NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date: January 14, 2019

Region: Fayetteville Regional Office
County: Richmond
NC Facility ID: 7700096
Inspector's Name: Joshua L. Harris
Date of Last Inspection: 11/07/2017
Compliance Code: 3 / Compliance - inspection

Facility Data

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

Facility Address:
Enviva Pellets Hamlet, LLC
1125 North NC Highway 177
Hamlet, NC 28345

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

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

Permit Applicability (this application only)

SIP: 15A NCAC 02Q .0300, 02D .0515, .0516, .0521, .0540
NSPS: 15A NCAC 02D .0524 – 40 CFR Part 60, Subpart IIII
NESHAP: 15A NCAC 02D .1111 – 40 CFR Part 63, Subpart ZZZZ
PSD: N/A
PSD Avoidance: 15A NCAC 02Q .0317 less than 250 tpy VOC
NC Toxics: N/A
112(r): N/A
Other: N/A

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Kai Simonsen Air Permit Engineer (919) 428-0289 4242 Six Forks Road, Suite 1050 Raleigh, NC 27609	Royal Smith EVP of Operations (240) 482-3841 7200 Wisconsin Avenue Bethesda, MD 20814	Kai Simonsen Air Permit Engineer (919) 428-0289 4242 Six Forks Road, Suite 1050 Raleigh, NC 27609

Application Data

Application Number: 7700096.18A
Date Received: 05/14/2018
Application Type: Modification
Application Schedule: TV- State Only

Existing Permit Data

Existing Permit Number: 10365/R02
Existing Permit Issue Date: 06/08/2017
Existing Permit Expiration Date: 02/28/2021

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP

No emissions inventory on record. The emissions inventory is due June 30th of every year.

Review Engineer: Kevin Godwin

Review Engineer's Signature: Kevin T. Godwin **Date:** 1-14-19

Comments / Recommendations:
Issue 10365/R03
Permit Issue Date: 01/14/2019
Permit Expiration Date: 02/28/2021

I. Introduction and Purpose of Application

A. According to application No. 7700096.18A, Enviva Pellets Hamlet, LLC (Enviva) was initially permitted to construct a wood pellets manufacturing plant in Richmond County, North Carolina under the authorization of Prevention of Significant Deterioration (PSD) Permit No. 10365R00 on March 29, 2016. The plant is currently permitted to produce up to 537,625 oven-dried tons (ODT) per year of wood pellets utilizing up to 75% softwood on a 12-month rolling basis. The plant will consist of the following processes: Log Debarker, Log Chipper, Bark Hog, Green Wood Hammermills, Rotary Dryer, Dry Hammermills, Pellet Presses and Coolers, Product Loadout operations and other ancillary activities. Enviva has initiated onsite construction activities on the Hamlet plant but has not yet completed construction activities.

B. Enviva is submitting this permit modification application to reflect planned changes for the Hamlet plant since the submittal of the original construction permit application. These changes are being implemented to meet new customer softwood percentage and production rate demands and to incorporate emission reduction efforts. Because of these changes, the Hamlet plant will take a PSD avoidance limit and potential emissions for all criteria pollutants will be less than the PSD major source threshold of 250 tpy. The facility will continue to be classified as a major source under the 40 CFR Part 70, Title V and 40 CFR Part 63, Maximum Achievable Control Technology (MACT) programs. This application is being submitted to modify the existing PSD permit to incorporate the proposed changes and to reclassify the facility as a PSD Minor stationary source (PSD Avoidance).

This permit action will address the following changes associated with the new plant design as outlined in the application:

1. Increase production rate from 537,625 ODT per year to 625,011 ODT per year by upgrading pellet dies with a new prototype while increasing the amount of softwood processed from a maximum of 75% to a maximum of 85%;
2. Add a regenerative thermal oxidizer (CD-RTO-1) following the currently permitted Dryer wet electrostatic precipitator (CD-WESP) for volatile organic compound (VOC), HAP and particulate matter (PM) emissions control;
3. Install a third Green Wood Hammermill;
4. Remove the Green Wood Hammermill cyclones from the permit and recirculate the exhaust to either the inlet of the Dryer furnace or directly to the WESP/RTO system (CD-WESP/CD-RTO-1) to reduce VOC, HAP and PM emissions;
5. Following the six (6) Pellet Cooler product recovery cyclones, install one wet scrubber (CD-WSB) to reduce PM emissions;
6. Add a regenerative catalytic oxidizer (CD-RCO), which can operate in thermal mode (as an RTO) for backup during catalyst cleaning, to control combined emissions of VOC, HAP and PM from the Pellet Coolers and Pellet Mills;
7. Decrease the amount of wood that can bypass the Dry Hammermills from 25% to 15%;
8. Incorporate construction of a baghouse (CD-HMC-BH) installed to control fugitive emissions that escape from the Hammermill Collection Conveyor (ES-HMC);
9. Add an emission point for the Pellet Cooler Low Pressure (LP) Fines Relay System (ES-PCLP) and add a corresponding baghouse (CD-PCLP-BH);
10. Remove the hammermill area (ES-HMA) emission point which will no longer be an emission point;
11. Rename the Pellet Fines Bin (ES-PFB) and associated baghouse (CD-PFB-BV) as the Pellet Cooler High Pressure (HP) Fines Relay System (ES-PCHP) and associated baghouse (CD-PCHP-BH), respectively;
12. Rename the Pellet Sampling Transfer Bin (ES-PSTB) to the Pellet Dust Collection Transfer Bin (ES-PDCTB);
13. Change the number of Pellet Loadout Bins (ES-PB-1 to 8) from eight (8) to (2) bins (ES-PB-1 and 2);
14. Remove the truck loadout station (ES-PL-1 to 3) emissions point because pellets will be loaded into closed top hopper rail cars that are entirely enclosed; and
15. Add Additive Handling and Storage (ES-ADD) and associated baghouse (CD-ADD-BH) for storage of a powder additive to be added during pelletizing.

In addition to these physical design changes, Enviva is proposing the following changes to the previous PSD permit as part of this application:

16. Update site emissions to reflect planned insignificant activities including:
    a. Adding two storage piles for a total of four Green Wood Storage Piles (IES-GWSP-1 through 4);
    b. Adding Bark Fuel Storage Piles (IES-BFSP-1 and 2);

c. Reclassifying the Chipper (IES-CHIP-1) and Bark Hog (IES-BARKHOG) as insignificant activities instead of as permitted equipment (previously, ES-CHIP-1 and ES-BARKHOG, respectively); and
d. Adding Dry Shavings Handling (IES-DRYSHAVE) and storage silo to allow the facility to process dry shavings which will not require drying.

17. Update HAP emission factors to reflect new testing data from other similar facilities.
18. Bin vent filter (CD-BV) and bagfilter (CD-BF) descriptions have been changed to baghouse (CD-BH) to more accurately reflect planned control equipment to be utilized at the Hamlet plant. In addition, some control device nomenclature was updated to reference the equipment it controls to be consistent with nomenclature used for the other units in Enviva's permit (e.g. CD-DC-BF-3 is relabeled as CD-PDCTB-BH, and CD-DC-BV1 and CD-DC-BV2 are relabeled CD-DWH-BH1 and CD-DWH-BH2).
19. Update the emergency generator rating to a proposed rating of 671 brake horsepower (bhp) instead of the proposed 536 bhp unit referenced in the initial PSD application.
20. Update the Fire Pump Engine rating from 250 bhp to 131 bhp.
21. Cyclones on the Dry Hammermills (ES-HM-1 to 8) and Dryer (ES-DRYER) will not be used as air pollution control devices but rather are used for product recovery. Therefore, CD-HM-CYC-1 through 8 and CD-DC1 through 4 for the ES-HM-1 through 8 and ES-DRYER, respectively, should be removed from the control device description in Section 1 of the Hamlet plant's permit.

II. Changes to Existing Air Permit

The following changes were made to the existing Permit:

Page No.	Section	Description of Changes
N/A	Attachment – List of Insignificant Activities	<u>Included the following sources:</u> Log Chipping (ID No. IES-CHIP-1), Bark Hog (ID No. IES-BARKHOG), Emergency Generator (ID No. IES-GN), Fire water pump (ID No. IES-FWP), Dried shaving material handling (ID No. IES-DRYSHAVE), Bark fuel storage piles (ID No. IES-BFSP-1 and 2), Bark fuel bin (ID No. IES-BFB). <u>Updated storage tank capacities as follows:</u> Diesel fuel storage tank (ID No. IES-TK-1, 1,000 gallons capacity), Diesel fuel storage tank (ID No. IES-TK-2, 185 gallons capacity), Diesel fuel storage tanks (ID No. IES-TK-3, 5,000 gallons capacity).

Page No.	Section	Description of Changes
3	Table of Permitted Emission Sources	Removed the PSD designation throughout the table. <u>Included the following sources and control devices:</u> Hammermill collection conveyor (ID No. ES-HMC) controlled by bagfilter (ID No. CD-HMC-BH), Pellet cooler high pressure fines relay (ID No. ES-PCHP) controlled by bagfilter (ID No. CD-PCHP-BH), Pellet cooler low pressure fines relay (ID No. ES-PCLP) controlled by bagfilter (ID No. CD-PCLP-BH), Pellet dust collection transfer bin (ID No. PDCTB) controlled by bagfilter (ID No. CD-PDCTB-BH), Additive handling and storage (ID No. ES-ADD) controlled by bagfilter (ID No. CD-ADD-BH). Removed cyclones as control devices. Removed Hammermill Area (ID No. ES-HMA) emission source. Changed the Pellet Loadout Bins from eight (8) to two (2) bins (ID Nos. ES-PB-1 and 2) Included new regenerative thermal oxidizer (ID No. CD-RTO-1) installed on Green wood hammermills (ID No. GMH-1 through 3) and Rotary dryer (ID No. ES-DRYER). Included new wet scrubber (ID No. CD-WSB) and regenerative catalytic oxidizer (ID No. CD-RCO) installed on Pellet coolers (ID Nos. ES-CLR-1 through 6) <u>Moved the following sources to the insignificant activity list:</u> Log Chipping (ID No. IES-CHIP-1), Bark Hog (ID No. IES-BARKHOG), Emergency Generator (ID No. IES-GN), and Fire water pump (ID No. IES-FWP).
4	2.1 A.	Updated emission source description to reflect the proposed emission source configuration.
5	2.1 A.1	Updated the 15A NCAC 02D .0515 condition to reflect the proposed control device configuration.
8	2.2 A.2.	Removed the existing PSD condition and replaced with a PSD avoidance condition.

III. Statement of Compliance

The facility is currently under construction and does not have a compliance history.

IV. Process Description

The wood pellet manufacturing process description is detailed in the application as follows:

A. <u>Green Wood Handling and Storage</u>

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

(IES-GWSP-1 through 4) or to Bark Fuel Storage Piles (IES-BFSP-1 and 2). Conveyors transferring green wood chips will be enclosed.

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

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

Logs will be debarked by the electric-powered rotary drum Debarker (IES-DEBARK-1) and then sent to the Chipper (IES-CHIP-1) to chip the wood to specification for drying. Bark from the Debarker and purchased bark/chips will be transferred to the Bark Hog (IES-BARKHOG) via conveyor for further processing.

Material processed by the Bark Hog will be transferred to the Bark Fuel Storage Piles (IES-BFSP-1 and 2) via conveyor. The primary Bark Fuel Storage Pile (IES-BFSP-1) will be located under a covered structure. The secondary Bark Fuel Storage Pile (IES-BFSP-2) will serve as overflow storage as needed. Following storage in the Bark Fuel Storage Piles (IES-BFSP-1 and 2), the bark will be transferred via a walking floor to a covered conveyor to a fully enclosed Bark Fuel Bin (IES-BFB) where the material will be pushed into the furnace.

C. Green Wood Hammermills

Chipped wood used in pellet production will be further processed in the Green Wood Hammermills (ES-GHM-1, 2, and 3) to reduce material to the proper size. The facility is currently permitted to install two Green Wood Hammermills (ES-GHM-1 and 2) each with its own cyclone control device (CD-GHM-CYC1 and CD-GHM-CYC2). Enviva is now proposing to install three Green Wood Hammermills total, to remove the cyclones from the design, and to directly route the vent streams to either the inlet of the Dryer furnace (which is ultimately routed to WESP/RTO control system) or directly into the WESP/RTO control system (CD-WESP/CD-RTO-1) to control PM, VOC, and HAP emissions.

D. Dryer

Green wood will be conveyed to a single pass rotary Dryer system (ES-DRYER). Direct contact heat will be provided to the system via a 250.4 million Btu per hour total heat input furnace that uses bark and wood chips as fuel. Green wood will be fed into the Dryer where the moisture content will be reduced to the desired level and routed to four (4) identical product recovery cyclones operating in parallel, which will capture dried wood for further processing. Emissions from the Dryer cyclones will be combined into a common duct which will include the proposed vent from the Green Hammermills (ES-GHM-1 through 3) and routed to a WESP (CD-WESP) for additional particulate, metallic HAP, and hydrogen chloride removal. As part of this application, Enviva is proposing to install a natural gas-fired RTO (32 million Btu per hour, CD-RTO-1) following the WESP to provide further PM, VOC, and HAP emissions control.

E. Dried Wood Handling

Dried materials from the Dryer product recovery cyclones will be conveyed to screening operations that remove smaller wood particles. Oversized wood will be diverted to the Dry Hammermills (ES-HM-1 through 8) for further size reduction prior to pelletization, each of which will be followed by a product recovery cyclone that is controlled by a bagfilter. Smaller particles passing through the screens will bypass these hammermills and be pneumatically conveyed directly to the product recovery cyclones for the Dry Hammermills. Enviva estimates that approximately 15% of the total material leaving the Dryer will bypass the Dry Hammermills and be sent directly to the pelletizing operations. It should be noted that the current permit basis assumes 25% will bypass the Dry Hammermills.

There will be several other conveyor transfer points located between the Dryer and Dry Hammermills comprising the Dried Wood Handling (ES-DWH) emission source. These transfer points will be completely enclosed with only two (2) emission points that will be controlled by individual bagfilters (CD-DWH-BH1 and 2).

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

F. Dry Hammermills

Prior to pelletization, dried wood is reduced to the appropriate size using eight (8) Dry Hammermills operating in parallel (ES-HM-1 through ES-HM-8). Each Dry Hammermill will include a product recovery cyclone for capturing additional dried wood for further processing. Particulate emissions from each of the Dry Hammermills will be controlled using individual bagfilters (CD-HM-BH1 through 8).

G. Hammermill Conveyors

The Hammermill Conveyors (ES-HMC) will transport material from the product recovery cyclones associated with the Dry Hammermills (ES-HM-1 through 8) to the pelletizing process. Emissions from the Hammermill Conveyors will be captured and controlled by the Hammermill Conveyor bagfilter (CD-HMC-BH).

H. Pellet Mill Feed Silo

Sized wood from the Dry Hammermill product recovery cyclones will be transported by a set of conveyors to the Pellet Mill Feed Silo (ES-PMFS) prior to pelletization. Particulate emissions from the Pellet Mill Feed Silo will be controlled by a bagfilter (CD-PMFS-BH).

I. Additive Handling and Storage

Additive will be used in the pellet production process to increase the durability of the final product. The additive will be added to sized wood from the Pellet Mill Feed Silo discharge screw conveyor prior to transfer to the Pellet Presses. The additive contains no hazardous chemicals or VOCs.

Bulk additive material will be delivered by truck and pneumatically unloaded into a storage silo (ES-ADD) equipped with a bagfilter (CD-ADD-BH) to control emissions from air displaced during the loading of additive material to the silo. The additive will then be conveyed via screw conveyor from the storage silo to the milled fiber conveyor which transfers milled wood to the Pellet Presses.

J. Pellet Press System and Pellet Coolers

Dried processed wood will be mechanically compacted through pellet press dies. Exhaust from the Pellet Press System and Pellet Press conveyors will be vented through the Pellet Cooler aspiration material recovery cyclones and pollutant controls as described below, and then to the atmosphere. No resin or other chemical binding agents are needed for pelletization. As discussed in Section 1, Enviva is proposing to increase the permitted production rate from 537,625 ODT per year to 625,011 ODT per year by upgrading the design of the pellet dies to use a new prototype.

Formed pellets will be discharged into one of six (6) Pellet Coolers (ES-CLR-1 through ES-CLR-6) where cooling air will be passed through the pellets. At this point, the pellets will contain a small amount of wood fines which will be swept out with the cooling air and controlled utilizing a single wet scrubber (CD-WSB).

The exhaust from the scrubber will then be sent to a natural gas-fired RCO (CD-RCO) for control of VOC, HAP, and PM. The RCO will also be able to operate in thermal mode during catalyst cleaning.

An aspiration system will be used to recirculate air for the pellet coolers. Emissions from the Pellet Cooler LP Fines Relay System (ES-PCLP) will be controlled by a bagfilter (CD-PCLP-BH). A second aspiration system, referred to as the Pellet Cooler HP Fines Relay System (ES-PCHP), will pull collected fines from the Pellet Cooler screens and from the Pellet Cooler LP Fines Relay System baghouse to the associated bagfilter (CD-PCHP-BH). From the collection system, the fines will be reintroduced to the Pellet Presses for re-use in the process.

The final product, wood pellets, will be transferred from the Pellet Coolers to the rail loadout operation via a conveyor that will be controlled by the Pellet Dust Collection Transfer Bin (ES-PDCTB) bagfilter (CD-PDCTB-BH).

K. Finished Product Handling and Loadout

Final product will be conveyed to two storage bins (ES-PB-1 and ES-PB-2) that will feed a rail loadout station. At the rail loadout station, pellets will be gravity fed into closed top rail cars. Atmospheric emissions from pellet loadout will be minimal because dried wood fines will have been removed in the pellet screener, and a slight negative pressure will be maintained in the loadout building as a fire prevention measure to prevent any buildup of dust on surfaces within the building. This slight negative pressure will be produced via an induced draft fan that will exhaust to the Finished Product Handling bagfilter (CD-FPH-BH). This bagfilter will control emissions from Finished Product Handling (ES-FPH) and the two (2) Pellet Loadout Bins (ES-PB-1 to ES-PB-2). Rail car loading will be entirely enclosed because material will be loaded into closed top hopper cars.

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

The plant will have a 671 brake horsepower (bhp) diesel-fired Emergency Generator (IES-GN) for emergency operations and a 131 bhp diesel-fired Fire Water Pump Engine (IES-FWP). Aside from maintenance and readiness testing, the generator and fire water pump engines will only be utilized for emergency operations.

Diesel for the emergency generator will be stored in a tank of up to 1,000 gallons capacity (IES-TK-1) and diesel for the fire water pump engine will be stored in a storage tank of up to 185 gallons capacity (IES-TK-2). The plant will also have a third diesel storage tank with a capacity of up to 5,000 gallons (IES-TK-3) for distributing diesel fuel to mobile equipment.

V. Emissions

The following table provides a summary of Facility-wide criteria pollutant emissions

Table 2
Summary of Facility-wide Potential Emissions
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Emission Unit ID	Source Description	Control Device ID	Control Device Description	CO (tpy)	NO_x (tpy)	PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	VOC (tpy)	CO_2e (tpy)
IES-CHIP-1	Log Chipping	--	--	--	--	--	--	--	--	1.6	--
IES-BARKHOG	Bark Hog	--	--	--	--	0.23	0.13	--	--	0.28	--
ES-DRYER	250.4 MMBtu/hr Wood-fired Direct Heat Drying System	CD-WESP CD-RTO-1	WESP; RTO	219	219	33	33	33	27	39	243,754
ES-GHM-1 through 3	Three (3) Green Wood Hammermills										
ES-HM-1 through 8	Eight (8) Dry Hammermills	CD-HM-BH1 through 8	Eight (8) baghouses	--	--	18	18	0.31	--	135	--
ES-HMC	Hammermill Collection Conveyor	CD-HMC-BH	One (1) baghouse	--	--	0.23	0.23	0.23	--	--	--
ES-PCHP	Pellet Cooler HP Fines Relay System	CD-PCHP-BH	One (1) baghouse	--	--	0.075	0.075	0.075	--	--	--
ES-PCLP	Pellet Cooler LP Fines Relay System	CD-PCLP-BH	One (1) baghouse	--	--	0.47	0.47	0.47	--	--	--
ES-PMFS	Pellet Mill Feed Silo	CD-PMFS-BH	One (1) baghouse	--	--	0.37	0.37	0.37	--	--	--
ES-CLR-1 through 6[1]	Six (6) Pellet Coolers	CD-CLR-1 through 6 (or CD-WSB) CD-RCO	Six (6) baghouses (one on each cooler) or wet scrubber; RCO	12	15	15	4.6	1.5	0.082	24	20,683
ES-DCTB	Pellet Dust Collection Transfer Bin	CD-PDCTB-BH	One (1) baghouse	--	--	0.45	0.45	0.45	--	--	--
ES-FPH	Finished Product Handling	CD-FPH-BH	One (1) baghouse	--	--	1.3	1.2	0.022	--	--	--
ES-PB-1 and 2	Two (2) Pellet Loadout Bins										
ES-DWH	Dried Wood Handling Operations	CD-DWH-BH1 and 2	Two (2) baghouses	--	--	0.30	0.30	0.30	--	39	--
ES-ADD	Additive Handling and Storage	CD-ADD-BH	One (1) baghouse	--	--	0.15	0.15	0.15	--	--	--
IES-GWH	Green Wood Handling Operations	--	--	--	--	0.077	0.036	0.0055	--	--	--
IES-TK-1	1,000 gallon Diesel Storage Tank	--	--	--	--	--	--	--	--	0.00058	--
IES-TK-2	185 gallon Diesel Storage Tank	--	--	--	--	--	--	--	--	0.00016	--
IES-TK-3	5,000 gallon Diesel Storage Tank	--	--	--	--	--	--	--	--	0.0033	--
IES-GWSP-1 through 4	Green Wood Storage Piles	--	--	--	--	13	6.7	1.0	--	6.9	--
IES-BFSP-1 and 2	Bark Fuel Storage Piles	--	--	--	--	0.56	0.28	0.042	--	0.29	--
IES-DRYSHAVE	Dry Shaving Material Handling	--	--	--	--	0.054	0.025	0.0039	--	--	--
IES-DEBARK-1	Debarker	--	--	--	--	1.1	0.59	--	--	--	--
IES-BFB[2]	Bark Fuel Bin	--	--	--	--	--	--	--	--	--	--
IES-GN	500 kW Diesel-fired Emergency Generator	--	--	0.14	2.5	0.0078	0.0078	0.0078	0.00066	1.7	179
IES-FWP	250 hp Diesel-fired Fire Water Pump	--	--	0.070	0.18	0.0092	0.0092	0.0092	0.00048	0.0081	50
--	Paved Roads	--	--	--	--	16	3.2	0.78	--	--	--
			Total Emissions:	**231**	**236**	**100**	**70**	**39**	**28**	**248**	**264,666**
			Total Excluding Fugitives[3]:	**231**	**236**	**71**	**60**	**37**	**28**	**241**	**264,666**
			PSD Major Source Threshold:	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**--**

tes:

The pellet coolers will be equipped with either six (6) baghouses (one on each cooler) or a single wet scrubber for PM control. The emissions are expected to be the same whether the scrubber or baghouses are installed. In addition, the pellet coolers will be equipped with an RCO for VOC control that will operate primarily in catalytic mode with thermal (RTO) mode as a backup. The RTO and RCO modes have the same control efficiency so there will be no impact on emissions during thermal mode usage.

Bark is transferred from the primary Bark Fuel Storage Pile by walking floor to covered conveyors which transfer the bark into the fully enclosed Bark Fuel Bin. There are no emissions expected from transfer of material into the bin.

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.

breviations:

ES - Emission Source
IES - Insignificant Emission Source
CO - carbon monoxide
CO_2e - carbon dioxide equivalent
NO_X - nitrogen oxides
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 compounds
WESP - Wet Electrostatic Precipitator

Copies of detailed potential emissions calculations spreadsheets are included in Attachment 1 of this document and in the application, Appendix C.

A. Green Wood Handling (IES-GWH)

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

Green wood and bark contain a high moisture content approaching 50 percent water by weight. Therefore, Green Wood Handling will have insignificant PM emissions. Per 15A NCAC 02Q .0503(8), Green Wood Handling (IES-GWH) is an insignificant activity, because potential uncontrolled PM emissions are less than 5 tpy.

B. Green Wood Storage Piles (IES-GWSP-1 through 4) and Bark Fuel Storage Piles (IES-BFSP-1 and 2)

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

VOC emissions from storage piles were quantified based on the exposed surface area of the pile and emission factors from the National Council for Air and Stream Improvement (NCASI). 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.

Per 15A NCAC 02Q .0503(8), the Green Wood Storage Piles (IES-GWSP-1 through 4) and the Bark Fuel Storage Piles (IES-BFSP-1 and 2) are insignificant activities based on each having potential uncontrolled PM and VOC emissions less than 5 tpy.

C. Debarker (IES-DEBARK-1)

PM emissions will occur as a result of log debarking. Potential PM emissions from debarking were quantified based on emission factors from EPA's *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants* for Source Classification Code (SCC) 3-07-008-01 (Log Debarking).[5] All PM was assumed to be larger than 2.5 microns in diameter. PM emissions from debarking will be minimal due to the high moisture content of green wood (~50%) and the fact that the

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[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.

debarking drum will be enclosed, except for the two ends where logs enter and material exits after debarking. A 90% control efficiency was applied for partial enclosure.

The Debarker is considered an insignificant activity per 15A NCAC 02Q .0503(8) due to potential uncontrolled PM emissions less than 5 tpy.

D. Bark Hog (IES-BARKHOG)

Processing of bark by the Bark Hog will result in emissions of PM, VOC, and methanol. Particulate emission factors were not available for this specific operation; therefore, potential PM emissions were quantified based on emission factors from EPA's *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants* for log debarking (SCC 3-07-008-01).[6] The Bark Hog is primarily enclosed and thus has minimal PM emissions. 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*.[7]

The Bark Hog is considered an insignificant activity per 15A NCAC 02Q .0503(8) due to potential uncontrolled emissions less than 5 tpy.

E. Chipper (IES-CHIP-1)

The Chipper will be located inside of a building; therefore, PM emissions will be negligible and were not quantified. The chipping process will also result in emissions of VOC and methanol. VOC and methanol emissions were quantified based on emission factors for log chipping from AP-42 Section 10.6.3, *Medium Density Fiberboard*.[8]

The Chipper is considered an insignificant activity per 15A NCAC 02Q .0503(8) due to potential uncontrolled emissions less than 5 tpy.

F. Bark Fuel Bin (IES-BFB)

Bark will be transferred from the Bark Fuel Storage Piles via a walking floor to a covered conveyor and then to the fully enclosed Bark Fuel Bin (IES-BFB). Due to complete enclosure of the Bark Fuel Bin, emissions from transfer of material into the bin were not explicitly quantified. Per 15A NCAC 02Q .0503(8), the Bark Fuel Bin is an insignificant activity due to potential uncontrolled PM emissions less than 5 tpy.[9]

G. Dryer (ES-DRYER) and Green Wood Hammermills (ES-GHM-1 through 3)

Exhaust from the Dryer and Green Wood Hammermills will be routed to a WESP/RTO control system for control of PM, VOC, and HAP. Potential emissions of PM, PM less than 10 microns in diameter (PM_{10}), PM less than 2.5 microns in diameter ($PM_{2.5}$), carbon monoxide (CO) and oxides of nitrogen (NO_X), including NO_x and CO emissions generated during thermal oxidation, are based on guaranteed pound per hour (lb/hr) emission rates provided by the RTO vendor. Potential emissions of sulfur dioxide (SO_2) were calculated based on an emission factor from AP-42 Section 10.6.2, *Particle Board Manufacturing*.[10] VOC emissions were calculated using an emission factor derived from stack testing conducted at Enviva and other similar wood pellet manufacturing facilities.

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[6] Ibid.

[7] USEPA AP-42 Section 10.6.3, *Medium Density Fiberboard Manufacturing* (08/02).

[8] Ibid.

[9] Due to complete enclosure of the Bark Fuel Bin, emissions were not quantified.

[10] USEPA AP-42 Section 10.6.2, *Particle Board Manufacturing* (6/02).

HAP and toxics air pollutant (TAP) emissions were calculated based on emission factors from several data sources including stack testing data from other similar facilities, emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers*[11], and NC DAQ's Wood Waste Combustion Spreadsheet[12]. HAP emissions from natural gas combustion by the RTO burners were calculated based on AP-42 Section 1.4, *Natural Gas Combustion.*[13]

Combustion of wood by the Dryer furnace and natural gas by the RTO burners will also result in emissions of GHG. The emissions were quantified based on emission factors from AP-42, Section 10.6.1 for a rotary dryer with an RTO control device. Enviva has conservatively calculated the CO_2 emissions using the higher hardwood emission factor because the dryer at the Hamlet facility will use a combination of hardwood and softwood.

H. Dried Wood Handling (ES-DWH)
ES-DWH will include conveyor transfer points located between the Dryer and Dry Hammermills with emissions controlled by two (2) bagfilters (CD-DWH-BH-1 and 2). PM emissions from these bagfilters were calculated based on manufacturer guaranteed exit grain loading rates and the maximum nominal exhaust flow rate of the baghouses.

Additionally, the dried material may continue to emit VOC and HAP as it is transferred between the Dryer and Dry Hammermills due to the elevated temperature of the material. Potential VOC and HAP emissions were calculated based on NCASI dry wood handling emission factors.[14]

I. Dry Shavings Handling (IES-DRYSHAVE)
Particulate emissions will occur during unloading of dry shavings from trucks and may also occur because of air displaced during silo loading. Potential emissions were calculated based on AP-42, Section 13.2.4, *Aggregate Handling and Storage Piles.*[15] Dry shavings will be transferred into the new dry shavings silo via an enclosed bucket elevator. Because the actual transfer will be enclosed within the silo, a 90% control efficiency was applied for this material transfer point.

Per 15A NCAC 02Q .0503(8), Dry Shavings Handling (IES-DRYSHAVE) is considered an insignificant activity because potential uncontrolled PM emissions are less than 5 tpy.

J. Dry Hammermills (ES-HM-1 through 8)
The Dry Hammermills will generate PM, VOC, and HAP emissions during the process of reducing wood chips to the required size. PM emissions from the Dry Hammermills will be controlled using individual bagfilters (CD-HM-BH-1 through 8). Particulate emissions from each bagfilter were calculated using a manufacturer guaranteed exit grain loading rate and the maximum nominal exhaust flow rate of the bagfilter.

VOC and HAP emissions were calculated based on stack testing data from comparable Enviva facilities.

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[11] USEPA AP-42 Section 1.6, *Wood Residue Combustion in Boilers* (09/03).

[12] 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.

[13] USEPA AP-42 Section 1.4, *Natural Gas Combustion* (07/98).

[14] NCASI VOC Dry Wood handling factor based oriented-strand board operations.

[15] USEPA AP-42 Section 13.2.4, *Aggregate Handling and Storage Piles* (11/06).

K. Pellet Cooler HP Fines Relay System (ES-PCHP) and Pellet Cooler LP Fines Relay System (ES-PCLP)
An induced draft fan will be used to transfer dust generated from a number of enclosed transfer/handling sources around the Dry Hammermill Area to the Pellet Cooler HP Fines Relay System, controlled by a bagfilter (CD-PCHP-BH). PM emissions from this bagfilter, which will control emissions from ES-PCHP, were calculated based on a manufacturer guaranteed exit grain loading rate and the maximum nominal exhaust flow rate of the bagfilter. A second bagfilter (CD-PCLP-BH) will control emissions from Pellet Cooler LP Fines Relay System (ES-PCLP) and PM emissions were calculated based on a manufacturer guaranteed exit grain loading rate and the maximum nominal exhaust flow rate of the bagfilter.

L. Dry Hammermill Conveying System (ES-HMC)
Fugitive PM emissions that escape the Hammermill Collection Conveyor will be controlled by a bagfilter (CD-HMC-BH). PM emissions from this baghouse were calculated based on a manufacturer guaranteed exit grain loading rate and the maximum nominal exhaust flow rate of the bagfilter.

M. Pellet Mill Feed Silo (ES-PMFS)
The Pellet Mill Feed Silo will be equipped with a bagfilter (CD-PMFS-BH) to control PM emissions associated with silo loading and unloading operations. PM emissions are calculated based on a manufacturer guaranteed exit grain loading rate and the maximum nominal exhaust flow rate of the bagfilter.

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

O. Pellet Press System and Pellet Coolers (ES-CLR-1 through 6)
Pellet Press and Pellet Cooler operations will generate PM, HAP, and VOC emissions during the forming and cooling of wood pellets. The Pellet Mill and Coolers will be equipped with a single wet scrubber (CD-WSB) for PM control, followed by an RCO (CD-RCO) for VOC and HAP control from the exhaust of the scrubber. The oxidizer will operate in thermal mode as an RTO during catalyst cleaning. PM emissions from the Pellet Press System (Pellet Mills) and Pellet Coolers were calculated based on a maximum exit grain loading rate and the maximum nominal exhaust flow rate for the proposed bagfilters.

Uncontrolled VOC and HAP emissions at the outlet of the Pellet Cooler wet scrubber (CD-WSB) were quantified based on stack testing data from comparable Enviva plants. This includes emissions from both the Pellet Mills and the Pellet Coolers. Controlled emissions were estimated based on a 95% control efficiency for the RCO. Operation in thermal mode will achieve the same control efficiency and will have no impact on the calculated emissions. NO_x and CO emissions resulting from thermal oxidation were calculated using AP-42 Section 1.4, *Natural Gas Combustion*[16], and the maximum high heating value of the anticipated VOC constituents.

Emissions of criteria pollutants, HAP, and TAP from natural gas combustion by the RCO burners were estimated using emission factors from AP-42 Section 1.4. Potential GHG emissions from natural gas combustion were quantified based on emission factors from Subpart C of 40 CFR Part 98. Emissions were converted to carbon dioxide equivalent (CO_2e) based on Global Warming Potentials from Subpart A of 40 CFR 98.

[16] USEPA AP-42 Section 1.4, *Natural Gas Combustion* (07/98).

P. Pellet Dust Collection Transfer Bin (ES-PDCTB)

PM emissions will occur during transfer of wood pellets into the Pellet Dust Collection Transfer Bin. Particulate emissions from the bagfilters that controls the Pellet Dust Collection Transfer Bin (CD-PDCTB-BH) were calculated assuming a manufacturer guaranteed exit grain loading rate and the maximum nominal exhaust flow rate of the bagfilter.

Q. Pellet Loadout Bins (ES-PB-1 through 2) and Finished Product Handling (ES-FPH)

PM emissions result from the transfer of finished product to the Pellet Loadout Bins. No emissions are anticipated for the transfer of pellets from the bins to rail cars because wood pellets will be loaded into closed top rail cars that are entirely enclosed. PM emissions from Finished Product Handling and the two (2) Pellet Loadout Bins will be controlled by a bagfilter (CD-FPH-BH). Potential PM emissions from the baghouse were calculated based on a maximum exit grain loading rate and the maximum nominal exhaust flow rate of the bagfilter.

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

Operation of the Emergency Generator and Fire Water Pump will generate emissions of criteria pollutants, HAP, and GHG. Potential PM, NO_X, VOC, and CO emissions from operation of the Emergency Generator and Fire Water Pump Engine were calculated based on emission factors from their respective manufacturer specification sheets and the maximum horsepower rating of the engines. VOC emissions were calculated based on the manufacturer's emission factor for hydrocarbons. Potential SO_2 emissions were calculated based on the fuel sulfur restriction in NSPS Subpart IIII, and by assuming that all the sulfur present in the diesel fuel becomes SO_2 air emissions.[17] Potential HAP emissions were quantified based on emission factors from AP-42 Section 3.3, *Stationary Internal Combustion Engines*.[18] Annual potential emissions were conservatively calculated based on 500 hours per year.

Combustion of diesel fuel by the engines will also result in emissions of GHG. Potential GHG emissions from each engine were quantified based on emission factors from Subpart C of 40 CFR Part 98. Emissions were converted to CO_2e based on Global Warming Potentials from Subpart A of 40 CFR 98.

The Emergency Generator and Fire Water Pump Engine qualify as insignificant activities pursuant to 15A NCAC 02Q .0503(8).

S. Diesel Storage Tanks (IES-TK-1 through 3)

The storage of diesel in on-site storage tanks will generate emissions of VOC. VOC emissions from the three (3) Diesel Storage Tanks were calculated using EPA's TANKS 4.0 software based on actual tank characteristics (e.g., orientation, dimensions, etc.) and potential annual throughput. VOC emissions from the storage tanks are below 5 tpy and thus, per 15A NCAC 02Q .0503(8) they are listed as insignificant sources in the permit.

T. Paved Roads

Fugitive PM emissions will occur as a result of trucks and employee vehicles traveling on paved roads on the Hamlet plant property. Emission factors were calculated based on Equation 2 from AP-42 Section 13.2.1, *Paved Roads*[19] using the mean silt loading for quarries (8.2 g/m^2) and 110 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

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

[18] USEPA AP-42 Section 3.3, *Stationary Internal Combustion Engines* (10/96).

[19] USEPA AP-42 Section 13.2.1, *Paved Roads* (01/11).

activities followed by sweeping. This control efficiency is based on data from the *Air Pollution Engineering Manual* of the Air and Waste Management Association.

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 equation:

$$E = 4.10 \times P^{0.67} \qquad \text{for } P < 30 \text{ tph}$$
$$E = 55 \times P^{0.11} - 40 \qquad \text{for } P \geq 30 \text{ tph}$$

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

According to the application, the most significant source of PM emissions is the dryer system operating at 80 ODT/hr. The allowable emission rate is calculated to be 49.1 lb/hr. Maximum PM emission rate estimate is provided by the dryer vendor. The maximum hourly controlled emission rate is 7.6 lb/hr. Therefore, compliance is indicated.

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

Control Device Monitoring

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

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

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

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

Because the application relies on vendor guaranteed emission factors and does not include estimated control efficiency, performance testing will be required to establish control efficiency within 90 days of commencement of operation.

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

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

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. Both the 671 hp emergency generator and the 131 hp fire pump engine are subject to the requirements of this regulation.

Under NSPS Subpart IIII, owners or operators of emergency generators manufactured in 2007 or later with a maximum engine power greater than or equal to 50 hp are required to comply with the with the emission standards for new nonroad CI engines in §60.4202, for all pollutants, for the same model year and maximum engine power for their 2007 model year and later emergency stationary CI ICE. These limits are as follows: 0.20 g/kW for PM; 3.5 g/kW for CO; and 4 g/kW for NOx + nonmethane hydrocarbons (NMHC).

Under NSPS Subpart IIII, owners or operators of fire pump engines manufactured after July 1, 2006 must comply with the emission limits in Table 4 of the subpart. The limits are as follows: 0.30 g/kW for PM and 4 g/kW for NOx + NMHC.

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

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

B. 15A NCAC 02D .1111 "Maximum Achievable Control Technology, Subpart ZZZZ" – 40 CFR Part 63 applies to RICE located at a major or area source of hazardous air pollutants (HAP). Pursuant to 40 CFR §63.6590(c) (amended January 30, 2013), a new stationary RICE located at a major source must meet the requirements of this part by meeting the requirements of 40 CFR Part 60 Subpart IIII for compression ignition engines. No further requirements apply to such engines under this part.

C. 15A NCAC 02D .1111 "Maximum Achievable Control Technology, 112(g)" - Clean Air Act (CAA) Section 112(g)(2)(B) requires that a new or reconstructed stationary source that does not belong to a regulated "source category" for which a NESHAP has been promulgated must control emissions to levels that reflect "maximum achievable control technology" (MACT). Because Wood Pellet Manufacturing Plants are not a regulated source category under 40 CFR 63, the Hamlet plant was subject to 112(g) and underwent a case-by-case MACT analysis pursuant to 40 CFR 63 Subpart B as part of the initial PSD construction permitting process. NC DAQ concluded that case-by-case MACT was use of a low HAP-emitting design for the Dryer (ES-DRYER) without the addition of add-on controls, and that the Hamlet plant was not subject to numeric HAP emission limits under Section 112(g).[20] While not required under case-by-case MACT, the plant is subject to other requirements that have the ancillary benefit of reducing HAP emissions such as a limitation on softwood to reduce VOC emissions, RTO control on the green wood hammermills and dryer, and RCO/RTO control on the pellet coolers. Previous BACT requirements include a limitation on PM from the Dryer achieved through use of a WESP, that provides control of metallic and inorganic HAP emissions resulting from wood combustion in the furnace. Although BACT will no longer be applicable since the plant will now be a synthetic minor source with respect to PSD, Enviva is still proposing to install and operate the WESP.

Enviva has initiated construction activities at the Hamlet plant but has not yet completed construction. The proposed permit modifications outlined in this application include changes to the wood pellet manufacturing process that will decrease total potential HAP emissions by approximately 126 tpy. As provided in §63.40(b), a case-by-case MACT evaluation is only required prior to the construction or reconstruction of a major source of HAP emissions.

The regulation defines "construct a major source" as the fabrication, erection, or installation of a **new greenfield site** emitting greater than the HAP major source thresholds, or of a new process or production unit at an existing site, provided the new process or production unit in and of itself emits above the HAP major source thresholds.[21] The rule further defines process or production unit as "any collection of structures and/or equipment that processes, assembles, applies, or otherwise uses material inputs to produce or store an intermediate or final product [bold emphasis added]."[22]

Since Enviva has already commenced construction of the Hamlet plant under the currently effective PSD permit, the proposed project does not constitute construction of a greenfield site as defined in §63.41. Furthermore, the proposed changes to the plant design do not constitute reconstruction of a major source. Per §63.41, reconstruction is defined as the replacement of components at an existing process or production unit such that the fixed capital cost of the new components exceeds 50% of that which would be required to construct a comparable new process or production unit. The "process or production unit" at the Hamlet plant is the collection of all equipment used to manufacture the wood pellet product. The fixed capital costs associated with the proposed project are significantly less than 50% of the fixed capital costs that would be required to construct a comparable new wood pellet manufacturing facility. As such, the project also does not constitute reconstruction of the process or production unit.

Based on this review, the proposed project does not trigger a requirement to perform a new case-by-case MACT evaluation under Section 112(g), as the project does not constitute construction of a major source or reconstruction of the process or production unit.

As part of the proposed project, Enviva is requesting an increase in the maximum amount of softwood that can be used from 75% up to a maximum of 85%. However, Enviva is also proposing to install an RTO to

[20] Air Quality Permit No. 10365R02, Section 2.1.A, Condition 4

[21] §63.41

[22] Ibid.

follow the WESP for the Dryer exhaust which will significantly reduce emissions of VOC and organic HAP. In addition, the exhaust stream from the Green Wood Hammermills (ES-GHM-1 to 3) will be routed to either the inlet of the Dryer furnace or directly to the WESP/RTO system (CD-WESP/CD-RTO-1), which will control VOC and organic HAP emissions from the Green Wood Hammermills. Enviva is proposing to install an RCO (with RTO backup) to control VOC and organic HAP emissions from the twelve (12) Pellet Mills and six (6) Pellet Coolers (ES-CLR-1 through 6). With the installation of the RTO and RCO, Enviva will surpass the level of control required under the original case-by-case MACT determination for the Hamlet plant and believes the intent of the original case-by-case MACT determination continues to be satisfied after completion of the proposed project.

Other sources of organic HAP emissions at the plant include the following: Log Chipper (IES-CHIP-1), the Bark Hog (IES-BARKHOG), Dried Wood Handling (ES-DWH), and eight (8) Dry Hammermills (ES-HM-1 through 8) as well as the Emergency Generator (IES-GEN) and Fire Water Pump (IES-FWP). For these sources, MACT was determined to be good process design and maintenance of equipment in accordance with manufacturer specifications and/or standard industry practices. Enviva is not requesting any modifications to the existing MACT determinations for these process sources.

Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall establish emission factors for HAPs by conducting an initial performance test on the wood-fired direct heat drying system (ID No. ES-DRYER), the green wood hammermills (ID Nos. ES-GHM-1, ES-GHM-2, and ES-GHM-3), the dry hammermills (ID Nos. ES-HM-1 to ES-HM-8), the dry wood handling operations (ID Nos. ES-DWH), and the pellet presses and coolers (ID Nos. ES-CLR-1 through ES-CLR-6).

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

Emission Source	Pollutant
Dryer system/greenwood hammermills controlled via a RTO	Acetaldehyde Acrolein Formaldehyde Methanol Phenol Propionaldehyde
Pellet coolers pellet presses controlled via a RCO	
One dry hammermill	
Dry wood handling operations	

Periodic performance testing, monitoring, recordkeeping, and reporting are required according to the PSD Avoidance Condition.

D. Compliance Assurance Monitoring (CAM)
This permit (revision R03) is a non-Title V permit and CAM will be addressed at the time the Title V permit is developed.

E. 15A NCAC 02Q .0317 "Avoidance Conditions" for avoidance of 15A NCAC 02D .0530 "Prevention of Significant Deterioration" – The facility has requested enforceable limits so that emissions of VOC, NOx, and CO remain below the 250 tpy PSD major source threshold. The facility will be limited to an annual process rate 625,011 ODT/year on a rolling 12-month average basis, with a maximum 85% softwood and use an RTO and RCO to control VOC emissions. A condition is included in the permit with the limits and restrictions necessary not to exceed those limits.

Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall demonstrate compliance with the PSD avoidance limits by conducting an initial performance test on the wood-fired direct heat drying system (ID No. ES-DRYER), the green wood hammermills (ID Nos. ES-GHM-1, ES-GHM-2, and ES-GHM-3), the dry hammermills (ID Nos. ES-HM-1 to ES-HM-8), the dry wood handling operations (ID

Emission Sources	Pollutant
Dryer system/greenwood hammermills controlled via a RTO	VOC
	PM/PM10/PM2.5
	NOx
	CO
Pellet coolers pellet presses controlled via a RCO	VOC
	PM/PM10/PM2.5
One dry hammermill	VOC
	PM/PM10/PM2.5
Dry wood handling operations	VOC
	PM/PM10/PM2.5

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

The Permittee shall conduct periodic performance tests when the following conditions are met:
(A) As the softwood content increases by more than 10 percentage points over what was established during the initial test up to 85%, or
(B) As the production rate increases by more than 10 percentage points over what was established during the initial test up to 625,011 ODT/year.
(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, for the regenerative thermal oxidizer and regenerative catalytic oxidizer (ID Nos. CD-RTO-1 and CD-RCO) to monitor the temperature in the combustion chamber (the second half of the oxidizer away from the flame zone) to ensure the average combustion temperature does not drop below the temperature range established during the performance test.

The Permittee shall develop and maintain a written malfunction plan for the temperature monitoring and recording system that describes, in detail, the operating procedures for periods of malfunction and a protocol to address 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.

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 VOC, NOx, and CO emissions shall be recorded monthly in a logbook (written or electronic format) and made available to an authorized representative upon request. Semi-annual reporting of monitoring activities is required.

For the dryer system, GHG (CO_2e) emissions shall be calculated on a monthly basis and compliance demonstrated using the applicable Part 98 emission factors. Compliance shall be documented on a 12-month rolling basis.

F. 15A NCAC 02D .0540 Particulate from Fugitive Dust Emission Sources

15A NCAC 02D .0540 requires 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. Previous dispersion modeling for the Hamlet plant did not show a violation or the potential for a violation of the PM_{10} or $PM_{2.5}$ NAAQS. As such, a fugitive dust control plan is not required at this time.

G. 15A NCAC 02D .1100 Control of Toxic Air Pollutant (TAP) Emissions

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.

A TAP modeling analysis was performed as part of the permitting effort in January 2015 and the results demonstrated that the facility would not exceed any TAP ambient air standards. Individual TAP increases are below the previously modeled rates. As part of this permit modification Enviva is proposing to reduce total TAP emissions from 31.6 tpy to 20.5 tpy. Therefore, additional TAP modeling is not required.

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

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

VI. Other Regulatory Considerations

- An application fee of $947.00 was received by the DAQ on May 14, 2018.
- The appropriate number of application copies was received by the DAQ.
- A Professional Engineer's Seal is required for this application and was provided (ref. Russell Kemp, P.E. Seal # 19628, 4-4-18).
- Receipt of the request for a zoning consistency determination was acknowledged by Tracy R. Parris, Planning Director, Richmond County on May 15, 2018. The proposed operation is consistent with applicable zoning ordinances.
- Public notice is not required for this modification to the State Permit issued under 15A NCAC 02Q .0300. Due to public interest in this project, the DAQ Director did require a public hearing. The hearing was held on November 8, 2018.
- IBEAM Emission Source Module (ESM) update was verified on August 31, 2018.
- According to the application, the facility does not store any materials in excess of the 112r applicability threshold.
- The application was signed by Mr. Steve Reeves, EVP and CFO - Accounting, on May 3, 2018.

VII. Recommendations

This application has been reviewed by the DAQ to determine compliance with all procedures and requirements. The DAQ has determined that this facility appears to be or is expected to achieve compliance as specified in the permit with all applicable requirements. A draft permit was provided to the Fayetteville Regional Office (FRO) on August 22, 2018. The FRO responded with "no comments" to the draft on August 30, 2018. A draft permit was provided to the applicant on August 22, 2018. The applicant responded with minor comments on August 27, 2018. All comments have been addressed. According to a January 8, 2019 memo from Michael Abraczinskas, Director, the DAQ recommends issuance of Permit No. 1036R03.

ATTACHMENT 1

Table 1

Calculation Inputs

Enviva Pellets Hamlet, LLC

Hamlet, Richmond County, North Carolina

Operational Data	
Green Hammermills, Dryers, Pellet Coolers	
Short-Term Throughput (ODT/hr)	80
Annual Throughput (ODT/yr)	625,011
Hours of Operation (hr/yr)	8,760
Softwood Composition	85%
Dry Hammermills	
Short-Term Throughput (ODT/hr)	68
Annual Throughput (ODT/yr)[1]	531,259
Hours of Operation (hr/yr)	8,760
Softwood Composition	85%

85% raw material process by hammermil

85% of raw material is processed by the dry hammermills.

Moisture Content of Finished Pellets:	5.5%
Metric Tonnes:	600,000

1 ton = 0.91 metric tonnes

Table 3

Summary of Facility-wide HAP Emissions

Enviva Pellets Hamlet, LLC

Hamlet, Richmond County, North Carolina

Pollutant	CD-RTO-1[1] (tpy)	ES-HM-1 through 8 (tpy)	CD-RCO[2] (tpy)	ES-DWH	IES-GN (tpy)	IES-FWP (tpy)	IES-BARKHOG (tpy)	IES-CHIP-1 (tpy)	Total HAP (tpy)
Acetaldehyde	1.8	2.4	0.13	--	9.0E-04	1.8E-04	--	--	4.3
Acetophenone	1.8E-07	--	--	--	--	--	--	--	1.8E-07
Acrolein	1.0	2.9	0.79	--	1.1E-04	2.1E-05	--	--	4.7
Antimony and compounds	6.3E-04	--	--	--	--	--	--	--	6.3E-04
Arsenic and compounds	1.8E-03	--	2.7E-05	--	--	--	--	--	1.8E-03
Benzene	0.23	--	2.9E-04	--	1.1E-03	2.1E-04	--	--	0.23
Benzo(a)pyrene	1.4E-04	--	1.6E-07	--	2.2E-07	4.3E-08	--	--	1.4E-04
Beryllium metal	8.9E-05	--	1.6E-06	--	--	--	--	--	9.1E-05
Butadiene, 1,3-	--	--	--	--	4.6E-05	9.0E-06	--	--	5.5E-05
Cadmium Metal	4.8E-04	--	1.5E-04	--	--	--	--	--	6.3E-04
Carbon tetrachloride	2.5E-03	--	--	--	--	--	--	--	2.5E-03
Chlorine	0.87	--	--	--	--	--	--	--	0.87
Chlorobenzene	1.8E-03	--	--	--	--	--	--	--	1.8E-03
Chloroform	1.5E-03	--	--	--	--	--	--	--	1.5E-03
Chromium VI	4.7E-04	--	1.9E-04	--	--	--	--	--	6.6E-04
Chromium-Other compounds	1.4E-03	--	--	--	--	--	--	--	1.4E-03
Cobalt compounds	5.3E-04	--	1.2E-05	--	--	--	--	--	5.4E-04
Dichlorobenzene	1.6E-04	--	1.6E-04	--	--	--	--	--	3.3E-04
Dichloroethane, 1,2-	1.6E-03	--	--	--	--	--	--	--	1.6E-03
Dichloropropane, 1,2-	1.8E-03	--	--	--	--	--	--	--	1.8E-03
Dinitrophenol, 2,4-	9.9E-06	--	--	--	--	--	--	--	9.9E-06
Di(2-ethylhexyl)phthalate	2.6E-06	--	--	--	--	--	--	--	2.6E-06
Ethyl benzene	1.7E-03	--	--	--	--	--	--	--	1.7E-03
Formaldehyde	0.94	2.1	0.50	0.26	1.4E-03	2.7E-04	--	--	3.8
Hexane	0.25	--	0.25	--	--	--	--	--	0.49
Hydrochloric acid	2.1	--	--	--	--	--	--	--	2.1
Lead and lead compounds	3.9E-03	--	6.9E-05	--	--	--	--	--	4.0E-03
Manganese and compounds	0.13	--	5.2E-05	--	--	--	--	--	0.127
Mercury, vapor	3.1E-04	--	3.6E-05	--	--	--	--	--	3.5E-04
Methanol	2.1	1.4	3.8	0.61	--	--	5.7E-02	0.31	8.2
Methyl bromide	8.2E-04	--	--	--	--	--	--	--	8.2E-04
Methyl chloride	1.3E-03	--	--	--	--	--	--	--	1.3E-03
Methylene chloride	1.6E-02	--	--	--	--	--	--	--	1.6E-02
Naphthalene	5.4E-03	--	8.4E-05	--	1.0E-04	1.9E-05	--	--	5.6E-03
Nickel metal	2.9E-03	--	2.9E-04	--	--	--	--	--	3.2E-03
Nitrophenol, 4-	6.0E-06	--	--	--	--	--	--	--	6.0E-06
Pentachlorophenol	5.6E-05	--	--	--	--	--	--	--	5.6E-05
Perchloroethylene	4.2E-02	--	--	--	--	--	--	--	0.042
Phenol	1.3	1.1	0.39	--	--	--	--	--	2.8
Phosphorus metal, yellow or white	2.1E-03	--	--	--	--	--	--	--	2.1E-03
Polychlorinated biphenyls	4.5E-07	--	--	--	--	--	--	--	4.5E-07
Propionaldehyde	0.45	5.0	0.17	--	--	--	--	--	5.6
Selenium compounds	2.3E-04	--	3.3E-06	--	--	--	--	--	2.3E-04
Styrene	0.10	--	--	--	--	--	--	--	0.10
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	4.7E-10	--	--	--	--	--	--	--	4.7E-10
Toluene	2.1E-03	--	4.7E-04	--	4.8E-04	9.4E-05	--	--	3.2E-03
Total PAH (POM)	0.14	--	9.6E-05	--	2.0E-04	3.9E-05	--	--	0.14
Trichloroethane, 1,1,1-	3.4E-02	--	--	--	--	--	--	--	3.4E-02
Trichloroethylene	1.6E-03	--	--	--	--	--	--	--	1.6E-03
Trichlorophenol, 2,4,6-	1.2E-06	--	--	--	--	--	--	--	1.2E-06
Vinyl chloride	9.9E-04	--	--	--	--	--	--	--	9.9E-04
Xylene	1.4E-03	--	--	--	3.3E-04	6.5E-05	--	--	1.8E-03
Total HAP Emissions[3] (tpy)	**11**	**15**	**6.0**	**0.87**	**4.5E-03**	**8.9E-04**	**0.057**	**0.31**	**34**
Maximum Individual HAP (tpy)	**Hydrochloric acid**	**Propionaldehyde**	**Methanol**	**Methanol**	**Formaldehyde**	**Formaldehyde**	**Methanol**	**Methanol**	**Methanol**
Maximum Individual HAP Emissions (tpy)	**2.1**	**5.0**	**3.8**	**0.61**	**1.4E-03**	**2.7E-04**	**0.057**	**0.31**	**8.2**

otes:

Includes emissions at outlet of RTO-1 stack as well as the HAP combustion emissions resulting from NG by the RTO-1 burners. RTO-1 controls emissions from the dryer (ES-DRYER) and green hammermills (ES-GHM-1 through 3).

Includes emissions at outlet of RCO stack as well as the HAP combustion emissions resulting from NG by the RCO burners. RCO controls emissions from the pellet coolers and pellet mill (ES-CLR-1 through 6). The pellet coolers will be equipped with an RCO that will operate primarily in catalytic mode with thermal (RTO) mode as a backup. The RTO and RCO modes have the same control efficiency so there will be no impact on emissions during thermal mode usage.

Because benzo(a)pyrene and naphthalene emissions were presented individually and as components of total PAH emissions, the total HAP emissions presented here do not match the sum of all pollutant emissions to avoid double counting benzo(a)pyrene and naphthalene emissions.

bbreviations:

HAP - hazardous air pollutant	RTO - regenerative thermal oxidizer
RCO - regenerative catalytic oxidizer	tpy - tons per year

Table 4
Potential Emissions at Outlet of RTO-1 Stack
ES-DRYER and ES-GHM-1 through 3
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Calculation Basis

Hourly Throughput	80	ODT/hr
Annual Throughput	625,011	ODT/yr
Hourly Heat Input Capacity	250.4	MMBtu/hr
Annual Heat Input Capacity	2,193,504	MMBtu/yr
Hours of Operation	8,760	hr/yr
Number of RTO Burners	4	burners
RTO Burner Rating	8	MMBtu/hr
RTO Control Efficiency	95%	

Potential Criteria Pollutant and Greenhouse Gas Emissions

Pollutant	Controlled Emission Factor	Units	Emissions at RTO-1 Outlet[1]	
			(lb/hr)	(tpy)
CO	50	lb/hr[2]	50	219
NO_X	50	lb/hr[2]	50	219
SO_2	0.025	lb/MMBtu[3]	6.3	27
VOC	0.12	lb/ODT[4]	10	39
$PM/PM_{10}/PM_{2.5}$ (Filterable + Condensable)	7.6	lb/hr[2]	7.6	33
CO_2	780	lb/ODT[5]	62,400	243,754

Notes:

1. Exhaust from the dryer (ES-DRYER) and green hammermills (ES-GHM-1 through 3) are routed to a WESP and then RTO for control of VOC, HAP, and particulates.
2. Emission rate based on data provided by RTO vendor (Lundberg) and include thermal emissions from the use of the RTO.
3. No emission factor is provided in AP-42, Section 10.6.2 for SO_2 for rotary dryers. Enviva has conservatively calculated SO_2 emissions based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
4. VOC emission factor based on source test results from similar Enviva facilities.
5. Emission factor for CO_2 from AP-42, Section 10.6.1 for rotary dryer with RTO control device. Enviva has conservatively calculated the CO_2 emissions using the hardwood emission factor because the dryer at Hamlet uses a combination of hardwood and softwood and the hardwood emission factor is greater than the softwood emission factor.

Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Biomass Source								
Acetaldehyde	Y	Y	Y	5.7E-03	lb/ODT	1	0.46	1.8
Acrolein	Y	Y	Y	3.2E-03	lb/ODT	1	0.26	1.0
Formaldehyde	Y	Y	Y	3.0E-03	lb/ODT	1	0.24	0.92
Methanol	Y	N	Y	6.6E-03	lb/ODT	1	0.53	2.1
Phenol	Y	Y	Y	4.1E-03	lb/ODT	1	0.33	1.3
Propionaldehyde	Y	N	Y	1.4E-03	lb/ODT	1	0.12	0.45
Acetophenone	Y	N	Y	3.2E-09	lb/MMBtu	1	4.0E-08	1.8E-07
Antimony and compounds	Y	N	N	7.9E-06	lb/MMBtu	2,4	1.4E-04	6.3E-04
Arsenic	Y	Y	N	2.2E-05	lb/MMBtu	2,4	4.0E-04	1.7E-03
Benzene	Y	Y	Y	4.2E-03	lb/MMBtu	2,3	5.3E-02	0.23
Benzo(a)pyrene	Y	Y	Y	2.6E-06	lb/MMBtu	2,3	3.3E-05	1.4E-04
Beryllium	Y	Y	N	1.1E-06	lb/MMBtu	2,4	2.0E-05	8.7E-05
Cadmium	Y	Y	N	4.1E-06	lb/MMBtu	2,4	7.4E-05	3.3E-04
Carbon tetrachloride	Y	Y	Y	4.5E-05	lb/MMBtu	2,3	5.6E-04	2.5E-03
Chlorine	Y	Y	N	7.9E-04	lb/MMBtu	2	0.20	0.87
Chlorobenzene	Y	Y	Y	3.3E-05	lb/MMBtu	2,3	4.1E-04	1.8E-03
Chloroform	Y	Y	Y	2.8E-05	lb/MMBtu	2,3	3.5E-04	1.5E-03
Chromium VI	-	Y	N	3.5E-06	lb/MMBtu	2,4,5	6.4E-05	2.8E-04
Chromium–Other compounds	Y	N	N	1.8E-05	lb/MMBtu	2,4	3.2E-04	1.4E-03
Cobalt compounds	Y	N	N	6.5E-06	lb/MMBtu	2,4	1.2E-04	5.2E-04
Dichloroethane, 1,2-	Y	Y	Y	2.9E-05	lb/MMBtu	2,3	3.6E-04	1.6E-03
Dichloropropane, 1,2-	Y	N	Y	3.3E-05	lb/MMBtu	2,3	4.1E-04	1.8E-03
Dinitrophenol, 2,4-	Y	N	Y	1.8E-07	lb/MMBtu	2,3	2.3E-06	9.9E-06
Di(2-ethylhexyl)phthalate	Y	Y	Y	4.7E-08	lb/MMBtu	2,3	5.9E-07	2.6E-06
Ethyl benzene	Y	N	Y	3.1E-05	lb/MMBtu	2,3	3.9E-04	1.7E-03
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	N	Y	Y	1.8E-11	lb/MMBtu	2,3	2.2E-10	9.8E-10
Hydrochloric acid	Y	Y	N	1.9E-02	lb/MMBtu	2,6	0.48	2.1
Lead and lead compounds	Y	N	N	4.8E-05	lb/MMBtu	2,4	8.7E-04	3.8E-03
Manganese and compounds	Y	Y	N	1.6E-03	lb/MMBtu	2,4	2.9E-02	0.13
Mercury, vapor	Y	Y	N	3.5E-06	lb/MMBtu	2,4	6.4E-05	2.8E-04
Methyl bromide	Y	N	Y	1.5E-05	lb/MMBtu	2,3	1.9E-04	8.2E-04
Methyl chloride	Y	N	Y	2.3E-05	lb/MMBtu	2,3	2.9E-04	1.3E-03
Methyl ethyl ketone	N	Y	Y	5.4E-06	lb/MMBtu	2,3	6.8E-05	3.0E-04
Methylene chloride	Y	Y	Y	2.9E-04	lb/MMBtu	2,3	3.6E-03	1.6E-02
Naphthalene	Y	N	Y	9.7E-05	lb/MMBtu	2,3	1.2E-03	5.3E-03
Nickel metal	Y	Y	N	3.3E-05	lb/MMBtu	2,4	6.0E-04	2.6E-03
Nitrophenol, 4-	Y	N	Y	1.1E-07	lb/MMBtu	2,3	1.4E-06	6.0E-06
Pentachlorophenol	Y	Y	N	5.1E-08	lb/MMBtu	2	1.3E-05	5.6E-05
Perchloroethylene	Y	Y	N	3.8E-05	lb/MMBtu	2	9.5E-03	4.2E-02
Phosphorus metal, yellow or white	Y	N	N	2.7E-05	lb/MMBtu	2,4	4.9E-04	2.1E-03
Polychlorinated biphenyls	Y	Y	Y	8.2E-09	lb/MMBtu	2,3	1.0E-07	4.5E-07
Polycyclic Organic Matter	Y	N	N	1.3E-04	lb/MMBtu	2	3.1E-02	0.14
Selenium compounds	Y	N	N	2.8E-06	lb/MMBtu	2,4	5.1E-05	2.2E-04
Styrene	Y	Y	Y	1.9E-03	lb/MMBtu	2,3	2.4E-02	0.10
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	Y	Y	8.6E-12	lb/MMBtu	2,3	1.1E-10	4.7E-10
Toluene	Y	Y	Y	3.0E-05	lb/MMBtu	2,3	3.8E-04	1.6E-03
Trichloroethane, 1,1,1-	Y	Y	N	3.1E-05	lb/MMBtu	2	7.8E-03	3.4E-02
Trichloroethylene	Y	Y	Y	3.0E-05	lb/MMBtu	2,3	3.8E-04	1.6E-03
Trichlorofluoromethane	N	Y	Y	4.1E-05	lb/MMBtu	2,3	5.1E-04	2.2E-03
Trichlorophenol, 2,4,6-	Y	N	Y	2.2E-08	lb/MMBtu	2,3	2.8E-07	1.2E-06
Vinyl chloride	Y	Y	Y	1.8E-05	lb/MMBtu	2,3	2.3E-04	9.9E-04
Xylene	Y	Y	Y	2.5E-05	lb/MMBtu	2,3	3.1E-04	1.4E-03
				Total HAP Emissions (related to biomass)			2.8	11.2
				Total TAP Emissions (related to biomass)			2.1	8.5

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Natural Gas Source								
2-Methylnaphthalene	Y	N	Y	2.4E-05	lb/MMscf	7	7.5E-07	3.3E-06
3-Methylchloranthrene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.6E-05	lb/MMscf	7	5.0E-07	2.2E-06
Acenaphthene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Acenaphthylene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Acetaldehyde	Y	Y	Y	1.5E-05	lb/MMscf	7	4.8E-07	2.1E-06
Acrolein	Y	Y	Y	1.8E-05	lb/MMscf	7	5.6E-07	2.5E-06
Ammonia	N	Y	N	3.2	lb/MMscf	7	0.10	0.44
Anthracene	Y	N	Y	2.4E-06	lb/MMscf	7	7.5E-08	3.3E-07
Arsenic	Y	Y	N	2.0E-04	lb/MMscf	7	6.3E-06	2.7E-05
Benz(a)anthracene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Benzene	Y	N	Y	2.1E-03	lb/MMscf	7	6.6E-05	2.9E-04
Benzo(a)pyrene	Y	Y	Y	1.2E-06	lb/MMscf	7	3.8E-08	1.6E-07
Benzo(b)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Benzo(g,h,i)perylene	Y	N	Y	1.2E-06	lb/MMscf	7	3.8E-08	1.6E-07
Benzo(k)fluoranthene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Beryllium	Y	Y	N	1.2E-05	lb/MMscf	7	3.8E-07	1.6E-06
Cadmium	Y	Y	N	1.1E-03	lb/MMscf	7	3.5E-05	1.5E-04
Chromium VI	Y	N	N	1.4E-03	lb/MMscf	7	4.4E-05	1.9E-04
Chrysene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Cobalt	Y	N	N	8.4E-05	lb/MMscf	7	2.6E-06	1.2E-05
Dibenzo(a,h)anthracene	Y	N	Y	1.2E-06	lb/MMscf	7	3.8E-08	1.6E-07
Dichlorobenzene	Y	Y	Y	1.2E-03	lb/MMscf	7	3.8E-05	1.6E-04
Fluoranthene	Y	N	Y	3.0E-06	lb/MMscf	7	9.4E-08	4.1E-07
Fluorene	Y	N	Y	2.8E-06	lb/MMscf	7	8.8E-08	3.8E-07
Formaldehyde	Y	Y	Y	7.5E-02	lb/MMscf	7	2.4E-03	1.0E-02
Hexane	Y	Y	Y	1.8	lb/MMscf	7	5.6E-02	0.25
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.8E-06	lb/MMscf	7	5.6E-08	2.5E-07
Lead	Y	N	N	5.0E-04	lb/MMscf	7	1.6E-05	6.9E-05
Manganese	Y	Y	N	3.8E-04	lb/MMscf	7	1.2E-05	5.2E-05
Mercury	Y	Y	N	2.6E-04	lb/MMscf	7	8.2E-06	3.6E-05
Naphthalene	Y	N	Y	6.1E-04	lb/MMscf	7	1.9E-05	8.4E-05
Nickel	Y	Y	N	2.1E-03	lb/MMscf	7	6.6E-05	2.9E-04
Phenanthrene	Y	N	Y	1.7E-05	lb/MMscf	7	5.3E-07	2.3E-06
Pyrene	Y	N	Y	5.0E-06	lb/MMscf	7	1.6E-07	6.9E-07
Selenium	Y	N	N	2.4E-05	lb/MMscf	7	7.5E-07	3.3E-06
Toluene	Y	Y	Y	3.4E-03	lb/MMscf	7	1.1E-04	4.7E-04
				Total HAP Emissions (related to natural gas)			0.059	0.26
				Total TAP Emissions (related to natural gas)			0.16	0.70

Notes:

1. Emission factor derived based on stack testing data from comparable Enviva facilities.
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 95% for the RTO is applied to all VOC hazardous and toxic pollutants for those emission factors that are not derived from Enviva stack test data.
4. The control efficiency of the wet electrostatic precipitator (WESP) for filterable particulate matter is applied to all metal hazardous and toxic pollutants. Actual design filterable efficiency is estimated to 96.4%, but 92.75% is assumed for toxics permitting.
5. Chromium VI is a subset of chrome 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.
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 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.

Abbreviations:

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

Table 5
Summary of Potential Emissions from Baghouses
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Emission Unit ID	Source Description	Control Device ID	Control Device Description	Exhaust Flow Rate[1]	Exit Grain Loading	Particulate Speciation		Potential Emissions					
								PM		PM_{10}		$PM_{2.5}$	
				(cfm)	(gr/cf)	PM_{10} (% of PM)	$PM_{2.5}$ (% of PM)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
ES-HM-1	Dry Hammermill	CD-HM-BH1	One (1) baghouse[2,3]	15,000	0.004	100%	1.7%	0.51	2.3	0.51	2.3	8.7E-03	0.038
ES-HM-2	Dry Hammermill	CD-HM-BH2	One (1) baghouse[2,3]	15,000	0.004	100%	1.7%	0.51	2.3	0.51	2.3	8.7E-03	0.038
ES-HM-3	Dry Hammermill	CD-HM-BH3	One (1) baghouse[2,3]	15,000	0.004	100%	1.7%	0.51	2.3	0.51	2.3	8.7E-03	0.038
ES-HM-4	Dry Hammermill	CD-HM-BH4	One (1) baghouse[2,3]	15,000	0.004	100%	1.7%	0.51	2.3	0.51	2.3	8.7E-03	0.038
ES-HM-5	Dry Hammermill	CD-HM-BH5	One (1) baghouse[2,3]	15,000	0.004	100%	1.7%	0.51	2.3	0.51	2.3	8.7E-03	0.038
ES-HM-6	Dry Hammermill	CD-HM-BH6	One (1) baghouse[2,3]	15,000	0.004	100%	1.7%	0.51	2.3	0.51	2.3	8.7E-03	0.038
ES-HM-7	Dry Hammermill	CD-HM-BH7	One (1) baghouse[2,3]	15,000	0.004	100%	1.7%	0.51	2.3	0.51	2.3	8.7E-03	0.038
ES-HM-8	Dry Hammermill	CD-HM-BH8	One (1) baghouse[2,3]	15,000	0.004	100%	1.7%	0.51	2.3	0.51	2.3	8.7E-03	0.038
ES-HMC	Hammermill Collection Conveyor	CD-HMC-BH	One (1) baghouse[2,4]	1,500	0.004	100%	100%	0.051	0.23	0.051	0.23	0.051	0.23
ES-PCHP	Pellet Cooler HP Fines Relay System	CD-PCHP-BH	One (1) baghouse[2,4]	500	0.004	100%	100%	0.017	0.075	0.017	0.075	0.017	0.075
ES-PCLP	Pellet Cooler LP Fines Relay System	CD-PCLP-BH	One (1) baghouse[2,4]	3,102	0.004	100%	100%	0.11	0.47	0.11	0.47	0.11	0.47
ES-PMFS	Pellet Mill Feed Silo	CD-PMFS-BH	One (1) baghouse[2,4]	2,444	0.004	100%	100%	0.084	0.37	0.084	0.37	0.084	0.37
ES-CLR-1	Pellet Cooler	CD-CLR-BH1	One (1) baghouse[5]	15,000	0.004	26.1%	3.2%	0.51	2.3	0.13	0.59	0.016	0.072
ES-CLR-2	Pellet Cooler	CD-CLR-BH2	One (1) baghouse[5]	15,000	0.004	26.1%	3.2%	0.51	2.3	0.13	0.59	0.016	0.072
ES-CLR-3	Pellet Cooler	CD-CLR-BH3	One (1) baghouse[5]	15,000	0.004	26.1%	3.2%	0.51	2.3	0.13	0.59	0.016	0.072
ES-CLR-4	Pellet Cooler	CD-CLR-BH4	One (1) baghouse[5]	15,000	0.004	26.1%	3.2%	0.51	2.3	0.13	0.59	0.016	0.072
ES-CLR-5	Pellet Cooler	CD-CLR-BH5	One (1) baghouse[5]	15,000	0.004	26.1%	3.2%	0.51	2.3	0.13	0.59	0.016	0.072
ES-CLR-6	Pellet Cooler	CD-CLR-BH6	One (1) baghouse[5]	15,000	0.004	26.1%	3.2%	0.51	2.3	0.13	0.59	0.016	0.072
ES-DCTB	Pellet Dust Collection Transfer Bin	CD-PDCTB-BH	One (1) baghouse[2,4]	3,000	0.004	100%	100%	0.10	0.45	0.10	0.45	0.10	0.45
ES-FPH ES-PB-1 and 2	Finished Product Handling Two (2) Pellet Loadout Bins	CD-FPH-BH	One (1) baghouse[3,6]	8,500	0.004	91%	1.7%	0.29	1.3	0.27	1.2	5.0E-03	0.022
ES-DWH	Dried Wood Handling-Operations (conveyors)	CD-DWH-BH1	One (1) baghouse[2,4]	1,000	0.004	100%	100%	0.034	0.15	0.034	0.15	0.034	0.15
		CD-DWH-BH2	One (1) baghouse[2,4]	1,000	0.004	100%	100%	0.034	0.15	0.034	0.15	0.034	0.15
ES-ADD	Additive Handling and Storage	CD-ADD-BH	One (1) baghouse[2,4]	1,000	0.004	100%	100%	0.034	0.15	0.034	0.15	0.034	0.15

tes:

Control device flow rate (cfm) based on updated emission point data provided by Enviva on 3/16/18.

No speciation data is available for PM_{10}. Therefore, it is conservatively assumed to be equal to total PM.

Dry Hammermills and finished product handling $PM_{2.5}$ speciation based on April 2014 Enviva Southampton $PM_{2.5}$ speciation tests.

No speciation data is available for $PM_{2.5}$. Therefore, it is conservatively assumed to be equal to total PM.

Exit flow rate provided by Enviva. Exit grain loading assumed to be the same as for other baghouses at the facility. A single wet scrubber may be used in place of the six (6) baghouses for PM control. The emissions are expected to be the same whether the scrubber or baghouses are installed. Baghouse or scrubber emissions will exhaust through CD-RCO.

Finished product handling PM_{10} speciation based on emission factors for wet wood combustion controlled by a mechanical separator from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03. Because the particle size of particulate matter from finished product handling is anticipated to be larger than flyash, this factor is believed to be a conservative indicator of speciation.

breviations:

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

14.74	average pressure, Sampson County
53	F, mean temp for Sampson County in March
4.89%	moisture
13000	dscfm

nversions

60	min = 1 hour
7000	grains = 1 lb
2000	lb = 1 ton

Table 6
Dry Hammermill Potential VOC and HAP Emissions
ES-HM-1 through 8
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Calculation Basis

Hourly Throughput	68	ODT/hr
Annual Throughput	531,259	ODT/yr
Hours of Operation	8,760	hr/yr

Potential VOC and HAP Emissions

Pollutant	CAS No.	NC TAP	VOC	Emission Factor[1]	Potential Emissions	
				(lb/ODT)	(lb/hr)	(tpy)
Acetaldehyde	75-07-0	Y	Y	0.0091	0.62	2.4
Acrolein	107-02-8	Y	Y	0.011	0.73	2.9
Formaldehyde	50-00-0	Y	Y	0.0080	0.55	2.1
Methanol	67-56-1	N	Y	0.0052	0.35	1.4
Phenol	108-95-2	Y	Y	0.0041	0.28	1.1
Propionaldehyde	123-38-6	N	Y	0.019	1.3	5.0
				Total HAP Emissions	**3.8**	**15**
				Total TAP Emissions	**2.2**	**8.5**
Total VOC	--	--	Y	0.51	35	135

Notes:

1. Emission factors are based on stack testing data from comparable Enviva facilities.

Abbreviations:

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

Table 7

Potential VOC and HAP Emissions at Outlet of RCO Stack

ES-CLR-1 through 6

Enviva Pellets Hamlet, LLC

Hamlet, Richmond County, North Carolina

Calculation Basis

Hourly Throughput	80	ODT/hr
Annual Throughput	625,011	ODT/yr
Hours of Operation	8,760	hr/yr
Number of Burners	4	burners
RCO/RTO Burner Rating	8	MMBtu/hr
RCO/RTO Control Efficiency	95%	

Pellet Cooler and Pellet Mill Potential Process VOC and HAP Emissions

Pollutant	CAS No.	NC TAP	VOC	Uncontrolled Emission Factor[1]	Emissions at RCO Outlet[2]	
				(lb/ODT)	(lb/hr)	(tpy)
Acetaldehyde	75-07-0	Y	Y	0.0084	0.034	0.13
Acrolein	107-02-8	Y	Y	0.050	0.20	0.79
Formaldehyde	50-00-0	Y	Y	0.031	0.12	0.49
Methanol	67-56-1	N	Y	0.24	0.96	3.8
Phenol	108-95-2	Y	Y	0.025	0.10	0.39
Propionaldehyde	123-38-6	N	Y	0.011	0.043	0.17
				Total HAP Emissions	**1.5**	**5.7**
				Total TAP Emissions	**0.46**	**1.8**
Total VOC	--	--	Y	1.5	6.0	23

Notes:

1. Emission factors were derived based on stack testing data from comparable Enviva facilities.
2. A 95% control efficiency is applied to the potential emissions for the RCO. The pellet coolers will be equipped with an RCO that will operate primarily in catalytic mode with thermal (RTO) mode as a backup. The RTO and RCO modes have the same control efficiency so there will be no impact on emissions during thermal mode usage.

Thermal Generated Potential Criteria Pollutant Emissions

Maximum high heating value of VOC constituents	1.8E-02	MMBtu/lb
Uncontrolled VOC emissions	467	tons/yr
Heat input of uncontrolled VOC emissions	17,284	MMBtu/yr

Pollutant	Emission Factor	Units	Potential Emissions	
			(lb/hr)	(tpy)
CO	8.2E-02	lb/MMBtu[1]	0.16	0.71
NO_X	9.8E-02	lb/MMBtu[1]	0.19	0.85

Natural Gas Combustion Potential Criteria Pollutant and Greenhouse Gas Emissions

Pollutant	Emission Factor	Units	Potential Emissions	
			(lb/hr)	(tpy)
CO	8.2E-02	lb/MMBtu[1]	2.6	12
NO_X	9.8E-02	lb/MMBtu[1]	3.1	14
SO_2	5.9E-04	lb/MMBtu[1]	1.9E-02	8.2E-02
VOC	5.4E-03	lb/MMBtu[1]	0.17	0.76
PM	7.5E-03	lb/MMBtu[1]	0.24	1.0
PM_{10}	7.5E-03	lb/MMBtu[1]	0.24	1.0
$PM_{2.5}$	7.5E-03	lb/MMBtu[1]	0.24	1.0
CO_2	66.9	kg/MMBtu[2]	4,718	20,666
CH_4	1.0E-03	kg/MMBtu[2]	7.1E-02	0.31
N_2O	1.0E-04	kg/MMBtu[2]	7.1E-03	3.1E-02
CO_2e			4,722	20,683

Thermal Generated Potential Criteria Pollutant Emissions

Maximum high heating value of VOC constituents	1.8E-02	MMBtu/lb
Uncontrolled VOC emissions	467	tons/yr
Heat input of uncontrolled VOC emissions	17,284	MMBtu/yr

Pollutant	Emission Factor	Units	Potential Emissions	
			(lb/hr)	(tpy)
CO	8.2E-02	lb/MMBtu[1]	0.16	0.71
NO_X	9.8E-02	lb/MMBtu[1]	0.19	0.85

Natural Gas Combustion Potential Criteria Pollutant and Greenhouse Gas Emissions

Pollutant	Emission Factor	Units	Potential Emissions	
			(lb/hr)	(tpy)
CO	8.2E-02	lb/MMBtu[1]	2.6	12
NO_X	9.8E-02	lb/MMBtu[1]	3.1	14
SO_2	5.9E-04	lb/MMBtu[1]	1.9E-02	8.2E-02
VOC	5.4E-03	lb/MMBtu[1]	0.17	0.76
PM	7.5E-03	lb/MMBtu[1]	0.24	1.0
PM_{10}	7.5E-03	lb/MMBtu[1]	0.24	1.0
$PM_{2.5}$	7.5E-03	lb/MMBtu[1]	0.24	1.0
CO_2	66.9	kg/MMBtu[2]	4,718	20,666
CH_4	1.0E-03	kg/MMBtu[2]	7.1E-02	0.31
N_2O	1.0E-04	kg/MMBtu[2]	7.1E-03	3.1E-02
CO_2e			4,722	20,683

Table 8
Dried Wood Handling Potential Emissions
ES-DWH
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Calculation Basis

Hourly Throughput[1]	80	ODT/hr
Annual Throughput[1]	625,011	ODT/yr

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor (lb/ODT)	Potential Emissions[1]	
		(lb/hr)	(tpy)
Formaldehyde	8.4E-04	0.067	0.26
Methanol	2.0E-03	0.16	0.61
Total HAP Emissions		**0.22**	**0.87**
VOC as carbon[2]	0.10	8.1	32
VOC as propane[3]	0.12	9.9	39

Notes:

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

Abbreviations:

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

Table 9

Emergency Generator Potential Emissions

IES-GN

Enviva Pellets Hamlet, LLC

Hamlet, Richmond County, North Carolina

Calculation Basis

Engine Output	500	kW
Horsepower Rating	671	brake hp
Diesel Heating Value	19,300	Btu/lb
Hours of Operation	500	hr/yr
Conversion factor	2,545	Btu/hr/hp
Hourly Fuel Consumption	31.9	gal/hr[1]
Energy Input	4.37	MMBtu/hr[2]

Notes:

1. Fuel consumption calculated using a factor of 0.0476 gal/hr-hp. Advanced Environmental Interface, Inc. (1998). General Permits for Emergency Engines. INSIGHTS, 98-2, 3.
2. Energy calculated on a fuel consumption basis, using an energy factor of 0.137 MMBtu/gal.

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor	Units	Potential Emissions[1] (lb/hr)	Potential Emissions[1] (tpy)
CO[2]	0.39	g/hp-hr	0.58	0.14
NO_X[2]	6.65	g/hp-hr	9.8	2.5
SO_2[3]	15	ppmw	2.7E-03	6.6E-04
VOC[2]	0.01	lb/hp-hr	6.7	1.7
PM[2]	0.021	g/hp-hr	3.1E-02	7.8E-03
PM_{10}[2]	0.021	g/hp-hr	3.1E-02	7.8E-03
$PM_{2.5}$[2]	0.021	g/hp-hr	3.1E-02	7.8E-03
CO_2	74.0	kg/MMBtu[4]	713	178
CH_4	3.0E-03	kg/MMBtu[4]	2.9E-02	7.2E-03
N_2O	6.0E-04	kg/MMBtu[4]	5.8E-03	1.4E-03
CO_2e			715	179

Notes:

1. NSPS allows for only 100 hrs/yr of non-emergency operation of these engines. Potential emissions for the emergency generator are conservatively based on 500 hr/yr.
2. Emission factors for Particulate Matter (TSP/PM_{10}/$PM_{2.5}$), Nitrous Oxide (NO_x), 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 factors from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-1.

Potential HAP Emissions

Pollutant	CAS No.	NC TAP	VOC	Emission Factor[1]	Potential Emissions[2]	
				(lb/hp-hr)	(lb/hr)	(tpy)
Acetaldehyde	75-07-0	Y	Y	5.37E-06	3.6E-03	9.0E-04
Acrolein	107-02-8	Y	Y	6.48E-07	4.3E-04	1.1E-04
Benzene	71-43-2	Y	Y	6.53E-06	4.4E-03	1.1E-03
Benzo(a)pyrene[3]	50-32-8	Y	Y	1.32E-09	8.8E-07	2.2E-07
1,3-Butadiene	106-99-0	Y	Y	2.74E-07	1.8E-04	4.6E-05
Formaldehyde	50-00-0	Y	Y	8.26E-06	5.5E-03	1.4E-03
Naphthalene[3]	91-20-3	N	Y	5.94E-07	4.0E-04	1.0E-04
Total PAH (POM)	--	N	Y	1.18E-06	7.9E-04	2.0E-04
Toluene	108-88-3	Y	Y	2.86E-06	1.9E-03	4.8E-04
Xylene	1330-20-7	Y	Y	2.00E-06	1.3E-03	3.3E-04
				Total HAP Emissions	**1.8E-02**	**4.5E-03**
				Total TAP Emissions	**1.7E-02**	**4.3E-03**

Notes:

1. Emission factors obtained from AP-42 Section 3.3 - Stationary Internal Combustion Engines, 10/96, Table 3.3-2.
2. NSPS allows for only 100 hrs/yr of non-emergency operation of these engines. Potential emissions for the emergency generator are conservatively based on 500 hr/yr.
3. Benzo(a)pyrene and naphthalene are included as HAPs in Total PAH.

Abbreviations:

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

Conversions:

1 kW =	1.34	hp
1 lb =	453.59	g
2.20462	pounds = 1 kg	

40 CFR Part 98 - Table A-1 Global Warming Potentials

CO_2	1
CH_4	25
N_2O	298

Table 10

Fire Pump Potential Emissions

IES-FWP

Enviva Pellets Hamlet, LLC

Hamlet, Richmond County, North Carolina

Calculation Basis

Engine Output	0.10	MW
Horsepower Rating	131	brake hp
Diesel Density[1]	7.1	lb/gal
Hours of Operation	500	hr/yr
Hourly Fuel Consumption	9	gal/hr[1]
Energy Input	1.23	MMBtu/hr[2]

Notes:

1. Diesel density from AP-42 Section 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines, 10/96, Table 3.4-1, footnote a.
2. Energy calculated on a fuel consumption basis, using an energy factor of 0.137 MMBtu/gal.

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor	Units	Potential Emissions[1] (lb/hr)	Potential Emissions[1] (tpy)
CO[2]	1.3	g/kW-hr	0.28	7.0E-02
NO_X[2]	3.4	g/kW-hr	0.72	0.18
SO_2[3]	15	ppmw	1.9E-03	4.8E-04
VOC[2]	0.15	g/kW-hr	3.2E-02	8.1E-03
PM[2]	0.17	g/kW-hr	3.7E-02	9.2E-03
PM_{10}[2]	0.17	g/kW-hr	3.7E-02	9.2E-03
$PM_{2.5}$[2]	0.17	g/kW-hr	3.7E-02	9.2E-03
CO_2	74	kg/MMBtu[4]	201	50
CH_4	3.0E-03	kg/MMBtu[4]	8.2E-03	2.0E-03
N_2O	6.0E-04	kg/MMBtu[4]	1.6E-03	4.1E-04
CO_2e			202	50

Notes:

1. NSPS allows for only 100 hrs/yr of non-emergency operation of these engines. Potential emissions for the fire pump are conservatively based on 500 hr/yr.
2. Emissions factors for $PM/PM_{10}/PM_{2.5}$, NO_X, hydrocarbons, and CO obtained from generator's spec sheet.
3. Sulfur content in accordance with Year 2013 standards of 40 CFR 80.510(a) as required by NSPS Subpart IIII.
4. Emission factors from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-1.

Potential HAP Emissions

Pollutant	CAS No.	NC TAP	VOC	Emission Factor[1]	Potential Emissions[2]	
				(lb/hp-hr)	(lb/hr)	(tpy)
Acetaldehyde	75-07-0	Y	Y	5.4E-06	7.0E-04	1.8E-04
Acrolein	107-02-8	Y	Y	6.5E-07	8.5E-05	2.1E-05
Benzene	71-43-2	Y	Y	6.5E-06	8.6E-04	2.1E-04
Benzo(a)pyrene	50-32-8	Y	Y	1.3E-09	1.7E-07	4.3E-08
1,3-Butadiene	106-99-0	Y	Y	2.7E-07	3.6E-05	9.0E-06
Formaldehyde	50-00-0	Y	Y	8.3E-06	1.1E-03	2.7E-04
Naphthalene	91-20-3	N	Y	5.9E-07	7.8E-05	1.9E-05
Total PAH (POM)[3]	--	N	Y	1.2E-06	1.5E-04	3.9E-05
Toluene	108-88-3	Y	Y	2.9E-06	3.8E-04	9.4E-05
Xylene	1330-20-7	Y	Y	2.0E-06	2.6E-04	6.5E-05
				Total HAP Emissions	**3.6E-03**	**8.9E-04**
				Total TAP Emissions	**3.4E-03**	**8.5E-04**

Notes:

1. Emission factor obtained from NCDAQ Internal Combustion (Small Gasoline and Diesel Engines) Spreadsheet/AP-42 Section 3.3 - Stationary Internal Combustion Engines, 10/96, Table 3.3-2.
2. NSPS allows for only 100 hrs/yr of non-emergency operation of these engines. Potential emissions for the fire pump are conservatively based on 500 hr/yr.
3. The PAH emission factor includes all the PAH compounds listed in AP-42. Emissions for naphthalene and benzo(a)pyrene are also calculated separately. For the purposes of calculating total HAP emissions, the naphthalene and benzo(a)pyrene are not included separately to avoid double counting these emissions.

Abbreviations:

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

Conversions:

1 kW =	1.34	hp
1 lb =	453.59	g
2.20462	pounds = 1 kg	

40 CFR Part 98 - Table A-1 Global Warming Potentials

CO_2	1
CH_4	25
N_2O	298

Table 11
Log Chipper Potential Emissions
IES-CHIP-1
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Calculation Basis

Hourly Throughput[1]	275	ton/hr, wet
	138	ODT/hr
Annual Throughput	625,011	ODT/yr

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor		Potential Emissions[1] (lb/hr)	(tpy)
THC as carbon[2]	4.1E-03	lb/ODT	0.56	1.3
VOC as propane[3]	5.0E-03	lb/ODT	0.69	1.6
Methanol[2]	1.0E-03	lb/ODT	0.14	0.31

Notes:

1. Hourly chipper throughput data provided by Enviva (email from Kai Simonsen dated 12/21/17).
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, Table 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
yr - year

Table 12

Bark Hog Potential Emissions

IES-BARKHOG

Enviva Pellets Hamlet, LLC

Hamlet, Richmond County, North Carolina

Calculation Basis

Hourly Throughput[1]	50	ton/hr, wet
	25	ODT/hr
Annual Throughput[2]	113,638	ODT/yr
	227,277	ton/yr, wet
Approx. Moisture Content[1]	50%	of total weight

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor		Potential Emissions[1] (lb/hr)	Potential Emissions[1] (tpy)
THC as carbon[3]	4.1E-03	lb/ODT	0.10	0.23
VOC as propane[4]	5.0E-03	lb/ODT	0.13	0.28
Methanol[3]	1.0E-03	lb/ODT	2.5E-02	5.7E-02
TSP[5]	2.0E-02	lb/ton	0.10	0.23
PM_{10}[5]	1.1E-02	lb/ton	5.5E-02	0.13

Notes:

1. Hourly bark hog throughput data and approximate moisture content provided by Enviva (email from Kai Simonsen dated 12/21/17).
2. Maximum throughput assumes bark hog usage is proportional to the amount of log chipping that occurs for maximum pellet ODT and maximum 75% purchase of green wood from logs.
3. 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.
4. Emission factor for VOC as propane is from AP-42, Section 10.6.3., Medium Density Fiberboard, 08/02, Table 7.
5. 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
tpy - tons per year
yr - year

Table 13
Green Wood Handling
IES-GWH
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Source	Transfer Activity[1]	Number of Drop Points	Material Moisture Content[2]	PM Emission Factor[3]	PM_{10} Emission Factor[3]	$PM_{2.5}$ Emission Factor[3]	Potential Throughput[4]		Potential PM Emissions[5]		Potential PM_{10} Emissions[5]		Potential $PM_{2.5}$ Emissions[5]	
			(%)	(lb/ton)	(lb/ton)	(lb/ton)	(tph)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
ES-GWH	Purchased Bark/Fuel Chips Transfer to Outdoor Storage Area	1	48%	5.0E-05	2.4E-05	3.6E-06	25	81,640	1.2E-03	2.0E-03	5.9E-04	9.6E-04	8.9E-05	1.5E-04
	Purchased Wood Chips to Outdoor Storage Area	4	42%	6.0E-05	2.8E-05	4.3E-06	69	312,505	1.6E-02	3.7E-02	7.8E-03	1.8E-02	1.2E-03	2.7E-03
	Processed Wood Chips to Outdoor Storage Area	2	42%	6.0E-05	2.8E-05	4.3E-06	138	312,505	1.6E-02	1.9E-02	7.8E-03	8.9E-03	1.2E-03	1.3E-03
	Chip Truck Dump to Dumpers	2	42%	6.0E-05	2.8E-05	4.3E-06	69	312,505	8.2E-03	1.9E-02	3.9E-03	8.9E-03	5.9E-04	1.3E-03
								Total Emissions:	4.2E-02	7.7E-02	2.0E-02	3.6E-02	3.0E-03	5.5E-03

Notes:

1. These green wood handling emissions are representative of the fugitive emissions at the site.
2. Average moisture content for bark based on material balance provided by design engineering firm (Mid-South Engineering). Moisture content for purchased and process wood chips provided by Enviva on July 12, 2017. Assumed the lower moisture content between pine and hardwood to conservatively estimate PM emissions. (Hardwood 42% moisture; pine 51% (purchased wood chips) and 49% (processed wood chips).
3. Emission factor calculation based on formula from AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, Equation 13.2.1, (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)	7.85

4. Throughputs represent dry weight of materials, calculated based on listed material moisture contents. Hourly purchased bark throughput based on bark hog hourly throughput. Hourly purchased wood chip throughput based on weight of chips delivered to the facility. Hourly processed wood chip throughput based on log chipping hourly throughput.

Abbreviations:

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

Table 14

Storage Pile Wind Erosion

IES-GWSP-1 through -4, and IES-BFSP-1 and -2

Enviva Pellets Hamlet, LLC

Hamlet, Richmond County, North Carolina

Source	Description	PM Emission Factor[1]		VOC Emission Factor[2]		Pile Width	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/ft²)	(lb/day/acre)	(lb/hr/ft²)	(ft)	(ft)	(ft)	(ft²)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
IES-GWSP-1	Green Wood Storage Pile No. 1	8.6	8.2E-06	3.6	3.4E-06	100	310	30	66,720	0.55	2.4	0.27	1.2	0.041	0.18	0.28	1.2
IES-GWSP-2	Green Wood Storage Pile No. 2	8.6	8.2E-06	3.6	3.4E-06	100	310	30	66,720	0.55	2.4	0.27	1.2	0.041	0.18	0.28	1.2
IES-GWSP-3	Green Wood Storage Pile No. 3	8.6	8.2E-06	3.6	3.4E-06	220	310	30	120,000	0.99	4.3	0.49	2.2	0.074	0.32	0.50	2.2
IES-GWSP-4	Green Wood Storage Pile No. 4	8.6	8.2E-06	3.6	3.4E-06	220	310	30	120,000	0.99	4.3	0.49	2.2	0.074	0.32	0.50	2.2
IES-BFSP-1	Bark Fuel Storage Pile No. 1	8.6	8.2E-06	3.6	3.4E-06	60	100	15	12,960	0.11	0.47	0.053	0.23	8.0E-03	0.035	0.054	0.24
IES-BFSP-2	Bark Fuel Storage Pile No. 2	8.6	8.2E-06	3.6	3.4E-06	25	25	15	2,550	0.021	0.092	0.010	0.046	1.6E-03	6.9E-03	0.011	0.047
									Total Emissions:	**3.2**	**14**	**1.6**	**7.0**	**0.24**	**1.1**	**1.6**	**7.2**

Notes:

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

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

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

2. Emission factors obtained from NCASI document provided by the South Carolina Department of Health and Environmental Control (DHEC) for the calculation of fugitive VOC emissions from Douglas Fir wood storage piles. Emission factors ranged from 1.6 to 3.6 lb C/acre-day. Enviva chose to employ the maximum emission factor for purposes of conservatism.
3. The surface area is calculated as [2*H*L+2*W*H+L*W] + 20% to consider the sloping pile edges. Length and width based on proposed site design with a conservative height.
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	PM - particulate matter
ft - feet	PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
ft² - square feet	$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
lb - pound	tpy - tons per year
mph - miles per hour	TSP - total suspended particulate
NC - North Carolina	yr - year
NCASI - National Council for Air and Stream Improvement, Inc.	VOC - volatile organic compound
NWS - National Weather Service	

Conversions

43,560	ft² = 1 acre
24	hr = 1 day
1.22	conversion from "as carbon" to "as propane"

Table 15
Potential Fugitive PM Emissions from Paved Roads
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Vehicle Activity	Distance Traveled per Roundtrip[1] (ft)	Trips Per Day[2]	Daily VMT	Events Per Year (days)	Empty Truck Weight (lb)	Loaded Truck Weight (lb)	Average Truck Weight (ton)	Annual VMT	PM Emission Factor[3] (lb/VMT)	PM_{10} Emission Factor[3] (lb/VMT)	$PM_{2.5}$ Emission Factor[3] (lb/VMT)	Potential PM Emissions (lb/day)	Potential PM Emissions (tpy)	Potential PM_{10} Emissions (lb/day)	Potential PM_{10} Emissions (tpy)	Potential $PM_{2.5}$ Emissions (lb/day)	Potential $PM_{2.5}$ Emissions (tpy)
Logs Delivery to Crane Storage Area	9,000	47	80	365	40,480	102,540	35.8	29,241	2.7	0.53	0.13	21	3.9	4.2	0.78	1.0	0.19
Logs Delivery to South Log Storage Area	11,700	31	69	365	40,480	102,540	35.8	25,089	2.7	0.53	0.13	18	3.3	3.6	0.67	0.89	0.16
Logs Delivery to North Log Storage Area	8,475	14	23	365	40,480	102,540	35.8	8,261	2.7	0.53	0.13	6.0	1.1	1.2	0.22	0.29	5.4E-02
Chips/Hog Fuel Delivery	8,475	94	151	365	40,960	101,440	35.6	55,071	2.6	0.53	0.13	40	7.3	8.0	1.5	2.0	0.36
Pellet Truck Delivery to Pellet Loadout Area (Truck Back-up)	9,075	60	103	10	40,480	102,540	35.8	1,031	2.7	0.53	0.13	27	0.14	5.5	2.7E-02	1.3	6.7E-03
Pellet Truck Delivery to Pellet Loadout Area (Normal Operations)	900	2	0.34	300	40,480	102,540	35.8	102	2.7	0.53	0.13	9.0E-02	1.4E-02	1.8E-02	2.7E-03	4.4E-03	6.7E-04
Employee Car Parking	2,250	75	32	365	4,000	4,000	2.0	11,665	0.14	0.028	6.9E-03	0.45	8.2E-02	8.9E-02	1.6E-02	2.2E-02	4.0E-03
											Total Emissions:	**113**	**16**	**23**	**3.2**	**5.6**	**0.78**

Notes:

1. Distance traveled per round trip was estimated based on truck route and site layout.
2. Daily trip counts based on original permit application estimation.
3. 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	110	Per AP-42, Section 13.2.1, Figure 13.2.1-2 (Richmond County, NC).

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

Abbreviations:

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

Table 16
Diesel Storage Tanks
IES-TK-1 through 3
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Source ID	Description	Design Volume[1]	Working Volume[2]	Tank Dimensions[5]		Orientation	Throughput[3]	Turnovers	VOC Emissions[4]	
				Diameter	Length					
		(gal)	(gal)	(ft)	(ft)		(gal/yr)		(lb/hr)	(tpy)
IES-TK-1	Emergency Generator Fuel Storage Tank[2]	1,000	500	5.3	6	Horizontal	15,958	31.9	1.3E-04	5.8E-04
IES-TK-2	Fire Pump Fuel Storage Tank[2]	185	93	3.3	3.3	Horizontal	4,500	48.6	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
								Total Emissions:	**9.3E-04**	**4.1E-03**

tes:

Conservative design specifications.
Working volume conservatively assumed to be 50% of tank design volume because tanks will not be full at all times.
Throughput for IES-TK-1 and IES-TK-2 based on fuel consumption provided by Enviva and 500 hours of operation per year. Throughput for IES-TK-3 provided by Enviva.
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.
IES-TK-3 length was estimated based on the capacity of the tank and the diameter.

breviations:

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

Table 17
Dry Shaving Material Handling
IES-DRYSHAVE
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Source	Transfer Activity	Number of Drop Points	Material Moisture Content[1]	PM Emission Factor[2]	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[2]	Potential Throughput[3,4]		Potential PM Emissions		Potential PM_{10} Emissions		Potential $PM_{2.5}$ Emissions	
			(%)	(lb/ton)	(lb/ton)	(lb/ton)	(tph)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
IES-DRYSHAVE	Dry Shaving Material Handling - Truck dump to truck dumper	1	10%	4.5E-04	2.1E-04	3.2E-05	25	219,000	1.1E-02	4.9E-02	5.3E-03	2.3E-02	8.0E-04	3.5E-03
	Dry Shaving Material Handling - Bucket elevator to silo[5]	1	10%	4.5E-04	2.1E-04	3.2E-05	25	219,000	1.1E-03	4.9E-03	5.3E-04	2.3E-03	8.0E-05	3.5E-04
							Total Emissions:		**1.2E-02**	**5.4E-02**	**5.8E-03**	**2.5E-02**	**8.8E-04**	**3.9E-03**

Notes:

1. Moisture content for dry shavings based on information provided by Enviva.
2. Emission factor calculation based on formula from AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, Equation 13.2.1, (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)	7.85

3. Hourly throughput based on a maximum transfer rate of 100 ton/hr of dry shaving material.
4. Annual throughput based on 4 dry shaving deliveries per week and a maximum storage capacity of 1360 tons for the dry shaving material storage silo.
5. Bucket elevator to silo material handling transfer point emissions account for a 90% control efficiency due to the enclosed nature of the silo (San Diego County, 1993).

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

Reference:

San Diego County. 1993. Cement & Fly Ash Storage Silos. June 7. Available online at: https://www.sandiegocounty.gov/content/dam/sdc/apcd/PDF/Toxics_Program/APCD_silo1.pdf.

90%	Control efficiency for bucket elevator to silo drop
25	tons/hr, maximum hourly transfer rate
600	tons/day, maximum daily throughput
365	days/year

Table 18
Debarker Potential Emissions
IES-DEBARK-1
Enviva Pellets Hamlet, LLC
Hamlet, Richmond County, North Carolina

Calculation Basis

Hourly Throughput[1]	275	ton/hr
Annual Throughput[1]	1,078,143	ton/yr

Potential Criteria Pollutant Emissions

Source	Pollutant	Emission Factor (lb/ton)	Potential Emissions	
			(lb/hr)	(tpy)
IES-DEBARK-1	TSP[2]	2.0E-02	0.55	1.1
	PM_{10}[2]	1.1E-02	0.30	0.59

Notes:

1. Hourly bark hog throughput data provided by Enviva (email from Kai Simonsen dated 12/21/17). Annual throughput of logs delivered for debarking, as reported for log chipping. Per 12/21/17 email from Enviva, 2 tons of green material is needed for every 1 ODT of pellets, and 1.15 times that amount for purchased logs. At most, Enviva would purchase 75% of the needed logs with the remaining 25% of green material coming from purchased chips.
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 debarker being partially enclosed (assumed 90% control).

Abbreviations:

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