NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date: August 24, 2021

Region: Raleigh Regional Office
County: Northampton
NC Facility ID: 6600167
Inspector's Name: Dawn Reddix
Date of Last Inspection: 04/04/2020
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 02D .0515, .0516, .0521, .0524, .0540, .1100, .1111, 02Q .0300, .0318, .0711, 02Q .0317 of 02D.0530, and 02Q. 0317 of 02D. 1112
NSPS: IIII
NESHAP: ZZZZ**PSD:** N/A
PSD Avoidance: less than 250 tpy VOC, CO, NO_X, and PM/PM_{10}/$PM_{2.5}$
NC Toxics: phenol, manganese, HCL, chlorine, formaldehyde, cadmium, , benzene, arsenic, acrolein, acetaldehyde, methanol, propionaldehyde
112(r): N/A
Other: N/A

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Emily Huegel EHS Manager (252) 971-2054 309 Enviva Blvd. Garysburg, NC 27831	Roland Burnett Plant Manager (252) 541-2631 309 Enviva Blvd. Garysburg, NC 27831	Kai Simonsen Sr Environmental Permitting Engineer and Manager 4242 Six Forks Road Suite 1050 Raleigh, NC 27609

Application Data

Application Number: 6600167.14B
Date Received: 04/22/2014
Application amended: 08/09/2016, 01/21/2020, 04/03/2020 and 11/23/2020
Application Type: Modification
Application Schedule: TV-1st Time

Existing Permit Data
Existing Permit Number: 10203/R07
Existing Permit Issue Date: 10/21/2020
Existing Permit Expiration Date: 10/31/2023

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP
2019	17.45	112.39	343.49	54.61	69.52	26.00	10.75 [Methanol (methyl alcohol)]
2018	17.76	130.23	384.44	63.27	72.17	28.03	11.68 [Methanol (methyl alcohol)]
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)]

Review Engineer: Richard Simpson

Review Engineer's Signature: *Richard Simpson* **Date:** *August 24, 2021*

Comments / Recommendations:
Issue 10203/T08
Permit Issue Date: August 24, 2021
Permit Expiration Date: July 31, 2026

I. Introduction and Purpose of Application

Enviva Pellets Northampton, LLC (referred to as EnvivaNOR or Northampton throughout this document) currently holds Air Permit No. 10203R07 with an expiration date of February 28, 2025 for a wood pellets manufacturing plant in Garysburg, Northampton County, North Carolina. The submittal of this application is for a first time Title V Air Permit. Per Air Permit No. 10203R07 issued October 21, 2020, the facility was required to submit an amended Title V application within 30 days of permit issuance. Application No. 6600167.14B was submitted on April 22, 2014, within 12 months of commencing operation of the facility, and was amended on August 9, 2016, January 21, 2020, April 3, 2020, and November 23, 2020. The November 23, 2020 amended application was considered complete on that date and replaces all of the other amended 1st Time Title V Air Permit applications. This application will be processed in accordance with 15A NCAC 2Q .0501(c)(1) and will go through a 30 day public notice and a 45 day EPA review at this time.

A. The plant is currently permitted to produce up to 625,225 oven-dried tons (ODT) per year of wood pellets 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, dried wood handling, dry hammermills, pellet presses and coolers, product loadout operations, and other ancillary activities.

B. Permit 10203R06 that was issued on October 30, 2019 incorporated 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 .1112: 112(g) Case-by-Case Maximum Available Control Technology (MACT) Standards for HAPs. After additional control devices are installed per permit 10203R06 Section 2.2 A.3 and 4, the facility is permitted to increase potential facility throughput to 781,255 ODT per year and increased softwood percentages from 30% to 80%.

C. Air Permit No. 10203R07 that was issued October 21, 2020 incorporated additional emission reductions and updated emission sources along with added control devices.

D. Application No. 6600167.14B was initially received on April 22, 2016. The application has been revised and amended several times: August 9, 2016, January 21, 2020, April 3, 2020, and November 23, 2020. Detailed updates are located in the Table of Changes in Section 3.

II. History/Background/Application Chronology

April 22, 2014 - First time Title V application No. 6600167.14B was submitted within 12 months of commencing operation of the facility.

May 13, 2014 - Permit R03 was issued adding an eighth hammermill.

October 12, 2015 - Permit R04 was issued with modified dryer and the material handling system.

August 9, 2016 - An amended version to the first time Title V application 6600167.16A was submitted from the facility.

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 first time Title V permit was placed on hold pending response to those comments.

February 28, 2017 - Permit R04 expired.

March 3, 2017 - Permit R05 was issued.

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, 2019 – A permit addendum was received from the facility for permit application 6600167.18A.

March 29, 2019 – An amended permit for application 6600167.18A was received that replaced all other addendums and applications (except 6600167.14B - first time Title V).

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

January 21, 2020 – An amended version to the first time Title V application was received by the DAQ.

February 6, 2020 – Permit application 6600167.20A was received.

March 24, 2020 – An addendum to the permit modification 6600167.20A was received from the facility.

April 3, 2020 – An amended version to Application 6600167.14B (the first time Title V application) was submitted from the facility.

September 14, 2020 - The facility sent an addendum to permit application 6600167.20A that replaced all other addendums and applications (except 6600167.14B - first time Title V).

October 21, 2020 – Permit 10203R07 was signed and issued.

January 5– 6, 2021 – DAQ permitting engineer requested the facility to update the flow diagram and discussed removal of the dryer bypass stacks.

January 5– 20, 2021 – DAQ permitting Supervisors were requested by the Permitting Section engineer Richard Simpson to comment on the draft permit and review. Comments were received and included in the permit.

January 21– February 2, 2021 – The Raleigh Regional Office, and Stationary Source Compliance Branch were requested by the Permitting Section to comment on the draft permit and review. Comments were received and included in the permit from DAQ.

February 3- 19, 2021 – The facility was requested by the Permitting Section to comment on the draft permit and review. Comments were received and included in the permit. Details of comments are included in Section IX of this review.

February 12, 2021 – Facility representatives held a Teams meeting with DAQ's permitting and regional offices requesting changes to various permit requirements and monitoring parameters. Details of requested changes and responses are included in Section IX of this review.

February 22 – March 12, 2021 – Permitting and SSCB held a Teams meeting to better understand 3-hour block vs rolling averages for parametric monitoring on the oxidizers. Permitting requested compliance clarification from SSCB on additional language the facility proposed for RTO operational time on a semi-annual period and for allowed time to send stack test results. Details of requested changes and responses are included in Section IX of this review.

April 9 - 15, 2021 – Comments were received from Permit Supervisor and implemented into the draft permit and review. The facility was provided a draft of the permit and review before public notice. Facility comments were received and some but not all were included into the draft documents.

April 15, 2021 - The modeling memorandum was updated on April 15, 2021 for a correction noting acetaldehyde and beryllium were not required to be modeled since their emissions were below the TPER.

April 24 – May26, 2021 – On Saturday April 24, 2021, a notice of public hearing was published in the Roanoke Chowan News Herald and on the DAQ website. A public hearing was held online via Webex on Monday, May 24, 2021. The public comment period was April 24, 2021 through May 26, 2021 at 5:00 PM. Copies of the permit application review and draft air permit were made available for public review.

May 10 – May 24, 2021 – The facility requested to add two electric boilers as an insignificant activity per 15A NCAC 02Q .0318. DAQ determined that the requested change meets the requirements of 15A NCAC 02Q .0318, "Changes Not Requiring a Permit Revisions" and the sources were added to the Attachment of the permit.

May 27 – June 28, 2021 – The public hearing officer's report was prepared and signed by DAQ engineer, Karyn Kurek.

July 7 – August 21, 2021 – DRAFT permit was sent to the EPA for review. The required 45-day EPA review period ended.

August 20, 2021 – Title V Equipment Editor (TVEE) changes were approved by Ms. Jenny Sheppard TVEE Coordinator.

August 24, 2021 – Permit 10203T08 was signed and issued.

III. Permit Modifications/Changes and TVEE Discussion

The following changes were made to Enviva Pellets Northampton, LLC, Garysburg, NC., Air Permit No. 10203R07.

Page No.	Section	Description of Changes
Cover Letter	N/A	Updated cover letter with application number, permit numbers, and dates.
Attachment	Insignificant Activities	Added two electric boilers with ID Nos. IES-EB01 and IES-EB02
3	Section 1	Moved footnote 2 to Section 2.2 A.5.
3, 7	Section 1, Section 2.1 A.	Deleted the Dryer 1 and 2 Bypass since they are used only for malfunctions.
3, 7	Section 1, Section 2.1 A.	Deleted the dry hammermill pre-screeners 1 and 2 since the systems are totally enclosed.

Page No.	Section	Description of Changes
7	Section 2.1 A	Moved all other sources to Sections 2.1 B, 2.1 C, and 2.1 D except ID Nos. ES-GWHS, ES-GHM-1 through ES-GHM-5, ES-DRYER-1, ES-DRYER-2, ES-FURNACEBYP-1, ES-FURNACEBYP-2, and associated control devices.
7	Section 2.1 A.	In Table, added oxidizer's ID Nos. for SO2.
7, 39	Section 2.1 A., Section 2.2 A.11	Removed 15A NCAC 02D .0540 "Fugitive Dust" since rule is in the General Conditions.
8, 10, 11	Sections 2.1 A.1, 2, and 3.	Added Title V noncompliance language for 15A NCAC 02D .0515, .0516, and .0521.
9	Section 2.1 A.1., Section 2.1 B.1.	For 15A NCAC 02D .0515, included separate monitoring/recordkeeping and reporting requirements to uncontrolled sources
9	Section 2.1 A.1.	Updated parametric parameter language.
9	Section 2.1 A.2.	For 15A NCAC 02D .0516, added the oxidizers. Moved the diesel limitation and record requirements to Section 2.2 A.5 and deleted fuel supplier certification. Removed the word "bypasses" and noncompliance fuel recordkeeping language.
11	Section 2.1 A.3.	Added the specific emission points associated with the 15A NCAC 02D .0521 regulation. Added separate requirements for the furnace bypass idle mode operation.
11	Section 2.1 A.3.d.	Updated noncompliance language to "…for these sources in the first idle bypass mode following the effective date of this permit or beginning of operation.
12	Section 2.1 A.4.	Removed 15A NCAC 02D .0535 "Excess Emissions Reporting and Malfunctions" since rule is in the General Conditions.
12	Section 2.1 B.	From Section 2.1 A., created Section 2.1 B. for sources ID. Nos. ES-DWH-1, ES-DWH-2, ES-HM-1 through ES-HM-8, ES-DLC-1 with associated bagfilters.
14, 15	Sections 2.1 B.1 and 2.	Added Title V noncompliance language for 15A NCAC 02D .0515 and .0521.
14	Section 2.1 B.1.d.	For clarity, deleted "or the types of materials and finishes are not monitored."
14	Section 2.1 B.1.g.	Added language to monitor CD-WESP-1 and CD-RTO-1 as specified in Section 2.1 A.1.g and h.
15	Section 2.1 B.2.	Added the specific emission points associated with the 15A NCAC 02D .0521 regulation.
16	Section 2.1 C.	From Section 2.1 A., created Section 2.1 C. for sources ID. Nos. ES-DSR, ES-DSS, ES-DSHM-1, ES-DSHM-2, with associated control devices.
17, 18	Sections 2.1 C.1 and 2.	Added Title V noncompliance language for 15A NCAC 02D .0515 and .0521.
18	Section 2.1 C.1.e.	Added language to monitor CD-WESP-1 and CD-RTO-1 as specified in Section 2.1 A.1.g and h.
18	Section 2.1 C.2.	Added the specific emission points associated with the 15A NCAC 02D .0521 regulation.

Page No.	Section	Description of Changes
19	Section 2.1 D.	From Section 2.1 A., created Section 2.1 D. for sources ID. Nos. ES-PMFS, ES-CLR-1 through ES-CLR-6, ES-PCHP, ES-FPH, ES-PB-1 through ES-PB-12, ES-PL-1, ES-PL-2 with associated control devices.
21, 22	Sections 2.1 D.1, 2, and 3.	Added Title V noncompliance language for 15A NCAC 02D .0515, .0516, and .0521.
22	Section 2.1 D.3.	Added the specific emission points associated with the 15A NCAC 02D .0521 regulation.
39	Sections 2.2 A.	Removed 15A NCAC 02Q .0207 "Annual Emission Reporting" since the rule is in the General Conditions.
39	Sections 2.2 A.	Removed 15A NCAC 02Q .0304 "Permit Renewal Application" since the rule is in the General Conditions.
25	Sections 2.2 A. 1.	Removed reporting for moisture content parameter since stack test will be used for compliance with emission limits.
25, 26	Sections 2.2 A.1 and 2.	Added Title V noncompliance language for 15A NCAC 02D .0530.
25	Sections 2.2 A.2.b.	For clarity, added "with aerodynamic diameter less than" for PM10 and PM2.5.
26	Sections 2.2 A.2.	Removed "reserved" from previously deleted sections and removed redundant air flow language.
26	Sections 2.2 A.2.	Moved diesel startup usage and recording requirements to Section 2.2 A.5.
26	Sections 2.2 A.2.	Updated stack test report submittals from 60 days to 30 days.
26	Sections 2.2 A.2.	Removed the notification requirement since the Raleigh Regional Office has received notification of the completion of the modification.
26, 33	Sections 2.2 A.2., Section 2.2 A.3.	Updated the parametric monitoring data.
29	Section 2.2 A.2.f.	Removed the following language: "(the second half of the oxidizer away from the flame zone)".
30	Section 2.2 A.2.j.	Included updated reference sections for the bagfilters and cyclones.
30, 31	Section 2.2 A.2.n.i, ii, and iii	Updated the following language for each pollutant to: "…not installed) until site-specific NOx, VOC, or CO emission factors established through stack testing and approved by DAQ."
31	Section 2.2 A.2.n.ii.	Corrected the RCO2 VOC emission factor from 0.77 to 0.0722.
33	Sections 2.2 A.3.	Added Title V noncompliance language for 15A NCAC 02D .1112.
37	Sections 2.2 A..6.	Updated 15A NCAC 02Q .0711 requirements to the current shell.
39	Section 2.2 A.11.	Deleted section for 15A NCAC 02Q .0504 since this permit is for Title V.
38	Section 2.3.	Updated Section 2.3 "Construction Schedule".
39-49	Section B	The General Conditions were updated to the latest version of DAQ shell in Section 3

The changes mentioned above will be made to the Title V Equipment Editor (TVEE) under this permit application.

IV. First Time Title V Description

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

A. Green Wood Handling and Storage (ID Nos. ES-GWHS)
"Green" (i.e., fresh cut) wood is delivered to the plant via trucks as either pre-chipped wood or whole logs from commercial harvesting for on-site chipping. Pre-chipped wood is screened to remove oversize material which goes to the furnace fuel pile and acceptably sized chips are conveyed to storage piles. Logs are debarked and chipped in the Debarker (IES-Debark) and Chipper (IES-EPWC). Chipped wood for drying is conveyed to a chipped wood storage pile and bark is conveyed to a bark fuel storage pile. All transfer points and storage piles are captured by the Green Wood Handling and Storage source (ES-GWHS).

B. Debarking (IES-Debark), Chipping (IES-EPWC), Bark Hog (IES-Bark), and Green Wood Fuel Storage Bins (IES-GWFB)
Logs are debarked by the electric-powered rotary drum Debarker (IES-Debark) and then sent to the electric powered green woodchipper (IES-EPWC) to chip the wood to acceptable size. The chips are then routed to Green Wood Storage Piles. Purchased chips received by three (3) truck dumps are also transferred to Green Wood Storage Piles. Bark from the Debarker is hogged (IES-Bark) and transferred to the Bark Fuel Storage Piles along with purchased bark/fuel chips received via truck dump or walking floor trailers. Following storage in the Bark/Fuel Chip Storage Piles, the bark/fuel chips are transferred to a blend pile, then transferred via walking floor to a covered conveyor, and finally to an enclosed Green Wood Fuel Storage Bin (IES-GWFB) where the material is pushed into the furnaces.

C. Green Hammermills (ES-GHM-1 through ES-GHM-5)
Prior to drying, chips from the Green Wood Storage Piles are processed in the Green Hammermills to reduce material to the proper size. Exhaust from the five (5) new closed-loop green hammermills (ES-GHM-1 through ES-GHM-5) will be routed to the existing WESP (CD-WESP-1) and then routed to a Regenerative Thermal Oxidizer (CD-RTO-1) for further emissions control prior to being released into the atmosphere. The Green Hammermills will also have the ability to be routed to and controlled by the Dryer #2, WESP (CD-WESP-2) and RTO (CD-RTO-2), once constructed, when the Dryer #1, WESP (CD-WESP-1) and RTO (CD-RTO-1) are shut down.

D. Dryers (ES-DRYER-1 and ES-DRYER-2) and Double Duct Burners (IES-DDB-1 through IES-DDB-4)
Dryer #1 (ES-DRYER-1) uses direct contact heat provided to the system via a 175.3 million British thermal unit per hour (MMBtu/hr) total heat input furnace that uses 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 multi-clone separator, consisting of three identical material handling integral cyclones that remove wood fiber from the dryer exhaust gas. Emissions from each cyclone are combined into a common duct and are routed to the WESP (CD-WESP-1) for particulate, metallic HAP, and hydrogen chloride removal. Exhaust from the WESP will then be routed to an RTO (CD-RTO-1) for additional VOC control.

A second direct contact rotary dryer system (ES-DRYER-2) will also be equipped with a WESP (CD-WESP-2) and RTO (CD-RTO-2) for the same emissions control described above for Dryer

#1. Dryer #2 and its associated control equipment are authorized for construction and operation in Northampton's current air permit, 10203R07. The new dryer, similar to the existing dryer, will use direct contact heat provided to the system via a 180 MMBtu/hr total heat input furnace that uses bark and fuel chips as fuel.

As flue gas exits the dryers and begins to cool, wood tar can condense and coat the inner walls of the dryer ducts creating a risk of fire. To prevent condensation from occurring and thus reduce the risk of fire, each dryer system will include double ducts which will be heated. The duct from the cyclone outlet to the ID fan will be heated by one low-NOx burner with a maximum heat input rating of 2.5 MMBtu/hr, and a second 2.5 MMBtu/hr low-NOx burner will heat the duct used for exhaust gas recirculation and the WESP. The double duct burners (IES-DDB-1 through IES-DDB-4) are Title V insignificant activities and will combust natural gas, or propane as back-up, and exhaust directly to atmosphere.

E. Furnace Bypass Stacks (ES-FURNACEBYP-1, ES-FURNACEBYP-2)

The Furnace Bypass stacks are used to exhaust hot gases during start-ups (for temperature control) and planned shutdowns. Specifically, the Furnace Bypass Stacks are used in the following situations:

- Cold Start-ups: The furnace bypass stacks are used when the furnace is started up from a cold shutdown until the refractory is heated to a temperature sufficient to sustain combustion operations at a minimal level or 8 hours, whichever is less. The bypass stack is then closed, and the furnace is slowly brought up to a normal operating rate. The furnace bypasses are limited to no more than 50 hours per year per furnace for start-ups (for temperature control) and shutdowns. The furnace bypasses shall not be utilized at the same time and shall be limited to a cold startup of 15% maximum heat input or 26.3 million Btu/hr for furnace 1 and 27.0 million Btu/hr for furnace 2. For each furnace, diesel fuel as a startup accelerant shall be limited to 30 gallons per startup and 200 gallons per year. Emissions resulting from diesel combustion are insignificant. The maximum sulphur content of any diesel fuel received and burned shall not exceed 0.5 percent by weight.
- Planned Shutdown: In the event of a planned shutdown the furnace heat input is decreased, and all remaining fuel is moved through the system to prevent a fire during the shutdown period. The remaining fuel is combusted prior to opening the furnace bypass stack. The furnace bypass stack is not utilized until after the furnace achieves an idle state (10 MMBtu/hr or less). Until this time, emissions continue to be controlled by the WESP and RTO.
- 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. Each furnace in idle mode, defined as maximum heat input of 10 million Btu per hour each, may operate up to 500 hours per year with emissions routed to the Furnace Bypass Stacks.
- The Dryer 1 and Dryer 2 bypass stacks are only used during a Dryer malfunction and are not considered as emission sources. The two Dryer Bypasses (ID Nos. ES-DRYERBYP-1 and ES-DRYERBYP-2) were removed from this permit.

F. Dried Wood Handling (ES-DWH-1 and ES-DWH-2)

Dried materials from the Dryer material integral cyclones are conveyed to screening operations that remove smaller wood particles which bypass the Dry Hammermills. The Dried Wood Handling emission sources each include partially enclosed conveyor systems and conveyor transfer points located after each dryer (ES-DWH-1 and ES-DWH-2). Emissions associated with ES-DWH-1 are controlled by a passive bin vent (CD-DWH-BV) and emissions associated with ES-DWH-2 will be controlled by a baghouse (CD-DWH-BF-2). Pre-screening may be

accomplished with two (2) existing pre-screeners which are enclosed and do not emit to the atmosphere.

G. Dry Shavings Reception and Handling (ES-DSR, IES-DRYSHAVE), Dry Hammermills (ES-HM-1 through ES-HM-8), Dry Line Conveyor (ES-DLC-1), Dry Line Hopper (IES-DLH), Dry Shavings Hammermills (ES-DSHM-1 and 2) and Dry Shavings Silo (ES-DSS)
Oversized wood is diverted to one of eight (8) Dry Hammermills (ES-HM-1 through ES-HM-8) for further size reduction prior to pelletization. Each Dry Hammermill includes a product integral cyclone which is routed to one of three (3) baghouses (CD-HM-BF-1 through CD-HM-BF-3) for particulate matter control. A portion of the exhaust exiting the product recovery cyclones will be recirculated back to the front end of the Dry Hammermills and the remaining exhaust stream will be routed through the three (3) baghouses (CD-HM-BF-1 through CD-HM-BF-3) to a quench duct for fire safety and then to either the Dryer #1 (ES-DRYER-1) furnace, the Dryer #1 WESP (CD-WESP-1), or a combination of the two, and then to the Dryer #1 RTO (CD-RTO-1) to control VOC and HAP emissions. The quench duct is being installed for safety purposes to reduce the risk of fire and is not considered a control device. Material from the dry hammermill integral cyclones as well as smaller particles that pass through the pre-screeners are transferred to the Dry Hammermill system discharge collection enclosed drag chain conveyor, and then to the Pellet Mill Feed Silo infeed screw via enclosed drag chain conveyors to be made into pellets.

Purchased dry shavings are also used to produce wood pellets in addition to green chips or logs, forgoing the drying process and thus minimizing on-site VOC and HAP emissions. Currently, the plant receives dry shavings at the bark truck dump where they are moved to an open dry shavings pile via front end loader or are received via walking floor trailer at the pile. Dry shavings are added to the existing Dry Line Hopper (IES-DLH) and subsequently transferred to the dry hammermill pre-screeners via the existing Dry Line Feed Conveyor (ES-DLC-1) and dry hammermill feed conveyor. These transfer activities make up the existing Dry Shaving Material Handling and Storage (IES-DRYSHAVE) emission source that is used for feeding pre-dried materials. Particulate emissions from Dry Shavings Reception (ES-DSR) will be controlled by the Dry Shavings Reception baghouse (CD-DSR-BF).

A Dry Shavings Silo (IES-DSS) will be used to store dry shavings used in pellet production. The purchased dry shavings will be unloaded from trucks via a 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 Dry Shavings Hammermills (ES-DSHM-1 and ES-DSHM-2) for additional processing. Milled dry shavings will then be transferred to the Pellet Mill Feed Silo. The dry shavings hammermill exhaust will be routed to a baghouse (CD-HM-BF-3) and then to a quench duct for fire safety and then to either the Dryer #1 (ES-DRYER-1) furnace, the Dryer #1 WESP (CD-WESP-1), or a combination of the two, and then to the Dryer #1 RTO (CD-RTO-1) for control of VOC and HAP emissions.

Under normal operations, all air flow from the bagfilters on the dry hammermills and dry shavings hammermills is ducted to the dryer furnace prior to treatment by the WESP1 and the RTO1. In the event of reduced furnace/dryer operation, a portion of the air flow from the bagfilters on the dry hammermills and from the bagfilter on dry shavings hammermills is ducted directly to the WESP1 for treatment by the WESP1 in series with the RTO1. In the event of the shutdown of the furnace/dryer system, all air flow from the bagfilters on the dry hammermills and dry shavings hammermills is ducted directly to the WESP-1 and RTO-1. The purpose of the recirculation process is to reduce the volume of air that is ultimately routed to the downstream control devices CD-WESP-1 and CD-RTO-1. All rerouted gases from the dry and dry shavings hammermills are required to pass through the precipitator (CD-WESP-1) and oxidizer (CD-RTO-1).

The purpose of the quench duct is to protect the RTO by reducing the risk of fire. Operation of the DHM and DSHM will be interlocked with operation of the quench duct (i.e., the quench duct must operate in order for the DHM and DSHM to operate). If flow in the quench duct drops below a minimum flow rate, the DHM and DSHM will shut down. All exhaust from the DHM will still be routed through existing baghouses, and all exhaust from the DSHM will be routed through baghouse (CD-HM-BF-3).

H. Pellet Mill Feed Silo (ES-PMFS) and Pellet Cooler HP Fines Relay System (ES-PCHP)
Milled wood from the Dry Hammermill material 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 are controlled by a bin vent filter (CD-PMFS-BV).
Fines from Finished Product Handling (ES-FPH) are collected by the Pellet Cooler HP Fines Relay System (ES-PCHP) which is controlled by a baghouse (CD-PCHP-BV). The Pellet Cooler HP Fines Relay System transfers this material to the Pellet Mill Feed Silo (ES-PMFS).

I. Additive Handling and Storage (IES-ADD)
Additive may be used in pellet production to act as a lubricant for the dies and increase the durability of the final product. The additive is received in 500 lb supersacks and is emptied into a hopper. The additive is transferred from the hopper via enclosed screw conveyor and is added to milled 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.

J. Pellet Press System and Pellet Coolers (ES-CLR-1 through ES-CLR-6)
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 is vented through the Pellet Cooler aspiration material recovery cyclones and emission 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). VOC and organic HAP emissions will be controlled by an RTO/RCO (CD-RCO-2).

A quench duct will be installed prior to RTO/RCO (CD-RCO-2) for safety purposes to reduce the risk of fire and is not considered a control device. The quench duct is inherent for the RTO/RCO (CD-RCO-2) to operate safely (protection from fire). A safety interlock will be installed to cease operation of the pellet presses and pellet coolers if a minimum flowrate is not maintained.

K. Finished Product Handling (ES-FPH) and Loadout (ES-PL-1, ES-PL-2, ES-PB-1 through ES-PB-12)
Final product is conveyed to pellet loadout bins (ES-PB-1 through ES-PB-12) that 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 by the pellet screeners, 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) and the Pellet Loadout Bins (ES-PB-1 through ES-PB-12). Fine material from loadout operations is transferred to the Pellet Mill Feed Silo (ES-PMFS).

L. Emergency Generators (IES-GN-1 and IES-GN-2), Fire Water Pump Engine (IES-FWP), and Diesel Storage Tanks (IES-TK-1 through IES-TK-4)

The plant has a 350 horsepower (hp) diesel-fired Emergency Generator (IES-GN-1) for emergency operations and a 300 hp diesel-fired Fire Water Pump Engine (IES-FWP). Aside from maintenance and readiness testing, the generator and Fire Water Pump Engine are only utilized for emergency operations. Diesel for the IES-GN-1 is stored in a tank of up to 2,500 gallons capacity (IES-TK-1) and diesel for the fire water pump engine is stored in a storage tank of up to 500-gallon capacity (IES-TK-2).

A 671 hp diesel-fired Emergency Generator (IES-GN-2) is required to support operations of the facility, and diesel for IES-GN-2 is stored in a 1,000-gallon diesel storage tank (IES-TK-4). The plant also includes a diesel storage tank with a capacity of up to 5,000 gallons that is used for distributing diesel fuel to mobile equipment (IES-TK-3).

M. Propane Vaporizer (IES-PVAP)

A direct-fired propane vaporizer (IES-PVAP) may be used to vaporize liquid propane for combustion by the RTO burners, RTO/RCO burners, and double duct burners (IES-DDB-1 through IES-DDB-4). The vaporizer will have a maximum heat input capacity of 1 MMBtu/hr and will combust propane. Propane may be used until natural gas service is available to the facility, after which natural gas will be the primary fuel for all burners with propane used as a back-up fuel.

N. Electric Boilers (IES-EB01 and IES-EB02)

The two electric boilers supply low pressure steam to the pellet mills. The electric boilers help improve product quality and uniformity while reducing electric power consumption from the pellet mills. Steam will be injected into the raw wood fibers prior to the pelletizing process and will act as a lubricant for the raw wood fibers.

V. Potential Emissions

The following table is the estimated potential to emit (PTE) from the first time Title V application. Detailed facility-wide emissions for criteria pollutants are located in Appendix 1 of this review.

Enviva's Estimated PTE	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)
Title V 11/17/2020 application	171.2	213.0	120.0	89.4	75.4	39.1	120.3	383,222	18.0

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

Fugitive PM emissions result from unloading purchased chips and bark from trucks into hoppers and the 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]. Detailed potential emission calculations are included in Appendix 1.

B. Green Wood Storage Piles and Bark Fuel Storage Piles (ES-GWHS)

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 inch 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). 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. Detailed potential emission calculations are included in Appendix 1.

C. Debarker (IES-Debark) and Bark Hog (IES-Bark)

PM emissions occur as a result of log debarking and processing. Potential PM emissions from debarking and the 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 are 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 use of water spray in the debarker. The Bark Hog is also largely enclosed, and a 90% control efficiency was applied for partial enclosure. VOC and methanol emissions were quantified based on emission factors for log chipping from AP-42 Section 10.6.3, *Medium Density Fiberboard*[6]. Detailed potential emission calculations for the debarker and bark hog are included in Appendix 1.

The Debarker (IES-Debark) and Bark Hog (IES-Bark) are considered insignificant activities per 15A NCAC 02Q .0503 due to potential uncontrolled PM and VOC emissions less than 5 tpy and potential HAP emissions less than 1,000 pounds per year (lb/yr).

D. Chipper (IES-EPWC)

The chipping process results in emissions of VOC and HAP. VOC and HAP 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]. Detailed emission calculations are included in Appendix 1. The chipper is considered an insignificant activity per 15A NCAC 02Q .0503 due to potential uncontrolled HAP and VOC emissions less than 1,000 lb/yr and 5 tpy, respectively.

E. Green Wood Fuel Storage Bins (IES-GWFB)

Bark and chips are transferred from the fuel storage piles via a walking floor to a covered conveyor and then to the fully enclosed Green Wood Fuel Storage Bins (IES-GWFB). Due to complete enclosure of the Green Wood Fuel Storage Bins (IES-GWFB), emissions from transfer of material into the bin were not specifically quantified.

F. Dryers (ES-DRYER-1 and ES-DRYER-2), Green Hammermills (ES-GHM-1 through ES-GHM-5), Dry Hammermills (ES-HM-1 through 8), and Dry Shavings Hammermills (ES-DSHM-1 and ES-DSHM-2)

Exhaust from the dryers will be routed to two dedicated WESP/RTO control systems (one for each dryer line) for control of PM, VOC, and HAP. The Green Hammermills will share the existing dryer's 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 constructed) when the Dryer #1 WESP and RTO are shut down. It should be noted that for potential-to-emit emission estimates, Green Hammermill emissions are accounted for under the Dryer #1 WESP and RTO.

Emissions of particulate matter are based on process knowledge and engineering judgement. Carbon monoxide (CO) emissions generated during green wood combustion are based on information from the NCASI database, process knowledge, and an appropriate contingency based on engineering judgement. Oxides of nitrogen (NO_X) emissions are based on process information and an appropriate contingency based on engineering judgement. Potential emissions of sulphur dioxide (SO_2) from green wood combustion were calculated based on the heat input of the furnace and an emission factor for wood combustion from AP-42, Section 1.6, *Wood Residue Combustion in Boilers*[8]. VOC emissions were calculated using an emission factor derived from process information and an appropriate contingency based on engineering judgement. HAP and toxics air pollutant (TAP) emissions from green wood combustion were calculated based on emission factors from several data sources including engineering judgement/process knowledge, and emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers*[8].

The Dry Hammermill and Dry Shavings Hammermills generate PM, PM_{10}, $PM_{2.5,}$ VOC, and HAP emissions during sizing of dried wood. PM emissions from the eight (8) Dry Hammermills and two (2) Dry Shavings Hammermills are routed to baghouses for control of PM emissions (CD-HM-BF-1 through CD-HM-BF-3). Particulate emissions from each baghouse were calculated using an exit grain loading rate, the maximum nominal exhaust flow rate of the baghouse, and the expected control efficiency of the WESP (CD-WESP-1). Note that the $PM_{2.5}$ speciation reflects a recent review of National Council for Air and Stream Improvement, Inc. (NCASI) particle size distribution data for similar baghouses used in the wood products industry.

The Dry Hammermill and Dry Shavings Hammermill exhaust through baghouses (CD-HM-BF-1 through 3 for Dry Hammermills and CD-HM-BF-3 for Dry Shavings Hammermills) and will be routed to a quench duct for fire safety and then to either the Dryer #1 (ES-DRYER-1) furnace, the Dryer #1 WESP (CD-WESP-1), or a combination of the two, and then to the Dryer #1 RTO (CD-RTO-1) for HAP and VOC control. Note, the quench duct is being installed for safety purposes only to reduce the risk of fire and is not considered a control device.

Uncontrolled VOC and HAP emissions at the outlet of the Dry Hammermill baghouses (CD-HM-BF-1 through 3) were quantified based on process knowledge and an appropriate contingency based on engineering judgement. Controlled emissions were estimated based on the expected destruction efficiency for the RTO. NO_x and CO emissions resulting from thermal oxidation were calculated using AP-42 Section 1.4, *Natural Gas Combustion*[9]. and the maximum high heating value of the anticipated VOC constituents.

Emissions from natural gas and propane combustion by the RTO were calculated based on AP-42 Section 1.4, *Natural Gas Combustion*[9], AP-42 Section 1.5, *Liquefied Petroleum Gas Combustion*[10], NC DAQ's Wood Waste Combustion Spreadsheet[11], and emission factors from the South Coast Air Quality Management District's (SCAQMD) Air Emissions Reporting (AER) Tool. Detailed emission calculations are included in Appendix 1.

G. Furnace Bypass (Cold Start-up)

Potential emissions of CO, NOx, SO2, 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*[8]. Emissions were based on 15% of the maximum heat input capacity of the furnaces and 50 hours per year per furnace. Diesel fuel may be used as an accelerant for cold start-ups; however, as the amount used per event is typically 15 – 30 gallons and the annual usage is

typically 100 – 200 gallons, emissions resulting from the use of diesel fuel are insignificant and are not included in the ES-FURNACEBYP-1 and ES-FURNACEBYP-2 emission estimates. Detailed potential emissions calculations are included in Appendix 1.

H. Furnace Bypass (Idle Mode)

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 10 MMBtu/hr. During this time, emissions will exhaust out of the furnace bypass stacks. Potential emissions of CO, NOX, SO2, PM, VOC, and HAP were calculated based on emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers*[8]. Detailed potential emission calculations are included in Appendix 1.

I. 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, AP-42 Section 1.5, Liquefied Petroleum Gas Combustion, NC DAQ's Natural Gas Combustion Spreadsheet, and emission factors from the South Coast Air Quality Management District's (SCAQMD) Air Emissions Reporting (AER) Tool. Detailed emission calculations are included in Appendix 1. Per 15A NCAC 02Q .0503, the double duct burners (IES-DDB-1 through IES-DDB-4) and propane vaporizer (IES-PVAP) are considered insignificant activities because potential uncontrolled criteria pollutant and HAP emissions are less than 5 tpy and 1,000 lb/yr, respectively.

J. Dried Wood Handling (ES-DWH)

As previously described in Section 2, Dried Wood Handling (ES-DWH-1 and ES-DWH-2) will include partially enclosed conveyor systems and conveyor transfer points located after each dryer. Particulate matter emissions from transfers associated with ES-DWH-1 were calculated based on AP-42 Section 13.2.4, *Aggregate Handling and Storage Piles*[1]. Although particulate emissions are controlled by the existing passive bin vent, no control efficiency was applied for the bin vent. Emissions from transfers associated with ES-DWH-2 will be routed through a baghouse (CD-DWH-BF-2). Particulate emissions from the baghouse (CD-DWH-BF-2) were calculated based on the exhaust flow rate and exit grain loading. Potential VOC and HAP emissions from Dried Wood Handling (ES-DWH-1 and ES-DWH-2) were calculated based on emission factors derived from NCASI's Wood Products Database (February 2013) for dry wood handling operations at an oriented strand board (OSB) mill and process knowledge and an appropriate contingency based on engineering judgement. Detailed potential emission calculations are provided in Appendix 1.

K. Dry Shavings Handling (IES-DRYSHAVE), Dry Line Feed Conveyor (ES-DLC-1) and Dry Line Hopper (IES-DLH)

Particulate emissions occur during transfer of dry shavings to the dry shavings pile (IES-DRYSHAVE), the Dry Line Hopper (IES-DLH), and Dry Line Feed Conveyor (ES-DLC-1). Potential emissions from material transfer were calculated based on Equation 1 of AP-42, Section 13.2.4, *Aggregate Handling and Storage Piles*.[1] Per 15A NCAC 02Q .0503, the Dry Line Hopper is an insignificant activity due to uncontrolled emissions below 5 tpy.

Particulate emission factors used to quantify emissions from storage pile wind erosion for the Dry Shavings Storage Pile (IES-DRYSHAVE) were calculated based on USEPA's *Control of Open Fugitive Dust Source*[2]. The number of days with rainfall greater than 0.01 inch was obtained from AP-42 Section 13.2.2, *Unpaved Roads*[3], and the percentage of time that wind speed exceeds 12 mph was determined based on the AERMOD-ready meteorological dataset for the Maxton 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 the storage pile were quantified based on the exposed surface area of the pile and emission factors from the National Council for Air and Stream Improvement (NCASI). 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. Detailed potential emissions calculations can be found in Appendix 1.

L. Dry Shavings Reception, Handling, and Silo (ES-DSR, IES-DRYSHAVE, and ES-DSS)
Particulate emissions will occur during unloading of dry shavings from the existing and new dry shavings truck dumps (IES-DRYSHAVE). 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*[5].

Particulate emissions from Dry Shavings Reception (ES-DSR) will be controlled by the Dry Shavings Reception baghouse. 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 Dry Shavings Silo (CD-DSS-BF) were calculated based on the baghouse exhaust flow rate and exit grain loading. Detailed potential emission calculations are provided in Appendix 1.

M. Pellet Cooler HP Fines Relay System (ES-PCHP)
Fine pellet material is conveyed from finished product handling to the Pellet Cooler High Pressure Fines Relay System, controlled by a baghouse (CD-PCHP-BV). PM emissions from this baghouse were calculated based on an exit grain loading rate and the maximum nominal exhaust flow rate of the baghouse. Potential emission calculations are provided in Appendix 1.

N. Pellet Mill Feed Silo (ES-PMFS)
The Pellet Mill Feed Silo is equipped with a bin vent filter (CD-PMFS-BV) to control PM emissions associated with silo loading and unloading operations. PM emissions are calculated based on an exit grain loading rate and the maximum nominal exhaust flow rate of the baghouse. Potential emission calculations are provided in Appendix 1.

O. Additive Handling and Storage (IES-ADD)
An additive may be used in the pellet production process to increase the durability of the final product. Potential emissions from transfer activities associated with Additive Handling (IES-ADD) were calculated based on AP-42, Section 13.2.4, *Aggregate Handling and Storage Piles*[1]. Detailed potential emissions calculations are provided in Appendix 1. Per 15A NCAC 02Q .0503, Additive Handling and Storage (IES-ADD) is considered an insignificant activity because potential uncontrolled PM emissions are less than 5 tpy.

P. Pellet Press System and Pellet Coolers (ES-CLR-1 through ES-CLR-6)
Pellet Press System (Pellet Mills) and Pellet Cooler (ES-CLR-1 through 6) 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 quench duct and then through the RTO/RCO (CD-RCO-2) for VOC and HAP control. Note, the quench duct being installed is for safety purposes only to reduce the risk of fire in the RTO/RCO and is not considered a control device. 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 cyclones. Potential criteria pollutant emissions from natural gas and propane combustion by the RTO/RCO were calculated based on AP-42 Section 1.4, *Natural Gas Combustion*[9] and AP-42 Section 1.5, *Liquefied Petroleum Gas Combustion*[10]. NOx and CO emissions resulting from thermal

oxidation were calculated using emission factors from AP-42 Section 1.4, *Natural Gas Combustion*[9] and the maximum high heating value of the anticipated VOC constituents.

Uncontrolled VOC and HAP emissions at the outlet of the Pellet Cooler were quantified based on process information and an appropriate contingency based on engineering judgement. This includes emissions from both the Pellet Mills and the Pellet Coolers. Controlled emissions were conservatively based on a 95% control efficiency for the RTO/RCO. The RTO and RCO modes have the same control efficiency so there is no impact on emissions when switching between operating modes. Emissions of HAP from natural gas/propane combustion by the RTO/RCO burners were estimated using emission factors from AP-42 Section 1.4 and the *SCAQMD's AER Tool*[12]. Detailed calculations are provided in Appendix 1.

Q. Pellet Loadout Bins (ES-PB-1 through ES-PB-12), Pellet Mill Loadout (ES-PL-1 and ES-PL-2), and Finished Product Handling (ES-FPH)
Particulate emissions result from the transfer of finished product to the Pellet Loadout Bins. PM emissions from transfers associated with Finished Product Handling, Pellet Mill Loadout, and the Pellet Loadout Bins are controlled by a baghouse (CD-FPH-BF). 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 baghouse. Detailed potential emissions calculations are provided in Appendix 1.

R. Emergency Generator (IES-GN-1 and ES-GN-2) 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, NOX, and CO emissions from operation of the existing Emergency Generator (IES-GN-1) 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, while emissions of PM, NOX, VOC, and CO from the new Emergency Generator (IES-GN-2) were calculated based on emission factors from the manufacturer specification sheet. Potential SO2 emissions from all three engines 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 SO2 air emissions[13]. Potential VOC emissions from the existing Emergency Generator and Fire Water Pump and HAP emissions from all three engines were quantified based on emission factors from AP-42 Section 3.3, *Stationary Internal Combustion Engines*[14]. 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 .0503 because potential uncontrolled criteria pollutant and HAP emissions are less than 5 tpy and 1,000 lb/yr, respectively. Refer to Appendix 1 for detailed potential emission calculations.

S. Diesel Storage Tanks (IES-TK-1 through IES-TK-4)
The storage of diesel in on-site storage tanks generates emissions of VOC. VOC emissions from the four (4) Diesel Storage Tanks were calculated using equations and methodologies from AP-42, Chapter 7 (November 2019) 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 .0503 they are listed as insignificant sources in the permit. Refer to Appendix 1 for detailed potential emission calculations.

T. 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*[15] 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* 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. Refer to Appendix 1 for detailed potential emissions calculations.

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. USEPA AP-42 Section 1.6, *Wood Residue Combustion in Boilers* (09/03).
9. USEPA AP-42 Section 1.4, *Natural Gas Combustion* (07/98).
10. AP-42 Section 1.5, *Liquefied Petroleum Gas Combustion* (07/08
11. 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.
12. South Coast Air Quality Management District's (SCAQMD) Air Emissions Reporting (AER) Tool. Available online at: http://www3.aqmd.gov/webappl/help/newaer/index.html
13. Sulphur content in accordance with Year 2010 standards of 40 CFR 80.510(b) as required by NSPS Subpart IIII.
14. USEPA AP-42 Section 3.3, *Stationary Internal Combustion Engines* (10/96).
15. USEPA AP-42 Section 13.2.1, *Paved Roads* (01/11).

VI. 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 the dryer system operating at approximately 143.4 wet tons per hour exhausting through CD-RTO-1. The allowable emission rate is calculated to be 55.0 lbs/hr. The maximum hourly controlled emission rate at the outlet of RTO1 is 15.43 lbs/hr based on process knowledge and an appropriate contingency based on engineering judgement. Therefore, compliance is expected.

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 furnace 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. The RTOs and RCO/RTO burn propane or natural gas, which is inherently low in sulfur. 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.

VII. 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. This permit application does not affect this status.

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. This permit application does not affect this status.

C. "Compliance Assurance Monitoring" (CAM)

CAM plans that may be required are not due until submittal of the initial Title V renewal.

D. 15A NCAC 02Q .0317 "Avoidance Conditions" for avoidance of 15A NCAC 02D .1112 "112(g) Case-by-Case Maximum Achievable Control Technology" – After all of Permit 10203T08 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. Note: these sources are subject to the Case-by-Case MACT because the US EPA has not promulgated any federal MACTs for these types of sources or industry. 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 wet electrostatic precipitators (CD-WESP-1 or 2) and regenerative thermal oxidizers (CD-RTO-1 or 2). Dryer 1 HAPs will be controlled by the existing wet electrostatic precipitator (CD-WESP-1), in series with regenerative thermal oxidizer (CD-RTO-1), and Dryer 2 HAPs will be controlled with wet electrostatic precipitator (CD-WESP-2), in series with regenerative thermal oxidizer (CD-RTO-2).

HAP emissions from the Dry Hammermills (ES-HM-1 through ES-HM-8) will be routed through integral cyclones, in series with furnace/dryer system (ES-DRYER-1), in series with a wet electrostatic precipitator (ID No. CD-WESP-1), in series and controlled by a regenerative thermal oxidizer (ID No. CD-RTO-1). HAP emissions from the Dry Hammermills can also be routed through integral cyclones, controlled by three bagfilters (ID Nos. CD-HM-BF-1 through CD-HM-BF-3), controlled by a wet electrostatic precipitator (ID No. CD-WESP-1), in series with a regenerative thermal oxidizer (ID No. CD-RTO-1).

HAP emissions from the Dry Shavings Hammermills (ES-DSHM-1 and ES-DSHM-2) will be controlled by bagfilter (ID No. CD-HM-BF-3), in series with a wet electrostatic precipitator (ID No. CD-WESP-1), in series with a regenerative thermal oxidizer (ID No. CD-RTO-1). HAP emissions

from the Dry Shavings Hammermills can also be controlled by bagfilter (ID No.CD- HM-BF-3), in series with furnace/dryer system (ES-DRYER-1), in series with a wet electrostatic precipitator (ID No. CD-WESP-1), in series with a regenerative thermal oxidizer (ID No. CD-RTO-1).

All air flow from the dry hammermills is controlled by bagfilters (ID Nos. CD-HM-BF-1 through CD-HM-BF-3), the WESP1 (ID No. CD-WESP-1), and the RTO1 (ID No. CD- RTO-1). All air flow from the dry shavings hammermills is controlled by bagfilter (ID Nos. CD-HM-BF-3), the WESP1 (ID No. CD-WESP-1), and the RTO1 (ID No. CD- RTO-1). Under normal operations, all air flow from the bagfilters on the dry hammermills and dry shavings hammermills is ducted to the dryer furnace prior to treatment by the WESP1 and the RTO1. In the event of reduced furnace/dryer operation, a portion of the air flow from the bagfilters on the dry hammermills and from the bagfilter on dry shavings hammermills is ducted directly to the WESP1 for treatment by the WESP1 in series with the RTO1. In the event of the shutdown of the furnace/dryer system, all air flow from the bagfilters on the dry hammermills and dry shavings hammermills is ducted directly to the WESP-1 and RTO-1." The Pellet Press System and the six (6) pellet coolers (ES-CLR-1 thru ES-CLR-6) will route HAP exhausts through cyclones (ID Nos. CD-CLR-1 through CD-CLR-6), in series with a regenerative catalytic oxidizer (ID No. CD-RCO-2) that can also operate as a regenerative thermal oxidizer.

Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall establish emission factors for HAPs 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 Source	Pollutants
Green hammermills and dryer system 1, dry hammermills, dry shavings hammermills, controlled via oxidizer CD-RTO-1	Acetaldehyde Acrolein Formaldehyde Methanol Phenol Propionaldehyde
Green hammermills and dryer system 2 controlled via oxidizer CD-RTO-2	
Pellet coolers controlled via cyclones and oxidizer CD-RCO-2	

After construction and operation of the proposed control devices is completed, monitoring, recordkeeping, and reporting will be required according to the MACT Avoidance Condition, including calculations done on a 12-month rolling average. Because the facility has accepted an avoidance condition to limit the emissions of HAPs, it will be considered a Title III minor facility and avoid the 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 10203T08 Section 2.2 A.1 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 10203T08 Section 2.2 A.2 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 of 781,255 ODT/year on a rolling 12-month average basis with a maximum 80% softwood content and use RTOs and an RCO/RTO to control VOC emissions. 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	Pollutants
Green hammermills ,dryer system 1, dry hammermills, and dry shavings hammermills, controlled via oxidizer CD-RTO-1	VOC
	PM/PM10/PM2.5
	NOx
	CO
	PM/PM10/PM2.5
Green hammermills and dryer system 2 controlled via oxidizer CD-RTO-2	VOC
	PM/PM10/PM2.5
	NOx
	CO
Pellet coolers controlled via cyclones and oxidizer CD-RCO-2	VOC
	PM/PM10/PM2.5

Initial testing shall be completed within 180 days of commencement of operation, and the report shall be submitted to the DAQ within 30 days of the completions of initial testing unless an alternative date is approved by the DAQ..

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 thermal/catalytic oxidizers (ID Nos. CD-RTO-1, CD-RTO-2, 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 shall be logged for five years.

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 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.

Monthly NOx emissions, in tons, shall be calculated by the following equations and emission factors 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 the new site-specific approved NOx emission factors have been established through stack testing:

$$E_{\mathrm{NOx(Total)}} = \sum E_{\mathrm{NOx(Dryer1)}} + \sum E_{\mathrm{NOx(Dryer2)}} + \sum E_{\mathrm{NOx(RTO1)}} + \sum E_{\mathrm{NOx(RTO2)}} + \sum E_{\mathrm{NOx(RCO2)}} + 0.72$$

$$E_{\mathrm{NOx(Dryer1\ or\ Dryer2)}} = \frac{(0.47\ x\ Q_D)}{2{,}000}$$

$$E_{\mathrm{NOx(RTO1\ or\ RTO2)}} = \left(\frac{(3.53 \times P_{\mathrm{RTO}}) + (2.43 \times NG_{\mathrm{RTO}})}{2{,}000}\right)$$

Where:

$E_{\mathrm{NOx(Total)}}$ = total tons of NOx emissions per month from the facility.
$E_{\mathrm{NOx(Dryer1\ or\ 2)}}$ = 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.
$E_{NOx(RCO2)}$ = number of tons of NOx emissions per month from RCO2.
Q_D = the oven dried tons of processed wood through the dryers per month.
0.47 = dryer line NOx emission factor of 0.47 lb/ODT is derived from the October 2013 site specific stack test of 33.48 lb/hr at a 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 3.54 lb/hr (from DAQ combustion spreadsheet).
$NG_{RTO1 \text{ or } RTO2}$ = 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 2.43 lb/hr (from DAQ combustion spreadsheet).
0.72 = equates to the monthly potential to emit (PTE) tons for the miscellaneous sources including; double duct burners, propane vaporizer, bypass stacks, emergency generators, and a fire water pump (per application 6600167.20A).

Example Calculations for NOx emissions per month:

Dryer 1 2013 NOx stack test emission factor = 0.47 lb/ODT
Emission inventory 2019 annual throughput: = 528,092 ODT/yr
Average 2019 monthly throughput for facility: = 44,008 ODT/month
Average 2019 monthly throughput for Dryer 1and Dryer 2 :
= (44,008 ODT/month)/2 Dryers =22,004 ODT/month for each Dryer

NOx emissions from Dryers 1 and 2
(0.47 lbs NOx/ODT x 22,004 ODT/month)/ (2,000 lbs/ton) = 5.17 tons NOx/month for Dryer 1
(0.47 lbs NOx/ODT x 22,004 ODT/month)/ (2,000 lbs/ton) = 5.17 tons NOx/month for Dryer 2

NOx emissions from the RTO1 and RTO2 using propane:
((24 hours/day x 30 days/month) x (3.53 lb/hr)) / (2,000 lb/ton)) = 1.27 tons/month of NOx for RTO1
((24 hours/day x 30 days/month) x (3.53 lb/hr)) / (2,000 lb/ton)) = 1.27 tons/month of NOx for RTO2

NOx emissions from the RTOs using natural gas:
((0 hours/day x 0 days/month) x (2.43 lb/hr)) / (2,000 lb/ton)) = 0 tons/month of NOx for RTO1
((0 hours/day x 0 days/month) x (2.43 lb/hr)) / (2,000 lb/ton)) = 0 tons/month of NOx for RTO2

NOx emissions from the RCO2 using propane:
((24 hours/day x 30 days/month) x (2.13 lb/hr)) / (2,000 lb/ton)) = 0.77 tons/month of NOx for RCO2

NOx emissions from the RCO2 using natural gas:
((0 hours/day x 0 days/month) x (0.98 lb/hr)) / (2,000 lb/ton)) = 0.77 tons/month of NOx for RCO2

Maximum NOx emissions from all other sources facility-wide: 0.72 tons/month of NOx

Total facility NOx emissions example: 5.17 + 5.17 + 1.27 + 1.27 + 0.77 + 0.72 = 14.37 tons NOx/month

Monthly VOC emissions, in tons, shall be calculated by the following equations and emission factors 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 the new site-specific approved VOC emission factors have been established through stack testing:

$$E_{\mathrm{VOC(Total)}} = \sum E_{\mathrm{VOC(RTO1)}} + \sum E_{VOC(\mathrm{RTO2})} + \sum E_{\mathrm{VOC(RCO2)}} + 5.16$$

$$E_{\mathrm{VOC(RTO1)}} = \frac{(0.113\ x\ Q_{D1})}{2{,}000} \qquad E_{\mathrm{VOC(RTO2)}} = \frac{(0.066\ x\ Q_{D2})}{2{,}000}$$

$$E_{\mathrm{VOC(RCO2)}} = \frac{(0.0722\ x\ Q_{P})}{2{,}000}$$

Where:

$E_{VOC\ (Total)}$	=	total tons of VOC emissions per month from the facility.
$E_{VOC\ (RTO1\ or\ RTO2)}$	=	total tons of VOC emissions per month from each thermal oxidizer.
$E_{VOC\ (RCO2)}$	=	total tons of VOC emissions per month from RCO2 outlet.
Q_{D1}	=	the oven dried tons of processed wood through the dryer 1 per month.
Q_{D2}	=	the oven dried tons of processed wood through the dryer 2 per month.
Q_P	=	the oven dried tons of processed wood through the pellet coolers per month.

0.113 for RTO1 E_{VOC}= dryer line 1 VOC emission factor of 0.113 lb/ODT is based on facility process knowledge and an appropriate contingency based on engineering judgement at outlet of the RTO1 and includes emissions from the green hammermills, dry hammermills, dry shavings hammermills. Factor represents controlled emissions with an RTO control efficiency at 97.5%.

0.066 for RTO2 E_{VOC}= dryer line 2 VOC emission factor of 0.066 lb/ODT is based on facility process knowledge and an appropriate contingency based on engineering judgement at outlet of RTO2. Factor represents controlled emissions with an RTO control efficiency at 97.5%.

0.0722 for RCO2 E_{VOC} = pellet cooler VOC emission factor of 0.0722 lb/ODT is based on facility process knowledge and an appropriate contingency based on engineering judgement at outlet of the RCO2. Factor represents controlled emissions with an RCO2 control efficiency at 95%.

5.16 = equates to the monthly VOC PTE tons for the miscellaneous sources including, double duct burners, propane vaporizer, bypass stacks, emergency generators, fire water pump, dry wood handling, dry shaving material handling and storage, green wood handling and storage, electric chipper, back hog, and diesel tanks (per application 6600167.20A).

Monthly CO emissions, in tons, shall be calculated by the following equations and emission factors 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 the new site-specific approved CO emission factors have been established through stack testing:

$$E_{\mathrm{CO(Total)}} = \sum E_{\mathrm{CO(RTO1)}} + \sum E_{\mathrm{CO(RTO2)}} + \sum E_{\mathrm{CO(RCO2)}} + 0.73$$

$$E_{\mathrm{CO(RTO1)}} = \frac{(0.40\ x\ Q_{D1})}{2{,}000} \qquad E_{\mathrm{CO(RTO2)}} = \frac{(0.40\ x\ Q_{D2})}{2{,}000}$$

$$E_{\mathrm{CO(RCO2)}} = \frac{(0.009\ x\ Q_{P})}{2{,}000}$$

Where:

$E_{CO(Total)}$	=	total tons of CO and emissions per month from the facility.
$E_{CO\ (RTO1\ or\ RTO2)}$	=	total tons of CO and emissions per month from each thermal oxidizer.
$E_{CO,\ VOCs\ (RCO2)}$	=	total tons of CO and VOC emissions per month from RCO2 outlet.
Q_{D1}	=	the oven dried tons of processed wood through the dryer 1 per month.
Q_{D2}	=	the oven dried tons of processed wood through the dryer 2 per month.
Q_P	=	the oven dried tons of processed wood through the pellet coolers per month.

0.40 for RTO1 or RTO2 E_{CO} = dryer line 1 and 2 CO emission factor of 0.40 lb/ODT is based on facility process knowledge and/or information from NCASI database and includes appropriate contingency based on engineering judgement. Factor used based on the outlet of RTO1 and/or RTO2.

0.009 for RCO2 E_{CO}= pellet cooler CO emission factor of 0.009 lb/ODT is based on facility process knowledge and/or AP-42 emission factors. Factor used based on the outlet of RCO2.

0.73 = equates to the monthly CO PTE tons for the miscellaneous sources including; double duct burners, propane vaporizer, bypass stacks, emergency generators, and a fire water pump (per application 6600167.20A).

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. Particulate emissions are well below the thresholds of 250 tpy; thus, compliance is expected.

PSD Increment Tracking:

Northampton County has triggered increment tracking under PSD for NOx, SO_2, PM-10, and PM-2.5. However, this permit does not consume or expand increments for any pollutants.

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. This condition is listed in the General Conditions in the Title V permit (Section 2.3, Item MM).

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. This permit application does not affect this status.

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. 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.

Air toxics modeling was performed for air Permit 10203R06. Thirteen TAPs have emissions in excess of the TPER thresholds in 15A NCAC 02Q .0711 and Enviva demonstrated compliance with the Acceptable Ambient Levels (AALs) in 15A NCAC 02D .1100. Enviva modeling was approved on June 3, 2019 by DAQ AQAB meteorologist Nancy Jones and supervisor Tom Anderson.

Permit 10203R07 triggered modeling requirements to evaluate those toxics whose rates are expected to exceed the levels outlined in 15A NCAC 2Q .0700 and there are decreases from thirteen TAPS to nine TAPs that were above the levels in 15A NCAC 2Q .0700. The nine TAPs that were evaluated in the facility-wide modeling are: acrolein, arsenic, benzene, cadmium, chlorine, formaldehyde, HCl, manganese, and phenol. On June 26, 2020, the modeling was approved by DAQ meteorologist Nancy Jones and Tom Anderson. By email, the modeling review was sent to the facility on June 29, 2020. The modeling memorandum was updated on April 15, 2021 with the following note: "This memo corrects the June 24, 2020 memo that had impacts from acetaldehyde and beryllium. These TAPs were not required to be modeled since their emissions were below the TPER." With the wide margins of percent AAL, the facility will continue to ensure compliance. Below is a summary of AQAB Enviva modeling results from April 15, 2021 memo.

TAP	Averaging Period	Scenario	Max. Conc. ($\mu g/m^3$)	AAL ($\mu g/m^3$)	% of AAL
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 %
Cadmium	Annual	FBYP1	4e-5	0.0055	1 %
Chlorine	1-hour	FBYP2	0.3	900	<1 %
	24-hour	FBYP2	0.1	37.5	<1 %
Formaldehyde	1-hour	FBYP1	22.1	150	15 %
HCl	1-hour	FBYP2	7.12	700	1 %
Manganese	24-hour	FBYP2	0.19	31	1 %
Phenol	1-hour	NORM	0.37	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.

VIII. Compliance Status

The most recent inspection was conducted on April 7, 2020 by Dawn Reddix of RRO. The inspection report Conclusions/Recommendations read: "Based on records review and conversations for this PCE, Enviva Pellets Northampton, LLC's Gaston plant appeared to be operating in compliance with reviewed permit requirements. The remaining permit stipulations should be evaluated during the onsite inspection. The inspection should be conducted in the early morning to allow the inspector to obtain reliable opacity readings from the high efficiency cyclones."

According to the RRO compliance database, no Notices of Violation (NOVs) have been issued to this facility. A Notice of Deficiency (NOD) dated December 7, 2016 was issued for failing to submit a permit renewal application.

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

Comments on Draft Permit received February 2, 2021
Significant comments from Enviva are addressed here. Minor typographical errors, incorrect references, etc. are not addressed below but are corrected in the permit.

- Rerouting of the dry hammermill and dry shavings hammermill exhaust for control by WESP-1/RTO-1 and installation of CD-RCO-2 have already been completed and notice was provided to DAQ on February 4, 2021. Enviva requests that the permit be updated to remove all conditions applicable prior to completion of the modifications authorized by Air Quality Permit R07 as this language is no longer relevant. The applicant submitted these deletions in their comments to the draft permit that was submitted for their review prior to going to public notice.

Response

The facility's request includes removing preconstruction permit Section 2.2 A.1. (15A NCAC 02Q .0317 for avoidance of 15A NCAC 02D .0530), Section 2.2 A.4. (15A NCAC 02D .1100 Toxics), Section 2.3 (Construction Schedule) and the referenced sections in Tables throughout the permit.

Section 2.3 states "Within 24 months from 10203R06 permit issuance dated October 30, 2019, the Permittee shall complete installation of new control devices **(ID Nos. CD-RTO-1, CD-RCO-2, CD-DWH-2, CD-DSR-BF, and CD-DSS-BF excluding Dryer Line 2 controls (ID Nos. CD-WESP-2 and CD-RTO-2) in the event Line 2 equipment is not installed)**; and demonstrate

initial compliance with 15A NCAC 02D .0515, .0521, .1100, 15A NCAC 02Q .0317 for avoidance of 15A NCAC 02D .0530, and 15A NCAC 02Q .0317 for avoidance of 15A NCAC 02D .1112 MACT."

The facility has not demonstrated initial post construction compliance with all of the referenced regulations; therefore these requirements will remain in the draft permit.

- Enviva request to perform inspections for 15A NCAC 02D .0515 control devices either annually or "at the next cold outage."

  Response
  DAQ uses the annual regulatory language for all of N.C. Title V facilities. The language and frequency will remain annual.

- RTO and RTO/RCO Permit Conditions – Enviva requests changes in the firebox temperature averaging period, method of average firebox determination requirements, and listing of parameters in permit conditions.

  Response
  These requests are addressed below in the discussion of consistency across permits. NCDAQ does not agree with Enviva's requests, and no changes to the permit will be made.

- Although the two pre-screeners were represented as emission sources in the permit application, it has since been determined that they are entirely enclosed and do not emit to the atmosphere. As such, Enviva requests that they be removed from the permit.

  Response
  NCDAQ agrees with Enviva's request and the enclosed pre-screeners will be removed.

- The permit does not include specific values for parametric monitoring; therefore, no permit modification is necessary. Enviva requests removal of the following WESP language, "If the new parametric operating values re-established during periodic testing are more stringent, the Permittee shall submit a request to revise the value(s) in the permit at the same time the test report required pursuant to General Condition JJ is submitted and the permit revision will be processed pursuant to 15A NCAC 02Q .0514. If during performance testing, the new parametric operating values are less stringent, the Permittee may request to revise the value(s) in the permit pursuant to 15A NCAC 02Q .0515."

  Response
  DAQ agrees to remove the requested permit language and update it to: "Once initial testing has been performed, the parameters in Section 2. A.1.f. will be established and included in the next permit." The wet electrostatic precipitator with the minimum number of grid, the minimum secondary voltage, and the minimum current will be established during compliance testing.

- Diesel Recordkeeping Sulfur Certification Requirements – Enviva request removal of diesel fuel startup certification from Section 2.1 A.2.

Response
The request is addressed below in the discussion of consistency across permits. NCDAQ agrees with Enviva's requests and the fuel certification will be removed.

- Enviva requests that the frequency of visible emissions observations for demonstrating compliance with 15A NCAC 02D .0521 be changed from weekly to monthly for all sources except the furnace bypass stacks. The furnace bypass stacks are used for planned start-up/shutdown which may not occur on a monthly basis. Enviva proposes to conduct observations when these stacks are in use.

  Response
  The request is addressed below in the discussion of consistency across permits. The permit section defers to the Regional Offices to justify the frequency based on previous inspections and/or compliance history. The Raleigh Regional Office determined the frequency of visible emission observation shall remain weekly at this time.

  Additional language was included for visible emissions for the furnace bypass stacks. Visible emissions are not conducted during startup and shutdown. Enviva has permitted the furnace bypass stacks during idle mode. The following language was added: "To ensure compliance and during idle mode operation, the Permittee shall observe the emission points of these sources **(ID Nos. ES-FURNACEBYP-1, and ES-FURNACEBYP-2)** for any visible emissions above normal. The idle mode observation must be made for each furnace idle mode of the calendar year period to ensure compliance with this requirement."

- Enviva proposes the addition of this condition. This proposed language is based on the Chemours Company – Fayetteville Works Air Quality Permit No. 03735T48 issued on May 13, 2020 and the Technical Coating International, Inc. Air Quality Permit No. 07436T10 issued on July 6, 2017. "Failure to operate the regenerative thermal oxidizers or regenerative catalytic/thermal oxidizer (ID Nos. CD-RTO-1, CD-RTO-2, and CD-RCO-2) for at least 97 percent of the total operational time per semi-annual period shall constitute noncompliance with 15A NCAC 02D .0530, 15A NCAC 02D .1112, and 15A NCAC 02D .1100. When the regenerative thermal oxidizer or regenerative catalytic/thermal oxidizer is operated at a combustion temperature below the average minimum temperature established during the performance test, or if the temperature is not monitored, the oxidizer shall be deemed "not in operation" and the VOC and organic HAP/TAP emissions shall be based on an uncontrolled rate, assuming 0% control efficiency."

  Response
  After discussions with Enviva, and within the Permits Section, this issue was deferred to the SSCB. After consultation with the SSCB, DAQ will not include the requested language in the permit."

<u>Consistency Issues Discussed during Call on February 12, 2021</u>

- Firebox Temperature Averaging Period – Enviva proposes monitoring overall average temperature across all fireboxes for a given RTO or RCO rather than monitoring the individual average temperature for each firebox.

  Response
  Destruction removal efficiency (DRE) of an RTO or RCO is non-linear with respect to temperature. At lower temperatures, small changes can significantly affect DRE, while larger changes at higher temperatures have only a slight increase.

Because of this relationship, operating a firebox at a lower temperature (i.e., insufficient DRE) while maintaining the others at higher temperatures can result in an exceedance of an emission limit, even though the average temperature across all fireboxes is maintained. For this reason, DAQ does not agree with using an average temperature across all fireboxes. This permit requirement will not be modified, and the permit will continue to require monitoring the average temperature for each induvial firebox to demonstrate compliance.

- Method of Average Firebox Determination Requirements – Enviva proposes use of a 3-hour block average temperature for RTOs and RCOs rather than a 3-hour rolling average. This averaging period is consistent with Enviva's permits in other states and with DAQ permits issued to identical control devices used at wood product plants subject to the Plywood and Composite Wood Products MACT (40 CFR 63 Subpart DDDD), DAQ's incinerator regulations, and other recently issued permits by DAQ.

  Response
  DAQ will continue to research this issue, including reviewing how other states handle temperature averaging. DAQ management recommends maintaining the 3-hour rolling averages of RTO/RCO temperature at this time.

- Listing of Parameter in Permit Condition – Enviva requests that the permits not include specific parametric values for control device monitoring. This is consistent with several Enviva NC permits and Enviva permits in other states and will eliminate unneeded permit revisions to update parameters when reestablished based on compliance testing.

  Response
  Including specific parametric values in the permit allows for both the Permittee and the DAQ to easily identify compliant operation. DAQ management recommends maintaining parametric values in the permits and allowing for modification of parametric values by procedures specified in the permit.

- Diesel Recordkeeping Sulfur Certification Requirements – Enviva contends that it is no longer possible to purchase diesel fuel with a sulfur content in excess of 0.5 percent by weight. As such, Enviva requests that the requirement to maintain copies of fuel supplier certifications be removed from the permit.

  Response
  Most diesel fuel in-use is well below 15 ppm sulfur and is considered ultra-low sulfur diesel (ULSD). Given the small amount of diesel fuel used for startup at Enviva and the low concentration of sulfur in most diesel fuels, certification requirements are not necessary. DAQ will remove this requirement from the permit.

- Frequency of Visible Emissions Observations - Enviva requests that the frequency of visible emissions observations for demonstrating compliance with 15A NCAC 02D .0521 be monthly for all its NC facilities.

  Response
  DAQ maintains "shell conditions" for regulations common in most permits. (Regulation 15A NCAC 02D .0521 is one example). These conditions can be modified to reduce or increase monitoring given the circumstances at a given facility. The regional office can justify the frequency of observation based on inspections and compliance history.

- Submittal of stack test reports – Enviva's NC permits are inconsistent with regard to due dates for submittal of stack testing reports. As documented in numerous Enviva extension requests, analytical test methods for certain pollutants take significant time with lab turnarounds ranging from 3-6 weeks. Permit conditions that require reports to be submitted within 30 days from sample collection are not practical. Enviva request that submittal of test reports be modified to 60 days within sample collection.

  Response
  Regulation 15A NCAC 02D .2600(f) requires the final test report be submitted to the DAQ no later than no later than 30 days following sample collection. All NC Enviva permits will be modified to reflect a 30-day submittal requirement in accordance with 15A NCAC 02D .02600(f). The permits will also be modified to allow Enviva to request an extension of time in which to submit the final test report, pursuant with 15A NCAC 02D .2600(f)(4).

Comments on Draft Permit received April 14, 2021
Significant comments from Enviva are addressed here. Minor typographical errors, incorrect references, clarifications, etc. are not addressed below but are corrected in the permit.

- To change the visible emission monitoring language in Section 2.1 A.3.d. from "required weekly" to "periodic".

Response
The requested change is inconsistent with DAQ's permit shell and other Title V facilities. The language will remain "required weekly".

- In Section 2.2 A.2.f., to delete "(the second half of the oxidizer away from the flame zone)" in the monitoring and recordkeeping requirements. Enviva noted that the location of the temperature probes is defined by the equipment manufacturer and is used for safety interlocks for the operation of the equipment and coincidentally environmental control and recordkeeping. This language is not consistent with the equipment configuration.

Response
The requested change has been reviewed by SSCB in previous applications. The language will remain the same.

- In Section 2.2 A.2.n., to change an "and" to an "or" for estimated emission equations.

Response
The requested change will remain as "and".

- In Section 2.2 A.2.n.ii, to correct the RCO2 oxidizer VOC emission factor from 0.77 to 0.0722. Enviva noted that this was an error in R07 permit. Emission factor is calculated by summing the VOC emissions at the outlet of the RCO2 and the VOC emissions from propane combustion (tpy) then dividing by the potential annual throughput (i.e., (27.60 + 0.59) * 2,000 / 781,255).

Response
The requested VOC emission factor correction was made from 0.77 to 0.722.

Comments on Draft Permit received May 26, 2021
The Director of Enviva Environmental Affairs submitted comments requesting permit changes the company's own permit.

- Method of Average Firebox Determination Requirements – Enviva proposes use of a 3-hour block average temperature for RTOs and RCOs rather than a 3-hour rolling average.

Response

This comment was addressed above in Section IX. No changes to the draft permit are deemed necessary to address these comments.

- Removal of language in Section 2.2 A.2.f - Enviva requests the statement "(the second half of the oxidizer away from the flame zone)," which describes the location of the RTO's temperature probe, be removed from the permit. Enviva contends that the language is not consistent with the equipment configuration as specified by the vendor design specifications and that it contradicts Sections 2.2 A.2.d.vi of the draft permit, which accurately reflect the location of the thermocouples.

Response

The NCDAQ concurs and this statement "(the second half of the oxidizer away from the flame zone)" will be removed from Section 2.2 A.2.f of the permit.

- To change visible emission monitoring language from "weekly" to "monthly" throughout Section 2.1.

Response

This comment was addressed above in Section IX. The language will remain "weekly".

- To correct to Condition 2.1 A.1.h to reference the correct citation.

Response

The NCDAQ concurs.

- To revise visible emission under normal operation for the furnace bypass stacks idle mode from 30 days to 180 days in Section 2.1 A.3.d.

Response

The NCDAQ will change the language to "at the first idle bypass mode after the effective date of this permit or beginning of operation".

- To delete the word "bypass" in Section 2.1 A.2.C.

Response

The NCDAQ concurs.

- To revise the language in Section 2.2 A.2.n for clarity for stack testing and emission factors.

Response

The NCDAQ concurs.

X. Public Notice/EPA and Affected State(s) Review

A thirty-day public notice period and a forty-five-day EPA review period is required for this first time Title V application. A notice of the DRAFT Title V Permit shall be made pursuant to 15A NCAC

02Q .0521. The notice will provide for a 30-day comment period, with an opportunity for a public hearing. Copies of the public notice shall be sent to persons on the Title V mailing list and EPA. Pursuant to 15A NCAC 02Q .0522, a copy of each permit application, each proposed permit and each final permit pursuant shall be provided to the EPA. Also pursuant to 02Q .0522, a notice of the DRAFT Title V Permit shall be provided to each affected State at or before the time notice is provided to the public under 02Q .0521 above.

EPA's 45 Day Review period
Michael Sparks (U.S. EPA, Region IV) was provided a PROPOSED permit for review on July 7, 2021. EPA 45-day review period ended on August 21, 2021. *No comments were offered or received*.

Public Notice
The 30-day public notice of the PROPOSED permit was posted on the NCDAQ website on April 24, 2021. Comments were offered or received. See Hearing Officer's recommendations in Section XII below and the full report is posted on the DAQ website.

XI. Other Regulatory Considerations

- An application fee for this amended first time Title V application is not required.
- The appropriate number of application copies was received by the DAQ.
- A Professional Engineer's Seal is not required for this application. Russell Kemp did seal this first time Title V application on November 12, 2020 with Professional Engineer Seal No. 19628
- A zoning consistency determination is not required for this application.
- According to the application, the facility does not store any materials in excess of the 112r applicability threshold.
- The application was signed by Mr. Roland Burnett, Plant Manager, on November 18, 2020.
- Due to public interest in this project, the DAQ Director did require a public hearing.

XII. Recommendations

The public comment period for this draft permit ran from April 24 through May 26, 2021. Comments were received and a Hearing Officer's Report was created with the following recommendations.

- It is recommended that the language requiring monitoring in "the second half of the oxidizer away from the flame zone" be removed from Condition 2.2 A.2.f.
- Also recommended is correcting a typo for the numbering of Section 2.1.A.1.h.
- It is recommended under Condition 2.1.A.3.d to change the 30-day requirement to "at the first idle bypass mode after the effective date of this permit or beginning of operation."
- It is recommended that draft permit Condition 2.1.A.2.c be modified to reflect the clarified language listed below:

  Monitoring/Recordkeeping/Reporting *[15A NCAC 02Q .0508(f)]*
  c. No monitoring/recordkeeping/reporting is required for sulfur dioxide emissions from the firing of biomass in the wood-fired direct heat drying systems ***(ID Nos. ES-DRYER-1 and ES-DRYER-2)****, propane or natural gas for regenerative thermal oxidizers (ID No. CD-RTO-1 and CD-RTO-2), and diesel fuel in the furnace* ***(ID No. ES- FURNACEBYP-1 and ES-FURNACEBYP-2)****.*
- It is recommended that the draft permit Condition 2.2.A.2.n, be modified to reflect the clarified language listed below:

  i. The Permittee shall calculate the total emissions of NOx, CO, VOC, and filterable PM monthly and shall record the emissions monthly in a logbook (written or electronic format) kept on-site and made available to DAQ personnel

upon request. Monthly NOx emissions, in tons, shall be calculated by the following equations and emission factors (excluding the new wood dryer controls in the event the second dryer is not installed) ***until*** *site-specific NOx emission factors* ***are*** *established through stack testing* ***and approved by DAQ:***

ii. *Monthly VOC emissions, in tons, shall be calculated by the following equations and emission factors (excluding the new wood dryer controls in the event the second dryer is not installed)* ***until*** *site-specific VOC emission factors* ***are*** *established through stack testing* ***and approved by DAQ****:*

The permit application for Enviva Pellets Northampton, LLC, Northampton County, North Carolina has been reviewed by DAQ to determine compliance with all procedures and requirements. The DAQ has determined that this facility will achieve compliance, as specified in the permit, with all requirements that are applicable to the affected sources. The DAQ recommends the issuance of Air Permit No. 10203T08.

ATTACHMENT 1

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

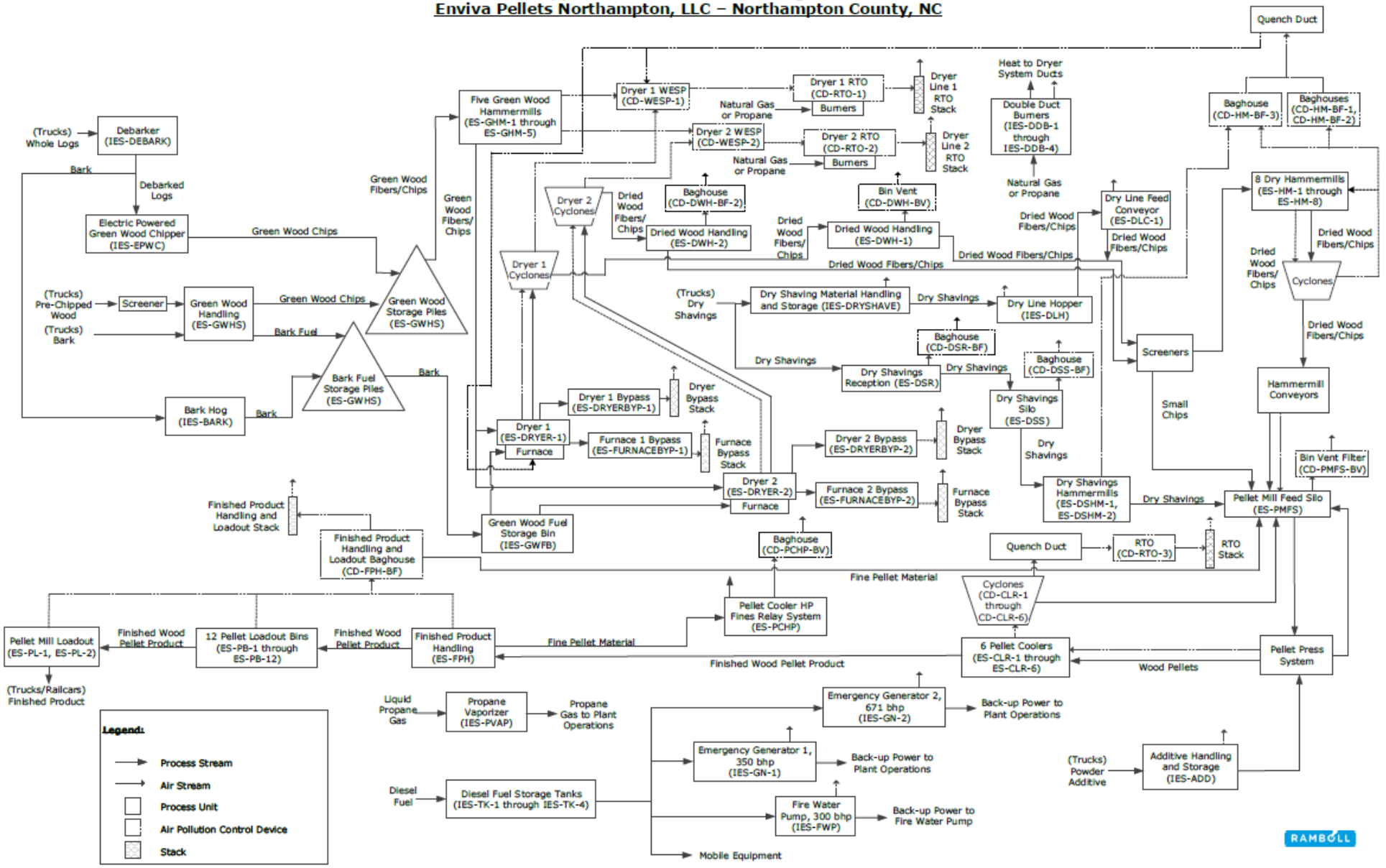

Table 1
Facility-wide Criteria and CO_2e Emissions Summary
Enviva Pellets Northampton, LLC

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	157.0	195.7	67.6	67.6	67.0	38.9	38.7	364,960
ES-DRYER-1[1]	Dryer #1										
ES-HM-1 through ES-HM-8	Dry Hammermills 1 through 8	CD-HM-CYC-1 through 8; CD-HM-BF-1 through 3; CD-WESP-1; CD-RTO-1	Cyclones; Baghouses; WESP; RTO								
ES-DSHM-1 and ES-DSHM-2	Dry Shavings Hammermills 1 and 2										
ES-DRYER-2[1]	Dryer #2	CD-WESP-2; CD-RTO-2	WESP; RTO								
ES-FURNACEBYP-1	Furnace #1 Bypass	--	--	1.89	0.69	1.82	1.63	1.41	0.079	0.054	662
IES-DDB-1 and -2	Dryer #1 Double Duct Burners	--	--	1.80	1.56	0.17	0.17	0.17	0.013	0.24	3,048
ES-FURNACEBYP-2	Furnace #2 Bypass	--	--	1.91	0.70	1.83	1.64	1.42	0.079	0.054	665
IES-DDB-3 and -4	Dryer #2 Double Duct Burners	--	--	1.80	1.56	0.17	0.17	0.17	0.013	0.24	3,048
IES-PVAP	Propane Vaporizer	--	--	0.36	0.62	0.034	0.034	0.034	0.0026	0.048	610
ES-CLR-1 through ES-CLR-6	Pellet Coolers 1 through 6	CD-CLR-1 through CD-CLR-6; CD-RCO-2	Simple Cyclones; RCO/RTO	5.31	8.72	38.9	10.5	1.65	0.032	28.2	9,852
ES-DWH-1[4]	Dried Wood Handling 1	CD-DWH-BV	Passive Bin Vent	--	--	0.53	0.45	0.39	--	48.5	--
ES-DWH-2[4]	Dried Wood Handling 2	CD-DWH-BF-2	Baghouse								
ES-PS-1 and -2	Dry Hammermill Prescreeners 1 and 2	--	--	--	--	0.24	0.11	0.017	--	--	--
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 Loadout 1 and 2	CD-FPH-BF	Baghouse	--	--	5.33	4.85	2.13	--	--	--
IES-ADD	Additive Handling and Storage	--	--	--	--	0.26	0.12	0.018	--	--	--
IES-DLH	Dry Line Hopper	--	--	--	--	0.01	0.003	0.001	--	--	--
ES-DLC-1	Dry Line Feed Conveyor	--	--	--	--	0.01	0.003	0.001	--	--	--
IES-DRYSHAVE	Dry Shaving Material Handling and Storage	--	--	--	--	0.44	0.22	0.033	--	0.19	--
ES-DSS	Dry Shavings Silo	CD-DSS-BF	Baghouse	--	--	0.08	0.08	0.08	--	--	--
ES-DSR	Dry Shavings Reception	CD-DSR-BF	Baghouse	--	--	0.38	0.38	0.38	--	--	--
ES-GWHS	Green Wood Handling and Storage	--	--	--	--	16.3	8.17	1.23	--	8.30	--
IES-EPWC	Electric Powered Green Wood Chipper	--	--	--	--	--	--	--	--	1.95	--
IES-BARK	Bark Hog	--	--	--	--	0.47	0.26	--	--	0.59	--
IES-DEBARK	Debarker	--	--	--	--	1.56	0.86	--	--	--	--
IES-GWFB[2]	Green Wood Fuel Bin	--	--	--	--	--	--	--	--	--	--
IES-GN-1	Emergency Generator 1	--	--	0.50	0.58	0.029	0.029	0.029	0.0010	0.0015	100
IES-GN-2	Emergency Generator 2	--	--	0.14	2.46	0.0078	0.0078	0.0078	0.0018	1.68	192
IES-FWP	Fire Water Pump	--	--	0.43	0.49	0.025	0.025	0.025	8.16E-04	0.0013	85.9
IES-TK-1	Diesel Storage Tank for Emergency Generator #1	--	--	--	--	--	--	--	--	5.75E-04	--
IES-TK-2	Diesel Storage Tank for Fire Water Pump	--	--	--	--	--	--	--	--	1.60E-04	--
IES-TK-3	Mobile Fuel Diesel Storage Tank	--	--	--	--	--	--	--	--	0.0033	--
IES-TK-4	Diesel Storage Tank for Emergency Generator #2	--	--	--	--	--	--	--	--	5.75E-04	--
--	Haul Road Emissions	--	--	--	--	43.3	11.4	0.92	--	--	--
			Total Emissions:	**171.2**	**213.0**	**180.5**	**109.6**	**78.0**	**39.1**	**128.8**	**383,222**
			Total Excluding Fugitives[3]:	**171.2**	**213.0**	**120.0**	**89.4**	**75.4**	**39.1**	**120.3**	**383,222**
			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).

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

Description	HAP	CD-RTO-1 and CD-RTO-2 [1] (tpy)	ES-FURNACE BYP-1 (tpy)	IES-DDB-1 and -2 (tpy)	ES-FURNACE BYP-2 (tpy)	IES-DDB-3 and -4 (tpy)	IES-PVAP (tpy)	CD-RCO-2 (tpy)	ES-DWH-1 and -2 (tpy)	IES-GN-1 (tpy)	IES-GN-2 (tpy)	IES-FWP (tpy)	IES-EPWC (tpy)	IES-BARK (tpy)	Total (tpy)	Major Source?
Acetaldehyde	Y	1.82E+00	2.62E-03	3.26E-07	2.64E-03	3.26E-07	-	4.92E-01	-	4.70E-04	2.96E-05	4.03E-04	-	-	2.32E+00	No
Acrolein	Y	1.34E+00	1.26E-02	3.86E-07	1.27E-02	3.86E-07	-	9.75E-01	-	5.67E-05	9.25E-06	4.86E-05	-	-	2.34E+00	No
Formaldehyde	Y	1.87E+00	1.39E-02	3.29E-02	1.40E-02	3.29E-02	6.57E-03	2.03E-01	3.28E-01	7.23E-04	9.26E-05	6.20E-04	-	-	2.50E+00	No
Methanol	Y	1.48E+00	-	-	-	-	-	4.14E-01	7.62E-01	-	-	-	3.91E-01	1.17E-01	3.16E+00	No
Phenol	Y	6.43E-01	1.61E-04	-	1.62E-04	-	-	4.92E-01	-	-	-	-	-	-	1.14E+00	No
Propionaldehyde	Y	5.47E-01	1.93E-04	-	1.94E-04	-	-	2.85E-01	8.20E-02	-	-	-	-	-	9.14E-01	No
Acetophenone	Y	1.24E-07	1.01E-08	-	1.02E-08	-	-	-	-	-	-	-	-	-	1.45E-07	No
Ammonia	N	6.82E-01	-	6.87E-02	-	6.87E-02	-	1.70E-01	-	-	-	-	-	-	9.89E-01	No
Antimony and compounds	Y	8.91E-04	2.49E-05	-	2.51E-05	-	-	-	-	-	-	-	-	-	9.41E-04	No
Arsenic	Y	2.52E-03	6.95E-05	4.29E-06	6.99E-05	4.29E-06	-	1.06E-05	-	-	-	-	-	-	2.68E-03	No
Benzene	Y	3.18E-01	-	1.55E-02	-	1.55E-02	3.11E-03	3.86E-02	-	5.71E-04	9.11E-04	4.90E-04	-	-	3.92E-01	No
Benzo(a)pyrene	Y	1.01E-04	8.21E-06	2.58E-08	8.26E-06	2.58E-08	-	6.39E-08	-	2.39E-05	3.02E-07	9.87E-08	-	-	1.42E-04	No
Beryllium	Y	1.27E-04	3.47E-06	2.58E-07	3.49E-06	2.58E-07	-	6.39E-07	-	-	-	-	-	-	1.35E-04	No
1,3-Butadiene	Y	-	-	-	-	-	-	-	-	2.39E-05	-	2.05E-05	-	-	4.45E-05	No
Cadmium	Y	6.97E-04	1.29E-05	2.36E-05	1.30E-05	2.36E-05	-	5.86E-05	-	-	-	-	-	-	8.29E-04	No
Carbon tetrachloride	Y	1.75E-03	1.42E-04	-	1.43E-04	-	-	-	-	-	-	-	-	-	2.04E-03	No
Chlorine	Y	1.23E+00	2.49E-03	-	2.51E-03	-	-	-	-	-	-	-	-	-	1.23E+00	No
Chlorobenzene	Y	1.28E-03	1.04E-04	-	1.05E-04	-	-	-	-	-	-	-	-	-	1.49E-03	No
Chloroform	Y	1.09E-03	-	-	-	-	-	-	-	-	-	-	-	-	1.09E-03	No
Chromium VI	Y	6.93E-04	-	3.01E-05	-	3.01E-05	-	7.45E-05	-	-	-	-	-	-	8.28E-04	No
Chromium-Other compounds	Y	1.97E-03	6.63E-05	-	6.67E-05	-	-	-	-	-	-	-	-	-	2.11E-03	No
Cobalt compounds	Y	7.33E-04	2.05E-05	-	2.06E-05	-	-	4.47E-06	-	-	-	-	-	-	7.79E-04	No
Dichlorobenzene	Y	2.56E-04	-	2.58E-05	-	2.58E-05	-	6.39E-05	-	-	-	-	-	-	3.71E-04	No
Dichloroethane, 1,2-	Y	1.13E-03	9.16E-05	-	9.21E-05	-	-	-	-	-	-	-	-	-	1.31E-03	No
Dichloropropane, 1,2-	Y	1.28E-03	1.04E-04	-	1.05E-04	-	-	-	-	-	-	-	-	-	1.49E-03	No
Dinitrophenol, 2,4-	Y	7.00E-06	5.68E-07	-	5.72E-07	-	-	-	-	-	-	-	-	-	8.14E-06	No
Di(2-ethylhexyl)phthalate	Y	1.83E-06	3.09E-08	-	3.17E-08	-	-	-	-	-	-	-	-	-	1.89E-06	No
Ethyl benzene	Y	1.21E-03	9.79E-05	-	9.84E-05	-	-	-	-	-	-	-	-	-	1.40E-03	No
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	N	6.96E-10	-	-	-	-	-	-	-	-	-	-	-	-	6.96E-10	No
Hexane	Y	3.83E-01	-	3.86E-02	-	3.86E-02	-	9.58E-02	-	-	-	-	-	-	5.57E-01	No
Indeno(1,2,3-cd)pyrene	Y	3.83E-07	-	3.86E-08	-	3.86E-08	-	9.58E-08	-	-	-	-	-	-	5.57E-07	No
Hydrochloric acid	Y	2.96E+00	6.00E-02	-	6.03E-02	-	-	-	-	-	-	-	-	-	3.08E+00	No
Lead	Y	5.52E-03	-	1.07E-05	-	1.07E-05	-	2.66E-05	-	-	-	-	-	-	5.57E-03	No
Manganese	Y	1.81E-01	5.05E-03	8.16E-06	5.08E-03	8.16E-06	-	2.02E-05	-	-	-	-	-	-	1.91E-01	No
Mercury	Y	4.50E-04	1.11E-05	5.58E-06	1.11E-05	5.58E-06	-	1.38E-05	-	-	-	-	-	-	4.97E-04	No
Methyl bromide	Y	5.84E-04	4.74E-05	-	4.76E-05	-	-	-	-	-	-	-	-	-	6.79E-04	No
Methyl chloride	Y	8.95E-04	7.26E-05	-	7.30E-05	-	-	-	-	-	-	-	-	-	1.04E-03	No
Methyl ethyl ketone	N	2.10E-04	-	-	-	-	-	-	-	-	-	-	-	-	2.10E-04	No
3-Methylchloranthrene	Y	3.83E-07	-	3.86E-08	-	3.86E-08	-	9.58E-08	-	-	-	-	-	-	5.57E-07	No
Methylene chloride	Y	1.13E-02	-	-	-	-	-	-	-	-	-	-	-	-	1.13E-02	No
Naphthalene	Y	3.91E-03	3.06E-04	1.31E-05	3.08E-04	1.31E-05	-	3.25E-05	-	-	1.53E-04	-	-	-	4.73E-03	No
Nickel	Y	4.17E-03	1.04E-04	4.51E-05	1.05E-04	4.51E-05	-	1.12E-04	-	-	-	-	-	-	4.58E-03	No
Nitrophenol, 4-	Y	4.28E-06	3.47E-07	-	3.49E-07	-	-	-	-	-	-	-	-	-	4.98E-06	No
Pentachlorophenol	Y	1.98E-06	1.61E-07	-	1.62E-07	-	-	-	-	-	-	-	-	-	2.31E-06	No
Perchloroethylene	Y	1.48E-03	1.20E-04	-	1.21E-04	-	-	-	-	-	-	-	-	-	1.72E-03	No
Phosphorus metal, yellow or white	Y	3.05E-03	8.52E-05	-	8.57E-05	-	-	-	-	-	-	-	-	-	3.22E-03	No
Polychlorinated biphenyls	Y	3.17E-07	2.57E-08	-	2.59E-08	-	-	-	-	-	-	-	-	-	3.69E-07	No
Polycyclic Organic Matter	Y	1.36E-02	3.95E-04	8.76E-04	3.97E-04	8.76E-04	1.75E-04	2.17E-03	-	1.03E-04	2.49E-04	8.82E-05	-	-	1.89E-02	No
Selenium compounds	Y	3.21E-04	8.84E-06	5.15E-07	8.89E-06	5.15E-07	-	1.28E-06	-	-	-	-	-	-	3.41E-04	No
Styrene	Y	7.39E-02	-	-	-	-	-	-	-	-	-	-	-	-	7.39E-02	No
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	3.35E-10	2.72E-11	-	2.73E-11	-	-	-	-	-	-	-	-	-	3.89E-10	No
Toluene	Y	1.89E-03	-	7.30E-05	-	7.30E-05	-	1.81E-04	-	2.51E-04	3.30E-04	2.15E-04	-	-	3.01E-03	No
Trichloroethane, 1,1,1-	Y	1.21E-03	9.79E-05	-	9.84E-05	-	-	-	-	-	-	-	-	-	1.40E-03	No
Trichloroethylene	Y	1.17E-03	1.97E-05	-	2.03E-05	-	-	-	-	-	-	-	-	-	1.21E-03	No
Trichlorofluoromethane	N	1.60E-03	-	-	-	-	-	-	-	-	-	-	-	-	1.60E-03	No
Trichlorophenol, 2,4,6-	Y	8.56E-07	6.95E-08	-	6.99E-08	-		-	-	-	-	-	-	-	9.95E-07	No
Vinyl chloride	Y	7.00E-04	5.68E-05	-	5.72E-05	-	-	-	-	-	-	-	-	-	8.14E-04	No
Xylene	Y	9.73E-04	-	-	-	-	-	-	-	1.75E-04	2.26E-04	1.50E-04	-	-	1.52E-03	No
TOTAL HAP		**12.9**	**0.099**	**0.088**	**0.099**	**0.088**	**0.010**	**3.00**	**1.17**	**0.0024**	**0.0018**	**0.0020**	**0.39**	**0.12**	**18.0**	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.

Table 3
Potential Emissions Summary
RTO #1 and #2 (CD-RTO-1 and CD-RTO-2)
Enviva Pellets Northampton, LLC

Description: Potential emissions for the RTOs include the sum of emissions from the dryer/furnace (ES-DRYER-1), Green Hammermills, Dry Hammermills, and Dry Shavings Hammermills as estimated in Tables 3a through 3d, 4a, and 4b. This includes combustion emissions from fuel and vent gases, particulate emissions, VOC, and HAPs.

Summary of Potential Emissions for CD-RTO-1 and CD-RTO-2

Pollutant	Max (lb/hr)	Annual (tpy)
CO	33.11	157.04
NOx	44.79	195.68
SO_2	8.88	38.91
PM	15.43	67.59
PM_{10}	15.43	67.59
$PM_{2.5}$	15.29	66.98
VOC	9.92	38.75
Acetaldehyde	4.09E-01	1.82E+00
Acrolein	3.24E-01	1.34E+00
Formaldehyde	4.17E-01	1.87E+00
Methanol	1.70E-01	1.48E+00
Phenol	2.93E-02	6.43E-01
Propionaldehyde	5.78E-02	5.47E-01
Acetophenone	2.84E-08	1.24E-07
Ammonia	1.56E-01	6.82E-01
Antimony and compounds	2.03E-04	8.91E-04
Arsenic	5.76E-04	2.52E-03
Benzene	7.25E-02	3.18E-01
Benzo(a)pyrene	2.32E-05	1.01E-04
Beryllium	2.89E-05	1.27E-04
Cadmium	1.59E-04	6.97E-04
Carbon tetrachloride	4.00E-04	1.75E-03
Chlorine	2.81E-01	1.23E+00
Chlorobenzene	2.93E-04	1.28E-03
Chloroform	2.49E-04	1.09E-03
Chromium VI	1.58E-04	6.93E-04
Chromium–Other compounds	4.51E-04	1.97E-03
Cobalt compounds	1.67E-04	7.33E-04
Dichlorobenzene	5.84E-05	2.56E-04
Dichloroethane, 1,2-	2.58E-04	1.13E-03
Dichloropropane, 1,2-	2.93E-04	1.28E-03
Dinitrophenol, 2,4-	1.60E-06	7.00E-06

Table 3
Potential Emissions Summary
RTO #1 and #2 (CD-RTO-1 and CD-RTO-2)
Enviva Pellets Northampton, LLC

Description: Potential emissions for the RTOs include the sum of emissions from the dryer/furnace (ES-DRYER-1), Green Hammermills, Dry Hammermills, and Dry Shavings Hammermills as estimated in Tables 3a through 3d, 4a, and 4b. This includes combustion emissions from fuel and vent gases, particulate emissions, VOC, and HAPs.

Summary of Potential Emissions for CD-RTO-1 and CD-RTO-2

Pollutant	Max (lb/hr)	Annual (tpy)
Di(2-ethylhexyl)phthalate	4.17E-07	1.83E-06
Ethyl benzene	2.75E-04	1.21E-03
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	1.59E-10	6.96E-10
Hexane	8.75E-02	3.83E-01
Indeno(1,2,3-cd)pyrene	8.75E-08	3.83E-07
Hydrochloric acid	6.75E-01	2.96E+00
Lead	1.26E-03	5.52E-03
Manganese	4.12E-02	1.81E-01
Mercury	1.03E-04	4.50E-04
Methyl bromide	1.33E-04	5.84E-04
Methyl chloride	2.04E-04	8.95E-04
Methyl ethyl ketone	4.80E-05	2.10E-04
3-Methylchloranthrene	8.75E-08	3.83E-07
Methylene chloride	2.58E-03	1.13E-02
Naphthalene	8.91E-04	3.91E-03
Nickel	9.52E-04	4.17E-03
Nitrophenol, 4-	9.77E-07	4.28E-06
Pentachlorophenol	4.53E-07	1.98E-06
Perchloroethylene	3.38E-04	1.48E-03
Phosphorus metal, yellow or white	6.95E-04	3.05E-03
Polychlorinated biphenyls	7.24E-08	3.17E-07
Polycyclic Organic Matter	3.09E-03	1.36E-02
Selenium compounds	7.33E-05	3.21E-04
Styrene	1.69E-02	7.39E-02
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	7.64E-11	3.35E-10
Toluene	4.32E-04	1.89E-03
Trichloroethane, 1,1,1-	2.75E-04	1.21E-03
Trichloroethylene	2.66E-04	1.17E-03
Trichlorofluoromethane	3.64E-04	1.60E-03
Trichlorophenol, 2,4,6-	1.95E-07	8.56E-07
Vinyl chloride	1.60E-04	7.00E-04
Xylene	2.22E-04	9.73E-04

Table 3a
Potential Criteria Emissons
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	6.2 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 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.
- The total furnace heat input is listed as 175.3 MMBtu/hr. This is equal to the sum of 155.3 MMBtu/hr from the grate and 2 additional 10 MMBtu/hr dust burners which have been permitted but not installed.

[2] Emissions based on process knowledge and/or information from NCASI database and includes appropriate contingency based on engineering judgement.

[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 process knowledge and an appropriate contingency based on engineering judgement.

[5] VOC emission factor based on process knowledge and an appropriate contingency based on engineering judgement. Factor represents uncontrolled emissions.

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

Abbreviations:

hr - hour
lb - pound
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NO_X - nitrogen oxides
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

References:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.
U.S. EPA. AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

Table 3bi
Potential VOC Emissons
Green Hammermills (ES-GHM-1 through ES-GHM-5, CD-WESP-1, CD-RTO-1 or CD-WESP-2, CD-RTO-2)
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

Pollutant	CAS No.	HAP	NC TAP	VOC	Emission Factor[2]	Potential Emissions[3]	
					(lb/ODT)	Max (lb/hr)	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 * (1 - 50% moisture content) = 150 ODT/hr).
2. Emission factors based on process knowledge and an appropriate contingency based on engineering judgement. 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).

Thermally 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)	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
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NC - North Carolina
ODT - oven dried tons
RTO - Regenerative Thermal Oxidizer
TAP - toxic air pollutant
tph - tons per hour
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
yr - year

Reference:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.

Table 3bii
Potential Emissions at Outlet of RTO-1 Stack (CD-RTO-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	100%	
Hours of Operation	8760	hr/yr

Hammermills Annual Throughput	781,255	ODT/yr
Hammermills Hourly Throughput	144	ODT/hr
Number of RTO Burners	4	
RTO Burner Rating	6.2	MMBtu/hr
Control Efficiency[1]	97.5%	

Potential VOC and HAP Emissions

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	0.0073	0.026	0.071
Acrolein	107-02-8	Y	Y	Y	0.0092	0.033	0.090
Formaldehyde	50-00-0	Y	Y	Y	0.0071	0.026	0.069
Methanol	67-56-1	Y	N	Y	0.0071	0.026	0.069
Phenol	108-95-2	Y	Y	Y	0.0028	0.010	0.027
Propionaldehyde	123-38-6	Y	N	Y	0.012	0.045	0.12
				Total HAP Emissions		**0.17**	**0.45**
				Total TAP Emissions		**0.10**	**0.26**
Total VOC (as propane)	--		--	Y	0.77	2.75	7.47

Notes:

1. A 97.5% control efficiency is applied to the potential emissions for the RTO.
2. Emission factors based on process knowledge and an appropriate contingency based on engineering judgement. The emission factors represent uncontrolled emissions.
3. The emissions from the dry hammermills will be routed to the Dryer 1 Furnace, Dryer 1 WESP, or a combination of the two then controlled by the RTO on the existing dryer line (CD-RTO-1).

Thermally Generated Potential Criteria Pollutant Emissions

Maximum high heating value of VOC constituents	0.018	MMBtu/lb
Uncontrolled VOC emissions	299	tons/yr
Uncontrolled VOC emissions	110	lb/hr
Heat input of uncontrolled VOC emissions	11,054	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	0.082	lb/MMBtu	0.17	0.46
NO_X	0.098	lb/MMBtu	0.20	0.54

Notes:

1. Emission factor for CO and NOx 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.

Abbreviations:

CAS - chemical abstract service
CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NC - North Carolina
NO_X - nitrogen oxides
ODT - oven dried tons
RTO - Regenerative Thermal Oxidizer
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
yr - year

References:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.

Table 3biii
Potential Emissions at Outlet of RTO-1 Stack (CD-RTO-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
RTO Control Efficiency[1]	97.5%	

Potential PM, VOC, and HAP Emissions

Pollutant	CAS No.	HAP	NC TAP	VOC	Emission Factor[2]	Potential Emissions[3]	
					(lb/ODT)	Max (lb/hr)	Annual (tpy)
Acetaldehyde	75-07-0	Y	Y	Y	0.0073	0.0051	0.022
Acrolein	107-02-8	Y	Y	Y	0.0092	0.0064	0.028
Formaldehyde	50-00-0	Y	Y	Y	0.0071	0.0050	0.022
Methanol	67-56-1	Y	N	Y	0.0071	0.0050	0.022
Phenol	108-95-2	Y	Y	Y	0.0028	0.0020	0.009
Propionaldehyde	123-38-6	Y	N	Y	0.0124	0.0087	0.038
					Total HAP Emissions	0.032	0.14
					Total TAP Emissions	0.018	0.081
Total VOC (as propane)	--		--	Y	0.765	0.53	2.34

Notes:

1. A 97.5% control efficiency is applied to the potential emissions for the RTO.
2. Emission factors based on process knowledge and an appropriate contingency based on engineering judgement. The emission factors represent uncontrolled emissions.
3. The emissions from the two dry shavings hammermills will be routed to the Dryer 1 Furnace, Dryer 1 WESP, or a combination of the two then controlled by the RTO on the existing dryer line (CD-RTO-1).

Thermally Generated Potential Criteria Pollutant Emissions

Maximum high heating value of VOC constituents	0.018	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[1]	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	0.082	lb/MMBtu	0.033	0.14
NO_X	0.098	lb/MMBtu	0.039	0.17

Notes:

1. Emission factor for CO and NOx 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.

Abbreviations:

CAS - chemical abstract service
CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NC - North Carolina
NO_X - nitrogen oxides
ODT - oven dried tons
RTO - Regenerative Thermal Oxidizer
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
yr - year

References:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.

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

Calculation Basis

Annual Dried Wood Throughput[10]	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	6.2	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)	Annual (tpy)
Dryer Burner - Biomass Source								
Acetaldehyde	Y	Y	Y	1.7E-01	lb/ODT	1	0.30	1.64
Acrolein	Y	Y	Y	1.1E-01	lb/ODT	1	0.20	1.07
Formaldehyde	Y	Y	Y	1.4E-01	lb/ODT	1	0.26	1.40
Methanol	Y	N	Y	1.0E-01	lb/ODT	1	0.19	1.02
Phenol	Y	Y	Y	5.8E-02	lb/ODT	1	0.10	0.56
Propionaldehyde	Y	N	Y	3.9E-02	lb/ODT	1	0.07	0.38
Acetophenone	Y	N	Y	3.2E-09	lb/MMBtu	2,3	1.4E-08	6.1E-08
Antimony and compounds	Y	N	N	7.9E-06	lb/MMBtu	2,4	1.0E-04	4.4E-04
Arsenic	Y	Y	N	2.2E-05	lb/MMBtu	2,4	2.8E-04	1.2E-03
Benzene	Y	Y	Y	4.2E-03	lb/MMBtu	2,3	1.8E-02	8.1E-02
Benzo(a)pyrene	Y	Y	Y	2.6E-06	lb/MMBtu	2,3	1.1E-05	5.0E-05
Beryllium	Y	Y	N	1.1E-06	lb/MMBtu	2,4	1.4E-05	6.1E-05
Cadmium	Y	Y	N	4.1E-06	lb/MMBtu	2,4	5.2E-05	2.3E-04
Carbon tetrachloride	Y	Y	Y	4.5E-05	lb/MMBtu	2,3	2.0E-04	8.6E-04
Chlorine	Y	Y	N	7.9E-04	lb/MMBtu	2,9	1.4E-01	6.1E-01
Chlorobenzene	Y	Y	Y	3.3E-05	lb/MMBtu	2,3	1.4E-04	6.3E-04
Chloroform	Y	Y	Y	2.8E-05	lb/MMBtu	2,3	1.2E-04	5.4E-04
Chromium VI	-[5]	Y	N	3.5E-06	lb/MMBtu	2,4,5	4.4E-05	1.9E-04
Chromium--Other compounds	Y	N	N	1.8E-05	lb/MMBtu	2,4	2.2E-04	9.7E-04
Cobalt compounds	Y	N	N	6.5E-06	lb/MMBtu	2,4	8.3E-05	3.6E-04
Dichloroethane, 1,2-	Y	Y	Y	2.9E-05	lb/MMBtu	2,3	1.3E-04	5.6E-04
Dichloropropane, 1,2-	Y	N	Y	3.3E-05	lb/MMBtu	2,3	1.4E-04	6.3E-04
Dinitrophenol, 2,4-	Y	N	Y	1.8E-07	lb/MMBtu	2,3	7.9E-07	3.5E-06
Di(2-ethylhexyl)phthalate	Y	Y	Y	4.7E-08	lb/MMBtu	2,3	2.1E-07	9.0E-07
Ethyl benzene	Y	N	Y	3.1E-05	lb/MMBtu	2,3	1.4E-04	6.0E-04
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	N	Y	Y	1.8E-11	lb/MMBtu	2,3	7.8E-11	3.4E-10
Hydrochloric acid	Y	Y	N	1.9E-02	lb/MMBtu	2,6	3.3E-01	1.5E+00
Lead	Y	N	N	4.8E-05	lb/MMBtu	2,4	6.1E-04	2.7E-03
Manganese	Y	Y	N	1.6E-03	lb/MMBtu	2,4	2.0E-02	8.9E-02
Mercury	Y	Y	N	3.5E-06	lb/MMBtu	2,4	4.4E-05	1.9E-04
Methyl bromide	Y	N	Y	1.5E-05	lb/MMBtu	2,3	6.6E-05	2.9E-04
Methyl chloride	Y	N	Y	2.3E-05	lb/MMBtu	2,3	1.0E-04	4.4E-04
Methyl ethyl ketone	N	Y	Y	5.4E-06	lb/MMBtu	2,3	2.4E-05	1.0E-04
Methylene chloride	Y	Y	Y	2.9E-04	lb/MMBtu	2,3	1.3E-03	5.6E-03
Naphthalene	Y	N	Y	9.7E-05	lb/MMBtu	2,3	4.3E-04	1.9E-03
Nickel	Y	Y	N	3.3E-05	lb/MMBtu	2,4	4.2E-04	1.8E-03
Nitrophenol, 4-	Y	N	Y	1.1E-07	lb/MMBtu	2,3	4.8E-07	2.1E-06
Pentachlorophenol	Y	Y	N	5.1E-08	lb/MMBtu	2	2.2E-07	9.8E-07
Perchloroethylene	Y	Y	N	3.8E-05	lb/MMBtu	2	1.7E-04	7.3E-04
Phosphorus metal, yellow or white	Y	N	N	2.7E-05	lb/MMBtu	2,4	3.4E-04	1.5E-03
Polychlorinated biphenyls	Y	Y	Y	8.2E-09	lb/MMBtu	2,3	3.6E-08	1.6E-07
Polycyclic Organic Matter	Y	N	N	1.3E-04	lb/MMBtu	2	5.5E-04	2.4E-03
Selenium compounds	Y	N	N	2.8E-06	lb/MMBtu	2,4	3.6E-05	1.6E-04
Styrene	Y	Y	Y	1.9E-03	lb/MMBtu	2,3	8.3E-03	3.6E-02
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	Y	Y	8.6E-12	lb/MMBtu	2,3	3.8E-11	1.7E-10
Toluene	Y	Y	Y	3.0E-05	lb/MMBtu	2,3	1.3E-04	5.8E-04
Trichloroethane, 1,1,1-	Y	Y	N	3.1E-05	lb/MMBtu	2	1.4E-04	6.0E-04
Trichloroethylene	Y	Y	Y	3.0E-05	lb/MMBtu	2,3	1.3E-04	5.8E-04
Trichlorofluoromethane	N	Y	Y	4.1E-05	lb/MMBtu	2,3	1.8E-04	7.9E-04
Trichlorophenol, 2,4,6-	Y	N	Y	2.2E-08	lb/MMBtu	2,3	9.6E-08	4.2E-07
Vinyl chloride	Y	Y	Y	1.8E-05	lb/MMBtu	2,3	7.9E-05	3.5E-04
Xylene	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	5.8E-07	2.6E-06
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	7	4.4E-08	1.9E-07
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	7	3.9E-07	1.7E-06
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	7	4.4E-08	1.9E-07
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	7	4.4E-08	1.9E-07
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	7	3.7E-07	1.6E-06
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	7	4.4E-07	1.9E-06
Ammonia	N	Y	N	3.2	lb/MMscf	7	7.8E-02	3.4E-01
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	7	5.8E-08	2.6E-07
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	7	4.9E-06	2.1E-05
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	7	4.4E-08	1.9E-07
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	8	1.8E-02	7.7E-02
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	7	2.9E-08	1.3E-07
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	7	4.4E-08	1.9E-07
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	7	2.9E-08	1.3E-07
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	7	4.4E-08	1.9E-07
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	7	2.9E-07	1.3E-06
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	7	2.7E-05	1.2E-04
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	7	3.4E-05	1.5E-04
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	7	4.4E-08	1.9E-07
Cobalt	Y	N	N	8.4E-05	lb/MMscf	7	2.0E-06	8.9E-06
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	7	2.9E-08	1.3E-07
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	7	2.9E-05	1.3E-04
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	7	7.3E-08	3.2E-07
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	7	6.8E-08	3.0E-07
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	8	3.7E-02	1.6E-01
Hexane	Y	Y	Y	1.8	lb/MMscf	7	4.4E-02	1.9E-01
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	7	4.4E-08	1.9E-07
Lead	Y	N	N	5.0E-04	lb/MMscf	7	1.2E-05	5.3E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	7	9.2E-06	4.0E-05
Mercury	Y	Y	N	2.6E-04	lb/MMscf	7	6.3E-06	2.8E-05
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	7	1.5E-05	6.5E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	7	5.1E-05	2.2E-04
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	8	9.9E-04	4.3E-03
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	7	4.1E-07	1.8E-06
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	7	1.2E-07	5.3E-07
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	7	5.8E-07	2.6E-06
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	7	8.3E-05	3.6E-04
Total HAP Emissions (related to natural gas/propane)							**0.10**	**0.44**
Total TAP Emissions (related to natural gas/propane)							**0.16**	**0.36**

Notes:

1. Emission factors based on process knowledge and an appropriate contingency based on engineering judgement. 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:

HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NC - North Carolina
ODT - oven dried tons
RTO - regenerative thermal oxidizer
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
yr - year

References:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.
U.S. EPA. AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
South Coast Air Quality Management District. AER Reporting tool. Emission factors available in the Help and Support Manual at: http://www.aqmd.gov/home/rules-compliance/compliance/annual-emission-reporting
U.S. EPA WebFIRE database available at: https://cfpub.epa.gov/webfire/

Table 3d
Potential PM Emissions from Baghouses/Cyclones
Enviva Pellets Northampton, LLC

Emission Unit ID [1]	Source Description	Control Device ID	Control Device Description	Exhaust Flow Rate[1]	Exit Grain Loading[2]	Annual Operation	Particulate Speciation		Potential Emissions[5]					
									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	One (1) existing baghouse[3]	45,000	0.004	8,760	100%	40%	0.08	0.34	0.08	0.34	0.03	0.14
ES-HM-4 through 6	Dry Hammermills 4 through 6	CD-HM-BF-2	One (1) existing baghouse[3]	45,000	0.004	8,760	100%	40%	0.08	0.34	0.08	0.34	0.03	0.14
ES-HM-7 and 8 ES-DSHM-1 and -2	Dry Hammermills 7 through 8 Dry Shavings Hammermills 1 and 2	CD-HM-BF-3	One (1) existing baghouse[3]	45,000	0.004	8,760	100%	40%	0.08	0.34	0.08	0.34	0.03	0.14

Notes:

1. ES-HM-1 through 8, ES-DSHM-1 and 2, and the associated baghouses are not release points to the atmosphere. These calculations estimate the contribution of PM emissions from these units that will be emitted at CD-RTO-1.
2. Filter, Vent, and Cyclone inlet flow rate (cfm) provided by design engineering firm (Mid-South Engineering Co.). The exit flowrate was conservatively assumed to be the same as the inlet flowrate.
3. Pollutant loading provided by Aircon.
4. No speciation data is available for PM_{10}. Therefore, it is conservatively assumed to be equal to total PM. $PM_{2.5}$ speciation based on NCASI data for similar wood products sources.
5. Potential emissions assume a 95% control efficiency for Dryer Line #1 wet electrostatic precipitator (CD-WESP-1).

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

Reference:

U.S. EPA. AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

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

Calculation Basis

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

Potential Criteria Pollutant Emissions - Furnace Bypass (Cold Start-up)

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	15.8	0.39
NO_X	0.22	lb/MMBtu[2]	5.78	0.14
SO_2	0.025	lb/MMBtu[2]	0.66	0.016
VOC	0.017	lb/MMBtu[2]	0.45	0.011
Total PM	0.58	lb/MMBtu[2]	15.2	0.38
Total PM_{10}	0.52	lb/MMBtu[2]	13.6	0.34
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	11.8	0.29

Notes:

1. 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. Diesel fuel may be used as an accelerant for cold start-up. The amount used per event is typically 15 – 30 gallons and the annual usage is typically 100 – 200 gallons and emissions resulting from diesel combustion are insignificant. 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. The furnace bypass stack is not utilized during a planned shutdown until after the furnace achieves an idle state (defined as 10 MMBtu/hr or less).

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) (Cold Start-up)[1]
Enviva Pellets Northampton, LLC

Potential HAP Emissions - Furnace Bypass (Cold Start-up)

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**	**0.02**

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:

CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
NO_X - nitrogen oxides
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	10 MMBtu/hr
Annual Heat Input Capacity	5,000 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]	6.00	1.50
NO_X	0.22	lb/MMBtu[2]	2.20	0.55
SO_2	0.025	lb/MMBtu[2]	0.25	0.063
VOC	0.017	lb/MMBtu[2]	0.170	0.043
Total PM	0.58	lb/MMBtu[2]	5.77	1.44
Total PM_{10}	0.52	lb/MMBtu[2]	5.17	1.29
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	4.47	1.12

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	8.30E-03	2.08E-03
Acrolein	4.00E-03	lb/MMBtu	1	4.00E-02	1.00E-02
Formaldehyde	4.40E-03	lb/MMBtu	1	4.40E-02	1.10E-02
Phenol	5.10E-05	lb/MMBtu	1	5.10E-04	1.28E-04
Propionaldehyde	6.10E-05	lb/MMBtu	1	6.10E-04	1.53E-04
Acetophenone	3.20E-09	lb/MMBtu	1	3.20E-08	8.00E-09
Antimony and compounds	7.90E-06	lb/MMBtu	1	7.90E-05	1.98E-05
Arsenic	2.20E-05	lb/MMBtu	1	2.20E-04	5.50E-05
Benzo(a)pyrene	2.60E-06	lb/MMBtu	1	2.60E-05	6.50E-06
Beryllium	1.10E-06	lb/MMBtu	1	1.10E-05	2.75E-06
Cadmium	4.10E-06	lb/MMBtu	1	4.10E-05	1.03E-05
Carbon tetrachloride	4.50E-05	lb/MMBtu	1	4.50E-04	1.13E-04
Chlorine	7.90E-04	lb/MMBtu	1	7.90E-03	1.98E-03
Chlorobenzene	3.30E-05	lb/MMBtu	1	3.30E-04	8.25E-05
Chromium–Other compounds	2.10E-05	lb/MMBtu	1	2.10E-04	5.25E-05
Cobalt compounds	6.50E-06	lb/MMBtu	1	6.50E-05	1.63E-05
Dinitrophenol, 2,4-	1.80E-07	lb/MMBtu	1	1.80E-06	4.50E-07
Bis(2-ethylhexyl)phthalate	4.70E-08	lb/MMBtu	1	4.70E-07	1.18E-07
Ethyl benzene	3.10E-05	lb/MMBtu	1	3.10E-04	7.75E-05
Dichloroethane, 1,2-	2.90E-05	lb/MMBtu	1	2.90E-04	7.25E-05
Hydrochloric acid	1.90E-02	lb/MMBtu	1	1.90E-01	4.75E-02
Lead	4.80E-05	lb/MMBtu	1	4.80E-04	1.20E-04
Manganese	1.60E-03	lb/MMBtu	1	1.60E-02	4.00E-03
Mercury	3.50E-06	lb/MMBtu	1	3.50E-05	8.75E-06
Methyl bromide	1.50E-05	lb/MMBtu	1	1.50E-04	3.75E-05
Methyl chloride	2.30E-05	lb/MMBtu	1	2.30E-04	5.75E-05
Trichloroethane, 1,1,1-	3.10E-05	lb/MMBtu	1	3.10E-04	7.75E-05
Naphthalene	9.70E-05	lb/MMBtu	1	9.70E-04	2.43E-04
Nickel	3.30E-05	lb/MMBtu	1	3.30E-04	8.25E-05
Nitrophenol, 4-	1.10E-07	lb/MMBtu	1	1.10E-06	2.75E-07
Pentachlorophenol	5.10E-08	lb/MMBtu	1	5.10E-07	1.28E-07
Perchloroethylene	3.80E-05	lb/MMBtu	1	3.80E-04	9.50E-05
Phosphorus metal, yellow or white	2.70E-05	lb/MMBtu	1	2.70E-04	6.75E-05
Polychlorinated biphenyls	8.15E-09	lb/MMBtu	1	8.15E-08	2.04E-08
Polycyclic Organic Matter	1.25E-04	lb/MMBtu	1	1.25E-03	3.13E-04
Dichloropropane, 1,2-	3.30E-05	lb/MMBtu	1	3.30E-04	8.25E-05
Selenium compounds	2.80E-06	lb/MMBtu	1	2.80E-05	7.00E-06
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.60E-12	lb/MMBtu	1	8.60E-11	2.15E-11
Trichloroethene	3.00E-05	lb/MMBtu	1	3.00E-04	7.50E-05
Trichlorophenol, 2,4,6-	2.20E-08	lb/MMBtu	1	2.20E-07	5.50E-08
Vinyl chloride	1.80E-05	lb/MMBtu	1	1.80E-04	4.50E-05
Total HAP Emissions (Biomass Combustion)				**0.31**	**0.079**

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:
CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
NO_x - nitrogen oxides
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	2.5 MMBtu/hr
Number of Duct Burners	2
Annual Operation	8,760 hr/yr

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	0.41	1.80
NO_X	50.0	lb/MMscf	Note 2	0.25	1.07
SO_2	0.60	lb/MMscf	Note 1	0.0029	0.013
VOC	5.50	lb/MMscf	Note 1	0.027	0.12
$PM/PM_{10}/PM_{2.5}$ Condensable	5.70	lb/MMscf	Note 1	0.028	0.12
$PM/PM_{10}/PM_{2.5}$ Filterable	1.90	lb/MMscf	Note 1	0.0093	0.041
Total $PM/PM_{10}/PM_{2.5}$				0.037	0.16

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	0.41	1.80
NO_X	6.50	lb/Mgal	Note 4	0.36	1.56
SO_2	0.054	lb/Mgal	Note 3,5	0.0030	0.013
VOC	1.00	lb/Mgal	Note 3	0.055	0.24
$PM/PM_{10}/PM_{2.5}$ Condensable	0.50	lb/Mgal	Note 3	0.027	0.12
$PM/PM_{10}/PM_{2.5}$ Filterable	0.20	lb/Mgal	Note 3	0.011	0.048
Total $PM/PM_{10}/PM_{2.5}$				0.038	0.17

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-
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	1.2E-07	5.2E-07
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	1	7.8E-08	3.4E-07
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	1	7.5E-08	3.3E-07
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	1	8.8E-08	3.9E-07
Ammonia	N	Y	N	3.2	lb/MMscf	1	1.6E-02	6.9E-02
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	1	1.2E-08	5.2E-08
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	1	9.8E-07	4.3E-06
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	2	3.6E-03	1.6E-02
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	1	5.9E-09	2.6E-08
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	1	5.9E-09	2.6E-08
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	1	5.9E-08	2.6E-07
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	1	5.4E-06	2.4E-05
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	1	6.9E-06	3.0E-05
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Cobalt	Y	N	N	8.4E-05	lb/MMscf	1	4.1E-07	1.8E-06
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	1	5.9E-09	2.6E-08
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	1	5.9E-06	2.6E-05
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	1	1.5E-08	6.4E-08
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	1	1.4E-08	6.0E-08
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	2	7.5E-03	3.3E-02
Hexane	Y	Y	Y	1.8	lb/MMscf	1	8.8E-03	3.9E-02
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Lead	Y	N	N	5.0E-04	lb/MMscf	1	2.5E-06	1.1E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	1	1.9E-06	8.2E-06
Mercury	Y	Y	N	2.6E-04	lb/MMscf	1	1.3E-06	5.6E-06
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	1	3.0E-06	1.3E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	1	1.0E-05	4.5E-05
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	2	2.0E-04	8.8E-04
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	1	8.3E-08	3.7E-07
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	1	2.5E-08	1.1E-07
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	1	1.2E-07	5.2E-07
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	1	1.7E-05	7.3E-05
Total HAP Emissions (related to natural gas/propane)							**0.020**	**0.088**
Total TAP Emissions (related to natural gas/propane)							**0.032**	**0.14**

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.

Table 3g

Potential Emissions

Dryer #1 Double Duct Burners (IES-DDB-1 and -2)

Enviva Pellets Northampton, LLC

Abbreviations:

CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
LPG - liquified petroleum gas
Mgal - thousand gallons
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NC - North Carolina
NO_x - nitrogen oxides
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
yr - year

References:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.

U.S. EPA. AP-42, Section 1.5 - Liquefied Petroleum Gas Production, 07/08.

South Coast Air Quality Management District. AER Reporting tool. Emission factors available in the Help and Support Manual at: http://www.aqmd.gov/home/rules-compliance/compliance/annual-emission-reporting

U.S. EPA WebFIRE database available at: https://cfpub.epa.gov/webfire/

A National Methodology and Emission Inventory for Residential Fuel Combustion (2001). Retrieved from https://www3.epa.gov/ttnchie1/conference/ei12/area/haneke.pdf.

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	6.2 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 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 hr/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] Emissions based on process knowledge and/or information from NCASI database and includes appropriate contingency based on engineering judgement.

[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 furnace using an emission factor for wood combustion from AP-42, Section 1.6.

[4] Particulate emission factor is based on process knowledge and an appropriate contingency based on engineering judgement.

[5] VOC emission factor based on process knowledge and an appropriate contingency based on engineering judgement. Factor represents uncontrolled emissions.

Abbreviations:

hr - hour
lb - pound
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NO_X - nitrogen oxides
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

References:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.
U.S. EPA. AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.

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	6.2 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)	Annual (tpy)
Biomass Source								
Acetaldehyde	Y	Y	Y	1.7E-01	lb/ODT	2	0.35	1.64
Acrolein	Y	Y	Y	1.1E-01	lb/ODT	2	0.23	1.07
Formaldehyde	Y	Y	Y	1.4E-01	lb/ODT	2	0.29	1.40
Methanol	Y	N	Y	1.0E-01	lb/ODT	2	0.22	1.02
Phenol	Y	Y	Y	5.8E-02	lb/ODT	2	0.12	0.56
Propionaldehyde	Y	N	Y	3.9E-02	lb/ODT	2	0.08	0.38
Acetophenone	Y	N	Y	3.2E-09	lb/MMBtu	3,4	1.4E-08	6.3E-08
Antimony and compounds	Y	N	N	7.9E-06	lb/MMBtu	3,5	1.0E-04	4.5E-04
Arsenic	Y	Y	N	2.2E-05	lb/MMBtu	3,5	2.9E-04	1.3E-03
Benzene	Y	Y	Y	4.2E-03	lb/MMBtu	3,4	1.9E-02	8.3E-02
Benzo(a)pyrene	Y	Y	Y	2.6E-06	lb/MMBtu	3,4	1.2E-05	5.1E-05
Beryllium	Y	Y	N	1.1E-06	lb/MMBtu	3,5	1.4E-05	6.3E-05
Cadmium	Y	Y	N	4.1E-06	lb/MMBtu	3,5	5.4E-05	2.3E-04
Carbon tetrachloride	Y	Y	Y	4.5E-05	lb/MMBtu	3,4	2.0E-04	8.9E-04
Chlorine	Y	Y	N	7.9E-04	lb/MMBtu	3,10	1.4E-01	6.2E-01
Chlorobenzene	Y	Y	Y	3.3E-05	lb/MMBtu	3,4	1.5E-04	6.5E-04
Chloroform	Y	Y	Y	2.8E-05	lb/MMBtu	3,4	1.3E-04	5.5E-04
Chromium VI	.[5]	Y	N	3.5E-06	lb/MMBtu	3,5,6	4.6E-05	2.0E-04
Chromium--Other compounds	Y	N	N	1.8E-05	lb/MMBtu	3,5	2.3E-04	1.0E-03
Cobalt compounds	Y	N	N	6.5E-06	lb/MMBtu	3,5	8.5E-05	3.7E-04
Dichloroethane, 1,2-	Y	Y	Y	2.9E-05	lb/MMBtu	3,4	1.3E-04	5.7E-04
Dichloropropane, 1,2-	Y	N	Y	3.3E-05	lb/MMBtu	3,4	1.5E-04	6.5E-04
Dinitrophenol, 2,4-	Y	N	Y	1.8E-07	lb/MMBtu	3,4	8.1E-07	3.5E-06
Di(2-ethylhexyl)phthalate	Y	Y	Y	4.7E-08	lb/MMBtu	3,4	2.1E-07	9.3E-07
Ethyl benzene	Y	N	Y	3.1E-05	lb/MMBtu	3,4	1.4E-04	6.1E-04
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	N	Y	Y	1.8E-11	lb/MMBtu	3,4	8.1E-11	3.5E-10
Hydrochloric acid	Y	Y	N	1.9E-02	lb/MMBtu	3,7	3.4E-01	1.5E+00
Lead	Y	N	N	4.8E-05	lb/MMBtu	3,5	6.3E-04	2.7E-03
Manganese	Y	Y	N	1.6E-03	lb/MMBtu	3,5	2.1E-02	9.1E-02
Mercury	Y	Y	N	3.5E-06	lb/MMBtu	3,5	4.6E-05	2.0E-04
Methyl bromide	Y	N	Y	1.5E-05	lb/MMBtu	3,4	6.8E-05	3.0E-04
Methyl chloride	Y	N	Y	2.3E-05	lb/MMBtu	3,4	1.0E-04	4.5E-04
Methyl ethyl ketone	N	Y	Y	5.4E-06	lb/MMBtu	3,4	2.4E-05	1.1E-04
Methylene chloride	Y	Y	Y	2.9E-04	lb/MMBtu	3,4	1.3E-03	5.7E-03
Naphthalene	Y	N	Y	9.7E-05	lb/MMBtu	3,4	4.4E-04	1.9E-03
Nickel	Y	Y	N	3.3E-05	lb/MMBtu	3,5	4.3E-04	1.9E-03
Nitrophenol, 4-	Y	N	Y	1.1E-07	lb/MMBtu	3,4	5.0E-07	2.2E-06
Pentachlorophenol	Y	Y	N	5.1E-08	lb/MMBtu	3	2.3E-07	1.0E-06
Perchloroethylene	Y	Y	N	3.8E-05	lb/MMBtu	3	1.7E-04	7.5E-04
Phosphorus metal, yellow or white	Y	N	N	2.7E-05	lb/MMBtu	3,5	3.5E-04	1.5E-03
Polychlorinated biphenyls	Y	Y	Y	8.2E-09	lb/MMBtu	3,4	3.7E-08	1.6E-07
Polycyclic Organic Matter	Y	N	N	1.3E-04	lb/MMBtu	3	5.6E-04	2.5E-03
Selenium compounds	Y	N	N	2.8E-06	lb/MMBtu	3,5	3.7E-05	1.6E-04
Styrene	Y	Y	Y	1.9E-03	lb/MMBtu	3,4	8.6E-03	3.7E-02
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	Y	Y	8.6E-12	lb/MMBtu	3,4	3.9E-11	1.7E-10
Toluene	Y	Y	Y	3.0E-05	lb/MMBtu	3,4	1.4E-04	5.9E-04
Trichloroethane, 1,1,1-	Y	Y	N	3.1E-05	lb/MMBtu	3	1.4E-04	6.1E-04
Trichloroethylene	Y	Y	Y	3.0E-05	lb/MMBtu	3,4	1.4E-04	5.9E-04
Trichlorofluoromethane	N	Y	Y	4.1E-05	lb/MMBtu	3,4	1.8E-04	8.1E-04
Trichlorophenol, 2,4,6-	Y	N	Y	2.2E-08	lb/MMBtu	3,4	9.9E-08	4.3E-07
Vinyl chloride	Y	Y	Y	1.8E-05	lb/MMBtu	3,4	8.1E-05	3.5E-04
Xylene	Y	Y	Y	2.5E-05	lb/MMBtu	3,4	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	8	5.8E-07	2.6E-06
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	8	4.4E-08	1.9E-07
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	8	3.9E-07	1.7E-06
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	8	4.4E-08	1.9E-07
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	8	4.4E-08	1.9E-07
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	8	3.7E-07	1.6E-06
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	8	4.4E-07	1.9E-06
Ammonia	N	Y	N	3.2	lb/MMscf	8	7.8E-02	3.4E-01
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	8	5.8E-08	2.6E-07
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	8	4.9E-06	2.1E-05
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	8	4.4E-08	1.9E-07
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	9	1.8E-02	7.7E-02
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	8	2.9E-08	1.3E-07
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	8	4.4E-08	1.9E-07
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	8	2.9E-08	1.3E-07
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	8	4.4E-08	1.9E-07
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	8	2.9E-07	1.3E-06
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	8	2.7E-05	1.2E-04
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	8	3.4E-05	1.5E-04
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	8	4.4E-08	1.9E-07
Cobalt	Y	N	N	8.4E-05	lb/MMscf	8	2.0E-06	8.9E-06
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	8	2.9E-08	1.3E-07
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	8	2.9E-05	1.3E-04
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	8	7.3E-08	3.2E-07
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	8	6.8E-08	3.0E-07
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	9	3.7E-02	1.6E-01
Hexane	Y	Y	Y	1.8	lb/MMscf	8	4.4E-02	1.9E-01
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	8	4.4E-08	1.9E-07
Lead	Y	N	N	5.0E-04	lb/MMscf	8	1.2E-05	5.3E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	8	9.2E-06	4.0E-05
Mercury	Y	Y	N	2.6E-04	lb/MMscf	8	6.3E-06	2.8E-05
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	8	1.5E-05	6.5E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	8	5.1E-05	2.2E-04
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	9	9.9E-04	4.3E-03
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	8	4.1E-07	1.8E-06
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	8	1.2E-07	5.3E-07
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	8	5.8E-07	2.6E-06
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	8	8.3E-05	3.6E-04
Total HAP Emissions (related to natural gas/propane)							**0.10**	**0.44**
Total TAP Emissions (related to natural gas/propane)							**0.16**	**0.36**

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), 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.
2. Emission factor based on process knowledge and an appropriate contingency based on engineering judgement. The emission factors represent uncontrolled emissions.
3. 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.
4. The control efficiency of 97.5% for the RTO is applied to all VOC hazardous and toxic pollutants.
   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.
5. WESP Control Efficiency for metal HAP 92.8%
6. 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.
   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.
7. WESP HCl Control Efficiency 90.00%
8. 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.
9. 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.
10. It was assumed that chlorine is not oxidized in the RTO.

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

Abbreviations:

HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NC - North Carolina
ODT - oven dried tons
RTO - regenerative thermal oxidizer
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
yr - year

References:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.
U.S. EPA. AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
South Coast Air Quality Management District. AER Reporting tool. Emission factors available in the Help and Support Manual at: http://www.aqmd.gov/home/rules-compliance/compliance/annual-emission-reporting
U.S. EPA WebFIRE database available at: https://cfpub.epa.gov/webfire/

Table 4c
Potential Emissions
Dryer #2 Furnace Bypass (ES-FURNACEBYP-2) (Cold Start-up)[1]
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Heat Input Capacity	27 MMBtu/hr
Annual Heat Input Capacity	1,350 MMBtu/yr
Hours of Operation[1]	50 hr/yr

Potential Criteria Pollutant Emissions - Furnace Bypass (Cold Start-up)

Pollutant	Emission Factor	Units	Potential Emissions	
			Max (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	16.2	0.41
NO_X	0.22	lb/MMBtu[2]	5.94	0.15
SO_2	0.025	lb/MMBtu[2]	0.68	0.017
VOC	0.017	lb/MMBtu[2]	0.46	0.011
Total PM	0.58	lb/MMBtu[2]	15.6	0.39
Total PM_{10}	0.52	lb/MMBtu[2]	14.0	0.35
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	12.1	0.30

Notes:

1. 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. Diesel fuel may be used as an accelerant for cold start-up. The amount used per event is typically 15 – 30 gallons and the annual usage is typically 100 – 200 gallons and emissions resulting from diesel combustion are insignificant. 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. The furnace bypass stack is not utilized during a planned shutdown until after the furnace achieves an idle state (defined as 10 MMBtu/hr or less).
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 4c
Potential Emissions
Dryer #2 Furnace Bypass (ES-FURNACEBYP-2) (Cold Start-up)[1]
Enviva Pellets Northampton, LLC

Potential HAP Emissions - Furnace Bypass (Cold Start-up)

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**	**0.02**

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:

CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
NO_X - nitrogen oxides
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 4d
Potential Emissions
Dryer #2 Furnace Bypass (ES-FURNACEBYP-2) (Idle Mode)[1]
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Heat Input Capacity	10 MMBtu/hr
Annual Heat Input Capacity	5,000 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]	6.00	1.50
NO_X	0.22	lb/MMBtu[2]	2.20	0.55
SO_2	0.025	lb/MMBtu[2]	0.25	0.063
VOC	0.017	lb/MMBtu[2]	0.170	0.043
Total PM	0.58	lb/MMBtu[2]	5.77	1.44
Total PM_{10}	0.52	lb/MMBtu[2]	5.17	1.29
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	4.47	1.12

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 4d
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	8.30E-03	2.08E-03
Acrolein	4.00E-03	lb/MMBtu	1	4.00E-02	1.00E-02
Formaldehyde	4.40E-03	lb/MMBtu	1	4.40E-02	1.10E-02
Phenol	5.10E-05	lb/MMBtu	1	5.10E-04	1.28E-04
Propionaldehyde	6.10E-05	lb/MMBtu	1	6.10E-04	1.53E-04
Acetophenone	3.2E-09	lb/MMBtu	1	3.20E-08	8.00E-09
Antimony and compounds	7.9E-06	lb/MMBtu	1	7.90E-05	1.98E-05
Arsenic	2.2E-05	lb/MMBtu	1	2.20E-04	5.50E-05
Benzo(a)pyrene	2.6E-06	lb/MMBtu	1	2.60E-05	6.50E-06
Beryllium	1.1E-06	lb/MMBtu	1	1.10E-05	2.75E-06
Cadmium	4.1E-06	lb/MMBtu	1	4.10E-05	1.03E-05
Carbon tetrachloride	4.5E-05	lb/MMBtu	1	4.50E-04	1.13E-04
Chlorine	7.9E-04	lb/MMBtu	1	7.90E-03	1.98E-03
Chlorobenzene	3.3E-05	lb/MMBtu	1	3.30E-04	8.25E-05
Chromium-Other compounds	2.1E-05	lb/MMBtu	1	2.10E-04	5.25E-05
Cobalt compounds	6.5E-06	lb/MMBtu	1	6.50E-05	1.63E-05
Dinitrophenol, 2,4-	1.8E-07	lb/MMBtu	1	1.80E-06	4.50E-07
Bis(2-ethylhexyl)phthalate	4.7E-08	lb/MMBtu	1	4.70E-07	1.18E-07
Ethyl benzene	3.1E-05	lb/MMBtu	1	3.10E-04	7.75E-05
Dichloroethane, 1,2-	2.9E-05	lb/MMBtu	1	2.90E-04	7.25E-05
Hydrochloric acid	1.9E-02	lb/MMBtu	1	1.90E-01	4.75E-02
Lead	4.8E-05	lb/MMBtu	1	4.80E-04	1.20E-04
Manganese	1.6E-03	lb/MMBtu	1	1.60E-02	4.00E-03
Mercury	3.5E-06	lb/MMBtu	1	3.50E-05	8.75E-06
Methyl bromide	1.5E-05	lb/MMBtu	1	1.50E-04	3.75E-05
Methyl chloride	2.3E-05	lb/MMBtu	1	2.30E-04	5.75E-05
Trichloroethane, 1,1,1-	3.1E-05	lb/MMBtu	1	3.10E-04	7.75E-05
Naphthalene	9.7E-05	lb/MMBtu	1	9.70E-04	2.43E-04
Nickel	3.3E-05	lb/MMBtu	1	3.30E-04	8.25E-05
Nitrophenol, 4-	1.1E-07	lb/MMBtu	1	1.10E-06	2.75E-07
Pentachlorophenol	5.1E-08	lb/MMBtu	1	5.10E-07	1.28E-07
Perchloroethylene	3.8E-05	lb/MMBtu	1	3.80E-04	9.50E-05
Phosphorus metal, yellow or white	2.7E-05	lb/MMBtu	1	2.70E-04	6.75E-05
Polychlorinated biphenyls	8.2E-09	lb/MMBtu	1	8.15E-08	2.04E-08
Polycyclic Organic Matter	1.3E-04	lb/MMBtu	1	1.25E-03	3.13E-04
Dichloropropane, 1,2-	3.3E-05	lb/MMBtu	1	3.30E-04	8.25E-05
Selenium compounds	2.8E-06	lb/MMBtu	1	2.80E-05	7.00E-06
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.6E-12	lb/MMBtu	1	8.60E-11	2.15E-11
Trichloroethene	3.0E-05	lb/MMBtu	1	3.00E-04	7.50E-05
Trichlorophenol, 2,4,6-	2.2E-08	lb/MMBtu	1	2.20E-07	5.50E-08
Vinyl chloride	1.8E-05	lb/MMBtu	1	1.80E-04	4.50E-05
Total HAP Emissions (Biomass Combustion)				**0.31**	**0.079**

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:
CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
NO_x - nitrogen oxides
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 Double Duct Burners (IES-DDB-3 and -4)
Enviva Pellets Northampton, LLC

Duct Burner Inputs

Duct Burner Rating	2.5 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	0.41	1.80
NO_X	50.0	lb/MMscf	Note 2	0.25	1.07
SO_2	0.60	lb/MMscf	Note 1	0.0029	0.013
VOC	5.50	lb/MMscf	Note 1	0.027	0.12
$PM/PM_{10}/PM_{2.5}$ Condensable	5.70	lb/MMscf	Note 1	0.028	0.12
$PM/PM_{10}/PM_{2.5}$ Filterable	1.90	lb/MMscf	Note 1	0.0093	0.041
Total $PM/PM_{10}/PM_{2.5}$				0.037	0.16

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	0.41	1.80
NO_X	6.50	lb/Mgal	Note 4	0.36	1.56
SO_2	0.054	lb/Mgal	Note 3,5	0.0030	0.013
VOC	1.00	lb/Mgal	Note 3	0.055	0.24
$PM/PM_{10}/PM_{2.5}$ Condensable	0.50	lb/Mgal	Note 3	0.027	0.12
$PM/PM_{10}/PM_{2.5}$ Filterable	0.20	lb/Mgal	Note 3	0.011	0.048
Total $PM/PM_{10}/PM_{2.5}$				0.038	0.17

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
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 4e
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	1.2E-07	5.2E-07
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	1	7.8E-08	3.4E-07
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	1	7.5E-08	3.3E-07
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	1	8.8E-08	3.9E-07
Ammonia	N	Y	N	3.2	lb/MMscf	1	1.6E-02	6.9E-02
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	1	1.2E-08	5.2E-08
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	1	9.8E-07	4.3E-06
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	2	3.6E-03	1.6E-02
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	1	5.9E-09	2.6E-08
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	1	5.9E-09	2.6E-08
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	1	5.9E-08	2.6E-07
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	1	5.4E-06	2.4E-05
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	1	6.9E-06	3.0E-05
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Cobalt	Y	N	N	8.4E-05	lb/MMscf	1	4.1E-07	1.8E-06
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	1	5.9E-09	2.6E-08
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	1	5.9E-06	2.6E-05
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	1	1.5E-08	6.4E-08
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	1	1.4E-08	6.0E-08
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	2	7.5E-03	3.3E-02
Hexane	Y	Y	Y	1.8	lb/MMscf	1	8.8E-03	3.9E-02
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	1	8.8E-09	3.9E-08
Lead	Y	N	N	5.0E-04	lb/MMscf	1	2.5E-06	1.1E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	1	1.9E-06	8.2E-06
Mercury	Y	Y	N	2.6E-04	lb/MMscf	1	1.3E-06	5.6E-06
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	1	3.0E-06	1.3E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	1	1.0E-05	4.5E-05
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	2	2.0E-04	8.8E-04
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	1	8.3E-08	3.7E-07
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	1	2.5E-08	1.1E-07
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	1	1.2E-07	5.2E-07
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	1	1.7E-05	7.3E-05
Total HAP Emissions (related to natural gas/propane)							**0.020**	**0.088**
Total TAP Emissions (related to natural gas/propane)							**0.032**	**0.14**

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.

Table 4e

Potential Emissions

Dryer #2 Double Duct Burners (IES-DDB-3 and -4)

Enviva Pellets Northampton, LLC

Abbreviations:

CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
LPG - liquified petroleum gas
Mgal - thousand gallons
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NC - North Carolina
NO_X - nitrogen oxides
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
yr - year

References:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.

U.S. EPA. AP-42, Section 1.5 - Liquefied Petroleum Gas Production, 07/08.

South Coast Air Quality Management District. AER Reporting tool. Emission factors available in the Help and Support Manual at: http://www.aqmd.gov/home/rules-compliance/compliance/annual-emission-reporting

U.S. EPA WebFIRE database available at: https://cfpub.epa.gov/webfire/

A National Methodology and Emission Inventory for Residential Fuel Combustion (2001). Retrieved from https://www3.epa.gov/ttnchie1/conference/ei12/area/haneke.pdf.

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:

CAS - chemical abstract service
gal - gallon
HAP - hazardous air pollutant
hp - horsepower
hr - hour
lb - pound
MMBtu - Million British thermal units
NO_X - nitrogen oxides
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
SO_2 - sulfur dioxide
tpy - tons per year
TOC - total organic compounds
yr - year

References:

U.S. EPA. AP-42, Section 1.5 - Liquefied Petroleum Gas Production, 07/08.
South Coast Air Quality Management District. AER Reporting tool. Emission factors available in the Help and Support Manual at: http://www.aqmd.gov/home/rules-compliance/compliance/annual-emission-reporting
A National Methodology and Emission Inventory for Residential Fuel Combustion (2001). Retrieved from https://www3.epa.gov/ttnchie1/conference/ei12/area/haneke.pdf.

Table 6
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	6.2 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/RTO 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 based on process knowledge and an appropriate contingency based on engineering judgement. The emission factors represent uncontrolled emissions.

2. A 95.0% control efficiency is applied to the potential emissions for the RTO.
Emissions from the pellet mills and pellet coolers will be controlled by an RCO/RTO that can operate in either catalytic mode (RCO) or thermal mode (RTO). The RTO and RCO modes have the same control efficiency so there will be no impact on emissions when switching between operating modes.

Thermally 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	1.02	4.47
NO_X	4.9E-02	lb/MMBtu	0.61	2.66
SO_2	5.9E-04	lb/MMBtu	0.0073	0.032
VOC	5.4E-03	lb/MMBtu	0.067	0.29
Total PM	7.5E-03	lb/MMBtu	0.092	0.40
Total PM_{10}	7.5E-03	lb/MMBtu	0.092	0.40
Total $PM_{2.5}$	7.5E-03	lb/MMBtu	0.092	0.40

Potential Criteria Pollutant Emissions - Propane Combustion

Pollutant	Emission Factor[2]	Units	Potential Emissions Max (lb/hr)	Annual (tpy)
CO	7.50	lb/Mgal	1.02	4.45
NO_X	13.0	lb/Mgal	1.76	7.72
SO_2	0.054	lb/Mgal	0.0073	0.032
VOC	1.00	lb/Mgal	0.14	0.59
$PM/PM_{10}/PM_{2.5}$ Condensable	0.50	lb/Mgal	0.068	0.30
$PM/PM_{10}/PM_{2.5}$ Filterable	0.20	lb/Mgal	0.027	0.12
Total $PM/PM_{10}/PM_{2.5}$			0.095	0.42

Table 6
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	3	2.9E-07	1.3E-06
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	3	2.2E-08	9.6E-08
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	3	1.9E-07	8.5E-07
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	3	2.2E-08	9.6E-08
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	3	2.2E-08	9.6E-08
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	3	1.8E-07	8.1E-07
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	3	2.2E-07	9.58E-07
Ammonia	N	Y	N	3.2	lb/MMscf	3	3.89E-02	1.70E-01
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	3	2.9E-08	1.3E-07
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	3	2.4E-06	1.1E-05
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	3	2.2E-08	9.6E-08
Benzene	Y	N	Y	7.1E-04	lb/MMBtu	4	8.8E-03	3.9E-02
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	3	1.5E-08	6.4E-08
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	3	2.2E-08	9.6E-08
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	3	1.5E-08	6.4E-08
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	3	2.2E-08	9.6E-08
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	3	1.5E-07	6.4E-07
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	3	1.3E-05	5.9E-05
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	3	1.7E-05	7.5E-05
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	3	2.2E-08	9.6E-08
Cobalt Compounds	Y	N	N	8.4E-05	lb/MMscf	3	1.0E-06	4.5E-06
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	3	1.5E-08	6.4E-08
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	3	1.5E-05	6.4E-05
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	3	3.6E-08	1.6E-07
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	3	3.4E-08	1.5E-07
Formaldehyde	Y	Y	Y	1.5E-03	lb/MMBtu	4	1.9E-02	8.1E-02
Hexane	Y	Y	Y	1.8	lb/MMscf	3	2.2E-02	9.6E-02
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	3	2.2E-08	9.6E-08
Lead	Y	N	N	5.0E-04	lb/MMscf	3	6.1E-06	2.7E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	3	4.6E-06	2.0E-05
Mercury	Y	Y	N	2.6E-04	lb/MMscf	3	3.2E-06	1.4E-05
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	3	7.4E-06	3.2E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	3	2.6E-05	1.1E-04
Polycyclic Organic Matter	Y	N	N	4.0E-05	lb/MMBtu	4	5.0E-04	2.2E-03
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	3	2.1E-07	9.1E-07
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	3	6.1E-08	2.7E-07
Selenium compounds	Y	N	N	2.4E-05	lb/MMscf	3	2.9E-07	1.3E-06
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	3	4.1E-05	1.8E-04
					Total HAP Emissions (natural gas combustion)		**0.050**	**0.22**
					Total TAP Emissions (natural gas combustion)		**0.08**	**0.35**

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 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.
4. The RCO/RTO 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
CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
LPG - liquified petroleum gas
Mgal - thousand gallons
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NC - North Carolina
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
RCO - regenerative catalytic oxidizer
RTO - regenerative thermal oxidizer
TAP - toxic air pollutant
tpy - tons per year
SO_2 - sulfur dioxide
VOC - volatile organic compound
yr - year

References:

U.S. EPA. AP-42, Section 1.4 - Natural Gas Combustion, 07/98.
U.S. EPA. AP-42, Section 1.5 - Liquefied Petroleum Gas Production, 07/08.
South Coast Air Quality Management District. AER Reporting tool. Emission factors available in the Help and Support Manual at:
U.S. EPA WebFIRE database available at: https://cfpub.epa.gov/webfire/
A National Methodology and Emission Inventory for Residential Fuel Combustion (2001). Retrieved from https://www3.epa.gov/ttnchie1/conference/ei12/area/haneke.pdf.

Table 7
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	0.13	0.33
Methanol[2]	2.0E-03	0.30	0.76
Propionaldehyde[5]	2.1E-04	0.03	0.08
Total HAP Emissions		**0.46**	**1.17**
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 the combined dryer throughputs.
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).
5. Emission factor based on process knowledge and an appropriate contingency based on engineering judgement.

Abbreviations:

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

Table 8
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-PCHP	Pellet Cooler HP Fines Relay System	CD-PCHP-BV	One (1) baghouse[4]	3,600	0.004	8,760	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[4]	2,500	0.004	8,760	100%	100%	0.086	0.38	0.086	0.38	0.086	0.38
ES-CLR-1	Pellet Cooler	CD-CLR-1	One (1) existing Cyclone[5]	17,100	0.01	8,760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.047	0.21
ES-CLR-2	Pellet Cooler	CD-CLR-2	One (1) existing Cyclone[5]	17,100	0.01	8,760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.047	0.21
ES-CLR-3	Pellet Cooler	CD-CLR-3	One (1) existing Cyclone[5]	17,100	0.01	8,760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.047	0.21
ES-CLR-4	Pellet Cooler	CD-CLR-4	One (1) existing Cyclone[5]	17,100	0.01	8,760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.047	0.21
ES-CLR-5	Pellet Cooler	CD-CLR-5	One (1) existing Cyclone[5]	17,100	0.01	8,760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.047	0.21
ES-CLR-6	Pellet Cooler	CD-CLR-6	One (1) existing Cyclone[5]	17,100	0.01	8,760	26.1%	3.2%	1.47	6.42	0.38	1.68	0.047	0.21
ES-DWH-2	Dried Wood Handling-2	CD-DWH-BF-2	One (1) baghouse	2,500	0.004	8,760	100%	100%	0.086	0.38	0.086	0.38	0.086	0.38
ES-DSR	Dry Shavings Reception	CD-DSR-BF	One (1) baghouse	2,500	0.004	8760	100%	100%	0.086	0.38	0.086	0.38	0.086	0.38
ES-FPH; ES-PB-1 through 12; ES-PL-1 and -2	Finished Product Handling; Twelve pellet loadout bins; Pellet mill loadout 1 and 2	CD-FPH-BF	One (1) baghouse[3,6]	35,500	0.004	8,760	91%	40%	1.22	5.33	1.11	4.85	0.49	2.13
ES-DSS	Dry Shavings Silo	CD-DSS-BF	One (1) baghouse[4]	500	0.004	8,760	100%	100%	0.02	0.08	0.02	0.08	0.02	0.08

Notes:

1. Filter, Vent, and Cyclone inlet flow rate (cfm) provided by design engineering firm (Mid-South Engineering Co.). The exit flowrate was conservatively assumed to be the same as the inlet flowrate.
2. Pollutant loading provided by Aircon.
3. Finished product handling $PM_{2.5}$ speciation based on review of NCASI data for similar baghouses in the wood products industry.
4. No speciation data is available for $PM_{10}/PM_{2.5}$. Therefore, it is conservatively assumed to be equal to total PM.
5. Pellet cooler $PM_{10}/PM_{2.5}$ speciation based on process knowledge and engineering judgement.
6. 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

Reference:

U.S. EPA. AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03

Table 9a
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[1]	PM_{10} Emission Factor[1]	$PM_{2.5}$ Emission Factor[1]	Potential Throughput[2]		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	44	389,054	8.3E-03	3.6E-02	3.9E-03	1.7E-02	5.9E-04	2.6E-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[3]	--	--	0	45%	4.1E-05	1.9E-05	2.9E-06	44	389,054	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[3]	--	--	0	48%	3.7E-05	1.8E-05	2.7E-06	300	1,502,414	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	44	389,054	5.5E-03	2.4E-02	2.6E-03	1.1E-02	3.9E-04	1.7E-03
IES-DLH	Drop point for dry shavings to dry line hopper	--	--	1	8.0%	4.6E-04	2.2E-04	3.3E-05	10.0	87,600	4.6E-03	2.0E-02	2.2E-03	9.5E-03	3.3E-04	1.4E-03
ES-DLC-1	Drop point for dry line hopper to dry line feed conveyor	--	--	1	8.0%	4.6E-04	2.2E-04	3.3E-05	10.0	87,600	4.6E-03	2.0E-02	2.2E-03	9.5E-03	3.3E-04	1.4E-03
IES-DRYSHAVE	Existing dry shaving walking floor truck dump	--	--	1	8.0%	4.6E-04	2.2E-04	3.3E-05	48.0	87,600	2.2E-02	2.0E-02	1.0E-02	9.5E-03	1.6E-03	1.4E-03
	Existing dry shaving loader	--	--	2	8.0%	4.6E-04	2.2E-04	3.3E-05	10.0	87,600	9.2E-03	4.0E-02	4.3E-03	1.9E-02	6.6E-04	2.9E-03
IES-ADD	Additive Handling and Storage	--	--	1	0.25%	5.9E-02	2.8E-02	4.2E-03	1.0	8,760	5.9E-02	2.6E-01	2.8E-02	1.2E-01	4.2E-03	1.8E-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	300.0	1,502,414	9.6E-02	2.4E-01	4.5E-02	1.1E-01	6.9E-03	1.7E-02
ES-DWH-1	Dried Wood Handling 1[4]	--	--	2	17.0%	1.6E-04	7.6E-05	1.1E-05	185.3	941,271	5.9E-02	1.5E-01	2.8E-02	7.1E-02	4.2E-03	1.1E-02
										Total Emissions:	**0.28**	**0.84**	**0.13**	**0.40**	**0.020**	**0.060**

Notes:

1. 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

2. Throughputs represent actual weight of materials. Throughput for dry shaving material handling is based on comparable Enviva facilities.

3. Activity is enclosed and there are no associated emissions.

4. Emissions from dried wood handling associated with the existing dryer line are controlled by an existing passive bin vent.

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

References:

U.S. EPA. AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, 11/06.

Table 9b
Potential Emissions from Wood Storage Pile Wind Erosion
Enviva Pellets Northampton, LLC

Source	Description	PM Emission Factor[1]		VOC Emission Factor[2]		Pile Width/ Diameter	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	0.38	0.04	0.19	0.007	0.03	0.04	0.19
IES-GWHS	Green Wood Storage Pile No. 1	8.6	8.2E-06	3.6	3.4E-06	155	--	72	30,907	0.25	1.11	0.13	0.56	0.019	0.08	0.13	0.57
	Green Wood Storage Pile No. 2	8.6	8.2E-06	3.6	3.4E-06	350	400	25	213,000	1.75	7.67	0.88	3.84	0.131	0.58	0.89	3.92
	Green Wood Storage Pile No. 3	8.6	8.2E-06	3.6	3.4E-06	150	150	25	45,000	0.37	1.62	0.19	0.81	0.028	0.12	0.19	0.83
	Green Wood Storage Pile No. 4	8.6	8.2E-06	3.6	3.4E-06	200	200	25	72,000	0.59	2.59	0.30	1.30	0.044	0.19	0.30	1.32
	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	0.19	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	0.18	0.77
	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**	**16.6**	**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. VOC emission factor obtained from NCASI Technical Bulletin 700. 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 maximum 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

Reference:

U.S. EPA. AP-42, Section 13.2.2 - Unpaved Roads, 11/06.
U.S. EPA. Control of Open Fugitive Dust Sources, Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988.
U.S. EPA. Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors. November 2006.
NCASI. Technical Bulletin No. 700. Preliminary Investigation of Releases of Volatile Organic Compounds from Wood Residual Storage Piles. October 1995.

Table 10
Potential Emissions
Electric Powered Green Wood Chipper (IES-EPWC)
Enviva Pellets Northampton, LLC

Calculation Basis

Annual Throughput of Chipper	781,255	ODT/year[1]
Short Term Throughput	178.50	ODT/hr[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	0.73	1.60
VOC as propane[3]	0.0050	lb/ODT	0.89	1.95
Methanol[2]	0.0010	lb/ODT	0.18	0.39

Notes:

[1] The annual throughput for the chipper is conservatively assumed to be the same as the total dryer throughput. The hourly throughput for the chipper is assumed to be 85% of the debarker hourly throughput.

[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.

Abbreviations:

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

References:

U.S. EPA. AP-42, Section 10.6.3 - Medium Density Fiberboard, 08/02.
U.S. EPA. AP-42, Section 10.6.4 - Hardboard and Fiberboard, 10/02.

Table 11
Potential Emissions
Bark Hog (IES-BARK)
Enviva Pellets Northampton, LLC

Calculation Basis

Annual Throughput of Bark Hog	234,377	ODT/year[1]
Short-term Throughput of Bark Hog	31.50	ODT/hr[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).

Abbreviations:

hr - hour
lb - pound
ODT - oven dried tons
THC - total hydrocarbon
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
tpy - tons per year
VOC - volatile organic compound
yr - year

References:

U.S. EPA. AP-42, Section 10.6.3 - Medium Density Fiberboard, 08/02.

U.S. EPA. AP-42, Section 10.6.4 - Hardboard and Fiberboard, 10/02.

U.S. EPA. 1990. *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants*. Source Classification Code 3-07-008-01 (Log Debarking).

Table 12
Potential Emissions
Debarker (IES-DEBARK)
Enviva Pellets Northampton, LLC

Calculation Basis

Hourly Throughput[1]	210 ODT/hr
Annual Throughput[1]	781,255 ODT/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
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
tpy - tons per year
TSP - total suspended particulate
yr - year

Reference:

U.S. EPA. 1990. *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants*. Source Classification Code 3-07-008-01 (Log Debarking).

Table 13
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 13
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 13
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 13
Potential Emissions
Emergency Generators (IES-GN-1 and IES-GN-2) and Fire Water Pump (IES-FWP)
Enviva Pellets Northampton, LLC

Abbreviations:

Btu - British thermal unit
CARB - California Air Resources Board
CAS - chemical abstract service
CFR - Code of Federal Regulations
CH_4 - methane
CO - carbon monoxide
CO_2 - 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
NMHC - Non-methane hydrocarbon
NO_X - nitrogen oxides
N_2O - nitrous oxide
NSPS - New Source Performance Standards
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
ppmw - parts per million by weight
PSD - prevention of significant deterioration
PTE - potential to emit
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compound
yr - year

References:

U.S. EPA. AP-42, Section 3.3 - Stationary Internal Combustion Engines, 10/96.
U.S. EPA. AP-42, Section 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines, 10/96.

Table 14
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 15a
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	0.004	0.005	0.001	0.001	0.0002
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	0.003	0.005	0.001
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	0.013	0.018	0.003
											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
g - gram
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

References:

U.S. EPA. AP-42, Section 13.2.1 - Paved Roads, 01/11.

Table 15b
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	Emperical 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

References:

U.S. EPA. AP-42, Section 13.2.2 - Unpaved Roads, 11/06.

Table 16
Potential GHG Emissions
Facility-wide
Enviva Pellets Northampton, LLC

Operating Data:

Dryer-1 Heat Input	175.3	MMBtu/hr
Annual Heat Input	1,554,814	MMBtu/yr
Duct Burner 1 and 2 Heat Input	3	MMBtu/hr
Number of Burners	2	
Operating Schedule	8,760	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	3	MMBtu/hr
Number of Burners	2	
Operating Schedule	8,760	hrs/yr
RTO-1 Heat Input	31.6	MMBtu/hr
Operating Schedule	8,760	hrs/yr
Furnace 1 Bypass Heat Input	26	MMBtu/hr
Operating Schedule	50	hrs/yr
Furnace 1 Idle Heat Input	10	MMBtu/hr
Operating Schedule	500	hrs/yr
RTO-2 Heat Input	28.8	MMBtu/hr
Operating Schedule	8,760	hrs/yr
Furnace 2 Bypass Heat Input	27	MMBtu/hr
Operating Schedule	50	hrs/yr
Furnace 2 Idle Heat Input	10	MMBtu/hr
Operating Schedule	500	hrs/yr
RCO-2 Heat Input	16.2	MMBtu/hr
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 16
Potential GHG Emissions
Facility-wide
Enviva Pellets Northampton, LLC

Emission Unit ID	Fuel Type	Emission Factors from Table C-1 (kg/MMBtu)[1]			Tier 1 Emissions (short tons)			
		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	160,761	308	1,839	162,908
IES-DDB-1 and -2	Propane	62.87	7.50E-02	1.79E-01	3,035	3.62	8.63	3,048
ES-DRYER-2	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	163,034	313	1,865	165,212
IES-DDB-3 and -4	Propane	62.87	7.50E-02	1.79E-01	3,035	3.62	8.63	3,048
CD-RTO-1[2]	Propane	62.87	7.50E-02	1.79E-01	19,202	22.91	54.61	19,280
ES-FURNACEBYP-1	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	136	0.26	1.55	138
ES-FURNACEBYP-1 (Idle Mode)	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	517	0.99	5.91	524
CD-RTO-2[3]	Propane	62.87	7.50E-02	1.79E-01	17,489	20.86	49.74	17,560
ES-FURNACEBYP-2	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	140	0.27	1.60	141
ES-FURNACEBYP-2 (Idle Mode)	Wood and Wood Residuals	93.80	1.80E-01	1.07E+00	517	0.99	5.91	524
CD-RCO-2[4]	Propane	62.87	7.50E-02	1.79E-01	9,812	11.71	27.91	9,852
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	0.10	0.24	100
IES-GN-2	No. 2 Fuel Oil (Distillate)	73.96	7.50E-02	1.79E-01	191	0.19	0.46	192
IES-FWP	No. 2 Fuel Oil (Distillate)	73.96	7.50E-02	1.79E-01	86	0.09	0.21	86

Notes:

[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] CD-RTO-1 heat input includes heat input contributed by VOC in the furnace/dryer, green hammermill, dry hammermill, and dry shavings hammermills' exhaust streams in addition to the RTO burners.

[3] CD-RTO-2 heat input includes heat input contributed by VOC in the furnace/dryer exhaust stream in addition to the RTO burners.

[4] CD-RCO-2 heat input includes the heat input contributed by VOC in the pellet cooler exhaust stream in addition to the RCO/RTO burners.