the same fashion as the RTO, but it requires only moderate reheating to the operating range of the catalyst, approximately 450 °F. Furthermore, RCOs can achieve a high thermal efficiency of 95% because they utilize a ceramic bed to recapture the heat of the stream exiting the combustion zone. Particulate control must be placed upstream of an RCO.

THERMAL CATALYTIC OXIDATION: Operating much in the same fashion as an RCO, thermal catalytic oxidation (TCO), passes heated gases through a catalyst without the regenerative properties attributed by the ceramic bed used to recapture heat.

PACKED-BED CATALYTIC WET SCRUBBER: This technology is reportedly able to reduce overall VOC emissions by approximately 30 percent.

BIO-OXIDATION / BIO-FILTRATION: Bio-filtration offers an alternative to thermal or catalytic units. It is an air pollution control technology – offering upwards of 80% or more control efficiency – in which VOCs are oxidized using living micro-organisms on a media bed (sometimes referred to a “bioreactor”). A fan is typically used to collect or draw contaminated air from a building or process. If the air is not properly conditioned (heat, humidity, solids), then pre-treatment may be a necessary step to obtain optimum gas stream conditions before introducing it into the bioreactor. As the emissions flow through the bed media, the pollutants are absorbed by moisture on the bed media and come into contact with the microbes. The microbes consume and metabolize the excess organic pollutants, converting them into CO₂ and water, much like a traditional oxidation process.

“Mesophilic” microbes are typically used in these systems. Mesophilic microbes can survive and metabolize VOC materials at conditions up to 110°F to 120°F.

4.7.2.2. Eliminate Technically Infeasible Options

As indicated in the previous subsection, there are a variety of combustion techniques that can be used to control VOC. However, the following technologies are not practical for VOC control at the Enviva plant:

- Packed Bed Catalytic Scrubber,
- Bio-oxidation / Bio-filtration, and
- Thermal Catalytic Oxidation (TCO).

PACKED BED WET SCRUBBER: This technology is still in a startup mode of operation at its first full-scale demonstration in Moncure, NC. Until the technology can be demonstrated to operate

reliably with an established VOC control efficiency over an extended period of time, this technology is not considered to be a feasible control technology.

BIO-OXIDATION / BIO-FILTRATION: In the case of bio-oxidation or bio-filtration, many questions still remain on the technology's efficacy to remove VOC and HAP emissions at the Enviva plant.

To our knowledge, use of this technology has not been demonstrated in practice at a pellet manufacturing facility. Due to the undemonstrated nature of this technology at a pellet manufacturing facility, it has been eliminated from further consideration in this BACT analysis.

4.7.2.3. Rank Remaining Control Technologies by Effectiveness

After eliminating the technically infeasible control options, Enviva has determined the following options remain and has ranked them in order of greatest to least control of VOC emissions:

- Regenerative thermal oxidation (RTO) designed for 90% control efficiency with additional PM control (baghouse).
- Regenerative catalytic oxidation (RCO) designed for 90% control efficiency with upgraded PM control (baghouse).

4.7.2.4. Evaluate Most Effective Control Option (Impacts Analysis)

As demonstrated in Section 4.5.1, baghouse control on the pellet coolers was determined to not be cost effective based on incremental cost effectiveness over cyclone control. However, in order to consider additional VOC control using either an RTO or RCO, additional PM reduction is required to prevent catalyst blinding in an RCO and media plugging in either an RCO or RTO. Therefore, use of RCO and RTO on the pellet coolers is presumed to require use of a bagfilter instead of cyclones for improved PM control to protect the operational stability of the RCO and RTO. In order to account for this required upgrade, the incremental capital and annual operating costs for use of bagfilters instead of cyclones has been added to the capital and annual operating costs of RTO and RCO controls. Please refer to the PM BACT analysis for the pellet coolers for calculation of capital and operating costs of bagfilter and cyclone controls.

4.7.2.4.1 Regenerative Thermal Oxidation (0.30 lb/ODT VOC)

Economic Impacts

Results of the economic impacts evaluation for operation of the RTO are presented in Tables D-24 and D-26. Capital and operating costs are based on vendor quotes, the OAQPS Manual, and incremental baghouse capital and annual operating cost. Other cost impacts were estimated using EPA cost methodologies. Table D-24 presents a breakout of costs used in the economic impacts evaluation.

As shown in Table D-26, the cost-effectiveness of operation of the RTO is approximately \$4,743/ton VOC, which is considered cost prohibitive.

Energy Impacts

The additional energy required to operate the RTO is about 4.3×10^6 KWH/yr.

Environmental Impacts

There are adverse impacts from the operation of an RTO in the form of increased emissions of criteria pollutants, particularly NO_x, and GHGs emitted as by-products of natural gas used for supplemental fuel.

4.7.2.4.1 Regenerative Catalytic Oxidation (0.30 lb/ODT VOC)

Economic Impacts

Results of the economic impacts evaluation for operation of an RCO are presented in Tables D-25 and D-26. Capital and operating costs were based on vendor quotes, OAQPS Manual, and incremental baghouse capital and annual operating cost. Other cost impacts were estimated using EPA cost methodologies. Table D-25 presents a breakout of costs used in the economic impacts evaluation. A detailed discussion of key cost estimates is provided in the following text.

As shown in Table D-26, the cost-effectiveness of operation of the RCO is approximately \$4,516/ton VOC, which is considered cost prohibitive.

Energy Impacts

The additional energy required to operate the RCO is about 1.48×10^6 KWH/yr.

Environmental Impacts

There are adverse impacts from the operation of an RTO in the form of increased emissions of criteria pollutants, particularly NO_x, and GHGs emitted as by-products of natural gas used for supplemental fuel.

4.7.2.5. Select BACT

Since the RTO and RCO abatement technologies were deemed cost prohibitive, the plant will utilize good operating and maintenance procedures to achieve the proposed BACT of 2.30 lb/ODT on an annual average basis. This emission rate is based on the weighted uncontrolled AP-42 emission factors for wood chip drying at 75 and 25 percent softwood and hardwood usage on an annualized basis, respectively. An alternative proposed BACT of 3.01 lb/ODT is proposed on a short-term basis when operating using 100 percent softwood. This variability is needed because during typical periods of production, the facility will be drying exclusively softwood.

4.8. LOG BARK HOG/ LOG CHIPPING/ DIESEL STORAGE TANKS

VOC emissions from these emission sources are considered fugitive emissions and add on emission controls are not practicable. There are no know good operating practices that would reduce emissions. Therefore, no control is proposed for VOC emissions for these emission sources.

4.9. GREEN WOOD HANDLING & STORAGE PILE- PM, PM₁₀, PM_{2.5}, VOC

PM/PM₁₀/PM_{2.5} emissions from the storage pile and handling are considered fugitive source emissions. As presented in emission calculations in this application, PM emissions from the green wood storage piles and green wood handling are negligible due to the high inherent moisture content of green wood. Thus use of water sprays or chemical suppressants is unnecessary and would result in notable increases in emissions of criteria pollutants from the

dryer due to combustion of additional fuel to remove the additional moisture that would be added.

In addition to particulate emissions, fugitive VOC will be emitted. There are no practicable methods for reduction of VOC emissions from these sources.

4.10. ROADS - PM, PM₁₀, PM_{2.5}

Raw material delivery, pellet loadout, and employee traffic will result in fugitive particulate matter emissions from paved and unpaved roads at the site. It should be noted that unpaved roads at the site will be covered with heavy-duty crushed stone instead of dirt.

Fugitive road emissions are most commonly controlled at large industrial facilities using periodic application of water on unpaved roads when road conditions become dry enough to create notable fugitive dust. This technique reduces emissions by an estimated 80 percent as documented in the emission calculations in this application. This technique is proposed as BACT for unpaved roads.

Based on observation at other Enviva facilities, it is anticipated that watering of paved roads is generally unnecessary due to low soil loading; however, Enviva proposes to water areas of paved roads. This technique reduces emissions by an estimated 90 percent as documented in the emission calculations in Appendix B and is proposed as BACT for paved roads.

4.11. EMERGENCY FIRE PUMP, EMERGENCY GENERATOR, & PORTABLE CHIPPER

A 250 hp emergency generator, 250 hp fire pump, and (up to) 1,300 hp portable chipper will be installed as part of this project. Each diesel-fired engine will be certified to meet the emissions standards of NSPS Subpart IIII. If a diesel-fired portable chipper is utilized at the site, only units certified to meet at least Tier 2 NSPS standards will be used. All engines will be fired with only ultra-low sulfur diesel (ULSD) with a maximum sulfur content of 0.0015 weight percent (15 ppmw).

The following NSPS emission limits will apply to two proposed emergency engines and effectively set the floor for BACT for these units for certain pollutants:

- CO limit of 3.5 g/KW-hr
- PM limit of 0.20 g/kW-hr
- NMHC + NOX limit of 4.0 g/kW-hr

Other than for use during emergency service, the emergency fire pump and emergency generator engines are limited to a maximum of 100 hours per year of operation for maintenance and readiness testing under the NSPS standards of Subpart IIII. Enviva will use non-resettable hour meters to monitor and record the monthly engine operation to ensure non-emergency operation does not exceed 100 hours for each rolling 12-month period.

Although a specific number of hours is not proposed for use of a portable chipper at the site, use of a diesel-fired chipper will be minimized because its operating costs are considerably higher (e.g., fuel and rental) than the permanent on-site electric-powered chipper.

Add-on controls for the fire pump, generator, and portable chipper are impractical given the intermittent operation of these sources. Accordingly, Enviva proposes BACT for these engines to be good combustion practices (i.e., operate under manufacturer's guidance), to ensure compliance with all applicable requirements of NSPS Subpart IIII for the fire pump and generator, including the use of low sulfur fuel, and to limit annual non-emergency operation to 100 hours per year per engine. No specific emission limits beyond those required by NSPS Subpart IIII are necessary.

4.12. SUMMARY OF PROPOSED BACT EMISSIONS LIMITS

TABLE 4-2: PROPOSED BACT TABLE

Source	Pollutant	Control/Operation	Proposed Emission Limit	Emission Limit Units
Dryer System	NO _x	Good combustion practices; burner design	0.228	lb/MMBtu
	TSP/PM ₁₀ /PM _{2.5} (filterable)	Cyclones + WESP	0.073	lb/ODT (filterable)
	VOC	Process Design	3.59	lb/ODT (annual)
			4.70	lb/ODT (short-term)
Green Wood Hammermills	TSP/PM ₁₀ /PM _{2.5} (filterable)	Cyclone	0.025/ 0.0018/ 0.0002	gr/cf
	VOC	Good operating & maintenance procedures	1.1	lb/ODT
Hammermill Area	TSP/PM ₁₀ /PM _{2.5} (filterable)	Fabric Filter	0.003	gr/cf
Coarse Hammermills	TSP/PM ₁₀ /PM _{2.5} (filterable)	Cyclones + Fabric Filter	0.003	gr/cf
	VOC	Process Design	0.71	lb/ODT (annual)
			0.93	lb/ODT (short-term)
Pellet Mill Feed Silo	TSP/PM ₁₀ /PM _{2.5} (filterable)	Bin Vent Filter	0.003	gr/cf
Pellet Mill Fines Bin	TSP/PM ₁₀ /PM _{2.5} (filterable)	Bin Vent Filter	0.003	gr/cf
Final Product Handling	TSP/PM ₁₀ /PM _{2.5} (filterable)	Fabric Filter	0.003	gr/cf
Pellet Coolers	TSP/PM ₁₀ /PM _{2.5} (filterable)	Cyclones	0.020/ 0.0035/ 0.0004	gr/cf
	VOC	Process Design	2.30	lb/ODT (annual)
			3.01	lb/ODT (short-term)
Log Bark Hog	VOC	Fugitive - N/A	N/A	N/A
Chipper	VOC	Fugitive - N/A	N/A	N/A
Storage Tanks	VOC	Fugitive - N/A	N/A	N/A

Source	Pollutant	Control/Operation	Proposed Emission Limit	Emission Limit Units
Green Wood Handling	TSP/PM ₁₀ /PM _{2.5}	Inherent Moisture	N/A	N/A
Storage Piles	TSP/PM ₁₀ /PM _{2.5}	Inherent Moisture	N/A	N/A
	VOC	Fugitive - N/A	N/A	N/A
Roads	TSP/PM ₁₀ /PM _{2.5}	Paving & Water Spray	N/A	N/A
Emergency Generator	All Pollutants	NSPS Certification	N/A	N/A
Firewater Pump	All Pollutants	NSPS Certification	N/A	N/A
Backup Chipper	All Pollutants	NSPS Certification	N/A	N/A

5. PSD AND STATE AIR TOXICS MODELING REQUIREMENTS

The remainder of this application addresses the dispersion modeling analyses required as part of the PSD review.

Following NCDAQ policy, Trinity, on behalf of Enviva, submitted a dispersion modeling protocol describing the proposed methodologies and data resources for the project.¹⁶ The protocol included a description of the proposed facility, an overview of the required PSD and State-only modeling analyses, and a description of the methodology proposed to be used in those modeling analyses. The analyses discussed included evaluations of National Ambient Air Quality Standards (NAAQS), PSD Increment, additional impacts analyses for visibility and non-air quality impacts, as well as the ambient impact assessment of toxic air pollutant (TAP) emissions. The protocol was approved by NCDAQ, with limited comments on January 6, 2014.¹⁷ The remaining sections of this application summarize the modeling requirements, methodologies and results. The results demonstrate that the proposed project will not cause or contribute to a modeled violation of any federal or state air pollution standard.

The dispersion modeling analyses were conducted in accordance with the following guidance documents:

- U.S. EPA's *Guideline on Air Quality Models* 40 CFR 51, Appendix W (Revised, November 9, 2005), herein referred to as the *Guideline*;
- U.S. EPA's *AERMOD Implementation Guide* (Revised March 19, 2009);
- U.S. EPA's *New Source Review Workshop Manual* (Draft, October, 1990);
- U.S. EPA, Office of Air Quality Planning and Standards, Memorandum from Mr. Tyler Fox to Regional Air Division Directors. *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO₂ National Ambient Air Quality Standard* (March 1, 2011);
- U.S. EPA, Office of Air Quality Planning and Standards, *Draft Guidance for PM_{2.5} Permit Modeling* (March 4, 2013), herein referred to as *PM_{2.5} Guidance*;
- North Carolina's *PSD Modeling Guidance* (January 6, 2012); and
- North Carolina's *Guidelines for Evaluating the Air Quality Impacts of Toxic Air Pollutants in North Carolina* (December 2009).

5.1. PROJECT LOCATION AND CLASSIFICATION

Figure E-1 provides a map of the area surrounding the Hamlet property. The approximate central Universal Transverse Mercator (UTM) coordinates of the facility are 624.5 kilometers (km) east and 3,866.7 km north in Zone 17 (NAD 83). A detailed site layout showing the locations of the facility fence line as well as of all modeled sources and structures is included in Figure E-2.

For modeling purposes, the appropriate urban/rural land use classification for the area was determined using the Auer technique, which is recommended in the *Guideline*. In accordance

¹⁶ Letter from Jonathan Hill (Trinity) to Mark Cuilla (NCDAQ) dated December 17, 2013.

¹⁷ Letter from Tom Anderson (NCDAQ) to Jonathan Hill (Trinity) dated January 6, 2014.

with this technique, the area within a 3-km radius of the facility was identified on US Geological Survey (USGS) topographic maps (and was delineated by land use type). More than 50 percent of the surrounding land use can be classified as undeveloped rural (i.e., Auer's A4 classification), therefore the area is classified as rural.

5.2. PSD APPLICABILITY

Part C of Title I of the Clean Air Act, 42 U.S.C. §§7470-7492, is the statutory basis for the PSD program. U.S. EPA has codified PSD definitions, applicability, and requirements in 40 CFR Part 51.166. North Carolina has incorporated the PSD rules into their regulations and is a federally-approved program for PSD implementation. PSD is one component of the federal New Source Review (NSR) permitting program applicable in areas that are designated as in attainment of the NAAQS. Hamlet County, in which the proposed facility will be located, is currently designated as unclassifiable or in attainment for all criteria pollutants.¹⁸

As discussed in Section 3, PSD review will be triggered for NO_x, PM, PM₁₀, and PM_{2.5}. PSD is also triggered for VOC but no modeling is required.

5.3. PSD MODELING ANALYSES

Trinity has prepared this modeling analysis to demonstrate that the Hamlet plant does not cause or contribute to exceedances of the NAAQS or PSD Increment, as applicable, for NO_x, PM₁₀, and PM_{2.5} and that no other adverse impacts at Class I areas are attributable to the proposed facility.

A standard PSD air quality modeling analysis is conducted in three (3) principal steps. A flow chart of the overall PSD modeling process is included in Appendix F. Each of the steps for completing the Class II Area modeling analysis: the Significance Analysis, the NAAQS Analysis, and the PSD Increment Analysis are described below.

5.4. SIGNIFICANCE ANALYSIS

The Significance Analysis is conducted to determine whether the emissions associated with the proposed new construction project could cause a significant impact upon the area surrounding the facility. "Significant" impacts are defined by ambient concentration thresholds commonly referred to as the Significant Impact Levels (SIL). Table 5-1 lists the SIL, NAAQS, and PSD Increments for all relevant NSR regulated pollutants for this project.

If the highest modeled ambient concentrations for a pollutant for all averaging periods are less than the applicable SIL when emissions from only the project are modeled, then further analyses (NAAQS and PSD Increment) are not required for that pollutant. If, however, modeled impacts are greater than the SIL for any averaging period, a full NAAQS and PSD Increment analysis is required for that pollutant and averaging period to demonstrate that the project neither causes nor contributes to any exceedances. The geographic extent to which significant impacts occur is used to define the significantly impacted receptors within which compliance with the NAAQS and PSD Increments must be demonstrated.

¹⁸ 40 CFR §81.334

TABLE 5-1. PSD MODELING THRESHOLDS AND STANDARDS

Pollutant	Averaging Period	PSD SIL ($\mu\text{g}/\text{m}^3$)	Primary and Secondary NAAQS ($\mu\text{g}/\text{m}^3$)	Class II PSD Increment ($\mu\text{g}/\text{m}^3$)	Significant Monitoring Concentration ($\mu\text{g}/\text{m}^3$)
NO ₂	1-hour	10 ¹	188 (100 ppb) ²	--	--
	Annual	1	100 (0.053 ppm) ³	25	14
PM ₁₀	24-hour	5	150 ⁴	30	10
	Annual	1	N/A	17	--
PM _{2.5}	24-hour	1.2 ⁵	35	9 ⁵	-- ⁶
	Annual	0.3 ⁵	12	4 ⁵	--

- 1 Until EPA develops and promulgates a 1-hr NO₂ SIL for the recently promulgated NO₂ 1-hr NAAQS, NCDAQ has adopted an interim 1-hr NO₂ SIL of 10 $\mu\text{g}/\text{m}^3$. The 10 $\mu\text{g}/\text{m}^3$ SIL was developed by the Northeast States for Coordinated Air Use Management (NESCAUM) and is based on the ratio of the existing 1-hr CO SIL to the 1-hr CO NAAQS.
- 2 The 3-year average of the 98th percentile of the daily maximum 1-hr average.
- 3 Annual arithmetic average.
- 4 Not to be exceeded more than three times in 3 consecutive years.
- 5 On January 22, 2013, the U.S. Court of Appeals for the District of Columbia Circuit vacated two provisions in EPA's PSD regulations containing SILs for PM_{2.5}. (*Sierra Club v. EPA*, No. 10-1413 (D.C. Circuit), 2013 WL 216018). The court decision does not preclude the use of SILs for PM_{2.5}, but requires that EPA correct the error in the SIL regulations for PM_{2.5} at 51.166(k)(2) and 52.21(k)(2). In the interim, the EPA states that permitting authorities may continue to apply SILs for PM_{2.5} to support a PSD permitting decision, but permitting authorities should take care to ensure that SILs are not used in a manner that is inconsistent with the requirements of Section 165(a)(3) of the CAA.
- 6 The PM_{2.5} SMC was vacated on January 22, 2013 (*Sierra Club v. EPA*, No. 10-1413 (D.C. Circuit), 2013 WL 216018).

5.5. AMBIENT MONITORING REQUIREMENTS

In addition to determining whether the applicant can forego further modeling analyses, the PSD Significance Analysis is also used to determine whether the applicant is exempt from ambient monitoring requirements. To determine whether pre-construction monitoring should be considered, the maximum impacts attributable to the proposed project are assessed against significant monitoring concentrations (SMC). The SMC for the applicable averaging periods for NO_x and PM₁₀ are listed in Table 5-1. A pre-construction air quality analysis using continuous monitoring data may be required for pollutants subject to PSD review. If either the predicted modeled impact from an emissions increase or the existing ambient concentration is less than the SMC, an applicant may be exempt from pre-construction ambient monitoring. As shown in this report, ambient impacts exceeded the SMC for PM₁₀. However, given the availability of representative monitoring data in the vicinity of the project, Enviva proposes to use existing ambient monitor data in lieu of pre-construction monitoring requirements.

The PM_{2.5} SMC was vacated on January 22, 2013 by the U.S. Court of Appeals for the District of Columbia Circuit.¹⁹ Per the *PM_{2.5} Guidance*, as a result of the court decision, EPA will not rely on, and advises states with SIP-approved PSD programs not to rely on, the SMC for PM_{2.5} to exempt projects from preconstruction monitoring requirements.²⁰ However, EPA states that PSD permit applicants can continue to meet pre-construction monitoring requirements by using data from existing monitors that are determined by the permitting authority to be representative of the area surrounding the proposed project. Given the availability of representative monitoring data in the area surrounding the proposed project, Enviva is proposes to use existing ambient monitor data in lieu of pre-construction monitoring requirements.

5.6. BACKGROUND CONCENTRATIONS

If the maximum modeled impacts for a PSD triggering pollutant are greater than the SIL in the Significance Analysis, a NAAQS analysis is required for that pollutant. In the NAAQS analysis, modeled impacts from the facility will be combined with background concentrations, which represent the air quality concentrations due to sources that are not explicitly modeled (e.g., mobile sources, small but local stationary sources, non-regulated fugitive sources, and large but distant sources). Selection of the existing monitoring station data that is “representative” of the ambient air quality in the area surrounding the proposed facility is determined based on the following three criteria: 1) monitor location, 2) data quality, and 3) data currentness. Key considerations based on the monitor location criteria include proximity to the significant impact area of the proposed facility, similarity of emission sources impacting the monitor to the emission sources impacting the airshed surrounding the proposed facility, and the similarity of the land use and land cover (LULC) surrounding the monitor and proposed facility. The data quality criteria refer to the monitor being an approved SLAM or similar monitor type subject to the quality assurance requirements in 40 CFR Part 58 Appendix A. Data currentness refers to the fact that the most recent three complete years of quality assured data are generally preferred.

As shown later in this report, ambient impacts of NO₂, PM₁₀, and PM_{2.5} exceed their respective SILs and thus triggered NAAQS modeling requirements. Table 5-2 presents the background values that were provided by NCDAQ and added to the modeled impacts.²¹

¹⁹ *Sierra Club v. EPA*, No. 10-1413 (D.C. Circuit), 2013 WL 216018.

²⁰ U.S. EPA, Office of Air Quality Planning and Standards, *Draft Guidance for PM_{2.5} Permit Modeling* (March 4, 2013).

²¹ Letter from Tom Anderson (NCDAQ) to Jonathan Hill (Trinity) on August 13, 2013.

TABLE 5-2. AMBIENT BACKGROUND CONCENTRATIONS USED IN THE ANALYSIS

Pollutant	Averaging Period	Background Concentration¹ ($\mu\text{g}/\text{m}^3$)
NO ₂	1-Hour	32.1
	Annual	5.3
PM ₁₀	24-Hour	25.0
PM _{2.5} ²	24-Hour	17.3
	Annual	8.9

¹ Background Concentrations provided in email from Tom Anderson (NCDAQ) to Jonathan Hill (Trinity) on December 16, 2013.

5.7. REGIONAL SOURCE INVENTORY DEVELOPMENT

For any off-site impact calculated in the PSD Significance Analysis that was greater than the SIL for a given pollutant, other regional sources of the affected pollutant(s) were evaluated for possible inclusion in the NAAQS and PSD Increment analyses. The NAAQS regional source inventory was comprised of all sources (major and minor) that were not otherwise excluded based on the "20D" procedure.²² Using this procedure, sources are excluded from the inventory if the entire facility's emissions (tpy) are less than 20 times the distance (km) from the facility to the Hamlet site.

Sources in the inventories provided by NCDAQ²³ were evaluated for inclusion in the NAAQS and PSD Increment analyses. The final inventory was discussed with and approved by NCDAQ.^{24,25} The complete list of modeled inventory sources and the associated model input parameters are provided on the CD-ROM included as Appendix G.

5.8. NAAQS ANALYSIS

The primary NAAQS are the maximum concentration ceilings, measured in terms of total concentration of a pollutant in the atmosphere, which define the "levels of air quality that the EPA judges are necessary, with an adequate margin of safety, to protect the public health."²⁶ Secondary NAAQS define the levels that "protect the public welfare from any known or anticipated adverse effects of a pollutant." The primary and secondary NAAQS are shown in Table 5-1 for NO_x, PM₁₀, and PM_{2.5}. In the NAAQS analysis, the potential emissions from all emission units at the facility as well as sources included in the regional NAAQS inventory were modeled together to compute the cumulative impact.

²² *Federal Register* 8079, March 6, 1992.

²³ Email from Connie Horne (NCDAQ) to Jonathan Hill (Trinity) on November 21, 2013.

²⁴ Letter from Jonathan Hill (Trinity) to Mark Cuilla (NCDAQ) on December 20, 2013.

²⁵ Email from Tom Anderson (NCDAQ) to Jonathan Hill (Trinity) on January 6, 2014.

²⁶ 40 CFR §50.2(b).

The objective of the NAAQS Analysis is to demonstrate through air quality modeling that emissions from the facility do not cause or contribute to an exceedance of the NAAQS at any ambient location at which the impact from the proposed project is greater than the SIL. The modeled cumulative impacts were added to appropriate background concentrations and assessed against the applicable NAAQS to demonstrate compliance.

The following modeling results for each PSD triggering pollutant and averaging period were used to determine the design concentration in the NAAQS Analysis:

- The maximum-modeled annual arithmetic mean impact from the full five years of meteorological data to demonstrate compliance with the annual NO₂ standard.
- The 1-hr NO₂ standard is the five year average of the 98th percentile [approximated by the high-eighth-high (H8H) modeled concentration] daily maximum 1-hr concentration.
- The modeled annual arithmetic mean impact averaged over the full five years to demonstrate compliance with the annual PM_{2.5} standard.
- The 24-hr PM_{2.5} standard is the five year average of the 98th percentile (H8H) modeled 24-hr concentrations.
- The 24-hr PM₁₀ standard is not to be exceeded more than 3 times in any consecutive 3 year period, meaning that generally the highest sixth-high (H6H) modeled concentration over the full five years of meteorological data is compared against the NAAQS. However, the highest second-high (H2H) concentration was used in this analysis, as a more conservative estimate.

5.9. PSD INCREMENT ANALYSIS

The PSD regulations were enacted to “prevent significant deterioration” of air quality in areas of the country where the air quality was better than the NAAQS. To achieve this goal, the EPA established PSD Increments for NO₂, SO₂, PM₁₀, and PM_{2.5}.²⁷ The PSD Increments are divided into Class I, II, and III Increments. No Class III air quality areas have been established. The Class I modeling portion of this report is limited only to the increment screening procedure described later in the document. The Class II PSD Increments for NO₂, PM₁₀ and PM_{2.5} are listed in Table 5-1.

Since all short-term PSD Increments are not to be exceeded more than once per year, the highest-second-high modeled impacts for PM₁₀ and PM_{2.5} from among the five meteorological years modeled were compared against the short-term increment. The highest annual average PM₁₀, PM_{2.5} and NO₂ impacts were compared against the annual increments.

The sum of the PSD Increment concentration and a baseline concentration defines a “reduced” ambient standard, either lower than or equal to the NAAQS that must be met in a designated attainment area. Significant deterioration is said to have occurred if the *change* in emissions occurring since a baseline date results in an off-property impact greater than the PSD Increment (i.e., the increased emissions “consume” more than the available PSD Increment).

²⁷ The PM_{2.5} PSD Increments became effective on October 20, 2011 (i.e., one year after the date of promulgation).

The determination of whether an emissions change at a given source consumes or expands increment is based on the source definition (major or minor for PSD) and the time the change occurs in relation to baseline dates. The major source baseline date for both SO₂, PM₁₀ and PM_{2.5} is January 6, 1975 and for NO_x is February 8, 1988. Increases or decreases in actual emissions at major sources after the major source baseline date as a result of construction of a new source, a physical or operational change (i.e., modification) to an existing source, or shutdown of an existing source affect the available increment, and therefore, must be included in an increment analysis. Actual emission changes at minor sources only affect increment after the minor source baseline date (MSBD), which is set at the date the first complete PSD permit application is submitted in a county. The MSBDs for PM₁₀, PM_{2.5} and NO_x were established in Richmond County on February 26, 1999, and as such, changes at minor sources after that date affect increment.²⁸ In order to maintain conservatism, the increment modeling was conservatively performed by using the previously described NAAQS inventory rather than restricting the inventory to only those post-baseline date increases/decreases.

5.10. OZONE AMBIENT IMPACT ANALYSIS

Elevated ground-level ozone concentrations are the result of photochemical reactions among various chemical species. These reactions are more likely to occur under certain ambient conditions (e.g., high ground-level temperatures, light winds, and sunny conditions). The chemical species that contribute to ozone formation, referred to as ozone precursors, include NO_x and VOC emissions from both anthropogenic (e.g., mobile and stationary sources) and natural sources (e.g., vegetation). While the facility will not directly emit ozone, the facility will emit both NO_x and VOC at levels that are greater than the PSD SER for ozone precursors, and thus, ambient ozone impacts must be addressed. Enviva proposes that no modeling be required for ozone since the use of reactive plume models is rarely conducted on an individual source basis. In addition, NCDAQ and other Region 4 states have only very rarely assessed single source impacts on ozone in PSD air quality analyses and as such a qualitative rather than quantitative analysis was performed.

The two closest ambient ozone monitors to the project site, located in Union and Cumberland County, NC, are in attainment with the current ozone standard. The Union County monitored design value is 0.073 ppm and the Cumberland County monitored design value is 0.072 ppm, both in relation to the NAAQS of 0.075 ppm. The monitors are located in suburban to rural locations, with more vehicle traffic than the very rural project site would experience. Therefore, given the attainment status of the area, the low vehicle traffic counts and the very small individual source contributions associated with projects of this nature, Enviva believes that no further ozone ambient impact analysis is warranted.

5.11. CLASS I AREA ANALYSIS

Class I areas are federally protected areas for which more stringent air quality standards apply to protect unique natural, cultural, recreational, and/or historic values. There are five (5) Class I areas within 300 km of the Hamlet facility as follow:

²⁸ <http://daq.state.nc.us/permits/psd/docs/mbd1.pdf>

- Cape Romain National Wildlife Refuge located 205 km to the south-southeast;
- Linville Gorge Wilderness Area located 225 km to the west-northwest;
- Shining Rock Wilderness Area located 291 km to the west;
- James River Face Wilderness Area located 291 km to the north; and
- Swanquarter National Wildlife Refuge located 295 km to the east.

The Federal Land Managers (FLM) have the authority to protect air quality related values (AQRVs), and to consider in consultation with the permitting authority whether a proposed major emitting facility will have an adverse impact on such values. Upon receiving the modeling protocol for this project, NCDAQ contacted the FLM and determined that no AQRV analysis would be required.²⁹

In addition to the AQRV analysis, Class I PSD Increment consumption at the affected Class I areas was required to be assessed. The assessment was performed for the proposed dryer stack in AERMOD by placing a ring of receptors at 50 km distance (along 1 degree radials). Figure E-3 illustrates the receptors included in the analysis. This Class I increment “screening” procedure was originally proposed by EPA Region 4 and has been used in several recent PSD applications to fulfill the Class I increment modeling requirement.

5.12. MODEL SELECTION

The latest version (13350) of the AERMOD modeling system was used to estimate maximum ground-level concentrations in all Class II Area analyses conducted for this application. AERMOD is a refined, steady-state, multiple source, Gaussian dispersion model and was promulgated in December 2005 as the preferred model for use by industrial sources in this type of air quality analysis.³⁰ The AERMOD model has the Plume Rise Modeling Enhancements (PRIME) incorporated in the regulatory version, so the direction-specific building downwash dimensions used as inputs are determined by the Building Profile Input Program, PRIME version (BPIP PRIME), version 04274.³¹ BPIP PRIME is designed to incorporate the concepts and procedures expressed in the GEP Technical Support document, the Building Downwash Guidance document, and other related documents, while incorporating the PRIME enhancements to improve prediction of ambient impacts in building cavities and wake regions.³²

The AERMOD modeling system is composed of three modular components: AERMAP, the terrain preprocessor; AERMET, the meteorological preprocessor; and AERMOD, the control module and modeling processor. AERMAP is the terrain pre-processor that is used to import terrain elevations for selected model objects and to generate the receptor hill height scale data that are used by AERMOD to drive advanced terrain processing algorithms. National Elevation Dataset

²⁹ Protocol Approval Letter from Tom Anderson (NCDAQ) to Jonathan Hill (Trinity) on January 7, 2014.

³⁰ 40 CFR Part 51, Appendix W—*Guideline on Air Quality Models*, Appendix A.1—AMS/EPA Regulatory Model (AERMOD).

³¹ Earth Tech, Inc., *Addendum to the ISC3 User's Guide, The PRIME Plume Rise and Building Downwash Model*, Concord, MA.

³² U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (Revised)*, Research Triangle Park, North Carolina, EPA 450/4-80-023R, June 1985.

(NED) data available from the United States Geological Survey (USGS) were utilized to interpolate surveyed elevations onto user specified receptor grids and buildings and sources in the absence of more accurate site-specific (i.e., site surveys, GPS analyses, etc.) elevation data.

AERMET generates a separate surface file and vertical profile file to pass meteorological observations and turbulence parameters to AERMOD. AERMET meteorological data are refined for a particular analysis based on the choice of micrometeorological parameters that are linked to the land use and land cover (LULC) around the meteorological site shown to be representative of the application site.

The most recent versions of AERMOD and AERMAP (version 11103) were used to estimate ambient impacts from the modeled sources in the Class II area. Per NCDAQ guidelines, AERMOD was run using all regulatory default options.

5.13. MODELED RECEPTOR GRIDS

Modeled concentrations were calculated at receptors beginning at the ambient air boundary, which consists of those areas on facility property with clear deterrents to public access (e.g. fencing, regular security patrols). Receptors were placed along the fence line and also on a Cartesian receptor grid. Fence line receptors were spaced 25 meters apart as specified in NCDAQ's PSD Guidance for facilities with sources within 100 meters of the fence line.³³ Beyond the fence line, receptors were spaced 100 meters apart in a Cartesian grid extending out 1.5 km, 200 meters apart out to 5 km, and then 500 meters out to 10 km for the significance analyses with the exception of the 1-hour NO₂ SIL analysis. That grid included receptors out to 30 km. All SIL results were reviewed to ensure that the grid captured all potential areas of significant impacts. Figures E-4 and E-5 present plots of the receptor grids utilized in the significance analysis.

Based on the extent of the SIA, the NAAQS and Increment analyses included a 100 meter-spaced grid out to 2.5 km again with the exception of 1-hour NO₂ which extended out 30 km at various receptor densities. Figures E-6 and E-7 present the NAAQS modeling receptor grids.

The NC TAP analysis included a grid, conservatively beginning at the fence line, which consisted of 100 meter-spaced receptors extending out 2 km, which was more than sufficient given that the maximum impacts were all located along or very near the fence line. Figure E-8 illustrates the extent of the TAP modeling receptor grid.

Receptor elevations required by AERMOD were determined using the AERMAP terrain preprocessor. AERMAP also calculates hill height parameters required by AERMOD. Terrain elevations from the USGS 1 arc second NED were used for the AERMAP processing. AERMAP was also used to determine elevations for the modeled sources and buildings.

5.14. METEOROLOGICAL DATA

The AERMOD modeling results were based on sequential hourly surface observations from Maxton, NC and upper air data from Greensboro, NC. These stations are recommended by

³³ http://www.ncair.org/permits/mets/psd_guidance.pdf

NCDAQ for modeling facilities located in Richmond County and the 2008-2012 files were downloaded from the NCDAQ website.³⁴ Per NCDAQ guidance, the base elevation (PROFBASE) for the Maxton surface station was set to 66 m.³⁵

5.15. BUILDING DOWNWASH ANALYSIS

AERMOD incorporates the Plume Rise Model Enhancements (PRIME) downwash algorithms. Direction-specific building parameters required by AERMOD are calculated using the BPIP-PRIME preprocessor (version 04274).

5.16. REPRESENTATION OF EMISSION SOURCES

5.16.1. Source Types and Parameters

The AERMOD dispersion model allows for emission units to be represented as point, area, or volume sources. All of the point sources planned for the facility have clearly discernable emission points with vertical orientations and no rain caps. As such those sources were characterized as point sources and were modeled with actual stack parameters (i.e., height, diameter, exhaust gas temperature, and gas exit velocity). A list of modeled point sources and locations is presented in Table 5-3 and the modeled stack parameters are shown in Table 5-4. In addition to the modeled point sources, two area sources were included in the model to represent ground-level emissions from the paved and unpaved roadway areas (PAVEDRDS and UNPVDRDS) at the site. Those areas are polygon-shaped with areas of 104,366 m² and 37,333 m², respectively. The release height and initial vertical dimensions for the roadways (based on an average truck height of 12 feet) were set to 3.5 m and 3.26 m, respectively. Those parameters were calculated using the methodology in the NC Quarry Modeling Guidance document.³⁶

³⁴ <http://www.ncair.org/permits/mets/metdata.shtml>

³⁵ <http://www.ncair.org/permits/mets/ProfileBaseElevations.pdf>

³⁶ <http://www.ncair.org/permits/mets/quarry1.pdf>

TABLE 5-3. MODELED SOURCE LOCATIONS

Model ID	Description	UTM-E (m)	UTM-N (m)	Elevation (m)
EP1	Dryer/WESP	624,362.8	3,866,547.6	128.12
EP2	Hammermill Common Stk	624,264.1	3,866,627.3	124.86
EP3	Pellet Press Silo	624,236.4	3,866,687.2	122.68
EP4	EmGen	624,322.6	3,866,541.8	127.64
EP5	Fire Pump	624,566.9	3,866,296.2	127.64
EP6	Rechipper Air Assist	624,443.2	3,866,595.9	126.74
EP7	Fines Bin Vent	624,248.8	3,866,651.4	123.60
EP8	Loadout Filter	624,164.8	3,866,823.2	121.01
EP9	Portable Greenwood Chipper	624,485.4	3,866,702.2	124.67
EP10	Pellet Cooler 1	624,195.4	3,866,717.2	122.06
EP11	Pellet Cooler 2	624,197.6	3,866,713.5	122.10
EP12	Pellet Cooler 3	624,199.1	3,866,707.7	122.16
EP13	Pellet Cooler 4	624,202.0	3,866,701.1	122.23
EP14	Pellet Cooler 5	624,205.7	3,866,695.3	122.29
EP15	Pellet Cooler 6	624,208.6	3,866,689.4	122.37
PAVEDRDS	Paved Roadway Areas	625,084.6	3,866,512.4	123.14
UNPVDRDS	Unpaved Road Areas	624,555.6	3,866,321.7	128.11

Note that EP6, identified above as the Rechipper Air Assist stack, is referred to as the Greenwood Hammermill in the permit application.

TABLE 5-4. MODELED STACK PARAMETERS

Model ID	Stack Height (m)	Stack Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
EP1	36.58	355.37	7.57	3.05
EP2	36.58	310.93	17.82	2.13
EP3	22.86	305.37	0.01	0.61
EP4	4.57	919.82	78.30	0.09
EP5	4.57	954.00	109.18	0.06
EP6	6.10	310.93	19.80	0.91
EP7	14.02	293.15	13.78	0.40
EP8	16.76	310.93	14.35	1.22
EP9	6.10	310.93	19.81	0.91
EP10	18.29	316.48	21.73	0.76
EP11	18.29	316.48	21.73	0.76
EP12	18.29	316.48	21.73	0.76
EP13	18.29	316.48	21.73	0.76
EP14	18.29	316.48	21.73	0.76
EP15	18.29	316.48	21.73	0.76

Table 5-5 presents the modeled emission rates for each of the modeled sources.

TABLE 5-5. MODELED EMISSION RATES

Model ID	Modeled Emission Rates (g/s)			
	TSP	PM ₁₀	PM _{2.5}	NO _x
EP1	1.04E+00	1.04E+00	1.04E+00	5.04E+00
EP2	4.37E-01	4.37E-01	4.37E-01	-
EP3	8.10E-03	8.10E-03	8.10E-03	-
EP4	1.04E-02	1.04E-02	1.04E-02	1.04E-01
EP5	1.04E-02	1.04E-02	1.04E-02	1.04E-01
EP6	7.44E-01	5.21E-02	5.95E-03	-
EP7	1.17E-02	1.17E-02	1.17E-02	-
EP8	1.15E-01	1.05E-01	6.33E-02	-
EP9	5.38E-02	5.38E-02	5.38E-02	1.72E+00
EP10	4.54E-01	7.94E-02	9.07E-03	-
EP11	4.54E-01	7.94E-02	9.07E-03	-
EP12	4.54E-01	7.94E-02	9.07E-03	-
EP13	4.54E-01	7.94E-02	9.07E-03	-
EP14	4.54E-01	7.94E-02	9.07E-03	-
EP15	4.54E-01	7.94E-02	9.07E-03	-
PAVEDRDS*	5.09E-07	1.02E-07	2.50E-08	-
UNPVD RDS*	2.41E-06	6.14E-07	6.14E-08	-

* Area source emission rates expressed per unit area (g/s/m²)

5.16.2. GEP Stack Height Analysis

EPA has promulgated stack height regulations that restrict the use of stack heights in excess of "Good Engineering Practice" (GEP) in air dispersion modeling analyses. Under these regulations, that portion of a stack in excess of the GEP height is generally not creditable when modeling to determine source impacts. This essentially prevents the use of excessively tall stacks to reduce ground-level pollutant concentrations. The minimum stack height not subject to the effects of downwash, called the GEP stack height, is defined by the following formula:

$$H_{GEP} = H + 1.5L, \text{ where:}$$

H_{GEP} = minimum GEP stack height,

H = structure height, and

L = lesser dimension of the structure (height or projected width).

This equation is limited to stacks located within 5L of a structure. Stacks located at a distance greater than 5L are not subject to the wake effects of the structure. The wind direction-specific

downwash dimensions and the dominant downwash structures used in this analysis are determined using BPIP. In general, the lowest GEP stack height for any source is 65 meters by default.³⁷ None of the proposed emission units at the Hamlet plant will exceed GEP height.

Figure E-2 presents a site layout for the proposed facility that shows the source and building arrangement as modeled.

5.17. NO₂ MODELING APPROACH

EPA's *Guideline on Air Quality Models (Guideline)*, in 40 CFR Part 51, Appendix W, recommends a tiered approach for modeling annual average NO₂ from point sources. The tiers are described in Section 6.2.3 of the *Guideline*:

- a) *A tiered screening approach is recommended to obtain annual average estimates of NO₂ from point sources for New Source Review analysis, including PSD... For Tier 1 ... use an appropriate Gaussian model to estimate the maximum annual average concentration and assume a total conversion of NO to NO₂. If the concentration exceeds the NAAQS and/or PSD Increments for NO₂, proceed to the 2nd level screen.*
- b) *For Tier 2 (2nd level) screening analysis, multiply the Tier 1 estimate(s) by an empirically derived NO₂/NO_x value of 0.75 (annual national default).*
- c) *For Tier 3 (3rd level) analyses, a detailed screening method may be selected on a case-by-case basis. For point source modeling, detailed screening techniques such as the Ozone Limiting Method may also be considered.*

Enviva utilized the Ambient Ratio Method (ARM), or Tier 2 approach, which has evolved from previous representations of the oxidation of nitric oxide (NO) by ambient ozone and other photochemical oxidants to form nitrogen dioxide (NO₂ – the regulated ambient pollutant). EPA issued a memo on March 1, 2011 providing additional clarifications regarding application of Appendix W modeling guidance for the 1-hr NO₂ NAAQS.³⁸ Per the memo, EPA recommends the use of 0.80 as a default ambient ratio for the 1-hour NO₂ standard under the Tier 2 approach. Based on this updated EPA guidance, Enviva utilized 0.80 as the ambient NO₂ to NO_x ratio in the significance, NAAQS and PSD Increment modeling analyses, even conservatively for the annual analyses.

5.18. SECONDARY PM_{2.5} EVALUATION

The AERMOD model, the preferred dispersion model for near-field analyses, does not currently include chemical transformation algorithms required in order to address the formation of secondary PM_{2.5}. The draft *PM_{2.5} Guidance* provides recommendations on how applicants should address secondary PM_{2.5} in the context of a PSD modeling analysis. The PSD SERs for NO_x and SO₂ (PM_{2.5} precursors) are utilized to determine whether a proposed source or modification will

³⁷ 40 CFR §51.100(ii)

³⁸ U.S. EPA, Region 4, Memorandum from Mr. Tyler Fox to Regional Air Division Directors. Research Triangle Park, North Carolina. March 1, 2011.

contribute sufficient quantities of precursor emissions requiring consideration. In their *PM_{2.5} Guidance*, EPA proposed four “assessment” cases outlining what air quality analysis, if any, is required to demonstrate compliance with the *PM_{2.5} NAAQS*.

The proposed project falls under Assessment Case 3, with direct *PM_{2.5}* emissions and *NO_x* emissions greater than the respective *SERs*. This case requires that both primary and secondary *PM_{2.5}* impacts be addressed. Per the *PM_{2.5} Guidance*, an applicant can account for the impact of precursor emissions on secondary *PM_{2.5}* formation in a completely qualitative manner, through the use a hybrid of qualitative and quantitative assessment using existing technical work, or through a full quantitative photochemical grid modeling approach.

The only continuous source of precursor emissions at the facility will be the wood dryer. At facilities such as wood pellet mills, *PM_{2.5}* impacts are very localized in nature (along or very near the fence line) and are generally dominated by the ambient/near-ambient release sources (e.g. hammermills, pellet coolers) which do not emit precursor pollutants. Further, the maximum impacts resulting from the dryer and other particulate emission sources are not typically collocated in time or space. The modeled impacts presented in Tables 5-10 through 5-11 are below any *NAAQS* or increment standards such that negligible impacts from secondary formation do not alter the conclusions presented in the results sections. As such, Enviva concludes that a quantitative analysis of secondary *PM_{2.5}* formation does not need to be included in this modeling evaluation.

5.19. STATE-ONLY MODELING REQUIREMENTS

In addition to the federal *NAAQS* and *PSD* increment standards that are required to be analyzed under *PSD* review, North Carolina has two additional, state-only modeling requirements that pertain to this project.

5.19.1. Toxic Air Pollutant Modeling

As shown in Table 3-3 of this application, several toxic air pollutants (*TAP*) will exceed their facility-wide toxics permitting emission rates (*TPER*) under the *NC Air Toxics Rules*. However, those emissions emanate from sources covered by a *NESHAP/MACT* regulation and as such, are exempt from modeling requirements. Since this project is for a new, greenfield facility, as an informative conservative exercise, Enviva has elected to perform a *NC TAP* modeling analysis to demonstrate compliance in any case.

Table 5-6 presents the modeled emission rates for each *TAP* above the *TPER*.

TABLE 5-6. MODELED TAP EMISSION RATES

Model ID	Modeled Emission Rates (g/s)													
	ACET	ACRO	ARSENIC	BENZENE	BAP	CADMIUM	CL	FORM	HXCLPDXN	HCL	MERCURY	NICKEL	PHENOL	VNYLCHLR
EP1	6.78E-01	2.08E-01	3.52E-05	6.87E-02	5.74E-05	6.57E-06	1.75E-02	1.27E+00	3.53E-05	4.20E-02	7.73E-05	7.29E-04	2.53E-01	3.98E-04
EP2	1.12E-01	3.43E-02	0.00E+00	1.13E-02	0.00E+00	0.00E+00	0.00E+00	2.09E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.17E-02	0.00E+00
EP3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EP4	1.69E-04	2.04E-05	0.00E+00	2.06E-04	4.15E-08	0.00E+00	0.00E+00	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EP5	1.69E-04	2.04E-05	0.00E+00	2.06E-04	4.15E-08	0.00E+00	0.00E+00	2.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EP6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EP7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EP8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EP9	8.79E-04	1.06E-04	0.00E+00	1.07E-03	2.16E-07	0.00E+00	0.00E+00	1.35E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EP10	5.56E-02	1.71E-02	0.00E+00	5.64E-05	0.00E+00	0.00E+00	0.00E+00	1.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	0.00E+00
EP11	5.56E-02	1.71E-02	0.00E+00	5.64E-05	0.00E+00	0.00E+00	0.00E+00	1.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	0.00E+00
EP12	5.56E-02	1.71E-02	0.00E+00	5.64E-05	0.00E+00	0.00E+00	0.00E+00	1.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	0.00E+00
EP13	5.56E-02	1.71E-02	0.00E+00	5.64E-05	0.00E+00	0.00E+00	0.00E+00	1.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	0.00E+00
EP14	5.56E-02	1.71E-02	0.00E+00	5.64E-05	0.00E+00	0.00E+00	0.00E+00	1.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	0.00E+00
EP15	5.56E-02	1.71E-02	0.00E+00	5.64E-05	0.00E+00	0.00E+00	0.00E+00	1.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	0.00E+00

The TAP modeling analyses were performed in accordance with the North Carolina's *Guidelines for Evaluating the Air Quality Impacts of Toxic Air Pollutants in North Carolina* (December 2009). The modeling was generally conducted using the same methodology and data resources in AERMOD as described in the previous sections of this report.

5.19.2. Total Suspended Particulate Modeling

15A NCAC 2D .0403 establishes the ambient air quality standards for total suspended particulate matter (TSP). The standards are the following:

- (1) 75 micrograms per cubic meter annual geometric mean,
- (2) 150 micrograms per cubic meter maximum 24-hour concentration not to be exceeded more than once per year.

Trinity performed an analysis to demonstrate compliance with this applicable state standard.

5.20. PSD MODELING RESULTS

The following sections summarize the results of the PSD Class II dispersion modeling analyses which demonstrate that Enviva's proposed Hamlet facility will neither cause nor contribute to an exceedance of the NAAQS or PSD Increment. Electronic copies of all modeling input and output files are included on the CD-ROM in Appendix G.

5.21. SIGNIFICANCE ANALYSIS

5.21.1. Class II Significance Analysis

As discussed in Section 5-5, a Significance Analysis was conducted to determine the need for further pollutant modeling. The results of the Significance Analysis for each pollutant are provided in Table 5-7. Figures E-9 through E-14 present plots of the significance results which were used to determine the SIA. The red receptors represent the areas where modeled concentrations exceeded the SIL.

TABLE 5-7. CLASS II SIGNIFICANCE MODEL RESULTS

Pollutant	Averaging Period	Concentration Basis	UTM-E (m)	UTM-N (m)	Date/Time	Modeled Concentration ($\mu\text{g}/\text{m}^3$)	SIL ($\mu\text{g}/\text{m}^3$)	SIA (km)
NO ₂	1-Hour	5-Year Avg. H1H	624,253.1	3,866,456.8	2008-2012	117.6	10	29.5
	Annual	H1H in any year	624,253.1	3,866,456.8	2008	5.7	1	1.7
PM ₁₀	24-Hour	H1H in any year	624,175.0	3,866,554.3	12112124	22.8	5	2.0
	Annual	H1H in any year	624,159.3	3,866,573.9	2012	4.4	1	1.3
PM _{2.5}	24-Hour	5-Year Avg. H1H	624,610.3	3,866,258.9	2008-2012	6.0	1.2	2.3
	Annual	5-Year Avg. H1H	624,159.3	3,866,573.9	2008-2012	1.0	0.3	1.2

As shown in the results table, NO₂, PM₁₀, and PM_{2.5} exceed the Class II SILs, requiring further analysis to demonstrate compliance with NAAQS and Class II Increment (where established).

5.21.2. Class I Significance Analysis

As discussed in Section 5-12, a Class I Significance Analysis was conducted to determine the need for further Class I increment review. The results of the Significance Analysis for each pollutant are provided in Table 5-8 and demonstrate that no additional modeling was required.

TABLE 5-8. CLASS I SIL MODELING RESULTS

Pollutant	Averaging Period	UTM-E (m)	UTM-N (m)	Date/Time	Modeled Concentration (µg/m³)	SIL (µg/m³)	Exceeds SIL? (Yes/No)
PM _{2.5}	24-Hour	655,283.1	3,906,100.5	08072224	0.069	0.07	No
	Annual	645,630.9	3,912,015.4	2011	0.004	0.06	No
PM ₁₀	24-Hour	655,283.1	3,906,100.5	08072224	0.069	0.32	No
	Annual	645,630.9	3,912,015.4	2011	0.004	0.20	No
NO ₂	Annual	645,630.9	3,912,015.4	2011	0.020	0.1	No

5.22. NAAQS ANALYSIS

The NAAQS Analysis for NO₂, PM₁₀, and PM_{2.5} was conducted using the approach described in Section 5-9 with the emissions and stack parameter data shown in Tables 5-4 through and 5-6 for the proposed emissions sources and Appendix G for regional sources.

Table 5-9 presents the results for the NAAQS modeling analyses. The concentrations shown represent the maximum modeled concentrations required by each standard at which the proposed Hamlet facility is also significant. The results demonstrate that the proposed facility will neither cause nor contribute to a violation of the NAAQS.

TABLE 5-9. NAAQS MODELING RESULTS

Pollutant	Averaging Period	UTM-E (m)	UTM-N (m)	Date/Time	Modeled Concentration ($\mu\text{g}/\text{m}^3$)	Background Concentration ¹ ($\mu\text{g}/\text{m}^3$)	Total Concentration ($\mu\text{g}/\text{m}^3$)	NAAQS ($\mu\text{g}/\text{m}^3$)	Exceeds NAAQS? (Yes/No)
NO ₂	1-Hour	624,253.1	3,866,456.8	2008-2012	95.74	32.10	127.84	188	No
	Annual	624,253.1	3,866,456.8	2008	5.68	5.30	10.98	100	No
PM ₁₀	24-Hour	624,175.0	3,866,554.3	11102324	21.62	25.00	46.62	150	No
PM _{2.5}	24-Hour	624,610.3	3,866,258.9	2008-2012	3.65	17.30	20.95	35	No
	Annual	624,159.3	3,866,573.9	2008-2012	1.01	8.87	9.88	12	No

¹ Background Concentrations provided in email from Tom Anderson (NCDAQ) to Jon Hill (Trinity) on December 16, 2013.

5.23. PSD INCREMENT ANALYSIS

The PSD Increment Analysis for NO₂, PM₁₀ and PM_{2.5} was conducted using the approach described in Section 5-10. Emissions and stack parameter data are shown in Tables 5-3 through 5-5 for the facility proposed emissions sources, and Appendix G for regional sources. The modeling results presented in Table 5-10 demonstrate that the proposed facility will neither cause nor contribute to an exceedance of the PSD Increment for NO₂, PM₁₀, or PM_{2.5}.

TABLE 5-10. CLASS II PSD INCREMENT RESULTS

Pollutant	Averaging Period	UTM-E (m)	UTM-N (m)	Date/Time	Modeled Concentration ($\mu\text{g}/\text{m}^3$)	Increment ($\mu\text{g}/\text{m}^3$)	Exceeds Increment? (Yes/No)
NO ₂	Annual	624,253.1	3,866,456.8	2008	5.68	25	No
PM ₁₀	24-Hour	624,175.0	3,866,554.3	11102324	21.62	30	No
	Annual	624,159.3	3,866,573.9	2012	4.45	17	No
PM _{2.5}	24-Hour	624,200.0	3,866,200.0	12111824	5.92	9	No
	Annual	624,159.3	3,866,573.9	2012	1.16	4	No

5.24. STATE-ONLY MODELING RESULTS

5.24.1. Toxic Air Pollutant Modeling

Table 5-11 presents the results for the state toxics modeling that was performed for the proposed Enviva Hamlet facility. As shown, the project will not cause an exceedance of any pollutant AAL. All modeled TAP except for formaldehyde had impacts less than 50% of the AAL, and as such, only the most recent meteorological year (2012) was modeled. For formaldehyde, 5 years of meteorological data were used to determine the maximum result.

TABLE 5-11. TAP MODELING RESULTS

Pollutant	Averaging Period	UTM-E (m)	UTM-N (m)	Date/Time (YYMMDDHH)	Maximum Concentration ($\mu\text{g}/\text{m}^3$)	AAL ($\mu\text{g}/\text{m}^3$)	% of AAL (%)
Acetaldehyde	1-Hour	624,175.00	3,866,554.30	12082120	59.75	27,000	0.22%
Acrolein	1-Hour	624,175.00	3,866,554.30	12082120	18.32	80	22.90%
Arsenic	Annual	624,200.00	3,866,200.00	2012	1.00E-05	2.30E-04	4.35%
Benzene	Annual	624,200.00	3,866,300.00	2012	1.93E-02	1.20E-01	16.12%
Benzo(a)pyrene	Annual	624,200.00	3,866,200.00	2012	1.00E-05	3.30E-02	0.03%
Cadmium ¹	Annual	624,200.00	3,866,200.00	2012	1.22E-06	5.50E-03	0.02%
Chlorine	1-Hour	624,200.00	3,866,200.00	12102716	0.14	900	0.02%
	24-Hour	624,200.00	3,866,200.00	12102724	8.54E-02	37.5	0.23%
Formaldehyde	1-hour	624,175.00	3,866,554.30	11091305	116.62	150	77.75%
Hexachlorodibenzo-p-dioxin 1,2,3,6,7,8	Annual	624,200.00	3,866,200.00	2012	1.00E-05	7.60E-05	13.16%
Hydrogen chloride (hydrochloric acid)	1-Hour	624,200.00	3,866,200.00	12102716	0.33	700	0.05%
Mercury	24-Hour	624,200.00	3,866,200.00	12102724	3.80E-04	0.6	0.06%
Nickel	24-Hour	624,200.00	3,866,200.00	12102724	3.57E-03	6	0.06%
Phenol	1-hour	624,175.00	3,866,554.30	12082120	22.30	950	2.35%
Vinyl chloride	Annual	624,200.00	3,866,200.00	2012	7.00E-05	0.38	0.02%

¹ The AERMOD output for cadmium is expressed in units of nanograms per cubic meter in order to capture enough significant figures to compare to the AAL.

5.24.2. Total Suspended Particulate Modeling

Table 5-12 presents the results for the TSP modeling analysis that was performed for the proposed Hamlet facility. As shown, the project will not cause any violation of the TSP SAAQS.

TABLE 5-12. TSP MODELING RESULTS

Pollutant	Averaging Period	UTM-E (m)	UTM-N (m)	Date/Time	Modeled Concentration ($\mu\text{g}/\text{m}^3$)	SAAQS ($\mu\text{g}/\text{m}^3$)	Exceeds SAAQS? (Yes/No)
TSP	24-Hour	624,175.0	3,866,554.3	11102324	114.58	150	No
	Annual	624,159.3	3,866,573.9	2012	21.13	75	No