NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date: October 30, 2019

Region: Raleigh Regional Office
County: Northampton
NC Facility ID: 6600167
Inspector's Name: Dawn Reddix
Date of Last Inspection: 04/30/2019
Compliance Code: 3 / Compliance - inspection

Facility Data

Applicant (Facility's Name): Enviva Pellets Northampton, LLC

Facility Address:
Enviva Pellets Northampton, LLC
309 Enviva Boulevard
Garysburg, NC 27831

SIC: 2499 / Wood Products, Nec
NAICS: 321999 / All Other Miscellaneous Wood Product Manufacturing

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

Permit Applicability (this application only)

SIP: 15A NCAC 02Q .0300, .0711, 02D .0515, .0516, .0521, .0540, .1100,
NSPS: 15A NCAC 02D .0524 – 40 CFR Part 60, Subpart IIII
NESHAP: 15A NCAC 02D .1111 – 40 CFR Part 63, Subpart ZZZZ, 15A NCAC 02Q .0317 less than 25 tpy all HAPs and 10 tpy of single HAP
PSD: N/A
PSD Avoidance: 15A NCAC 02Q .0317 less than 250 tpy VOC, CO, NO_X, and $PM/PM_{10}/PM_{2.5}$
NC Toxics: 15A NCAC 02D .1100 and 02Q .0711
112(r): N/A
Other: N/A

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Heath Lucy EH&S Manager (910) 318-2743 309 Enviva Blvd Garysburg, NC 27831	Mark Jordan Plant Manager (252) 541-2631 309 Enviva Blvd Garysburg, NC 27831	Joe Harrell Corporate EHS Manager (252) 209-6032 142 NC Route 561 East Ahoskie, NC 27910

Application Data

Application Number: 6600167.18A
Date Received: 10/01/2018
Application Type: Modification
Application Schedule: State

Existing Permit Data

Existing Permit Number: 10203/R05
Existing Permit Issue Date: 03/03/2017
Existing Permit Expiration Date: 02/28/2025

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP
2017	19.14	130.68	382.86	63.50	72.82	25.25	10.73 [Methanol (methyl alcohol)]
2016	18.00	130.36	381.42	63.35	72.92	21.90	9.63 [Methanol (methyl alcohol)]
2015	17.68	126.53	337.00	61.47	71.52	18.61	8.43 [Methanol (methyl alcohol)]
2014	19.20	107.54	213.08	52.23	89.86	17.22	7.33 [Methanol (methyl alcohol)]
2013	10.80	60.32	113.88	29.51	53.49	9.32	3.31 [Formaldehyde]

Review Engineer: Richard Simpson

Review Engineer's Signature: Richard Simpson **Date: October 30, 2019**

Comments / Recommendations:
Issue: 10203/R06
Permit Issue Date: October 30, 2019
Permit Expiration Date: February 28, 2025

I. Introduction and Purpose of Application

A. Enviva Pellets Northampton, LLC (referred to as Enviva or Northampton throughout this document) currently holds Air Permit No. 10203R05 with an expiration date of February 28, 2025 for a wood pellets manufacturing plant in Garysburg, Northampton County, North Carolina. The plant is currently permitted to produce up to 535,260 oven-dried tons (ODT) per year of wood utilizing up to 30% softwood on a 12-month rolling basis. The plant consists of a log chipper, green wood hammermills, bark hog, wood-fired rotary dryer, dry hammermills, pellet presses and coolers, product loadout operations, and other ancillary activities.

B. Permit application No. 6600167.18A was received on October 1, 2018 and an amended version was received on April 1, 2019 for a modification that incorporates emission reduction efforts to comply with 15A NCAC 02Q .0317 Avoidance Conditions for 15A NCAC 02D .0530: Prevention of Significant Deterioration and 15A NCAC 02Q .0317 Avoidance Condition for 15A NCAC 02D .1111: Maximum Available Control Technology (MACT) Standards for HAPs. The proposed modification is also being implemented to meet new customer demands for increased softwood percentage and production rates. The Table of Changes located in Section III includes details associated with the proposed modification such as Insignificant Activities, emission source name changes, etc. This permit action will address the following main changes associated with the modification as outlined in the application:

- Increase production rate from an approximate actual facility throughput of 535,260 ODT per year to a potential facility throughput at 781,255 ODT per year by upgrading pellet dies with a new prototype;
- Increase the amount of softwood processed from 30% to a maximum of 80%;
- For the existing Dryer (ES-DRYER-1), add a regenerative thermal oxidizer (CD-RTO-1) after the existing wet electrostatic precipitator (CD-WESP-1) for volatile organic compound (VOC), HAP and particulate matter (PM) emissions control;
- Install a new direct-fired wood dryer (ES-DRYER-2) equipped with a new wet electrostatic precipitator (CD-WESP-2) in series with a regenerative thermal oxidizer (CD-RTO-2);
- Remove two existing Green Wood Hammermills (previously referred to as wood re-chippers) and construct five new Green Hammermills (ES-GWH-1 through ES-GWH-5) and route the exhaust to the existing wet electrostatic precipitator (CD-WESP-1) in series with a new regenerative thermal oxidizer (CD-RTO-1). The Green Hammermills will have the capability to be exhausted to CD-WESP-2 and CD-RTO-2 when CD-WESP-1 and CD-RTO-1 are shut down;
- Exhaust the existing Dry Wood Handling (ES-DWH-1 and ES-DWH-2) to new bagfilters (CD-DWH-BF-1 and CD-DWH-BF-2);
- Install Dry Shaving Material Handling (ES-DRYSHAVE-1), Dry Shavings Reception (ES-DSR-1) with associated bagfilter (CD-DSR-BF), and a Dry Shavings Silo (ES-DSS) with associated bagfilter (CD-DSS-BF);
- Install two new Dry Shavings Hammermills (ES-DSHM-1 and ES-DSHM-2) for dry shavings and route the exhaust to a new wet scrubber (CD-WS-1) in series with a new regenerative catalytic oxidizer (CD-RCO-1) that can also operate as a regenerative thermal oxidizer;
- Exhaust the existing Dry Hammermills (ES-HM-1 through 8) from the existing bagfilters to a new wet scrubber (CD-WS-1) in series with a new regenerative catalytic oxidizer (CD-RCO-1);
- Route exhaust from the existing dust control system to a new wet scrubber (CD-WS-1) and regenerative catalytic oxidizer (CD-RCO-1) that can also operate as an RTO and
- Exhaust from the Pellet Presses and Pellet Coolers cyclones will be routed to a new wet scrubber (CD-WS-2) in series with a new regenerative catalytic oxidizer (CD-RCO-2) that can also operate as a regenerative thermal oxidizer.

**Changes made as a result of public comments, applicant comments, and hearing Officer's recommendations.*

- Add a new dryer bypass stack (ES-DRYBYP-2) and furnace bypass stack (ES-FURNACEBYP-2) for low load startups, shutdowns, and idling operations;
- Add an existing dryer bypass stack (ES-DRYBYP-1) and furnace bypass stack (ES-FURNACEBYP-1) for low load startups, shutdowns, and idling operations;

III. History/Background/Application Chronology

April 22, 2014 -Application 6600167.14B was received for a first time Title V permit.

August 9, 2016 - Amendment 6600167.16A was received and incorporated into 6600167.14B.

March 3, 2017 - Air Permit R05 was issued.

August 28, 2018 - The facility was inspected by Raleigh Regional Office engineer Steven Carr. At the time of the inspection, the facility appeared to operate in compliance with all applicable regulations and permit conditions.

September 20, 2017 - October 20, 2018 – The first time Title V application went through public notice. Comments were received during the public comment period from the general public and Environmental Integrity Project (EIP). Issuance of the 1st time Title V permit was placed on hold pending response to those comments.

October 1, 2018 – Permit application 6600167.18A was received for several modifications and a permit acknowledgement was sent to the facility on the same day.

November 16, 2018 – The facility requested that permit application processing be put on hold due to an upcoming addendum to the previous modification.

January 10-14, 2019 – A permit addendum was received from the facility. DAQ permit engineer Richard Simpson called the facility and requested the facility send in a signed A1 permit application form. An A1 form was received from the facility a few days later.

January 30, 2019 - February 6, 2019 – Through emails and a conference call with the facility, discrepancies were found for several sources in the permit application and the addendum. To help simplify the modification, the facility agreed to send an amended application that would combine the October 1, 2018 application with the January 10, 2019 addendum.

March 6, 2019 - Current – DAQ created an Enviva Workgroup for Enviva's Northampton, Hamlet, and Sampson facilities to provide consistency to each of the updated air permits.

March 14, 2019 - Permit engineer Richard Simpson preformed a facility site visit.

March 29, 2019 – April 1, 2019 – An amended permit was received by email and paper copy.

April 10 - 19, 2019 – The facility sent particulate testing emission factor results from their Greenwood facility for Northampton's Dry Shavings Hammermill. DAQ's SSCB Supervisor Gary Saunders reviewed the testing data and no issues were noted in the reported values.

April 12, 2019 - May 23, 2019 - DAQ requested by letter additional information on NC air toxics modeling and emission sources. The facility was requested to remodel. The facility sent the additional information on May 2, 2019 and the electronic modeling files a few weeks later. Ray Stewart and Dawn Reddix of RRO inspected the facility on April 30, 2019.

May 7 - 23, 2019 – DAQ's permit engineers, Raleigh Regional Office, and Stationary Compliance Section were requested to comment on a version of the draft permit. Comments were received and included in the permit from DAQ.

May 23 - June 5, 2019 – The Air Quality Analysis Branch received updated facility modeling. On June 3, 2019, the modeling was approved by DAQ meteorologist Nancy Jones and Tom Anderson. By email, the modeling review was sent to the facility on June 5, 2019.

May 31 – June 5, 2019 – The facility submitted a request to replace four failing presses without increasing throughput to RRO. RRO forward the information to the Permitting Section where the request was entered into the DAQ data system as Applicability Determination No. 3432. The request was approved and a letter was sent to the facility on June 5, 2019.

May 31 - June 7, 2019 – A first draft of the permit was sent to facility representatives, Kai Simonsen and Theron Grim of Enviva Raleigh office, consultant Michael Carbon and DAQ engineers for comments and any potential updates since the amended application. Comments and updates were received.

June 19 – June 21, 2019 – An email was sent to the facility's representatives on items that needed to be addressed or clarified. Updates and clarifications were provided by the facility.

June 20 – July 15, 2019 – An email was sent to the facility about the zoning consistency determination status. On July 15, 2019, William Flynn, Director of the Northampton County Code Enforcement, signed the zoning consistency determination and approved that the facility's proposed operations are consistent with applicable zoning ordinances.

June 26 – July 2, 2019 – The facility, Raleigh Regional Office, and Stationary Compliance Section were requested by the Permitting Section to comment on the draft permit and review. Comments were received and included in the permit from DAQ

July 1 – July 5, 2019 – A second draft of the permit and a first draft of the review were sent to facility representatives, Kai Simonsen and Theron Grim and consultant, Michael Carbon, for comments and any potential updates. Comments and updates were received.

July 8 – 17, 2019 – Phone calls and emails were made to facility representatives on items that needed to be addressed or clarified along with sending a draft of the permit and review. Updates, clarifications, and comments were received and incorporated into the documents.

July 19, 2019 – Draft permit and review were sent to public notice prior to issuance.

August 20, 2019 – A public meeting and hearing were held for the draft permit and review at the Northampton High School.

August 23, 2019 – Public comment period closed. Approximately 2,400 comments were received.

August 26 - September 23, 2019 – Approximately 46 comments were received following the close of the official comment period including those from the Environmental Integrity Project (EIP).

August 21-October 28, 2019 – Phone calls and emails were made with DAQ, Virginia DEQ, and facility representatives for stack tests, emission inventories emission factors, and bypass language to address potential updates to the permit and responses to EIP comments.

October 25, 2019 – A final Hearing Officer's report was sent to the DAQ Director for review.

October 28, 2019 – DAQ Director authorizes issuance of modified permit in response to Hearing Officer's recommendations.

October 30, 2019 – Permit 10203R06 was signed and issued.

III. Permit Modifications/Changes and ESM Discussion

The following changes were made to Enviva Pellets Northampton, LLC, Garysburg, NC., Air Permit No. 10203R05 (*Table of Changes as sent to public notice July 19, 2019*).

Page No.	Section	Description of Changes
Cover Letter	N/A	Updated cover letter with application number, permit numbers, dates, fee class, and Director name.
NA	Insignificant Activities	Added new sources debarker IES-Debark, bark hog IES-Bark, four natural gas/propane double duct burners IES-DDB-1 through IES-DDB-4, dry shaving handling and storage systems IES-DRYSHAVE, dry shaving handling and storage systems IES-DRYSHAVE-1 with one bagfilter CD-DSR-BF, propane vaporizer IES-PVAP, additive handling and storage IES-ADD with one bagfilter CD-ADD-BF, one emergency use generator IES-GN-2, mobile diesel storage tank IES-TK3, and diesel storage tank IES-TK4.
NA	Insignificant Activities	Reclassified dry line hopper to an insignificant source and changed ID No. to IES-DLH.
NA	Insignificant Activities	Reclassified dry wood handling IES-DWH and green wood handling and storage IES-GWHS as significant sources and changed ID Nos. to ES-DWH-1 and ES-GWHS.
NA	Insignificant Activities	Pellet press system IES-PP was deleted since it is incorporated with the pellet coolers.
NA	Insignificant Activities	Finished product handling IES-FPH was deleted since it is incorporated with handling ES-FPH.
NA	Insignificant Activities	Log chipper IES-CHIP-1 was deleted since it is incorporated with chipper IES-EPWC.
NA	Insignificant Activities	Two electric powered wood re-chippers, IES-RCHP-1 and IES-RCHP-2, were deleted since they are being replaced by five new green hammermills (ES-GHM-1 through ES-GHM-5).
NA	Insignificant Activities	Generator ID No. was changed from IES-GN to IES-GN-1. Diesel storage tanks ID Nos. were changed from IS-TK1 and IS-TK2 to IES-TK1 and IES-TK2. IES-TK2 capacity was updated from 500 gallons to 600 gallons.

Page No.	Section	Description of Changes
3, 6	Section 1 and Section 2.1 A.	Add five (5) new closed-loop green hammermills (ES-GHM-1 through ES-GHM-5) and route the exhaust to the existing wet electrostatic precipitator (CD-WESP-1) and the new regenerative thermal oxidizer (CD-RTO-1). The Green hammermills exhaust will also have the ability to be routed and controlled by new CD-WESP-2 and new CD-RTO-2 when the CD-WESP-1 and CD-RTO-1 are shut down. Simple cyclone CD-DC is for product handling and deleted from the permit as a control device.
3, 6	Section 1 and Section 2.1 A.	Updated wood dryer ID No. from (ES-DRYER) to (ES-DRYER-1). The exhaust will route to existing wet electrostatic precipitator (CD-WESP-1) and the new regenerative thermal oxidizer (CD-RTO-1).
3, 6	Section 1 and Section 2.1 A.	Added dryer 1 bypass ES-DRYERBYP-1 and furnace 1 bypass (ES-FURNACEBYP-1).
3, 6	Section 1 and Section 2.1 A.	Added a new direct heat wood fired dryer (ES-DRYER-2) controlled by new wet electrostatic precipitator CD-WESP-2 in series with a new regenerative thermal oxidizer (CD-RTO-2).
3, 6	Section 1 and Section 2.1 A.	Added dryer 2 bypass (ES-DRYERBYP-2) and furnace 2 bypass (ES-FURNACEBYP-2).
3, 6	Section 1 and Section 2.1 A.	Added a new dry wood handling (ES-DWH-2) controlled by a new bagfilter (CD-DWH-BF-2).
3, 6	Section 1 and Section 2.1 A.	Assigned source ID Nos. (ES-PS-1) and (ES-PS-2) to existing dry hammermill pre-screeners.
4, 6	Section 1 and Section 2.1 A.	The eight existing dry hammermills exhaust will also route through new wet scrubber (CD-WS-1) and regenerative catalytic oxidizer (CD-RCO-1) that can also operate as an RTO.
4, 6	Section 1 and Section 2.1 A.	Renamed existing nuisance system to dust control system (ES-DCS) and update the permit to reflect that the exhaust will route through new wet scrubber (CD-WS-1) and regenerative catalytic oxidizer (CD-RCO-1) that can operate as an RTO.
4, 6	Section 1 and Section 2.1 A.	Added a new dry shavings reception (ES-DSR) controlled by a new bagfilter (CD-DSR-BF).
4, 6	Section 1 and Section 2.1 A.	Added a new dry shavings silo (ES-DSS) controlled by a new bagfilter (CD-DSS-BF).
4, 6	Section 1 and Section 2.1 A.	Added two new dry shavings hammermills (ES-DSHM-1 and ES-DSHM-2) controlled by new wet scrubber (CD-WS-1) and regenerative catalytic oxidizer (CD-RCO-1) that can operate as an RTO.
5, 6	Section 1 and Section 2.1 A.	The six existing pellet coolers exhaust will also route through new wet scrubber (CD-WS-2) and regenerative catalytic oxidizer (CD-RCO-2) that can operate as an RTO.
5, 6	Section 1 and Section 2.1 A.	Rename the currently permitted Pellet Fines Bin (ES-PFB-1) and associated bin vent filter (CD-PFB-BV) to Pellet Cooler Fines Relay System (ES-PCHP) and baghouse (CD-PCHP-BV.)
NA	Section 1 and Section 2.1 A.	Since the sources will not be utilized, deleted bagging system conveyor and screens (ES-BSC-1, ES-BSS-1, and ES-BSS-2) and associated filters (CD-BS-BF-1 and CD-BS-BF-2).

Page No.	Section	Description of Changes
NA	Section 1 and Section 2.1 A.	Since the sources will not be utilized, deleted bagging systems (ES-BSC-2, ES-BSC-3, ES-BSB-1, and ES-BSB-2).
6, 11	Section 2.1 A. and Section 2.1 4.	Added 15A NCAC 02D .0535 Excess emissions reporting and malfunctions rule to the table and section.
6	Section 2.1 A.	Added PM, NOx, and CO to the table for PSD avoidance.
8	Section 2.1 A.1.c.	To demonstrate compliance with 15A NCAC 02D .0515, added particulate testing.
8, 9	Section 2.1 A.1.d through i.	Added the new control devices for monitoring requirements.
9	Section 2.1 A.1.j.	Added the recordkeeping requirements.
10	Section 2.1 A.2.	Added the new wood dryer to the 15A NCAC 02D .0516 requirements.
11	Section 2.2 A.	Added the table for the regulated pollutants and applicable standards.
12	Section 2.2 A.1.	Added regulation 15A NCAC 02D .0540 Particulates from Fugitive Dust Emissions.
12	Section 2.2 A.2.	Included existing PSD avoidance conditions until the facility meets Construction Schedule per Section 2.3. Also updated conditions to include dryer, dry hammermill, and pellet cooler systems throughput limitations along with associated percent softwood limitations on a rolling 12-month average basis.
13	Section 2.2 A.3.	Added regulation 15A NCAC 02Q .0317 Avoidance Condition for 15A NCAC 02D .0530: Prevention of Significant Deterioration facility-wide for PM, VOCs, and NOx. Conditions include throughput and softwood limits along with initial and periodic testing, monitoring, recordkeeping, and reporting for the proposed modification.
18	Section 2.2 A.4.	Added regulation 15A NCAC 02Q .0317 Avoidance Condition for 15A NCAC 02D .1111: Maximum Available Control Technology (MACT) Standards facility-wide for HAPs. Conditions include initial and periodic testing, monitoring, recordkeeping, and reporting.
19	Section 2.2 A.5.	Included existing 15A NCAC 02D .1100 Toxics Air Pollutant Emissions Limitation and Requirement until the facility meets Construction Schedule per Section 2.3.
20	Section 2.2 A.6.	Added eleven toxics pollutants and new associated equipment to 15A NCAC 02D .1100 Toxics Air Pollutant Emissions Limitation and Requirement.
22	Section 2.2 A.7.	Deleted the eleven toxics pollutants that were moved to Section 2.2 A.4.
23	Section 2.2 A.8.	Added regulation 15A NCAC 02Q .1806 Control and Prohibition of Odorous Emissions.
23	Section 2.2 A.9.	Added regulation 15A NCAC 02Q .0207 Annual Emissions Reporting.
23	Section 2.2 A.10.	Added regulation 15A NCAC 02Q .0304 Applications Annual Emissions Reporting.
23	Section 2.2 A.11.	Added regulation 15A NCAC 02Q .0504 Option for Obtaining Construction and Operation Permit.

Page No.	Section	Description of Changes
23	Section 2.3.	Added Section 2.3 for a Construction Schedule.
25-27	Section 3	The General Conditions were updated to the latest version of DAQ shell.

Summary of Changes to Permit

The following changes were made to Enviva Pellets Northampton, LLC, Garysburg, NC., Air Permit No. 10203R05 (*Table of Changes in response to Hearing Officer's recommendations*).

Page No.	Section	Description of Changes
10	Section 2.1 A.1.l.	Added semiannual reporting requirements.
11	Section 2.1 A.3.e.	Added semiannual reporting requirements.
12	Section 2.2 A.2.b.i. and 2.2 A.2.b.ii.	Changed the word pellets to wood.
14	Section 2.2 A.3.c.vii.	Deleted dryer bypass malfunction hours and reserved the section
14	Section 2.2 A.3.c.viii.	Deleted furnace bypass malfunction hours. Added maximum heat input percentage for cold startup. Added description:"The cold startup period of time begins when a wood-fired furnace is started up and lasts until the wood-fired furnace's refractory is heated to a temperature sufficient to sustain combustion operations at a minimal level or 8 hours, whichever is less;".
17	Section 2.2 A.3.o.	Deleted "for malfunctions".
17	Section 2.2 A.3.q.	Added an equation to calculate monthly NOx emissions.
18	Section 2.2 A.3.t.	Added reporting requirements: "The monthly ODT of pellets per year for the previous 17 months." and "The monthly hardwood/softwood mix for the previous 17 months."
22	Section 2.2 A.6.b.	Added current shell language for 15A NCAC 02D .1100 regulations including the date the facility submitted the modeling analysis and the date the modeling analysis was reviewed and approved by the AQAB.
23	Section 2.2 A.11.a.	Changed 15A NCAC 02Q .0504 condition to: "Pursuant to 15A NCAC 02Q .0504, the Permittee filed its first time Title V Air Quality Permit Application (6600167.14B) on April 22, 2014."
23	Section 2.2 A.11.b.	Changed 15A NCAC 02Q .0504 condition to: "The Permittee shall amend the first time Title V Air Quality Permit Application (6600167.14B) within 90 days of the issuance of Permit No. 10203R06." Deleted the reporting requirements.

The changes mentioned above will be made to the Emission Source Module (ESM) under this permit modification.

IV. Statement of Compliance

The most recent inspection conducted on April 30, 2019 by Ray Stewart and Dawn Reddix of RRO. According the RRO compliance databases, no Notices of Violation (NOVs) have been issued to this

facility. A Notice of Deviation (NOD) dated December 7, 2016 was issued for failing to submit a permit renewal application. Previously, a NOD dated August 22, 2014 was issued for failing to submit a semiannual report.

V. Process Description

The flow diagram is located in Attachment 1. The wood pellet manufacturing process description is detailed in the application as follows:

A. Green Wood Handling and Storage

"Green" (i.e., wet) wood is delivered to the plant via trucks as either pre-chipped wood or unchipped logs from commercial harvesting for on-site chipping. Purchased chips and bark will be unloaded from trucks into hoppers that feed conveyors that transfer the material to Green Wood Handling and Storage Piles (ES-GWHS). Conveyors transferring green wood chips will be enclosed.

Purchased chips will be screened prior to transfer to the Green Wood Storage Piles.

B. Debarking, Chipping, Bark Hog, Storage Piles and Bin

Unchipped logs are to be debarked by the electric-powered rotary drum Debarker (IES-DEBARK) and then sent to the electric-powered Green Wood Chipper (IES-EPWC) to chip the wood to specification for drying. Bark from the Debarker and purchased bark/chips are transferred to the Bark Hog (IES-BARK) via conveyor for further processing.

Material processed by the Electric Chipper and Bark Hog are handled and transferred to the Storage Piles (ES-GWHS) via conveyor. The Green Wood Fuel Storage Bin (IES-GWFB) is to be located under a covered structure. Following storage in the Fuel Storage Bin, the fuel is transferred and pushed into the furnace.

C. Green Hammermills

Chipped wood used in pellet production will be further processed in the Green Hammermills (ES-GHM-1 through 5) to reduce material to the proper size. The Green Hammermills will route the vent streams to the existing wet electrostatic precipitator (CD-WESP-1) and the new natural gas/propane-fired regenerative thermal oxidizer (CD-RTO-1) to control PM, VOC, and HAP emissions. The Green Hammermills will have the ability to be routed and controlled by the new Dryer 2 wet electrostatic precipitator (CD-WESP-2) in series with regenerative thermal oxidizer (CD-RTO-2) when CD-WESP-1 and CD-RTO-1 are shutdown.

D. Dryers

Green wood will be conveyed to two rotary Dryer systems (ES-DRYER-1 rated at 175.3 million Btu/hr and ES-DRYER-2 rated at 180 million Btu/hr). Direct contact heat will be from the furnaces that use bark and wood chips as fuel. Green wood is fed into the dryer where the moisture content is reduced to the desired level and routed to a multicyclone separator consisting of three identical cyclones equipped to control the discharge of the rotary dryer system. The cyclones are closed loop and are used for material handling for the dryer system. Emissions from Dryer 1 will exhaust to existing wet electrostatic precipitator (CD-WESP-1) in series with a new natural gas/propane-fired regenerative thermal oxidizer (CD-RTO-1) to provide further PM, VOC, and HAP emissions control. Emissions from Dryer 2 will exhaust to a new wet electrostatic precipitator (CD-WESP-2) in series with a new natural gas/propane-fired regenerative thermal oxidizer (CD-RTO-2).

As the flue gas exits the dryers and begins to cool, wood tar can condense and coat the inner walls of the dryer ducts creating a fire risk. To prevent condensation from occurring and thus reduce the fire risk, each dryer system will include double ducts which will be heated. The duct from the cyclone outlet to the induced draft fan will be heated by one low-NOx burner with a maximum heat input rating of 1 million Btu/hr and a second 1 million Btu/hr low-NOx burner will be used to heat the duct used for exhaust gas recirculation and the WESP. The double duct burners (IES-DDB-1 through IES-DDB-4) will combust natural gas, or propane as back-up, and will exhaust directly to atmosphere.

E. Bypass Stacks

There are bypass stacks following each rotary drum dryer (ES-DRYERBYP-1 and ES-DRYERBYP-2). Venting of emissions through the dryer bypass stacks only occurs in the event of a malfunction, during which the furnace or dryer itself can abort and open the bypass stack. An abort may be caused by failsafe interlocks associated with the dryer and emissions control systems as well as utility supply systems (i.e., electricity, compressed air, water/fire protection). Dryer abort may also be triggered if a spark is detected. Malfunctions are infrequent and unpredictable. Use of the Dryer Bypass Stacks for malfunctions will be limited to 100 hours per year (i.e., 50 hours per stack of dryer bypass at full capacity).

The furnace bypass stacks (ES-FURNACEBYP-1 and ES-FURNACEBYP-2) may be used to exhaust hot gases during cold start-ups (for temperature control), planned shutdowns, and malfunctions.

-**Cold Start-ups:** The furnace bypass stacks will be used when the furnace is started up from a cold shutdown until the refractory is sufficiently heated and can sustain operations at a low level (limited to 15% of the maximum heat input rate or 26.3 million Btu/hr for furnace 1 and 27.0 million Btu/hr for furnace 2). The bypass stack will then be closed, and the furnace will slowly be brought up to a normal operating rate. The duration of a cold start-up is typically between 6 to 8 hours and there are generally two (2) cold start-ups per year.

-**Malfunction:** The furnace itself can abort and open the bypass stack in the event of a malfunction. This may occur as a result of a number of different interlocks such as power failure, dryer induced draft fan failure, etc. As soon as the furnace aborts it will automatically switch to "idle mode" (limited operation up to a maximum heat input rate of 5 million Btu/hr). The fuel feed is significantly reduced, and the heat input rate drops rapidly. Malfunctions are infrequent and unpredictable.

- **Planned Shutdown:** In the event of a planned shutdown the furnace heat input will be decreased, and all remaining fuel will be moved through the system to prevent a fire during the shutdown period. The remaining fuel will be combusted prior to opening the furnace bypass stack.

Use of the Furnace Bypass Stacks for start-up, shutdown, and malfunctions will be limited to 100 hours per year (i.e., 50 hours of furnace bypass per stack at full capacity). Each Furnace Bypass Stack is limited to 500 hours per year in "idle mode". The purpose of operation in "idle mode" is to maintain the temperature of the fire brick lining the furnaces which may be damaged if it cools too rapidly. Operation in "idle mode" also significantly reduces the amount of time required to restart the dryers.

**Note: As a result of public comments, the Hearing Officer recommended modifications to this section and corresponding sections in the draft permit. See Section X of this document below for a summary of the recommendations.*

F. Dried Wood Handling

Dried materials from the Dryer product recovery cyclones will be conveyed to screening operations that remove smaller wood particles. These smaller particles are diverted to the dry hammermill discharge conveyor, while oversized wood is sent to the dry hammermills (ID Nos. ES-HM-1 through 8) for further size reduction prior to pelletization. Smaller particles passing through the screens (ES-PS-1 and ES-PS-2) will bypass these hammermills and be pneumatically conveyed directly to the product recovery for the Dry Hammermills. Enviva estimates that approximately 15% of the total material leaving the Dryer will bypass the Dry Hammermills and be sent directly to the pelletizing operations.

There will be several other conveyor transfer points located between the Dryer and Dry Hammermills comprising the Dried Wood Handling (ES-DWH-1 and ES-DWH-2) emission sources. These transfer points will be completely enclosed with only two (2) emission points that will be controlled by individual bagfilters (CD-DWH-1 and CD-DWH-2).

G. Dry Hammermills

After screening, oversized dry wood is reduced to the appropriate size using one of eight (8) existing Dry Hammermills (ES-HM-1 through ES-HM-8) for further size reduction prior to pelletization. Each Dry Hammermill includes a product recovery cyclone (CD-HM-CYC-1 through CD-HM-CYC-8) which is routed to one of three (3) bagfilters (CD-HM-BF-1 through CD-HM-BF-3) for particulate matter control. Following the dry hammermills, the Dust Control System (ES-DCS) collects smaller wood and is controlled by a bagfilter (CD-HM-BF-3). The facility will route the exhaust from the existing dry hammermill baghouses to the new wet scrubber (CD-WS-1) in series with a regenerative catalytic oxidizer (CD-RCO-1) that can also operate as an RTO for control of PM, VOC, and HAP emissions.

H. Dry Shavings Process

As part of this application, Enviva will purchase dry shavings to produce wood pellets in addition to green chips or logs, forgoing the drying process and thus lowering VOC and HAP emissions. The purchased dry shavings will be unloaded from trucks into a hopper that feeds material via enclosed conveyors to a bucket elevator that ultimately fills a silo. Each of these material transfer points will be entirely enclosed except for truck unloading (IES-DRYSHAVE). From the silo, the dry shavings will then be transferred via an enclosed screw conveyor to the Dry Hammermills for additional processing.

Currently the plant receives dry shavings at the bark truck dump where they are moved to an open dry shavings pile (IES-DRYSHAVE) via front end loader or are received via walking floor trailer at the pile. Dry shavings are added to the Dry Line Hopper (IES-DLH) which transfers via Dry Line Feed Conveyor (ES-DLC-1) to the dry hammermill feed conveyor at the point of the hammermill pre-screens.

As part of this application, Enviva is proposing to add a new Dry Shavings Material Handling and Storage source (IES-DRYSHAVE-1) and assign a source ID for the Dry Shavings Reception (ES-DSR) both of which will be controlled by a proposed new Dry Shavings Reception Dust Control Baghouse (CD-DSR-BF). The facility will also install a Dry Shavings Silo (IES-DSS) controlled

by a bagfilter (CD-DSS-BF) to store dry shavings and two new Dry Shavings Hammermills (ES-DSHM-1 and ES-DSHM-2). The purchased dry shavings will be unloaded from trucks via a new truck dump into a hopper that feeds material via enclosed conveyors to a bucket elevator that ultimately fills a silo. From the silo, the dry shavings will then be transferred via an enclosed conveyor to the new Dry Shavings Hammermills for additional processing. Milled dry shavings will be transferred to the pellet mill feed silo. The dry shavings hammermill exhaust will be routed to the new wet scrubber (CD-WS-1) in series with a regenerative catalytic oxidizer (CD-RCO-1) that can also operate as an RTO for control of PM, VOC, and HAP emissions.

I. Pellet Mill Feed Silo and Relay System

Milled wood from the Dry Hammermill product recovery cyclones is transported by a set of conveyors to the Pellet Mill Feed Silo (ES-PMFS) prior to pelletization. Particulate emissions from the Pellet Mill Feed Silo will be controlled by a bagfilter (CD-PMFS-BH). Fines from Finished Product Handling (ES-FPH) are collected by the Pellet Cooler HP Fines Relay System (ES-PCHP) which is controlled by a bagfilter (CD-PCHP-BV). The Pellet Cooler HP Fines Relay System transfers this material to the Pellet Mill Feed Silo.

J. Additive Handling and Storage

Additive may be used in the pellet production process to increase the durability of the final product. The additive will be added to sized wood from the Pellet Mill Feed Silo discharge screw conveyor prior to transfer to the Pellet Presses. The additive contains no hazardous chemicals or VOCs. Bulk additive material will be delivered by truck and pneumatically unloaded into a storage silo (ES-ADD) equipped with a bagfilter (CD-ADD-BF) to control emissions from air displaced during the loading of additive material to the silo. The additive will then be conveyed via screw conveyor from the storage silo to the milled conveyor which transfers milled wood to the Pellet Presses.

K. Pellet Press System and Pellet Coolers

Dried processed wood is mechanically compacted through twelve (12) presses in the Pellet Press System. Exhaust from the Pellet Press System and Pellet Press conveyors will be vented through the Pellet Cooler aspiration material recovery cyclones and pollutant controls as described below, and then to the atmosphere. Formed pellets are discharged into one of six (6) pellet coolers (ES-CLR-1 thru ES-CLR-6). Chilled 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 (6) cyclones (CD-CLR-1 thru CD-CLR-6). Following the cyclones, the exhaust will be routed to a new wet (scrubber CD-WS-2) in series with a regenerative catalytic oxidizer (CD-RCO-2) that can also operate as an RTO for control of PM, VOC, and HAP emissions. The facility will also upgrade the pellet press dies to a new design. The manufacturer of the pellet presses does not make the same 1250 mm size press or any replacement parts. The replacement is a 1500 mm press along with the associated screw conveying system.

L. Finished Product Handling and Loadout

Final product is conveyed to pellet load-out bins (ES-PB-1 through ES-PB-12) that will feed pellet truck loadout operations (ES-PL-1 and ES-PL-2). Pellet loadout is accomplished by gravity feed of the pellets through a covered chute to reduce emissions. Emissions from pellet loadout are minimal because dried wood fines will have been removed in the pellet screener and future screener, and a slight negative pressure is maintained in the loadout area as a fire

prevention measure to prevent any build-up of dust on surfaces within the building. This slight negative pressure is produced via an induced draft fan that exhausts to the Finished Product Handling baghouse (CD-FPH-BF). This baghouse controls emissions from Finished Product Handling (ES-FPH), Pellet Loadout Bins (ES-PB-1 through ES-PB-12), and pellet truck loadout operations (ES-PL-1 and ES-PL-2. Fine material from loadout operations is transferred to the Pellet Mill Feed Silo (ES-PMFS).

M. Emergency Generator, Fire Water Pump Engine, and Diesel Storage Tanks

The plant has a 350 brake horsepower (bhp) diesel-fired Emergency Generator (IES-GN) for emergency operations and a 300 bhp diesel-fired Fire Water Pump Engine (IES-FWP). Aside from maintenance and readiness testing, the generator and fire water pump engines are only utilized for emergency operations. The facility proposes to change the existing Emergency Generator ID from IES-GN to IES-GN-1 and add a second diesel-fired Emergency Generator (IES-GN-2) rated at 671 bhp. The facility also proposes to add a third diesel storage tank with a capacity of up to 5,000 gallons (IES-TK-3) for distributing diesel fuel to mobile equipment and a fourth diesel storage tank with a capacity of 1,000 gallons (IES-TK-4) for the proposed generator (IES-GN-2).

N. Propane Vaporizer

With this application, Enviva proposes to add a propane vaporizer. A direct-fired propane vaporizer (IES-PVAP) rated at 1 million Btu/hour will be located on-site to vaporize propane gas for combustion by the RTO burners, RCO burners, and double duct burners. The vaporizer will have a maximum heat input capacity of 1 million Btu/hour and will combust propane. Propane may be used initially until natural gas service is completed. Natural gas will be the primary fuel for all burners and propane may be used as a back-up fuel.

VI. Emissions

The following table is a comparison of the currently permitted PTE (R04 application) to the proposed estimated PTE (R06 application) after incorporating the changes proposed in this application.

Emissions Scenario	CO (tpy)	NO_X (tpy)	PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	VOC (tpy)	CO_2e (tpy)	Total HAPs (tpy)
Proposed PTE[1]	182.73	242.21	148.97	118.75	83.75	39.52	129.68	399,490.52	21.71
Previous PTE	61.88	126.57	128.84	121.79	93.79	19.20	456.40	162,292.20	37.82
Change in PTE	**+120.85**	**+115.64**	**+20.13**	**-3.04**	**-10.04**	**+20.32**	**-326.72**	**+237,198.3**	**-16.11**

1. Proposed PTE excludes fugitive emissions.

The following table provides a summary (R06 application) of facility-wide criteria pollutant emissions on a source by source basis.

Table 1
Facility-wide Criteria and CO_2e Emissions Summary
Enviva Pellets Northampton, LLC

Emission Unit ID	Source Description	Control Device ID	Control Device Description	CO (tpy)	NOx (tpy)	TSP (tpy)	PM-10 (tpy)	PM-2.5 (tpy)	SO2 (tpy)	Total VOC (tpy)	CO_{2e} (tpy)
ES-GHM-1 through ES-GHM-5	Green Hammermills 1 through 5	CD-WESP-1; CD-RTO-1	WESP; RTO	156.44	194.96	66.58	66.58	66.58	38.91	28.93	365,608.88
ES-DRYER-1[1]	Dryer #1										
ES-DRYER-2[1]	Dryer #2	CD-WESP-2; CD-RTO-2	WESP; RTO								
ES-DRYERBYP-1	Dryer #1 Bypass	--	--	0.54	0.66	1.52	1.52	1.52	0.11	0.35	918.37
ES- FURNACEBYP-1	Furnace #1 Bypass	--	--	3.38	1.24	3.25	3.17	3.09	0.14	0.10	1,180.31
ES-DDB-1 and -2	Dryer #1 Double Duct Burners	--	--	0.72	0.62	0.07	0.07	0.07	0.01	0.10	1,219.07
ES-DRYERBYP-2	Dryer #2 Bypass	--	--	0.54	0.66	1.56	1.56	1.56	0.11	0.35	942.99
ES- FURNACEBYP-2	Furnace #2 Bypass	--	--	3.45	1.27	3.32	3.24	3.16	0.13	0.10	1,204.93
ES-DDB-3 and -4	Dryer #2 Double Duct Burners	--	--	0.72	0.62	0.07	0.07	0.07	0.01	0.10	1,219.07
ES-PVAP	Propane Vaporizer	--	--	0.36	0.62	0.03	0.03	0.03	0.003	0.05	609.53
ES-HM-1 through ES-HM-8; ES-NDS[5]	Dry Hammermills 1 through 8; Nuisance Dust System	CD-HM-CYC-1 through CD-HM-CYC-8; CD-HM-BF-1 through CD-HM-BF-3; CD-WS-1; CD-RCO-1	Cyclones; Baghouses; Wet Scrubber; RCO	7.60	14.88	20.93	20.93	1.00	0.05	16.32	12,841.84
ES-DSHM-1 and ES-DSHM-2	Dry Shavings Hammermills 1 and 2	CD-WS-1; CD-RCO-1	Wet Scrubber; RCO			2.01	2.01	2.01			
ES-CLR-1 through ES-CLR-6	Pellet Coolers 1 through 6	CD-CLR-1 through CD-CLR-6; CD-WS-2; CD-RCO-2	Simple Cyclones; Wet Duct Scrubber; RCO	7.91	23.16	39.18	10.71	1.89	0.05	28.53	13,367.45
ES-DWH-1[4]	Dried Wood Handling-1	CD-DWH-BF-1	Baghouse	--	--	0.38	0.38	0.38	--	48.53	--
ES-DWH-2[4]	Dried Wood Handling-2	CD-DWH-BF-2	Baghouse	--	--	0.38	0.38	0.38	--		
ES-PS-1 and -2	Dry Hammermill Prescreeners 1 and 2	--	--	--	--	0.30	0.16	0.02	--	--	--
ES-PCHP	Pellet Cooler HP Fines Relay System	CD-PCHP-BV	Baghouse	--	--	0.54	0.54	0.54	--	--	--
ES-PMFS	Pellet Mill Feed Silo	CD-PMFS-BV	Baghouse	--	--	0.38	0.38	0.38	--	--	--
ES-FPH; ES-PB-1 through ES-PB-12; ES-PL-1 and ES-PL-2	Finished Product Handling; Twelve pellet loadout bins; Pellet mill load-out 1 and 2	CD-FPH-BF	Baghouse	--	--	5.33	4.85	0.09	--	--	--
ES-ADD	Additive Handling and Storage	CD-ADD-BF	Baghouse	--	--	3.31E-03	3.31E-03	3.31E-03	--	--	--
ES-DLH	Dry Line Hopper	--	--	--	--	0.15	0.07	0.01	--	--	--
ES-DLC-1	Dry Line Feed Conveyor	--	--	--	--	0.15	0.07	0.01	--	--	--
ES-DRYSHAVE	Dry Shaving Material Handling and Storage	--	--	--	--	0.77	0.38	0.06	--	0.19	--
ES-DSS	Dry Shaving Silo	CD-DSS-BF	Baghouse	--	--	0.54	0.54	0.54	--	--	--
ES-DSR; ES-DRYSHAVE-1	Dry Shavings Reception; Dry Shaving Material Handling	CD-DSR-BF	Baghouse	--	--	0.38	0.38	0.38	--	--	--
ES-GWHS	Green Wood Handling and Storage	--	--	--	--	16.32	8.35	1.22	--	8.30	--
ES-EPWC	Electric Powered Green Wood Chipper	--	--	--	--	--	--	--	--	1.95	--
ES-BARK	Bark Hog	--	--	--	--	0.47	0.26	--	--	0.59	--
ES-DEBARK	Debarker	--	--	--	--	1.56	0.86	--	--	--	--
ES-GWFB[2]	Green Wood Fuel Bin	--	--	--	--	--	--	--	--	--	--
ES-GN-1	Emergency Generator 1	--	--	0.50	0.58	0.03	0.03	0.03	0.001	0.002	100.21
ES-GN-2	Emergency Generator 2	--	--	0.14	2.46	0.01	0.01	0.01	0.002	1.68	191.98
ES-FWP	Fire Water Pump	--	--	0.43	0.49	0.02	0.02	0.02	0.001	0.001	85.90
ES-TK-1	Diesel Storage Tank for Emergency Generator #1	--	--	--	--	--	--	--	--	5.75E-04	--
ES-TK-2	Diesel Storage Tank for Fire Water Pump	--	--	--	--	--	--	--	--	1.60E-04	--
ES-TK-3	Mobile Fuel Diesel Storage Tank	--	--	--	--	--	--	--	--	3.33E-03	--
ES-TK-4	Diesel Storage Tank for Emergency Generator #2	--	--	--	--	--	--	--	--	5.75E-04	--
--	Haul Road Emissions	--	--	--	--	43.31	11.41	0.923	--	--	--
			Total Emissions:	**182.73**	**242.21**	**209.53**	**138.95**	**85.96**	**39.52**	**138.17**	**399,490.52**
			Total Excluding Fugitives[3]:	**182.73**	**242.21**	**148.97**	**118.75**	**83.75**	**39.52**	**129.66**	**399,490.52**
			PSD Major Source Threshold:	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**--**
			Major Source?	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**--**

Notes:

[1] Each dryer line is routed to a separate RTO (CD-RTO-1 and CD-RTO-2). Although dryer line 1 and dryer line 2 are capable of processing up to 537,625 ODT/yr and 620,000 ODT/yr, respectively, the combined throughput of both dryers will not exceed 781,255 ODT/yr. In order to provide Enviva with the flexibility to use either dryer line up to its individual capacity, the total emissions from the two RTO's are based on the total facility throughput and are calculated as follows:
- Where individual dryer emissions were calculated based on throughput (i.e. lb/ODT), the total emissions are estimated based on the total throughput of 781,255 ODT/yr, plus the emissions from the green hammermills.
- Where individual dryer emissions were calculated based on fuel use (i.e. lb/MMBtu or lb/MMscf) or hourly test/vendor data (i.e., lb/hr), the total emissions are conservatively set equal to the sum of the emissions from the two dryer lines plus the emissions from the green hammermills assuming both dryer lines operate 8,760 hrs/yr.

[2] Bark is transferred from the raw wood chip storage pile by walking floor to covered conveyors which transfer the material into the fully enclosed Green Wood Fuel Storage Bin. There are no emissions expected from transfer of material into the bin.

[3] Fugitive emissions are not included in comparison against the major source threshold because the facility is not on the list of 28 source categories in 40 CFR 52.21.

[4] As Total VOC emissions are based on throughput, the calculated VOC emissions represent the total emissions from Dried Wood Handling 1 and 2 (ES-DWH-1 and ES-DWH-2).

[5] Emissions from the Nuisance Dust System (ES-NDS) are routed to the inlet of CD-HM-BF-3.

Referenced footnotes are located at the end of this section. Copies of detailed potential emissions calculations spreadsheets are included in Attachment 1 of this document and in Appendix C of the permit application.

A. Green Wood Handling and Storage (ES-GWHS)

Fugitive PM emissions will result from unloading purchased chips and bark from trucks into hoppers and transfer of these materials to storage piles via conveyors. Fugitive PM emissions from chip and bark transfer operations were calculated based on AP-42 Section 13.2.4, *Aggregate Handling and Storage Piles*.[1] Chip conveyors are enclosed; therefore, emissions were only quantified for the final drop points (i.e., from conveyor to pile). Bark conveyors will not be enclosed; however, due to the large size of this material any fugitive PM emissions occurring along the conveyor itself will be negligible. Green wood and bark contain a high moisture content approaching 50 percent water by weight. As such, particulate emissions were only quantified for the final drop points from the conveyors.

Particulate emission factors used to quantify emissions from storage pile wind erosion for the four (4) Green Wood Storage Piles and three (3) Bark Fuel Storage Piles were calculated based on USEPA's *Control of Open Fugitive Dust Sources*.[2] The number of days with rainfall greater than 0.01 inches was obtained from AP-42 Section 13.2.2, *Unpaved Roads*[3], and the percentage of time that wind speed exceeds 12 miles per hour (mph) was determined based on the AERMOD-ready meteorological dataset for the Maxton National Weather Service (NWS) Station provided by DAQ[4]. The mean silt content of 8.4% for unpaved roads at lumber mills from AP-42 Section 13.2.2 was conservatively applied in the absence of site-specific data. The exposed surface area of the pile was calculated based on worst-case pile dimensions.

VOC emissions from storage piles were quantified based on the exposed surface area of the pile and emission factors from the National Council for Air and Stream Improvement (NCASI) for Douglas Fir wood storage piles. NCASI emission factors range from 1.6 to 3.6 pounds (lb) VOC as carbon/acre-day; however, emissions were conservatively based on the maximum emission factor.

B. Debarker (IES-DEBARK) and Bark Hog (IES-BARK)

PM emissions will occur from log debarking and processing. Potential PM emissions from debarking and bark hog were quantified based on emission factors from EPA's *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants* for Source Classification Code (SCC) 3-07-008-01 (Log Debarking).[5] All PM was assumed to be larger than 2.5 microns in diameter. PM emissions from debarking will be minimal due to the high moisture content of green wood (~50%) and the fact that bark is removed in pieces larger than that which can become airborne. A 90% control efficiency was applied for the use of water spray. VOC and methanol emissions were quantified based on emission factors for log chipping from AP-42 Section 10.6.3, *Medium Density Fiberboard*.[6]

The Debarker (IES-DEBARK) and Bark Hog (IES-BARK) are considered insignificant activities per 15A NCAC 02Q .0102(h) due to potential uncontrolled PM emissions less than 5 tpy.

D. Chipper (IES-EPWC)

The chipping process will result in emissions of VOC and HAPs. VOC and HAPs emissions were quantified based on emission factors for log chipping from AP-42 Section 10.6.3, *Medium Density Fiberboard*.[6] and AP-42 Section 10.6.4, *Hardboard and Fiberboard*.[7] The Chipper is

considered an insignificant activity per 15A NCAC 02Q .0102(h) due to potential uncontrolled emissions less than 5 tpy.

E. Green Wood Storage Bin (IES-GWFB)
Bark is transferred from the fuel storage piles via a walking floor to a covered conveyor and then to the fully enclosed Green Wood Fuel Storage Bin (IES-GWFB). Due to complete enclosure of the Green Wood Fuel Storage Bin (IES-GWFB), emissions from transfer of material into the bin were not specifically quantified.[8] Both the Green Wood Storage Bin and the Bark Fuel Bin have emissions of less than 5 tons per year each and are each insignificant activities per 15A NCAC 02Q .0102(h).

F. Dryers (ES-DRYER-1 and ES-DRYER-2) and Green Hammermills (ES-GHM-1 through 5)
Exhaust from the Dryers and Green Hammermills will be routed to a shared WESP/RTO control system for control of PM, VOC, and HAP. The Green Hammermills will have the ability to be routed and controlled by the Dryer #2 WESP and RTO when the Dryer #1 WESP and RTO are shut down. It should be noted that potential-to-emit emission estimates from the Green Hammermills are accounted for under the Dryer #1 WESP and RTO. Potential uncontrolled emissions of PM, PM less than 10 microns in diameter (PM_{10}) and PM less than 2.5 microns in diameter ($PM_{2.5}$) are based on guaranteed pound per hour (lb/hr) emission rates provided by the RTO vendor. Carbon monoxide (CO) emissions generated during green wood combustion are based on data from similar Enviva facilities and information from the NCASI database. Oxides of nitrogen (NO_X) emissions are based on stack test results from similar facilities plus a 30% contingency. Potential emissions of sulfur dioxide (SO_2) from green wood combustion were calculated based on the heat input of the dryer burners and an emission factor for wood combustion from AP-42, Section 1.6, *Wood Residue Combustion in Boilers*[9]. VOC emissions were calculated using an emission factor derived from stack testing conducted at Enviva and other similar wood pellet manufacturing facilities.

HAP and toxic air pollutant (TAP) emissions from green wood combustion were calculated based on emission factors from several data sources including stack testing data from other similar facilities, engineering judgement/process knowledge, emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers*[9], and NC DAQ's Wood Waste Combustion Spreadsheet[10]. HAP emissions from natural gas and propane combustion by the RTO burners were calculated based on AP-42 Section 1.4, *Natural Gas Combustion*[11] AP-42 Section 1.5, *Liquefied Petroleum Gas Combustion*[12], NC DAQ's Wood Waste Combustion Spreadsheet[10], and emission factors from the South Coast Air Quality Management District's (SCAQMD) Air Emissions Reporting (AER) Tool.

G. Dryer Bypass Stacks (Full Capacity)
Bypass stacks following each rotary drum dryer (ES-DRYERBYP-1 and ES-DRYERBYP-2) may be used to exhaust hot gases during malfunctions. Venting of emissions through the dryer bypass stacks only occurs in the event of a malfunction, during which the furnace or dryer itself can abort and open the bypass stack. An abort may be caused by failsafe interlocks associated with the furnace or dryer and emissions control systems as well as utility supply systems (i.e., electricity, compressed air, water/fire protection). Dryer abort may also be triggered if a spark is detected. Malfunctions are infrequent and unpredictable. Potential emissions associated with dryer bypass were calculated based on stack testing data from comparable Enviva facilities with the exception of condensable PM and SO_2 emissions which were calculated based on emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers*[9]. Emissions were based on the full capacity of the furnaces and limited to 50 hours per year per dryer.

**Note: As a result of public comments, the Hearing Officer recommended modifications to this section and corresponding sections in the draft permit. See Section X of this document below for a summary of the recommendations.*

H Furnace Bypass Stacks

The furnace bypass stacks (ES-FURNACEBYP-1 and ES-FURNACEBYP-2) may be used to exhaust hot gases during start-ups (for temperature control), planned shutdowns, and malfunctions. Venting at full capacity only occurs in the event of a malfunction. As soon as the furnace aborts during a malfunction, the fuel feed is significantly reduced, and the heat input rate drops rapidly as the furnace quickly transitions to "idle mode". In the event of a planned dryer shutdown, the dryer throughput and furnace heat input are decreased. Dryer raw material input ceases, and all remaining material is moved through the system to prevent a fire. On shutdown of the dryer, the furnace operating rate quickly approaches idle state. As such, emissions during planned shutdowns are minimal.

During cold start-ups, the furnace bypass stack is used until the refractory is sufficiently heated and can sustain operations at a low level (approximately 15% of the maximum heat input rate). The furnace bypass stack is then closed, and the furnace is slowly brought up to a normal operating rate. The duration of a cold start-up is typically between 6 to 8 hours and there are generally two (2) cold start-ups per year. The furnace bypass stack is not utilized during a planned shutdown until after the furnace achieves an idle state. Until this time, emissions continue to be controlled by the WESP and RTO. Only one dryer line will be operated in cold start-up at a time.

Potential emissions of CO, NO_X, SO_2, PM, VOC, and HAP for furnace bypass conditions were calculated based on emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers*[9]. Emissions were based on the full capacity of the furnaces and limited to 50 hours per year per furnace.

**Note: As a result of public comments, the Hearing Officer recommended modifications to this section and corresponding sections in the draft permit. See Section X of this document below for a summary of the recommendations.*

I. Furnace Bypass Stacks (Idle Mode)

During furnace "idle mode" operation, emissions will be vented through the furnace bypass stacks (ES-FURNACEBYP-1 and ES-FURNACEBYP-2). Each furnace may operate up to 500 hours per year in "idle mode", which is defined as operation up to a maximum heat input rate of 5 million Btu/hr. During this time, emissions will exhaust out of the furnace bypass stacks. Potential emissions of CO, NO_X, SO_2, PM, VOC, and HAP were calculated based on emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers.*[9]

J. Double Duct Burners (IES-DDB-1 through IES-DDB-4) and Propane Vaporizer (IES-PVAP)

Emissions from natural gas and propane combustion by the double duct burners (IES-DDB-1 through IES-DDB-4) and propane vaporizer (IES-PVAP) were calculated based on AP-42 Section 1.4, *Natural Gas Combustion*[11], AP-42 Section 1.5, *Liquefied Petroleum Gas Combustion*[12], and emission factors from the South Coast Air Quality Management District's (SCAQMD) Air Emissions Reporting (AER) Tool.

Per 15A NCAC 02Q .0102(h), the double duct burners (IES-DDB-1 through IES-DDB-4) and propane vaporizer (IES-PVAP) are considered insignificant activities because potential uncontrolled emissions are less than 5 tpy.

K. Dried Wood Handling (ES-DWH-1 and ES-DWH-2)
Dried Wood Handling (ES-DWH-1 and ES-DWH-2) will include conveyor transfer points located after each dryer. Emissions from these transfers will be routed through either baghouse CD-DWH-BF-1 or CD-DWH-BF-2 (one on each dryer line) at the post dryer conveyors. Particulate emissions from the baghouse were calculated based on the exhaust flow rate and exit grain loading.

Additionally, the dried material may continue to emit VOC and HAP as it is transferred between the Dryer and Dry Hammermills due to the elevated temperature of the material. Potential VOC and HAP emissions were calculated based on NCASI dry wood handling emission factors.

L. Dry Shavings Handling (IES-DRYSHAVE), Dry Line Feed Conveyor (ES-DLC-1) and Dry Line Hopper (IES-DLH)
Particulate emissions will occur during unloading of dry shavings walking floor trucks to the dry shavings pile (IES-DRYSHAVE). Potential emissions were calculated based on AP-42, Section 13.2.4, *Aggregate Handling and Storage Piles*.[1] A front end loader fills the Dry Line Hopper (IES-DLH) which feeds the Dry Line Feed Conveyor (ES-DLC-1) to introduce pre-dried wood into the process prior to the hammermills.

Emissions from the Dry Line Hopper (IES-DLH) and Dry Line Feed Conveyor (ES-DLC-1) were calculated using equation 1 in AP-42 Section 13.2.4. Per 15A NCAC 02Q .0102(h), the Dry Line Hopper will be re-classified as an insignificant activity due to emissions being below 5 tpy.

M. Dry Shavings Reception, Handling, and Silo (ES-DSR, IES-DRYSHAVE-1, and ES-DSS)
Particulate emissions will occur during unloading of dry shavings from existing and new dry shavings truck dump (IES-DRYSHAVE and IES-DRYSHAVE-1). Potential emissions from dry shavings storage piles and dry shavings transfer activities associated with IES-DRYSHAVE were calculated based on AP-42, Section 13.2.4, *Aggregate Handling and Storage Piles*.[1]

The Dry Shavings Reception Dust Control Baghouse (CD-DSR-BF) controls particulate emissions from the receiving area, from IES-DRYSHAVE, and from Dry Shavings Reception (ES-DSR). Particulate emissions from the baghouse were calculated based on the exhaust flow rate and exit grain loading. Dry shavings will be transferred into the new dry shavings silo (ES-DSS) via an enclosed conveyor and bucket elevator. Particulate emissions from the baghouse on the dry shavings silo (CD-DSS-BF) were calculated based on the exhaust flow rate and exit grain loading.

Per 15A NCAC 02Q .0102(h), Dry Shavings Handling (IES-DRYSHAVE-1) is considered an insignificant activity because potential uncontrolled PM emissions are less than 5 tpy.

N. Dry Hammermills (ES-HM-1 through 8) and Dry Shavings Hammermills (ESDSHM-1 and ES-DSHM-2)
The Dry Hammermills generate PM, VOC, and HAP emissions during the process of reducing wood chips to the required size. PM emissions from the existing Dry Hammermill cyclones (CD-HM-CYC-1 through 8) are controlled using baghouses (CD-HM-BF-1 through CD-HM-BF- 3). PM emissions from the Dust Control System (ES-DCS) are controlled by a bagfilter (CD-HM-

BF-3). Particulate emissions from each baghouse were calculated using a manufacturer guaranteed exit grain loading rate and the maximum nominal exhaust flow rate of the baghouse.

The Dry Hammermill and Dry Shavings Hammermill exhaust will be routed to the proposed new wet scrubber (CD-WS-1) and RCO/RTO (CD-RCO-1) for HAP and VOC control. The oxidizer will operate in thermal mode as an RTO during maintenance of the RCO. The RTO and RCO modes have the same control efficiency so there will be no impact on emissions when operating in thermal mode. VOC and HAP emissions were calculated based on stack testing data from comparable Enviva facilities. PM emissions from the Dry Shavings Hammermills are based on test data performed at Enviva's Greenwood facility.[13] Criteria and HAP emissions from natural gas and propane combustion by the RTO burners were calculated based on AP-42 Section 1.4, *Natural Gas Combustion,*[11] AP-42 Section 1.5, *Liquefied Petroleum Gas Combustion.*[12]

O. Pellet Cooler HP Fines Relay System (ES-PCHP) and Pellet Mill Feed Silo (ES-PMFS)
Pellet material fines will be conveyed from finished product handling to the Pellet Cooler High Pressure Fines Relay System (ES-PCHP) and controlled by a baghouse (CD-PCHP-BV). The Pellet Mill Feed Silo (ES-PMFS) is equipped with a bin vent filter (CD-PMFS-BV) to control PM emissions associated with silo loading and unloading operations. PM emissions from these baghouses were calculated based on a manufacturer guaranteed exit grain loading rate and the maximum nominal exhaust flow rate of the baghouse.

P. Additive Handling and Storage (IES-ADD)
An additive may be used in the pellet production process to increase the durability of the final product. Material will be pneumatically conveyed from the delivery trucks to the storage silo equipped with a bagfilter (CD-ADD-BH). PM emissions from the bagfilter were calculated based on an assumed exit grain loading rate and the maximum nominal exhaust flow rate of the baghouse.

Q. Pellet Press System and Pellet Coolers (ES-CLR-1 through 6)
Pellet Press and Pellet Cooler operations will generate PM, HAP, and VOC emissions during the forming and cooling of wood pellets. The Pellet Mills and Coolers are equipped with six (6) simple cyclones (CD-CLR-1 through CD-CLR-6) and will be routed to a proposed new wet scrubber (CD-WS-2) for PM control and then through the proposed RCO/RTO (CD-RCO-2) for VOC and HAP control. The oxidizer will operate in thermal mode as an RTO during backup of the RCO. PM emissions from the Pellet Press System (Pellet Mills) and Pellet Coolers were calculated based on a maximum exit grain loading rate and the maximum nominal exhaust flow rate for the proposed scrubber.

Uncontrolled VOC and HAP emissions at the outlet of the Pellet Cooler wet scrubber (CD-WS-2) were quantified based on stack testing data from comparable Enviva plants and/or engineering judgement/process knowledge, including any appropriate contingency. This includes emissions from both the Pellet Mills and the Pellet Coolers. Controlled emissions were estimated based on a 95% control efficiency for the RCO. The RTO and RCO modes have the same control efficiency so there will be no impact on emissions when operating in thermal mode. Criteria and HAP emissions from natural gas and propane combustion by the oxidizer's burners were calculated based on AP-42 Section 1.4, *Natural Gas Combustion,*[11] AP-42 Section 1.5, *Liquefied Petroleum Gas Combustion.*[12]

R. Pellet Loadout Bins (ES-PB-1 through 12), Pellet Mill Loadout (ES-PL-1 and ES-PL-2), and Finished Product Handling (ES-FPH)

PM emissions result from the transfer of finished product handling to the Pellet Loadout Bins. PM emissions from Finished Product Handling, the two (2) Pellet Loadout Bins, and the Pellet Mill Loadout will be controlled by a bagfilter (CD-FPH-BH). Potential PM emissions from the baghouse were calculated based on a maximum exit grain loading rate and the maximum nominal exhaust flow rate of the bagfilter.

S. Emergency Generator (IES-GN) and Fire Water Pump Engine (IES-FWP)

Operation of the Emergency Generator and Fire Water Pump generates emissions of criteria pollutants and HAP. Potential PM, NO_X, VOC, and CO emissions from operation of the Emergency Generators and Fire Water Pump Engine were calculated based on emission standards from NSPS Subpart IIII (or 40 CFR 89 where applicable) and the maximum horsepower rating of the engines. Potential SO_2 emissions were calculated based on the fuel sulfur restriction in NSPS Subpart IIII, and by assuming that all the sulfur present in the diesel fuel becomes SO_2 air emissions.[14] Potential VOC and HAP emissions were quantified based on emission factors from AP-42 Section 3.3, *Stationary Internal Combustion Engines*.[15] Annual potential emissions were conservatively calculated based on 500 hours per year. The Emergency Generators and Fire Water Pump Engine are considered insignificant activities pursuant to 15A NCAC 02Q .0102(h).

T. Diesel Storage Tanks (IES-TK-1 through 4)

The storage of diesel in on-site storage tanks will generate emissions of VOC. VOC emissions from the four (4) Diesel Storage Tanks were calculated using EPA's TANKS 4.0 software based on actual tank characteristics (e.g., orientation, dimensions, etc.) and potential annual throughput. VOC emissions from the storage tanks are below 5 tpy and thus, per 15A NCAC 02Q .0102(h), they are listed as insignificant sources in the permit.

U. Haul Roads

Fugitive PM emissions occur as a result of trucks and employee vehicles traveling on paved and unpaved roads on the Northampton plant property. Emission factors for paved roads were calculated based on Equation 2 from AP-42 Section 13.2.1, *Paved Roads*[16] using the mean silt loading for quarries (8.2 g/m2) and 120 days with rainfall greater than 0.01 inch based on Figure 13.2.1-2. Emission factors for unpaved roads were calculated based on Equation 1a from AP-42 Section 13.2.2, *Unpaved Roads*[3] using a surface material silt content (8.4%) and 120 days with rainfall greater than 0.01 inch based on Figure 13.2.1-2. A 90% control efficiency was applied for water/dust suppression activities. This control efficiency is based on data from the *Air Pollution Engineering Manual* of the Air and Waste Management Association.

Reference footnotes:

1. USEPA AP-42 Section 13.2.4, *Aggregate Handling and Storage Piles* (11/06).
2. USEPA *Control of Open Fugitive Dust Sources*, Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988.
3. USEPA AP-42 Section 13.2.2, *Unpaved Roads* (11/06).
4. Data provided via email to Aubrey Jones (Ramboll) by Matthew Porter (NC DAQ) on July 27, 2017.
5. USEPA. Office of Air Quality Planning and Standards. *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants*. EPA 450/4-90-003. March 1990.
6. USEPA. AP-42 Section 10.6.3, *Medium Density Fiberboard* (08/02).
7. AP-42 Section 10.6.4, *Hardboard and Fiberboard*
8. Due to complete enclosure of the Green Wood Storage Bin, emissions were not quantified.
9. USEPA AP-42 Section 1.6, *Wood Residue Combustion in Boilers* (09/03).
10. NCDAQ Wood Waste Combustion Spreadsheet for a wood stoker boiler. Available online at: https://files.nc.gov/ncdeq/Air%20Quality/permits/files/WWC_rev_K_20170308.xlsx.
11. USEPA AP-42 Section 1.4, *Natural Gas Combustion* (07/98).
12. AP-42 Section 1.5, *Liquefied Petroleum Gas Combustion* (07/08)
13. Enviva's Greenwood South Carolina facility stack test performed 12/4/2018 with PM approval by SSCB on April 29, 2019

14. Sulphur content in accordance with Year 2010 standards of 40 CFR 80.510(b) as required by NSPS Subpart IIII.
15. USEPA AP-42 Section 3.3, *Stationary Internal Combustion Engines* (10/96).
16. USEPA AP-42 Section 13.2.1, *Paved Roads* (01/11).

VII. Regulatory Review – Specific Emission Source Limitations and Conditions

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 equations:

$E = 4.10 \times P^{0.67}$ 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)

According to the application, the most significant source of PM emissions is Green Wood Handling and Storage (ES-GWHS) operating at 400 tons per hour. The allowable emission rate is calculated to be 66.3 lb/hr. Maximum PM emission rate estimates are based on EPA AP-42 factors, see Section VI.A. The maximum hourly nonfugitive uncontrolled emission rate is less than a pound per hour. Therefore, compliance is indicated.

The second most significant source of PM emissions is the Green Hammermills (ES-GHM-1 through ES-GHM-5) operating at 299 ODT/hr. The allowable emission rate is calculated to be 63.0 lb/hr. Maximum PM emission rate estimate is provided by stack test data at similar Enviva facility. Since the Green Hammermills exhaust to the Dryer, the combined maximum hourly controlled emission rate is 7.6 lb/hr. Therefore, compliance is indicated.

The Green Hammermills PM emissions are controlled by a wet electrostatic precipitator (WESP) that 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 has 29,904 square feet of collection plate area and can handle a maximum air flow of 117,000 acfm.

Control Device Monitoring

For bagfilters and cyclones:
To ensure 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, and
ii. an annual (for each 12-month period following the initial inspection) internal inspection of the bagfilters and structural integrity.

For WESP:
To ensure 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 maintain the minimum secondary voltage and minimum current at the level established during compliance testing. To ensure compliance and effective operation of the wet electrostatic precipitator, the Permittee shall monitor and record the secondary voltage and current for each grid of 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.

For WS:
To ensure 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 maintain the required minimum liquid recirculation rate at the level established during compliance testing. To ensure compliance and effective operation of the wet scrubber, the Permittee shall monitor and record the minimum liquid recirculation rate 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 stack tests from similar Enviva facilities, 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 three 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. For the new or replaced sources, the Permittee will be required to establish 'normal' visible emissions from these sources within the first 30-days following the commencement of operation. In order to demonstrate compliance, the Permittee will be required to observe actual visible emissions on a weekly 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.

D. 15A NCAC 02D .0535 "Excess Emissions Reporting and Malfunctions" – This regulation establishes reporting and corrective action measures when a source has excess emissions that last for more than four hours and that results from a malfunction, a breakdown of process or control equipment or any other abnormal conditions. The facility must notify the Division within an appropriate amount of time and describe the nature and cause of the malfunction or breakdown, the time when the malfunction or breakdown is first observed, the expected duration, and an estimated rate of emissions. Malfunctions are infrequent and unpredictable. Compliance with this standard is expected.

VIII. Regulatory Review – Multiple Emission Source Limitations and Conditions

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. The 350 and 671 horsepower emergency generators and the 300 horsepower 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 standards for new nonroad CI engines in §60.4202, for all pollutants, for the same model year and maximum engine power for their 2007 model year and later emergency stationary CI ICE. These limits are as follows: 0.20 g/kW for PM; 3.5 g/kW for CO; and 4 g/kW for NOx + 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 and 4 g/kW for NOx + 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, the 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 "Generally 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. 40 CFR Part 63, Subpart ZZZZ compliance is ensured by meeting the requirements of 40 CFR Part 60, Subpart IIII. No further requirements apply to such engines under this part.

C. Compliance Assurance Monitoring (CAM)
This permit (revision R06) is a non-Title V permit and CAM will be addressed at the time the Title V permit is developed.

D. 15A NCAC 02Q .0317 "Avoidance Conditions" for avoidance of 15A NCAC 02D .1111 "Maximum Achievable Control Technology, 112(g)" – After all of Permit 10203R06 Specific Limitations and Conditions from Section 2.3 A., "Actions to be Taken by the Permittee", have been met, the facility will accept a permit condition to limit emissions of any single HAP to less than 10 tpy and to less than 25 tpy for any combination of HAPs for avoidance of becoming a Title III major facility. Most of the HAP emissions are from the dryers, hammermills, and pellet cooler systems. The facility will ensure the avoidance limits are met by proper operation and maintenance of existing and proposed control devices.

For the facility to comply with the avoidance condition, the Green Hammermills will exhaust to an existing wet electrostatic precipitator (CD-WESP-1) and a new regenerative thermal oxidizer (CD-RTO-1 or 2). Dryer 1 HAPs will be controlled by the existing wet electrostatic precipitator (CD-WESP-1) in series with a new regenerative thermal oxidizer (CD-RTO-1) and Dryer 2 HAPs will be controlled with a new wet electrostatic precipitator (CD-WESP-2) in series with a new regenerative thermal oxidizer (CD-RTO-2). Emissions from the Dry Hammermills (ES-HM-1 through ES-HM-8) and the Dry Shavings Hammermills (ES-DSHM-1 and ES-DSHM-2) are controlled by new wet scrubber (CD-WS-1) in series with a regenerative catalytic oxidizer (CD-RCO-1) that can also operate as an RTO. The Pellet Press System and the six (6) pellet coolers (ES-CLR-1 thru ES-CLR-6) will control HAPs with new wet scrubber (CD-WS-2) in series with a regenerative catalytic oxidizer (CD-RCO-2) that can also operate as an RTO.

As part of the proposed project, the facility is requesting to increase the throughput from 535,260 ODT to 781,255 ODT and increase in the maximum amount of softwood that can be used from 30% up to a maximum of 80%. The proposed permit modifications outlined in this application include changes to the wood pellet manufacturing process that will decrease total potential HAP emissions by approximately 16 tpy. Other sources of organic HAP emissions at the plant include the following: Furnace Bypass Stacks (ES-FURNACE-1 and 2), Dryer Bypass Stacks (ES-DRYERBYP-1 and 2), Double Duct Burners (IES-DDB-1 through 4), Propane Vaporizer (IES-PVAP), Dried Wood Handlings (ES-DWH-1 and 2), Emergency Generators (IES-GEN-1 and 2), Fire Water Pump (IES-FWP), Electric Powered Green Wood Chipper (IES-EPWC), and a Bark Hog (IES-BARKHOG).

Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall establish emission factors for HAPs by conducting an initial and periodic performance tests on the green hammermills (ID Nos. ES-GHM-1 through ES-GHM-5), the wood-fired direct heat drying systems (ID No. ES-DRYER-1 and ES-DRYER-2), the dry hammermills (ID Nos. ES-HM-1 to ES-HM-8), the dry shavings hammermills (ID Nos. ES-DSHM-1 and ES-DSHM-2), and the pellet coolers (ID Nos. ES-CLR-1 through ES-CLR-6).

The pollutants and emission sources to be tested during the initial and periodic performance tests are listed in the following table:

Emission Sources	Pollutant
Green hammermills and dryer system controlled via RTO	Acetaldehyde Acrolein Formaldehyde Methanol Phenol Propionaldehyde
Dry and dry shavings hammermills controlled via RCO	
Pellet coolers controlled via RCO	

Monitoring, recordkeeping, and reporting are required according to the MACT Avoidance Condition. Because the facility has accepted an avoidance condition to limit emissions of HAPs, it remains a Title III minor facility and avoids applicability to MACT standards.

E. 15A NCAC 02Q .0317 "Avoidance Conditions" for avoidance of 15A NCAC 02D .0530 "Prevention of Significant Deterioration" – The avoidance conditions in Permit 10203R06 Section 2.2 A.2 apply until all of Section 2.3 A., "Actions to be Taken by the Permittee", have been met. Until such time as this condition is no longer applicable, the facility remains classified as PSD major. The facility has enforceable limits so that emissions sources shall discharge into the atmosphere less than 456.4 tons of volatile organic compounds (VOC) and 250 tons of carbon monoxide (CO) per consecutive 12-month period. To ensure that the limits established above are not exceeded, the facility's wood-fired dryer system will not process more than 537,625 oven dried tons per year ODT/year. To ensure that the limits established above are not exceeded, the facility's dry hammermill system will not process more than 531,441 ODT/year. To ensure that the limits established above are not exceeded, the facility's the pellet cooler system will not process more than 625,225 ODT/year. All process limits include a maximum softwood content of 30% and are for a rolling 12-month period. The conditions are included in the permit with the limits and restrictions necessary to ensure compliance.

F. 15A NCAC 02Q .0317 "Avoidance Conditions" for avoidance of 15A NCAC 02D .0530 "Prevention of Significant Deterioration" – The avoidance conditions in Permit 10203R06 Section 2.2 A.3 apply after all of Section 2.3 A., "Actions to be Taken by the Permittee", have been met. Following the applicability of this condition, the facility will be classified as PSD minor. The facility has enforceable limits so that emissions of particulate matter, particulate matter 10 micrometers, particulate matter 2.5 micrometers, volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) remain below the 250 tpy PSD major source thresholds. The facility will be limited to an annual process rate 781,255 ODT/year on a rolling 12-month average basis, with a maximum 80% softwood content and use RTOs and RCOs to control VOC emissions. The dry hammermills will not process more than 85% of the maximum facility throughput or a total of 664,067 oven dried tons per year (ODT/year) on a rolling 12-month average basis. The conditions are included in the permit with the limits and restrictions necessary to ensure compliance.

Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall demonstrate compliance with the PSD avoidance limits by conducting initial and periodic performance tests on the Green Hammermills (ID Nos. ES-GHM-1 through ES-GHM-5), the wood-fired direct heat drying systems (ID No. ES-DRYER-1 and ES-DRYER-2), the dry hammermills (ID Nos. ES-HM-1 to ES-HM-8), the dry shavings hammermills (ID Nos. ES-DSHM-1 and ES-DSHM-2), and the pellet coolers (ID Nos. ES-CLR-1 through ES-CLR-6). The pollutants and emission sources to be tested during the initial and periodic performance tests are listed in the following table:

Emission Sources	Pollutant
Green hammermills and dryer systems controlled via RTO	VOC
	PM/PM10/PM2.5
	NOx
	CO
Dry and dry shavings hammermills controlled via RCO	VOC
	PM/PM10/PM2.5
Pellet coolers controlled via RCO	VOC
	PM/PM10/PM2.5

Initial testing shall be completed within 180 days of commencement of operation.

The Permittee shall conduct periodic performance tests when the following conditions are met:

(A) The monthly average softwood content exceeds the average softwood percentage documented during prior performance testing by more than 10 percentage points, or

(B) The monthly production rate exceeds the average production rate documented during prior performance testing by more than 10 percentage points, or

(C) At a minimum testing shall be conducted annually. Annual performance tests shall be completed no later than 13 months after the previous performance test.

The Permittee shall install, calibrate, operate, maintain, and inspect a continuous temperature monitoring, and recording system, in accordance with manufacturer's recommendations and the most recent performance test, for the regenerative thermal oxidizers and the regenerative catalytic oxidizers (ID Nos. CD-RTO-1, CD-RTO-2, CD-RCO-1, and CD-RCO-2). To ensure compliance and effective operation of the oxidizers, the Permittee shall maintain a 3-hour rolling average firebox temperature for each of the fireboxes comprising the RTO or RCO at or above the minimum average temperatures established during the most recent performance testing. The Permittee shall maintain records of the 3-hour rolling average temperatures for each firebox. The monitoring shall be recorded continuously and data logged.

For the oxidizers, the Permittee shall develop and maintain a malfunction plan for the temperature monitoring and recording system that describes, in detail, the operating procedures for periods of malfunctions so that corrective actions can immediately be investigated. The malfunction plan shall identify malfunctions, as described by the manufacturer, and ensure the operators are prepared to correct such malfunctions as soon as practical. The Permittee shall keep any necessary parts for routine repairs of the temperature monitoring and recording system readily available. The Permittee shall perform periodic inspection and maintenance for the oxidizers as recommended by the manufacturer. At a minimum, the Permittee shall perform an annual internal inspection of the primary heat exchanger and associated inlet/outlet valves of the control device to ensure structural integrity.

To ensure compliance and effective operation of the wet scrubbers (ID No. CD-WS-1 and CD-WS-2), the Permittee shall perform inspections, maintenance, and maintain the required minimum liquid recirculation rate. To ensure compliance and effective operation of the wet electrostatic precipitators (ID No. CD-WESP-1 and CD-WESP-2), the Permittee shall perform inspections and maintenance and maintain the minimum secondary voltage and minimum current of the wet electrostatic precipitator. To ensure compliance and effective operation of the bagfilters and cyclones, the Permittee shall perform inspections and maintenance.

The process rate and hardwood/softwood mix shall be recorded in a monthly log kept on site. The results of the calculations and the total amount of PM, PM_{10}, $PM_{2.5}$, VOC, NOx, and CO emissions shall be recorded monthly in a logbook (written or electronic format) and made available to an authorized representative upon request. Semi-annual reporting of monitoring activities is required.

For the dryer system, GHG (CO_2e) 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.

G. 15A NCAC 02D .0540 Particulate from Fugitive Dust Emission Sources (State-enforceable only)
15A NCAC 02D .0540 requires that a fugitive dust control plan be prepared if ambient monitoring or air dispersion modeling show violation or a potential for a violation of a PM NAAQS, or if NC DAQ observes excess fugitive dust emissions from the facility beyond the property boundary for six (6) minutes in any one hour using EPA Method 22. 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). A fugitive dust control plan is not required at this time.

H. 15A NCAC 02D .1806: Control and Prohibition of Odorous Emissions (State-enforceable only)
The Permittee shall not operate the facility without implementing management practices or installing and operating odor control equipment sufficient to prevent odorous emissions from the facility from causing or contributing to objectionable odors beyond the facility's boundary.

I. 15A NCAC 02D .1100 Control of Toxic Air Pollutant (TAP) Emissions and 15A NCAC 02Q Toxic Air Pollutant Emission Rates Requiring a Permit – Pursuant to 15A NCAC 02Q .0711 (State-enforceable only)
15A NCAC 02D .1100 outlines the procedures that must be followed if a TAP permit and associated modeling are required under 15A NCAC 02Q .0700. Under 15A NCAC 02Q .0704(d), a TAP permit application is required to include an evaluation of the TAP emissions from a facility's sources, excluding exempt sources listed in Rule .0702 of this Section. Per NCAC 02Q .0706, the facility shall submit an application that complies with 15A NCAC 02D .1100(1) if the modification results in a net increase in emissions or ambient concentration as determined in 15A NCAC 02D .1106 and 15A NCAC 02Q .0709 of any toxic air pollutant that the facility was emitting before the modification; or (2) emissions of any toxic air pollutant that the facility was not emitting before the modification if such emissions exceed the levels set forth in 15A NCAC 02Q .0711. Air toxics modeling was performed for this facility.

15A NCAC 02D .1100 outlines the procedures that must be followed if a TAP permit and associated modeling is required under 15A NCAC 02Q .0700. Modeling was completed for the Northampton plant in April 2014. DAQ Air Quality Analysis Branch (AQAB) meteorologist Tom Anderson reviewed Enviva's modeling and approved the analysis on May 8, 2014. The toxics emissions limitations and requirements located in permit Section 2.2 A.4. shall remain in effect until all of the requirements from permit Section 2.3 A. have been met.

Modeling for this modification was completed for the Northampton plant in September 2018. Thirteen TAPs were evaluated in the updated facility-wide modeling: acetaldehyde, acrolein, arsenic, benzene, beryllium, cadmium, chlorine, formaldehyde, HCl, manganese, mercury, nickel, and phenol. The modeled concentrations for eleven (11) of the thirteen (13) TAP were less than 1% of their respective Acceptable Ambient Level (AAL). The worst-case TAP was benzene, with a maximum modeled concentration that was less than 22% of its AAL. Although several changes are being proposed, (e.g., addition of a separate wet scrubber and RCO to control the Pellet Mills/Pellet Coolers) to the facility since the September 2018 modeling analysis was completed, given the magnitude of the previous modeled concentrations it was not anticipated that these design changes would significantly impact the previous results. Due to equipment changes from the initial application, Enviva conducted revised modeling at the request of DAQ and submitted the report on May 7, 2019 with the electronic files received on May 23, 2019. The worst-case TAP for the most recent modeling was benzene, with a maximum modeled concentration that was less than 24% of its AAL.

Enviva conducted air dispersion modeling for 13 TAPs with emissions in excess of the TPER thresholds in 15A NCAC 02Q .0711 to demonstrate compliance with the Acceptable Ambient Levels (AALs) in 15A NCAC 02D .1100. The AALs are in place to ensure that emissions from a facility do not adversely affect human health. Modeling for each TAP was conducted for the most recent year of meteorological data available (2017) and maximum concentrations were compared to the AALs. Enviva utilized AERMOD-ready meteorological data processed by NC DAQ for the Rocky Mount National Weather Service (NWS) surface station (ID: 93759) and upper air data from the Newport NWS Station (ID: 93768) for the period 2012-2016.20. The meteorological data were processed by NC DAQ using version 18081 of AERMET.

DAQ Air Quality Analysis Branch (AQAB) meteorologist Nancy Jones and supervisor Tom Anderson reviewed Enviva's modeling. Enviva's modeling was approved on June 3, 2019. Below is a summary of AQAB Enviva modeling results.

TAP	Averaging Period	Scenario	Max. Conc. ($\mu g/m^3$)	AAL ($\mu g/m^3$)	% of AAL
Acetaldehyde	1-hour	NORM	0.54	27,000	<1 %
Acrolein	1-hour	FBYP2	1.36	80	2 %
Arsenic	Annual	FBYP1	1.9e-4	0.0021	9 %
Benzene	Annual	NORM	0.028	0.12	24 %
Beryllium	Annual	FBYP1	9.7e-6	0.0041	<1 %
Cadmium	Annual	FBYP1	4e-5	0.0055	1 %
Chlorine	1-hour	FBYP2	6.45	900	1 %
	24-hour	FBYP2	2.23	37.5	6 %
Formaldehyde	1-hour	FBYP1	8	150	5 %
HCl	1-hour	FBYP2	6.45	700	1 %
Manganese	24-hour	FBYP2	0.19	31	1 %
Mercury	24-hour	FBYP2	4.2E-4	0.6	<1 %
Nickel	24-hour	FBYP2	3.9E-3	6	<1 %
Phenol	1-hour	NORM	0.22	95	<1 %

This compliance demonstration assumes the source parameters and pollutant emission rates used in the analysis are correct. The modeling adequately demonstrates compliance, on a source-by-source basis, for all toxics modeled. The toxics emissions limitations and requirements located in permit Section 2.2 A.5. and approved in the AAL Table above shall become effective after all of the requirements from permit Section 2.3 A. have been met.

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

This facility is being processed under the state construction and operating permit program initially. Within one year after commencement of facility operation, the Permittee was required to submit a complete Title V application. From September 20, 2017 - October 20, 2018, the first time Title V application went through public notice and major comments were received during the public comment period from the Environmental Integrity Project (EIP). Issuance of the 1st time Title V permit was placed on hold and DEQ received an updated permit application from the facility that would add controls to make the facility minor for PSD. The Permittee shall file a Title V Air Quality Permit Application pursuant to 15A NCAC 02Q .0504., to amend the existing Title V first time application (6600167.14B) on or before 12 months after commencing operation of any of the new sources or control devices listed in this permit.

**Note: As a result of public comments, the Hearing Officer recommended modifications to this section and corresponding sections in the draft permit. See Section X of this document below for a summary of the recommendations.*

IX. Other Regulatory Considerations

- An application fee of $947.00 was received by the DAQ on October 1, 2018.
- The appropriate number of application copies was received by the DAQ.
- A Professional Engineer's Seal is required for this amended application and was provided (ref. Russell Kemp, P.E. Seal # 19628, 5-27-2019).
- Receipt of the request for a zoning consistency determination was acknowledged by William Flynn, Director, Northampton County Code Enforcement on October 31, 2018. On July 15, 2019, Mr. Flynn signed the zoning consistency determination and approved that the facility's proposed operations are consistent with applicable zoning ordinances.
- According to the application, the facility does not store any materials in excess of the 112r applicability threshold.
- The application was signed by Mr. Royal Smith Executive Vice President Operations, on March 27, 2019.
- Public notice is not required for this modification to the State Permit issued under 15A NCAC 02Q .0300. Due to public interest in this project, the DAQ Director did require a public hearing.

X. Recommendations

The public comment period for this draft permit ran from July 19 through August 23, 2019. Comments were received and a Hearing Officer's Report was created with recommendations. The Hearing Officer's Report, which was finalized on October 25, 2019, addresses comments received during the public comment period, including those regarding the PSD avoidance, malfunctions, forestry management, Executive Order 80, Environmental Justice, among others. The Environmental Integrity Project (EIP) and the Southern Environmental Law Center (SELC) submitted detailed comments on August 23, 2019, and many of these comments related specifically to the PSD avoidance and other issues germane to the draft permit and technical review.

All public comments were addressed in the Hearing Officer's Report. The following changes were made to the Draft Permit that went to public notice on July 19, 2019, as recommended by Bruce Ingle, the Hearing Officer *(Note: The following discussion pertains only to those sections of the permit where the Hearing Officer recommends modification. Refer to the text of the complete Hearing Officer's report for a discussion of all other items – Attachment 2).*

Comment 1 (EIP & SELC Letter Item - I.A): Enviva Underestimates Potential NOx Emissions for the Existing Dryer 1 Compared to Source-Specific Testing at Enviva Northampton.

Comment 2 (EIP & SELC Letter Item - I.B): Enviva Also Underestimates NOx Emissions for the New Dryer 2 Compared to Emissions Estimates for an Identical Dryer at Enviva Southampton.

Comment 3 (EIP & SELC Letter Item - I.C): As a Major Source of NOx Emissions, Enviva Must Undergo PSD Review or Restrict its PTE to Become a True Synthetic Minor Source.

Comment 4 (EIP & SELC Letter Item - I.D): Enviva and DAQ Must Identify the Particular Source Test Relied Upon For the Dryer Emission Factors.

Recommendation (Item I.A, Page 7 of 32):
It is recommended that the permit reflect the requirement of Enviva Northampton to use the scaled site-specific NOx emission factor of 33.48 lb/hr until all of the proposed control devices are installed (excluding the new wood dryer controls in the event the second dryer is not installed) and new site-specific approved NOx emission factors have been established through stack testing.

Recommendation (Items I.B-D, Pages 8, 10, 11 of 32):
No changes other than those discussed in response to SECTION I, Item 1.A above are deemed necessary to address this comment.

Resolution:
The NOx emission factor of 33.48 lb/hr will be incorporated as suggested by the Hearing Officer. The NOx emission factor is reflected in the equation for PSD avoidance. See response to Comment 8 below.

Comment 5 (EIP & SELC Letter Item - II.A): The Permitted Dryer Bypass Operations Cause Exceedances of the NAAQS and AALs.

Recommendation (Item II.A, Page 13 of 32):
It is recommended to remove the malfunction language noted above *(i.e. remove the condition allowing up to 50 hours of malfunction for each dryer line bypass stack.)*

Resolution:
Deleted malfunction language in permit Sections 2.2 A.3.c.vii and 2.2 A.3.c.viii. Added startup, shutdown and malfunction language in permit Section 2.2 A.3.c.x.

Comment 6 (EIP & SELC Letter Item - II.B.): The Malfunction Exemption is Also Contrary to Recent Enviva Permits.

Comment 7 (EIP & SELC Letter Item - III): To Ensure that the Facility Will Not Cause or Contribute to a Violation of the NAAQS or AALs, the Draft Permit Must Require Enviva to Promptly Shut Down the Dryer Whenever Use of the Dryer Bypass Stacks Becomes Necessary.

Recommendation (Item II.B, Page 14 of 32 and Item III, Page 15 of 32):
It is recommended to remove the malfunction language noted in SECTION II, Item II.A. above, include similar cold start-up bypass language, and be consistent with bypass conditions with Enviva Sampson.

Resolution:
Deleted malfunction language in permit Sections 2.2 A.3.c.vii and 2.2 A.3.c.viii. Added bypass language in permit Section 2.2 A.3.c.viii.

Comment 8 (EIP & SELC Letter Item - IV): The Permit Must Incorporate Emission Factors and Equations Used to Calculate 12-Month Rolling Emissions to Make the PTE Limits Enforceable.

Recommendation (Item IV, Page 16 of 32):
It is recommended that the NOx equation be added to the PSD avoidance condition related to operations post modification in order to determine compliance with the 250 ton per year NOx PSD Avoidance limit.

$$E_{NOx(Total)} = \sum E_{NOx(Dryer1)} + \sum E_{NOx(Dryer2)} + \sum E_{NOx(RTO1)} + \sum E_{NOx(RTO2)} + 3.94$$

$$E_{NOx(Dryer1\ or\ Dryer2)} = \frac{(0.47\ x\ Q_D)}{2000}$$

$$E_{NOx(RTO1\ or\ RTO2)} = \left(\frac{(4.55 \times P_{RTO}) + (3.15 \times NG_{RTO})}{2{,}000}\right)$$

Where:

$E_{NOx(Total)}$	=	total tons of NOx emissions per month from the facility.
$E_{NOx(Dryer1\ or\ 2)}$	=	total tons of NOx emissions per month from each dryer
$E_{NOx(RTO1)}$	=	number of tons of NOx emissions per month from RTO1 fuel combustion.
$E_{NOx(RTO2)}$	=	number of tons of NOx emissions per month from RTO2 fuel combustion.
Q_D	=	the oven dried tons of processed wood through the dryers per month.
0.47	=	dryer line NOx emission factor 0.47 lbs/ODT is derived from the October 2013 site-specific stack test of 33.48 lb/hr at maximum throughput.
$P_{RTO1\ or\ RTO2}$	=	propane hours per month when oxidizer deemed "in operation", is not bypassed, and oxidizer temperature is greater than or equal to the hourly block average temperature specified per stack test with an emission factor of 4.55 lb/hr.
$NG_{RTO1\ or\ RTO2}$	=	natural gas hours per month when oxidizer deemed "in operation", is not bypassed, and oxidizer temperature is greater than or equal to the hourly block average temperature specified per stack test with an emission factor of 3.15 lb/hr.
3.94	=	equates to the monthly PTE for the miscellaneous sources including; double duct burners, propane vaporizer, catalytic oxidizers, bypass stacks, emergency generators, and a fire water pump

Resolution:
Added the NOx equation to permit Section 2.2 A.3.q.

Comment 11 (EIP & SELC Letter Item - VII): Post-Modification Reporting Requirements Should Include Production Information and Implement Heat Rate Input Monitoring.

Recommendation (Item VII, Page 19 of 32):
It is recommended to modify the reporting condition in Permit Condition 2.2 A.3.t to add reporting of monthly ODT levels as well as hardwood/softwood mixes.

Resolution: Added reporting conditions to permit Section 2.2 A.3.t.
Comment 17 (EIP & SELC Letter Item - X): DAQ Should Expedite Processing of the Enviva Northampton Title V Permit.

Recommendation (Item X, Page 26 of 32):
It is recommended to include the amended permit condition as described above (i.e. requiring that the Title V first time application (6600167.14B) be amended to include the facility modifications described in application 6600167.18A within 90 days of the issuance of Permit No. 10203R06).

Resolution:
Modified Section 2.2 A. 11 requiring that the Title V first time application (6600167.14B) be amended to include the facility modifications described in application 6600167.18A within 90 days of the issuance of Permit No. 10203R06.

This application has been reviewed by the DAQ to determine compliance with all procedures and requirements. The DAQ has determined that this facility appears to be or is expected to achieve compliance as specified in the permit with all applicable requirements. DAQ recommends issuance of Permit No. 10203R06.

ATTACHMENT 1

Appendix B - Process Flow Diagram
Enviva Pellets Northampton, LLC – Northampton County, NC

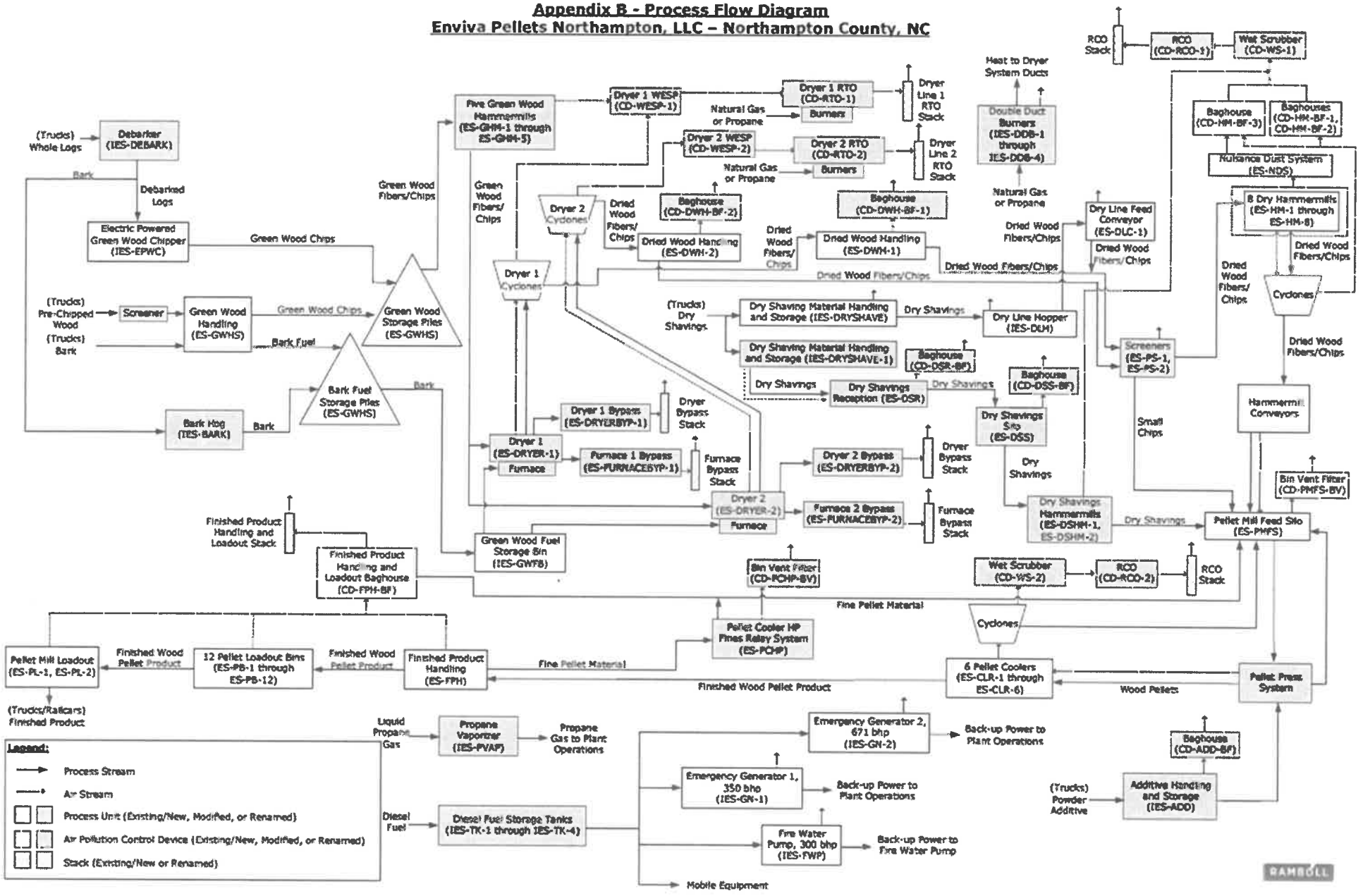


Table 2
Facility-Wide HAP Emissions Summary
Enviva Pellets Northampton, LLC

Description	HAP	CD-RTO-1 and CD-RTO-2 (tpy)	ES-DRYER-BYP-1 (tpy)	ES-FURNACE-BYP-1 (tpy)	IES-DDB-1 and -2 (tpy)	ES-DRYER-BYP-2 (tpy)	ES-FURNACE-BYP-2 (tpy)	IES-DDB-3 and -4 (tpy)	IES-PVAP (tpy)	CD-RCO-1 (tpy)	CD-RCO-2 (tpy)	ES-DWH-1 and -2 (tpy)	IES-GN-1 (tpy)	IES-GN-2 (tpy)	IES-FWP1 (tpy)	IES-EPWC (tpy)	IES-BARK (tpy)	Total (tpy)	Major Source
Acetaldehyde	Y	1.73E+00	3.02E-01	6.57E-03	1.37E-07	3.46E-01	4.77E-03	1.31E-07	-	3.66E-01	4.92E-01	-	4.70E-04	2.96E-03	4.01E-04	-	-	3.04E+00	No
Acrolein	Y	1.23E+00	1.97E-01	2.25E-02	1.55E-07	2.26E-01	2.30E-02	1.55E-07	-	2.09E-01	9.75E-01	-	5.67E-05	9.25E-06	4.86E-05	-	-	2.88E+00	No
Formaldehyde	Y	1.87E+00	2.57E-01	2.48E-02	1.31E-02	2.95E-01	2.53E-02	1.31E-02	6.57E-03	2.90E-01	2.50E-01	3.28E-01	7.23E-04	9.26E-05	6.70E-04	-	-	3.37E+00	No
Methanol	Y	1.39E+00	1.88E-01	-	-	2.15E-01	-	-	-	1.62E-01	4.14E-01	7.82E-01	-	-	-	3.93E-03	1.17E-03	3.84E+00	No
Phenol	Y	6.07E-01	1.03E-01	2.67E-03	-	1.18E-01	2.93E-03	-	-	6.36E-02	4.92E-01	-	-	-	-	-	-	1.35E+00	No
Propionaldehyde	Y	3.88E-01	6.90E-02	3.44E-04	-	7.90E-02	3.51E-04	-	-	2.82E-01	2.85E-01	-	-	-	-	-	-	1.10E+00	No
Acetophenone	Y	1.24E-07	1.40E-08	1.80E-08	-	1.44E-08	1.84E-08	-	-	-	-	-	-	-	-	-	-	1.89E-07	No
Ammonia	N	8.79E-01	-	-	2.75E-02	-	-	2.75E-02	-	2.69E-01	2.69E-01	-	-	-	-	-	-	1.47E+00	No
Antimony and compounds	Y	8.91E-04	3.45E-03	6.45E-05	-	5.58E-05	6.58E-05	-	-	-	-	-	-	-	-	-	-	1.05E-03	No
Arsenic	Y	2.54E-03	9.64E-03	1.24E-04	1.72E-06	9.90E-05	1.27E-04	1.72E-06	-	1.68E-05	1.68E-05	-	-	-	-	-	-	3.02E-03	No
Benzene	Y	3.62E-01	-	-	6.22E-02	-	-	6.22E-03	3.11E-03	6.10E-02	6.10E-02	-	5.71E-04	9.11E-04	4.90E-04	-	-	5.02E-01	No
Benzo(a)pyrene	Y	1.01E-04	1.14E-05	1.46E-05	1.01E-06	1.17E-05	1.50E-05	1.01E-06	-	1.01E-07	1.01E-07	-	2.39E-05	3.02E-07	9.87E-06	-	-	1.79E-04	No
Beryllium	Y	1.27E-04	4.82E-06	6.20E-06	1.01E-07	4.95E-06	6.33E-06	1.01E-07	-	1.01E-06	1.01E-06	-	-	-	-	-	-	1.92E-04	No
1,3-Butadiene	Y	-	-	-	-	-	-	-	-	-	-	-	2.39E-05	-	2.05E-05	-	-	4.45E-05	No
Cadmium	Y	7.65E-04	1.88E-03	2.31E-05	9.45E-06	1.85E-05	2.36E-05	9.45E-06	-	9.26E-05	9.26E-05	-	-	-	-	-	-	2.03E-03	No
Carbon tetrachloride	Y	1.73E-03	1.97E-04	2.55E-04	-	2.03E-04	2.59E-04	-	-	-	-	-	-	-	-	-	-	2.66E-03	No
Chlorine	Y	1.23E+00	3.45E-03	4.45E-03	-	3.56E-03	4.54E-03	-	-	-	-	-	-	-	-	-	-	1.25E+00	No
Chlorobenzene	Y	1.26E-03	1.45E-04	1.86E-04	-	1.49E-04	1.90E-04	-	-	-	-	-	-	-	-	-	-	1.95E-03	No
Chloroform	Y	1.09E-03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.09E-03	No
Chromium VI	Y	7.80E-04	-	-	1.20E-05	-	-	1.20E-05	-	1.18E-04	1.18E-04	-	-	-	-	-	-	3.04E-03	No
Chromium, Other compounds	Y	1.97E-03	7.67E-05	1.18E-04	-	7.88E-05	1.21E-04	-	-	-	-	-	-	-	-	-	-	2.37E-03	No
Cobalt compounds	Y	7.33E-04	2.85E-05	3.66E-05	-	2.93E-05	3.74E-05	-	-	7.07E-06	7.07E-06	-	-	-	-	-	-	8.79E-04	No
Dichlorobenzene	Y	1.20E-04	-	-	5.03E-03	-	-	5.03E-03	-	5.01E-04	5.01E-04	-	-	-	-	-	-	1.11E-02	No
Dichloroethane, 1,2-	Y	1.13E-03	1.27E-04	1.63E-04	-	1.31E-04	1.67E-04	-	-	-	-	-	-	-	-	-	-	3.52E-03	No
Dichloropropane, 1,2-	Y	1.28E-03	1.45E-04	1.86E-04	-	1.49E-04	1.90E-04	-	-	-	-	-	-	-	-	-	-	3.72E-03	No
Dinitrophenol, 2,4-	Y	7.00E-06	7.89E-07	1.01E-06	-	8.10E-07	1.04E-06	-	-	-	-	-	-	-	-	-	-	1.95E-03	No
Diethylhexyl phthalate	Y	1.83E-06	2.06E-07	2.63E-07	-	2.12E-07	2.70E-07	-	-	-	-	-	-	-	-	-	-	1.07E-03	No
Dimethylbenzene	Y	1.21E-03	1.36E-04	1.75E-04	-	1.40E-04	1.78E-04	-	-	-	-	-	-	-	-	-	-	2.72E-03	No
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	N	6.95E-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.83E-03	No
Hexane	Y	4.95E-01	-	-	1.55E-02	-	-	1.55E-02	-	1.51E-01	1.51E-01	-	-	-	-	-	-	6.06E-10	No
Isomers, 1,2,3 compound	Y	4.95E-07	-	-	1.55E-06	-	-	1.55E-06	-	1.51E-07	1.51E-07	-	-	-	-	-	-	8.29E-01	No
Hydrochloric acid	Y	2.96E+00	8.33E-02	1.07E-01	-	8.55E-02	1.09E-01	-	-	-	-	-	-	-	-	-	-	8.29E-07	No
Lead	Y	3.93E-03	-	-	4.29E-06	-	-	4.29E-06	-	4.21E-05	4.21E-05	-	-	-	-	-	-	3.34E+00	No
Manganese	Y	1.81E-02	7.01E-03	9.01E-05	1.26E-06	7.20E-03	2.20E-05	1.26E-06	-	3.20E-05	3.20E-05	-	-	-	-	-	-	5.65E-03	No
Mercury	Y	4.66E-04	1.53E-05	1.97E-05	2.23E-06	1.58E-05	2.01E-05	2.23E-06	-	2.19E-05	2.19E-05	-	-	-	-	-	-	2.13E-03	No
Methyl bromide	Y	5.84E-04	6.57E-05	8.45E-05	-	6.75E-05	8.62E-05	-	-	-	-	-	-	-	-	-	-	5.86E-04	No
Methyl chloride	Y	8.95E-04	1.01E-04	1.30E-04	-	1.04E-04	1.32E-04	-	-	-	-	-	-	-	-	-	-	8.88E-04	No
Methyl ethyl ketone	N	2.10E-04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.16E-03	No
3-Methylcholanthrene	Y	4.95E-07	-	-	1.55E-06	-	-	1.55E-06	-	1.51E-07	1.51E-07	-	-	-	-	-	-	2.10E-04	No
Methylene chloride	Y	1.13E-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.29E-07	No
Naphthalene	Y	3.95E-03	4.25E-04	5.45E-04	5.24E-06	4.37E-04	5.58E-04	5.24E-06	-	5.13E-03	5.13E-03	-	-	-	-	-	-	1.13E-02	No
Nickel	Y	4.30E-03	1.45E-04	1.86E-04	2.80E-05	1.49E-04	1.90E-04	2.80E-05	-	1.77E-04	1.77E-04	-	-	1.33E-04	-	-	-	6.18E-03	No
Nitrophenol, 4-	Y	4.28E-06	4.82E-07	6.20E-07	-	4.95E-07	6.33E-07	-	-	-	-	-	-	-	-	-	-	5.35E-03	No
Pentachlorophenol	Y	1.98E-06	2.24E-07	2.87E-07	-	2.30E-07	2.93E-07	-	-	-	-	-	-	-	-	-	-	6.51E-06	No
Perchloroethylene	Y	1.48E-03	1.67E-04	2.14E-04	-	1.71E-04	2.19E-04	-	-	-	-	-	-	-	-	-	-	3.02E-06	No
Phosphorus metal, yellow or white	Y	3.05E-03	1.18E-04	1.52E-04	-	1.22E-04	1.55E-04	-	-	-	-	-	-	-	-	-	-	2.23E-03	No
Polychlorinated biphenyls	Y	3.17E-07	3.57E-08	4.59E-08	-	3.67E-08	4.69E-08	-	-	-	-	-	-	-	-	-	-	3.39E-03	No
Polycyclic Organic Matter	Y	1.61E-02	5.48E-04	7.06E-04	3.50E-04	5.63E-04	7.19E-04	3.50E-04	1.75E-04	3.43E-03	3.43E-03	-	1.03E-04	2.49E-04	6.82E-05	-	-	2.08E-02	No
Selenium compounds	Y	3.23E-04	1.23E-05	1.58E-05	2.06E-07	1.26E-05	1.61E-05	2.06E-07	-	2.02E-06	2.02E-06	-	-	-	-	-	-	3.84E-04	No
Styrene	Y	7.39E-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.39E-02	No
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	3.35E-10	3.77E-11	4.84E-11	-	3.87E-11	4.95E-11	-	-	-	-	-	-	-	-	-	-	9.09E-10	No
Toluene	Y	2.10E-03	-	-	2.92E-03	-	-	2.92E-03	-	2.86E-04	2.86E-04	-	2.51E-04	3.30E-04	2.15E-04	-	-	5.33E-03	No
Trichloroethane, 1,1,1-	Y	1.21E-03	1.36E-04	1.75E-04	-	1.40E-04	1.78E-04	-	-	-	-	-	-	-	-	-	-	1.83E-03	No
Trichloroethylene	Y	1.17E-03	1.31E-04	1.31E-04	-	1.35E-04	1.73E-04	-	-	-	-	-	-	-	-	-	-	1.74E-03	No
Trichlorofluoromethane	N	1.60E-03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.60E-03	No
Trichlorophenol, 2,4,5-	Y	8.56E-07	9.64E-08	1.24E-07	-	9.90E-08	1.27E-07	-	-	-	-	-	-	-	-	-	-	1.10E-06	No
Vinyl chloride	Y	7.00E-04	7.89E-05	1.01E-04	-	8.10E-05	1.04E-04	-	-	-	-	-	-	-	-	-	-	1.07E-03	No
Xylene	Y	9.73E-04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.52E-03	No
TOTAL HAPs		12.57	1.21	0.18	0.04	1.38	0.18	0.04	0.01	1.38	3.12	1.09	2.37E-03	1.85E-03	2.03E-03	0.39	0.12	31.71	No

Notes:

[1] Each dryer line is routed to a separate RTO (CD-RTO-1 and CD-RTO-2). Although dryer line 1 and dryer line 2 are capable of processing up to 537,625 ODT/yr and 620,000 ODT/yr, respectively, the combined throughput of both dryers will not exceed 781,255 ODT/yr. In order to provide Enviva with the flexibility to use either dryer line up to its individual capacity, the total emissions from the two RTO's are based on the total facility throughput and are calculated as follows:
- Where individual dryer emissions were calculated based on throughput (i.e., lb/ODT), the total emissions are estimated based on the total throughput of 781,255 ODT/yr, plus the emissions from the green hammermill.
- Where individual dryer emissions were calculated based on fuel use (i.e., lb/MMBtu or lb/gal) or hourly test/vendor data (i.e., lb/hr), the total emissions are conservatively set equal to the sum of the emissions from the two dryer lines plus the emissions from the green hammermill, assuming both dryer lines operate 8,760 hrs/yr.

Table 3a.
Potential Criteria Emissions
Dryer #1 (ES-DRYER-1, CD-WESP-1, CD-RTO-1)
Enviva Pellets Northampton, LLC

Calculation Basis

Annual Dried Wood Throughput[1]	781,255 ODT/year
Max. Hourly Dried Wood Throughput of Dryer	71.71 ODT/hr
Burner Heat Input	175.3 MMBtu/hr
Percent Hardwood	20.0%
Percent Softwood	80.0%
Annual Operation	8,760 hr/yr
Annual Heat Input	1,535,628 MMBtu/yr
Number of RTO Burners	4
RTO Burner Rating	8 MMBtu/hr
RTO Control Efficiency	97.50%

Potential Criteria Emissions

Pollutant	Biomass Emission Factor	Units	Emission Factor Source	Uncontrolled Emissions		Controlled Emissions	
				Max (lb/hr)	Annual (tpy)	Max (lb/hr)	Annual (tpy)
CO	0.4	lb/ODT	Note 2	--	--	28.68	156.3
NO_x	22.23	lb/hr	Note 2	--	--	22.23	97.4
$PM/PM_{10}/PM_{2.5}$ (Filterable + Condensable)	7.6	lb/hr	Note 4	--	--	7.60	33.3
SO_2	0.025	lb/MMBtu	AP-42, Section 1.6[3]	--	--	4.38	19.2
Total VOC (as propane)	2.64	lb/ODT	Note 5	189.31	1031.3	4.73	25.8

Notes:

[1] Annual dried wood throughput is based on total facility production. Although dryer line 1 and dryer line 2 are capable of processing up to 537,625 ODT/yr and 620,000 ODT/yr, respectively, the combined throughput of both dryers will not exceed 781,255 ODT/yr. In order to provide Enviva with the flexibility to use either dryer line up to its individual capacity, the total emissions from the two dryer lines are based on the total facility throughput and calculated as follows:
- Where individual dryer emissions are calculated based on throughput (i.e. lb/ODT), the total emissions are estimated based on the total throughput of 781,255 ODT/yr.
- Where individual dryer emissions are calculated based on fuel use (i.e. lb/MMBtu or lb/MMscf) or hourly test/vendor data (i.e., lb/hr), the total emissions are conservatively set equal to the sum of the emissions from the two dryer lines assuming both dryer lines operate 8,760 hrs/yr.
- Dryer line 1 described as 175.3 MMBtu/hr = 155.3 MMBtu/hr from the grate and 2 additional 10 MMBtu/hr dust burners permitted but not added.

[2] CO emissions based on data from similar Enviva facilities and information from NCASI database.
NOx emissions based on stack test results from similar Enviva facility plus 30% contingency.

[3] No emission factor is provided in AP-42, Section 10.6.2 for SO_2 for rotary dryers. Enviva has conservatively calculated SO_2 emissions based upon the heat input of the dryer burners using an emission factor for wood combustion from AP-42, Section 1.6.

[4] Particulate emission factor is based on data from similar Enviva facilities.

[5] VOC emission factor based on source test data for similar pellet manufacturing facilities and represents uncontrolled emissions.

Table 3b
Potential VOC Emissions
Green Hammermills (ES-GHM-1 through ES-GHM-5, CD-WESP-1, CD-RTO-1 or CD-WESP-2, CD-RTO-2)[1]
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Throughput[1]	150.0 ODT/hr
Annual Throughput	781,255 ODT/yr
Hours of Operation	8,760 hr/yr
RTO Control Efficiency	97.50%

Potential VOC Emissions[2]

Pollutant	CAS No.	HAP	NC TAP	VOC	Emission Factor[2] (lb/ODT)	Potential Emissions[3] Max (lb/hr)	Potential Emissions[3] Annual (tpy)
Acetaldehyde	75-07-0	Y	Y	Y	8.4E-03	0.032	0.082
Acrolein	107-02-8	Y	Y	Y	1.6E-02	0.059	0.15
Formaldehyde	50-00-0	Y	Y	Y	4.8E-03	0.018	0.047
Methanol	67-56-1	Y	N	Y	3.7E-02	0.140	0.36
Phenol	108-95-2	Y	Y	Y	4.6E-03	0.017	0.045
Propionaldehyde	123-38-6	Y	N	Y	1.2E-03	0.005	0.012
					Total TAP Emissions	0.125	0.326
					Total HAP Emissions	**0.27**	**0.70**
Total VOC (as propane)	--	N/A	N/A	Y	0.32	1.21	3.15

Notes:
1. The max hourly throughput is based on the maximum capacity for the 2 existing green hammermills ratioed up to reflect 3 additional hammermills (i.e. 119.4 tph * 5/2).
2. Emission factors were derived based on stack testing data from comparable Enviva facilities and/or engineering judgement and include contingency. The emission factors represent uncontrolled emissions.
3. The emissions from the green hammermills will primarily be controlled by the RTO on the existing dryer line (CD-RTO-1). During periods when the existing dryer line is down, the emissions from the green hammermills will be controlled by the RTO on the new dryer line (CD-RTO-2).

Thermal Generated Potential Criteria Pollutant Emissions

Maximum high heating value of VOC constituents	0.018 MMBtu/lb
Uncontrolled VOC emissions	126 tons/yr
Uncontrolled VOC emissions	48 lb/hr
Heat input of uncontrolled VOC emissions	4,666 MMBtu/yr
Heat input of uncontrolled VOC emissions	0.9 MMBtu/hr

Pollutant	Emission Factor	Units	Potential Emissions Max (lb/hr)	Potential Emissions Annual (tpy)
CO	8.2E-02	lb/MMBtu[1]	0.07	0.19
NO$_x$	9.8E-02	lb/MMBtu[1]	0.09	0.23

Notes:
1. CO and NO$_x$ emission factors are from AP-42, Fifth Edition, Volume 1, Chapter 1.4 -- Natural Gas Combustion, 07/98 for small boilers.

Abbreviations:
CAS -- chemical abstract service
HAP -- hazardous air pollutant
hr -- hour
lb -- pound
NC -- North Carolina
ODT -- oven dried tons
RTO -- Regenerative Thermal Oxidizer
TAP -- toxic air pollutant
tpy -- tons per year
VOC -- volatile organic compound
yr -- year

Table 3c
Potential HAP and TAP Emissions
Dryer #1 (ES-DRYER-1, CD-WESP-1, CD-RTO-1)
Enviva Pellets Northampton, LLC

alculation Basis

nnual Dried Wood Throughput*	→	781,255 ODT/year
ax. Hourly Dried Wood Throughput of Dryer	→	71.71 ODT/hr
umer Heat Input	→	175.3 MMBtu/hr
ercent Hardwood	→	20.0%
ercent Softwood	→	80.0%
nnual Operation	→	8,760 hr/yr
nnual Heat Input	→	1,535,628 MMBtu/yr
umber of RTO Burners	→	4
TO Burner Rating	→	8 MMBtu/hr
TO Control Efficiency	→	97.50%

otential HAP and TAP Emissions

Pollutant	HAP	NC-TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							Max (lb/hr)	Annual (tpy)
ryer-Burner—Biomass-Source								
cetaldehyde	Y	Y	Y	1.7E-01	lb/ODT	1	0.30	1.64
crolein	Y	Y	Y	1.1E-01	lb/ODT	1	0.20	1.07
rmaldehyde	Y	Y	Y	1.4E-01	lb/ODT	1	0.26	1.40
lethanol	Y	N	Y	1.0E-01	lb/ODT	1	0.19	1.02
henol	Y	Y	Y	5.8E-02	lb/ODT	1	0.10	0.56
ropionaldehyde	Y	N	Y	3.9E-02	lb/ODT	1	0.07	0.38
cetophenone	Y	N	Y	3.2E-09	lb/MMBtu	2,3	1.4E-08	6.1E-08
ntimony and compounds	Y	N	N	7.9E-06	lb/MMBtu	2,4	1.0E-04	4.4E-04
rsenic	Y	Y	N	2.2E-05	lb/MMBtu	2,4	2.8E-04	1.2E-03
enzene	Y	Y	Y	4.2E-03	lb/MMBtu	2,3	1.8E-02	8.1E-02
enzo(a)pyrene	Y	Y	Y	2.6E-06	lb/MMBtu	2,3	1.1E-05	5.0E-05
eryllium	Y	Y	N	1.1E-06	lb/MMBtu	2,4	1.4E-05	6.1E-05
admium	Y	Y	N	4.1E-06	lb/MMBtu	2,4	5.2E-05	2.3E-04
arbon tetrachloride	Y	Y	Y	4.5E-05	lb/MMBtu	2,3	2.0E-04	8.6E-04
hlorine	Y	Y	N	7.9E-04	lb/MMBtu	2,9	1.4E-01	6.1E-01
hlorobenzene	Y	Y	Y	3.3E-05	lb/MMBtu	2,3	1.4E-04	6.3E-04
hloroform	Y	Y	Y	2.8E-05	lb/MMBtu	2,3	1.2E-04	5.4E-04
hromium VI	Y	Y	N	3.5E-06	lb/MMBtu	2,4,5	4.4E-05	1.9E-04
hromium Other compounds	Y	N	N	1.8E-05	lb/MMBtu	2,4	2.2E-04	9.7E-04
obalt compounds	Y	N	N	6.5E-06	lb/MMBtu	2,4	8.3E-05	3.6E-04
ichloroethane, 1,2-	Y	Y	Y	2.9E-05	lb/MMBtu	2,3	1.3E-04	5.6E-04
ichloropropane, 1,2-	Y	N	Y	3.3E-05	lb/MMBtu	2,3	1.4E-04	6.3E-04
initrophenol, 2,4-	Y	N	Y	1.8E-07	lb/MMBtu	2,3	7.9E-07	3.5E-06
i(2-ethylhexyl)phthalate	Y	Y	Y	4.7E-08	lb/MMBtu	2,3	2.1E-07	9.0E-07
thyl benzene	Y	N	Y	3.1E-05	lb/MMBtu	2,3	1.4E-04	6.0E-04
exachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	N	Y	Y	1.8E-11	lb/MMBtu	2,3	7.8E-11	3.4E-10
ydrochloric acid	Y	Y	N	1.9E-02	lb/MMBtu	2,6	3.3E-01	1.5E+00
ead	Y	N	N	4.8E-05	lb/MMBtu	2,4	6.1E-04	2.7E-03
anganese	Y	Y	N	1.6E-03	lb/MMBtu	2,4	2.0E-02	8.9E-02
ercury	Y	Y	N	3.5E-06	lb/MMBtu	2,4	4.4E-05	1.9E-04
ethyl bromide	Y	N	Y	1.5E-05	lb/MMBtu	2,3	6.6E-05	2.9E-04
ethyl chloride	Y	N	Y	2.3E-05	lb/MMBtu	2,3	1.0E-04	4.4E-04
ethyl ethyl ketone	N	Y	Y	5.4E-06	lb/MMBtu	2,3	2.4E-05	1.0E-04
ethylene chloride	Y	Y	Y	2.9E-04	lb/MMBtu	2,3	1.3E-03	5.6E-03
aphthalene	Y	N	Y	9.7E-05	lb/MMBtu	2,3	4.3E-04	1.9E-03
ickel	Y	Y	N	3.3E-05	lb/MMBtu	2,4	4.2E-04	1.8E-03
itrophenol, 4-	Y	N	Y	1.1E-07	lb/MMBtu	2,3	4.8E-07	2.1E-06
entachlorophenol	Y	Y	N	5.1E-08	lb/MMBtu	2	2.2E-07	9.8E-07
erchloroethylene	Y	Y	N	3.8E-05	lb/MMBtu	2	1.7E-04	7.3E-04
hosphorus metal, yellow or white	Y	N	N	2.7E-05	lb/MMBtu	2,4	3.4E-04	1.5E-03
olychlorinated biphenyls	Y	Y	Y	8.2E-09	lb/MMBtu	2,3	3.6E-08	1.6E-07
olycyclic Organic Matter	Y	N	N	1.3E-04	lb/MMBtu	2	5.5E-04	2.4E-03
olenium compounds	Y	N	N	2.8E-06	lb/MMBtu	2,4	3.6E-05	1.6E-04
yrene	Y	Y	Y	1.9E-03	lb/MMBtu	2,3	8.3E-03	3.6E-02
etrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	Y	Y	8.6E-12	lb/MMBtu	2,3	3.8E-11	1.7E-10
oluene	Y	Y	Y	3.0E-05	lb/MMBtu	2,3	1.3E-04	5.8E-04
richloroethane, 1,1,1-	Y	Y	N	3.1E-05	lb/MMBtu	2	1.4E-04	6.0E-04
richloroethylene	Y	Y	Y	3.0E-05	lb/MMBtu	2,3	1.3E-04	5.8E-04
richlorofluoromethane	N	Y	Y	4.1E-05	lb/MMBtu	2,3	1.8E-04	7.9E-04
richlorophenol, 2,4,6-	Y	N	Y	2.2E-08	lb/MMBtu	2,3	9.6E-08	4.2E-07
nyl chloride	Y	Y	Y	1.8E-05	lb/MMBtu	2,3	7.9E-05	3.5E-04
ylene	Y	Y	Y	2.5E-05	lb/MMBtu	2,3	1.1E-04	4.8E-04
					Total HAP Emissions (related to biomass)		**1.64**	**8.38**
					Total TAP Emissions (related to biomass)		**1.38**	**6.97**

Table 3c
Potential HAP and TAP Emissions
Dryer #1 (ES-DRYER-1, CD-WESP-1, CD-RTO-1)
Enviva Pellets Northampton, LLC

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							Max (lb/hr)	Annual (tpy)
RTO - Natural Gas/Propane Source								
2-Methylnaphthalene	Y	N	Y	2.4E-05	lb/MMscf	7	7.5E-07	3.3E-06
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	7	5.0E-07	2.2E-06
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	7	4.8E-07	2.1E-06
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	7	5.6E-07	2.5E-06
Ammonia	N	Y	N	3.2	lb/MMscf	7	1.0E-01	4.4E-01
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	7	7.5E-08	3.3E-07
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	7	6.3E-06	2.7E-05
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	8	2.3E-02	1.0E-01
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	7	3.8E-08	1.6E-07
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	7	3.8E-08	1.6E-07
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	7	3.8E-07	1.6E-06
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	7	3.5E-05	1.5E-04
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	7	4.4E-05	1.9E-04
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Cobalt	Y	N	N	8.4E-05	lb/MMscf	7	2.6E-06	1.2E-05
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	7	3.8E-08	1.6E-07
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	7	3.8E-05	1.6E-04
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	7	9.4E-08	4.1E-07
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	7	8.8E-08	3.8E-07
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	8	4.8E-02	2.1E-01
Hexane	Y	Y	Y	1.8	lb/MMscf	7	5.6E-02	2.5E-01
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Lead	Y	N	N	5.0E-04	lb/MMscf	7	1.6E-05	6.9E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	7	1.2E-05	5.2E-05
Mercury	Y	Y	N	2.6E-04	lb/MMscf	7	8.2E-06	3.6E-05
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	7	1.9E-05	8.4E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	7	6.6E-05	2.9E-04
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	8	1.3E-03	5.6E-03
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	7	5.3E-07	2.3E-06
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	7	1.6E-07	6.9E-07
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	7	7.5E-07	3.3E-06
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	7	1.1E-04	4.7E-04
Total HAP Emissions (related to natural gas/propane)							**0.13**	**0.56**
Total TAP Emissions (related to natural gas/propane)							**0.21**	**0.46**

Notes:

1 Emission factor derived based on stack testing data from comparable Enviva facilities and/or engineering judgement and include contingency. The emission factors represent uncontrolled emissions.

2 Emission factors (criteria and HAP/TAP) for wood combustion in a stoker boiler from NCDAQ Wood Waste Combustion Spreadsheet/AP-42, Fifth Edition, Volume 1, Chapter 1.6 - Wood Residue Combustion in Boilers, 09/03.

3 The control efficiency of 97.5% for the RTO is applied to all VOC hazardous and toxic pollutants.

4 The control efficiency of the wet electrostatic precipitator (WESP) for filterable particulate matter is applied to all metal hazardous and toxic pollutants from the dryer and duct burners. Actual design filterable efficiency is estimated to 96.4%, but 92.75% is assumed for toxics permitting.

WESP Control Efficiency for metal HAP 92.8%

5 Chromium VI is a subset of chromium compounds, which is accounted for separately as a HAP. As such, Chromium VI is only calculated as a TAP.

6 The WESP employs a caustic solution in its operation in which hydrochloric acid will have high water solubility. This caustic solution will neutralize the acid and effectively control it by 90%, per conversation on October 18, 2011 with Steven A. Jaasund, P.E. of Lundberg Associates, a manufacturer of WESPs.

WESP HCl Control Efficiency 90.00%

7 Emission factors for natural gas combustion are from NCDAQ Natural Gas Combustion Spreadsheet and AP-42, Fifth Edition, Volume 1, Chapter 1.4 - Natural Gas Combustion, 07/98. The emission factors for acetaldehyde, acrolein, and ammonia are cited in the NCDAQ spreadsheet as being sourced from the USEPA's WebFIRE database.

8 The RTO burners can fire either natural gas or propane; Propane is worst-case for these HAP emissions. Emission factors for propane combustion from the South Coast Air Quality Management District's Air Emissions Reporting Tool for external combustion equipment fired with LPG.

9 It was assumed that chlorine is not oxidized in the RTO.

10 Annual dried wood throughput is based on total facility production. Although dryer line 1 and dryer line 2 are capable of processing up to 537,625 ODT/yr and 620,000 ODT/yr, respectively, the combined throughput of both dryers will not exceed 781,255 ODT/yr. In order to to provide Enviva with the flexibility to use either dryer line up to its individual capacity, the total emissions from the two dryer lines are based on the total facility throughput and calculated as follows:

- Where individual dryer emissions are calculated based on throughput (i.e. lb/ODT), the total emissions are estimated based on the total throughput of 781,255 ODT/yr.
- Where individual dryer emissions are calculated based on fuel use (i.e. lb/MMBtu or lb/MMscf), the total emissions are conservatively set equal to the sum of the emissions from the two dryer lines assuming both dryer lines operate 8,760 hrs/yr.

Table 3c
Potential HAP and TAP Emissions
Dryer #1 (ES-DRYER-1, CD-WESP-1, CD-RTO-1)
Enviva Pellets Northampton, LLC

Abbreviations:

CAS - chemical abstract service
CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - Million British thermal units
NC - North Carolina
NO_x - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
RTO - regenerative thermal oxidizer
SO_2 - sulfur dioxide
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
yr - year

Table 3d
Potential Emissions
Dryer #1 Bypass (ES-DRYERBYP-1) (Full Capacity)[1]
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Throughput[1]	71.71 ODT/hr
Hourly Heat Input Capacity	175.3 MMBtu/hr
Annual Heat Input Capacity	8,765 MMBtu/yr
Hours of Operation[1]	50 hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions per Dryer Line

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	21.4	lb/hr[2]	21.4	0.54
NO_X	26.3	lb/hr[2]	26.3	0.66
SO_2	0.025	lb/MMBtu[3]	4.38	0.110
VOC	14.0	lb/hr[2]	14.0	0.35
$PM/PM_{10}/PM_{2.5}$ Condensable	0.017	lb/MMBtu[4]	2.98	0.075
$PM/PM_{10}/PM_{2.5}$ Filterable	0.33	lb/MMBtu[5]	57.8	1.45
Total $PM/PM_{10}/PM_{2.5}$			60.8	1.52

Notes:

1. During startup and shutdown (for temperature control) or malfunction, excess emissions can be vented out either the dryer bypass stacks or the furnace bypass stacks. Use of the bypass stacks is limited to 2 hours in any 24-hour period and 50 hours per 12-month rolling period for each dryer line. As the feed to the dryer is typically stopped during shutdown and malfunction events, the hourly throughput is equal to the annual average of the dryer feed rate.
2. CO, NO_X, and VOC emission rates based on data from a comparable Enviva facility.
3. No emission factor is provided in AP-42, Section 10.6.2 for SO_2 for rotary dryers. Enviva has conservatively calculated SO_2 emissions based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
4. Emission factor for condensable PM based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
5. Uncontrolled filterable PM emission factor is based on testing at a comparable Enviva facility.

Table 3d
Potential Emissions
Dryer #1 Bypass (ES-DRYERBYP-1) (Full Capacity)[1]
Enviva Pellets Northampton, LLC

Potential HAP Emissions per Dryer Line

Pollutant	Emission Factor	Units	Footnote	Potential Emissions[1]	
				Max (lb/hr)	Annual (tpy)
Acetaldehyde	0.168	lb/ODT	2	12.1	0.30
Acrolein	0.110	lb/ODT	2	7.89	0.197
Formaldehyde	0.144	lb/ODT	2	10.29	0.26
Methanol	0.105	lb/ODT	2	7.52	0.19
Phenol	0.058	lb/ODT	2	4.13	0.10
Propionaldehyde	0.039	lb/ODT	2	2.76	0.069
Acetophenone	3.2E-09	lb/MMBtu	3	5.61E-07	1.40E-08
Antimony and compounds	7.9E-06	lb/MMBtu	3	1.38E-03	3.46E-05
Arsenic	2.2E-05	lb/MMBtu	3	3.86E-03	9.64E-05
Benzo(a)pyrene	2.6E-06	lb/MMBtu	3	4.56E-04	1.14E-05
Beryllium	1.1E-06	lb/MMBtu	3	1.93E-04	4.82E-06
Cadmium	4.1E-06	lb/MMBtu	3	7.19E-04	1.80E-05
Carbon tetrachloride	4.5E-05	lb/MMBtu	3	7.89E-03	1.97E-04
Chlorine	7.9E-04	lb/MMBtu	3	1.38E-01	3.46E-03
Chlorobenzene	3.3E-05	lb/MMBtu	3	5.78E-03	1.45E-04
Chromium--Other compounds	1.8E-05	lb/MMBtu	3	3.07E-03	7.67E-05
Cobalt compounds	6.5E-06	lb/MMBtu	3	1.14E-03	2.85E-05
Dinitrophenol, 2,4-	1.8E-07	lb/MMBtu	3	3.16E-05	7.89E-07
Di(2-ethylhexyl)phthalate	4.7E-08	lb/MMBtu	3	8.24E-06	2.06E-07
Ethyl benzene	3.1E-05	lb/MMBtu	3	5.43E-03	1.36E-04
Dichloroethane, 1,2-	2.9E-05	lb/MMBtu	3	5.08E-03	1.27E-04
Hydrochloric acid	1.9E-02	lb/MMBtu	3	3.33E+00	8.33E-02
Lead	4.8E-05	lb/MMBtu	3	8.41E-03	2.10E-04
Manganese	1.6E-03	lb/MMBtu	3	2.80E-01	7.01E-03
Mercury	3.5E-06	lb/MMBtu	3	6.14E-04	1.53E-05
Methyl bromide	1.5E-05	lb/MMBtu	3	2.63E-03	6.57E-05
Methyl chloride	2.3E-05	lb/MMBtu	3	4.03E-03	1.01E-04
Trichloroethane, 1,1,1-	3.1E-05	lb/MMBtu	3	5.43E-03	1.36E-04
Naphthalene	9.7E-05	lb/MMBtu	3	1.70E-02	4.25E-04
Nickel	3.3E-05	lb/MMBtu	3	5.78E-03	1.45E-04
Nitrophenol, 4-	1.1E-07	lb/MMBtu	3	1.93E-05	4.82E-07
Pentachlorophenol	5.1E-08	lb/MMBtu	3	8.94E-06	2.24E-07
Perchloroethylene	3.8E-05	lb/MMBtu	3	6.66E-03	1.67E-04
Phosphorus metal, yellow or white	2.7E-05	lb/MMBtu	3	4.73E-03	1.18E-04
Polychlorinated biphenyls	8.2E-09	lb/MMBtu	3	1.43E-06	3.57E-08
Polycyclic Organic Matter	1.3E-04	lb/MMBtu	3	2.19E-02	5.48E-04
Dichloropropane, 1,2-	3.3E-05	lb/MMBtu	3	5.78E-03	1.45E-04
Selenium compounds	2.8E-06	lb/MMBtu	3	4.91E-04	1.23E-05
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.6E-12	lb/MMBtu	3	1.51E-09	3.77E-11
Trichloroethylene	3.0E-05	lb/MMBtu	3	5.26E-03	1.31E-04
Trichlorophenol, 2,4,6-	2.2E-08	lb/MMBtu	3	3.86E-06	9.64E-08
Vinyl chloride	1.8E-05	lb/MMBtu	3	3.16E-03	7.89E-05
		Total HAP Emissions		48.5	1.21

Notes:

[1] During dryer bypass emissions are not controlled by the WESP and RTO; however, combustion in the furnace still results in a reduction in organic HAP emission rates.

[2] Organic HAP emissions rates were derived based on stack testing data from other similar Enviva plants and/or engineering judgement.

[3] Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - Million British thermal units
NO_x - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
RTO - regenerative thermal oxidizer
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
yr - year

Reference:

AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

Table 3e
Potential Emissions
Dryer #1 Furnace Bypass (ES-FURNACEBYP-1) (Full Capacity)[1]
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Heat Input Capacity	175.3 MMBtu/hr
Annual Heat Input Capacity	8,765 MMBtu/yr
Hours of Operation[1]	50 hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions per Dryer Line

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	105.2	2.63
NO_X	0.22	lb/MMBtu[2]	38.57	0.96
SO_2	0.025	lb/MMBtu[2]	4.38	0.110
VOC	0.017	lb/MMBtu[2]	2.98	0.075
Total $PM/PM_{10}/PM_{2.5}$	0.58	lb/MMBtu[2]	101.1	2.53

Notes:

1. During startup and shutdown (for temperature control) or malfunction, excess emissions can be vented out either the dryer bypass stacks or the furnace bypass stacks. Use of the bypass stacks is limited to 2 hours in any 24-hour period and 50 hours per 12-month rolling period for each dryer line.
2. CO, NO_X, SO_2, PM, and VOC emission rates based on AP-42, Chapter 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. VOC emission factor excludes formaldehyde.

Table 3e
Potential Emissions
Dryer #1 Furnace Bypass (ES-FURNACEBYP-1) (Full Capacity)[1]
Enviva Pellets Northampton, LLC

Potential HAP Emissions per Dryer Line

Pollutant	Emission Factor	Units	Footnote	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
Acetaldehyde	8.30E-04	lb/MMBtu	1	1.45E-01	3.64E-03
Acrolein	4.00E-03	lb/MMBtu	1	7.01E-01	1.75E-02
Formaldehyde	4.40E-03	lb/MMBtu	1	7.71E-01	1.93E-02
Phenol	5.10E-05	lb/MMBtu	1	8.94E-03	2.24E-04
Propionaldehyde	6.10E-05	lb/MMBtu	1	1.07E-02	2.67E-04
Acetophenone	3.2E-09	lb/MMBtu	1	5.61E-07	1.40E-08
Antimony and compounds	7.9E-06	lb/MMBtu	1	1.38E-03	3.46E-05
Arsenic	2.2E-05	lb/MMBtu	1	3.86E-03	9.64E-05
Benzo(a)pyrene	2.6E-06	lb/MMBtu	1	4.56E-04	1.14E-05
Beryllium	1.1E-06	lb/MMBtu	1	1.93E-04	4.82E-06
Cadmium	4.1E-06	lb/MMBtu	1	7.19E-04	1.80E-05
Carbon tetrachloride	4.5E-05	lb/MMBtu	1	7.89E-03	1.97E-04
Chlorine	7.9E-04	lb/MMBtu	1	1.38E-01	3.46E-03
Chlorobenzene	3.3E-05	lb/MMBtu	1	5.78E-03	1.45E-04
Chromium-Other compounds	2.1E-05	lb/MMBtu	1	3.68E-03	9.20E-05
Cobalt compounds	6.5E-06	lb/MMBtu	1	1.14E-03	2.85E-05
Dinitrophenol, 2,4-	1.8E-07	lb/MMBtu	1	3.16E-05	7.89E-07
Di(2-ethylhexyl)phthalate	4.7E-08	lb/MMBtu	1	8.24E-06	2.06E-07
Ethyl benzene	3.1E-05	lb/MMBtu	1	5.43E-03	1.36E-04
Dichloroethane, 1,2-	2.9E-05	lb/MMBtu	1	5.08E-03	1.27E-04
Hydrochloric acid	1.9E-02	lb/MMBtu	1	3.33E+00	8.33E-02
Lead	4.8E-05	lb/MMBtu	1	8.41E-03	2.10E-04
Manganese	1.6E-03	lb/MMBtu	1	2.80E-01	7.01E-03
Mercury	3.5E-06	lb/MMBtu	1	6.14E-04	1.53E-05
Methyl bromide	1.5E-05	lb/MMBtu	1	2.63E-03	6.57E-05
Methyl chloride	2.3E-05	lb/MMBtu	1	4.03E-03	1.01E-04
Trichloroethane, 1,1,1-	3.1E-05	lb/MMBtu	1	5.43E-03	1.36E-04
Naphthalene	9.7E-05	lb/MMBtu	1	1.70E-02	4.25E-04
Nickel	3.3E-05	lb/MMBtu	1	5.78E-03	1.45E-04
Nitrophenol, 4-	1.1E-07	lb/MMBtu	1	1.93E-05	4.82E-07
Pentachlorophenol	5.1E-08	lb/MMBtu	1	8.94E-06	2.24E-07
Perchloroethylene	3.8E-05	lb/MMBtu	1	6.66E-03	1.67E-04
Phosphorus metal, yellow or white	2.7E-05	lb/MMBtu	1	4.73E-03	1.18E-04
Polychlorinated biphenyls	8.2E-09	lb/MMBtu	1	1.43E-06	3.57E-08
Polycyclic Organic Matter	1.3E-04	lb/MMBtu	1	2.19E-02	5.48E-04
Dichloropropane, 1,2-	3.3E-05	lb/MMBtu	1	5.78E-03	1.45E-04
Selenium compounds	2.8E-06	lb/MMBtu	1	4.91E-04	1.23E-05
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.6E-12	lb/MMBtu	1	1.51E-09	3.77E-11
Trichloroethylene	3.0E-05	lb/MMBtu	1	5.26E-03	1.31E-04
Trichlorophenol, 2,4,6-	2.2E-08	lb/MMBtu	1	3.86E-06	9.64E-08
Vinyl chloride	1.8E-05	lb/MMBtu	1	3.16E-03	7.89E-05
Total HAP Emissions (Biomass Combustion)				5.51	0.14

Notes:

1. Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
NO_x - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
yr - year

Reference:

AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

Table 3f
Potential Emissions
Dryer #1 Furnace Bypass (ES-FURNACEBYP-1) (Idle Mode)[1]
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Heat Input Capacity	5 MMBtu/hr
Annual Heat Input Capacity	2,500 MMBtu/yr
Hours of Operation[1]	500 hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions per Dryer Line

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	3.00	0.75
NO_X	0.22	lb/MMBtu[2]	1.10	0.28
SO_2	0.025	lb/MMBtu[2]	0.13	0.031
VOC	0.017	lb/MMBtu[2]	0.085	0.021
Total PM	0.58	lb/MMBtu[2]	2.89	0.72
Total PM_{10}	0.52	lb/MMBtu[2]	2.59	0.65
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	2.24	0.56

Notes:

1. As part of this submittal Enviva is requesting a limit of 500 hours per year of "idle mode" for each furnace.
2. CO, NO_X, SO_2, PM, PM_{10}, $PM_{2.5}$, and VOC emission rates based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. PM_{10} and $PM_{2.5}$ factors equal to the sum of the filterable and condensible factors from Table 1.6-1. VOC emission factor excludes formaldehyde.

Table 3f
Potential Emissions
Dryer #1 Furnace Bypass (ES-FURNACEBYP-1) (Idle Mode)[1]
Enviva Pellets Northampton, LLC

Potential HAP Emissions per Dryer Line

Pollutant	Emission Factor	Units	Footnote	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
Acetaldehyde	8.30E-04	lb/MMBtu	1	4.15E-03	1.04E-03
Acrolein	4.00E-03	lb/MMBtu	1	2.00E-02	5.00E-03
Formaldehyde	4.40E-03	lb/MMBtu	1	2.20E-02	5.50E-03
Phenol	5.10E-05	lb/MMBtu	1	2.55E-04	6.38E-05
Propionaldehyde	6.10E-05	lb/MMBtu	1	3.05E-04	7.63E-05
Acetophenone	3.2E-09	lb/MMBtu	1	1.60E-08	4.00E-09
Antimony and compounds	7.9E-06	lb/MMBtu	1	3.95E-05	9.88E-06
Arsenic	2.2E-05	lb/MMBtu	1	1.10E-04	2.75E-05
Benzo(a)pyrene	2.6E-06	lb/MMBtu	1	1.30E-05	3.25E-06
Beryllium	1.1E-06	lb/MMBtu	1	5.50E-06	1.38E-06
Cadmium	4.1E-06	lb/MMBtu	1	2.05E-05	5.13E-06
Carbon tetrachloride	4.5E-05	lb/MMBtu	1	2.25E-04	5.63E-05
Chlorine	7.9E-04	lb/MMBtu	1	3.95E-03	9.88E-04
Chlorobenzene	3.3E-05	lb/MMBtu	1	1.65E-04	4.13E-05
Chromium-Other compounds	2.1E-05	lb/MMBtu	1	1.05E-04	2.63E-05
Cobalt compounds	6.5E-06	lb/MMBtu	1	3.25E-05	8.13E-06
Dinitrophenol, 2,4-	1.8E-07	lb/MMBtu	1	9.00E-07	2.25E-07
Bis(2-ethylhexyl)phthalate	4.7E-08	lb/MMBtu	1	2.35E-07	5.88E-08
Ethyl benzene	3.1E-05	lb/MMBtu	1	1.55E-04	3.88E-05
Dichloroethane, 1,2-	2.9E-05	lb/MMBtu	1	1.45E-04	3.63E-05
Hydrochloric acid	1.9E-02	lb/MMBtu	1	9.50E-02	2.38E-02
Lead	4.8E-05	lb/MMBtu	1	2.40E-04	6.00E-05
Manganese	1.6E-03	lb/MMBtu	1	8.00E-03	2.00E-03
Mercury	3.5E-06	lb/MMBtu	1	1.75E-05	4.38E-06
Methyl bromide	1.5E-05	lb/MMBtu	1	7.50E-05	1.88E-05
Methyl chloride	2.3E-05	lb/MMBtu	1	1.15E-04	2.88E-05
Trichloroethane, 1,1,1-	3.1E-05	lb/MMBtu	1	1.55E-04	3.88E-05
Naphthalene	9.7E-05	lb/MMBtu	1	4.85E-04	1.21E-04
Nickel	3.3E-05	lb/MMBtu	1	1.65E-04	4.13E-05
Nitrophenol, 4-	1.1E-07	lb/MMBtu	1	5.50E-07	1.38E-07
Pentachlorophenol	5.1E-08	lb/MMBtu	1	2.55E-07	6.38E-08
Perchloroethylene	3.8E-05	lb/MMBtu	1	1.90E-04	4.75E-05
Phosphorus metal, yellow or white	2.7E-05	lb/MMBtu	1	1.35E-04	3.38E-05
Polychlorinated biphenyls	8.2E-09	lb/MMBtu	1	4.08E-08	1.02E-08
Polycyclic Organic Matter	1.3E-04	lb/MMBtu	1	6.25E-04	1.56E-04
Dichloropropane, 1,2-	3.3E-05	lb/MMBtu	1	1.65E-04	4.13E-05
Selenium compounds	2.8E-06	lb/MMBtu	1	1.40E-05	3.50E-06
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.6E-12	lb/MMBtu	1	4.30E-11	1.08E-11
Trichloroethene	3.0E-05	lb/MMBtu	1	1.50E-04	3.75E-05
Trichlorophenol, 2,4,6-	2.2E-08	lb/MMBtu	1	1.10E-07	2.75E-08
Vinyl chloride	1.8E-05	lb/MMBtu	1	9.00E-05	2.25E-05
Total HAP Emissions (Biomass Combustion)				0.16	0.039

Notes:

[1] Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - Million British thermal units
NO_x - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
yr - year

Reference:

AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

Table 3g
Potential Emissions
Dryer #1 Double Duct Burners (IES-DDB-1 and -2)
Enviva Pellets Northampton, LLC

Duct Burner Inputs

Duct Burner Rating	1 MMBtu/hr
Number of Duct Burners	2
Annual Operation	8,760 hr/yr

Potential Criteria Pollutant Emissions:

Potential Criteria Pollutant Emissions - Natural Gas Combustion

Pollutant	Emission Factor	Units	Emission Factor Source	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
CO	84.0	lb/MMscf	Note 1	0.16	0.72
NO_X	50.0	lb/MMscf	Note 2	0.10	0.43
SO_2	0.60	lb/MMscf	Note 1	0.0012	0.005
VOC	5.50	lb/MMscf	Note 1	0.01	0.05
$PM/PM_{10}/PM_{2.5}$ Condensable	5.70	lb/MMscf	Note 1	0.01	0.05
$PM/PM_{10}/PM_{2.5}$ Filterable	1.90	lb/MMscf	Note 1	0.004	0.02
Total $PM/PM_{10}/PM_{2.5}$				0.015	0.065

Potential Criteria Pollutant Emissions - Propane Combustion

Pollutant	Emission Factor[3]	Units	Emission Factor Source	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
CO	7.50	lb/Mgal	Note 3	0.16	0.72
NO_X	6.50	lb/Mgal	Note 4	0.14	0.62
SO_2	0.054	lb/Mgal	Note 3,5	0.001	0.005
VOC	1.00	lb/Mgal	Note 3	0.02	0.10
$PM/PM_{10}/PM_{2.5}$ Condensable	0.50	lb/Mgal	Note 3	0.01	0.05
$PM/PM_{10}/PM_{2.5}$ Filterable	0.20	lb/Mgal	Note 3	0.004	0.02
Total $PM/PM_{10}/PM_{2.5}$				0.015	0.067

Notes:

1. Emission factors for natural gas combustion from AP-42 Section 1.4 - Natural Gas Combustion, 07/98. Natural gas heating value of 1,020 Btu/scf assumed per AP-42.
2. Emission factors for NO_X assume burners are low NO_X burners, per email from Kai Simonsen (Enviva) on August 8, 2018.
3. Emission factors for propane combustion obtained from AP-42 Section 1.5 - Liquefied Petroleum Gas Combustion, 07/08. Propane heating value of 91.5 MMBtu/Mgal assumed per AP-42.
4. AP-42 Section 1.5 does not include an emission factor for low NO_X burners. Per AP-42 Section 1.4, low NO_X burners reduce NO_X emissions by accomplishing combustion in stages, reducing NO_X emissions 40 to 85% relative to uncontrolled emission levels. A conservative control efficiency of 50% was applied to the uncontrolled NO_X emission factor from AP-42 Section 1.5. This reduction is consistent with the magnitude of reduction between the uncontrolled and low NO_X emission factors in AP-42 Section 1.4.
5. SO_2 emissions are based on an assumed fuel sulfur content of 0.54 grains/100 ft^3 per *A National Methodology and Emission Inventory for Residential Fuel Combustion*.

Table 3g
Potential Emissions
Dryer #1 Double Duct Burners (IES-DDB-1 and -2)
Enviva Pellets Northampton, LLC

Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							Max (lb/hr)	Annual (tpy)
Duct Burners - Natural Gas/Propane Source								
2-Methylnaphthalene	Y	N	Y	2.4E-05	lb/MMscf	1	4.7E-08	2.1E-07
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	1	3.1E-08	1.4E-07
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	1	3.0E-08	1.3E-07
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	1	3.5E-08	1.5E-07
Ammonia	N	Y	N	3.2	lb/MMscf	1	6.3E-03	2.7E-02
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	1	4.7E-09	2.1E-08
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	1	3.9E-07	1.7E-06
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	2	1.4E-03	6.2E-03
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	1	2.4E-09	1.0E-08
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	1	2.4E-09	1.0E-08
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	1	2.4E-08	1.0E-07
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	1	2.2E-06	9.4E-06
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	1	2.7E-06	1.2E-05
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Cobalt	Y	N	N	8.4E-05	lb/MMscf	1	1.6E-07	7.2E-07
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	1	2.4E-09	1.0E-08
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	1	2.4E-06	1.0E-05
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	1	5.9E-09	2.6E-08
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	1	5.5E-09	2.4E-08
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	2	3.0E-03	1.3E-02
Hexane	Y	Y	Y	1.8	lb/MMscf	1	3.5E-03	1.5E-02
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Lead	Y	N	N	5.0E-04	lb/MMscf	1	9.8E-07	4.3E-06
Manganese	Y	Y	N	3.8E-04	lb/MMscf	1	7.5E-07	3.3E-06
Mercury	Y	Y	N	2.6E-04	lb/MMscf	1	5.1E-07	2.2E-06
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	1	1.2E-06	5.2E-06
Nickel	Y	Y	N	2.1E-03	lb/MMscf	1	4.1E-06	1.8E-05
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	8	8.0E-05	3.5E-04
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	1	3.3E-08	1.5E-07
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	1	9.8E-09	4.3E-08
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	1	4.7E-08	2.1E-07
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	1	6.7E-06	2.9E-05
Total HAP Emissions (related to natural gas/propane)							0.008	0.035
Total TAP Emissions (related to natural gas/propane)							0.01	0.056

Table 3g
Potential Emissions
Dryer #1 Double Duct Burners (IES-DDB-1 and -2)
Enviva Pellets Northampton, LLC

Notes:

1. Emission factors for natural gas combustion are from NCDAQ Natural Gas Combustion Spreadsheet and AP-42, Fifth Edition, Volume 1, Chapter 1.4 - Natural Gas Combustion, 07/98. The emission factors for acetaldehyde, acrolein, and ammonia are cited in the NCDAQ spreadsheet as being sourced from the USEPA's WebFIRE database.

2. The duct burners can fire either natural gas or propane; Propane is worst-case for these HAP emissions. Emission factors for propane combustion from the South Coast Air Quality Management District's Air Emissions Reporting Tool for external combustion equipment fired with LPG.

Abbreviations:

CAS - chemical abstract service
CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - Million British thermal units
NC - North Carolina
NO_X - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
RTO - regenerative thermal oxidizer
SO_2 - sulfur dioxide
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
yr - year

Table 3h
Potential Emissions
Dryer #1 Furnace Bypass (ES-FURNACEBYP-1) (Cold Startup)
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Heat Input Capacity[1]	26.3 MMBtu/hr
Annual Heat Input Capacity	1,315 MMBtu/yr
Hours of Operation[2]	50 hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions per Dryer Line

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[3]	15.78	0.39
NO_X	0.22	lb/MMBtu[3]	5.78	0.14
SO_2	0.025	lb/MMBtu[3]	0.66	0.016
VOC	0.017	lb/MMBtu[3]	0.447	0.011
Total PM	0.58	lb/MMBtu[3]	15.17	0.38
Total PM_{10}	0.52	lb/MMBtu[3]	13.59	0.34
Total $PM_{2.5}$	0.45	lb/MMBtu[3]	11.75	0.29

Notes:

1. The hourly heat input for cold startup is estimated as follows (Hours 1-2, 6.75 MMBtu/hr; Hours 3-4, 13.5 MmBtu/hr; Hours 5-6, 20.25 MMBtu/hr; and Hours 7-8, 27 MMBtu/hr). Emissions are conservatively based on the heat input rate of 27 MMBtu/hr.
2. Estimated annual hours for cold startup.
3. CO, NO_X, SO_2, PM_{10}, $PM_{2.5}$, and VOC emission rates based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. PM_{10} and $PM_{2.5}$ factors equal to the sum of the filterable and condensible factors from Table 1.6-1. VOC emission factor excludes formaldehyde.

Table 3h
Potential Emissions
Dryer #1 Furnace Bypass (ES-FURNACEBYP-1) (Cold Startup)
Enviva Pellets Northampton, LLC

Potential HAP Emissions per Dryer Line

Pollutant	Emission Factor	Units	Footnote	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
Acetaldehyde	8.30E-04	lb/MMBtu	1	2.18E-02	5.46E-04
Acrolein	4.00E-03	lb/MMBtu	1	1.05E-01	2.63E-03
Formaldehyde	4.40E-03	lb/MMBtu	1	1.16E-01	2.89E-03
Phenol	5.10E-05	lb/MMBtu	1	1.34E-03	3.35E-05
Propionaldehyde	6.10E-05	lb/MMBtu	1	1.60E-03	4.01E-05
Acetophenone	3.2E-09	lb/MMBtu	1	8.41E-08	2.10E-09
Antimony and compounds	7.9E-06	lb/MMBtu	1	2.08E-04	5.19E-06
Arsenic	2.2E-05	lb/MMBtu	1	5.78E-04	1.45E-05
Benzo(a)pyrene	2.6E-06	lb/MMBtu	1	6.84E-05	1.71E-06
Beryllium	1.1E-06	lb/MMBtu	1	2.89E-05	7.23E-07
Cadmium	4.1E-06	lb/MMBtu	1	1.08E-04	2.70E-06
Carbon tetrachloride	4.5E-05	lb/MMBtu	1	1.18E-03	2.96E-05
Chlorine	7.9E-04	lb/MMBtu	1	2.08E-02	5.19E-04
Chlorobenzene	3.3E-05	lb/MMBtu	1	8.68E-04	2.17E-05
Chromium-Other compounds	2.1E-05	lb/MMBtu	1	5.52E-04	1.38E-05
Cobalt compounds	6.5E-06	lb/MMBtu	1	1.71E-04	4.27E-06
Dinitrophenol, 2,4-	1.8E-07	lb/MMBtu	1	4.73E-06	1.18E-07
Di(2-ethylhexyl)phthalate	4.7E-08	lb/MMBtu	1	1.24E-06	3.09E-08
Ethyl benzene	3.1E-05	lb/MMBtu	1	8.15E-04	2.04E-05
Dichloroethane, 1,2-	2.9E-05	lb/MMBtu	1	7.63E-04	1.91E-05
Hydrochloric acid	1.9E-02	lb/MMBtu	1	5.00E-01	1.25E-02
Lead	4.8E-05	lb/MMBtu	1	1.26E-03	3.16E-05
Manganese	1.6E-03	lb/MMBtu	1	4.21E-02	1.05E-03
Mercury	3.5E-06	lb/MMBtu	1	9.20E-05	2.30E-06
Methyl bromide	1.5E-05	lb/MMBtu	1	3.94E-04	9.86E-06
Methyl chloride	2.3E-05	lb/MMBtu	1	6.05E-04	1.51E-05
Trichloroethane, 1,1,1-	3.1E-05	lb/MMBtu	1	8.15E-04	2.04E-05
Naphthalene	9.7E-05	lb/MMBtu	1	2.55E-03	6.38E-05
Nickel	3.3E-05	lb/MMBtu	1	8.68E-04	2.17E-05
Nitrophenol, 4-	1.1E-07	lb/MMBtu	1	2.89E-06	7.23E-08
Pentachlorophenol	5.1E-08	lb/MMBtu	1	1.34E-06	3.35E-08
Perchloroethylene	3.8E-05	lb/MMBtu	1	9.99E-04	2.50E-05
Phosphorus metal, yellow or white	2.7E-05	lb/MMBtu	1	7.10E-04	1.77E-05
Polychlorinated biphenyls	8.2E-09	lb/MMBtu	1	2.14E-07	5.36E-09
Polycyclic Organic Matter	1.3E-04	lb/MMBtu	1	3.29E-03	8.22E-05
Dichloropropane, 1,2-	3.3E-05	lb/MMBtu	1	8.68E-04	2.17E-05
Selenium compounds	2.8E-06	lb/MMBtu	1	7.36E-05	1.84E-06
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.6E-12	lb/MMBtu	1	2.26E-10	5.65E-12
Trichloroethylene	3.0E-05	lb/MMBtu	1	7.89E-04	1.97E-05
Trichlorophenol, 2,4,6-	2.2E-08	lb/MMBtu	1	5.78E-07	1.45E-08
Vinyl chloride	1.8E-05	lb/MMBtu	1	4.73E-04	1.18E-05
Total HAP Emissions (Biomass Combustion)				0.83	0.021

Notes:

1. Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - Million British thermal units
NO_x - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
yr - year

Reference:

AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

Table 4a
Potential Criteria Emissons
Dryer #2 (ES-DRYER-2, CD-WESP-2, CD-RTO-2)
Enviva Pellets Northampton, LLC

Calculation Basis

Annual Dried Wood Throughput[1]	781,255 ODT/year
Max. Hourly Dried Wood Throughput of Dryer	82.10 ODT/hr
Burner Heat Input	180.0 MMBtu/hr
Percent Hardwood	20.0%
Percent Softwood	80.0%
Annual Operation	8,760 hr/yr
Annual Heat Input	1,576,800 MMBtu/yr
Number of RTO Burners	4
RTO Burner Rating	8 MMBtu/hr
RTO Control Efficiency	97.50%

Potential Criteria Emissions

Pollutant	Biomass Emission Factor	Units	Emission Factor Source	Uncontrolled Emissions		Controlled Emissions	
				Max (lb/hr)	Annual (tpy)	Max (lb/hr)	Annual (tpy)
CO	0.4	lb/ODT	Note 2	--	--	32.84	156.3
NO_X	22.23	lb/hr	Note 2	--	--	22.23	97.4
$PM/PM_{10}/PM_{2.5}$ (Filterable + Condensable)	7.6	lb/hr	Note 4	--	--	7.60	33.3
SO_2	0.025	lb/MMBtu	AP-42, Section 1.6[3]	--	--	4.50	19.7
Total VOC (as propane)	2.640	lb/ODT	Note 5	216.74	1031.3	5.42	25.8

Notes:

[1] Annual dried wood throughput is based on total facility production. Although dryer line 1 and dryer line 2 are capable of processing up to 537,625 ODT/yr and 620,000 ODT/yr, respectively, the combined throughput of both dryers will not exceed 781,255 ODT/yr. In order to to provide Enviva with the flexibility to use either dryer line up to its individual capacity, the total emissions from the two dryer lines are based on the total facility throughput and calculated as follows:

- Where individual dryer emissions are calculated based on throughput (i.e. lb/ODT), the total emissions are estimated based on the total throughput of 781,255 ODT/yr.
- Where individual dryer emissions are calculated based on fuel use (i.e. lb/MMBtu or lb/MMscf) or hourly test/vendor data (i.e., lb/hr), the total emissions are conservatively set equal to the sum of the emissions from the two dryer lines assuming both dryer lines operate 8,760 hrs/yr.
- Dryer line 1 described as 175.3 MMBtu/hr = 155.3 MMBtu/hr from the grate and 2 additional 10 MMBtu/hr dust burners permitted but not added.

[2] CO emissions based on data from similar Enviva facilities and information from NCASI database.
NOx emissions based on stack test results from similar Enviva facility plus 30% contingency.

[3] No emission factor is provided in AP-42, Section 10.6.2 for SO_2 for rotary dryers. Enviva has conservatively calculated SO_2 emissions based upon the heat input of the dryer burners using an emission factor for wood combustion from AP-42, Section 1.6.

[4] Particulate emission factor is based on data from similar Enviva facilities.

[5] VOC emission factor based on source test data for similar pellet manufacturing facilities and represents uncontrolled emissions.

Table 4b
Potential HAP and TAP Emissions
Dryer #2 (ES-DRYER-2, CD-WESP-2, CD-RTO-2)
Enviva Pellets Northampton, LLC

Calculation Basis

Annual Dried Wood Throughput[1]	781,255	ODT/year
Max. Hourly Dried Wood Throughput of Dryer	82.10	ODT/hr
Burner Heat Input	180.0	MMBtu/hr
Percent Hardwood	20.0%	
Percent Softwood	80.0%	
Annual Operation	8,760	hr/yr
Annual Heat Input	1,576,800	MMBtu/yr
Number of RTO Burners	4	
RTO Burner Rating	8	MMBtu/hr
RTO Control Efficiency	97.50%	

Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions Max (lb/hr)	Potential Emissions Annual (tpy)
Biomass Source								
Acetaldehyde	Y	Y	Y	1.7E-01	lb/ODT	1	0.35	1.64
Acrolein	Y	Y	Y	1.1E-01	lb/ODT	1	0.23	1.07
Formaldehyde	Y	Y	Y	1.4E-01	lb/ODT	1	0.29	1.40
Methanol	Y	N	Y	1.0E-01	lb/ODT	1	0.22	1.02
Phenol	Y	Y	Y	5.8E-02	lb/ODT	1	0.12	0.56
Propionaldehyde	Y	N	Y	3.9E-02	lb/ODT	1	0.08	0.38
Acetophenone	Y	N	Y	3.2E-09	lb/MMBtu	2,3	1.4E-08	6.3E-08
Antimony and compounds	Y	N	N	7.9E-06	lb/MMBtu	2,4	1.0E-04	4.5E-04
Arsenic	Y	Y	N	2.2E-05	lb/MMBtu	2,4	2.9E-04	1.3E-03
Benzene	Y	Y	Y	4.2E-03	lb/MMBtu	2,3	1.9E-02	8.3E-02
Benzo(a)pyrene	Y	Y	Y	2.6E-06	lb/MMBtu	2,3	1.2E-05	5.1E-05
Beryllium	Y	Y	N	1.1E-06	lb/MMBtu	2,4	1.4E-05	6.3E-05
Cadmium	Y	Y	N	4.1E-06	lb/MMBtu	2,4	5.4E-05	2.3E-04
Carbon tetrachloride	Y	Y	Y	4.5E-05	lb/MMBtu	2,3	2.0E-04	8.9E-04
Chlorine	Y	Y	N	7.9E-04	lb/MMBtu	2,9	1.4E-01	6.2E-01
Chlorobenzene	Y	Y	Y	3.3E-05	lb/MMBtu	2,3	1.5E-04	6.5E-04
Chloroform	Y	Y	Y	2.8E-05	lb/MMBtu	2,3	1.3E-04	5.5E-04
Chromium VI	-[5]	Y	N	3.5E-06	lb/MMBtu	2,4,5	4.6E-05	2.0E-04
Chromium-Other compounds	Y	N	N	1.8E-05	lb/MMBtu	2,4	2.3E-04	1.0E-03
Cobalt compounds	Y	N	N	6.5E-06	lb/MMBtu	2,4	8.5E-05	3.7E-04
Dichloroethane, 1,2-	Y	Y	Y	2.9E-05	lb/MMBtu	2,3	1.3E-04	5.7E-04
Dichloropropane, 1,2-	Y	N	Y	3.3E-05	lb/MMBtu	2,3	1.5E-04	6.5E-04
Dinitrophenol, 2,4-	Y	N	Y	1.8E-07	lb/MMBtu	2,3	8.1E-07	3.5E-06
Di(2-ethylhexyl)phthalate	Y	Y	Y	4.7E-08	lb/MMBtu	2,3	2.1E-07	9.3E-07
Ethyl benzene	Y	N	Y	3.1E-05	lb/MMBtu	2,3	1.4E-04	6.1E-04
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	N	Y	Y	1.8E-11	lb/MMBtu	2,3	8.1E-11	3.5E-10
Hydrochloric acid	Y	Y	N	1.9E-02	lb/MMBtu	2,6	3.4E-01	1.5E+00
Lead	Y	N	N	4.8E-05	lb/MMBtu	2,4	6.3E-04	2.7E-03
Manganese	Y	Y	N	1.6E-03	lb/MMBtu	2,4	2.1E-02	9.1E-02
Mercury	Y	Y	N	3.5E-06	lb/MMBtu	2,4	4.6E-05	2.0E-04
Methyl bromide	Y	N	Y	1.5E-05	lb/MMBtu	2,3	6.8E-05	3.0E-04
Methyl chloride	Y	N	Y	2.3E-05	lb/MMBtu	2,3	1.0E-04	4.5E-04
Methyl ethyl ketone	N	Y	Y	5.4E-06	lb/MMBtu	2,3	2.4E-05	1.1E-04
Methylene chloride	Y	Y	Y	2.9E-04	lb/MMBtu	2,3	1.3E-03	5.7E-03
Naphthalene	Y	N	Y	9.7E-05	lb/MMBtu	2,3	4.4E-04	1.9E-03
Nickel	Y	Y	N	3.3E-05	lb/MMBtu	2,4	4.3E-04	1.9E-03
Nitrophenol, 4-	Y	N	Y	1.1E-07	lb/MMBtu	2,3	5.0E-07	2.2E-06
Pentachlorophenol	Y	Y	N	5.1E-08	lb/MMBtu	2	2.3E-07	1.0E-06
Perchloroethylene	Y	Y	N	3.8E-05	lb/MMBtu	2	1.7E-04	7.5E-04
Phosphorus metal, yellow or white	Y	N	N	2.7E-05	lb/MMBtu	2,4	3.5E-04	1.5E-03
Polychlorinated biphenyls	Y	Y	Y	8.2E-09	lb/MMBtu	2,3	3.7E-08	1.6E-07
Polycyclic Organic Matter	Y	N	N	1.3E-04	lb/MMBtu	2	5.6E-04	2.5E-03
Selenium compounds	Y	N	N	2.8E-06	lb/MMBtu	2,4	3.7E-05	1.6E-04
Styrene	Y	Y	Y	1.9E-03	lb/MMBtu	2,3	8.6E-03	3.7E-02
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	Y	Y	8.6E-12	lb/MMBtu	2,3	3.9E-11	1.7E-10
Toluene	Y	Y	Y	3.0E-05	lb/MMBtu	2,3	1.4E-04	5.9E-04
Trichloroethane, 1,1,1-	Y	Y	N	3.1E-05	lb/MMBtu	2	1.4E-04	6.1E-04
Trichloroethylene	Y	Y	Y	3.0E-05	lb/MMBtu	2,3	1.4E-04	5.9E-04
Trichlorofluoromethane	N	Y	Y	4.1E-05	lb/MMBtu	2,3	1.8E-04	8.1E-04
Trichlorophenol, 2,4,6-	Y	N	Y	2.2E-08	lb/MMBtu	2,3	9.9E-08	4.3E-07
Vinyl chloride	Y	Y	Y	1.8E-05	lb/MMBtu	2,3	8.1E-05	3.5E-04
Xylene	Y	Y	Y	2.5E-05	lb/MMBtu	2,3	1.1E-04	4.9E-04
						Total HAP Emissions (related to biomass)	1.82	8.44
						Total TAP Emissions (related to biomass)	1.52	7.03

Table 4b
Potential HAP and TAP Emissions
Dryer #2 (ES-DRYER-2, CD-WESP-2, CD-RTO-2)
Enviva Pellets Northampton, LLC

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							Max (lb/hr)	Annual (tpy)
RTO - Natural Gas/Propane Source								
2-Methylnaphthalene	Y	N	Y	2.4E-05	lb/MMscf	7	7.5E-07	3.3E-06
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	7	5.0E-07	2.2E-06
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	7	4.8E-07	2.1E-06
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	7	5.6E-07	2.5E-06
Ammonia	N	Y	N	3.2	lb/MMscf	7	1.0E-01	4.4E-01
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	7	7.5E-08	3.3E-07
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	7	6.3E-06	2.7E-05
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	8	2.3E-02	1.0E-01
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	7	3.8E-08	1.6E-07
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	7	3.8E-08	1.6E-07
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	7	3.8E-07	1.6E-06
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	7	3.5E-05	1.5E-04
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	7	4.4E-05	1.9E-04
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Cobalt	Y	N	N	8.4E-05	lb/MMscf	7	2.6E-06	1.2E-05
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	7	3.8E-08	1.6E-07
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	7	3.8E-05	1.6E-04
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	7	9.4E-08	4.1E-07
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	7	8.8E-08	3.8E-07
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	8	4.8E-02	2.1E-01
Hexane	Y	Y	Y	1.8	lb/MMscf	7	5.6E-02	2.5E-01
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Lead	Y	N	N	5.0E-04	lb/MMscf	7	1.6E-05	6.9E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	7	1.2E-05	5.2E-05
Mercury	Y	Y	N	2.6E-04	lb/MMscf	7	8.2E-06	3.6E-05
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	7	1.9E-05	8.4E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	7	6.6E-05	2.9E-04
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	8	1.3E-03	5.6E-03
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	7	5.3E-07	2.3E-06
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	7	1.6E-07	6.9E-07
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	7	7.5E-07	3.3E-06
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	7	1.1E-04	4.7E-04
Total HAP Emissions (related to natural gas/propane)							**0.13**	**0.56**
Total TAP Emissions (related to natural gas/propane)							**0.21**	**0.46**

Notes:

1. Emission factor derived based on stack testing data from comparable Enviva facilities and/or engineering judgement and include contingency. The emission factors represent uncontrolled emissions.
2. Emission factors (criteria and HAP/TAP) for wood combustion in a stoker boiler from NCDAQ Wood Waste Combustion Spreadsheet/AP-42, Fifth Edition, Volume 1, Chapter 1.6 - Wood Residue Combustion in Boilers, 09/03.
3. The control efficiency of 97.5% for the RTO is applied to all VOC hazardous and toxic pollutants
4. The control efficiency of the wet electrostatic precipitator (WESP) for filterable particulate matter is applied to all metal hazardous and toxic pollutants from the dryer and duct burners. Actual design filterable efficiency is estimated to 96.4%, but 92.75% is assumed for toxics permitting.
   WESP Control Efficiency for metal HAP 92.8%
5. Chromium VI is a subset of chromium compounds, which is accounted for separately as a HAP. As such, Chromium VI is only calculated as a TAP.
6. The WESP employs a caustic solution in its operation in which hydrochloric acid will have high water solubility. This caustic solution will neutralize the acid and effectively control it by 90%, per conversation on October 18, 2011 with Steven A. Jaasund, P.E. of Lundberg Associates, a manufacturer of WESPs.
   WESP HCl Control Efficiency 90.00%
7. Emission factors for natural gas combustion are from NCDAQ Natural Gas Combustion Spreadsheet and AP-42, Fifth Edition, Volume 1, Chapter 1.4 - Natural Gas Combustion, 07/98. The emission factors for acetaldehyde, acrolein, and ammonia are cited in the NCDAQ spreadsheet as being sourced from the USEPA's WebFIRE database.
8. The RTO burners can fire either natural gas or propane; Propane is worst-case for these HAP emissions. Emission factors for propane combustion from the South Coast Air Quality Management District's Air Emissions Reporting Tool for external combustion equipment fired with LPG.
9. It was assumed that chlorine is not oxidized in the RTO.
10. Annual dried wood throughput is based on total facility production. Although dryer line 1 and dryer line 2 are capable of processing up to 537,625 ODT/yr and 620,000 ODT/yr, respectively, the combined throughput of both dryers will not exceed 781,255 ODT/yr. In order to to provide Enviva with the flexibility to use either dryer line up to its individual capacity, the total emissions from the two dryer lines are based on the total facility throughput and calculated as follows:
    - Where individual dryer emissions are calculated based on throughput (i.e. lb/ODT), the total emissions are estimated based on the total throughput of 781,255 ODT/yr.
    - Where individual dryer emissions are calculated based on fuel use (i.e. lb/MMBtu or lb/MMscf), the total emissions are conservatively set equal to the sum of the emissions from the two dryer lines assuming both dryer lines operate 8,760 hrs/yr.

Table 4b
Potential HAP and TAP Emissions
Dryer #2 (ES-DRYER-2, CD-WESP-2, CD-RTO-2)
Enviva Pellets Northampton, LLC

Abbreviations:

CAS - chemical abstract service

CH_4 - methane

CO - carbon monoxide

CO2 - carbon dioxide

CO_2e - carbon dioxide equivalent

HAP - hazardous air pollutant

hr - hour

kg - kilogram

lb - pound

MMBtu - Million British thermal units

NC - North Carolina

NO_X - nitrogen oxides

N_2O - nitrous oxide

ODT - oven dried tons

PM - particulate matter

PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns

$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less

RTO - regenerative thermal oxidizer

SO_2 - sulfur dioxide

TAP - toxic air pollutant

tpy - tons per year

VOC - volatile organic compound

WESP - wet electrostatic precipitator

yr - year

Table 4c
Potential Emissions
Dryer #2 Bypass (ES-DRYERBYP-2) (Full Capacity)[1]
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Throughput	82.10 ODT/hr
Hourly Heat Input Capacity	180 MMBtu/hr
Annual Heat Input Capacity	9,000 MMBtu/yr
Hours of Operation[1]	50 hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions per Dryer Line

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	21.4	lb/hr[2]	21.4	0.54
NO_X	26.3	lb/hr[2]	26.3	0.66
SO_2	0.025	lb/MMBtu[3]	4.50	0.113
VOC	14.0	lb/hr[2]	14.0	0.35
$PM/PM_{10}/PM_{2.5}$ Condensable	0.017	lb/MMBtu[4]	3.06	0.077
$PM/PM_{10}/PM_{2.5}$ Filterable	0.33	lb/MMBtu[5]	59.4	1.49
Total $PM/PM_{10}/PM_{2.5}$			62.5	1.56

Notes:

1. During startup and shutdown (for temperature control) or malfunction, excess emissions can be vented out either the dryer bypass stacks or the furnace bypass stacks. Use of the bypass stacks is limited to 2 hours in any 24-hour period and 50 hours per 12-month rolling period for each dryer line. As the feed to the dryer is typically stopped during shutdown and malfunction events, the hourly throughput is equal to the annual average of the dryer feed rate.
2. CO, NO_X, and VOC emission rates based on data from a comparable Enviva facility.
3. No emission factor is provided in AP-42, Section 10.6.2 for SO_2 for rotary dryers. Enviva has conservatively calculated SO_2 emissions based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
4. Emission factor for condensable PM based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
5. Uncontrolled filterable PM emission factor is based on testing at a comparable Enviva facility.

Table 4c
Potential Emissions
Dryer #2 Bypass (ES-DRYERBYP-2) (Full Capacity)[1]
Enviva Pellets Northampton, LLC

Potential HAP Emissions per Dryer Line

Pollutant	Emission Factor	Units	Footnote	Potential Emissions[2]	
				Max (lb/hr)	Annual (tpy)
Acetaldehyde	0.168	lb/ODT	2	13.8	0.35
Acrolein	0.110	lb/ODT	2	9.03	0.23
Formaldehyde	0.144	lb/ODT	2	11.78	0.29
Methanol	0.105	lb/ODT	2	8.61	0.22
Phenol	0.058	lb/ODT	2	4.73	0.12
Propionaldehyde	0.039	lb/ODT	2	3.16	0.079
Acetophenone	3.2E-09	lb/MMBtu	3	5.76E-07	1.44E-08
Antimony and compounds	7.9E-06	lb/MMBtu	3	1.42E-03	3.56E-05
Arsenic	2.2E-05	lb/MMBtu	3	3.96E-03	9.90E-05
Benzo(a)pyrene	2.6E-06	lb/MMBtu	3	4.68E-04	1.17E-05
Beryllium	1.1E-06	lb/MMBtu	3	1.98E-04	4.95E-06
Cadmium	4.1E-06	lb/MMBtu	3	7.38E-04	1.85E-05
Carbon tetrachloride	4.5E-05	lb/MMBtu	3	8.10E-03	2.03E-04
Chlorine	7.9E-04	lb/MMBtu	3	1.42E-01	3.56E-03
Chlorobenzene	3.3E-05	lb/MMBtu	3	5.94E-03	1.49E-04
Chromium-Other compounds	1.8E-05	lb/MMBtu	3	3.15E-03	7.88E-05
Cobalt compounds	6.5E-06	lb/MMBtu	3	1.17E-03	2.93E-05
Dinitrophenol, 2,4-	1.8E-07	lb/MMBtu	3	3.24E-05	8.10E-07
Di(2-ethylhexyl)phthalate	4.7E-08	lb/MMBtu	3	8.46E-06	2.12E-07
Ethyl benzene	3.1E-05	lb/MMBtu	3	5.58E-03	1.40E-04
Dichloroethane, 1,2-	2.9E-05	lb/MMBtu	3	5.22E-03	1.31E-04
Hydrochloric acid	1.9E-02	lb/MMBtu	3	3.42E+00	8.55E-02
Lead	4.8E-05	lb/MMBtu	3	8.64E-03	2.16E-04
Manganese	1.6E-03	lb/MMBtu	3	2.88E-01	7.20E-03
Mercury	3.5E-06	lb/MMBtu	3	6.30E-04	1.58E-05
Methyl bromide	1.5E-05	lb/MMBtu	3	2.70E-03	6.75E-05
Methyl chloride	2.3E-05	lb/MMBtu	3	4.14E-03	1.04E-04
Trichloroethane, 1,1,1-	3.1E-05	lb/MMBtu	3	5.58E-03	1.40E-04
Naphthalene	9.7E-05	lb/MMBtu	3	1.75E-02	4.37E-04
Nickel	3.3E-05	lb/MMBtu	3	5.94E-03	1.49E-04
Nitrophenol, 4-	1.1E-07	lb/MMBtu	3	1.98E-05	4.95E-07
Pentachlorophenol	5.1E-08	lb/MMBtu	3	9.18E-06	2.30E-07
Perchloroethylene	3.8E-05	lb/MMBtu	3	6.84E-03	1.71E-04
Phosphorus metal, yellow or white	2.7E-05	lb/MMBtu	3	4.86E-03	1.22E-04
Polychlorinated biphenyls	8.2E-09	lb/MMBtu	3	1.47E-06	3.67E-08
Polycyclic Organic Matter	1.3E-04	lb/MMBtu	3	2.25E-02	5.63E-04
Dichloropropane, 1,2-	3.3E-05	lb/MMBtu	3	5.94E-03	1.49E-04
Selenium compounds	2.8E-06	lb/MMBtu	3	5.04E-04	1.26E-05
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.6E-12	lb/MMBtu	3	1.55E-09	3.87E-11
Trichloroethylene	3.0E-05	lb/MMBtu	3	5.40E-03	1.35E-04
Trichlorophenol, 2,4,6-	2.2E-08	lb/MMBtu	3	3.96E-06	9.90E-08
Vinyl chloride	1.8E-05	lb/MMBtu	3	3.24E-03	8.10E-05
			Total HAP Emissions	55.12	1.38

Notes:

1. During dryer bypass emissions are not controlled by the WESP and RTO; however, combustion in the furnace still results in a reduction in organic HAP emission rates.
2. Organic HAP emissions rates were derived based on stack testing data from other similar Enviva plants and/or engineering judgement.
3. Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - Million British thermal units
NO_X - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
RTO - regenerative thermal oxidizer
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
yr - year

Reference:

AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

Table 4d
Potential Emissions
Dryer #2 Furnace Bypass (ES-FURNACEBYP-2) (Full Capacity)[1]
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Heat Input Capacity	180 MMBtu/hr
Annual Heat Input Capacity	9,000 MMBtu/yr
Hours of Operation[1]	50 hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions per Dryer Line

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	108.0	2.70
NO_X	0.22	lb/MMBtu[2]	39.60	0.99
SO_2	0.025	lb/MMBtu[2]	4.50	0.113
VOC	0.017	lb/MMBtu[2]	3.06	0.077
Total $PM/PM_{10}/PM_{2.5}$	0.58	lb/MMBtu[2]	103.9	2.60

Notes:

1. During startup and shutdown (for temperature control) or malfunction, excess emissions can be vented out either the dryer bypass stacks or the furnace bypass stacks. Use of the bypass stacks is limited to 2 hours in any 24-hour period and 50 hours per 12-month rolling period for each dryer line.
2. CO, NO_X, SO_2, PM, and VOC emission rates based on AP-42, Chapter 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. VOC emission factor excludes formaldehyde.

Table 4d
Potential Emissions
Dryer #2 Furnace Bypass (ES-FURNACEBYP-2) (Full Capacity)[1]
Enviva Pellets Northampton, LLC

Potential HAP Emissions per Dryer Line

Pollutant	Emission Factor	Units	Footnote	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
Acetaldehyde	8.30E-04	lb/MMBtu	1	1.49E-01	3.74E-03
Acrolein	4.00E-03	lb/MMBtu	1	7.20E-01	1.80E-02
Formaldehyde	4.40E-03	lb/MMBtu	1	7.92E-01	1.98E-02
Phenol	5.10E-05	lb/MMBtu	1	9.18E-03	2.30E-04
Propionaldehyde	6.10E-05	lb/MMBtu	1	1.10E-02	2.75E-04
Acetophenone	3.2E-09	lb/MMBtu	1	5.76E-07	1.44E-08
Antimony and compounds	7.9E-06	lb/MMBtu	1	1.42E-03	3.56E-05
Arsenic	2.2E-05	lb/MMBtu	1	3.96E-03	9.90E-05
Benzo(a)pyrene	2.6E-06	lb/MMBtu	1	4.68E-04	1.17E-05
Beryllium	1.1E-06	lb/MMBtu	1	1.98E-04	4.95E-06
Cadmium	4.1E-06	lb/MMBtu	1	7.38E-04	1.85E-05
Carbon tetrachloride	4.5E-05	lb/MMBtu	1	8.10E-03	2.03E-04
Chlorine	7.9E-04	lb/MMBtu	1	1.42E-01	3.56E-03
Chlorobenzene	3.3E-05	lb/MMBtu	1	5.94E-03	1.49E-04
Chromium-Other compounds	2.1E-05	lb/MMBtu	1	3.78E-03	9.45E-05
Cobalt compounds	6.5E-06	lb/MMBtu	1	1.17E-03	2.93E-05
Dinitrophenol, 2,4-	1.8E-07	lb/MMBtu	1	3.24E-05	8.10E-07
Di(2-ethylhexyl)phthalate	4.7E-08	lb/MMBtu	1	8.46E-06	2.12E-07
Ethyl benzene	3.1E-05	lb/MMBtu	1	5.58E-03	1.40E-04
Dichloroethane, 1,2-	2.9E-05	lb/MMBtu	1	5.22E-03	1.31E-04
Hydrochloric acid	1.9E-02	lb/MMBtu	1	3.42E+00	8.55E-02
Lead	4.8E-05	lb/MMBtu	1	8.64E-03	2.16E-04
Manganese	1.6E-03	lb/MMBtu	1	2.88E-01	7.20E-03
Mercury	3.5E-06	lb/MMBtu	1	6.30E-04	1.58E-05
Methyl bromide	1.5E-05	lb/MMBtu	1	2.70E-03	6.75E-05
Methyl chloride	2.3E-05	lb/MMBtu	1	4.14E-03	1.04E-04
Trichloroethane, 1,1,1-	3.1E-05	lb/MMBtu	1	5.58E-03	1.40E-04
Naphthalene	9.7E-05	lb/MMBtu	1	1.75E-02	4.37E-04
Nickel	3.3E-05	lb/MMBtu	1	5.94E-03	1.49E-04
Nitrophenol, 4-	1.1E-07	lb/MMBtu	1	1.98E-05	4.95E-07
Pentachlorophenol	5.1E-08	lb/MMBtu	1	9.18E-06	2.30E-07
Perchloroethylene	3.8E-05	lb/MMBtu	1	6.84E-03	1.71E-04
Phosphorus metal, yellow or white	2.7E-05	lb/MMBtu	1	4.86E-03	1.22E-04
Polychlorinated biphenyls	8.2E-09	lb/MMBtu	1	1.47E-06	3.67E-08
Polycyclic Organic Matter	1.3E-04	lb/MMBtu	1	2.25E-02	5.63E-04
Dichloropropane, 1,2-	3.3E-05	lb/MMBtu	1	5.94E-03	1.49E-04
Selenium compounds	2.8E-06	lb/MMBtu	1	5.04E-04	1.26E-05
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.6E-12	lb/MMBtu	1	1.55E-09	3.87E-11
Trichloroethylene	3.0E-05	lb/MMBtu	1	5.40E-03	1.35E-04
Trichlorophenol, 2,4,6-	2.2E-08	lb/MMBtu	1	3.96E-06	9.90E-08
Vinyl chloride	1.8E-05	lb/MMBtu	1	3.24E-03	8.10E-05
Total HAP Emissions (Biomass Combustion)				5.66	0.14

Notes:

[1] Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
NO_x - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
yr - year

Reference:

AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

Table 4e
Potential Emissions
Dryer #2 Furnace Bypass (ES-FURNACEBYP-2) (Idle Mode)[1]
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Heat Input Capacity	5 MMBtu/hr
Annual Heat Input Capacity	2,500 MMBtu/yr
Hours of Operation[1]	500 hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions per Dryer Line

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	3.00	0.75
NO_X	0.22	lb/MMBtu[2]	1.10	0.28
SO_2	0.025	lb/MMBtu[2]	0.13	0.031
VOC	0.017	lb/MMBtu[2]	0.085	0.021
Total PM	0.58	lb/MMBtu[2]	2.89	0.72
Total PM_{10}	0.52	lb/MMBtu[2]	2.59	0.65
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	2.24	0.56

Notes:

1. As part of this submittal Enviva is requesting a limit of 500 hours per year of "idle mode" for each furnace.
2. CO, NO_X, SO_2, PM_{10}, $PM_{2.5}$, and VOC emission rates based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. PM_{10} and $PM_{2.5}$ factors equal to the sum of the filterable and condensible factors from Table 1.6-1. VOC emission factor excludes formaldehyde.

Table 4e
Potential Emissions
Dryer #2 Furnace Bypass (ES-FURNACEBYP-2) (Idle Mode)[1]
Enviva Pellets Northampton, LLC

Potential HAP Emissions per Dryer Line

Pollutant	Emission Factor	Units	Footnote	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
Acetaldehyde	8.30E-04	lb/MMBtu	1	4.15E-03	1.04E-03
Acrolein	4.00E-03	lb/MMBtu	1	2.00E-02	5.00E-03
Formaldehyde	4.40E-03	lb/MMBtu	1	2.20E-02	5.50E-03
Phenol	5.10E-05	lb/MMBtu	1	2.55E-04	6.38E-05
Propionaldehyde	6.10E-05	lb/MMBtu	1	3.05E-04	7.63E-05
Acetophenone	3.2E-09	lb/MMBtu	1	1.60E-08	4.00E-09
Antimony and compounds	7.9E-06	lb/MMBtu	1	3.95E-05	9.88E-06
Arsenic	2.2E-05	lb/MMBtu	1	1.10E-04	2.75E-05
Benzo(a)pyrene	2.6E-06	lb/MMBtu	1	1.30E-05	3.25E-06
Beryllium	1.1E-06	lb/MMBtu	1	5.50E-06	1.38E-06
Cadmium	4.1E-06	lb/MMBtu	1	2.05E-05	5.13E-06
Carbon tetrachloride	4.5E-05	lb/MMBtu	1	2.25E-04	5.63E-05
Chlorine	7.9E-04	lb/MMBtu	1	3.95E-03	9.88E-04
Chlorobenzene	3.3E-05	lb/MMBtu	1	1.65E-04	4.13E-05
Chromium-Other compounds	2.1E-05	lb/MMBtu	1	1.05E-04	2.63E-05
Cobalt compounds	6.5E-06	lb/MMBtu	1	3.25E-05	8.13E-06
Dinitrophenol, 2,4-	1.8E-07	lb/MMBtu	1	9.00E-07	2.25E-07
Di(2-ethylhexyl)phthalate	4.7E-08	lb/MMBtu	1	2.35E-07	5.88E-08
Ethyl benzene	3.1E-05	lb/MMBtu	1	1.55E-04	3.88E-05
Dichloroethane, 1,2-	2.9E-05	lb/MMBtu	1	1.45E-04	3.63E-05
Hydrochloric acid	1.9E-02	lb/MMBtu	1	9.50E-02	2.38E-02
Lead	4.8E-05	lb/MMBtu	1	2.40E-04	6.00E-05
Manganese	1.6E-03	lb/MMBtu	1	8.00E-03	2.00E-03
Mercury	3.5E-06	lb/MMBtu	1	1.75E-05	4.38E-06
Methyl bromide	1.5E-05	lb/MMBtu	1	7.50E-05	1.88E-05
Methyl chloride	2.3E-05	lb/MMBtu	1	1.15E-04	2.88E-05
Trichloroethane, 1,1,1-	3.1E-05	lb/MMBtu	1	1.55E-04	3.88E-05
Naphthalene	9.7E-05	lb/MMBtu	1	4.85E-04	1.21E-04
Nickel	3.3E-05	lb/MMBtu	1	1.65E-04	4.13E-05
Nitrophenol, 4-	1.1E-07	lb/MMBtu	1	5.50E-07	1.38E-07
Pentachlorophenol	5.1E-08	lb/MMBtu	1	2.55E-07	6.38E-08
Perchloroethylene	3.8E-05	lb/MMBtu	1	1.90E-04	4.75E-05
Phosphorus metal, yellow or white	2.7E-05	lb/MMBtu	1	1.35E-04	3.38E-05
Polychlorinated biphenyls	8.2E-09	lb/MMBtu	1	4.08E-08	1.02E-08
Polycyclic Organic Matter	1.3E-04	lb/MMBtu	1	6.25E-04	1.56E-04
Dichloropropane, 1,2-	3.3E-05	lb/MMBtu	1	1.65E-04	4.13E-05
Selenium compounds	2.8E-06	lb/MMBtu	1	1.40E-05	3.50E-06
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.6E-12	lb/MMBtu	1	4.30E-11	1.08E-11
Trichloroethylene	3.0E-05	lb/MMBtu	1	1.50E-04	3.75E-05
Trichlorophenol, 2,4,6-	2.2E-08	lb/MMBtu	1	1.10E-07	2.75E-08
Vinyl chloride	1.8E-05	lb/MMBtu	1	9.00E-05	2.25E-05
Total HAP Emissions (Biomass Combustion)				0.16	0.039

Notes:

[1] Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - Million British thermal units
NO_x - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
yr - year

Reference:

AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

Table 4f
Potential Emissions
Dryer #2 Double Duct Burners (IES-DDB-3 and -4)
Enviva Pellets Northampton, LLC

Duct Burner Inputs

Duct Burner Rating	1 MMBtu/hr
Number of Duct Burners	2
Annual Operation	8,760 hr/yr

Potential Criteria Pollutant Emissions:

Potential Criteria Pollutant Emissions - Natural Gas Combustion

Pollutant	Emission Factor	Units	Emission Factor Source	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
CO	84.0	lb/MMscf	Note 1	0.16	0.72
NO_X	50.0	lb/MMscf	Note 2	0.10	0.43
SO_2	0.60	lb/MMscf	Note 1	0.0012	0.005
VOC	5.50	lb/MMscf	Note 1	0.01	0.05
$PM/PM_{10}/PM_{2.5}$ Condensable	5.70	lb/MMscf	Note 1	0.01	0.05
$PM/PM_{10}/PM_{2.5}$ Filterable	1.90	lb/MMscf	Note 1	0.004	0.02
Total $PM/PM_{10}/PM_{2.5}$				0.015	0.065

Potential Criteria Pollutant Emissions - Propane Combustion

Pollutant	Emission Factor	Units	Emission Factor Source	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
CO	7.50	lb/Mgal	Note 3	0.16	0.72
NO_X	6.50	lb/Mgal	Note 4	0.14	0.62
SO_2	0.054	lb/Mgal	Note 3,5	0.001	0.005
VOC	1.00	lb/Mgal	Note 3	0.02	0.10
$PM/PM_{10}/PM_{2.5}$ Condensable	0.50	lb/Mgal	Note 3	0.01	0.05
$PM/PM_{10}/PM_{2.5}$ Filterable	0.20	lb/Mgal	Note 3	0.004	0.02
Total $PM/PM_{10}/PM_{2.5}$				0.015	0.067

Notes:

1. Emission factors for natural gas combustion from AP-42 Section 1.4 - Natural Gas Combustion, 07/98. Natural gas heating value of 1,020 Btu/scf assumed per AP-42.
2. Emission factors for NO_X assume burners are low NO_X burners, per email from Kai Simonsen (Enviva) on August 8, 2018.
3. Emission factors for propane combustion obtained from AP-42 Section 1.5 - Liquefied Petroleum Gas Combustion, 07/08. Propane heating value of 91.5 MMBtu/Mgal assumed per AP-42.
4. AP-42 Section 1.5 does not include an emission factor for low NO_X burners. Per AP-42 Section 1.4, low NO_X burners reduce NO_X emissions by accomplishing combustion in stages, reducing NO_X emissions 40 to 85% relative to uncontrolled emission levels. A conservative control efficiency of 50% was applied to the uncontrolled NO_X emission factor from AP-42 Section 1.5. This reduction is consistent with the magnitude of reduction between the uncontrolled and low NO_X emission factors in AP-42 Section 1.4.
5. SO_2 emissions are based on an assumed fuel sulfur content of 0.54 grains/100 ft^3 per *A National Methodology and Emission Inventory for Residential Fuel Combustion*.

Table 4f
Potential Emissions
Dryer #2 Double Duct Burners (IES-DDB-3 and -4)
Enviva Pellets Northampton, LLC

Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							Max (lb/hr)	Annual (tpy)
Duct Burners - Natural Gas/Propane Source								
2-Methylnaphthalene	Y	N	Y	2.4E-05	lb/MMscf	1	4.7E-08	2.1E-07
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	1	3.1E-08	1.4E-07
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	1	3.0E-08	1.3E-07
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	1	3.5E-08	1.5E-07
Ammonia	N	Y	N	3.2	lb/MMscf	1	6.3E-03	2.7E-02
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	1	4.7E-09	2.1E-08
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	1	3.9E-07	1.7E-06
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	2	1.4E-03	6.2E-03
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	1	2.4E-09	1.0E-08
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	1	2.4E-09	1.0E-08
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	1	2.4E-08	1.0E-07
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	1	2.2E-06	9.4E-06
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	1	2.7E-06	1.2E-05
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Cobalt	Y	N	N	8.4E-05	lb/MMscf	1	1.6E-07	7.2E-07
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	1	2.4E-09	1.0E-08
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	1	2.4E-06	1.0E-05
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	1	5.9E-09	2.6E-08
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	1	5.5E-09	2.4E-08
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	2	3.0E-03	1.3E-02
Hexane	Y	Y	Y	1.8	lb/MMscf	1	3.5E-03	1.5E-02
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	1	3.5E-09	1.5E-08
Lead	Y	N	N	5.0E-04	lb/MMscf	1	9.8E-07	4.3E-06
Manganese	Y	Y	N	3.8E-04	lb/MMscf	1	7.5E-07	3.3E-06
Mercury	Y	Y	N	2.6E-04	lb/MMscf	1	5.1E-07	2.2E-06
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	1	1.2E-06	5.2E-06
Nickel	Y	Y	N	2.1E-03	lb/MMscf	1	4.1E-06	1.8E-05
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	8	8.0E-05	3.5E-04
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	1	3.3E-08	1.5E-07
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	1	9.8E-09	4.3E-08
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	1	4.7E-08	2.1E-07
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	1	6.7E-06	2.9E-05
Total HAP Emissions (related to natural gas/propane)							**0.008**	**0.035**
Total TAP Emissions (related to natural gas/propane)							**0.01**	**0.056**

Table 4f
Potential Emissions
Dryer #2 Double Duct Burners (IES-DDB-3 and -4)
Enviva Pellets Northampton, LLC

Notes:

1. Emission factors for natural gas combustion are from NCDAQ Natural Gas Combustion Spreadsheet and AP-42, Fifth Edition, Volume 1, Chapter 1.4 - Natural Gas Combustion, 07/98. The emission factors for acetaldehyde, acrolein, and ammonia are cited in the NCDAQ spreadsheet as being sourced from the USEPA's WebFIRE database.

2. The duct burners can fire either natural gas or propane; Propane is worst-case for these HAP emissions. Emission factors for propane combustion from the South Coast Air Quality Management District's Air Emissions Reporting Tool for external combustion equipment fired with LPG.

Abbreviations:

CAS - chemical abstract service
CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - Million British thermal units
NC - North Carolina
NO_X - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
RTO - regenerative thermal oxidizer
SO_2 - sulfur dioxide
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
yr - year

Table 4g
Potential Emissions
Dryer #2 Furnace Bypass (ES-FURNACEBYP-2) (Cold Startup)
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Heat Input Capacity[1]	27.0 MMBtu/hr
Annual Heat Input Capacity	1,350 MMBtu/yr
Hours of Operation[2]	50 hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions per Dryer Line

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[3]	16.20	0.41
NO_X	0.22	lb/MMBtu[3]	5.94	0.15
SO_2	0.025	lb/MMBtu[3]	0.68	0.017
VOC	0.017	lb/MMBtu[3]	0.459	0.011
Total PM	0.58	lb/MMBtu[3]	15.58	0.39
Total PM_{10}	0.52	lb/MMBtu[3]	13.96	0.35
Total $PM_{2.5}$	0.45	lb/MMBtu[3]	12.07	0.30

Notes:

1. The hourly heat input for cold startup is estimated as follows (Hours 1-2, 6.75 MMBtu/hr; Hours 3-4, 13.5 MmBtu/hr; Hours 5-6, 20.25 MMBtu/hr; and Hours 7-8, 27 MMBtu/hr). Emissions are conservatively based on the heat input rate of 27 MMBtu/hr.
2. Estimated annual hours for cold startup.
3. CO, NO_X, SO_2, PM_{10}, $PM_{2.5}$, and VOC emission rates based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. PM_{10} and $PM_{2.5}$ factors equal to the sum of the filterable and condensible factors from Table 1.6-1. VOC emission factor excludes formaldehyde.

Table 4g
Potential Emissions
Dryer #2 Furnace Bypass (ES-FURNACEBYP-2) (Cold Startup)
Enviva Pellets Northampton, LLC

Potential HAP Emissions per Dryer Line

Pollutant	Emission Factor	Units	Footnote	Potential Emissions	
				Max (lb/hr)	Annual (tpy)
Acetaldehyde	8.30E-04	lb/MMBtu	1	2.24E-02	5.60E-04
Acrolein	4.00E-03	lb/MMBtu	1	1.08E-01	2.70E-03
Formaldehyde	4.40E-03	lb/MMBtu	1	1.19E-01	2.97E-03
Phenol	5.10E-05	lb/MMBtu	1	1.38E-03	3.44E-05
Propionaldehyde	6.10E-05	lb/MMBtu	1	1.65E-03	4.12E-05
Acetophenone	3.2E-09	lb/MMBtu	1	8.64E-08	2.16E-09
Antimony and compounds	7.9E-06	lb/MMBtu	1	2.13E-04	5.33E-06
Arsenic	2.2E-05	lb/MMBtu	1	5.94E-04	1.49E-05
Benzo(a)pyrene	2.6E-06	lb/MMBtu	1	7.02E-05	1.76E-06
Beryllium	1.1E-06	lb/MMBtu	1	2.97E-05	7.43E-07
Cadmium	4.1E-06	lb/MMBtu	1	1.11E-04	2.77E-06
Carbon tetrachloride	4.5E-05	lb/MMBtu	1	1.22E-03	3.04E-05
Chlorine	7.9E-04	lb/MMBtu	1	2.13E-02	5.33E-04
Chlorobenzene	3.3E-05	lb/MMBtu	1	8.91E-04	2.23E-05
Chromium-Other compounds	2.1E-05	lb/MMBtu	1	5.67E-04	1.42E-05
Cobalt compounds	6.5E-06	lb/MMBtu	1	1.76E-04	4.39E-06
Dinitrophenol, 2,4-	1.8E-07	lb/MMBtu	1	4.86E-06	1.22E-07
Di(2-ethylhexyl)phthalate	4.7E-08	lb/MMBtu	1	1.27E-06	3.17E-08
Ethyl benzene	3.1E-05	lb/MMBtu	1	8.37E-04	2.09E-05
Dichloroethane, 1,2-	2.9E-05	lb/MMBtu	1	7.83E-04	1.96E-05
Hydrochloric acid	1.9E-02	lb/MMBtu	1	5.13E-01	1.28E-02
Lead	4.8E-05	lb/MMBtu	1	1.30E-03	3.24E-05
Manganese	1.6E-03	lb/MMBtu	1	4.32E-02	1.08E-03
Mercury	3.5E-06	lb/MMBtu	1	9.45E-05	2.36E-06
Methyl bromide	1.5E-05	lb/MMBtu	1	4.05E-04	1.01E-05
Methyl chloride	2.3E-05	lb/MMBtu	1	6.21E-04	1.55E-05
Trichloroethane, 1,1,1-	3.1E-05	lb/MMBtu	1	8.37E-04	2.09E-05
Naphthalene	9.7E-05	lb/MMBtu	1	2.62E-03	6.55E-05
Nickel	3.3E-05	lb/MMBtu	1	8.91E-04	2.23E-05
Nitrophenol, 4-	1.1E-07	lb/MMBtu	1	2.97E-06	7.43E-08
Pentachlorophenol	5.1E-08	lb/MMBtu	1	1.38E-06	3.44E-08
Perchloroethylene	3.8E-05	lb/MMBtu	1	1.03E-03	2.57E-05
Phosphorus metal, yellow or white	2.7E-05	lb/MMBtu	1	7.29E-04	1.82E-05
Polychlorinated biphenyls	8.2E-09	lb/MMBtu	1	2.20E-07	5.50E-09
Polycyclic Organic Matter	1.3E-04	lb/MMBtu	1	3.38E-03	8.44E-05
Dichloropropane, 1,2-	3.3E-05	lb/MMBtu	1	8.91E-04	2.23E-05
Selenium compounds	2.8E-06	lb/MMBtu	1	7.56E-05	1.89E-06
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.6E-12	lb/MMBtu	1	2.32E-10	5.81E-12
Trichloroethylene	3.0E-05	lb/MMBtu	1	8.10E-04	2.03E-05
Trichlorophenol, 2,4,6-	2.2E-08	lb/MMBtu	1	5.94E-07	1.49E-08
Vinyl chloride	1.8E-05	lb/MMBtu	1	4.86E-04	1.22E-05
Total HAP Emissions (Biomass Combustion)				0.85	0.021

Notes:

1. Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - Million British thermal units
NO_x - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
yr - year

Reference:

AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

Table 5
Potential Emissions
Propane Vaporizer (IES-PVAP)
Enviva Pellets Northampton, LLC

Calculation Basis

Heat Content[1]	91.5	MMBtu/10^3 gal propane
Hours of Operation	8,760	hr/yr
Vaporizer Heat Input[2]	1.00	MMBtu/hr

Notes:
1. Propane heat content from AP-42 Section 1.5 - Liquefied Petroleum Gas Production, 7/08, Table 1.5-1, footnote a.
2. Heat input based on information provided by Enviva in August 2018.

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor [1]	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	7.5	lb/10^3 gal	0.08	0.36
NO_X	13.0	lb/10^3 gal	0.14	0.62
SO_2[2]	0.05	lb/10^3 gal	0.001	0.003
TOC	1.0	lb/10^3 gal	0.01	0.05
$PM/PM_{10}/PM_{2.5}$[3]	0.70	lb/10^3 gal	0.01	0.03

Notes:
1. Emission factors obtained from AP 42 1.5, Liquefied Petroleum Gas Production, 10/96, Table 1.5-1.
2. AP 42 1.5, Liquefied Petroleum Gas Production, 10/96, Table 1.5-1 provides an SO_2 emission factor of 0.10S, where S equals the sulfur content of the fuel. The national sulfur fuel content for LPG of 0.54 grains/100 ft^3 as assigned by EPA was used (Source: A National Methodology and Emission Inventory for Residential Fuel Combustion).
3. All particulate matter was conservatively assumed to be less than 2.5 microns in size.

Potential HAP Emissions

Pollutant	CAS No.	Emission Factor[1]	Potential Emissions	
		(lb/MMBtu)	Max (lb/hr)	Annual (tpy)
Benzene	71-43-2	7.1E-04	7.10E-04	3.11E-03
Formaldehyde	50-00-0	1.5E-03	1.50E-03	6.57E-03
PAHs		4.0E-05	4.0E-05	1.75E-04
Total HAP Emissions			0.002	0.010

Notes:
1. Emission factors for propane combustion from the South Coast Air Quality Management District's Air Emissions Reporting Tool for external combustion equipment fired with LPG.

Abbreviations:

Btu - British thermal unit
CAS - chemical abstract service
CH_4 - methane
CO - carbon monoxide
CO2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
gal - gallon
HAP - hazardous air pollutant
hp - horsepower
hr - hour
kg - kilogram
kW - kilowatt
lb - pound
MW - megawatt
MMBtu - Million British thermal units
NO_X - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PAH - polycyclic aromatic hydrocarbon
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
POM - polycyclic organic matter
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
yr - year

References:

Advanced Environmental Interface, Inc. (1998). General Permits for Emergency Engines. INSIGHTS, 98-2, 3.
AP-42 Chapter 3.3, Stationary Internal Combustion Engines, 10/96.

Table 6a
Potential Emissions at Outlet of RCO-1 Stack (CD-RCO-1)
Dry Hammermills (ES-HM-1 through ES-HM-8)
Enviva Pellets Northampton, LLC

Calculation Basis

Total Plant Throughput	781,255	ODT/yr
% of Total Throughput to the Hammermills	85%	
Hours of Operation	8760	hr/yr

Hammermills Annual Throughput	664,067	ODT/yr
Hammermills Hourly Throughput	144	ODT/hr
Number of Burners	2	burners
RCO/RTO Burner Rating	9.8	MMBtu/hr
Control Efficiency[1]	95.0%	

Potential VOC and HAP Emissions

Pollutant	CAS No.	HAP	NC TAP	VOC	Emission Factor[2] (lb/ODT)	Potential Emissions Max (lb/hr)	Potential Emissions Annual (tpy)
Acetaldehyde	75-07-0	Y	Y	Y	0.0073	0.05	0.12
Acrolein	107-02-8	Y	Y	Y	0.0092	0.07	0.15
Formaldehyde	50-00-0	Y	Y	Y	0.0071	0.05	0.12
Methanol	67-56-1	Y	N	Y	0.0071	0.05	0.12
Phenol	108-95-2	Y	Y	Y	0.0028	0.02	0.05
Propionaldehyde	123-38-6	Y	N	Y	0.0124	0.09	0.21
					Total HAP Emissions	**0.33**	**0.76**
					Total TAP Emissions	**0.19**	**0.44**
Total VOC (as propane)	--		--	Y	0.77	5.51	12.70

Notes:

1. Emission factors were derived based on stack testing data from comparable Enviva facilities and/or engineering judgement and include contingency. The emission factors represent uncontrolled emissions.
2. A 95.0% control efficiency is applied to the potential emissions for the RCO.

Emissions from the pellet mills and pellet coolers will be controlled by an RCO that will operate primarily in catalytic mode with thermal (RTO) mode as a backup. The RTO and RCO modes have the same control efficiency so there will be no impact on emissions when operating in thermal mode.

Thermal Generated Potential Criteria Pollutant Emissions

Maximum high heating value of VOC constituents	1.8E-02 MMBtu/lb
Uncontrolled VOC emissions	254 tons/yr
Uncontrolled VOC emissions	110 lb/hr
Heat input of uncontrolled VOC emissions	9,396 MMBtu/yr
Heat input of uncontrolled VOC emissions	2 MMBtu/hr

Pollutant	Emission Factor[1]	Units	Potential Emissions Max (lb/hr)	Potential Emissions Annual (tpy)
CO	8.2E-02	lb/MMBtu	0.17	0.39
NO_x	9.8E-02	lb/MMBtu	0.20	0.46

Table 6a
Potential Emissions at Outlet of RCO-1 Stack (CD-RCO-1)
Dry Hammermills (ES-HM-1 through ES-HM-8)
Enviva Pellets Northampton, LLC

Natural Gas Combustion Potential Criteria Pollutant Emissions

Pollutant	Emission Factor[1]	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	8.2E-02	lb/MMBtu	1.61	7.07
NO_X	3.25	lb/hr [3]	3.25	14.25
SO_2	5.9E-04	lb/MMBtu	0.01	0.05
VOC	5.4E-03	lb/MMBtu	0.11	0.46
Total PM	7.5E-03	lb/MMBtu	0.15	0.64
Total PM_{10}	7.5E-03	lb/MMBtu	0.15	0.64
Total $PM_{2.5}$	7.5E-03	lb/MMBtu	0.15	0.64

Potential Criteria Pollutant Emissions - Propane Combustion

Pollutant	Emission Factor[2]	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	7.50	lb/Mgal	1.61	7.04
NO_X	3.25	lb/hr [3]	3.25	14.25
SO_2	0.054	lb/Mgal	0.01	0.05
VOC	1.00	lb/Mgal	0.21	0.94
PM/PM_{10}/$PM_{2.5}$ Condensable	0.50	lb/Mgal	0.11	0.47
PM/PM_{10}/$PM_{2.5}$ Filterable	0.20	lb/Mgal	0.04	0.19
Total PM/PM_{10}/$PM_{2.5}$			0.15	0.66

Natural Gas Combustion Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							Max (lb/hr)	Annual (tpy)
Natural Gas Source								
2-Methylnaphthalene	Y	N	Y	2.4E-05	lb/MMscf	4	4.6E-07	2.0E-06
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	4	3.1E-07	1.3E-06
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	4	2.9E-07	1.3E-06
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	4	3.5E-07	1.5E-06
Ammonia	N	Y	N	3.2	lb/MMscf	4	6.1E-02	2.7E-01
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	4	4.6E-08	2.0E-07
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	4	3.8E-06	1.7E-05
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Benzene	Y	N	Y	2.1E-04	lb/MMBtu	5	1.4E-02	6.1E-02
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	4	2.3E-08	1.0E-07
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	4	2.3E-08	1.0E-07
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	4	2.3E-07	1.0E-06
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	4	2.1E-05	9.3E-05
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	4	2.7E-05	1.2E-04
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Cobalt Compounds	Y	N	N	8.4E-05	lb/MMscf	4	1.6E-06	7.1E-06
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	4	2.3E-08	1.0E-07
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	4	2.3E-05	1.0E-04
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	4	5.8E-08	2.5E-07
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	4	5.4E-08	2.4E-07
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	5	2.9E-02	1.3E-01
Hexane	Y	Y	Y	1.8	lb/MMscf	4	3.5E-02	1.5E-01
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Lead	Y	N	N	5.0E-04	lb/MMscf	4	9.6E-06	4.2E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	4	7.3E-06	3.2E-05
Mercury	Y	Y	N	2.6E-04	lb/MMscf	4	5.0E-06	2.2E-05
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	4	1.2E-05	5.1E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	4	4.0E-05	1.8E-04
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	5	7.8E-04	3.4E-03
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	4	3.3E-07	1.4E-06
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	4	9.6E-08	4.2E-07
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	4	4.6E-07	2.0E-06
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	4	6.5E-05	2.9E-04
					Total HAP Emissions (natural gas combustion)		0.079	0.35
					Total TAP Emissions (natural gas combustion)		0.13	0.55

Notes:

1. Emission factors from AP-42, Section 1.4 - Natural Gas Combustion, 07/98. Emission factors converted from lb/MMscf to lb/MMBtu based on assumed heating value of 1,020 Btu/scf for natural gas per AP-42 Section 1.4.
2. Emission factors for propane combustion obtained from AP-42 Section 1.5 - Liquefied Petroleum Gas Combustion, 07/08.
3. Emission factor for NOx based on Vendor Guarantee.
4. Emission factors for natural gas combustion are from NCDAQ Natural Gas Combustion Spreadsheet and AP-42, Fifth Edition, Volume 1, Chapter 1.4 - Natural Gas Combustion, 07/98 for small boilers. The emission factors for acetaldehyde, acrolein, and ammonia are cited in the NCDAQ spreadsheet as being sourced from the USEPA's WebFIRE database.
5. The RCO burner can fire either natural gas or propane; Propane is worst-case for these HAP emissions. Emission factors for propane combustion from the South Coast Air Quality Management District's Air Emissions Reporting Tool for external combustion equipment fired with LPG.

Table 6a
Potential Emissions at Outlet of RCO-1 Stack (CD-RCO-1)
Dry Hammermills (ES-HM-1 through ES-HM-8)
Enviva Pellets Northampton, LLC

Abbreviations:

CAS - chemical abstract service
HAP - hazardous air pollutant
hr - hour
lb - pound
NC - North Carolina
ODT - oven dried tons
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
yr - year

Table 6b
Potential Emissions at Outlet of RCO-1 Stack (CD-RCO-1)
Dry Shavings Hammermills (ES-DSHM-1 and -2)
Enviva Pellets Northampton, LLC

Calculation Basis

Hammermills Hourly Throughput	28	ODT/hr
Hammermills Annual Throughput	245,000	ODT/yr
RCO Control Efficiency[1]	95.0%	
Wet Scrubber PM Control Efficiency	99.9%	

Potential PM, VOC, and HAP Emissions

Pollutant	CAS No.	HAP	NC TAP	VOC	Emission Factor[2] (lb/ODT)	Potential Emissions Max (lb/hr)	Potential Emissions Annual (tpy)
Acetaldehyde	75-07-0	Y	Y	Y	0.0073	0.010	0.04
Acrolein	107-02-8	Y	Y	Y	0.0092	0.013	0.06
Formaldehyde	50-00-0	Y	Y	Y	0.0071	0.010	0.04
Methanol	67-56-1	Y	N	Y	0.0071	0.010	0.04
Phenol	108-95-2	Y	Y	Y	0.0028	0.004	0.02
Propionaldehyde	123-38-6	Y	N	Y	0.0124	0.017	0.08
				Total HAP Emissions		0.06	0.28
				Total TAP Emissions		0.04	0.16
Total VOC (as propane)	--		--	Y	0.765	1.07	4.69
$PM/PM_{10}/PM_{2.5}$	--	--	--	--	16.44	0.46	2.01

Thermal Generated Potential Criteria Pollutant Emissions

Maximum high heating value of VOC constituents	1.8E-02	MMBtu/lb
Uncontrolled VOC emissions	94	tons/yr
Uncontrolled VOC emissions	21	lb/hr
Heat input of uncontrolled VOC emissions	3,467	MMBtu/yr
Heat input of uncontrolled VOC emissions	0.40	MMBtu/hr

Pollutant	Emission Factor[3]	Units	Potential Emissions Max (lb/hr)	Potential Emissions Annual (tpy)
CO	8.2E-02	lb/MMBtu	0.03	0.14
NO_x	9.8E-02	lb/MMBtu	0.04	0.17

Notes:

1. Exhaust from the two drying shavings hammermills will be routed to the wet scrubber and RCO at the pellet building, which control PM and VOC/HAP emissions with a 99.9% and 95.0% control efficiency, respectively.
2. Emission factors were derived based on stack testing data from comparable Enviva facilities and/or engineering judgement and include contingency. The emission factors represent uncontrolled emissions.
3. All particulate matter was conservatively assumed to be less than 2.5 microns in size.
4. CO and NOx emission factors are from AP-42, Fifth Edition, Volume 1, Chapter 1.4 - Natural Gas Combustion, 07/98 for small boilers.

Abbreviations:

CAS - chemical abstract service
HAP - hazardous air pollutant
hr - hour
lb - pound
NC - North Carolina
ODT - oven dried tons
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
yr - year

Table 7
Potential Emissions at Outlet of RCO-2 Stack (CD-RCO-2)
Pellet Coolers (ES-CLR-1 through ES-CLR-6)
Enviva Pellets Northampton, LLC

Calculation Basis

Annual Throughput	781,255 ODT/yr
Hourly Throughput	144 ODT/hr
Hours of Operation	8,760 hr/yr
Number of Burners	2 burners
RCO/RTO Burner Rating	9.8 MMBtu/hr
RCO/RTO Control Efficiency	95.0%

Pellet Cooler and Pellet Mill Potential Process VOC and HAP Emissions

Pollutant	CAS No.	NC TAP	VOC	Emission Factor[1] (lb/ODT)	Emissions at RCO Outlet[2] Max (lb/hr)	Annual (tpy)
Acetaldehyde	75-07-0	Y	Y	0.025	0.181	0.49
Acrolein	107-02-8	Y	Y	0.050	0.36	0.97
Formaldehyde	50-00-0	Y	Y	0.006	0.04	0.12
Methanol	67-56-1	N	Y	0.021	0.15	0.41
Phenol	108-95-2	Y	Y	0.025	0.18	0.49
Propionaldehyde	123-38-6	N	Y	0.015	0.105	0.29
				Total HAP Emissions	1.02	2.78
				Total TAP Emissions	0.77	2.08
Total VOC (as propane)	--	--	Y	1.4	10.17	27.60

Notes:
1. Emission factors were derived based on stack testing data from comparable Enviva facilities and/or engineering judgement and include contingency. The emission factors represent uncontrolled emissions.
2. A 95.0% control efficiency is applied to the potential emissions for the RCO.
Emissions from the pellet mills and pellet coolers will be controlled by an RCO that will operate primarily in catalytic mode with thermal (RTO) mode as a backup. The RTO and RCO modes have the same control efficiency so there will be no impact on emissions when operating in thermal mode.

Thermal Generated Potential Criteria Pollutant Emissions

Maximum high heating value of VOC constituents	1.8E-02 MMBtu/lb
Uncontrolled VOC emissions	552 tons/yr
Uncontrolled VOC emissions	203 lb/hr
Heat input of uncontrolled VOC emissions	20,417 MMBtu/yr
Heat input of uncontrolled VOC emissions	4 MMBtu/hr

Pollutant	Emission Factor[1]	Units	Potential Emissions Max (lb/hr)	Annual (tpy)
CO	8.2E-02	lb/MMBtu	0.31	0.84
NO_x	9.8E-02	lb/MMBtu	0.37	1.00

Natural Gas Combustion Potential Criteria Pollutant Emissions

Pollutant	Emission Factor[1]	Units	Potential Emissions Max (lb/hr)	Annual (tpy)
CO	8.2E-02	lb/MMBtu	1.61	7.07
NO_x	5.06	lb/hr [3]	5.06	22.16
SO_2	5.9E-04	lb/MMBtu	1.2E-02	0.05
VOC	5.4E-03	lb/MMBtu	0.11	0.46
Total PM	7.5E-03	lb/MMBtu	0.15	0.64
Total PM_{10}	7.5E-03	lb/MMBtu	0.15	0.64
Total $PM_{2.5}$	7.5E-03	lb/MMBtu	0.15	0.64

Potential Criteria Pollutant Emissions - Propane Combustion

Pollutant	Emission Factor[2]	Units	Potential Emissions Max (lb/hr)	Annual (tpy)
CO	7.50	lb/Mgal	1.61	7.04
NO_x	5.06	lb/hr [3]	5.06	22.16
SO_2	0.054	lb/Mgal	0.01	0.05
VOC	1.00	lb/Mgal	0.21	0.94
$PM/PM_{10}/PM_{2.5}$ Condensable	0.50	lb/Mgal	0.11	0.47
$PM/PM_{10}/PM_{2.5}$ Filterable	0.20	lb/Mgal	0.04	0.19
Total $PM/PM_{10}/PM_{2.5}$			0.15	0.66

Table 7
Potential Emissions at Outlet of RCO-2 Stack (CD-RCO-2)
Pellet Coolers (ES-CLR-1 through ES-CLR-6)
Enviva Pellets Northampton, LLC

Natural Gas Combustion Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							Max (lb/hr)	Annual (tpy)
Natural Gas Source								
2-Methylnaphthalene	Y	N	Y	2.4E-05	lb/MMscf	4	4.6E-07	2.0E-06
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	4	3.1E-07	1.3E-06
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	4	2.9E-07	1.3E-06
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	4	3.5E-07	1.51E-06
Ammonia	N	Y	N	3.2	lb/MMscf	4	6.15E-02	2.69E-01
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	4	4.6E-08	2.0E-07
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	4	3.8E-06	1.7E-05
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	5	1.4E-02	6.1E-02
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	4	2.3E-08	1.0E-07
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	4	2.3E-08	1.0E-07
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	4	2.3E-07	1.0E-06
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	4	2.1E-05	9.3E-05
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	4	2.7E-05	1.2E-04
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Cobalt Compounds	Y	N	N	8.4E-05	lb/MMscf	4	1.6E-06	7.1E-06
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	4	2.3E-08	1.0E-07
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	4	2.3E-05	1.0E-04
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	4	5.8E-08	2.5E-07
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	4	5.4E-08	2.4E-07
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	5	2.9E-02	1.3E-01
Hexane	Y	Y	Y	1.8	lb/MMscf	4	3.5E-02	1.51E-01
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	4	3.5E-08	1.5E-07
Lead	Y	N	N	5.0E-04	lb/MMscf	4	9.6E-06	4.2E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	4	7.3E-06	3.2E-05
Mercury	Y	Y	N	2.6E-04	lb/MMscf	4	5.0E-06	2.2E-05
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	4	1.2E-05	5.1E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	4	4.0E-05	1.8E-04
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	5	7.8E-04	3.4E-03
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	4	3.3E-07	1.4E-06
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	4	9.6E-08	4.2E-07
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	4	4.6E-07	2.0E-06
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	4	6.5E-05	2.9E-04
					Total HAP Emissions (natural gas combustion)		0.079	0.35
					Total TAP Emissions (natural gas combustion)		0.13	0.55

Notes:

1. Emission factors from AP-42, Section 1.4 - Natural Gas Combustion, 07/98. Emission factors converted from lb/MMscf to lb/MMBtu based on assumed heating value of 1,020 Btu/scf for natural gas per AP-42 Section 1.4.
2. Emission factors for propane combustion obtained from AP-42 Section 1.5 - Liquefied Petroleum Gas Combustion, 07/08.
3. Emission factor for NOx based on Vendor Guarantee.
4. Emission factors for natural gas combustion are from NCDAQ Natural Gas Combustion Spreadsheet and AP-42, Fifth Edition, Volume 1, Chapter 1.4 - Natural Gas Combustion, 07/98 for small boilers. The emission factors for acetaldehyde, acrolein, and ammonia are cited in the NCDAQ spreadsheet as being sourced from the USEPA's WebFIRE database.
5. The RCO burner can fire either natural gas or propane; Propane is worst-case for these HAP emissions. Emission factors for propane combustion from the South Coast Air Quality Management District's Air Emissions Reporting Tool for external combustion equipment fired with LPG.

Abbreviations:

CAS - chemical abstract service
HAP - hazardous air pollutant
hr - hour
lb - pound
NC - North Carolina
ODT - oven dried tons
RCO - regenerative catalytic oxidizer
RTO - regenerative thermal oxidizer
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
yr - year

Table 8
Potential VOC and HAP Emissions
Dried Wood Handling 1 and 2 (ES-DWH-1 and ES-DWH-2)
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Throughput[1]	154 ODT/hr
Annual Throughput[1]	781,255 ODT/yr

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor (lb/ODT)	Potential Emissions[4]	
		Max (lb/hr)	Annual (tpy)
Formaldehyde[2]	8.4E-04	0.129	0.33
Methanol[2]	2.0E-03	0.30	0.76
Total HAP Emissions		**0.43**	**1.09**
VOC as carbon[2]	0.10	15.6	39.5
VOC as propane[3]	0.12	19.1	48.5

Notes:

1. Hourly and annual throughputs assumed to be the same as dry hammermill throughput.
2. Emission factors derived from NCASI's Wood Products Database (February 2013) for dry wood handling operations at an OSB mill, mean emission factors. The emission factors were converted from lb/MSF (3/8") to lb/ODT using the typical density and moisture content of an OSB panel.
3. VOC as propane = (1.22 x VOC as carbon) + formaldehyde.
4. As emissions are based on throughput, the calculated emissions represent the total emissions from Dried Wood Handling 1 and 2 (ES-DWH-1 and ES-DWH-2).

Abbreviations:

hr - hour
lb - pound
ODT - oven dried tons
tpy - tons per year
VOC - volatile organic compound
yr - year

Table 9
Potential PM Emissions from Baghouses/Cyclones
Enviva Pellets Northampton, LLC

Emission Unit ID	Source Description	Control Device ID	Control Device Description	Exhaust Flow Rate[1]	Exit Grain Loading[2]	Annual Operation	Particulate Speciation		Potential Emissions					
									PM		PM_{10}		$PM_{2.5}$	
				(cfm)	(gr/cf)	(hours)	PM_{10} (% of PM)	$PM_{2.5}$ (% of PM)	Max (lb/hr)	Annual (tpy)	Max (lb/hr)	Annual (tpy)	Max (lb/hr)	Annual (tpy)
ES-HM-1 through 3	Dry Hammermills 1 through 3	CD-HM-BF-1; CD-WS-1	One (1) existing baghouse and one (1) new wet scrubber[3,4]	45,000	0.004	8760	100%	1.7%	1.54	6.76	1.54	6.76	0.03	0.11
ES-HM-4 through 6	Dry Hammermills 4 through 6	CD-HM-BF-2; CD-WS-1	One (1) existing baghouse and one (1) new wet scrubber[3,4]	45,000	0.004	8760	100%	1.7%	1.54	6.76	1.54	6.76	0.03	0.11
ES-HM-7 and 8; ES-NDS	Dry Hammermills 7 through 8; Nuisance Dust System	CD-HM-BF-3; CD-WS-1	One (1) existing baghouse and one (1) new wet scrubber[3,4]	45,000	0.004	8760	100%	1.7%	1.54	6.76	1.54	6.76	0.03	0.11
ES-PCHP	Pellet Cooler HP Fines Relay System	CD-PCHP-BV	One (1) baghouse[5]	3,600	0.004	8760	100%	100%	0.12	0.54	0.12	0.54	0.12	0.54
ES-PMFS	Pellet Mill Feed Silo	CD-PMFS-BV	One (1) baghouse[5]	2,500	0.004	8760	100%	100%	0.09	0.38	0.09	0.38	0.09	0.38
ES-CLR-1	Pellet Cooler	CD-CLR-1; CD-WS-2	One (1) existing Cyclone and one new wet scrubber[6]	17,100	0.01	8760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.05	0.21
ES-CLR-2	Pellet Cooler	CD-CLR-2; CD-WS-2	One (1) existing Cyclone and one new wet scrubber[6]	17,100	0.01	8760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.05	0.21
ES-CLR-3	Pellet Cooler	CD-CLR-3; CD-WS-2	One (1) existing Cyclone and one new wet scrubber[6]	17,100	0.01	8760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.05	0.21
ES-CLR-4	Pellet Cooler	CD-CLR-4; CD-WS-2	One (1) existing Cyclone and one new wet scrubber[6]	17,100	0.01	8760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.05	0.21
ES-CLR-5	Pellet Cooler	CD-CLR-5; CD-WS-2	One (1) existing Cyclone and one new wet scrubber[6]	17,100	0.01	8760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.05	0.21
ES-CLR-6	Pellet Cooler	CD-CLR-6; CD-WS-2	One (1) existing Cyclone and one new wet scrubber[6]	17,100	0.01	8760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.05	0.21
ES-DWH-1	Dried Wood Handling-1	CD-DWH-BF-1	One (1) baghouse[5]	2,500	0.004	8760	100%	100%	0.09	0.38	0.09	0.38	0.09	0.38
ES-DWH-2	Dried Wood Handling-2	CD-DWH-BF-2	One (1) baghouse[5]	2,500	0.004	8760	100%	100%	0.09	0.38	0.09	0.38	0.09	0.38
ES-DSR; IES-DRYSHAVE-1	Dry Shavings Reception; Dry Shaving Material Handling	CD-DSR-BF	One (1) baghouse[5]	2,500	0.004	8760	100%	100%	0.09	0.38	0.09	0.38	0.09	0.38
ES-FPH; ES-PB-1 through 12; ES-PL-1 and -2	Finished Product Handling; Twelve pellet loadout bins; Pellet mill load-out 1 and 2	CD-FPH-BF	One (1) baghouse[4,7]	35,500	0.004	8760	91%	2%	1.22	5.33	1.11	4.85	0.02	0.09
ES-DSS	Dry Shavings Silo	CD-DSS-BF	One (1) baghouse[5]	3,600	0.004	8760	100%	100%	0.12	0.54	0.12	0.54	1.2E-01	0.54
IES-ADD	Additive Handling and Storage	CD-ADD-BF	One (1) baghouse[5]	1,652	0.004	117	100%	100%	0.057	0.00	0.057	0.003	0.057	0.003

Notes:

1. Filter, Vent, and Cyclone inlet flow rate (cfm) provided by design engineering firm (Mid-South Engineering Co.). The exit flowrate was conservatalvely assumed to be the same as the inlet flowrate.
2. Pollutant loading provided by Aircon. For Pellet Coolers, pollutant loading based on data from other Enviva facilities reflecting addition of either a WESP or baghouse.
3. No speciation data is available for PM_{10}. Therefore, it is conservatively assumed to be equal to total PM.
4. Dry Hammermills and finished product handling $PM_{2.5}$ speciation based on April 2014 Enviva Southampton $PM_{2.5}$ speciation tests.
5. No speciation data is available for $PM_{10}/PM_{2.5}$. Therefore, it is conservatively assumed to be equal to total PM.
6. Pellet cooler $PM_{10}/PM_{2.5}$ speciation based on data for similar Enviva facility.
7. Finished product handling PM_{10} speciation based on AP-42 factors for wet wood combustion (Section 1.6) controlled by a mechanical separator. Since the particle size of particulate matter from a pellet cooler is anticipated to be larger than flyash, this factor is believed to be a conservative indicator of speciation.

Abbreviations:

cf - cubic feet
cfm - cubic feet per minute
ES - Emission Sources
IES - Insignificant Emission Source
gr - grain
hr - hour
lb - pound
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
tpy - tons per year

Table 10a
Potential Emissions from Material Handling
Enviva Pellets Northampton, LLC

Source	Transfer Activity[1]	Control	Control Description	Number of Drop Points	Material Moisture Content	PM Emission Factor[2]	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[2]	Potential Throughput[3]		Potential PM Emissions		Potential PM_{10} Emissions		Potential $PM_{2.5}$ Emissions	
					(%)	(lb/ton)	(lb/ton)	(lb/ton)	(tph)	(tpy)	Max (lb/hr)	Annual (tpy)	Max (lb/hr)	Annual (tpy)	Max (lb/hr)	Annual (tpy)
ES-GWHS	Material feed conveyance system to dryer burner fuel storage bin	--	--	5	48%	3.7E-05	1.8E-05	2.7E-06	30	252,692	5.6E-03	2.4E-02	2.7E-03	1.1E-02	4.0E-04	1.7E-03
	Material feed conveyance system to raw wood chip storage pile	--	--	1	48%	3.7E-05	1.8E-05	2.7E-06	400	1,502,414	1.5E-02	2.8E-02	7.1E-03	1.3E-02	1.1E-03	2.0E-03
	Material feed conveyance system to dryer burner	--	--	0	45%	4.1E-05	1.9E-05	2.9E-06	30	545,455	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Material feed conveyance system to rotary drum wood dryer	--	--	0	48%	3.7E-05	1.8E-05	2.7E-06	300	1,652,655	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Material feed conveyance system to fuel storage piles	--	--	3	45%	4.1E-05	1.9E-05	2.9E-06	30	238,909	3.7E-03	1.5E-02	1.7E-03	6.9E-03	2.6E-04	1.0E-03
IES-DLH	Drop point for dry shavings to dry line hopper	--	--	1	17%	1.6E-04	7.6E-05	1.1E-05	185.3	1,882,542	3.0E-02	1.5E-01	1.4E-02	7.1E-02	2.1E-03	1.1E-02
ES-DLC-1	Drop point for dry line hopper to dry line feed conveyor	--	--	1	17%	1.6E-04	7.6E-05	1.1E-05	185.3	1,882,542	3.0E-02	1.5E-01	1.4E-02	7.1E-02	2.1E-03	1.1E-02
IES-DRYSHAVE	Existing dry shaving walking floor truck dump	--	--	1	8.0%	4.6E-04	2.2E-04	3.3E-05	48.0	219,000	2.2E-02	5.0E-02	1.0E-02	2.4E-02	1.6E-03	3.6E-03
	Existing dry shaving loader	--	--	2	8.0%	4.6E-04	2.2E-04	3.3E-05	153.8	750,000	1.4E-01	3.4E-01	6.7E-02	1.6E-01	1.0E-02	2.5E-02
ES-PS-1 and 2	Drop points from the dry line feed conveyor to the Dry Hammermill Pre-screeners	--	--	2	17.0%	1.6E-04	7.6E-05	1.1E-05	185.3	1,882,542	5.9E-02	3.0E-01	2.8E-02	1.4E-01	4.2E-03	2.2E-02
										Total Emissions:	2.47E-01	7.62E-01	1.17E-01	3.60E-01	1.77E-02	5.46E-02

Notes:

[1] These dry wood handling emissions are representative of the fugitive emissions at the site.

[2] Emission factor calculation based on formula from AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, Equation 1, (11/06).

where:
- E = emission factor (lb/ton)
- k = particle size multiplier (dimensionless) for PM 0.74
- k = particle size multiplier (dimensionless) for PM_{10} 0.35
- k = particle size multiplier (dimensionless) for $PM_{2.5}$ 0.053
- U = mean wind speed (mph) 6.3

[3] Throughputs represent dry weight of materials, calculated based on listed material moisture contents. Throughput for dry shaving material handling is based on comparable Enviva facilities.

Abbreviations:

hr - hour
lb - pound
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
tpy - tons per year
yr - year

Table 10b
Potential Emissions from Wood Storage Pile Wind Erosion
Enviva Pellets Northampton, LLC

Source	Description	PM Emission Factor[1]		VOC Emission Factor[2]		Pile Width/ Diamter	Pile Length	Pile Height	Outer Surface Area of Pile[3]	Potential PM Emissions		Potential PM_{10} Emissions		Potential $PM_{2.5}$ Emissions		Potential VOC Emissions as propane[4]	
		(lb/day/acre)	(lb/hr/ft^2)	(lb/day/acre)	(lb/hr/ft^2)	(ft)	(ft)	(ft)	(ft^2)	Max (lb/hr)	Annual (tpy)	Max (lb/hr)	Annual (tpy)	Max (lb/hr)	Annual (tpy)	Max (lb/hr)	Annual (tpy)
IES-DRYSHAVE	Dry Shaving Storage Pile	8.6	8.2E-06	3.6	3.4E-06	100	--	25	10,537	0.09	0.4	0.04	0.2	0.007	0.03	0.04	0.2
IES-GWHS	Green Wood Storage Pile No. 1	8.6	8.2E-06	3.6	3.4E-06	155	--	72	30,907	0.25	1.1	0.13	0.6	0.019	0.08	0.13	0.6
	Green Wood Storage Pile No. 2	8.6	8.2E-06	3.6	3.4E-06	350	400	25	213,000	1.75	7.7	0.88	3.8	0.131	0.58	0.89	3.9
	Green Wood Storage Pile No. 3	8.6	8.2E-06	3.6	3.4E-06	150	150	25	45,000	0.37	1.6	0.19	0.8	0.028	0.12	0.19	0.8
	Green Wood Storage Pile No. 4	8.6	8.2E-06	3.6	3.4E-06	200	200	25	72,000	0.59	2.6	0.30	1.3	0.044	0.19	0.30	1.3
	Bark Fuel Storage Pile No. 1	8.6	8.2E-06	3.6	3.4E-06	150	150	25	45,000	0.37	1.62	0.185	0.81	2.8E-02	0.122	0.189	0.83
	Bark Fuel Storage Pile No. 2	8.6	8.2E-06	3.6	3.4E-06	100	200	25	42,000	0.345	1.513	0.173	0.757	2.6E-02	1.1E-01	0.176	0.773
	Bark Fuel Storage Pile No. 3	8.6	8.2E-06	3.6	3.4E-06	50	--	25	3,332	0.027	0.120	0.014	0.060	2.1E-03	9.0E-03	0.014	0.061
									Total Emissions:	**3.80**	**16.64**	**1.90**	**8.32**	**0.28**	**1.25**	**1.94**	**8.50**

Notes:

1. TSP emission factor based on U.S. EPA Control of Open Fugitive Dust Sources. Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988, Page 4-17.

$$E = 1.7\left(\frac{s}{1.5}\right)\left(\frac{(365-p)}{235}\right)\left(\frac{f}{15}\right) \text{ lb/day/acre}$$

where:			
	s, silt content of wood chips (%):	8.4	s - silt content (%) for lumber sawmills (mean) from AP-42, Section 13.2.2 - Unpaved Roads, 11/06, Table 13.2.2-1
	p, number of days with rainfall greater than 0.01 inch:	110	Based on AP-42, Section 13.2.2 - Unpaved Roads, 11/06, Figure 13.2.1-2.
	f (time that wind exceeds 5.36 m/s - 12 mph) (%):	12.5	Based on meteorological data averaged for 2012-2016 for Maxton, NC National Weather Service (NWS) Station
	PM_{10}/TSP ratio:	50%	PM_{10} is assumed to equal 50% of TSP based on U.S. EPA Control of Open Fugitive Dust Sources, Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988.
	$PM_{2.5}$/TSP ratio:	7.5%	$PM_{2.5}$ is assumed to equal 7.5 % of TSP U.S. EPA Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors. November 2006.

2. Emission factors obtained from NCASI document provided by the South Carolina Department of Health and Environmental Control (DHEC) for the calculation of fugitive VOC emissions from Douglas fir wood storage piles. Emission factors ranged from 1.6 to 3.6 lb C/acre-day. As Enviva has engineering data that shows VOC emissions from greenwood storage piles are less than the low end of the range of the factors listed, Enviva chose to employ the minimum emission factor from the NCASI document for purposes of conservatism.

3. The surface area for rectangular piles is calculated as {2*H*L+2*W*H+L*W} + 20% to consider the sloping pile edges. Pile dimensions were provided by Enviva.
The surface area for circular piles is calculated as $\{\Pi * R * (R^2+H^2)^{0.5}\}$ + 20% to consider the sloping pile edges. Diameter and height were provided by Enviva.

4. Emissions are calculated in tons of carbon per year by the following formula:
tons C/year = 5 acres * 365 days * 1.6 lb C/acre-day / 2000 lb/ton
Emission factor converted from as carbon to as propane by multiplying by 1.22.

Abbreviations:

EPA - Environmental Protection Agency
ft - feet
ft^2 - square feet
lb - pound
mph - miles per hour
NC - North Carolina
NCASI - National Council for Air and Stream Improvement, Inc.
NWS - National Weather Service
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
tpy - tons per year
TSP - total suspended particulate
yr - year
VOC - volatile organic compound

Table 11
Potential Emissions
Electric Powered Green Wood Chipper (IES-EPWC)
Enviva Pellets Northampton, LLC

Calculation Basis

Annual Throughput of Chipper	781,255	tons/year (dry wood)[1]
Short Term Throughput	119.40	tons/hr (dry wood)[1]
Approximate Moisture Content	50%	of total weight

Pollutant	Emission Factor		Emissions	
			Max (lb/hr)	Annual (tpy)
THC as Carbon[2]	0.0041	lb/ODT	0.49	1.60
VOC as propane[3]	0.0050	lb/ODT	0.60	1.95
Methanol[2]	0.0010	lb/ODT	0.12	0.39

Notes:

[1] The hourly and annual throughputs used for the chipper are conservatively assumed to be the same as the throughput of the dryer (note that 50% of the dryer throughput normally comes from purchased chips).

[2] Emission factor obtained from available emissions factors for chippers in AP-42 Section 10.6.3, Medium Density Fiberboard, 08/02, Table 7 and Section 10.6.4, Hardboard and Fiberboard, 10/02, Tables 7 and 9. Emission factors for THC and Methanol are the same across all three tables.

[3] Emission factor for VOC as propane is from AP-42, Section 10.6.3., Medium Density Fiberboard, 08/02, Table 7.

Table 12
Potential Emissions
Bark Hog (IES-BARK)
Enviva Pellets Northampton, LLC

Calculation Basis

Annual Throughput of Bark Hog	234,377	tons/year (dry wood)[1]
Short-term Throughput of Bark Hog	31.50	tons/hr (dry wood)[1]
Approximate Moisture Content	50%	of total weight

Pollutant	Emission Factor		Emissions	
			Max (lb/hr)	Annual (tpy)
THC as Carbon[2]	0.0041	lb/ODT	0.13	0.48
VOC as propane[3]	0.0050	lb/ODT	0.16	0.59
PM[4]	0.02	lb/ton	0.13	0.47
PM_{10}[4]	0.011	lb/ton	0.07	0.26
Methanol[2]	0.0010	lb/ODT	0.03	0.12

Notes:

[1] The annual throughput used for the bark hog is 30% of the annual throughput of the facility. The short-term throughput is 15% of maximum hourly capacity of the debarker.

[2] Emission factor obtained from available emissions factors for chippers in AP-42 Section 10.6.3, Medium Density Fiberboard, 08/02, Table 7 and Section 10.6.4, Hardboard and Fiberboard, 10/02, Tables 7 and 9. Emission factors for THC and Methanol are the same across all three tables.

[3] Emission factor for VOC as propane is from AP-42, Section 10.6.3., Medium Density Fiberboard, 08/02, Table 7.

[4] Particulate matter emission factors from the USEPA document titled *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants. Source Classification Code 3-07-008-01 (Log Debarking)*. All PM is assumed to be larger than 2.5 microns. PM emissions are assumed to be controlled due to the bark hog being partially enclosed (assumed 90% control).

Table 13
Potential Emissions
Debarker (IES-DEBARK)
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Throughput[1]	210 ton/hr
Annual Throughput[1]	781,255 ton/yr
Approximate Moisture Content	50% of total weight

Potential Criteria Pollutant Emissions

Source	Pollutant	Emission Factor (lb/ton)	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
IES-DEBARK	TSP[2]	2.0E-02	0.84	1.56
	PM_{10}[2]	1.1E-02	0.46	0.86

Notes:

1. The annual throughput used for the debarker is equal to the annual throughput of the dryers. The short-term throughput is based upon the maximum capacity of the debarker.
2. Particulate matter emission factors from the USEPA document titled *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants.* Source Classification Code 3-07-008-01 (Log Debarking). All PM is assumed to be larger than 2.5 microns in diameter. PM emissions are assumed to be controlled due to the use of water spray and the bark hog being partially enclosed (assumed 90% control).

Abbreviations:

hr - hour
lb - pound
ODT - oven dried tons
tpy - tons per year
yr - year

Table 14
Potential Emissions
Emergency Generators (IES-GN-1 and IES-GN-2) and Fire Water Pump (IES-FWP)
Enviva Pellets Northampton, LLC

Emergency Generator 1 - Emissions (IES-GN-1)

Equipment and Fuel Characteristics

Engine Output	0.26 MW
Engine Power	350 hp (brake)
Hours of Operation	500 hr/yr[1]
Heating Value of Diesel	19,300 Btu/lb
Power Conversion	7,000 Btu/hr/hp

Criteria Pollutant Emissions

Pollutant	Category	Emission Factor	Units	Emissions	
				Max lb/hr	Annual tpy
TSP	PSD	4.41E-04	lb/kW-hr (2)	0.12	2.88E-02
PM_{10}	PSD	4.41E-04	lb/kW-hr (2)	0.12	2.88E-02
$PM_{2.5}$	PSD	4.41E-04	lb/kW-hr (2)	0.12	2.88E-02
NO_x	PSD	8.82E-03	lb/kW-hr (5)	2.30	5.75E-01
SO_2	PSD	15	ppmw (3)	3.81E-03	9.52E-04
CO	PSD	7.72E-03	lb/kW-hr (2)	2.01	5.03E-01
VOC (NMHC)	PSD	2.51E-03	lb/MMBtu (4)	6.15E-03	1.54E-03

Hazardous Air Pollutant Emissions

Pollutant	Category	Emission Factor	Units	Emissions	
				Max lb/hr	Annual tpy
Acetaldehyde	HAP	5.37E-06	lb/hp-hr (4)	1.88E-03	4.70E-04
Acrolein	HAP	6.48E-07	lb/hp-hr (4)	2.27E-04	5.67E-05
Benzene	HAP	6.53E-06	lb/hp-hr (4)	2.29E-03	5.71E-04
Benzo(a)pyrene[6]	HAP	1.32E-09	lb/hp-hr (4)	4.61E-07	1.15E-07
1,3-Butadiene	HAP	2.74E-07	lb/hp-hr (4)	9.58E-05	2.39E-05
Formaldehyde	HAP	8.26E-06	lb/hp-hr (4)	2.89E-03	7.23E-04
Total PAH (POM)	HAP	1.18E-06	lb/hp-hr (4)	4.12E-04	1.03E-04
Toluene	HAP	2.86E-06	lb/hp-hr (4)	1.00E-03	2.51E-04
Xylenes	HAP	2.00E-06	lb/hp-hr (4)	6.98E-04	1.75E-04
			Highest HAP (Formaldehyde)	2.89E-03	7.23E-04
			Total HAPs	9.49E-03	2.37E-03

Notes:

[1] NSPS allows for only 100 hrs/yr of non-emergency operation of these engines (not the 500 hours shown). The PTE for the emergency generator is based on 500 hr/yr, though, because the regs allow non-emergency operation and EPA guidance is 500 hr/yr for emergency generators.

[2] Emissions factors from NSPS Subpart IIII (or 40 CFR 89.112 where applicable) in compliance with post-2009 construction.

[3] Sulfur content in accordance with Year 2010 standards of 40 CFR 80.510(a) as required by NSPS Subpart IIII.

[4] Emission factor obtained from AP-42 Section 3.3, Tables 3.3-1 Table 3.3-2.

[5] Emission factor for NOx is listed as NOx and NMHC (Non-Methane Hydrocarbons or VOC) in Table 4 of NSPS Subpart IIII. Conservatively assumed entire limit attributable to NOx.

[6] Benzo(a)pyrene is included as a HAP in Total PAH.

Table 14
Potential Emissions
Emergency Generators (IES-GN-1 and IES-GN-2) and Fire Water Pump (IES-FWP)
Enviva Pellets Northampton, LLC

Emergency Generator 2 - Emissions (IES-GN-2)

Equipment and Fuel Characteristics

Engine Output	500 kW
Engine Power	671 hp (brake)
Hours of Operation	500 hr/yr[1]
Heating Value of Diesel	19,300 Btu/lb
Power Conversion	7,000 Btu/hr/hp

Criteria Pollutant Emissions

Pollutant	Category	Emission Factor	Units	Emissions	
				Max lb/hr	Annual tpy
PM	PSD	0.021	g/hp-hr (2)	0.03	7.8E-03
PM_{10}	PSD	0.021	g/hp-hr (2)	0.03	7.8E-03
$PM_{2.5}$	PSD	0.021	g/hp-hr (2)	0.03	7.8E-03
NO_x	PSD	6.65	g/hp-hr (2)	9.83	2.46
SO_2	PSD	15.0	ppmw (3)	7.3E-03	1.8E-03
CO	PSD	0.39	g/hp-hr (2)	0.58	0.14
VOC (NMHC)	PSD	0.01	lb/hp-hr (2)	6.71	1.68

Hazardous Air Pollutant Emissions

Pollutant	Category	Emission Factor	Units	Emissions	
				Max lb/hr	Annual tpy
Acetaldehyde	HAP	2.52E-05	lb/MMTbu (4)	1.18E-04	2.96E-05
Acrolein	HAP	7.88E-06	lb/MMTbu (4)	3.70E-05	9.25E-06
Benzene	HAP	7.76E-04	lb/MMTbu (4)	3.64E-03	9.11E-04
Benzo(a)pyrene[5]	HAP	2.57E-07	lb/MMTbu (4)	1.21E-06	3.02E-07
Formaldehyde	HAP	7.89E-05	lb/MMTbu (4)	3.70E-04	9.26E-05
Naphthalene[5]	HAP	1.30E-04	lb/MMTbu (4)	6.10E-04	1.53E-04
Total PAH (POM)	HAP	2.12E-04	lb/MMTbu (4)	9.95E-04	2.49E-04
Toluene	HAP	2.81E-04	lb/MMTbu (4)	1.32E-03	3.30E-04
Xylenes	HAP	1.93E-04	lb/MMTbu (4)	9.06E-04	2.26E-04
			Highest HAP (Benzene)	3.64E-03	9.11E-04
			Total HAPs	7.39E-03	1.85E-03

Notes:

[1] NSPS allows for only 100 hrs/yr of non-emergency operation of these engines (not the 500 hours shown). The PTE for the emergency generator is based on 500 hr/yr, though, because the regs allow non-emergency operation and EPA guidance is 500 hr/yr for emergency generators.

[2] Emission factors for Particulate Matter (TSP/PM10/PM2.5), Nitrous Oxide (NOx), Volatile Organic Matter (VOC), and Carbon Monoxide (CO) obtained from generator's spec sheet. The generator's spec sheet does not include an emission factor for VOC so the hydrocarbon (HC) emission factor was used as a surrogate for VOC.

[3] Sulfur content in accordance with Year 2013 standards of 40 CFR 80.510(a) as required by NSPS Subpart IIII.

[4] Emission factor obtained from AP-42 Section 3.4, Tables 3.4-3 Table 3.4-4.

[5] Benzo(a)pyrene and naphthalene are included as HAPs in Total PAH.

Table 14
Potential Emissions
Emergency Generators (IES-GN-1 and IES-GN-2) and Fire Water Pump (IES-FWP)
Enviva Pellets Northampton, LLC

Firewater Pump Emissions (IES-FWP)

Equipment and Fuel Characteristics

Engine Output	0.22 MW
Engine Power	300 hp
Hours of Operation	500 hr/yr[1]
Heating Value of Diesel	19,300 Btu/lb
Power Conversion	7,000 Btu/hr/hp

Criteria Pollutant Emissions

Pollutant	Category	Emission Factor	Units	Emissions	
				Max lb/hr	Annual tpy
TSP	PSD	4.41E-04	lb/kW-hr (2)	0.10	2.47E-02
PM_{10}	PSD	4.41E-04	lb/kW-hr (2)	0.10	2.47E-02
$PM_{2.5}$	PSD	4.41E-04	lb/kW-hr (2)	0.10	2.47E-02
NO_x	PSD	8.82E-03	lb/kW-hr (5)	1.97	4.93E-01
SO_2	PSD	15	ppmw (3)	3.26E-03	8.16E-04
CO	PSD	7.72E-03	lb/kW-hr (2)	1.73	4.32E-01
VOC (NMHC)	PSD	2.51E-03	lb/MMBtu (4)	5.27E-03	1.32E-03

Hazardous Air Pollutant Emissions

Pollutant	Category	Emission Factor	Units	Emissions	
				Max lb/hr	Annual tpy
Acetaldehyde	HAP	5.37E-06	lb/hp-hr (4)	1.61E-03	4.03E-04
Acrolein	HAP	6.48E-07	lb/hp-hr (4)	1.94E-04	4.86E-05
Benzene	HAP	6.53E-06	lb/hp-hr (4)	1.96E-03	4.90E-04
Benzo(a)pyrene[6]	HAP	1.32E-09	lb/hp-hr (4)	3.95E-07	9.87E-08
1,3-Butadiene	HAP	2.74E-07	lb/hp-hr (4)	8.21E-05	2.05E-05
Formaldehyde	HAP	8.26E-06	lb/hp-hr (4)	2.48E-03	6.20E-04
Total PAH (POM)	HAP	1.18E-06	lb/hp-hr (4)	3.53E-04	8.82E-05
Toluene	HAP	2.86E-06	lb/hp-hr (4)	8.59E-04	2.15E-04
Xylenes	HAP	2.00E-06	lb/hp-hr (4)	5.99E-04	1.50E-04
			Highest HAP (Formaldehyde)	2.48E-03	6.20E-04
			Total HAPs	8.13E-03	2.03E-03

Notes:

[1] NSPS allows for only 100 hrs/yr of non-emergency operation of these engines (not the 500 hours shown). The PTE for the emergency generator is based on 500 hr/yr, though, because the regs allow non-emergency operation and EPA guidance is 500 hr/yr for emergency generators.

[2] Emissions factors from NSPS Subpart IIII (or 40 CFR 89.112 where applicable) in compliance with post-2009 construction.

[3] Sulfur content in accordance with Year 2010 standards of 40 CFR 80.510(a) as required by NSPS Subpart IIII.

[4] Emission factor obtained from AP-42 Section 3.3, Tables 3.3-1 Table 3.3-2.

[5] Emission factor for NOx is listed as NOx and NMHC (Non-Methane Hydrocarbons or VOC) in Table 4 of NSPS Subpart IIII. Conservatively assumed entire limit attributable to NOx.

[6] Benzo(a)pyrene is included as a HAP in Total PAH.

Table 15
Potential Emissions
Diesel Storage Tanks (IES-TK-1 through IES-TK-4)
Enviva Pellets Northampton, LLC

Source ID	Description	Design Volume[1]	Working Volume[2]	Tank Dimensions[5]		Orientation	Throughput[3]	Turnovers	VOC Emissions[4]	
				Diameter	Height/ Length					
		(gal)	(gal)	(ft)	(ft)		(gal/yr)		(lb/hr)	(tpy)
IES-TK-1	Emergency Generator #1 Fuel Storage Tank[2]	2,500	1,250	6.0	12	Horizontal	8,803	7.0	1.3E-04	5.8E-04
IES-TK-2	Fire Pump Fuel Storage Tank[2]	500	250	3.0	10.0	Horizontal	7,554	30.2	3.7E-05	1.6E-04
IES-TK-3	Mobile Fuel Diesel Storage Tank	5,000	2,500	6.0	23.7	Horizontal	200,000	80.0	7.6E-04	3.3E-03
IES-TK-4	Emergency Generator #2 Fuel Storage Tank[2]	1,000	500	5.3	6.0	Horizontal	15,958	31.9	1.3E-04	5.8E-04
								Total Emissions:	1.1E-03	4.6E-03

Notes:

1. Conservative design specifications.
2. Working volume conservatively assumed to be 50% of tank design volume because tanks will not be full at all times.
3. Throughput for IES-TK-1, IES-TK-2, and IES-TK-4 based on fuel consumption provided by Enviva and 500 hours of operation per year. Throughput for IES-TK-3 provided by Enviva.
4. Emissions calculated using EPA TANKS 4.0 software. A minimum tank length for the TANKS program of 5 feet was used to estimate the emissions for IES-TK-2.
5. IES-TK-3 length was estimated based on the capacity of the tank and the diameter.

Abbreviations:

EPA - Environmental Protection Agency
ft - feet
gal - gallon
lb - pound
yr - year
VOC - volatile organic compound

Table 16a
Haul Road Emissions
Potential Fugitive PM Emissions from Paved Roads
Enviva Pellets Northampton, LLC

Vehicle Activity	Distance Traveled per Roundtrip[1] (ft)	Trips Per Day[1]	Daily VMT	Events Per Year (days)	Empty Truck Weight (lb)	Loaded Truck Weight (lb)	Average Truck Weight (ton)	Annual VMT	PM Emission Factor[2] (lb/VMT)	PM_{10} Emission Factor[2] (lb/VMT)	$PM_{2.5}$ Emission Factor[2] (lb/VMT)	Potential PM Emissions[3]		Potential PM_{10} Emissions[3]		Potential $PM_{2.5}$ Emissions[3]	
												(lb/day)	(tpy)	(lb/day)	(tpy)	(lb/day)	(tpy)
Bark Delivery - Dumper	2,800	11	6	365	41,000	81,000	30.5	2,134	2.24	0.45	0.11	1.31	0.24	0.26	0.05	0.06	0.01
Bark Delivery - Self Unload	3,730	11	8	365	41,000	81,000	30.5	2,842	2.24	0.45	0.11	1.74	0.32	0.35	0.06	0.09	0.02
Log Delivery to Crane Storage Area	2,800	93	49	365	40,400	85,400	31.5	18,004	2.31	0.46	0.11	11.39	2.08	2.28	0.42	0.56	0.10
Log Delivery to Log Storage Area	2,800	93	49	365	40,400	85,400	31.5	18,004	2.31	0.46	0.11	11.39	2.08	2.28	0.42	0.56	0.10
Purchased Chip Delivery	2,800	114	61	365	41,000	91,000	33.0	22,095	2.42	0.48	0.12	14.68	2.68	2.94	0.54	0.72	0.13
Additive Delivery	2,000	0.26	0.1	365	41,000	91,000	33.0	36	2.42	0.48	0.12	0.02	0.00	0.00	0.00	0.00	0.00
Pellet Truck Delivery to Pellet Loadout Area (Normal Operations)	3,730	86	61	365	41,000	91,000	33.0	22,182	2.42	0.48	0.12	14.73	2.69	2.95	0.54	0.72	0.13
Dry Shavings	3,730	32	23	365	41,000	77,000	29.5	8,251	2.16	0.43	0.11	4.89	0.89	0.98	0.18	0.24	0.04
Contractor Vehicle	2,000	18	7	365	4,000	4,000	2.0	2,462	0.14	0.03	0.01	0.09	0.02	0.02	0.00	0.00	0.00
Employee Car Parking	2,000	68	26	365	4,000	4,000	2.0	9,470	0.14	0.03	6.8E-03	0.36	0.07	0.07	0.01	0.02	0.00
											Total Emissions:	60.60	11.06	12.12	2.21	2.97	0.54

Notes:

1. Distance traveled per round trip and daily trip counts were provided by Enviva.

2. Emission factors calculated based on Equation 2 from AP-42 Section 13.2.1 - Paved Roads, 01/11.

where:

E = emission factor (lb/ton)

k = particle size multiplier (dimensionless) for PM 0.011

k = particle size multiplier (dimensionless) for PM_{10} 0.0022

k = particle size multiplier (dimensionless) for $PM_{2.5}$ 0.00054

sL = mean road surface silt loading from AP-42 Table 13.2.1-3 for quarries (g/m^2) 8.2

P = No. days with rainfall greater than 0.01 inch 120 Per AP-42, Section 13.2.1, Figure 13.2.1-2 (Northampton County, NC).

3. Potential emissions calculated from appropriate emission factor times vehicle miles traveled with control efficiency of 90% for water / dust suppression activities followed by sweeping. Per Table 5 in Chapter 4 of the Air Pollution Engineering Manual, Air and Waste Management Association, page 141. Control efficiency (%) = 96-0.263*V, where V is the number of vehicle passes since application of water.

Abbreviations:

ft - feet
hr - hour
lb - pound
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
tpy - tons per year
yr - year
VMT - vehicle miles traveled
VOC - volatile organic compound

Table B-16b
Haul Road Emissions
Potential Fugitive PM Emissions from Unpaved Roads
Enviva Pellets Northampton, LLC

Vehicle Activity	Distance Traveled per Roundtrip[1] (ft)	Trips Per Day[1]	Daily VMT	Events Per Year (days)	Empty Truck Weight (lb)	Loaded Truck Weight (lb)	Average Truck Weight (ton)	Annual VMT
Log Delivery to Crane Storage Area	2,000	93	35	365	40,400	85,400	31.5	12,860
Log Delivery to Log Storage Area	2,000	93	35	365	40,400	85,400	31.5	12,860
Purchased Chip Delivery	7,000	114	151	365	41,000	91,000	33.0	55,238
Bark Delivery - Dumper	7,000	11	15	365	41,000	81,000	30.5	5,334
Additive Delivery	500	0.26	0.02	365	41,000	91,000	33.0	9
							32.4	86,300

Notes:

1. Distance traveled per round trip and daily trip counts were provided by Enviva.

Emission Calculations Unpaved Roads:

Pollutant	Emeperical Constant (k)[1]	Silt Content (S)[2]	Particle Constant a[1]	Particle Constant b[1]	Emission Factor[3]	Potential Emissions[4]
	(lb/VMT)	(%)	(-)	(-)	(lb/VMT)	(tpy)
PM	4.9	8.4	0.7	0.45	7.47	32.25
PM_{10}	1.5	8.4	0.9	0.45	2.13	9.19
$PM_{2.5}$	0.15	8.4	0.9	0.45	0.21	0.92

Notes:

1. Constants (k, a, & b) based on AP-42, Section 13.2.2 (Unpaved Roads), Table 13.2.2-2 for Industrial Roads, November 2006
2. Silt loading factor based on AP-42, Section 13.2.2 (Unpaved Roads), Table 13.2.2-1, Lumber Sawmills, November 2006
3. Emission factors calculated based on Equation 1a from AP-42 Section 13.2.2 - Unpaved Roads, 11/06.

   Particulate Emission Factor: $E_{ext} = k\,(s/12)^a \times (W/3)^b * (365-P/365)$

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

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

   s = surface material silt content (%)

   W = mean vehicle weight (tons)

   P=number of days with at least 0.01 in of precipitation during the averaging period =

   = 120 Per AP-42, Section 13.2.1, Figure 13.2.1-2 (Northampton, VA).
4. Potential emissions calculated from appropriate emission factor times vehicle miles traveled with control efficiency of 90% for water / dust suppression activities.

Abbreviations:

ft - feet
hr - hour
lb - pound
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
tpy - tons per year
yr - year
VMT - vehicle miles traveled
VOC - volatile organic compound

Table 17
Potential GHG Emissions
Facility-wide
Enviva Pellets Northampton, LLC

Operating Data:

Dryer-1 Heat Input	175.3 MMBtu/hr
Annual Heat Input	1,540,294 MMBtu/yr
Duct Burner 1 and 2 Heat Input	1 MMBtu/hr
Number of Burners	2
Operating Schedule	8,760 hrs/yr
Dryer 1 Bypass Heat Input	175 MMBtu/hr
Operating Schedule	50 hrs/yr
Dryer-2 Heat Input	180.0 MMBtu/hr
Annual Heat Input	1,576,800 MMBtu/yr
Duct Burner 3 and 4 Heat Input	1 MMBtu/hr
Number of Burners	2
Operating Schedule	8,760 hrs/yr
Dryer 2 Bypass Heat Input	180 MMBtu/hr
Operating Schedule	50 hrs/yr
RTO-1 Heat Input	32.0 MMBtu/hr
Operating Schedule	8,760 hrs/yr
Furnace 1 Bypass Heat Input	175 MMBtu/hr
Operating Schedule	50 hrs/yr
Furnace 1 Idle Heat Input	5 MMBtu/hr
Operating Schedule	500 hrs/yr
RTO-2 Heat Input	32.0 MMBtu/hr
Operating Schedule	8,760 hrs/yr
Furnace 2 Bypass Heat Input	180 MMBtu/hr
Operating Schedule	50 hrs/yr
Furnace 2 Idle Heat Input	5 MMBtu/hr
Operating Schedule	500 hrs/yr
RCO-1 Heat Input	184,558.6 MMBtu/yr
Operating Schedule	8,760 hrs/yr
RCO-2 Heat Input	192,112.5 MMBtu/yr
Operating Schedule	8,760 hrs/yr
Propane Vaporizer Heat Input	1 MMBtu/hr
Operating Schedule	8,760 hrs/yr
Emergency Generator 1 Output	350 bhp
Operating Schedule	500 hrs/yr
Power Conversion	7,000 Btu/hr/hp
Energy Input	2.450 MMBtu/hr
Emergency Generator 2 Output	671 bhp
Operating Schedule	500 hrs/yr
Power Conversion	7,000 Btu/hr/hp
Energy Input	4.69 MMBtu/hr
Fire Water Pump Output	300 bhp
Operating Schedule	500 hrs/yr
Power Conversion	7,000 Btu/hr/hp
Energy Input	2.100 MMBtu/hr

Table 17
Potential GHG Emissions
Facility-wide
Enviva Pellets Northampton, LLC

Emission Unit ID	Fuel Type	Emission Factors from Table C-1 (kg/MMBtu)[1,2]			Tier 1 Emissions (short tons)[2]			
		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	Total CO_2e
ES-DRYER-1	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	159,259.79	306	1,821	161,387
IES-DDB-1 and -2	Propane	62.87	7.50E-02	1.79E-01	1214.16	1.45	3.45	1,219
ES-DRYERBYP-1	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	906.26	1.74	10.37	918
ES-DRYER-2	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	163,034.40	313	1,865	165,212
IES-DDB-3 and -4	Propane	62.87	7.50E-02	1.79E-01	1214.16	1.45	3.45	1,219
ES-DRYERBYP-2	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	930.56	1.79	10.64	943
CD-RTO-1	Propane	62.87	7.50E-02	1.79E-01	19426.62	23.17	55.25	19,505
ES-FURNACEBYP-1	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	906.26	1.74	10.37	918
ES-FURNACEBYP-1 (Idle Mode)	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	258.49	0.50	2.96	262
CD-RTO-2	Propane	62.87	7.50E-02	1.79E-01	19426.62	23.17	55.25	19,505
ES-FURNACEBYP-2	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	930.56	1.79	10.64	943
ES-FURNACEBYP-2 (Idle Mode)	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	258.49	0.50	2.96	262
CD-RCO-1	Propane	62.87	7.50E-02	1.79E-01	12790.20	15.26	36.37	12,842
CD-RCO-2	Propane	62.87	7.50E-02	1.79E-01	13313.70	15.88	37.86	13,367
IES-PVAP	Propane	62.87	7.50E-02	1.79E-01	607.08	0.72	1.73	610
IES-GN-1	No. 2 Fuel Oil (Distillate)	73.96	7.50E-02	1.79E-01	100	1.01E-01	2.41E-01	100
IES-GN-2	No. 2 Fuel Oil (Distillate)	73.96	7.50E-02	1.79E-01	191	1.94E-01	4.63E-01	192
IES-FWP	No. 2 Fuel Oil (Distillate)	73.96	7.50E-02	1.79E-01	86	8.68E-02	2.07E-01	86

[1] Emission factors from Table C-1 and C-2 of GHG Reporting Rule. Emission factors for methane and N_2O already multiplied by their respective GWPs of 25 and 298.

[2] As per VADEQ guidance, VADEQ has adopted the GHG Biomass Deferral Rule which excludes CO_2 emissions from biomass combustion.

ATTACHMENT 2

Hearing Officer's Report and Recommendations

Enviva Pellets Northampton, LLC Public Hearing
August 20, 2019
Northampton High School
Gaston, NC

Public Comment Period: July 19, 2019 through August 23, 2019

Pertaining to Permit Application No. 6600167.18A and
Draft Air Permit No. 10203R06 for:

Enviva Pellets Northampton, LLC
309 Enviva Boulevard
Garysburg, Northampton County, NC
Facility ID No. 6600167
Fee Class: Title V
PSD Class: Major

Hearing Officer
Bruce Ingle, Regional Supervisor, Mooresville Regional Office

Background

On October 1, 2018, the North Carolina Department of Environmental Quality (NC DEQ), Division of Air Quality (DAQ) received an air quality permit application (App. No. 6600167.18A) from Enviva Pellets Northampton, LLC for the modification of its facility located at 309 Enviva Boulevard in Garysburg, North Carolina. The facility submitted an amended application on April 1, 2019. The facility produces wood pellets using the following process equipment: a debarker, wood chipper, green wood hammermills, wood-fired rotary dryer, dry hammermills, dry shavings handling, screeners, pellet presses and coolers, product loadout operations, and other process activities. The permit application requests the following modifications:

- Increase the permitted production rate up to 781,255 ODT per year;
- Cap the amount of softwood to be a maximum of 80%;
- Install a new regenerative thermal oxidizer (RTO) for VOC and HAP control on the existing wood-fired direct heat drying system;
- Install a new direct-fired wood dryer equipped with a new wet electrostatic precipitator in series with a second regenerative thermal oxidizer (construction is optional by application);
- Install four new bagfilters for PM control on the wood handling and dry shavings material operations;
- Install two new Dry Shavings Hammermills and route the exhaust to a new wet scrubber in series with a new regenerative catalytic oxidizer for PM, VOC, and HAP control;
- Install a new scrubber and catalytic oxidizer for PM, VOC, and HAP control on the existing Dry Hammermills;
- Install a new scrubber and catalytic oxidizer for PM, VOC, and HAP control on the exhaust from the Pellet Presses and Pellet Coolers cyclones.

These modifications triggered an air toxic compliance demonstration for 13 toxic air pollutants for 13 different sources. Enviva Pellets Northampton, LLC conducted air dispersion modeling for the TAPs with emissions in excess of the Toxic Air Pollutant Permitting Emission Rates (TPER) thresholds to demonstrate compliance with the Acceptable Ambient Levels (AALs). All modeled TAPs were determined to be less than 24% of the AALs (worst-case TAP) and the modeling was approved by DAQ's Air Quality Analysis Branch (AQAB) on June 3, 2019.

With the addition of the proposed air pollution control devices, the facility will be required to limit emissions from particulate matter, particulate matter less than 10 micrometers, particulate matter less than 2.5 micrometers, volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) to less than 250 tons per consecutive 12-month period for each pollutant in order to avoid the requirements of PSD. The modification also controls the emissions of hazardous air pollutants (HAPs) where the facility-wide annual combined HAPS are less than 25 tons per consecutive 12-month period and any single HAP to less than 10 tons per consecutive 12-month period. These limitations become effective following the complete installation of all controls as prescribed by the schedule contained in the draft permit.

The facility is currently a major source under prevention of significant deterioration (PSD) rules. Following are a summary of emissions before and after the modification…

Pollutant	Estimated Potential Emissions from Permit 10203R04 (in tons per year)	Estimated Potential Emissions from Permit 10203R06 (in tons per year)
Decreases		
Volatile Organic Compounds	456.40	129.68
Hazardous Air Pollutants	37.82	21.71
PM-10	121.79	118.75
PM-2.5	93.79	83.75
Increases		
NOx	126.57	242.21
CO	61.88	182.73
PM	128.84	148.97
SO2	19.20	39.52
Co2e	162,292.20	399,490.52

On July 19, 2019, a notice of public hearing was posted in the Roanoke Times and on the DAQ website. The public hearing was held on August 20, 2019 in Gaston, NC at the Northampton High School. The public comment period was July 19, 2019 through August 23, 2019. Copies of the permit application review and draft air permit were also posted on the Division of Air Quality website for public review. Copies of the air quality permit application and related documents were available for public review in DAQ's Raleigh Central Office (RCO) and Raleigh Regional Office (RRO) throughout the public comment period.

Air Quality Permit Application and Review

DAQ's mission is to work with the state's citizens to protect and improve outdoor, or ambient, air quality in North Carolina for the health, benefit, and economic well-being of all. To accomplish this mission, DAQ requires industrial facilities to apply for and receive air quality permits prior to construction and operation or modification of the air pollution sources to ensure compliance with all applicable federal and state regulations. Permit application No. 6600167.18A was received on October 1, 2018 and an amended version was received on April 1, 2019 for a modification that incorporates emission reduction efforts to comply with 15A NCAC 02Q .0317 Avoidance Conditions for 15A NCAC 02D .0530: Prevention of Significant Deterioration and 15A NCAC 02Q .0317 Avoidance Condition for 15A NCAC 02D .1111: Maximum Available Control Technology (MACT) Standards for HAPs. The proposed modification is also being implemented to meet new customer demands for increased softwood percentage and production rates.

Richard Simpson, permit engineer in the DAQ's RCO, reviewed the application submitted by Enviva Pellets Northampton, LLC and determined that the modifications requested by the facility would comply with all applicable federal and state air quality requirements. This permit action will address the following main changes associated with the modification as outlined in the application:

- Increase production rate from an approximate actual facility throughput of 535, 260 ODT per year to a potential facility throughput at 781,255 ODT per year by upgrading pellet dies with a new prototype;
- Increase the amount of softwood processed from 30% to a maximum of 80%;

- For the existing Dryer (ES-DRYER-1), add a regenerative thermal oxidizer (CD-RTO-1) after the existing wet electrostatic precipitator (CD-WESP-1) for volatile organic compound (VOC), HAP and particulate matter (PM) emissions control;
- Install a new direct-fired wood dryer (ES-DRYER-2) equipped with a new wet electrostatic precipitator (CD-WESP-2) in series with a regenerative thermal oxidizer (CD-RTO-2);
- Add a new dryer bypass stack (ES-DRYBYP-2) and furnace bypass stack (ES-FURNACEBYP-2) for malfunctions and low load startups, shutdowns, and idling operations;
- Remove two existing Green Wood Hammermills (previously referred to as wood re-chippers) and construct five new Green Hammermills (ES-GWH-1 through ES-GWH-5) and route the exhaust to the existing wet electrostatic precipitator (CD-WESP-1) in series with a new regenerative thermal oxidizer (CD-RTO-1). The Green Hammermills will have the capability to be exhausted to CD-WESP-2 and CD-RTO-2 when CD-WESP-1 and CD-RTO-1 are shut down;
- Existing Dry Wood Handling (ES-DWH-1 and ES-DWH-2) will exhaust to new bagfilters (CD-DWH-BF-1 and CD-DWH-BF-2);
- Install Dry Shaving Material Handling (ES-DRYSHAVE-1), Dry Shavings Reception (ES-DSR-1) with associated bagfilter (CD-DSR-BF), and a Dry Shavings Silo (ES-DSS) with associated bagfilter (CD-DSS-BF);
- Install two new Dry Shavings Hammermills (ES-DSHM-1 and ES-DSHM-2) for dry shavings and route the exhaust to a new wet scrubber (CD-WS-1) in series with a new regenerative catalytic oxidizer (CD-RCO-1) that can also operate as a regenerative thermal oxidizer;
- Existing Dry Hammermills (ES-HM-1 through 8) will exhaust from the existing bagfilters to a new wet scrubber (CD-WS-1) in series with a new regenerative catalytic oxidizer (CD-RCO-1);
- Route exhaust from the existing dust control system to a new wet scrubber (CD-WS-1_and regenerative catalytic oxidizer (CD-RCO-1) that can also operate as an RTO and
- Exhaust from the Pellet Presses and Pellet Coolers cyclones will be routed to a new wet scrubber (CD-WS-2) in series with a new regenerative catalytic oxidizer (CD-RCO-2) that can also operate as a regenerative thermal oxidizer.

Unless the public comments received during the public hearing reveal that DAQ was in error or incomplete in its evaluation of the proposed wood pellets plant from an air quality standpoint, and if the applicant has met all federal and state laws, regulations, and rules for the protection of the environment, the division is obligated to issue an air permit to Enviva Pellets Northampton, LLC. The following hearing officer's responses to written and oral public comments will address issues raised in light of these requirements.

Public Comments

Ninety-eight people were in attendance at the public hearing on August 20, 2019. Thirty-nine spoke at the hearing. Thirteen spoke in favor of the permit. Twenty-four spoke against the permit and two speakers did not express an opinion with regard to the permit. In addition to the speakers, three citizens provided written comments none of which addressed the issuance of the permit.

Additionally, 2,405 emails were received during the public comment period.

Of the written and oral comments received, the majority opposed DAQ granting the air permit. The comments have been separated into two sections. Section 1 summarizes and addresses the comments submitted by the Environmental Integrity Project (EIP) and the Southern Environmental Law Center (SELC).

Section 2 addresses comments received from individuals representing themselves or submitted on behalf of an organization. Those comments with similar concerns have been grouped together.

SECTION 1 - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 1 (EIP & SELC Letter Item - I.A):

To estimate NOx emissions from the existing dryer (ES-DRYER-1), Enviva states that "NOx emissions [are] based on stack test results from [a] similar Enviva facility plus 30% contingency." As has been the case with Enviva's other recent permit applications, Enviva provides no further details about which facility and what specific test it relies on, and DAQ admits it has not even requested the tests from Enviva. Here, however, Enviva Northampton has already conducted NOx testing on this dryer that resulted in NOx emissions roughly 25% higher than what Enviva now claims the dryer will emit. ***Most troubling, accepting all of Enviva's other emission factors but utilizing the source-specific Northampton test means the facility will have a PTE of at least 266 tpy,*** *exceeding the major source threshold.*

The 2013 compliance testing at Enviva Northampton, the only compliance testing required at the facility, resulted in an emission rate of 27.8 pounds per hour (lb/hr), which equates to 121.8 tpy. Despite the results of this source-specific testing, Enviva now claims that this same dryer has a lower PTE of 22.23 lb/hr (97.4 tpy), even when including a 30% contingency, based on tests at a different, unidentified Enviva plant. Additionally, DAQ has repeatedly approved a PTE for the existing dryer of 125.5 tpy, presumably also based on the source-specific test, which is significantly higher than the 97.4 tpy Enviva now claims the dryer will emit. For instance, in every single permit review issued by DAQ for Enviva Northampton since the testing occurred, including the most recent review in September 2017, DAQ lists the dryer's PTE as 125.5 tpy- until now.

There is no explanation provided in the permit record indicating that the 2013 source-specific testing is no longer applicable to estimate potential NOx emissions from the existing dryer, nor is there any indication that Enviva has, since the 2013 testing, somehow modified the dryer to reduce NOx emissions. For instance, the annual heat input rating listed in the current application has remained unchanged as compared to prior applications and the 2013 testing. Nor has Enviva stated that this particular modification would somehow result in lower NOx emissions - In fact, the addition of the RTO will actually lead to a slight increase in NOx emissions. Although DAQ believes Enviva may have improved the efficiency of the furnace, DAQ concedes that Enviva did not provide details to support that idea; rather, DAQ merely "assumed" this would be true.

Over the past year, DAQ and Enviva have consistently dismissed the applicability of non-source-specific testing when presented in public comments as a means for estimating a facility's potential emission. This was true even when the facility at issue was under construction and there was no source-specific testing available. For instance, DAQ dismissed tests from numerous facilities relating to VOC emissions at the Enviva Hamlet plant, stating that "[s]tack test data for any facility provides only data for that specific facility ... ***data specific to one Enviva facility should not be assumed to be applicable to another facility."*** *Instead, DAQ and Enviva consistently praise the value of source-specific testing after construction to verify emission estimates. Yet here, Enviva is essentially doing the exact opposite-*

Enviva is ignoring source- specific testing and utilizing testing from a different, unspecified Enviva plant to justify a lower emission rate that conveniently allows the plant to barely escape the major source threshold.

Because PTE is a "worst case" emission calculation, DAQ must reject the lower emission factor proposed by Enviva and rely instead on the source-specific emission factor, unless Enviva can somehow demonstrate that it is no longer capable of emitting NOx at the higher rate. Moreover, any operating practices or physical changes that have enabled the plant to reduce NOx emissions must be incorporated as enforceable permit conditions in order to adequately restrict PTE to avoid PSD. Otherwise, DAQ must implement limits restricting the heat input rate or operating hours of the dryer's furnace in order to restrict PTE to below the major source threshold. Alternatively, Enviva may opt to retain its major source status and treat this modification as a major modification subject to PSD.

Hearing Officer's Response to This Comment:
The DAQ agrees that Enviva Northampton NOx emission factors as presented in the application differ from those established during the site-specific stack testing. The stack test performed October 2013 resulted in a NOx emission factor of 27.8 lb/hr with an associated hardwood/softwood ratio of 94%/6%. During testing, the reported process rate of the dryer was approximately 60 oven dried tons (ODT) per hour. The described process rate of the dryer is 71.71 ODT/hr with a maximum heat capacity of 175.3 million Btu/hr. Scaling up the tested NOx emission factor to account for the described process rate of the existing dryer equates to an emission factor of 33.48 lb/hr or 0.47 lb/ODT. It should be noted that Enviva Northampton's most recently submitted inventories use this scaled factor to calculate its actual annual emissions.

The proposed NOx emission factor in the application is 22.23 lb/hr with an associated hardwood/softwood content of 20%/80% and with the operation of a proposed regenerative thermal oxidizer (RTO). In preparing its application, Enviva evaluated five different dryer NOx source tests from their Cottondale facility where the dryers were being controlled by an RTO. Those results indicated a NOx emission factor that ranged from 10.0 lb/hr to 17.1 lb/hr. Enviva took the highest factor of 17.1 lb/hr from a November 2011 test with an added 30% contingency factor, equating to the submitted 22.23 lb/hr. Each of the Cottondale dryers have a maximum capacity of 151 million Btu/hr.

The DAQ Stationary Source Compliance Branch Supervisor, Gary Saunders reviewed the supplied Cottondale Dryer 2 November 2011 engineering test and supplied the following comments via email:

> *I have reviewed the test data that was supplied for the Cottondale, Florida facility. As noted in the pages supplied, it was an "engineering test" conducted on November 16, 2011. There are a couple of points worth noting with this test including the note at the bottom that "the methods may not have been strictly followed":*
>
> *It appears that a single moisture test was conducted during the first run of the two NOx (and VOC) runs to represent the moisture in the stack during the two runs. If the moisture does not vary significantly (and there is no way to tell from a single run) then this does not present a serious issue. The moisture content in the gas stream is quite high at nearly 47% by volume. The presence of a high moisture level may help in the reduction of NOx formation during the combustion process by limiting the peak flame temperature that has a significant influence on formation.*
>
> *The velocity traverses conducted during each test run indicated two separate concerns. First was the temperature variation between individual points. That is likely due to the operation of the RTO and the way it might cycle through the regenerative cycle.*

The second item was the fact that flow rates were much higher on one side of the traverse than the other. It is possible that there is some biased flow in the ducts with implications for stratification in the duct work.

It appears that the pollutant test runs are sampled at a single point as there is no indication that multiple points were sampled or that a stratification test (part of the Method 7E testing methodology) was conducted prior to the sampling to justify single point sampling.

Finally, the engineering test consists of only two runs that are each 45 minutes in length. Although the calibration, bias, and drift tests for the emissions test monitors look correct and the calculations for the adjusted values also appear correct, there is concern that averaging two shortened runs may not be as representative of emissions that might be available from a more comprehensive test of three runs with all the testing requirements fulfilled.

I also checked the calculations contained in the report. The calculations associated with the flow rates and the concentrations appear correct (with slight differences that can be attributed to rounding issues) and there are example calculations for both moisture and gas flow rate calculations included in the report. Although example calculations for the emission rate are not given, calculation of the individual run values for lb/hr are also within the rounding error of the various data. However, the "average" lb/hr value reported from the table is not the average from the two runs and I am unable to determine how that value was derived.

Finally, because NOx formation is typically related to combustion conditions that may be nonlinear with respect to production rates and maybe dependent upon RTO or dryer combustion conditions, more comprehensive data than this engineering study may be necessary to determine whether this emission rate is characteristic of performance over a broad range of operation levels or for all systems that are similarly configured.

As a result of these comments and those presented by EIP, DAQ supports the use of site-specific emission factors for calculating NOx emissions from the existing and the proposed dryers.

The draft permit requires NOx testing to establish a new NOx emission factor once all the requirements of Section 2.3 A., "Actions to be Taken by the Permittee", have been met. Until that time, Enviva Northampton is not permitted to operate its existing dryer above current permitted levels as listed in Permit Conditions 2.2 A.2.b (i through iii). Existing inventories indicate NOx emissions below PSD significant thresholds at the current production rates. Once the new emission factor is approved, Enviva Northampton can submit an application to update the permitted limitations and conditions. After the construction has been completed, the facility is required to perform an initial stack test for all criteria pollutants and establish site-specific emission factors to demonstrate compliance with all of the PSD avoidance limits in Permit Condition 2.2 A.3.b.

Therefore, DAQ will require the Enviva Northampton scaled site-specific NOx emission factor of 33.48 lb/hr to be used until all of the proposed control devices are installed (excluding the new wood dryer controls in the event the second dryer is not installed) and new site-specific approved NOx factors have been established through stack testing.

Recommendation: It is recommended that the permit reflect the requirement of Enviva Northampton to use the scaled site-specific NOx emission factor of 33.48 lb/hr until all of the proposed control devices are installed (excluding the new wood dryer controls in the event the second dryer is not installed) and new site-specific approved NOx emission factors have been established through stack testing.

Comment 2 (EIP & SELC Letter - Item I.B):

As noted above, the second wood-fired furnace and dryer (ES-DRYER-2) that Enviva intends to install has a slightly higher heat input rating of 180 MMBtu/hr, compared to the 175.3 MMBtu/hr for the existing dryer. Despite the fact that higher heat input should mean more NOx emissions, Enviva claims that both dryers will have the same emission rate for NOx-22.23 lb/hr. Regardless of this apparent (and unexplained) discrepancy, Enviva appears to have otherwise underestimated the new dryer's PTE based on Enviva's own emissions estimates for an identical dryer at its Southampton, Virginia facility. ***Utilizing the emissions estimates for the Southampton dryer, even assuming all of Enviva's other emissions factors are correct (including for Dryer 1), results in the Northampton facility having a NOx PTE of 265,*** *exceeding the major source threshold.*

In its parallel permitting process in Virginia, Enviva is also installing a new 180 MMBtu/hr wood-fired furnace at the nearly identical Enviva Southampton facility. In almost all respects, the application for that permit modification is identical to the Enviva Northampton modification, e.g. both applications contemplate an increase to 781,255 tpy, 80% softwood, and the installation of RTOs. Yet for the new 180 MMBtu/hr dryer at Southampton, Enviva lists the emission rate of27.73 lb/hr, based on "stack test data from similar Enviva facilities." Enviva, of course, does not provide details on the test or facility, but this rate is remarkably similar to the rate from the Enviva Northampton stack test discussed above-27.8 lb/hr.

Given Enviva's use of a 27.73 lb/hr NOx emission rate for the 180 MMBtu/hr furnace at Southampton, Enviva's contention that an identical 180 MMBtu/hr furnace at Northampton will emit at a rate of only 22.23 lb/hr is highly suspect. DAQ must require Enviva to identify any differences between the 180 MMBtu/hr furnaces at the two plants that justifies Enviva's use of different NOx emission factors; if there are none, then DAQ must at a minimum utilize the higher emission rate of 27.73 lb/hr, which results in a facility-wide PTE of 265 tpy (ignoring, of course, the underestimated emission issues with Dryer I discussed above).

Moreover, even the 27.73 lb/hr rate used for Enviva Southampton may be an underestimation. If that rate does come from the Enviva Northampton testing, then it is flawed on at least three grounds: first, the rate is lower than the actual tested rate of 27.8 lb/hr; second, the testing occurred on a furnace with a lower heat input rate of 175.3 MMBtu/hr; third, the testing occurred on a dryer without an RTO, yet the new dryer will include an RTO, meaning NOx emissions from the RTO itself are not represented in the emission rate.

Hearing Officer's Response to This Comment:
EIP contends that Enviva Northampton's proposed dryer should have a different NOx emission factor than the existing dryer due to the size difference. The existing dryer is rated at 175.2 million Btu/hr and the new dryer is rated at 180 million Btu/hr; a difference less than 3%. Because DAQ is requiring the use of a higher NOx emission factor than presented in the application or suggested by EIP, DAQ believes the scaled emission factor of 33.48 lb/hr is appropriate for both dryers until new site-specific approved NOx factors have been established.

Recommendation: No changes other than those discussed in response to SECTION I, Item 1.A above are deemed necessary to address this comment.

Comment 3 (EIP & SELC Letter - Item I.C):

Under the Clean Air Act's PSD program, a wood pellet facility such as Enviva Northampton is considered a major stationary source if it "emits, or has the potential to emit, 250 tons per year or more of a regulated [new source review] pollutant." 40 C.F.R. § 52.21(B)(l)(i)(b). Potential to emit, in turn, is defined as the "maximum capacity of a stationary source to emit a pollutant under its physical and operational design." 40 C.F.R. § 52.21(B)(4) (emphasis added). As EPA and courts have explained, PTE is a "worst case emissions calculation" that is "not to be confused with actual emissions, which may be significantly lower."

As explained above, Enviva's PTE calculations for NOx emissions are flawed for two independent reasons. Utilizing the appropriate and verifiable rates listed above for NOx emissions from each of the two dryers, i.e. 27.8 lb/hr for Dryer 1 and 27.72 lb/hr for Dryer 2, the two dryers have a combined PTE of243.6 tpy. The non-dryer sources at Enviva Northampton, meanwhile, have a combined PTE of 47.25 tpy, ***meaning the facility-wide PTE is 290.85 tpy.*** *Moreover, even this calculation is likely an underestimation of the facility's potential NOx emissions because it does not include NOx emissions from the dryer RTOs (as explained above, the 2013 stack test occurred on a dryer without an RTO, and therefore did not include NOx emissions from the RTO Enviva will install as part of this modification), as well as the other flaws with the Dryer 2 emission rate addressed above.* ***Therefore, the actual PTE is likely to exceed at least 300 tpy.*** *Accordingly, the Enviva Northampton modification results in a PTE that exceeds the major-source threshold of250 tpy, and the facility is therefore a PSD major source for NOx.*

Additionally, because Enviva Northampton is currently a major source, unless the facility truly reduces its PTE to below 250 tpy, then the relevant threshold for PSD applicability is not 250 tpy, as it would be for a minor source, but is actually the threshold for a major modification applicable to major sources. For NOx, a major modification subject to PSD is any modification that increases PTE by greater than 40 tpy. 40 C.F.R. § 52.21(b)(23)(i). Here, of course, Enviva is proposing to increase NOx by 115 tpy by its own calculations. Further, the proposed modification would also constitute a major modification for carbon monoxide, as Enviva proposes to increase carbon monoxide emissions by 120 tpy, exceeding the significance threshold of 100 tpy.

For the foregoing reasons, DAQ must either require Enviva Northampton to apply for a PSD permit governing the modification, or DAQ must implement stricter operating limits to reduce PTE, such as limiting the annual heat input rate of the dryers. Currently, the two dryers have a combined annual heat input capacity of 3,112,248 MMBtu/yr. According to our calculations the permit must restrict the annual heat input to less than about 2,600,000 MMBtu/yr in order to restrict facility-wide NOx emissions to below the major source PSD threshold.

Finally, we emphasize that reliance on post-construction stack testing is especially inappropriate where the facility's PTE has already been established by source-specific testing. PSD is a preconstruction review, and limits established to avoid PSD must be sufficient to ensure a source does not undertake a major modification.

Hearing Officer's Response to This Comment:
DAQ agrees that the facility is currently classified as a major source for PSD because of volatile organic compounds (VOC) emissions. However, Enviva Northampton proposes to install wet electrostatic precipitators,

regenerative thermal or catalytic oxidizers, scrubbers, and new bagfilters as part of this application to limit facility-wide emissions of particulate matter, particulate matter less than 10 micrometers, particulate matter less than 2.5 micrometers, volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) to less than 250 tons per consecutive 12-month period for each pollutant. These limitations become effective following the complete installation of all controls as prescribed by the schedule contained in the permit. Once completed, this facility will be classified as a minor source for PSD for all pollutants. The restrictions to limit PTE from the facility are established in Permit Condition 2.2 A.3 of the permit.

Recommendation: No changes other than those discussed in response to SECTION I, Item 1.A above are deemed necessary to address this comment.

Comment 4 (EIP & SELC Letter - Item I.D):

As discussed above, Enviva is rejecting source-specific testing for NOx and instead using testing from a different but "similar" Enviva facility. As we have already emphasized, this is almost certainly wholly inappropriate in the face of representative source-specific testing. However, to the extent that DAQ decides to rely on the non-source-specific Enviva testing, Enviva must at least identify the testing, make the testing part of the permit record, and explain why it is more representative than source-specific testing. Furthermore, even if DAQ rejects the non-source- specific test for Dryer 1, Enviva still relies on the unidentified test for Dryer 2, which again is dubious considering the higher NOx emission rate selected for the Enviva Southampton plant.

DAQ concedes that Enviva has not submitted the "similar" NOx test to DAQ for review, nor has DAQ requested it. Nor has Enviva even provided the most basic of information regarding this test to DAQ, such as which facility was tested and the specific results of the test. While we do not necessarily expect DAQ to scrutinize every single source of every emission factor in every permit (although we certainly would not object), where a company is proposing to reject source- specific stack testing in favor of non-source-specific testing that is significantly lower, DAQ must verify that the testing is not only valid, but more suitable than the source-specific test.

Furthermore, for several reasons, we are skeptical that the test Enviva relies upon is truly representative of Northampton's existing wood dryer, or if it is, that it has ever been submitted to a state agency for review. First, there are only three Enviva plants in existence that operate a 175.3 MMBtu/hr wood-fired furnace: Enviva Northampton, Enviva Southampton, and Enviva Ahoskie. Each of the other Enviva plants has significantly different heat input ratings.

Therefore, the only two plants Enviva could reasonably call "similar" are Ahoskie and Southampton, but neither appear to have performed NOx testing that supports Enviva's emission factor. First, we cannot find any NOx testing for Enviva Ahoskie in the files available on DAQ's website, but permit applications for that plant do reference 2012 NOx testing. That test reportedly produced an emission factor of 0.243 lb/MMBtu, which equates to 186 tpy for Dryer 1 at Northampton-about double the 97.4 tpy that Enviva now claims for Northampton.

At Enviva Southampton, meanwhile, any compliance testing there could not possibly be representative of Enviva Northampton, because the furnace there is required to operate with selective non-catalytic reduction (SNCR), and the SNCR is required by permit to reduce NOx by at least 50%. As such, no

compliance testing submitted to the state agency would have occurred without using SNCR. Moreover, the stack testing that Southampton relies upon in the parallel proceeding for that plant is listed as "Southampton July 2015 VOC Compliance Stack Test." Virginia DAQ has confirmed that the July 2015 testing was only for VOC emissions and to date the permit writer has not been able to provide other NOx testing.

In sum, Enviva supports its calculation that the modified Northampton plant will not be a major source subject to PSD by relying on a single stack test at an unidentified Enviva facility. We have not been able to find any testing that supports Enviva's proposed emission rate. In fact, the only facility that is truly similar in terms of comparable furnace operations, Enviva Ahoskie, has apparently tested and produced a far higher emission factor.

Again, we believe source-specific testing should trump any non-source-specific testing, but if Enviva believes some other testing is somehow more representative, it must explain why and include the stack test results in the public permit record. Although we believe Enviva should always include this information in its permit applications, here, in the face of source-specific testing, it is especially vital that Enviva justify its decision to ignore that testing.

Moreover, DAQ has a duty as the permitting agency to verify the information provided by Enviva. Instead, as has been shown over the course of the past year, DAQ has repeatedly accepted Enviva's word as it relates to emissions calculations and other permitting decisions, even when faced with credible, contrary evidence. In particular, for the Northampton permit, DAQ has once again taken Enviva at face value by failing to even request copies or results of the stack testing Enviva purportedly relies on and by making assumptions in favor of the company, rather than acting to protect the people of North Carolina.

Hearing Officer's Response to This Comment:
As noted above in SECTION I, Item I.A., the engineering test that Enviva Northampton relied upon for the dryer NOx emission factor was from the Enviva Cottondale facility conducted in November 2011. Enviva Northampton supplied the engineering test on September 16, 2019. However, after review of the Cottondale test, DAQ agrees that the use of the Enviva Northampton site-specific stack tests are more appropriate as discussed in SECTION I, Item 1.A above.

Recommendation: No changes other than those discussed in response to SECTION I, Item 1.A above are deemed necessary to address this comment.

SECTION II - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 5 (EIP & SELC Letter - Item II.A.) -

At a fundamental level, the dryer bypass provision allows for significant periods of unnecessary air pollution. For instance, if Enviva has only used 15 hours of dryer bypass in the prior 12- month

period, the company has little incentive to shut down while addressing, for instance, a malfunction in the RTO. Most importantly, however, our modeling shows that by continuing to operate the facility's dryers at full capacity during use of the bypass stacks, Enviva will cause exceedances of the NAAQS and AALs.

Although malfunctions are generally considered too "unpredictable" to model, when, as here, a permit condition explicitly allows for a set amount of time of malfunction bypass, the layer of unpredictability for purposes of modeling is removed. In other words, if the permit treats malfunctions within the first 50 hours differently than malfunctions outside of that window, the impacts from the first 50 hours must be considered. Moreover, as discussed below, continuing to operate at full capacity while a control device malfunctions is not, in the totality, a malfunction-the decision to continue operating results in predictable and quantifiable emissions, based on which we have produce.A.d the following modeling data.

1. *NAAQS Exceedances*

Under North Carolina's federally approved state implementation plan (SIP), "any source of air pollution shall be operated with such control or in such manner that the source shall not cause the [N"AAQS] to be exceeded at any point beyond the premises." 15A N.C. Admin. Code 2D .050l(c). We conducted air dispersion modeling demonstrating that, with the emission rates and parameters given by Enviva, operations during dryer bypass mode will cause impermissible exceedances of the NAAQS for PM2.5, PMI0, and NOx. ·

Our air dispersion modeling utilized the data and parameters from Enviva' s own modeling files for the Northampton modification as well as the permit application. This modeling shows that "under dryer bypass conditions lasting only two (2) hours, modeled impacts (added to the appropriate background concentrations) result in ambient concentrations that exceed the PMI0 (24-hour), PM2.5 (24-hour), and NOX (I-hour) NAAQS." Specifically, during a two-hour bypass for one dryer, the relevant NAAQS were exceeded by 121 $\mu g/m^3$ (PM2.5), 143 $\mu g/m^3$ (PMIO), and 2,816 $\mu g/m^3$ (NOx):

TABLE 11
***NAAQS** RESULTS SUMMARY- **(1)** DRYER BYPASS*

Pollutant	Period	Metric	Impact (ug/m3)	Back (ug/m3)	Tata/ (ug/m3)	NMQS (ug/m3)	OK?
PM2.5	24-hour	H8H impact/5 years	140	16	156	35	NO
PM10	24-hour	H6H impact/5 years	235	58	293	150	NO
NOX	1-hour	H8H impact/5 years	2,946	58	3,004	188	NO

As this table and our report show, authorizing up to 50 hours per year for each dryer to continue operating and bypass controls during malfunctions is unacceptable because such operations cause or contribute to impermissible exceedances of the NAAQS.

Hearing Officer's Response to This Comment:

The DAQ agrees that North Carolina regulations define "malfunctions" as "any unavoidable failure of air pollution control equipment, process equipment, or process to operate in a normal or usual manner that results in excess emissions" [15A NCAC 02D .0535(a)(2)]. Similarly, EPA has defined malfunction as a "sudden and unavoidable" or "unpredictable and unforeseen" event [80 FR 33,840, at 33,842 and n. 2 (June 12, 2015)]. Accordingly, excess emissions from foreseeable events, including avoidable failures, are not considered malfunctions. *See, e.g.*, 15A NCAC 02D .0535(a)(2) ("Poor maintenance, careless operations or any other upset condition within the control of the emission source are not considered a malfunction"). The draft permit did authorize Enviva Northampton's two wood furnaces and dryers to bypass the control devices at normal load as a safety and malfunction measure as discussed in the application. Enviva Northampton described potential malfunction or abort periods caused by failsafe interlocks associated with the dryer and emissions control systems as well as utility supply systems (i.e., electricity, compressed air, water/fire protection). Dryer abort may also be triggered if a spark is detected. Enviva Northampton further mentioned that malfunctions are infrequent and unpredictable.

Because malfunctions cannot be planned for, the DAQ agrees to remove the condition allowing up to 50 hours of malfunction for each dryer line bypass stack. Any malfunction event for Enviva Northampton will be regulated per 15A NCAC 02D .0535 "Excess Emissions Reporting and Malfunctions". This regulation establishes reporting and corrective action measures when a source has excess emissions that last for more than four hours and that results from a malfunction, a breakdown of process or control equipment or any other abnormal conditions. The facility must notify the Division within an appropriate amount of time and describe the nature and cause of the malfunction or breakdown, the time when the malfunction or breakdown is first observed, the expected duration, and an estimated rate of emissions.

Recommendation: It is recommended to remove the malfunction language noted above.

Comment 6 (EIP & SELC Letter - Item II.B.):

In Enviva's parallel permitting procedure in Virginia for the Enviva Southampton plant, Enviva submitted an application that contains identical information regarding the use of the bypass stacks as here. Virginia apparently rejected the idea of preemptively authorizing the use of the bypass stacks during malfunction, as the draft permit currently undergoing public notice and comment contains no provision comparable to Condition 2.2(A)(3)(c)(vii) authorizing use of the dryer bypass during 50 hours of malfunction.

We support Virginia's approach to the bypassing issue and urge DAQ to adopt a similar approach that specifically limits bypassing to two well defined scenarios during which emissions will be minimized by limits on the heat input of the furnaces.

Finally, we note that none of the permits issued to Enviva over the past several years have contained blanket exemptions allowing for bypass stacks during any period of malfunction. For instance, neither of the two recent permits issued by DAQ to Enviva Hamlet or Enviva Sampson contain a comparable provision authorizing bypassing during malfunctions.

Hearing Officer's Response to This Comment:
As noted above, the DAQ agrees the Enviva Northampton draft permit included hourly limitations for the bypass stacks during malfunctions which are now being removed. This removal will make the draft permit consistent with the recently issued Enviva Hamlet and Enviva Sampson permits. The DAQ has reviewed the draft bypass language contained in the Enviva Sampson permit for cold start-up bypass mode and will implement similar language in the Northampton permit.

Recommendation: It is recommended to remove the malfunction language noted in SECTION II, Item II.A. above, include similar cold start-up bypass language, and be consistent with bypass conditions with Enviva Sampson.

SECTION III - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 7 (Section III):

It appears that Enviva desires the ability to continue operating its dryers at full capacity even when pollution controls are unavailable-for instance, Enviva lists the full dryer production rate of 71.71 ODT/hr for dryer bypass mode, and calculates the facility's compliance with its synthetic minor limit using this number. As discussed above, however, operating the dryers while using the dryer bypass stack to avoid controls leads to impermissible exceedances of the NAAQS and AALs. To ensure that emissions from this facility will not cause or contribute to exceedances of the NAAQS and AALs, Enviva's permit must expressly require Enviva to shut down the dryer whenever it becomes necessary to vent emissions through the dryer bypass stack. In addition, the permit must make clear that continuing to operate the dryer when the pollution controls are bypassed (beyond the amount of time that it takes to shut it down) cannot be considered a malfunction.

While unexpected events may certainly force Enviva to bypass the pollution controls-we do not dispute that malfunctions happen--continuing to operate the dryer without controls beyond the amount of time it takes to shut it down is not an "unavoidable" scenario beyond Enviva's controls. 15A N.C. Admin. Code 02D .0535(a)(2). Continuing to operate while the controls are bypassed is a deliberate and readily avoidable alternative operating scenario that must not be authorized. Moreover, North Carolina's regulations require that, when determining if excess emissions are the result of a malfunction, the "Director shall consider ... [whether] the amount and duration of the excess emissions ... have been minimized to the maximum extent practicable." 15A N.C. Admin. Code 02D .0535(c)(3). Authorizing continued operations at full capacity during bypass events plainly cannot qualify as "minimize[ing]" emissions to the "maximum extent practicable."

Hearing Officer's Response to This Comment:
DAQ agrees to remove the condition allowing up to 50 hours of malfunction for each dryer line bypass stack. Any malfunction event for Enviva Northampton will be regulated per 15A NCAC 02D .0535 "Excess Emissions Reporting and Malfunctions". This regulation establishes reporting and corrective action measures when a source has excess emissions that last for more than four hours and that results from a malfunction, a breakdown of process or control equipment or any other abnormal conditions. The facility must notify the Division within an appropriate amount of time and describe the nature and cause of the malfunction or breakdown, the time when the malfunction or breakdown is first observed, the expected duration, and an estimated rate of emissions.

Recommendation: It is recommended to remove the malfunction language noted in SECTION II, Item II.A. above, include similar cold start-up bypass language, and be consistent with bypass conditions with Enviva Sampson.

SECTION IV - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 8 (Section IV):

The draft permit requires Enviva to track and record its monthly emissions of NSR pollutants, and submit semi-annual reports of 17-months-worth of emissions. The permit does not, however, specify how Enviva shall calculate its emissions. In order to make the PTE limits enforceable, the permit must include an equation and the specific emission factors that Enviva shall use to calculate its rolling 12-month emissions. Most critically, it must be clear that emissions from startup, shutdown, malfunction, and idle modes shall be included in the 12-month rolling emissions.

As EPA has consistently explained, a limit intended to restrict PTE "can be relied upon ... only if it is legally and practicably enforceable." EPA has further explained practical enforceability as such:

> *In order to be considered practically enforceable, an emissions limit must be accompanied by terms and conditions that require a source to effectively constrain its operations so as to not exceed the relevant emissions threshold. These terms and conditions must also be sufficient to enable regulators and citizens to determine whether the limit has been exceeded and, if so, to take appropriate enforcement action.*

Without the emission factors in the permit, it is impossible for citizens to "determine whether the limit has been exceeded." More specifically, EPA has objected to permits that lacked emission factors because, "without a clearly identified method for determining monthly emissions ... the limitations on ... emissions are legally and practically unenforceable." Such is the case here.

The permit is silent on how Enviva shall calculate emissions and whether it must include emissions from malfunctions and startup and shutdown. DAQ must remedy this in order to ensure the PTE limits are enforceable as a practical matter.

Hearing Officer's Response to This Comment:
Excluding NOx emissions, the post modification potential emissions from each remaining criteria pollutant are below 183 tpy; therefore, specific equations are not necessary. Furthermore, compliance will be established via stack testing and the required semi-annual recordkeeping and reporting conditions.

Because the PTE for NOx is estimated to be close to the PSD threshold of 250 tpy, DAQ agrees the permit should include appropriate calculation methodology indicating compliance with the 12-month rolling average as stipulated in the permit. The following equation will be added to the permit in response to comments. The equation will enable regulators and citizens to determine compliance with the limit.

Total NOx emissions per month are from the combined operation of dryers with associated oxidizers, and other miscellaneous combustion sources. The miscellaneous sources at Enviva Northampton have a combined potential to emit of 47.25 tpy of NOx (3.94 tons per month). The dryer emission factor of 0.47 lb/ODT is derived and scaled up from the October 2013 site-specific stack test as noted in SECTION II, Item I.A. above. Each dryer RTO is rated at 32 million Btu/hr. The associated propane and natural gas hourly emission factors (lb/hr) are from the DAQ's website. Calculations shall be made monthly and recorded in a logbook (written or in electronic format), according to the following formula for the facility and then totaled:

$$E_{\text{NOx(Total)}} = \sum E_{\text{NOx(Dryer1)}} + \sum E_{\text{NOx(Dryer2)}} + \sum E_{\text{NOx(RTO1)}} + \sum E_{\text{NOx(RTO2)}} + 3.94$$

$$E_{\text{NOx(Dryer1 or Dryer2)}} = \frac{(0.47 \; x \; Q_D)}{2000}$$

$$E_{NOx(RTO1 \text{ or } RTO2)} = \left(\frac{(4.55 \times P_{RTO}) + (3.15 \times NG_{RTO})}{2{,}000}\right)$$

Where:

$E_{NOx(Total)}$	=	total tons of NOx emissions per month from the facility.
$E_{NOx(Dryer1 \text{ or } 2)}$	=	total tons of NOx emissions per month from each dryer
$E_{NOx(RTO1)}$	=	number of tons of NOx emissions per month from RTO1 fuel combustion.
$E_{NOx(RTO2)}$	=	number of tons of NOx emissions per month from RTO2 fuel combustion.
Q_D	=	the oven dried tons of processed wood through the dryers per month.
0.47	=	dryer line NOx emission factor 0.47 lbs/ODT is derived from the October 2013 site-specific stack test of 33.48 lb/hr at maximum throughput.
$P_{RTO1 \text{ or } RTO2}$	=	propane hours per month when oxidizer deemed "in operation", is not bypassed, and oxidizer temperature is greater than or equal to the hourly block average temperature specified per stack test with an emission factor of 4.55 lb/hr.
$NG_{RTO1 \text{ or } RTO2}$	=	natural gas hours per month when oxidizer deemed "in operation", is not bypassed, and oxidizer temperature is greater than or equal to the hourly block average temperature specified per stack test with an emission factor of 3.15 lb/hr.
3.94	=	equates to the monthly PTE for the miscellaneous sources including; double duct burners, propane vaporizer, catalytic oxidizers, bypass stacks, emergency generators, and a fire water pump

Recommendation: It is recommended that the equation above be added to the PSD avoidance condition related to operations post modification in order to determine compliance with the 250 ton per year NOx PSD Avoidance limit.

SECTION V - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 9 (Section V):

The draft permit is also deficient because it fails to require adequate monitoring to ensure compliance with the applicable 20% opacity limit set forth in 15A N.C. Admin. Code 02D .0521. In short, the monitoring requirement under Permit Condition 2.l(A)(3)(c) allows an untrained individual to pick any time during the first 30 days of the permit's effective period to subjectively determine a "normal" opacity level from the sources. The draft permit provides no further requirements for how normal opacity is determined. This then sets the bar for opacity monitoring for the subsequent, indefinite term of the permit. Once a week thereafter, the permittee makes another subjective observation concerning whether the opacity is "above normal." Notably, the draft permit does not require the original observer to record his or her qualitative description of the normal level of opacity and provides no mechanism for the original observer to communicate to any future observer what normal opacity looks like. Likewise, the recordkeeping requirement fails to require the weekly observers to record any description of their observations (only the "results," which presumably would be normal or not normal), the methods they used to make the observation, or the time of day and conditions at the time the observation was made.

The draft permit fails to assure compliance with the 20% opacity limit because (1) DAQ has not demonstrated that monthly monitoring is sufficient to assure compliance with a 20% opacity limit that applies at all times, (2) DAQ has not demonstrated that the parameter being monitored ("normal" opacity) correlates with demonstrating that opacity remains below 20% at all times, (3) the permit fails to specify the method that the facility must use to determine opacity, and (4) the permit lacks recordkeeping and reporting

needed to document the results of required monitoring. DAQ must amend the permit to require monitoring that objectively and adequately determines the level of visible emissions on a time frame sufficient to demonstrate ongoing compliance (i.e., at least daily), and require recordkeeping and reporting sufficient to document monitoring results and enable DAQ and the public to promptly identify any non-compliance.

Hearing Officer's Response to This Comment:
The air permit will require the facility to conduct monthly visible observations and establish "normal" within 30 days following commencement of operation of the equipment. If the visible emissions are above normal the appropriate action must be taken to correct the above normal emissions as soon as practicable and record the action taken or demonstrate that the percent opacity from the emission point is below the opacity limit in accordance with 15A NCAC 2D .2610 (Method 9).

The visible observation procedures are long established by DAQ and are sufficient to ensure compliance with 15A NCAC 02D .0521. The EPA periodically conducts audits of DAQ's Title V permitting program and routinely reviews Title V permits. The EPA has not indicated DAQ's visible observation procedures are deficient nor fail to meet the intent of the Title V monitoring requirements. In addition, during DAQ's annual full compliance evaluation inspection, the DAQ inspector, who is Method 9 certified, observes emission release points to determine compliance with the visible emission standard and reviews the facility's records to ensure the proper information is being recorded. The facility must record the following visible emission observation information:

1) the date and time of each recorded action;
2) 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
3) the results of any corrective actions performed.

Recommendation: No changes to the draft permit are deemed necessary to address this comment.

SECTION VI - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 10 (Section VI):

Wood pellet plants generate a lot of fugitive dust, i.e., airborne particulate matter. In fact, one of the most common air pollution complaints raised by residents of communities where wood pellet plants are located is the large amount of fugitive dust that escapes into surrounding neighborhoods. Enviva Northampton is no exception. As DAQ is aware, neighbors of the plant expressed frustration that dust is still coating their property years after first raising the issue with Enviva. As one commenter noted, fugitive dust plans should be standard for this industry.

Major sources of fugitive dust at wood pellet plants include wood handling, wood storage piles, conveyor transfer points, yard dust, haul road dust, and engine exhaust. Health problems associated with exposure to particulate matter pollution primarily involve damage to the lungs and respiratory system due to inhalation. Specifically, the inhalation of dust particles can irritate the eyes, nose and throat; cause respiratory distress, including coughing, difficulty in breathing and chest tightness; increase the severity of bronchitis, asthma and emphysema; cause heart attacks and aggravate heart disease; and lead to premature death in individuals with serious lung or heart diseases. When exposed repeatedly over a longer time period, fugitive

dust exposure can lead to severe illness such as cancers. In addition to affecting human health, fugitive dust reduces visibility, affects surface water, reduces plant growth, and can be a nuisance.

Condition 2.2(A)(l) of Enviva Northampton's draft permit addresses the requirements of North Carolina Rule 15A N.C. Admin. Code 02D .0540, "Particulates from Fugitive Dust Emission Sources." Under this draft permit condition, Enviva Northampton must "not cause or allow fugitive dust emissions to cause or contribute to substantive complaints or excess visible emissions beyond the property boundary." Furthermore, "[i]f 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)." (emphasis added).

In light of the well-documented fugitive dust problems associated with wood pellet manufacturing plants, and dust the complaints from several residents during the August 20 public hearing, DAQ should revise the draft permit to require Enviva to prepare such a fugitive dust control plan. DAQ should also include the specific requirements of such plan in the permit as enforceable conditions. The plan should be specific to the unique sources of dust at Enviva Northampton and require enforceable conditions to reduce fugitive dust emissions to the maximum degree reasonably achievable.

The need for a fugitive dust plan for this facility is especially acute due to the fact that, as discussed below, this facility will impact the health and well-being of communities that are already plagued by numerous polluting facilities. Because the draft permit authorizes the facility to increase its wood pellet production, the facility will generate substantially more fugitive dust than was originally projected. Given the vulnerability of the affected community, DAQ should be proactive in ensuring that Enviva does everything within reason to reduce the facility's adverse impact on nearby communities.

Hearing Officer's Response to This Comment:
As required by 15A NCAC 2D .0540 "Particulates From Fugitive Dust Emissions Sources", Enviva Northampton shall not cause or allow fugitive dust emissions to cause or contribute to substantive complaints or excess visible emissions beyond the property boundary. Enviva shall submit a fugitive dust plan within 30 days of receiving written notification from the Director of two substantive complaints in a 12-month period. Enviva shall also submit a fugitive dust plan if DAQ observes excessive fugitive dust emissions from the facility beyond the property boundaries for six minutes in any one hour (using Reference Method 22 in 40 CFR, Appendix A).

There have been no substantive fugitive dust complaints regarding the facility. In addition, the DAQ inspector has not observed any evidence of fugitive dust beyond the property boundaries during the full compliance evaluation inspections. If there are substantive fugitive dust complaints or excessive fugitive dust emissions from the facility, the facility may be required to submit a fugitive dust plant as described in 15A NCAC 2D .0540.

Recommendation: No changes to the draft permit are deemed necessary to address this comment.

SECTION VII - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 11 (Section VII):

First, we acknowledge and-appreciate that the reporting condition related to operations after the modification has expanded the list of pollutants that must be quantified and reported. See draft Condition (2.2)(A)(3)(t)(i). Yet the draft permit will cease requiring Enviva to report its production information after the modification. We are unsure why that reporting requirement would be dropped as the plant is still subject to a production limit to avoid PSD.

Perhaps more importantly, now that NOx will be the pollutant closes to the PSD threshold (and, we believe, exceeding it), the draft permit should implement the requirement to monitor and report the heat input of the dryers. While pellet production rates are loosely linked with NOx emissions, heat input is the key parameter most directly associated with NOx emissions. This is because Enviva may run the furnace at higher capacity than the dryer at times, especially during start-up, shutdown, and malfunction. Monitoring and reporting the heat input is the most direct way for the public to verify that the facility is not exceeding its NOx limit and the PSD major source threshold, or to take action when exceedances do occur.

Hearing Officer's Response to This Comment:
First, DAQ agrees that the current requirement for reporting production information should be retained post modification. Therefore, the draft permit should be modified to include in Permit Condition 2.2 A.3.t the requirement to track both monthly ODT of pellets per year and the monthly hardwood/softwood mix as currently required in Permit Condition 2.2 A.2.e.

Second, the DAQ also agrees that heat rate monitoring may be a better way to calculate the NOx emissions from the combustion processes at the Enviva Northampton facility; however, because the Division has not been able to identify any federal or site specific emissions factors for NOx emissions on a heat input basis (lbs/million Btu) for wood and bark direct-fired furnaces and dryers, we will continue to monitor NOx on a pound per ODT basis. This is consistent with the current application, site specific testing, and the other permits issued to Enviva plants in North Carolina. The permit will continue to require initial and periodic testing on an ODT basis as drafted.

Recommendation: It is recommended to modify the reporting condition in Permit Condition 2.2 A.3.t to add reporting of monthly ODT levels as well as hardwood/softwood mixes.

SECTION VIII - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 12 (EIP & SELC Letter - Item VIII.A.)

"Environmental justice" is defined as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." In 2000, North Carolina's Department of Environmental Quality (DEQ) (then, N.C. Department of Environment and Natural Resources) officially recognized the need to address environmental justice concerns and instituted a policy "[t]o ensure that agency programs substantially affecting human health or the environment operate without discrimination" and "[t]o provide information for citizens and neighborhood groups to allow meaningful participation in regulatory processes." With this initiative, DEQ set forth several actions it would take in order to meet these goals. Specifically, DEQ committed to:

- *Address environmental equity issues in permitting decisions for projects potentially having a disparate impact on communities protected by Title VI of the Civil Rights Act of 1964,*

- *Promote greater use and analysis of demographic information to identify communities that may be disproportionately impacted by sources of pollution,*
- *Use demographic information to determine whether there is: 1) a need for greater outreach to [a] community in order to encourage more meaningful participation, or 2) special health risks based on the nature of the population, [and]*
- *Develop guidelines for assessing the cumulative effects of permitted facilities.*

In May 2018, DEQ, which oversees DAQ, recommitted itself to these goals by establishing the Secretary's Environmental Justice and Equity Board "to assist [DEQ] in achieving and maintaining the fair and equal treatment and meaningful involvement of North Carolinians regardless of where they live, their race, religion or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

Despite its commitment to addressing environmental justice in permitting decisions, DAQ has issued the draft permit modification to Enviva Northampton without conducting a full environmental justice analysis. Instead, DAQ issued an "Environmental Justice Snapshot"-a document that merely provides an overview of demographic and socioeconomic data for a portion of the area affected by Enviva's planned modification. The Environmental Justice Snapshot ("Snapshot" or "Enviva Northampton Snapshot") fails to ensure adequate outreach to potentially impacted communities or inform DAQ of potential environmental justice concerns and therefore does not meet the commitments DEQ has set for itself in its Environmental Equity Initiative.

Hearing Officer's Response to This Comment:
The Department is committed to evaluate the community's demographic and socioeconomic make up. DEQ conducted an EJ Snapshot to inform the inclusive and meaningful engagement of the community for this permit application. A final EJ report has been completed as well. DAQ has considered environmental justice and equity.

Recommendation: No changes to the draft permit are deemed necessary to address this comment.

Comment 13 (EIP & SELC Letter - Item VIII.B.)

Over the course of the last year, DAQ has continued to rely on a new, two-step process for assessing environmental justice issues in the permitting process, at least as it pertains to wood pellet permitting actions. Under this new process, DAQ will first issue a "Snapshot ... at the beginning of the application process" that will be made available to the public "before the close of the public comment period." Then, at some point after close of the comment period DAQ may conduct a full environmental justice review and develop an environmental justice report. According to a July 11, 2018, DAQ presentation for the inaugural meeting of the Secretary's Environmental Justice and Equity Advisory Board, DAQ sets out this two-step process and makes clear that identification of impacted communities and further outreach to those communities, when necessary, will not be conducted until the "EJ Review" stage. Thus, according to DAQ's own explanation of its process, identification and increased outreach will not occur until after the notice and comment period has ended. This backwards process undercuts rather than supports DEQ's goal of meaningful participation in the permitting process.

A lack of meaningful participation is once again playing out, this time with respect to the draft permit for the Enviva Northampton modification. As discussed more fully below, the Enviva Northampton Snapshot is

inadequate to inform DAQ of the potential environmental justice impacts from the proposed modifications and DAQ's process has also not fostered meaningful participation. Based on the information provided to the public through the Snapshot, it does not appear that DAQ has taken the next step of using the information contained in the Snapshot to "identify communities that may be disproportionately impacted" or "determine whether there is ... a need for greater outreach ... or ... special health risks based on the nature of the population[.]" For public participation to be meaningful, potentially affected communities must be given the chance to participate in permitting decisions in a way that will actually contribute to and influence the decision-making process as EPA has explained,

> *The capacity of communities to participate in the decision-making process is a crucial determinant of the success of civic engagement in terms of preventing high burdens of emitting sources and exposure to environmental stressors at the community level. . . . [Thus,] when communities are unable to participate effectively in decision-making, they may be more likely to be the recipients of negative environmental consequences including impacts associated with emissions sources.*

In order for DAQ to ensure that all stakeholders are able to meaningfully participate in the permitting process, it must identify those potential environmental justice communities that require additional outreach. Then, it must actually engage in that heightened outreach prior to issuing the draft permit and prior to the close of the comment period. Accordingly, DAQ must conduct a full environmental justice review prior to issuing a modified draft permit for the Enviva Northampton facility.

Hearing Officer's Response to This Comment:
The Department utilized the results from the EJ Snapshot to conduct additional meaningful outreach. The outreach performed included:

- Notice of public hearing in the Roanoke Rapids Daily Herald on July 19, 2019 (required)
- Posted on website information on public comment period and public hearing. (required)
- Press releases mailed to all homes within a 1-mile radius of facility on July 30, 2019. (additional)
- Press releases mailed to 18 local community organizations, churches and schools on July 30, 2019. (additional)
- The DAQ Deputy Director called the Concerned Citizens of Northampton County & spoke to a member about the meeting, hearing & the proposed permit action. (additional)
- Staff trip to Northampton County on 8/9/19 to post flyers and talk with local business owners and community members to educate about the permit application and promote the public hearing. 20 local businesses, schools, organizations and churches were visited. (additional)

The final EJ Report is not completed until after the public comment period closes to provide staff an opportunity to consider comments received during the public comment period.

Recommendation: No changes to the draft permit are deemed necessary to address this comment.

Comment 14 (EIP & SELC Letter - Item VIII.C.)

DAQ arbitrarily narrowed the scope of its Environmental Justice Snapshot in a manner that fails to provide a full picture of the impacts of the proposed modification to nearby low-income communities and communities of color. With this overly narrow focus, the Snapshot does not provide full and accurate information to the public regarding the relevant geographic area that may be impacted by the proposed

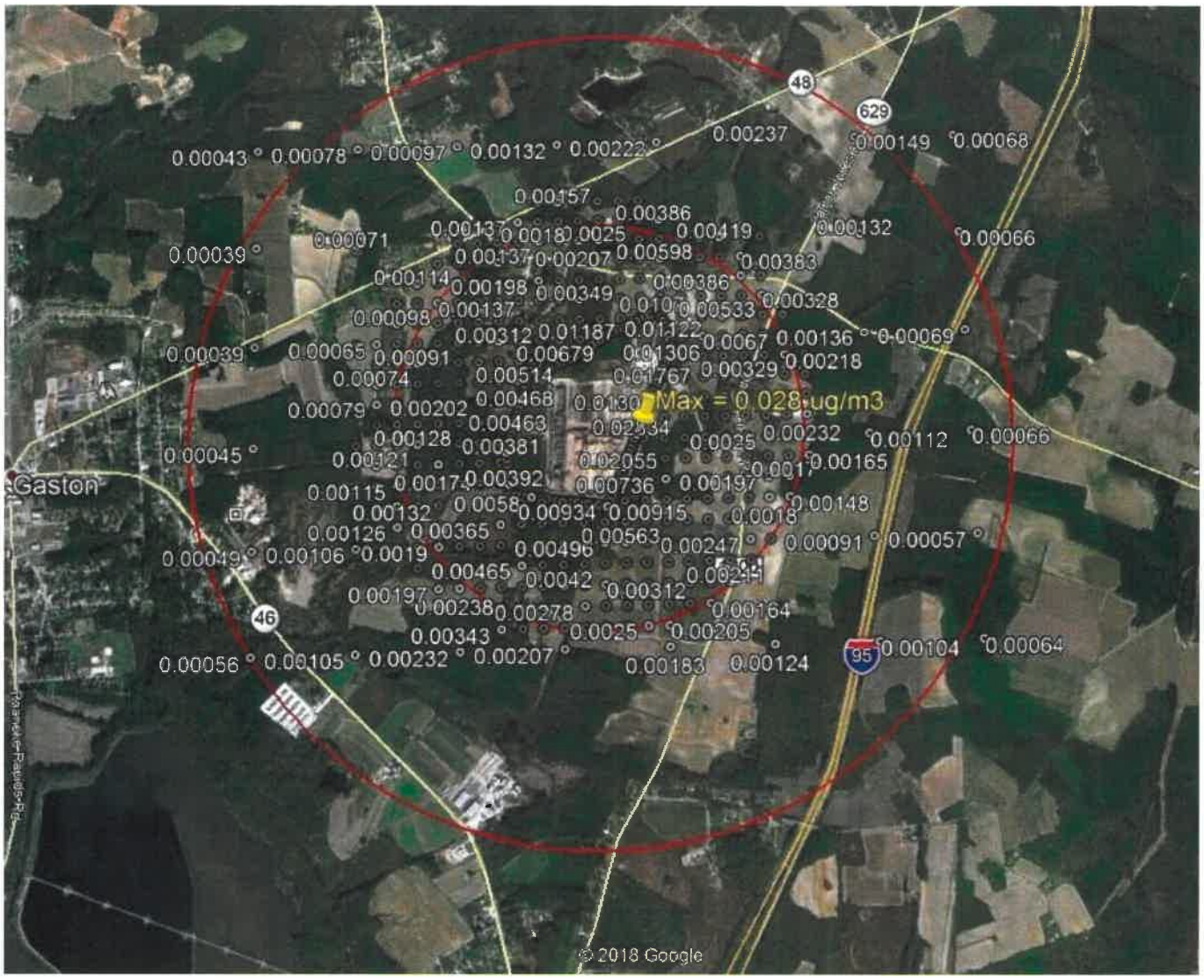
expansion. As such, the Snapshot fails to ensure that members of the public can meaningfully participate in the permitting process.

DAQ appears to have arbitrarily narrowed the Snapshot's focus to only a two-mile radius around the facility. DAQ provided essentially no explanation or documentation to support such a decision. Instead, DAQ states that because the highest ambient air impacts from the facility are at the fence line, a two-mile radius was used. No further explanation is provided and the passing reference to dispersion modeling is not explained, nor is the modeling or underlying data provided.to the public. By narrowing the geographic area of the Snapshot to two miles, DAQ has significantly limited its analysis to just over 1,000 individuals and only three additional sources of air pollution. Increasing the geographic area to a five-mile radius, provides DAQ will a more complete understanding of the potentially affected communities and environmental justice harms from the Enviva Northampton modification.

Specifically, DAQ's geographic scope excludes nearby Garysburg and Pleasant Hill, in Northampton County, as well as Roanoke Rapids in Halifax County. At a five-mile radius, the analysis would more appropriate consider the over 23,000 people living nearby to the Enviva Northampton facility. Within this area, the population is 48% minority and 49% low-income, with a demographic index in the 72nd percentile when compared to the rest of the state. EPA's EJSCREEN is an environmental justice screening tool that combines environmental and demographic indicators and provides national, regional, and state information on eleven environmental justice indexes ("EJ Indexes"). According to the EJSCREEN for a five-mile radius, this area is near the 70th percentile for several relevant EJ indexes. In particular, this area is ranked in the 69th percentile for PM2.s, 70th percentile for air toxics, and 71st percentile for respiratory hazards, all of which will be affected by Enviva Northampton's expanded operation.

Moreover, the Snapshot failed to include several "sensitive receptors" within DAQ's proscribed two-mile radius, as well as the many additional receptors located between two and five miles of the facility. Sensitive receptors are areas "where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals, pesticides, and other pollutants." Because children, the elderly, and those with preexisting medical conditions are generally more susceptible to the harmful effects of such pollutants, "sensitive receptors" often include hospitals, schools, daycares, and elderly care facilities. DAQ identified three such receptors within the proscribed two-mile radius, as well as an additional five receptors located outside this area. A quick google maps search, however, uncovers at least four additional sensitive receptors within a two-mile radius, and another four within a five-miles radius.

Hearing Officer's Response to This Comment:
According to the Division of Air Quality (DAQ), the highest off-site ambient air impacts from Enviva Pellets Northampton dispersion modeling occur at the plant fence line. The location and magnitude of the maximum modeled toxic impact (0.028 ug/m3 for Benzene) rapidly decrease with distance away from the facility with predicted concentrations at a 1-mile radius at roughly an order of magnitude less than the maximum concentration. The fence line level of Benzene is 24% of the Allowable Ambient Limit (AAL). All other Toxic Air Pollutants (TAP) modeled were under 10% of the AAL. Based on this modeling, a two-mile radius was used for analyzing the local demographics and socioeconomic factors. DAQ will look into the additional sensitive receptors identified in this comment and include those that were missed in the Snapshot in the full EJ Report.



Recommendation: No changes to the draft permit are deemed necessary to address this comment.

Comment 15 (EIP & SELC Letter - Item VIII.D.) -

Finally, DAQ's Snapshot failed to consider the cumulative impacts of the proposed modification on nearby communities. Specifically, the Snapshot does not present a full picture of other, nearby polluting sources because they fall outside the arbitrary two-mile radius.

Northampton County recently ranked 96 out of North Carolina's 100 counties for overall health outcomes, with neighboring Halifax County ranked 91 and of 100. This area's poor health outcomes are coupled with proximity to a large number of pollution sources that negatively impact the health and wellbeing of nearby communities. According to DAQ's air permit tracking system, there are 10 facilities with current air permits in Northampton County (excluding Enviva Northampton) and an additional 20 air permitted facilities in Halifax County. Specifically, within a five-mile radius from the Enviva Northampton facility there are a total of 17 additional sources of air pollution.

Additionally, there are multiple other sources of pollution within a five-mile radius of the Northampton facility, including 17 water discharges, IO toxic releases, and 5 brownfield sites. Not only were the pollution sources located outside the two-miles radius not included in the Snapshot's list of "local industrial sites," but DAQ failed to actually analyze the cumulative impact of all of these sources as it relates to the proposed modification at Enviva Northampton.

The proposed modification will add to the cumulative impact of pollution sources in the area. These other polluting sources must be considered in order for DAQ to adequately identify and address potential environmental justice concerns. In addition to using the pure demographic data presented in the Snapshot to determine whether there is need for greater outreach, DAQ should use that information to determine whether there are "special health risks based on the nature of the population" and assess "the cumulative effects of permitted facilities," as provided for in DEQ's Environmental Equity Initiative.

Hearing Officer's Response to This Comment:
As the commenters point out, NCDEQ's Snapshot acknowledges the presence of other permitted facilities in the area around the Northampton facility. Moreover, the decision to limit its analysis to a two-mile radius was not arbitrary. That decision was based on air quality impacts. The metrics considered within those two miles included race and poverty (decennial census year), per capita income and Ability to speak English (most current American Community Survey (ACS) census range), the current North Carolina Department of Commerce county tier, and presence of native American territory. NCDEQ is committed to environmental justice and equity; however, there is no state law or regulation relative to air permitting that either mandates or directs NCDEQ to perform the more expansive type of cumulative impact analysis envisioned by the commenters.

Recommendation: No changes to the draft permit are deemed necessary to address this comment.

SECTION IX - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 16 (EIP & SELC Letter - Item IX) -

On October 29, 2018, Governor Cooper signed Executive Order titled, "North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy." Executive Order 80 "reaffirms North Carolina's commitment to reducing statewide greenhouse gas emissions"77 and orders that North Carolina "will support the 2015 Paris Agreement goals and honor the state's commitments to the United States Climate Alliance." To do so, the Executive Order sets several goals, including a 40 percent greenhouse gas emissions reduction from 2005 levels by 2025. The order also created the North Carolina Climate Change Interagency Council, with representatives from every state cabinet, and directs DEQ specifically to develop a North Carolina Clean Energy Plan to encourage the use of clean energy, including wind, solar, energy efficiency, and energy storage. Finally, the order makes clear Governor Cooper's commitment to addressing resiliency throughout all state cabinets:

> *Cabinet agencies shall integrate climate adaptation. and resiliency planning into their policies, programs, and operations (i) to support communities and sectors of the economy that are vulnerable to the effects of climate change and (ii) to enhance the agencies' ability to protect human life and health, property, natural and built infrastructure, cultural resources, and other public and private assets of value to North Carolinians.*

With this executive order and North Carolina's recommitment to the goals of the Paris Agreement, the state and DEQ as the agency charged with protection of North Carolina's environmental resources need to reevaluate the role of biomass and the wood pellet industry in North Carolina. According to the United Nations Intergovernmental Panel on Climate Change ("IPCC"), the world only has twelve years to cut manmade carbon emissions to keep warming to no more than l .5°C and avoid the worst impacts from climate change. Contrary to Executive Order 80, the wood pellet industry results in a net increase in atmospheric CO2 emissions (especially over the relevant time frames needed to curb the worst impacts of climate change), destroys forest carbon stocks and thereby reduces the forests ability to absorb CO2, and decreases the resiliency of vulnerable communities when facing extreme weather events. DEQ must therefore re-examine its continuing support for the wood pellet industry and the expansion of the Enviva Northampton facility specifically.

Despite industry claims to the contrary, burning wood pellets for large-scale electricity production (as is the case with Enviva's products) is not carbon neutral, but actually emits as much or more CO2 per megawatt hour as coal. This instantaneous increase in atmospheric carbon can persist for decades to a century or more, even assuming trees are immediately replanted. In fact, the entire wood pellet supply chain-including the harvesting, transport, and manufacturing that occurs in North Carolina--emits CO2 and contributes to climate change. The Enviva Northampton modification itself will result in an increase of over 237,000 tpy of CO2 equivalent emissions. Moreover, numerous investigations have uncovered the fact that Enviva uses whole trees from clear-cut forests to supply its wood pellet plants, including those in North Carolina. Such a process liquidates carbon stocks, harms biodiversity, and removes needed storm and flood protections for vulnerable communities.

DAQ's draft permit modification allows the Enviva Northampton facility to increase its wood pellet production from 535,260 to 781,255 tons per year: This increased production will result in an additional 4,500 acres of forests being harvested from the area every year.

This proposed modification mirrors similar requests from Enviva at three of its other facilities in North Carolina (Enviva Sampson and Hamlet) and Virginia (Enviva Southampton, located just seven miles from the North Carolina border), and collectively Enviva requests a production increase of approximately 600,000 tons per year, which equates to an additional 10,000 acres of forests being harvested every year primarily from North Carolina. Such an increase in production and resulting forest harvests is inconsistent with the executive order's call for carbon reductions and building more resilient communities. DAQ must reexamine the draft permit modification for consistency with Executive Order 80.

Hearing Officer's Response to This Comment:
Governor Cooper's Executive Order 80 sets emission reduction goals for the state of North Carolina to strive to achieve. Those goals include a reduction in statewide greenhouse gas emissions of 40% below 2005 levels, an increase in zero emission vehicles, and energy consumption reductions in state owned buildings of 40% from 2002-2003 levels. The NC Climate Change Interagency Council is charged with developing holistic approaches and programs so that North Carolina can strive to accomplish all the goals in Executive Order 80 while ensuring that North Carolina's vibrant economy continues to expand. The Council presented the North Carolina Clean Energy Plan to Governor Cooper on September 27, 2019. A key outcome from this process is the level of greenhouse gas emissions expected under current conditions and reductions achievable under alternative future scenarios with recommended policy, administrative, and voluntary actions taken by public and private entities. Until such time when legislative or regulatory proposals are considered and acted upon, projects such as this proposed modification must be evaluated based on the current state and federal

rules and regulations in place. DAQ will continue to develop an emissions inventory of key sources and monitor the effects of large projects on projected emissions levels.

Recommendation: No changes to the draft permit are deemed necessary to address this comment.

SECTION X - Comments from the Environmental Integrity Project (EIP) and Southern Environmental Law Center (SELC)

Comment 17 (EIP & SELC Letter - Item X)

Under the Clean Air Act, facilities subject to Title V permits must apply for a Title V permit within 12 months of commencing operation. 40 C.F.R. 70.5(a)(l). Thereafter, permitting authorities must take final action issuing or denying the Title V permit within 18 months. 40 C.F.R. 70.7(a)(2). Here, Enviva Northampton submitted its initial Title V application in April 2014, more 64 months ago, yet DAQ has not issued a Title V permit to Enviva Northampton. While we understand the source of much of this delay, given the length of the delay to date we urge DAQ to expedite processing the Title V permit for this facility. Title V permits serve an important role in assuring facilities comply with all applicable requirements of the Clean Air Act, for instance by requiring annual compliance certifications. Moreover, Title V permits also help the public understand what requirements apply and whether the facility is in compliance with those requirements.

Hearing Officer's Response to This Comment:
DAQ agrees with EIP on the importance of issuing timely Title V permits. The permitting history of this facility is well documented including any delays associated with the processing of the applications in house (6600167.14B and 6600167.18A). It is important to draft a Title V permit that includes a complete picture of the facility's operations. In order to accomplish this task, Permit Condition 2.2 A.11 will be modified requiring that the Title V first time application (6600167.14B) be amended to include the facility modifications described in application 6600167.18A within 90 days of the issuance of Permit No. 10203R06.

Recommendation: It is recommended to include the amended permit condition as described above.

SECTION 2 – Comments Grouped by Similar Concerns

The following comments were provided by individuals representing themselves or an organization. Many of the comments express similar concerns. To address all issues and minimize redundancy, comments addressing similar issues have been grouped together.

Comment Grouping 1:

Of the 2405 emails received, 2,295 (95%) reference the paragraph below:

The wood pellet industry, led by Enviva, is driving the destruction and degradation of tens of thousands of acres of North Carolina forests, which are cut down, turned into wood pellets, and shipped overseas to be burned for electricity. We need standing, diverse, healthy forests to store carbon, protect us from flooding and storms, and provide us with clean air and water. Any expansion of this industry hampers North Carolina's ability to meet its commitment on climate mitigation and adaptation as well as communities' ability to rebound and recover after storms like Hurricane Florence.

Other comments expressed similar concerns:

- *Every agreed permit means more communities living with poor air, more wildlife with nowhere to live and more carbon dioxide in the atmosphere.*
- *We are not sure if Carbon sequestration is happening in young forest and until we are sure we should protect our citizens.*
- *Relative to land area they also sequester huge amounts of carbon in plants above ground and in roots and soil below.*
- *Alone that's more clear cuts, more carbon in the atmosphere, less habitat for wildlife, and less protection from natural disasters.*
- *This means 18,000 acres of forests to be cut down each year to feed that facility.*
- *Natural forests and wetlands absorb flood-waters and slow them down, buffering communities from flooding and reducing costly property damage.*
- *I ask you deny this permit and grant moratorium on the devastation of our forests.*
- *What is suffering, are our local communities, forests, and a climate on the brink.*
- *Forest are our number 1 defense against flooding filtering our air.*
- *NC cannot afford the scale of our increased forest degradation.*
- *Here to support my fellow North Carolinians in Northampton County because we need to plant forest without cutting forest.*
- *If Enviva operations in Northampton county are expanded the critical forests which alleviate disastrous storm waters will be at risk from clear cutting and removal.*
- *There is documented evidence that the company sources from bottomland and coastal hardwood forests.*

Hearing Officer's Response to These Comments

Many commenters expressed concerns with the impacts that harvesting trees for the forest products industry will have on the local community and environment, and climate worldwide. The sourcing of timber is also a concern especially from bottomland hardwood forests. Healthy trees and forests are an important part of the environment and it is important to protect and manage this resource.

An important indicator of a sustainable forest is a constant or increasing area to timberland and forest type. According to information from Enviva and their website, Enviva uses a Track and Trace program to manage the sourcing of the wood they process.

> *"Enviva records the geographic location, age, and forest type of all of the primary wood. We know how and by whom each tract was harvested, as well as the proportion of wood that was sent to Enviva versus other forest product industry consumers. Enviva does not source from old growth forest, protected forests or forests that are being harvested for land use conversion. Enviva works with the US Endowment for Forestry and Communities who independently identify bottomland forest ecosystems that may process high conservation value (HCV) attributes. We will only agree to purchase wood from a harvest once we have determined that the tract is a working forest that is likely to regenerate with the desired composition of species. When tracts are determined as non-HCV and where harvest is appropriate, Enviva works with suppliers to develop an individualized harvest technique that is most suitable for the site."*

Information provided by the United States Department of Agriculture (USDA) indicates the forests in North Carolina are stable. The Forest Inventory and Analysis program shows that approximately 55% of the state land area is forest and the diversity and mix is steady. The North Carolina Forestry Service (NCFS) indicates the forest size and mix has been steady since the early 2000s. The growth to removal rate of softwood is 1.61 and hardwood is 2.36 which indicates that inventory levels are expected to increase over time. The

North Carolina Greenhouse Gas Inventory (1990-2030) published January 2019 indicates that carbon sinks are primarily due to carbon sequestered in above ground biomass and storage of carbon in wood products. There has been a 4% increase in the annual carbon sequestered between 2005 and 2017. This annual sequestration of carbon reflects North Carolina's sustainable management of its forests and their economic uses.

An area of concern is the bottomland hardwood forests. The NCFS is aware of the concerns over the sustainability of bottomland hardwood forest and continues to manage and gather data on these areas. According to the NCFS, the net growth of bottomland hardwood forest has returned to more sustainable levels. The management of bottomland swamp forest is relatively passive and occurs over a much longer timeframe due to the relatively slower growth cycle of timber in swamps.

Properly managed forests provide many benefits to the environment. An unmanaged stand of trees may have high density with too many trees crowded together. This means the trees grow more slowly as they must compete for a limited amount of soil nutrients, water and light and this stress makes trees more susceptible to disease and pests. The NCFS is ultimately charged with overseeing the sustainability of timber crops. The NCFS is familiar with Enviva's operation and believe the suppliers are operating within generally accepted forest management practices.

Recommendation: No changes to the draft permit are deemed necessary to address these comments.

Comment Grouping 2

Of the 2405 emails received, 2,295 (95%) reference the paragraph below:

A report by the Environmental Integrity Project has shown a shocking pattern of air quality violations or noncompliance at all wood pellet facilities, with Enviva's North Carolina facilities being the most egregious in terms of skirting the Clean Air Act's requirements. In fact, Enviva's Northampton facility has been operating as an illegal major source for years now.

Other comments expressed similar concerns:

- *I would like to revisit the permitting of the Enviva facility in Richmond County. The Northampton facility has been operating for years as an illegal source of pollution to the local community.*
- *As an internal medicine physician who is deeply concerned about the health effects from air pollution and as Enviva has continued to be one of the worse offenders in violating the Clean Air Act*
- *This company has proven itself to be a notorious violator of air quality standards - across the board at ALL of its wood pellet facilities.*

Hearing Officer's Response to These Comments

A review of the compliance history for existing Enviva facilities indicate there have been two Notice of Deficiencies (NOD) at the Enviva Northampton facility since the facility began operations. No letters of violation have been issued. The deficiencies are as follows:

Northampton - NOD issued December 7, 2016 for late permit renewal
- NOD issued August 22, 2014 for late report

In addition to the Northampton facility, Enviva has one transport and three other manufacturing facilities in North Carolina. The facilities are located in Wilmington, Ahoskie, Hamlet, and Sampson. The compliance history for these facilities is as follows:

Wilmington - no violations or deficiencies (transport facility only)

Ahoskie
- NOV issued March 14, 2017 for a late Annual Compliance Certification
- NOV issued July 21, 2016 for 31 days of downtime for grid No. 1 on the WESP due to malfunctions. Grids 2 and 3 continued to operate as designed
- Notice of Deficiency (NOD) issued September 3, 2014 for a late report
- NOD issued July 28, 2014 for recordkeeping deficiencies
- NOD issued August 12, 2013 for late report
- NOV issued May 2, 2013 for fugitive dust plan deficiencies.

Hamlet - The facility commenced operation on July 24, 2019.

Sampson
- Notice of Violation with Recommendation for Enforcement (NRE) issued on June 5, 2018 for failed source test in March 2017 for VOC.
- NRE issued November 3, 2017 for failed source test in March 2017 for CO
- Notice of Violation (NOV) issued February 3, 2017 for visible emissions monitoring and recordkeeping violations.

Of the violations found at the Enviva facilities, two violations pertained to emission exceedances occurred at the Sampson facility. An initial stack test was conducted in March 2017 to assure compliance with designed performance specification for the wood dryer (ES-DRYER). The dryer had been installed but had not yet reached full production rate. The stack test indicated an exceedance of the permit limit for CO and was inconclusive for VOC. Operational changes were made by Enviva to maintain CO within permit limits. In November 2017 the DAQ required Enviva to retest for VOCs. A second test was performed in March 2018 for VOC and indicated non-compliance with the permit limit. Enviva attributed both stack test failures to the wood dryer (ES-DRYER) not meeting design specifications. The company responded that "It was only when production was increased for the compliance testing that it was realized the furnace was not designed to adequately operate at the elevated production rates for extended periods." As a result, a Special Order by Consent (SOC) was signed and the facility installed a Regenerative Thermal Oxidizer (RTO) as a control device for the dryer. A stack test was conducted on February 7, 2019. The stack test report was received by DAQ's Fayetteville Regional Office on March 6, 2019 and indicated compliance with the VOC emission rate for the wood-fired direct heat drying system while processing 50% softwood. The report was reviewed and approved by DAQ's Stationary Source Compliance Branch. As part of the air permit requirements, Enviva Sampson will be required to conduct stack testing for select criteria pollutants and hazardous air pollutants to ensure compliance with air emission limits. Full compliance evaluation inspections will continue to be conducted by DAQ staff to ensure compliance with all conditions of the air permit.

Recommendation: No changes to the draft permit are deemed necessary to address these comments.

Comment Grouping 4:

General comments not directly related to the expressed intent of the public hearing.

Below are sample comments paraphrased and in no particular order:

- *Do you really want to allow Enviva to expand when it regularly logs hardwood forest in a time when the Inter-Governmental Panel on Climate Change strongly recommends that we scale up forest protection?*
- *Enviva has increased our tax revenue and their proposed enhancement will increase it even more.*
- *The restoration economy supports more jobs than logging, coal mining, iron and steel. By their very nature restoration projects take place in rural areas. It is time for the South to capitalize on restoration opportunities.*
- *Wetlands are our most diverse habitats we have in North Carolina.*
- *Currently Enviva's tree farm group represents one out of every 11 acres certified when compared to the North Carolina State Tree Farm program.*
- *A partnership with Enviva and other forest industry allows land owners to become more aware of the role the forest industry plays in forest markets and products*
- *Natural forests and wetlands increase the resiliency of flood-prone areas, whereas forest degradation, clear cut logging, and conversion to plantations significantly decrease flood* protection benefits to surrounding communities.
- Investing financial and volunteer support on multiple occasions has proven to the local community that Enviva cares for the community and seeks to improve the lives of is staff and surrounding area.

Hearing Officer's Response to These Comments

While most of the comments received were thoughtful and worth considering in the proper forum, some of the comments received were not directly related to the Enviva Northampton, LLC air quality permit application or the air quality permitting process. As such, these comments fall outside the purview of this public hearing and are therefore not directly addressed in this report.

Recommendation: No changes to the draft permit are deemed necessary to address these comments.

Conclusions and Recommendations

After considering all the public comments regarding whether or not the Division of Air Quality should issue an air quality permit to Enviva Pellets Northampton, LLC to allow for the modification of a wood pellet manufacturing facility at 309 Enviva Boulevard, Garysburg, Northampton County, North Carolina, it is the recommendation of the hearing officer that the Director issue the Air Quality permit after considering the following:

- In response to Comments 1 through 4, it is recommended that the permit reflect the requirement of Enviva Northampton to use the scaled site-specific NOx emission factor of 33.48 lb/hr until all of the proposed control devices are installed (excluding the new wood dryer controls in the event the second dryer is not installed) and new site-specific approved NOx factors have been established through stack testing.

- In response to Comments 5 through 7, it is recommended to remove the malfunction language noted in SECTION II, Item II.A. above, include similar cold start-up bypass language, and be consistent with bypass conditions with Enviva Sampson.

- In response to Comment 8, it is recommended that the equation, as designated above, be added to the PSD avoidance condition related to operations post modification in order to determine compliance with the 250 ton per year PSD Avoidance limit.

- In response to Comment 11, it is recommended to modify the reporting condition in Permit Condition 2.2 A.3.t to add reporting of monthly ODT levels as well as hardwood/softwood mixes.

- In response to Comment 17, it is recommended that Permit Condition 2.2 A.11 be modified requiring that the Title V first time application (6600167.14B) be amended to include the facility modifications described in application 6600167.18A within 90 days of the issuance of Permit No. 10203R06.

Bruce Ingle, Hearing Officer

Date

SUPPORTING DOCUMENTS

(The following supporting documents are located on the DAQ SharePoint site)

Air Quality Permit Application Review and Draft Permit
Public Hearing Attendance Forms
Audio Recording of August 20, 2019 Public Hearing
Summary of Public Hearing Comments
Emails received during the Public Comment Period
Written Comments received during the Public Comment Period
Environmental Justice Study