NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date: January 20, 2022

Region: Fayetteville Regional Office
County: Sampson
NC Facility ID: 8200152
Inspector's Name: Stephen Allen
Date of Last Inspection: 05/28/2021
Compliance Code: B / Violation - emissions

Facility Data

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

Facility Address:
Enviva Pellets Sampson, LLC
5 Connector Road, US 117
Faison, NC 28341

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

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

Permit Applicability (this application only)

SIP: 02D .0515, 02D .0516, 02D .0521, 02D .0530, 02D .0540, 02D .1100, 02D .1111, 02D .1112, 02Q .0711, 02Q .0504, and 02Q .0317 for 02D .0530 and 02D .1112
NSPS: No
NESHAP: 112(g) Case-by-Case MACT
PSD: Yes, until controls are installed and avoidance limit is practically enforceable
PSD Avoidance: Yes, after controls installed and limit practically enforceable
NC Toxics: Yes, after facility becomes HAP minor
112(r): No
Other: Permit application to add controls and enforceable permit limits for HAP and PSD avoidance.

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Johnathan Toler EHS Manager (910) 515-5822 5 Connector Road, US 117 Faison, NC 28341	Mr. George Handler Plant Manager (984) 220-5640 5 Connector Road, US 117 Faison, NC 28341	Catherine Grazioli Regional Environmental Compliance Mgr. (919) 441-3710 4242 Six Forks Road, Suite 1050 Raleigh, NC 27609

Application Data

Application Number: 8200152.17B
Date Received: 09/29/2017
Application Type: Modification
Application Schedule: TV-1st Time

Existing Permit Data
Existing Permit Number: 10386/R05
Existing Permit Issue Date: 06/09/2021
Existing Permit Expiration Date: 09/30/2027

Total Actual emissions in TONS/YEAR:

CY	SO2	NOx	VOC	CO	PM10	Total HAP	Largest HAP
2019	18.14	37.35	403.25	37.43	69.96	9.09	2.68 [Methanol (methyl alcohol)]
2018	22.31	43.66	567.35	143.49	105.92	57.08	17.46 [Formaldehyde]
2017	20.85	166.90	509.38	175.19	96.90	62.58	18.36 [Formaldehyde]
2016	4.73	38.01	73.26	39.81	18.63	9.10	4.46 [Methanol (methyl alcohol)]

Review Engineer: Betty Gatano

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

Betty Gatano 01/20/2022

Comments / Recommendations:
Issue 10386/T06
Permit Issue Date: 01/20/2022
Permit Expiration Date: 12/31/2026

1. Purpose of Application

Enviva Pellets Sampson, LLC (Enviva) currently holds Air Permit No. 10386R05 with an expiration date of September 30, 2027 for a wood pellets manufacturing plant near Faison in Sampson County, North Carolina. Per 15A NCAC 02Q .0504, the facility is allowed to construct and operate under 15A NCAC 02Q .0300 when a Title V permit application is submitted within one year from the date of beginning of operation. The facility began operation on October 3, 2016, and the first time Title V permit application (8200152.17B) was received on September 29, 2017, which was within the time period allowed. Because the facility's operation and emission sources have been modified several times since the first time Title V permit application was submitted, an amended first time Title V permit application was submitted on October 2, 2020.

The following changes were requested in the amended first time Title V permit application:

- Remove the hammermill area (ID No. ES-HMA) and pellet cooler LP fines relay system (ID No. ES-PCLP) and associated baghouse (ID No. CD-PCLP-BH). This equipment is part of closed loop system and not vented to the atmosphere.
- Add two propane vaporizers (ID No. IES-PV-1 and 2) to the list of insignificant activities.
- Move the additive handling and storage (ID No. IES-ADD) to the insignificant activities list and update the calculation methodology for this emission source.
- Remove the pellet sampling transfer bin (ID No. ES-PSTB) and associated baghouse (ID No. CD-PSTB-BH). This equipment was not installed.
- Update the emission calculation methodology for volatile organic compounds (VOCs) from TANKS 4.0 Software to AP-42, Section 7.1 - Organic Liquid Storage Tanks, 07/2020 (IES-TK-1, IES-TK-2, and IES-TK-3).

2. Permitting History and Application Chronology

Permit History

November 17, 2014	Air Permit No. 10386R00 was issued for a greenfield facility to manufacture wood pellets in Sampson County. The proposed plant was designed to produce up to 537,625 oven-dried tons (ODT) of wood pellets per year utilizing up to 75% softwood on a 12-month rolling total basis. The facility was classified as a major source under Prevention of Significant Deterioration (PSD), with the incorporation of Best Available Control Technology (BACT) emission limits in the permit.
January 6, 2015	Air Permit No. 10386R01 was issued as an administrative amendment to correct the Regional Supervisor/Office listed in General Condition 1 in the permit.
January 27, 2016	Air Permit No. 10386R02 was issued as modification under 15A NCAC 02Q .0300. The following changes were made as part of this modification: • Added a third green wood hammermill (ID No. ES-GHM-3) controlled by a bagfilter (ID No. CD-GHM-BF-3), • Added a pellet sampling transfer bin (ID No. ES-PSTB) controlled by a bin vent filter (ID No. CD-DC-BV-3), • Added pellet cooler recirculation (ID No. ES-PCR) controlled by a bin vent filter (ID No. CD-PCR-BV),

- Modified the emergency engine (ID No. IES-EG) and fire water pump engine (ID No. IES-FWP) to 536 horsepower and 131 horsepower, respectively,
- Increased throughput through the green wood hammermills, and
- Updated prior air dispersion modeling analysis to reflect the updated design of the facility.

April 7, 2017 — Air Permit No. 10386R03 was issued as an administrative amendment to add General Condition 17, "General Emissions Testing and Reporting Requirement," to the permit. This condition was inadvertently omitted in the previous revision.

September 21, 2018 — Special Order by Consent (SOC) 2018-003 became effective on September 21, 2018. The SOC addressed exceedance of the BACT emission limit for VOCs from the dryer. Enviva intended to install a regenerative thermal oxidizer (RTO) on the dryer prior to permit issuance, and the SOC provided activities and milestones Enviva was required to meet until an updated PSD permit was issued.

October 2, 2019 — Air Permit No. 10386R04 was issued as a PSD permit to increase the permitted production rate from 537,625 ODT per year to 657,000 ODT per year by upgrading pellet dies with a new prototype and to increase the amount of softwood processed from 75% to a maximum of 100%. The permit also required the installation of the RTO and revised the BACT emission limits for the facility.

December 16, 2020 — SOC 2020-004 became effective on December 16, 2020. The SOC addressed exceedance of the BACT emission limit for particulate matter (PM) and provided a schedule for the installation of additional controls on the facility's pellet presses and coolers and dry hammermills to reduce potential emissions from the facility to below PSD applicability thresholds.

June 9, 2021 — Air Permit No. 10386R05 was issued to add controls to the pellet presses and coolers and dry hammermills and to incorporate avoidance limits. Once installed and operational, the controls will reduce emissions of VOCs and Hazardous Air Pollutants (HAPs), allowing the facility to become a minor source under PSD and an area source of HAPs.

<u>Application Chronology</u>

September 29, 2017 — First time Title V permit application received. The application was initially assigned to Kevin Godwin.

October 3, 2017 — Acknowledgement letter issued.

October 2019 — Application re-assigned to Betty Gatano

October 2, 2020 — Amendment to first time Title V permit application received.

June 21, 2021 — Betty Gatano requested an updated emission spreadsheet corresponding to the October 2, 2020 permit amendment. The updated emission spreadsheet was received on June 23, 2021.

June 24, 2021	Draft permit and permit review forwarded internally for comments.
July 2, 2021	Comments received from Steve Hall, Supervisor of the Stationary Source Compliance Branch (SSCB) of NCDAQ.
July 7, 2021	Comments received from Richard Simpson of the Permitting Section of NCDAQ. Comments were also received from Greg Reeves and Stephen Allen of the FRO.
July 14, 2021	Comments received from Booker Pullen, Permitting Supervisor.
July 16, 2021	Draft permit and permit review forwarded to Enviva for comments.
August 11, 2021	Comments received from Enviva.
August 17, 2021	Second draft of permit and permit review, incorporating Enviva's comments, forwarded internally for review.
August 31, 2021	Additional comments received from NCDAQ staff. NCDAQ incorporated changes.
September 3, 2021	Final drafts were forwarded to Enviva.
September 10, 2021	Minor comments were received from Enviva on the final drafts.
September 15, 2021	Draft permit and permit review forwarded to public notice, with a notice of public hearing. The public hearing announcement was published in the Sampson Independent on September 15, 2021, the Duplin Times on September 16, 2021, and the NCDAQ's website on September 15, 2021.
October 19, 2021	Public hearing held via WebEx.
October 21, 2021	Public comment period ended. All comments were addressed in the Hearing Officer's Report, as discussed in Section 12 below
November 30, 2021	Hearing Officer's Report finalized and signed by the Hearing Officer, Melinda Wolanin.
December 1, 2021	Draft permit and permit review forwarded to EPA for 45-day review.
January 15, 2022	EPA period ends.
January 5, 2022	Comments received from Estelle Bae, EPA Region 4. The comments referenced minor typos and formatting issues in the permit review and suggested minor changes to the discussion of MACT Subpart ZZZZ for the 689 hp diesel-fired emergency generator in the permit review. These comments were addressed.
January 20, 2022	Title V permit issued.

3. Permit Modifications/Changes and TVEE Discussion

The table below list changes to the current permit under this modification.

Pages	Section	Description of Changes
Cover and throughout	--	Updated all dates and permit revision numbers.
Insignificant activities	--	• Moved additive storage and handling (ID No. IES-ADD). • Added two propane vaporizers (ID Nos. IES-PV-1 and IES-PV-2).
3 and 4	1.0 Equipment List	• Moved additive storage and handling (ID No. IES-ADD) to the insignificant activities list. • Removed the hammermill area (ID No. ES-HMA) and pellet cooler LP fines relay system (ID No. ES-PCLP) and associated baghouse (ID No. CD-PCLP-BH). • Removed pellet sampling transfer bin (ID No. ES-PSTB) and associated baghouse (ID No. CD-PSTB-BH).
Throughout permit	2.1 and 2.2	Replaced reference to “15A NCAC 02Q .0308(a)” with “15A NCAC 02Q .0508(f)” for all monitoring, recordkeeping, and reporting requirements throughout the permit.
5	2.1 A	Restructured this section by moving emission sources (ID Nos. ES-DWH, ES-HM-1 through ES-HM-8, ES-HMC, ES-PCHP, ES-PMFS, ES-CLR-1 through ES-CLR-6, ES-FPH, ES-PB-1 through ES-PB-4, ES-PL-1 and ES-PL-2) to other sections of the permit.
6	2.1 A.1.b	Updated the testing requirement with the most current permitting language.
6	2.1 A.1.c	Clarified the testing requirements. Additional testing will be required when the dry hammermills are rerouted to the dryer furnace and WESP, in series with the RTO.
6 and 7	2.1 A.1.d through g	Added Title V noncompliance statements for 15A NCAC 02D .0515.
8	2.1 A.2	Added the furnace/dryer bypass (ID No. ES-F/DBYPASS) to 15A NCAC 02D .0516. No monitoring, recordkeeping, or reporting requirements are necessary to show compliance with this regulation.
8	2.1 A.2.b	• Removed requirement under 15A NCAC 02D .0516 specifying that the maximum content of diesel fuel fired in the wood-fired direct heat drying system (ID No. ES-DRYER) not exceed 0.5 percent by weight. This requirement is no longer necessary because federal fuel standards limit sulfur in fuel to 15 ppm (aka ultra-low sulfur diesel (ULSD)). • Renumbered permit conditions accordingly.
8	2.1 A.2.b (new numbering)	Updated the testing requirement with the most current permitting language.
8	2.1 A.3.b	Updated the testing requirement with the most current permitting language.
8 and 9	2.1 A.3.c through e	Added Title V noncompliance statements for 15A NCAC 02D .0515.
--	2.1 A.4 (old numbering)	Moved Section 2.1 A.4 for requirements under 15A NCAC 02D .1112 to Section 2.2. A.3.
9 – 12	2.1 B	Created Section 2.1 B. for dry wood hammermills (ID Nos. ES-HM-1 through ES-HM-8) and dried wood handing and conveying operations (ID Nos. ES-DWH and ES-HMC) from equipment previously listed Section 2.1 A.

Pages	Section	Description of Changes
10	2.1 B.1.b	Updated the testing requirement with the most current permitting language.
10 and 11	2.1 B.1.d, e, and f	Added Title V noncompliance statements for 15A NCAC 02D .0515.
11	2.1 B.2.b	Updated the testing requirement with the most current permitting language.
11 and 12	2.1 B.2.c and d	Added Title V noncompliance statements for 15A NCAC 02D .0521.
12 – 16	2.1 C	Created Section 2.1 C. for emission sources associated with the pellet mills and pellet coolers and finishing area (ID Nos. ES-CLR-1 through ES-CLR-5, ES-PMFS, ES-PCHP, ES-PB-1 through ES-PB-4, ES-PL-1 and ES-PL-2) from equipment previously listed Section 2.1 A.
13	2.1 C.1.b	Updated the testing requirement with the most current permitting language.
13	2.1 C.1.c	Clarified the testing requirements. Additional testing will be required when the regenerative catalytic oxidizer/regenerative thermal oxidizer (ID No. CD-RCO) is installed on the pellet presses and coolers (ID Nos. ES-CLR-1 through ES-CLR-6).
14	2.1 C.1.e, f, and g	Added Title V noncompliance statements for 15A NCAC 02D .0515.
15	2.1 C.2.b	Updated the testing requirement with the most current permitting language.
15	2.1 C.3.b	Updated the testing requirement with the most current permitting language.
15 and 16	2.1 C.3.c and d	Added Title V noncompliance statements for 15A NCAC 02D .0521.
17	2.2 A Regulations Table	Removed reference to the following rules because these are now listed in the General Conditions in Section 3.0. • 15A NCAC 02D .0535 • 15A NCAC 02D .0540 • 15A NCAC 02Q .0207 • 15A NCAC 02Q .0304
18	2.2 A.1.c	Removed BACT emission limits for the following emission sources, which have been removed from the permit: • Hammermill area (ID No. ES-HMA) and pellet cooler LP fines relay system (ID No. ES-PCLP) and associated baghouse (ID No. CD-PCLP-BH). • Pellet sampling transfer bin (ID No. ES-PSTB) and associated baghouse (ID No. CD-PSTB-BH).
--	2.2 A.1.g (old numbering)	This requirement was met with the submittal of Air Permit Application 8200152.20B on June 11, 2020. Therefore, the permit condition was removed, and the permit conditions were renumbered.
--	2.2 A.1.h and i (old numbering)	The requirement to reroute the exhaust from the green hammermills (ID Nos. ES-GHM-1 through ES-GHM-3) to the wet electrostatic precipitator (ID No. CD-WESP) and the regenerative thermal oxidizer (ID No. CD-RTO) has been met. Therefore, these permit conditions were removed, and the permit conditions were renumbered.
19 – 23	2.2 A.1.d, e, f and r	Added Title V noncompliance statements for 15A NCAC 02D .0530.

Pages	Section	Description of Changes
20	2.2 A.1.e.v	Removed requirement to conduct initial testing after issuance of Air Permit No. 10386R04. The Permittee completed the initial performance testing on December 16 through 20, 2019, with the exception of particulate matter emission testing from the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8).
22	2.2 A.1.g (new numbering)	This permit condition was modified because the requirement to reroute the exhaust from the green hammermills (ID Nos. ES-GHM-1 through ES-GHM-3) to the wet electrostatic precipitator (ID No. CD-WESP) and the regenerative thermal oxidizer (ID No. CD-RTO) has been met.
22	2.2 A.1.n	Removed reference to "two fireboxes." The regenerative thermal oxidizer (ID No. CD-RTO) is permitted for 45.2 million Btu per hour heat input, which is achieved with three fireboxes.
24 – 29	2.2 A.2.c, d, e, f. g, i and o	Added Title V noncompliance statements for 15A NCAC 02D .0530.
25	2.2 A.2.e.vii	Clarified the language regarding the timing of the initial performance test.
26 – 28	2.2 A.2.g	Updated constants used in avoidance equations.
28	2.2 A.2.j.i	Removed reference to "two fireboxes." The regenerative thermal oxidizer (ID No. CD-RTO) is permitted for 45.2 million Btu per hour heat input, which is achieved with three fireboxes.
29 – 31	2.2 A.3 (new numbering)	• Moved requirements under 15A NCAC 02D .1112 from Section 2.1 A.4 to Section 2.2. A.3. • Renumbered permit conditions accordingly.
29	2.2 A.3.a	• Added statement indicating the section is enforceable only until all controls have been constructed and are operational to reduce facility-wide HAP emissions to below the major source thresholds. • Renumbered the permit conditions accordingly.
29 – 30	2.2 A.3.b	• Added language clarifying schedule for installation and operation of control devices for compliance with 15A NCAC 02D .1112. • Added Title V noncompliance statement for 15A NCAC 02D .1112.
30	2.2 A.3.c	Changed reference for initial testing to Section 2.2 A.4.c.ii through viii.
30 - 31	2.2 A.3.c and d	Added Title V noncompliance statements for 15A NCAC 02D .1112.
32	2.2 A.4.c.vii	Clarified the language regarding the timing of the initial performance test.
32	2.2 A.4.c, d, and i	Added Title V noncompliance statements for 15A NCAC 02D .1112.
--	2.2 A.6 (old numbering)	Removed permit condition for 15A NCAC 02D .0535 because this regulation is included in the General Conditions in Section 3.0.
--	2.2 A.7 (old numbering)	Removed permit condition for 15A NCAC 02D .0540 because this regulation is included in the General Conditions in Section 3.0.
--	2.2 A.9 (old numbering)	Removed permit condition for 15A NCAC 02Q .0207 because this regulation is included in the General Conditions in Section 3.0.
--	2.2 A.10 (old numbering)	Removed permit condition for 15A NCAC 02Q .0304 because this regulation is included in the General Conditions in Section 3.0.
38 – 47	Section 3	Updated the General Conditions to the most recent revision for Title V permits (V5.5 08/25/2020).

Pages	Section	Description of Changes
48	Attachment	Added the list of acronyms.

The following changes were made to the Title V Equipment Editor (TVEE):

- Removed the hammermill area (ID No. ES-HMA) and pellet cooler LP fines relay system (ID No. ES-PCLP) and associated baghouse (ID No. CD-PCLP-BH).
- Added two propane vaporizers (ID No. IES-PV-1 and 2) to the list of insignificant activities.
- Moved the additive handling and storage (ID No. IES-ADD) to the list of insignificant activities.
- Removed the pellet sampling transfer bin (ID No. ES-PSTB) and associated baghouse (ID No. CD-PSTB-BH).

4. Facility Description

Enviva is a wood pellets manufacturing plant located in Faison, Sampson County, North Carolina. The facility is permitted to produce up to 657,000 ODT per year of wood pellets utilizing up to 100% softwood on a 12-month rolling basis. Enviva is currently classified as a major source under the PSD rules because potential emissions of VOCs exceed 250 tons per year (tpy). The facility is also currently considered a major source of HAPs due to total potential HAP emissions and maximum individual HAP emissions exceeding the major source thresholds of 25 tpy and 10 tpy, respectively. The facility has been permitted to install controls to reduce emissions from the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8) and the pellet presses and coolers (ID Nos. ES-CLR-1 through ES-CLR-6) and has accepted enforceable limits on emissions that will allow the facility to become a minor source under PSD and an area source of HAPs.

A description of the emissions sources at Enviva are provided below. Additionally, Figure 1 below provides a schematic of the wood pellets manufacturing process at Enviva.

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

"Green" (i.e., wet) wood is delivered to the plant via trucks as either pre-chipped wood or bark or unchipped logs. Purchased chips and bark are unloaded from trucks into hoppers. From the hoppers the chips and bark are fed to conveyors (ID No. IES-GWH) that transfer the material to green wood storage piles (ID Nos. IES-GWSP-1 through 4) or to bark fuel storage piles (ID Nos. IES-BFSP-1 and 2), as appropriate. Conveyors transferring green wood chips are enclosed.

Purchased chips are screened and oversized chips undergo additional chipping as needed prior to transfer to the green wood storage piles.

<u>Debarking, Chipping, Bark Hog, and Bark Fuel Storage Piles and Bin</u>

Unchipped logs are first debarked by the electric-powered rotary drum debarker (ID No. IES-DEBARK-1) and then sent to the electric-powered chipper (ID No. IES-CHIP-1), which chips the wood to specification for drying. Bark generated from the debarker is transferred via conveyor to the bark hog (ID No. IES-BARKHOG) for further processing.

Purchased bark and bark generated onsite are transferred to the bark fuel storage piles (ID Nos. IES-BFSP-1 and 2) via conveyor. The primary bark fuel storage pile (ID No. IES-BFSP-1) is located under a covered structure. The secondary bark fuel storage pile (ID No. IES-BFSP-2) serves as overflow storage as needed. Following storage in the bark fuel storage piles, the bark is transferred via a walking floor, to a covered conveyor, and finally to a fully enclosed bark fuel bin (ID No. IES-BFB) where the material is pushed into the dryer furnace.

Green Wood Hammermills

Chipped wood is further processed in the green wood hammermills (ID No. ES-GHM-1, ES-GHM-2, and ES-GHM-3) to reduce material to proper size. Emissions from the green wood hammermills are currently recirculated through the dryer and then exhausted to the wet electrostatic precipitator (WESP) and RTO for control (ID Nos. CD-WESP and CD-RTO).

Dryer

The wood-fired direct heat drying system (ID No. ES-DRYER) consists of a furnace and single rotary dryer, which is used to reduce the moisture content of processed green wood chips to a desired level. The direct contact heat is provided to the system via a 250.4 million British thermal unit per hour (MMBtu/hr) total heat input furnace burner system. Fuel for the furnace consists of self-generated and purchased bark; purchased fuel chips (lower grade than chips used in the pelletizing process) and off-specification raw material chips; thermally/ mechanically processed intermediate off-specification raw material; and off-specification wood pellets.

Wood from the dryer is routed to four (4) identical product recovery cyclones operating in parallel, which capture dried wood for further processing. Emissions from the dryer cyclones are combined into a common duct and routed to the existing WESP (ID No. CD-WESP) for PM and metallic HAP removal and then to a propane/natural gas-fired RTO (ID No. CD-RTO), with a maximum heat input rating of 45.2 MMBtu/hr, for control of PM, VOCs, and HAP emissions.

As flue gas exits the dryer and begins to cool, wood tar can condense and coat the inner walls of the dryer ducts creating a fire risk. Two (2) natural gas/propane-fired duct burners (ID Nos. IES-DDB-1 through IES-DDB- 2) (also referred to as double ducts) are used to prevent condensation from occurring and thus reduce the fire risk. The duct from the cyclone outlet to the induced draft fan is heated by one (1) low-NOx burner with a maximum heat input rating of 2.5 MMBtu/hr, and a second 2.5 MMBtu/hr low-NOx burner is used to heat the duct used for exhaust gas recirculation and the WESP.

Dryer and Furnace Bypasses

The furnace and rotary dryer both have bypass stacks (ID No. ES-F/DBYPASS) used to exhaust hot gases for temperature control during start-ups, shutdowns, and malfunctions. Specifically, the furnace bypass stack is used for cold startups, malfunctions, planned shutdowns, while the dryer bypass is used during malfunction and planned shutdowns.

Use of the furnace bypass stack for cold start-ups and shutdowns is limited to 50 hours per year, by permit. Diesel fuel may be used as an accelerant for cold start-up of the furnace. The permit limits the amount of fuel used to no more than 30 gallons per event and no more than 200 gallons per year.

The furnace may also operate in "idle mode" with emissions routed to the furnace bypass stack. The purpose of operation in "idle mode" is to maintain the temperature of the fire brick lining the furnace, which may be damaged if it cools too rapidly. Operation in "idle mode" also significantly reduces the amount of time required to restart the dryer. The furnace may operate up to 500 hours per year in "idle mode," which is defined as operation up to a maximum heat input rate of 10 MMBtu/hr.

Dried Wood Handling

Dried materials from the dryer product recovery cyclones are conveyed to screening operations to remove smaller wood particles. These smaller particles are diverted to the dry hammermill discharge conveyor, while oversized wood is sent to the dry hammermills (ID Nos. ES-HM-1 through 8) for further size reduction prior to pelletization.

Several conveyor transfer points located between the dryer and dry hammermills comprise the emission source collectively called dry wood handling (ID No. ES-DWH). This handling system is completely enclosed with two (2) emission points controlled by individual baghouses (ID Nos. CD-DWH-BH-1 and 2).

Purchased dry shavings are 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 are entirely enclosed except for truck unloading (ID No. IES-DRYSHAVE). From the silo, the dry shavings are then transferred via an enclosed screw conveyor to the dry hammermills for additional processing.

Dry Hammermills

Prior to pelletization, dried wood is reduced to the appropriate size using eight (8) dry hammermills operating in parallel (ID Nos. ES-HM-1 through ES-HM-8). Each dry hammermill includes a product recovery cyclone for capturing hammered wood for further processing.

A portion of the exhaust from each dry hammermill is routed back to the front end of the respective dry hammermill to reduce fresh intake air and thus decrease the volume of air routed to the initial downstream control device (i.e., a dry hammermill baghouse). All exhaust gases ultimately exiting the dry hammermill baghouses will be routed to a quench duct and then (1) to either the dryer furnace in series with the WESP (ID No. CD-WESP) in series with the RTO (ID No. CD-RTO) or (2) directly to the WESP in series with the RTO (ID No. CD-RTO) (or a combination of the (1) and (2)) for emissions control. Under normal operations, all exhaust gas from the dry hammermill baghouses will be exhausted to the dryer furnace prior to treatment by the WESP and RTO. In the event of reduced furnace/dryer operation, a portion of the air flow from the dry hammermill baghouses will be ducted directly to the WESP in series with the RTO. In the event of the shutdown of the furnace/dryer system, all air flow from the dry hammermill baghouses will be ducted directly to the WESP in series with the RTO. At all times during normal operations, one hundred percent (100%) of the exhaust gas from the dry hammermills will be controlled by a baghouse, WESP and RTO.

The purpose of the quench duct is to protect the RTO by reducing the risk of fire. The safety water quench duct is a water curtain and air/water separator system designed to provide a break (non-combustible zone) within the process exhaust ductwork and control device that is intended to defeat any potential deflagration that occurs upstream or downstream of the quench duct to eliminate the potential risk of fire/catastrophic explosion in the process and/or control equipment. Operation of the dry hammermills will be interlocked with operation of the quench duct (i.e., the quench duct must operate for the dry hammermills to operate). If flow in the quench duct drops below the safe level, the dry hammermills will shut down, and the associated control devices, if not affected by the event, will return to an idle ready state.

PM emissions from each existing dry hammermill are controlled via one of the eight (8) individual baghouses (ID Nos. CD-HM-BH-1 through 8) and WESP, and VOC and HAP emissions from the dry hammermills are ultimately controlled via the RTO.

Dry Hammermill Conveying System

A fully enclosed blower system collects and transports fines collected by the dry hammermill baghouses and discharges the fines into a cyclone to separate solids from process air. Process air from the cyclone is recirculated back to the blower, and the solids are discharged to the dry hammermill conveying system (ID No. ES-HMC).

Dried, milled wood is transferred from the dry hammermill material recovery cyclones to the pellet mill feed silo via the hammermill conveying system. This conveying system is controlled by a baghouse (ID NO. CD-HMC-BH).

Pellet Mill Feed Silo

Wood from the dry hammermill product recovery cyclones is transported by a set of conveyors to the pellet mill feed silo (ID No. ES-PMFS) prior to pelletization. PM emissions from the pellet mill feed silo are controlled by a baghouse (ID No. CD-PMFS-BH).

Additive Handling

A dry powder additive is used in the pellet production process to increase the durability of the final product. The powder is added to sized wood from the dry hammermills prior to transfer to the pellet presses. The dry powder contains no hazardous chemicals or VOC materials.

The additive is received in 2,000-pound supersacks and emptied into a hopper. The additive is then transferred from the hopper via screw conveyor and is added to the milled fiber conveyor that transfers milled wood to the pellet presses.

Pellet Press System and Pellet Coolers

Sized wood from the pellet mill feed silo (ID No. ES-PMFS) is mechanically compressed through twelve (12) pellet mills operating in parallel. Two electric boilers (IES-EB01 and IES-EB02) are used to produce steam, which is injected into the raw wood fibers prior to the pelletizing process. The steam acts as a lubricant for the raw wood fibers. Formed pellets are discharged into one of six (6) pellet coolers (ID Nos. ES-CLR-1 through ES-CLR-6) (two mills per each cooler), where cooling air is passed through the pellets. At this point, the pellets contain a small amount of wood fines which are swept out with the cooling air and are controlled utilizing six (6) cyclones operating in parallel prior to discharge to the atmosphere (ID Nos. CD-CLR-1 to 6). The exhaust from the pellet cooler cyclones will be routed to a quench duct and then to an RTO/RCO (ID No. CD-RCO) that will primarily operate in catalytic mode with thermal as a back-up during catalyst cleaning. The purpose of the quench duct is to protect the RTO/RCO by reducing the risk of fire. Operation of the pellet mills and coolers will be interlocked with operation of the quench duct (i.e., the quench duct must be ready for operation for the pellet mills and cooler to operate). No resin or other chemical binding agents are needed for pelletization.

Two high pressure blowers collect fines from the pellet cooler discharge cyclones (ID No. ES-PCHP) and convey them to the cooler high pressure fines filter (ID No. CD-PCHP-BH). Solids separated by the filter are returned to the dry hammermill conveying system (ID No. ES-HMC) and process air is discharged to atmosphere

Each pellet cooler discharges pellets on to screeners before pellets are discharged onto the conveyor transporting the pellets to the truck loadout bins. Pellet screener fines are collected by the pellet cooler low pressure fines relay system and discharged into a baghouse. The fines separated by the baghouse discharge into the pellet cooler high pressure fines relay system (ID No. ES-PCHP) and process air is recirculated back to the low-pressure blower. No emissions are vented to atmosphere from the pellet cooler low-pressure fines relay system, which is a closed loop system.

Finished wood pellets are transferred from the pellet coolers to the truck loadout operation via a conveyor controlled by the finished product handling baghouse (ID No. CD-FPH-BH).

Finished Product Handling and Loadout

Final product is conveyed to four (4) pellet loadout bins (ID Nos. ES-PB-1 through ES-PB-4) that feed the two (2) truck loadout stations (ID Nos. ES-PL-1 and ES-PL-2). At both truck loadout stations, pellets are gravity fed into trucks through a covered chute that automatically telescopes upward during the loadout process to maintain constant contact with the product while loading to prevent fugitive PM emissions. Atmospheric emissions from pellet loadout are minimal because dried wood fines have been removed in the pellet screener, and a slight negative pressure is maintained in the loadout building as a fire prevention measure to prevent any buildup of dust on surfaces within the building. Slight negative pressure is produced via an induced draft fan that exhausts to the finished product handling baghouse (ID No. CD-FPH-BH). This baghouse controls emissions from finished product handling, which encompasses the pellet loadout bins (ID Nos. ES-PB-1 through ES-PB-4) and truck loadout operations (ID Nos. ES-PL-1 and ES-PL-2). Trucks are covered immediately after loading.

Emergency Generator, Fire Water Pump, and Diesel Fuel Storage Tanks

The plant currently has a 689 brake horsepower (bhp) diesel-fired emergency generator (ID No. IES-EG) and a 131 bhp diesel-fired fire water pump engine (ID No. IES-FWP). Aside from maintenance and readiness testing, the generator and fire water pump engines are only used for emergency operations.

Diesel for the emergency generator is stored in a tank of up to 2,500 gallons capacity (ID No. IES-TK-1) and diesel for the fire water pump is stored in a storage tank of up to 1,000 gallons capacity (ID No. IES-TK-2). A third diesel storage tank (ID No. IES-TK-3) with a capacity of 2,500 gallons is also located on-site.

Propane Vaporizers

Enviva has two (2) propane vaporizers (ID Nos. IES-PV-1 and PV-2) to vaporize propane gas received by truck for combustion by the RTO burners, the RTO/RCO burners, and burners for the dryer system double ducts. Each vaporizer has a maximum heat input capacity of 1 MMBtu/hr and combusts propane.

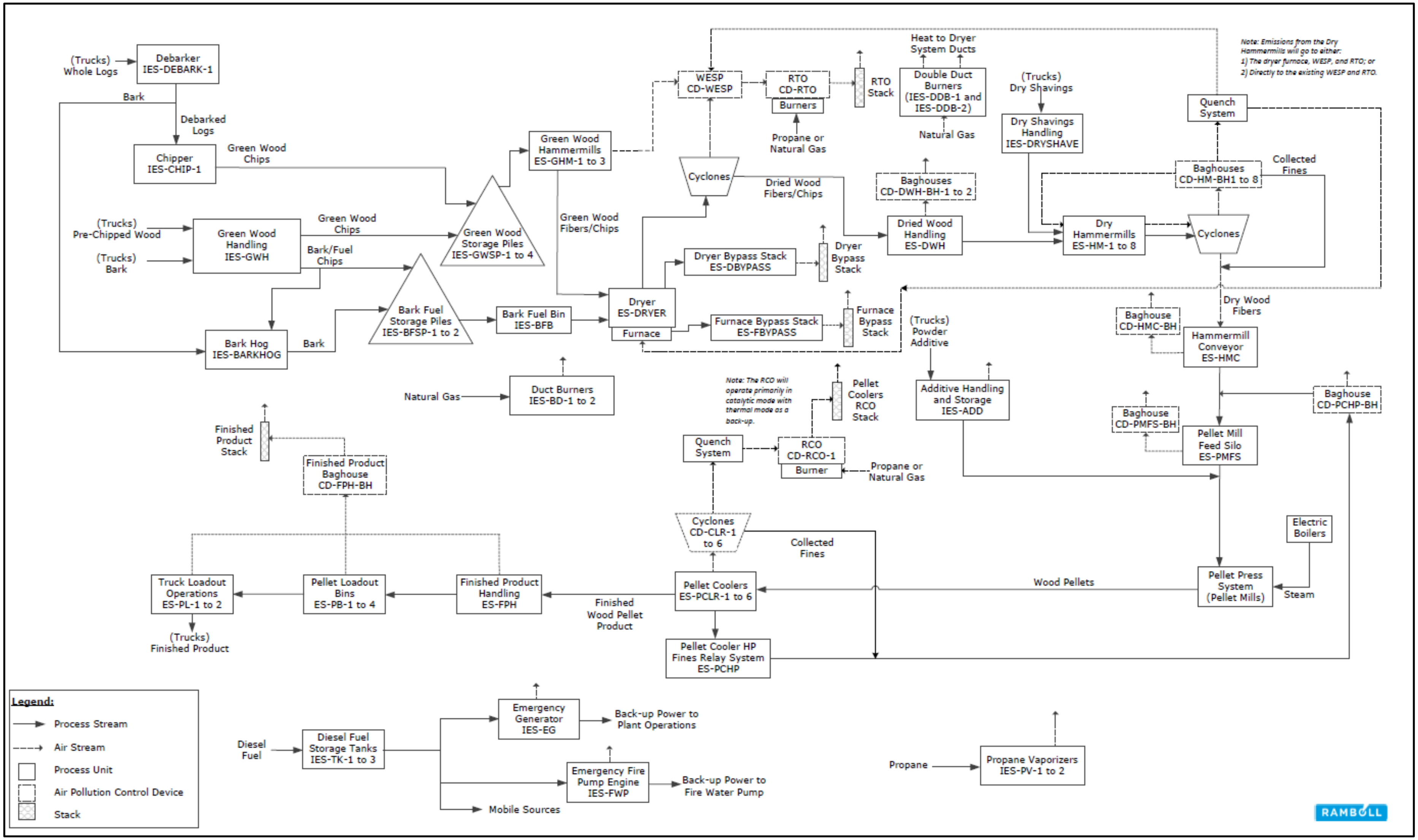

Figure 1. Flow Diagram of Wood Pellet Process at Enviva Sampson

4. Emissions Associated with Permit Modification

Enviva is currently classified as a major source under PSD and a major source of HAPs. The facility is permitted to install additional control devices on the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8) and the pellet presses and coolers (ID Nos. ES-CLR-1 through ES-CLR-6) and has accepted enforceable limits on emissions that will allow the facility to become a minor source under PSD and an area source of HAPs. Upon installation and operation of the additional control devices and initial testing to show compliance, the facility will no longer be a major source with respect to PSD or a major source of HAPs.

Facility-wide Emissions

Facility-wide emissions before and after installation and operation of additional controls on the dry hammermills and pellet presses and coolers are provided in the Table 1 below.

Table 1 – Facility-wide Emissions before and after Additional Controls

Pollutant	Facility-wide Emissions before Installation and Operation of Controls on Dry Hammermills and Pellet Presses and Coolers (tpy)	Facility-wide Emissions after Installation and Operation of Controls on Dry Hammermills and Pellet Presses and Coolers (tpy)	Major Source Threshold (tpy)
PM (TSP)	205	234	250
PM10	93	86.8	250
PM2.5	40	47.8	250
CO	219	108	250
NOx	221	112	250
SO_2	27.6	27.6	250
VOC	831	114	250
Largest HAP	83 (methanol)	6.8 (methanol)	10
Total HAPs	149	22.9	25
CO2e	256,475	273,545	100,000

Notes:

- Facility-wide emissions for before installation and operation of controls are provided in Appendix C of Permit Application No. 8200152.18A.
- Facility-wide emissions for after installation and operation of controls are provided in Appendix D of the amended first time Title V Permit Application No. 8200152.17B submitted on October 2, 2020.
- With the exception of HAP emissions, the emissions in this table do not include fugitive emissions. Enviva is not one of the 28 named categories under PSD regulations. In accordance with 40 CFR 51.166(b)(2)(v), "fugitive emissions shall not be included in determining for any of the purposes of this section whether a physical change in or change in the method of operation of a major stationary source is a major modification, unless the source belongs to one of the source categories listed in paragraph (b)(1)(iii) of this section."
- Although GHG emissions exceed the PSD threshold of 100,000 tons per year, the June 23, 2014 Supreme Court Decision in "Utility Air Regulatory Group v. EPA" indicates that EPA may not treat GHGs as an air pollutant for the specific purpose of determining whether a source is required to obtain a PSD permit. Therefore, Enviva will not become a major source under PSD due to GHG because all criteria pollutants remain below the PSD major thresholds after installation and operation of controls on the dry hammermills and pellet presses and coolers.

Emission calculations are provided in Attachment 1 to this document.

Changes in Emissions from Air Permit No. 10386R05

As noted in Section 1 above, Enviva has requested changes to the equipment at the facility, which will result in differences in emissions from the most recent permit (Air Permit No. 10386R05). An overview of these emissions changes is provided in Table 2 below, and more detailed calculations are provided in Attachment 1. Additional discussion is also provided below for the propane vaporizers and additive storage handling.

Propane Vaporizers

Enviva is adding two propane vaporizers (ID Nos. IES-PV-1 and 2) to the list of insignificant activities as part of this modification. The vaporizers have a maximum heat input of 1 MMBtu/hr, each, and the resulting emissions meet the definition of insignificant activities under 15A NCAC 02Q .0503(8). Please refer to page A-27 of the attachment for the emission calculations from the propane vaporizers.

Additive Storage and Handling

Additive storage and handling (ID No. ES-ADD) was previously permitted as an emission source controlled by a baghouse (ID No. CD-ADD) because bulk additive material was originally to be delivered by truck and pneumatically unloaded into a storage silo equipped with a baghouse. As noted above, this material is instead received in 2,000-pound supersacks and emptied into a hopper.

PM emissions from additive storage and handling were previously calculated based on an estimated exhaust flow rate of the baghouse and an estimated grain loading. The change in equipment configuration dictated a change in emission calculation methodology. Updated potential emissions from transfer activities are now calculated based on AP-42, Section 13.2.4, Aggregate Handling and Storage Piles. Updated emissions from the additive storage handling are below the thresholds in 15A NCAC 02Q .0503(8), and this source is considered an insignificant activity. Please refer to page A-28 of the attachment for the emission calculations from additive storage and handling.

Table 2 – Changes in Emissions Resulting from Requested Equipment Changes in Addendum to First Time Title V Permit Application

Pollutant	Emissions associated with Air Permit No. 10386R05 (including fugitives) (tpy)	Emissions as Reported in Amended First Time Title V Permit Application (including fugitives) (tpy)	Difference (tpy)	Description of Change
CO	107.07	107.79	0.72	Addition of IES-PV-1 and 2: +0.72 tpy
NOx	111.15	112.4	1.24	Addition of IES-PV-1 and 2: +1.24 tpy
PM	267.95	267.57	-0.38	Removal of ES-HMA and ES-PCLP: -0.47 tpy ES-PCHP exhaust flowrate increase: +0.32 tpy Addition of IES-PV-1 and 2: +0.067 tpy Removal of ES-PSTB emissions: -0.15 tpy Removal of CD-ADD-BH to control IES-ADD: -0.15 tpy
PM_{10}	99.07	98.69	-0.38	Removal of ES-HMA and ES-PCLP: -0.47 tpy ES-PCHP exhaust flowrate increase: +0.32 tpy Addition of IES-PV-1 and 2: +0.067 tpy Removal of ES-PSTB emissions: -0.15 tpy Removal of CD-ADD-BH to control IES-ADD: -0.15 tpy
$PM_{2.5}$	50.78	50.39	-0.38	Removal of ES-HMA and ES-PCLP: -0.47 tpy ES-PCHP exhaust flowrate increase: +0.32 tpy Addition of IES-PV-1 and 2: +0.067 tpy Removal of ES-PSTB emissions: -0.15 tpy Removal of CD-ADD-BH to control IES-ADD: -0.15 tpy
SO_2	27.57	27.58	0.005	Addition of IES-PV-1 and 2: +0.0052 tpy
VOC	122.3	122.4	0.09	Addition of IES-PV-1 and 2: +0.096 tpy Storage Tank calculation methodology update: -1.14E-03 tpy
CO_2e	272,322	273,545	1,223	Addition of IES-PV-1 and 2: +1223 tpy

Notes:
The emissions in this table differ from those in Table 1 because this table includes fugitive emissions. Emissions in Table 1 are being evaluated for applicability of PSD requirements, and fugitive emissions are not included in this evaluation because Enviva is not one of the 28 named categories under PSD regulations. In accordance with 40 CFR 51.166(b)(2)(v), "fugitive emissions shall not be included in determining for any of the purposes of this section whether a physical change in or change in the method of operation of a major stationary source is a major modification, unless the source belongs to one of the source categories listed in paragraph (b)(1)(iii) of this section."

Sample Calculation

A sample calculation of NOx emissions from the facility is provided below.

- **NOx Emissions from RTO controlling furnace, green hammermills, and dry hammermills**

NOx emissions from Dryer/Furnace, Green Hammermills, and RTO Fuel Combustion

NOx EF = 0.2845 lb/ODT: Emission factor (EF) based on Sampson December 2019 compliance test average results plus 50% contingency.

Throughput = 657,000 ODT/yr

NOx emissions = NOx EF (lb/ODT) * Throughput (ODT/yr) * (ton/2000 lbs)
= 0.285 lb/ODT * 657,000 ODT/yr * (ton/2000 lbs)
= 93.46 tons/yr

Thermally Generated NOx Emissions from Dry Hammermills

Maximum high heating value (HHV) of VOC constituents = 0.0185 MMBtu/lb

Uncontrolled VOC emissions = 204 tons/yr: Emissions based on Sampson December 2019 compliance test average result, adjusted for pine percentage plus 20% contingency, and an assumed VOC control of 95%

Heat input of uncontrolled VOC emissions = VOC emissions (tons/yr) * HHV (MMBtu/lb) * CF
= 204 ton/yr * 0.0185 MMBtu/lb * (2000 lb/ton)
= 7,552 MMBtu/yr

NOx EF = 0.098 lb/MMBtu: AP-42, Section 1.4 - Natural Gas Combustion, 07/98. EF converted from lb/mmscf to lb/MMBtu based on assumed heating value of 1,020 Btu/scf for natural gas per AP-42 Section 1.

NOx emissions = NOx EF (lb/MMBtu) * Heat input of VOC (MMBtu/yr) * (ton/2000 lbs)
= 0.098 lb/MMBtu * 7,552 MMBtu/yr * (ton/2000 lbs)
= 0.37 tons/yr

NOx emissions = 93.46 tons/yr + 0.37 tons/yr = 93.8 ton/yr

- **NOx Emissions from RCO/RTO controlling pellet coolers**

NOx emissions from propane combustion in RCO/RTO (propane is higher than natural gas for NOx emissions)

Total RCO/RTO heat input of burner = 19.8 MMBtu/hr

NOx EF = 13 lb/1000 gallons propane: EF for propane combustion obtained from AP-42 Section 1.5 - Liquefied Petroleum Gas Combustion, 07/08. Heat content of propane was assumed to be 91.5 MMBtu/1000 gal per AP-42 Section 1.5.

Gallons = Heat input of burners (MMBtu/hr) / heat content of propane (MMBtu/gal)
= 19.8 MMBtu/hr / 91.5 mmbtu/1000 gal = 216 gal/hour = 1,895,607 gal/yr

NOx emission = 13 lb/1000 gal * 1,895,607 gal/yr * (ton/2000 lb)

NOx emissions = 12.3 tons/yr

Thermally Generated Potential Criteria Pollutant Emissions from Pellet Mills and Pellet Coolers

Maximum HHV of VOC constituents = 0.0185 MMBtu/lb

Uncontrolled VOC emissions = 735 tons/yr: Emissions derived based on Sampson December 2019 compliance test, process information, an appropriate contingency based on engineering judgement and an assumed VOC control of 95%,

Heat input of uncontrolled VOC emissions = VOC emissions (tons/yr) * HHV (MMBtu/lb) * CF
= 735 ton/yr * 0.0185 MMBtu/lb * (2000 lb/ton)
= 27,189 MMBtu/yr

NOx EF = 0.098 lb/MMBtu: AP-42, Section 1.4 - Natural Gas Combustion, 07/98. EF converted from lb/mmscf to lb/MMBtu based on assumed heating value of 1,020 Btu/scf for natural gas per AP-42 Section 1

NOx emissions = NOx EF (lb/MMBtu) * Heat input of VOC (MMBtu/yr) * (ton/2000 lbs)
= 0.098 lb/MMBtu * 27,189 MMBtu/yr * (ton/2000 lbs)
= 1.33 tons/yr

NOx emissions = 12.3 tons/yr + 1.33 tons/yr = 13.63 ton/yr

- **NOx Emissions from Bypass Scenarios**

NOx emissions from furnace bypass during cold start
Heat input of furnace = 37.56 MMBtu/hr, assuming 15% of heat input of furnace
NOx EF = 0.22 lb/MMBtu: Emission rates based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers.
Annual operating hours = 50 hours per year
NOx emissions = NOx EF (lb/MMBtu) * Heat Input (MMBtu/hr) * (Hours per year) * (ton/2000 lbs)
= 0.22 lb/MMBtu * 37.56 MMBtu/hr * 50 hours/yr * (ton/2000 lbs)
= 0.21 tons/yr

NOx emissions from combustion of diesel fuel during cold start
Maximum diesel fuel usage = 200 gal/yr
NOx EF = 20 lb/10^3 gal: Emission factor as reported in NCDAQ's "Fuel Oil Combustion Emissions Calculator, Revision G" (11/15/2012) for No. 2 fuel oil.
NOx emissions = Fuel usage (gal/yr) * NOx EF (lb/10^3 gal) * (ton/2000 lbs)
=200 gal/yr * 20 lb/10^3 gal * (ton/2000 lbs)
= 2.0E-3 tons/yr

NOx emissions from furnace bypass during idle mode
(Idle mode is defined as operation at up to a maximum heat input rate of 10 MMBtu/hr for no more than 500 hours per year.)

Heat input of furnace = 10 MMBtu/hr
NOx EF = 0.22 lb/MMBtu: Emission rates based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers.
Annual operating hours = 500 hours per year
NOx emissions = NOx EF (lb/MMBtu) * Heat Input (MMBtu/hr) * (Hours per year) * (ton/2000 lbs)
= 0.22 lb/MMBtu * 10 MMBtu/hr * 500 hours/yr * (ton/2000 lbs)
= 0.55 tons/yr

NOx emissions = 0.21 tons/yr +2.0E-3 tons/yr + 0.55 tons/yr = 0.76 ton/yr

- **NOx Emissions from Duct Burners**

(propane is higher than natural gas for NOx emissions)
Heat input of burners = 2.5 MMBtu/hr per burner * 2 burners = 5 MMBtu/hr
NOx EF = 6.5 lb/1000 gal for low NOx burners. AP-42 Section 1.5 does not include an EF for low-NOx burners. Per AP-42 Section 1.4, low-NOx burners reduce NOx emissions by accomplishing combustion in stages, reducing NOx emissions 40 to 85% relative to uncontrolled emission levels. A conservative control efficiency of 50% was applied to the uncontrolled NOx EF from AP-42 Section 1.5. This reduction is consistent with the magnitude of reduction between the uncontrolled and low-NOx EF in AP-42 Section 1.4.

Gallons per year = Heat input of burners (MMBtu/hr) / heat content of propane (MMBtu/gal)
= 5 mm btu/hr / 91.5 mmbtu/1000 gal * 8,760 hours/yr
= 478,689 gal/yr
NOx emission = 6.5 lb/1000 gal * 478,689 gal/yr * (ton/2000 lb)
NOx emissions = 1.56 tons/yr

- **NOx Emissions from Diesel-fired Emergency Generator**
  Engine Size = 713 bhp
  Hours of Operation = 500 hours per year for an emergency generator
  NOx EF = 4.0 g/kW-hr = 6.57E-03 lb/hp-hr: EF based on emissions standards from NSPS Subpart IIII for emergency engines with a maximum power rating greater than 50 horsepower [§60.4202(a)(2)]. NOx emissions are based on combined emission standard for NMHC+NOx.

  NOx emissions = NOx EF (lb/hp-hr) * Engine Size (hp) * hours of operation per year * (ton/2000 lbs)
  = 6.57E-03 lb/hr-hr * 713 bhp * 500 hours/yr * (ton/2000 lbs)
  NOx emissions = 1.17 tons/yr

- **NOx Emissions from Diesel-fired Fire Pump**

  Engine Size = 131 bhp
  Hours of Operation = 500 hours per year for an emergency generator
  NOx EF = 3.40 g/kW-hr = 5.58E-03 lb/hp-hr: Emissions factor for NOx obtained from generator's spec sheet.

  NOx emissions = NOx EF (lb/hp-hr) * Engine Size (hp) * hours of operation per year * (ton/2000 lbs)
  = 5.58E-03 lb/hr-hr * 131 bhp * 500 hours/yr * (ton/2000 lbs)
  NOx Emissions = 0.18 tons/yr

- **NOx Emissions from Vaporizers**

  Heat input of burners = 1.0 MMBtu/hr per vaporizer * 2 vaporizers = 2 MMBtu/hr
  NOx EF = 13 lb/1000 gal. AP-42 Section 1.5, Table 1.5-1

  Gallons per year = Heat input of burners (MMBtu/hr) / heat content of propane (MMBtu/gal)
  = 2 MMBtu/hr / 91.5 mmbtu/1000 gal * 8,760 hours/yr
  = 191,475 gal/yr
  NOx emission = 13 lb/1000 gal * 191,475 gal/yr * (ton/2000 lb)
  NOx emissions = 1.24 tons/yr

- **Facility-Wide NOx Emissions**
  - NOx Emissions from RTO controlling furnace, green hammermills, and dry hammermills = 93.8 tons/yr
  - NOx Emissions from RCO/RTO controlling pellet coolers = 13.63 tons/yr
  - NOx Emissions from Bypass Scenarios = 0.76 tons/yr
  - NOx Emissions from Duct Burners = 1.56 tons/yr
  - NOx Emissions from Diesel-fired Emergency Generator = 1.17 tons/yr
  - NOx Emissions from Diesel-fired Fire Pump = 0.18 tons/yr
  - NOx Emissions from the vaporizers = 1.24 tons/yr

  Facility-Wide NOx Emissions = 112.4 tons/yr

Notes for Sample Calculation:
MM = million
Btu = British thermal unit
scf = standard cubic feet
ODT = oven dried tons

6. Applicable Regulations

Enviva is subject to the following regulations. For all regulations below, the permit conditions will be updated with the most current permitting language, and noncompliance statements will be added to the permit where applicable.

- 15A NCAC 02D .0515, Particulates from Miscellaneous Industrial Processes – The following emission sources are subject to 02D .0515:
  - The green wood hammermills (ID Nos. ES-GHM-1, ES-GHM-2 and ES-GHM-3) controlled by a wet electrostatic precipitator (ID No. CD-WESP) in series with a regenerative thermal oxidizer (ID No. CD-RTO);
  - The wood-fired direct heat drying system (ID No. ES-DRYER) controlled by a wet electrostatic precipitator (ID No. CD-WESP) in series with a regenerative thermal oxidizer (ID No. CD-RTO);
  - The dry wood handling operations (ID No. ES-DWH) controlled by baghouses (ID Nos. CD-DWH-BH-1 and CD-DWH-2);
  - The dry hammermills (ID Nos. ES-HM-1 through ES-HM-8) controlled by baghouses (ID Nos. CD-HM-BH1 through CD-HM-BH8) routed to a wet electrostatic precipitator (ID No. CD-WESP) in series with a regenerative thermal oxidizer (ID No. CD-RTO) OR by bagfilters (ID Nos. CD-HM-BH-1 through 8) routed to the dryer furnace (ID No. ES-DRYER), in series with a wet electrostatic precipitator (ID No. CD-WESP), in series with a regenerative thermal oxidizer (ID No. CD-RTO);
  - The hammermill conveying system (ID No. ES-HMC) controlled by baghouse (ID No. CD-HMC-BH);
  - The pellet mill feed silo (ID No. ES-PMFS) controlled by baghouse (ID No. CD-PMFS-BH);
  - The pellet presses and pellet coolers (ID Nos. ES-CLR-1 through ES-CLR-6) controlled by cyclones (ID Nos. CD-CLR-1 through CD-CLR-6) in series with a regenerative catalytic oxidizer/regenerative thermal oxidizer (ID No. CD-RCO);
  - The pellet cooler HP fines relay system (ID No. ES-PCHP) controlled by baghouse (ID No. CD-PCHP-BH); and
  - The finished product handling (ID No. ES-FPH), pellet load-out bins (ID Nos. ES-PB-1 through ES-PB-4), and pellet mill load-out (ID No. ES-PL-1 and ES-PL-2) controlled by baghouse (ID No. CD-FPH-BH).

  Allowable emissions of PM under 02D .0515 for these emission sources are calculated from the following equations:

  $E = 4.10 \times P^{0.67}$ for units with process weight rate less than 30 tons per hour

  or

  $E=55.0(P)^{0.11}- 40$ for units with process weight rates greater than 30 tons per hour

  where:

  E = allowable emission rate in pounds per hour calculated to three significant figures
  P = process weight rate in tons per hour

  Enviva conducted emission source testing from December 16 through 20, 2019. Shannon Vogel of the SSCB reviewed and approved the testing results in a memorandum dated March 11, 2020. The results of the tests indicated compliance with 02D .0515 for the dryer/green hammermill controlled via the WESP and RTO and the pellet presses controlled via cyclones, as shown in the table below.

Emission Source	Pollutant	Test Results (lb/hr)	Process Rate (ODT/hr)	Allowable PM (lb/hr)	Compliance Demonstrated
Dryer/Green Wood Hammermills – RTO Stack	Total PM	6.25	67.8	47.5	YES
Pellet Cooler ES-CLR-5		10.18	10.75	20.1	YES

Enviva did not conduct PM emission testing for compliance with 02D .0515 for the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8) during the December 2019 source tests due to issues with the BACT emission limit. See discussion under 15A NCAC 02D .0530 below for a detailed explanation.

In addition to testing, Enviva ensures compliance with 02D .0515 with the effective operation of the control devices (i.e., cyclones, baghouses, WESP, and RTO, RCO/RTO, as appropriate). Enviva also conducts visual inspections of baghouses and cyclones monthly and conducts internal inspections of the baghouses annually. To ensure compliance and effective operation of the WESP, Enviva monitors and records the secondary voltage and minimum current through each grid of the precipitator daily. Enviva is also required to conduct inspection and maintenance of the WESP, the RTO, and the RCO/RTO in accordance with the manufacturers' recommendations.

PM emissions are also expected from the bypass stacks (ID No. ES-F/DBYPASS), which are uncontrolled. Enviva must maintain production records of the process weight for the bypass events to allow for calculation of allowable emission ("E") in the above equation. As defined in 15A NCAC 02D .0515(b), "process rate means the total weight of all materials introduced into any specific process that may cause any emission of particulate matter. Solid fuels charged are considered as part of the process weight." No reporting is required for PM emissions from the bypass stacks (ID No. ID No. ES-F/DBYPASS).

Continued compliance is anticipated.

- o <u>15A NCAC 02D .0516, Sulfur Dioxide Emissions from Combustion Sources</u> – The wood-fired direct heat drying system (ID No. ES-DRYER), duct burners (ID Nos. IES-DDB-1 and IES-DDB-2), furnace bypass (ID No. ES-F/DBYPASS), propane vaporizers (IES-PV-1 and IES-PV-2), existing RTO (ID No. CD-RTO), and RCO/RTO (ID No. CD-RCO) are subject to this rule and are limited to a sulfur dioxide emission rate of no more than 2.3 pounds sulfur dioxide (SO_2) per million Btu heat input. No monitoring, recordkeeping, or reporting is required when firing wood, diesel fuel, natural gas, or propane in these emission sources because of the low sulfur content of the fuels. These fuels are inherently low enough in sulfur that continued compliance is anticipated.

- <u>15A NCAC 02D .0521, Control of Visible Emissions</u> –The following equipment was manufactured after July 1, 1971 and must not have visible emissions of more than 20 percent opacity when averaged over a six-minute period, except as specified in 15A NCAC 02D .0521(d).
  - o The green wood hammermills (ID Nos. ES-GHM-1, ES-GHM-2 and ES-GHM-3)
  - o The wood-fired direct heat drying system (ID No. ES-DRYER)
  - o The dry wood handling operations (ID No. ES-DWH)
  - o The dry hammermills (ID Nos. ES-HM-1 through ES-HM-8)
  - o The hammermill conveying system (ID No. ES-HMC)
  - o The pellet mill feed silo (ID No. ES-PMFS)

  - The pellet presses and pellet coolers (ID Nos. ES-CLR-1 through ES-CLR-6)
  - The pellet cooler HP fines relay system (ID No. ES-PCHP)
  - The finished product handling (ID No. ES-FPH), pellet load-out bins (ID Nos. ES-PB-1 through ES-PB-4), and pellet mill load-out (ID No. ES-PL-1 and ES-PL-2).
  - Furnace/dryer bypass (ID No. ES-F/DBYPASS).

  For all emission sources noted above, except for the furnace/dyer bypass, Enviva must conduct monthly visible emission observations to ensure compliance with 02D .0521. Enviva must conduct a visible emission evaluation for the bypass stacks (ID No. ES-F/DBYPASS) during each idle mode event. Continued compliance is anticipated.

- 15A NCAC 02D .0530, Prevention of Significant Deterioration – This regulation is applicable until the installation and operation of RCO/RTO controls on the pellet presses and coolers and the rerouting of the dry hammermill exhaust to the dryer furnace or WESP and initial testing is conducted to demonstrate compliance. Until that time, Enviva is considered a major source under PSD.

  Enviva previously triggered a facility-wide BACT analysis for emissions of NOx, VOC, PM/PM10/PM2.5, carbon monoxide (CO), and GHGs. The facility conducted source testing from December 16 through 20, 2019 to demonstrate compliance with BACT emission limits for NOx, VOC, PM/PM10/PM2.5, and CO. Shannon Vogel of the SSCB reviewed and approved the testing results in a memorandum dated March 11, 2020. The results of the BACT testing are provided in the table below.

Emission Source	Pollutant	Test Results	BACT Limit	Compliance Demonstrated
Dryer/Green Wood Hammermills – RTO Stack	PM filterable	0.018 lb/ODT	0.105 lb/ODT	Yes
	PM10	0.010 lb/ODT		Yes
	PM2.5	0.0041 lb/ODT		Yes
	NOx	0.078 lb/MMBtu	0.20 lb/MMBtu	Yes
	CO	0.078 lb/MMBtu	0.21 lb/MMBtu	Yes
	VOC - OTM 26	0.043 lb/ODT	0.15 lb/ODT	Yes
Dry wood handling	VOC - OTM 26	0.028 lb/ODT	0.12 lb/ODT	Yes
Dry hammermills (ID Nos. ES-HM-3 and 4)	VOC - OTM 26	0.40 lb/ODT	0.60 lb/ODT	Yes
Pellet Cooler ES-CLR-5	Total PM	0.074 gr/dscf	0.04 gr/dscf	**No**
	PM10	0.0072 gr/dscf	0.0057 gr/dscf	**No**
	PM2.5	0.00026 gr/dscf	0.0007 gr/dscf	Yes
	VOC - OTM 26	0.40 lb/ODT	0.60 lb/ODT	Yes

Notes:
- Emissions from two dry hammermills (ID Nos. ES-HM-3 and ES-HM-4) were tested, and the results were assumed to be representative of all eight hammermills.
- Emissions from one pellet cooler (ID No. ES-CLR-5) was tested, and the results were assumed to be representative for all six pellet coolers.
- PM emission testing of the dry wood handling system (ID No. ES-DWH) was not conducted because isokinetic sampling was not possible due to the small size of the exhaust vent. Therefore, only testing of VOC and HAP emissions was conducted for this emission source.

  The results of the test indicated compliance with all BACT emission limits tested, except for PM and PM10 emissions from the pellet coolers. NCDAQ issued Enviva a Notice of Violation (NOV) on May 5, 2020 for these violations. (See Section 10 below for more details on the violation.) The facility entered into SOC 2020-004 with NCDAQ to address this violation, and a schedule of compliance incorporating requirements of the SOC is included in Section 2.3 of the permit to enable the facility to operate until the facility becomes a PSD minor source pursuant to this permit.

The BACT emission limit for PM2.5 from the dry hammermills (ID Nos. ES-HM1 through ES-HM-8) is estimated as 0.35% of PM emissions. This fraction results in an exit grain loading rate that is cleaner than ambient air, which is not realistic. Consequently, Enviva did not conduct PM emission testing for the dry hammermills during the December 2019 source tests. Enviva instead requested, and was granted, an extension for testing PM from the dry hammermills until September 30, 2020. A second extension was requested and was addressed in SOC 2020-004.

Enviva submitted Permit Application No. 8200152.20A on February 17, 2020 to revise this BACT emission limit. With the issuance of Air Permit No 10386R05 on June 9, 2021, which will result in the facility being classified as a minor source of PSD, revising the BACT emission limit is no longer necessary. This permit application was withdrawn by Enviva on June 16, 2021.

- <u>15A NCAC 02D .0540, Particulates from Fugitive Dust Emissions</u> – This rule is applicable facility-wide, and as required by this rule, Enviva shall not cause or allow fugitive dust emissions to cause or contribute to substantive complaints or excess visible emissions beyond its property boundary.

  Under this rule, NCDAQ can require the facility develop a fugitive dust plan in certain situations. Pursuant to 15A NCAC 02D .0540(e), a fugitive dust plan shall be required if ambient monitoring or air dispersion modeling show a violation or a potential for a violation of a National Ambient Air Quality Standard (NAAQS) for PM, or if NCDAQ observes excess fugitive dust emissions from the facility beyond the property boundary for six (6) minutes in any one hour using EPA Method 22. This rule is complaint driven, meaning a fugitive dust plan is triggered by "a second substantive complaint in a 12-month period" in accordance with 15A NCAC 02D .0540(d).

  No fugitive dust complaints have been received against Enviva since beginning operations in October 2016. Therefore, a fugitive dust plan is not warranted at this time.

- <u>15A NCAC 02D .1100, Control of Air Toxic Pollutants</u> – When Enviva becomes a minor source of HAPs, the facility will no longer be subject to the 112(g) Case-by-Case MACT and will become subject to NC Air Toxics. The facility previously submitted air dispersion modeling to demonstrate compliance with NC Air Toxics. See Section 8 below for more discussion of NC Air Toxics.

- <u>15A NCAC 02D .1112, 112(g) Case-by-Case Maximum Achievable Control Technology</u> – This regulation is applicable until the installation and operation of RCO/RTO controls on the pellet presses and coolers and the rerouting of the dry hammermill exhaust to the dryer or WESP. Until that time, Enviva is considered a major source of HAPs and is subject to a Case-by-Case MACT determination under 112(g) of the Clean Air Act. NCDAQ concluded 112(g) Case-by-Case MACT was use of a low HAP emitting design for the dryer (ID No. ES-DRYER) without the addition of add-on controls and the Sampson facility was not subject to numeric HAP emission limits under Section 112(g).[1]

  NCDAQ issued a letter dated March 1, 2019 requiring Enviva to undergo a revised 112(g) Case-by-Case MACT determination for the pellet coolers and presses and to submit an amended permit

[1] Application No. 8200152.14B, received 09/03/2014.

application for the revised determination in accordance with 40 CFR 63.43(e). Enviva responded in a letter dated March 21, 2019. In accordance with the settlement agreement dated May 31, 2019 resolving the dispute between Enviva and NCDAQ and as incorporated into Section 2.1 A.4 of Air Permit No. 10386R05, Enviva must complete the following:

- Within six months of issuance of Air Permit No. 10386R04 on October 2, 2019, Enviva shall submit to NCDAQ an application requesting authorization for installation of an RCO/RTO to control VOC and HAP emissions from the pellet presses and pellet coolers (ID Nos. ES-CLR-1 through ES-CLR-6).

  Submittal of permit application no. 8200152.20B on April 2, 2020 (received April 7, 2020) fulfilled this requirement. Note: the permit application was deemed complete on June 11, 2020.

- Installation and startup of the control on the pellet presses and coolers shall be completed no later than June 1, 2021, provided that, if a permit authorizing the same is not issued until after June 1, 2020, installation and startup of the control device shall be completed within twelve months of permit issuance. Initial compliance for the RCO/RTO shall be demonstrated in accordance with the future issued permit.

  Because the permit was not issued by June 1, 2020, Enviva must complete installation and operation of the RCO/RTO within 12 months of the issuance of Air Permit No. 10386R05 on June 9, 2021.

- Within six months of issuance of Air Permit No. 10386R04 on October 2, 2019, Enviva shall submit to NCDAQ an application requesting authorization for either (i) the installation of an RCO/RTO to control VOC and HAP emissions from the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8), or (ii) an engineering solution that will result in an equivalent or greater reduction in VOC and HAP emissions from the dry hammermills.

  Submittal of permit application no. 8200152.20B on April 2, 2020 (received April 7, 2020) fulfilled this requirement. Note the permit application was deemed complete on June 11, 2020. This application requested that exhaust from the dry hammermills be rerouted to the dryer furnace or directly to the WESP. Emissions from the dry hammermills will ultimately be controlled by the existing baghouses, WESP, and RTO. This control schematic is considered an appropriate engineering solution as required by the settlement agreement.

- Installation and startup of the control device or engineering solution for the dry hammermills shall be completed by no later than June 1, 2021, provided that, if a permit authorizing the same is not issued until after June 1, 2020, installation and startup of the control device shall be completed within twelve months of permit issuance. Initial compliance for the RCO/RTO or engineering solution shall be demonstrated in accordance with the future issued permit.

  Because the permit was not issued by June 1, 2020, Enviva must complete rerouting of the exhaust from the dry hammermills within 12 months of the issuance of Air Permit No. 10386R05 on June 9, 2021.

- <u>15A NCAC 02Q .0317 "Avoidance Conditions"</u> – With the installation and operation of RCO/RTO (ID No. CD-RCO) on the pellet presses and coolers and the rerouting of the dry hammermill exhaust to the dryer furnace or WESP, Enviva will become a minor source of PSD and HAP emissions. Discussion on the avoidance conditions is provided below:

PSD Avoidance
The permit includes PSD avoidance conditions for CO, NOx, PM/PM10/PM2.5, and VOCs to limit emissions of these pollutants to below 250 tons per year. The PSD avoidance conditions for each of these pollutants are calculated as the sum of the following:

- Total tons of emissions from the outlet of the thermal regenerative oxidizer (ID No. CD-RTO) per month
- Total tons of emissions from the outlet of the catalytic regenerative oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) per month
- Total tons of emissions per month from the furnace/dryer bypass (ID No. ES-F/DBYPASS) per month
- Pollutant-Specific Constant determined from numerous miscellaneous sources at the facility.

Each pollutant specific constant is determined from the facility-wide the potential emissions from miscellaneous sources at the Enviva Sampson plant, and the constants are provided in the following table:

Pollutant	Potential to Emit (ton/month)	Sources of Emissions
PM	0.27	Emergency generator, fire water pump, baghouses, bark hog, propane vaporizers, double duct burners, additive handling and storage, and green wood handling operations
PM10	0.25	
PM2.5	0.19	
NOx	0.35	Emergency generator, fire water pump, double duct burners, and propane vaporizers
CO	0.30	Emergency generator, fire water pump, double duct burners, and propane vaporizers
VOC	1.25	Emergency generator, fire water pump, dried wood handling, bark hog, double duct burners, propane vaporizers, and storage tanks
Notes: Fugitive emissions are not included in the pollutant specific constants. Enviva is not one of the 28 named categories under PSD regulations. In accordance with 40 CFR 51.166(b)(2)(v), "fugitive emissions shall not be included in determining for any of the purposes of this section whether a physical change in or change in the method of operation of a major stationary source is a major modification, unless the source belongs to one of the source categories listed in paragraph (b)(1)(iii) of this section."		

The emissions must be calculated in a manner consistent with the calculation methodologies in the permit application supporting this limitation. Emission factors used in the calculations for each source shall be appropriate for the annual average softwood content that has been processed in the previous 12-month period. All emission factors, including those developed via testing, must be reviewed and approved by NCDAQ. Annual emissions must be calculated monthly and reported semiannually to ensure compliance with the PSD avoidance limit.

HAP Avoidance
The permit includes an avoidance condition to limit HAP emissions to less than 10 tons per year of any one HAP and less than 25 tons per year for all HAPs combined. Once the facility becomes a HAP minor source, Enviva will be required to quantify controlled HAP emissions via testing,

calculate annual HAP emissions monthly, and report emissions semiannually to ensure compliance with the HAP avoidance limit.

- 15A NCAC 02Q .0711, Emission Rates Requiring a Permit – When Enviva becomes a minor source of HAPs, the facility will no longer be subject to the 112(g) Case-by-Case MACT and will become subject to NC Air Toxics. TAP emissions from the reconfigured facility that are less than their TPER will be included in a permit condition. See Section 8 below for more discussion of NC Air Toxics.

7. NSPS, NESHAP/MACT, NSR/PSD, 112(r), CAM

NSPS

The diesel-fired emergency generator (ID No. IES-EG) and diesel-fired fire water pump (ID No. IES-FWP) are subject to "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines," 40 CFR 60, Subpart IIII (NSPS Subpart IIII). Because these emission sources are classified as insignificant activities, no NSPS permit condition for these engines is included in the permit. A summary of the requirements under NSPS Subpart IIII for these engines is provided in Attachment 2 for reference.

Continued compliance with NSPS Subpart IIII for these engines is anticipated. No changes to the NSPS status of the facility are expected as a result of this modification.

NESHAPS/MACT

Enviva will remain a major source of HAPs until the installation and operation of the RCO/RTO on the pellet presses and coolers and the rerouting of the dry hammermill exhaust to the dryer furnace or WESP. As a major source of HAPs, Enviva is subject to the following regulations.

Case-by-Case MACT

The Case-by-Case MACT for the dryer (ID No. ES-DRYER) is the low HAP dryer without the addition of add-on controls and no numeric HAP emission limits under Section 112(g). Case-by-Case MACT for the pellet presses and coolers is control by an RCO/RTO (ID No. CD-RCO) and the case-by-Case MACT for the dry hammermills is control by an RTO by either routing emissions to the dryer furnace followed by the WESP and RTO or directly to the WESP followed by the RTO. These emission control options were permitted with the issuance of Air Permit No. 10386R05 on June 9, 2021.

Extensive testing is required to quantify emission rates before and after installation of the new control devices.

MACT Subpart ZZZZ

The diesel-fired emergency generator (ID No. IES-EG) and diesel-fired fire water pump (ID No. IES-FWP) are subject to the "NESHAP for Stationary Reciprocating Internal Combustion Engines, 40 CFR Part 63," MACT Subpart ZZZZ. They are considered new under MACT Subpart ZZZZ because were constructed on or after June 12, 2006. Because these emission sources are classified as insignificant activities, no MACT permit condition for these engines is included in the permit. A summary of the requirements for MACT Subpart ZZZZ is provided below for reference:

Engine	Requirements under MACT Subpart ZZZZ
689 hp diesel-fired emergency generator (ID No. IES-EG)	Initial notification only required for this engine (*new stationary RICE with a site rating of more than 500 brake HP located at a major source of HAP emissions that does not operate or is not contractually obligated to be available for more than 15 hours per calendar year for the purposes specified in 40 CRF 63.6640(f)(2)(ii) and (iii))* [40 CFR 63.6590(b)(1)(i)]
131 hp diesel-fired fire water pump (ID No. IES-FWP)	This engine (*new stationary RICE with a site rating of less than or equal to 500 brake HP located at a major source of HAP emissions*) meets the requirements of MACT Subpart ZZZZ by meeting the requirements of NSPS Subpart IIII, for compression ignition engines. [40 CFR 63.6590(c)(7)]

Continued compliance with MACT Subpart ZZZZ for these engines is anticipated.

With the installation and operation of RCO/RTO on the pellet presses and coolers and the rerouting of the dry hammermill exhaust to the dryer furnace or WESP, Enviva will become a minor source of HAPs. Enviva will be required to quantify emissions of HAPs via testing, calculate HAP emissions monthly, and report emissions semiannually to ensure compliance with the HAP avoidance limit. Enviva will no longer be subject to Case-by-Case MACT, and the engines at the facility will become subject to GACT Subpart ZZZZ as discussed below.

GACT Subpart ZZZZ
The diesel-fired emergency generator (ID No. IES-EG) and diesel-fired fire water pump (ID No. IES-FWP) will become subject to the "NESHAP for Stationary Reciprocating Internal Combustion Engines, 40 CFR Part 63," GACT Subpart ZZZZ once the facility becomes an area source of HAPs. They are considered new under GACT Subpart ZZZZ because they were constructed on or after June 12, 2006. Because these emission sources are classified as insignificant activities, no GACT permit condition for these engines is included in the permit. A summary of the requirements for GACT Subpart ZZZZ for these engines is provided below for reference:

Engine	Requirements under MACT Subpart ZZZZ
689 hp diesel-fired emergency generator (ID No. IES-EG) 131 hp diesel-fired fire water pump (ID No. IES-FWP)	Theses engines (*new stationary RICE located at an area source of HAP emissions*) meet the requirements of MACT Subpart ZZZZ part by meeting the requirements of NSPS Subpart IIII, for compression ignition engines. [40 CFR 63.6590(c)(1)]

Compliance with GACT Subpart ZZZZ for these engines is anticipated.

<u>NSR/PSD</u>
Enviva will remain a major source under PSD until the installation and operation of the RCO/RTO on the pellet presses and coolers and the rerouting of the dry hammermill exhaust from the baghouses to either the dryer furnace, followed by the WESP and the RTO OR directly to the WESP and the RTO (when the furnace is bypassed). As a PSD major facility, the facility must comply with BACT emission

limits, follow all monitoring, recordkeeping, or reporting requirements, and conduct emission testing for BACT in accordance with the permitted schedule.

Once the facility becomes a PSD minor source, Enviva will be required to verify controlled emissions via testing, calculate emissions monthly, and report emissions semiannually to ensure compliance with the PSD avoidance limit.

NCDAQ will not require PM testing for the dry wood handling operations (ID No. ES-DWH) because the small size of the exhaust vent does not allow for isokinetic sampling. Additionally, PM emissions from this source are minimal and are estimated at only 0.15 tpy, as shown below on page A1-16 of Attachment 1.

112(r)
The facility is not required to maintain a written Risk Management Plan under Section 112(r) of the Clean Air Act because it does not store any of the regulated substances in quantities greater than the thresholds in 112(r).

Compliance Assurance Monitoring (CAM)
Compliance Assurance Monitoring (CAM) under 40 CFR 64 applies to emission units located at a Title V major source that use a control device to achieve compliance with an emission limit and whose pre-controlled emissions exceed the major source thresholds. A CAM plan is required to be submitted with the initial Title V operating permit application for emission units whose post-controlled emissions exceed the major source thresholds (i. e., large pollutant-specific emission units [PSEU]). For emission units with post-controlled emissions below the major source thresholds, a CAM plan must be submitted with the first Title V permit renewal application.

Enviva has no large PSEU, and any CAM plans that may be required are not due until submittal of the initial Title V renewal. Applicability of 40 CFR 64 requirements will be fully assessed at that time.

8. Facility Wide Air Toxic Emissions

An air toxics dispersion modeling analysis was conducted in support of Air Permit No. 10386R04 to evaluate ambient impacts of facility-wide toxic air pollutants (TAPs). Emissions rates of TAPs were first compared with their associated TAP permitting emission rate (TPERs) in 15A NCAC 02Q .0711. Nine TAPs exceeded their TPER and were further evaluated in facility-wide modeling.

Three scenarios were modeled (normal operation, furnace bypass – idle mode, and furnace bypass – cold start-up and planned shutdown) because different sources would be operating under each scenario. The maximum impact and associated scenario are provided in the table below. The air dispersion modeling adequately demonstrated compliance on a source-by-source basis for all TAPS modeled.

Pollutant	Averaging Period	Scenario	Maximum Impact (µg/m^3)	AAL (µg/m^3)	% of AAL
Acrolein	1-hour	Normal and Furnace Idle	66.9	80	84 %
Arsenic	Annual	Furnace Cold Start-Up	0.00021	0.0021	10 %
Benzene	Annual	Normal	0.0053	0.12	5 %
Cadmium	Annual	Furnace Cold Start-Up	0.0000392	0.0055	1 %
Chlorine	1-hour	Furnace Cold Start-Up	0.17	900	<1 %

Pollutant	Averaging Period	Scenario	Maximum Impact ($\mu g/m^3$)	AAL ($\mu g/m^3$)	% of AAL
	24-hour	Furnace Cold Start-Up	0.065	37.5	<1 %
Formaldehyde	1-hour	Normal and Furnace Idle	42.4	150	28 %
Hydrogen Chloride	1-hour	Furnace Cold Start-Up	4.1	700	1 %
Manganese	24-hour	Furnace Cold Start-Up	0.13	31	<1 %
Phenol	1-hour	Normal and Furnace Idle	33.3	950	4 %

Notes:
- Nancy Jones of the Air Quality Analysis Branch issued a memorandum on July 25, 2019 approving the air dispersion modeling. Note. the "% of AAL" for arsenic was mistakenly reported as 1% in this memorandum, but the value is actually 10%, as specified above.
- Emissions from the dryer bypass are accounted for in the furnace bypass stack modeled emission rates used in the air dispersion modeling. Tom Anderson, Supervisor of the AQAB, indicated in an e-mail on December 29, 2020 that additional air dispersion modeling for a separate dryer bypass is not warranted.

NCDAQ reviewed the TAP emissions provided in this permit application and noted that ten TAPs exceeded their TPERs. In addition to the nine TAPs modeled previously, hexachlorodibenzo-p-dioxin also exceeded its TPER, as shown in the table below.

TAPs	Potential Emissions			TPER			Modeling Required?
	lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr	
Hexachlorodibenzo-p-dioxin	2.13E-05	5.11E-04	0.186			0.0051	YES

Enviva provided additional air dispersion modeling for hexachlorodibenzo-p-dioxin on June 14, 2020.[2] Matt Porter of the AQAB issued a memorandum on August 10, 2020 approving the air dispersion modeling for this TAP. Three scenarios were modeled (normal operation, furnace bypass – idle mode, and furnace bypass – cold start-up and planned shutdown) and the scenario with the maximum impact is provided in the table below. The modeling adequately demonstrated compliance on a source-by-source basis for hexachlorodibenzo-p-dioxin. Therefore, this modification will not present "an unacceptable risk to human health."

Pollutant	Averaging Period	Max Impact Scenario	Maximum Impact ($\mu g/m^3$)	AAL ($\mu g/m^3$)	% of AAL
Hexachlorodibenzo-p-dioxin	Annual	Furnace Bypass Idle Mode	1.760E-05	7.60E-05	23.2 %

As indicated in the addendum to Permit Application No. 8200152.20B received on December 11, 2020, Enviva clarified that that diesel fuel may be used as an accelerant for cold start-up of the furnace. The permit limits the amount of fuel used to no more than 30 gallons per event and no more than 200 gallons per year. TAP emissions from the diesel fuel were estimated to ensure that additional air dispersion modeling was not required. TAP emissions are provided in the table below. Tom Anderson, supervisor

[2] In the letter issued on May 13, 2020 to Enviva, NCDAQ indicated styrene and hexachlorodibenzo-p-dioxin both exceeded their TPERS. However, this statement was in error. Styrene did not exceed its TPER and will not be addressed further in this review.

of the AQAB, reviewed these emissions and indicated in an e-mail on December 29, 2020 that additional air dispersion modeling is not warranted for fuel combustion in the furnace.

Toxic Air Pollutant	Emission Factor ($lb/10^3$ gal)	Emissions			TPERS			Modeling Required?
		lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr	
Arsenic Unlisted Compounds	5.60E-04	1.12E-04	1.12E-04	1.12E-04			0.053	NO
Benzene	2.75E-03	5.50E-04	5.50E-04	5.50E-04			8.1	NO
Beryllium Metal (unreacted)	4.20E-04	8.40E-05	8.40E-05	8.40E-05			0.28	NO
Cadmium Metal (elemental unreacted)	4.20E-04	8.40E-05	8.40E-05	8.40E-05			0.37	NO
Soluble chromate compounds, as chromium (VI) equivalent	4.20E-04	8.40E-05	8.40E-05	8.40E-05		0.013		NO
Fluorides (sum fluoride compounds)	3.73E-02	7.46E-03	7.46E-03	7.46E-03	0.064	0.34		NO
Formaldehyde	4.80E-02	9.60E-03	9.60E-03	9.60E-03	0.04			NO
Manganese Unlisted Compounds	8.40E-04	1.68E-04	1.68E-04	1.68E-04		0.63		NO
Mercury, vapor	4.20E-04	8.40E-05	8.40E-05	8.40E-05		0.013		NO
Methyl chloroform	2.36E-04	4.72E-05	4.72E-05	4.72E-05	64	250		NO
Nickle Metal	4.20E-04	8.40E-05	8.40E-05	8.40E-05		0.13		NO
Toluene	7.97E-02	1.59E-02	1.59E-02	1.59E-02	14.4	98		NO
Xylene	1.40E-03	2.80E-04	2.80E-04	2.80E-04	16.4	57		NO

Notes:
- Emission factors from NCDAQ's "Fuel Oil Combustion Emissions Calculator, Revision G" (11/15/2012) for No. 2 fuel oil.
- Emissions calculated assuming 200 gallons of diesel fuel fired per year, 200 gallons fired per day, and 200 gallons fired per hour as worst-case scenarios.

All emission sources at Enviva that emit TAPs are currently considered by NCDAQ to be affected sources pursuant to 40 CFR Part 63 because they are subject to either a 112(g) Case-by-Case MACT or a MACT standard under 40 CFR Part 63. Such emission sources are exempt from NC Air Toxics in accordance with 15A NCAC 02Q .0702(a)(27)(B) and (C).

Enviva will become a minor source of HAPs after installation and operation of the RCO/RTO on the pellet presses and coolers and the rerouting of the dry hammermill exhaust from the baghouses to either the dryer furnace, followed by the WESP and RTO OR directly to the WESP followed by the RTO (when the furnace is bypassed). At that time, the facility will lose this exemption and will become subject to NC Air Toxics. A condition is included in the permit for NC Air Toxics applicability after the facility becomes a minor source of HAPs. Compliance is anticipated.

The diesel-fired emergency generator (ID No. IES-EG) and diesel-fired fire water pump (ID No. IES-FWP) remain subject to the GACT Subpart ZZZZ when the facility becomes a minor source of HAPs. Therefore, these emission sources remain exempt from NC Air Toxics and are not included in the NC Air Toxics permit condition.

9. Compliance Status

DAQ has reviewed the compliance status of Enviva. Steve Allen of FRO conducted the most recent compliance inspection at the facility on May 28, 2021. The Permittee appeared to be operating in compliance during the inspection.

Enviva has had the following compliance issues within the past five years:

- On February 3, 2017, Enviva was issued a Notice of Violation (NOV) for recordkeeping violations observed during an inspection on January 26, 2017.
- On November 3, 2017, Enviva was issued a Notice of Violation/Notice of Recommendation for Enforcement (NOV/NRE) for exceeding the BACT emission limit for CO. During stack testing conducted April 18-19, 2017, the lowest three consecutive-run average of CO emissions was 0.224 pounds per million Btu, which exceeded the BACT limit of 0.21 pounds per million Btu.
- On March 5, 2018, Enviva was assessed a civil penalty in the amount of $5,333, including investigation costs, for the CO emission exceedance. The civil penalty was paid in full on March 26, 2018.
- On June 5, 2018, Enviva was issued a NOV/NRE for exceeding the BACT emission limit for VOC. During stack testing conducted March 29, 2018, the three-run average VOC emissions was 1.21 pounds per ODT, which exceeded the BACT emission limit of 1.07 pounds per ODT.
- On September 21, 2018, NCDAQ and Enviva finalized SOC 2018-003 addressing the exceedance of the BACT emission limit for VOC. The SOC expired on October 2, 2019 with the issuance of Air Permit No. 10386R04, which contained revised BACT limits.
- On May 5, 2020, NCDAQ issued an NOV for exceeding the BACT emission limits for PM and PM10 from the pellet presses and coolers during source testing in December 2019.
- On August 12, 2020, NCDAQ issued a NOV/NRE for operating the RCO below the minimum firebox temperatures established during the source testing in December 2019.
- On August 21, 2020, Enviva submitted an amended semiannual report for the first half 2020, indicating eighty-three (83) separate instances when the 3-hour rolling average was below the minimum firebox temperatures. On January 26, 2021, a civil penalty in the amount of $7,337, including costs, was assessed for these violations. The penalty was paid in full on February 23, 2021.
- On December 16, 2020, NCDAQ and Enviva finalized SOC 2020-004 addressing exceedance of the BACT emission limit for PM and PM_{10} provided a schedule for the installation of additional controls on the facility's pellet presses and coolers and dry hammermills to reduce potential emissions from the facility to below PSD applicability thresholds.

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

Enviva submitted comments on the draft permit on August 11, 2021. Significant comments from Enviva are addressed here. Minor typographical errors, incorrect references, etc. are not addressed below but are corrected in the permit.

- Clarification of production records under 15A NCAC 02D .0515 in Section 2.1 A.1.d – Enviva requests the permit condition for15A NCAC 02D .0515 for the furnace/dryer bypass (ID No. ES-F/DBYPASS) be modified to state "production records of fuel burned" for clarification.
  Response

This permit condition represents NCDAQ shell language and is generally not modified. However, NCDAQ agrees to this change for clarification because there is no drying taking place during cold start-up of the furnace. The process rate is the amount of solid fuel combusted in the furnace.

- Initial testing for BACT requirements – Enviva requests the requirement to conduct initial testing for compliance with BACT be removed. Testing required upon issuance of Air Permit No. 10386R04 was previously conducted on December 16 through 20, 2019, with the exception of particulate matter emission testing from the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8).

  Response
  NCDAQ concurs and will remove this requirement. The permit continues to require that initial compliance testing be conducted after completion of the Softwood Expansion Project (permitted as part of Air Permit No. 10386R04) and after installation of additional controls making the facility a PSD minor.

- Consolidate testing requirement – Enviva requests to consolidate the initial testing requirements to avoid having to conduct three separate compliance testing within a short time period. Enviva also requested to extend the time period of annual performance testing, if approved in advance by NCDAQ.

  Response
  NCDAQ will allow consolidated testing, provided the consolidated testing is approved in advance by NCDAQ. NCDAQ will not allow the annual testing to be extend beyond 13 months from the previous testing.

- Removal of initial testing under 15A NCAC 02Q .1112 – Enviva requests to remove the initial compliance testing required under Section 2.2 A.3.c for the Case-by-Case MACT. Enviva indicates this initial testing was conducted on December 16 through 20, 2019.

  Response
  As part of the settlement agreement dated May 31, 2019, Enviva had to propose controls on the dry hammermills and pellet presses and coolers for compliance with the Case-by-Case MACT. The testing conducted on December 16, through 20, 2019 did not include these proposed controls. Therefore, the initial testing for compliance with the Case-by-Case MACT has not been conducted, and this requirement will remain in the permit.

- Modification of emission tracking under PSD avoidance - Enviva requests to remove CO, NOx, PM, PM10, and PM2.5 emissions from tracking under PSD avoidance. As justification, Enviva indicates potential emissions are well below the major source threshold for these pollutants and tracking is not warranted.

  Response
  Enviva is currently a major facility under PSD, and the current permit (No. 10386R05) includes BACT emission limits for all these pollutants. The current permit also requires controls on the pellet presses and coolers and dry hammermills that will reduce emission to PSD minor source levels. Until the facility demonstrates it can operate at minor source levels, tracking these pollutants is warranted. No change will be made to the permit at this time.

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

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

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

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

11. Public Notice

A notice of the DRAFT Title V Permit shall be made pursuant to 15A NCAC 02Q .0521. The notice will provide for a 30-day comment period, with an opportunity for a public hearing. Consistent with 15A NCAC 02Q .0525, the EPA will have a concurrent 45-day review period. Copies of the public notice shall be sent to persons on the Title V mailing list and EPA. Pursuant to 15A NCAC 02Q .0522, a copy of each permit application, each proposed permit and each final permit shall be provided to EPA. Also, pursuant to 02Q .0522, a notice of the DRAFT Title V Permit shall be provided to each affected State at or before the time notice is provided to the public under 02Q .0521 above. No states or local agencies are affected entities within 50 miles of the facility.

The NCDAQ Director has also determined a public hearing for this permit application is in the best interest of the public, and a public hearing for the Draft Permit was held via WebEx on October 19, 2021. The public hearing announcement was published in the Sampson Independent on September 15, 2021, the Duplin Times on September 16, 2021, and the NCDAQ's website on September 15, 2021

12. Public Comments and Hearing Officer's Report

All public comments were addressed in the Hearing Officer's Report dated November 30, 2021 The following changes were made to the draft permit that went to public notice on September 15, 2021, as recommended in Melinda Wolanin's Hearing Officer's Report dated November 30, 2021.

Limit on maximum hourly production rate

Report Recommendation
The air permit should include the maximum hourly production rate of 120 ODT in the PSD Avoidance condition to ensure that production remains more consistent throughout the year.

Resolution
Section 2.2 A.2.c.v was modified to include the maximum hourly production rate, as provided below:

v. The Permittee shall not process more than 120 ODT per hour, not to exceed 657,000 ODT/year on a rolling 12-month average basis.

13. Other Regulatory Considerations

- A P.E. seal was included in the updated 1st time TV permit application addendum received on October 2, 2020.
- A zoning consistency determination is not required for this application.
- A permit fee is required and was paid on September 29, 2017.

14. Recommendations

The first-time Title V permit application for Enviva Pellets Sampson, LLC in Faison, Sampson County, NC has been reviewed by NCDAQ to determine compliance with all procedures and requirements. NCDAQ has determined this facility is complying or will achieve compliance, as specified in the permit, with all requirements that are applicable to the affected sources. NCDAQ recommends the issuance of Air Permit No. 10386T06.

ATTACHMENT 1
Emission Calculations

ATTACHMENT 1
Emission Calculations

Summary of Facility-wide Criteria Pollutant and CO_2e Potential Emissions
Enviva Pellets Sampson, LLC
Faison, Sampson 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	--	--	--	--	--	--	--	--	1.64	--
IES-BARKHOG	Bark Hog	--	--	--	--	0.24	0.13	0.13	--	0.30	--
ES-DRYER	250.4 MMBtu/hr wood-fired direct heat drying system	CD-WESP; CD-RTO	WESP; RTO	93.8	93.8	37.6	34.8	31.7	27.4	60.8	256,230
ES-GHM-1 through 3	Three (3) Green Wood Hammermills										
ES-HM-1 through 8	Eight (8) Dry Hammermills										
ES-FBYPASS	Furnace Bypass	--	--	2.06	0.76	1.98	1.78	1.54	0.086	0.058	721
IES-DDB-1 and -2	Double Duct Burners	--	--	1.80	1.56	0.17	0.17	0.17	0.013	0.24	3,048
ES-HMC	Hammermill Conveying System	CD-HMC-BH	One (1) baghouse	--	--	0.23	0.23	0.23	--	--	--
ES-PMFS	Pellet Mill Feed Silo	CD-PMFS-BH	One (1) baghouse	--	--	0.37	0.37	0.37	--	--	--
ES-CLR-1 through 6	Twelve Pellet Mills and Six (6) Pellet Coolers	CD-CLR-1 through 6; CD-RCO	Six (6) simple cyclones (one on each cooler); RCO/RTO	8.26	13.7	191	47.2	12.2	0.051	37.7	12,069
ES-PCHP	Pellet Cooler HP Fines Relay System	CD-PCHP-BH	One (1) baghouse	--	--	0.47	0.47	0.47	--	--	--
ES-FPH	Finished Product Handling	CD-FPH-BH	One (1) baghouse	--	--	1.28	1.16	0.51	--	--	--
ES-PB-1 through 4	Four (4) Pellet Loadout Bins										
ES-PL-1 and 2	Two (2) Pellet Mill Loadouts										
ES-DWH	Dried wood handling operations	CD-DWH-BH-1 through -2	Two (2) baghouses	--	--	0.30	0.30	0.30	--	14.3	--
IES-ADD	Additive Handling and Storage	--	--	--	--	3.67E-04	1.74E-04	2.63E-05	--	--	--
IES-GWH	Green wood handling operations	--	--	--	--	0.081	0.038	0.0058	--	--	--
IES-TK-1	2,500 gal diesel storage tank	--	--	--	--	--	--	--	--	3.32E-04	--
IES-TK-2	500 gal diesel storage tank	--	--	--	--	--	--	--	--	6.79E-05	--
IES-TK-3	3,000 gal diesel storage tank	--	--	--	--	--	--	--	--	0.0014	--
IES-GWSP-1 through 4	Green wood storage piles	--	--	--	--	15.4	7.68	1.15	--	6.87	--
IES-BFSP-1 and 2	Bark fuel storage piles	--	--	--	--	0.64	0.32	0.048	--	0.29	--
IES-DRYSHAVE	Dry shavings material handling	--	--	--	--	0.054	0.025	0.0039	--	--	--
IES-DEBARK-1	Debarker	--	--	--	--	1.13	0.62	0.62	--	--	--
IES-BFB[1]	Bark fuel bin	--	--	--	--	--	--	--	--	--	--
IES-EG	689 hp diesel-fired emergency generator	--	--	1.03	1.17	0.059	0.059	0.059	0.0019	0.114	204
IES-FWP	131 hp diesel-fired fire water pump	--	--	0.070	0.18	0.0092	0.0092	0.0092	4.79E-04	0.0081	50.4
--	Paved Roads	--	--	--	--	16.4	3.27	0.80	--	--	--
IES-PV-1 and 2	Two (2) 1 MMBtu/hr Propane Vaporizers	--	--	0.72	1.24	0.067	0.067	0.067	0.0052	0.096	1,223
			Total Emissions:	**108**	**112**	**268**	**98.7**	**50.4**	**27.6**	**122**	**273,545**
			Total Excluding Fugitives[2]:	**108**	**112**	**234**	**86.8**	**47.8**	**27.6**	**114**	**273,545**

Notes:

1. Bark fuel is transferred by walking floor to covered conveyors to fully enclosed bark fuel bin to pusher(s) into furnace. Therefore, there are no emissions expected from the bin.
2. 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.

Abbreviations:

ES - Emission Sources
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
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compounds

ATTACHMENT 1
Emission Calculations

Summary of Facility-wide HAP Potential Emissions
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Pollutant	HAP	NC TAP	CD-RTO[1] (tpy)	ES-FBYPASS (tpy)	IES-DDB-1 and -2 (tpy)	CD-RCO[2] (tpy)	IES-EG (tpy)	IES-FWP (tpy)	ES-DWH (tpy)	IES-CHIP-1 (tpy)	IES-BARKHOG (tpy)	IES-PV-2 and 2 (tpy)	Total (tpy)
Acetaldehyde	Y	Y	2.03	2.9E-03	3.3E-07	0.14	3.1E-05	1.8E-04	--	--	--	--	2.17
Acetophenone	Y	Y	1.8E-07	1.1E-08	--	--	--	--	--	--	--	--	1.9E-07
Acrolein	Y	Y	2.07	1.4E-02	3.9E-07	0.83	9.8E-06	2.1E-05	--	--	--	--	2.91
Ammonia	N	Y	0.62	--	0.069	0.27	--	--	--	--	--	--	0.96
Antimony & Compounds	Y	N	6.3E-04	2.7E-05	--	--	--	--	--	--	--	--	6.6E-04
Arsenic & Compounds	Y	Y	1.8E-03	7.6E-05	4.3E-06	1.7E-05	--	--	--	--	--	--	0.0019
Benzo(a)pyrene	Y	Y	1.4E-04	8.9E-06	2.6E-08	1.0E-07	3.2E-07	4.3E-08	--	--	--	--	1.5E-04
Benzene	Y	Y	0.37	1.4E-02	0.016	0.062	0.0010	2.1E-04	--	--	--	6.22E-03	0.47
Beryllium	Y	Y	9.0E-05	3.8E-06	2.6E-07	1.0E-06	--	--	--	--	--	--	9.5E-05
Butadiene, 1,3-	Y	Y	--	--	--	--	--	9.0E-06	--	--	--	--	9.0E-06
Cadmium	Y	Y	5.4E-04	1.4E-05	2.4E-05	9.4E-05	--	--	--	--	--	--	6.7E-04
Carbon tetrachloride	Y	Y	2.5E-03	1.5E-04	--	--	--	--	--	--	--	--	0.0026
Chlorine	Y	Y	0.87	2.7E-03	--	--	--	--	--	--	--	--	0.87
Chlorobenzene	Y	Y	1.8E-03	1.1E-04	--	--	--	--	--	--	--	--	0.0019
Chloroform	Y	Y	1.5E-03	9.6E-05	--	--	--	--	--	--	--	--	0.0016
Chromium VI	-[3]	Y	5.5E-04	1.2E-05	3.0E-05	1.2E-04	--	--	--	--	--	--	7.1E-04
Chromium–Other compds	Y	N	1.4E-03	6.0E-05	--	--	--	--	--	--	--	--	0.0015
Cobalt compounds	Y	N	5.2E-04	2.2E-05	1.8E-06	7.1E-06	--	--	--	--	--	--	5.5E-04
Dichlorobenzene	Y	Y	2.3E-04	--	2.6E-05	1.0E-04	--	--	--	--	--	--	3.6E-04
Dichloroethane, 1,2-	Y	Y	1.6E-03	1.0E-04	--	--	--	--	--	--	--	--	0.0017
Dichloropropane, 1,2-	Y	N	1.8E-03	1.1E-04	--	--	--	--	--	--	--	--	0.0019
Dinitrophenol, 2,4-	Y	N	9.9E-06	6.2E-07	--	--	--	--	--	--	--	--	1.0E-05
Di(2-ethylhexyl)phthalate	Y	Y	2.6E-06	1.6E-07	--	--	--	--	--	--	--	--	2.7E-06
Ethyl benzene	Y	N	1.7E-03	1.1E-04	--	--	--	--	--	--	--	--	0.0018
Formaldehyde	Y	Y	1.97	1.5E-02	0.033	0.64	0.0001	2.7E-04	0.07	--	--	0.013	2.74
Hexachlorodibenzo-p-dioxin	N	Y	8.8E-05	5.5E-06	--	--	--	--	--	--	--	--	9.32E-05
Hexane	Y	Y	0.35	--	0.039	0.15	--	--	--	--	--	--	0.54
Hydrochloric acid	Y	Y	2.08	6.5E-02	--	--	--	--	--	--	--	--	2.15
Lead and Lead Compounds	Y	N	3.8E-03	1.7E-04	1.1E-05	4.3E-05	--	--	--	--	--	--	0.0040
Manganese & Compounds	Y	Y	0.13	5.5E-03	8.2E-06	3.2E-05	--	--	--	--	--	--	0.13
Mercury	Y	Y	3.3E-04	1.2E-05	5.6E-06	2.2E-05	--	--	--	--	--	--	3.7E-04
Methanol	Y	N	2.28	--	--	3.94	--	--	0.16	0.33	0.060	--	6.77
Methyl bromide	Y	N	8.2E-04	5.2E-05	--	--	--	--	--	--	--	--	8.7E-04
Methyl chloride	Y	N	1.3E-03	7.9E-05	--	--	--	--	--	--	--	--	0.0013
Methyl ethyl ketone	N	Y	3.0E-04	1.9E-05	--	--	--	--	--	--	--	--	0.0003
Methylene chloride	Y	Y	0.016	1.0E-03	--	--	--	--	--	--	--	--	0.017
Naphthalene	Y	N	0.005	3.3E-04	1.3E-05	5.4E-05	1.6E-04	1.9E-05	--	--	--	--	0.0060
Nickel	Y	Y	3.0E-03	1.1E-04	4.5E-05	1.8E-04	--	--	--	--	--	--	0.0034
Nitrophenol, 4-	Y	N	6.0E-06	3.8E-07	--	--	--	--	--	--	--	--	6.4E-06
Pentachlorophenol	Y	Y	5.6E-05	1.8E-07	--	--	--	--	--	--	--	--	5.6E-05
Perchloroethylene	Y	Y	0.042	1.3E-04	--	--	--	--	--	--	--	--	0.042
Phenol	Y	Y	1.41	1.8E-04	--	0.41	--	--	--	--	--	--	1.82
Phosphorus Metal, Yellow or White	Y	N	2.1E-03	9.3E-05	--	--	--	--	--	--	--	--	0.0022
Polychlorinated Biphenyls	Y	Y	4.5E-07	2.8E-08	--	--	--	--	--	--	--	--	4.7E-07
Polycyclic Organic Matter	Y	N	0.15	4.3E-04	8.8E-04	3.5E-03	2.6E-04	3.9E-05	--	--	--	3.50E-04	0.15
Propionaldehyde	Y	N	1.69	2.1E-04	--	0.18	--	--	6.9E-02	--	--	--	1.94
Selenium Compounds	Y	N	2.2E-04	9.6E-06	5.2E-07	2.0E-06	--	--	--	--	--	--	2.3E-04
Styrene	Y	Y	0.10	6.5E-03	--	--	--	--	--	--	--	--	0.11
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	Y	4.7E-10	3.0E-11	--	--	--	--	--	--	--	--	5.0E-10
Toluene	Y	Y	5.1E-02	3.2E-03	7.3E-05	2.9E-04	3.5E-04	9.4E-05	--	--	--	--	0.0551
Trichloroethane, 1,1,1-	Y	Y	0.034	1.1E-04	--	--	--	--	--	--	--	--	0.034
Trichloroethylene	Y	Y	1.6E-03	1.0E-04	--	--	--	--	--	--	--	--	0.0017
Trichlorofluoromethane	N	Y	2.2E-03	1.4E-04	--	--	--	--	--	--	--	--	0.0024
Trichlorophenol, 2,4,6-	Y	N	1.2E-06	7.6E-08	--	--	--	--	--	--	--	--	1.3E-06
Vinyl Chloride	Y	Y	9.9E-04	6.2E-05	--	--	--	--	--	--	--	--	1.0E-03
Xylene	Y	Y	1.4E-03	8.6E-05	--	--	2.4E-04	6.5E-05	--	--	--	--	0.0018
Total HAP Emissions[4] (tpy)	**--**	**--**	**15.7**	**0.13**	**0.088**	**6.36**	**0.0020**	**8.88E-04**	**0.30**	**0.33**	**0.060**	**0.020**	**23.0**
Maximum Individual HAP (tpy)	**--**	**--**	**Methanol**	**Hydrochloric acid**	**Hexane**	**Methanol**	**Benzene**	**Formaldehyde**	**Methanol**	**Methanol**	**Methanol**	**Formaldehyde**	**Methanol**
Maximum Individual HAP Emissions (tpy)	**--**	**--**	**2.28**	**0.065**	**0.039**	**3.94**	**0.0010**	**2.71E-04**	**0.16**	**0.33**	**0.060**	**0.013**	**6.77**

Notes:

1. Includes emissions from the dryer (ES-DRYER), green hammermills (ES-GHM-1 through 3), and dry hammermills (ES-HM-1 through -8) as well as emissions from RTO fuel usage (maximum between natural gas and propane).
2. Includes emissions from the Pellet Mills and Pellet Coolers (ES-CLR-1 through -6) as well as emissions from RTO/RCO fuel usage (maximum between natural gas and propane).
3. Chromium VI is a subset of chromium compounds, which is accounted for separately as a HAP. As such, Chromium VI is only calculated as a TAP.
4. 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.

ATTACHMENT 1
Emission Calculations

Dryer, Green Hammermill, and Dry Hammermill Potential Emissions at Outlet of RTO Stack

ES-DRYER, ES-GHM-1 through -3, and ES-HM-1 through -8 (CD-WESP, CD-RTO)

Enviva Pellets Sampson, LLC

Faison, Sampson County, North Carolina

Calculation Basis

Hourly Throughput	120	ODT/hr
Annual Throughput	657,000	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
Total RTO/RCO Heat Input	45.2	MMBtu/hr
RTO Fuel Type	Natural Gas or Propane	
RTO control efficiency	95%	
WESP control efficiency	92.75%	

Total Potential Emissions at RTO Stack

Pollutant	Potential Emissions[1]	
	(lb/hr)	(tpy)
CO	34.3	93.8
NO_X	34.3	93.8
SO_2	6.26	27.4
VOC	22.2	60.8
Total PM	13.5	37.6
Total PM_{10}	12.5	34.8
Total $PM_{2.5}$	11.5	31.7
CO_2e	93,600	256,230
Total HAP	5.10	15.7
Total TAP	3.76	12.2

Notes:

1. Total emissions from the furnace/dryer, green hammermills, dry hammermills, and natural gas/propane combustion by the RTO (injection gas and burner fuel). Detailed calculations are provided below.

Potential Criteria Pollutant and Greenhouse Gas Emissions from Dryer/Furnace, Green Hammermills, and RTO Fuel Combustion

Pollutant	Emission Factor	Units	Potential Emissions[1]	
			(lb/hr)	(tpy)
CO	0.28	lb/ODT[2]	34.2	93.5
NO_X	0.28	lb/ODT[2]	34.1	93.5
SO_2	0.025	lb/MMBtu[3]	6.26	27.4
VOC	0.15	lb/ODT[4]	18.5	50.6
PM (Filterable + Condensable)	0.11	lb/ODT[5]	13.2	36.3
PM_{10} (Filterable + Condensable)	0.10	lb/ODT[5]	12.2	33.5
$PM_{2.5}$ (Filterable + Condensable)	0.095	lb/ODT[5]	11.4	31.2
CO_2	780	lb/ODT[6]	93,600	256,230

Notes:

1. Exhaust from the dryer (ES-DRYER), green hammermills (ES-GHM-1 through -3), and dry Hammermills (ES-HM-1 through -8) are routed to a WESP and then RTO for control of VOC and particulates. Additional emissions resulting from the dry hammermills are shown in the tables below.
2. Emission factor based on Sampson December 2019 compliance test average results plus 50% contingency.
3. No emission factor is provided in AP-42, Section 10.6.2 for SO_2 for rotary dryers. Enviva has conservatively calculated SO_2 emissions based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
4. VOC emission factor was derived based on process information and an appropriate contingency based on engineering judgement.
5. Emission factor based on Sampson December 2019 compliance test average results plus 20% contingency.
6. 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 Sampson uses a combination of hardwood and softwood and the hardwood emission factor is greater than the softwood emission factor.

ATTACHMENT 1
Emission Calculations

Dryer, Green Hammermill, and Dry Hammermill Potential Emissions at Outlet of RTO Stack
ES-DRYER, ES-GHM-1 through -3, and ES-HM-1 through -8 (CD-WESP, CD-RTO)
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Basis

Hourly Throughput	120	ODT/hr
Annual Throughput	657,000	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
Total RTO/RCO Heat Input	45.2	MMBtu/hr
RTO Fuel Type	Natural Gas or Propane	
RTO control efficiency	95%	
WESP control efficiency	92.75%	

Potential VOC Emissions from Dry Hammermills

Pollutant	Controlled Emission Factor	Units	Potential Emissions[1]	
			Hourly (lb/hr)	Annual (tpy)
VOC	0.031	lb/ODT[2]	3.73	10.2

Notes:
1. VOC emissions from the dry hammermill baghouses (ES-DHM-1 through 8) will be controlled by the RTO (CD-RTO).
2. Emission factor based on Sampson December 2019 compliance test average result, adjusted for pine percentage plus 20% contingency.

Potential Particulate Emissions from Dry Hammermills

Pollutant	Exhaust Flow Rate[1]	Exit Grain Loading[2,3]	Potential Emissions[4]	
	(cfm)	(gr/cf)	(lb/hr)	(tpy)
PM (Filterable)	120,000	0.004	0.30	1.31
PM_{10} (Filterable)		0.004	0.30	1.31
$PM_{2.5}$ (Filterable)		0.0016	0.12	0.52

Notes:
1. Total flow rate (scfm) from all 8 dry hammermill baghouses (CD-HM-BH1 through -BH8). Individual control device flowrate of 15,000 scfm was provided by design engineering firm (Mid-South Engineering Co.).
2. No speciation data is available for PM_{10}. Therefore, it is conservatively assumed to be equal to total PM.
3. $PM_{2.5}$ speciation (40% of total PM) based on a review of NCASI particle size distribution data for similar baghouses used in the wood products industry.
4. A 92.75% control efficiency is applied for the WESP (CD-WESP).

Thermally Generated Potential Criteria Pollutant Emissions from Dry Hammermills[1]

Maximum high heating value of VOC constituents	0.018	MMBtu/lb
Uncontrolled VOC emissions	204	tons/yr
Uncontrolled VOC emissions	75	lb/hr
Heat input of uncontrolled VOC emissions	7,552	MMBtu/yr
Heat input of uncontrolled VOC emissions	1.38	MMBtu/hr

Pollutant	Emission Factor[2]	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
CO	0.082	lb/MMBtu	0.11	0.31
NO_X	0.10	lb/MMBtu	0.14	0.37

Notes:
1. Emissions of CO and NO_X will be generated during combustion of VOC emissions by the RTO.
2. Emission factors from AP-42, Section 1.4 - Natural Gas Combustion, 07/98. Emission factors converted from lb/MMscf to lb/MMBtu based on assumed heating value of 1,020 Btu/scf for natural gas per AP-42 Section 1.4.

ATTACHMENT 1
Emission Calculations

Dryer, Green Hammermill, and Dry Hammermill Potential Emissions at Outlet of RTO Stack
ES-DRYER, ES-GHM-1 through -3, and ES-HM-1 through -8 (CD-WESP, CD-RTO)
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							(lb/hr)	(tpy)
Furnace Biomass Combustion, Dryer, Green Hammermills, and Dry Hammermills								
Acetaldehyde	Y	Y	Y	6.17E-03	lb/ODT	1	0.74	2.03
Acrolein	Y	Y	Y	6.30E-03	lb/ODT	1	0.76	2.07
Formaldehyde	Y	Y	Y	5.08E-03	lb/ODT	1	0.61	1.67
Methanol	Y	N	Y	6.93E-03	lb/ODT	1	0.83	2.28
Phenol	Y	Y	Y	4.28E-03	lb/ODT	1	0.51	1.41
Propionaldehyde	Y	N	Y	5.14E-03	lb/ODT	1	0.62	1.69
Acetophenone	Y	N	Y	3.20E-09	lb/MMBtu	2,3	4.01E-08	1.75E-07
Antimony & Compounds	Y	N	N	7.90E-06	lb/MMBtu	2,4	1.43E-04	6.28E-04
Arsenic & Compounds	Y	Y	N	2.20E-05	lb/MMBtu	2,4	3.99E-04	1.75E-03
Benzene	Y	Y	Y	4.20E-03	lb/MMBtu	2,3	5.26E-02	2.30E-01
Benzo(a)pyrene	Y	Y	Y	2.60E-06	lb/MMBtu	2,3	3.26E-05	1.43E-04
Beryllium	Y	Y	N	1.10E-06	lb/MMBtu	2,4	2.00E-05	8.75E-05
Cadmium	Y	Y	N	4.10E-06	lb/MMBtu	2,4	7.44E-05	3.26E-04
Carbon tetrachloride	Y	Y	Y	4.50E-05	lb/MMBtu	2,3	5.63E-04	2.47E-03
Chlorine	Y	Y	N	7.90E-04	lb/MMBtu	2	1.98E-01	8.66E-01
Chlorobenzene	Y	Y	Y	3.30E-05	lb/MMBtu	2,3	4.13E-04	1.81E-03
Chloroform	Y	Y	Y	2.80E-05	lb/MMBtu	2,3	3.51E-04	1.54E-03
Chromium VI	-[6]	Y	N	3.50E-06	lb/MMBtu	2,4	6.35E-05	2.78E-04
Chromium–Other compds	Y	N	N	1.75E-05	lb/MMBtu	2,4	3.18E-04	1.39E-03
Cobalt compounds	Y	N	N	6.50E-06	lb/MMBtu	2,4	1.18E-04	5.17E-04
Dichloroethane, 1,2-	Y	Y	Y	2.90E-05	lb/MMBtu	2,3	3.63E-04	1.59E-03
Dichloropropane, 1,2-	Y	N	Y	3.30E-05	lb/MMBtu	2,3	4.13E-04	1.81E-03
Dinitrophenol, 2,4-	Y	N	Y	1.80E-07	lb/MMBtu	2,3	2.25E-06	9.87E-06
Di(2-ethylhexyl)phthalate	Y	Y	Y	4.70E-08	lb/MMBtu	2,3	5.88E-07	2.58E-06
Ethyl benzene	Y	N	Y	3.10E-05	lb/MMBtu	2,3	3.88E-04	1.70E-03
Hexachlorodibenzo-p-dioxin	N	Y	Y	1.60E-06	lb/MMBtu	2,3	2.00E-05	8.77E-05
Hydrochloric acid	Y	Y	N	1.90E-02	lb/MMBtu	2,6	4.76E-01	2.08E+00
Lead and Lead compounds	Y	N	N	4.80E-05	lb/MMBtu	2,4	8.71E-04	3.82E-03
Manganese & compounds	Y	Y	N	1.60E-03	lb/MMBtu	2,4	2.90E-02	1.27E-01
Mercury	Y	Y	N	3.50E-06	lb/MMBtu	2,4	6.35E-05	2.78E-04
Methyl bromide	Y	N	Y	1.50E-05	lb/MMBtu	2,3	1.88E-04	8.23E-04
Methyl chloride	Y	N	Y	2.30E-05	lb/MMBtu	2,3	2.88E-04	1.26E-03
Methyl ethyl ketone	N	Y	Y	5.40E-06	lb/MMBtu	2,3	6.76E-05	2.96E-04
Methylene chloride	Y	Y	Y	2.90E-04	lb/MMBtu	2,3	3.63E-03	1.59E-02
Naphthalene	Y	N	Y	9.70E-05	lb/MMBtu	2,3	1.21E-03	5.32E-03
Nickel	Y	Y	N	3.30E-05	lb/MMBtu	2,4	5.99E-04	2.62E-03
Nitrophenol, 4-	Y	N	Y	1.10E-07	lb/MMBtu	2,3	1.38E-06	6.03E-06
Pentachlorophenol	Y	Y	N	5.10E-08	lb/MMBtu	2	1.28E-05	5.59E-05
Perchloroethylene	Y	Y	N	3.80E-05	lb/MMBtu	2	9.52E-03	4.17E-02
Phosphorus Metal, Yellow or White	Y	N	N	2.70E-05	lb/MMBtu	2,4	4.90E-04	2.15E-03
Polychlorinated biphenyls	Y	Y	Y	8.15E-09	lb/MMBtu	2,3	1.02E-07	4.47E-07
Polycyclic Organic Matter	Y	N	N	1.25E-04	lb/MMBtu	2	3.13E-02	1.37E-01
Selenium compounds	Y	N	N	2.80E-06	lb/MMBtu	2,4	5.08E-05	2.23E-04
Styrene	Y	Y	Y	1.90E-03	lb/MMBtu	2,3	2.38E-02	1.04E-01
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	Y	Y	8.60E-12	lb/MMBtu	2,3	1.08E-10	4.72E-10
Toluene	Y	Y	Y	9.20E-04	lb/MMBtu	2,3	1.15E-02	5.05E-02
Trichloroethane, 1,1,1-	Y	Y	N	3.10E-05	lb/MMBtu	2	7.76E-03	3.40E-02
Trichloroethylene	Y	Y	Y	3.00E-05	lb/MMBtu	2,3	3.76E-04	1.65E-03
Trichlorofluoromethane	N	Y	Y	4.10E-05	lb/MMBtu	2,3	5.13E-04	2.25E-03
Trichlorophenol, 2,4,6-	Y	N	Y	2.20E-08	lb/MMBtu	2,3	2.75E-07	1.21E-06
Vinyl chloride	Y	Y	Y	1.80E-05	lb/MMBtu	2,3	2.25E-04	9.87E-04
Xylene	Y	Y	Y	2.50E-05	lb/MMBtu	2,3	3.13E-04	1.37E-03
						Total HAP Emissions:	**4.92**	**14.9**
						Total TAP Emissions:	**3.44**	**10.75**

ATTACHMENT 1
Emission Calculations

Dryer, Green Hammermill, and Dry Hammermill Potential Emissions at Outlet of RTO Stack
ES-DRYER, ES-GHM-1 through -3, and ES-HM-1 through -8 (CD-WESP, CD-RTO)
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions (lb/hr)	Potential Emissions (tpy)
RTO Burners - Natural Gas/Propane Combustion								
2-Methylnaphthalene	Y	N	Y	2.40E-05	lb/MMscf	7	1.06E-06	4.66E-06
3-Methylchloranthrene	Y	N	Y	1.80E-06	lb/MMscf	7	7.98E-08	3.49E-07
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.60E-05	lb/MMscf	7	7.09E-07	3.11E-06
Acenaphthene	Y	N	Y	1.80E-06	lb/MMscf	7	7.98E-08	3.49E-07
Acenaphthylene	Y	N	Y	1.80E-06	lb/MMscf	7	7.98E-08	3.49E-07
Acetaldehyde	Y	Y	Y	1.52E-05	lb/MMscf	7	6.74E-07	2.95E-06
Acrolein	Y	Y	Y	1.80E-05	lb/MMscf	7	7.98E-07	3.49E-06
Ammonia	N	Y	N	3.2	lb/MMscf	7	1.42E-01	6.21E-01
Anthracene	Y	N	Y	2.40E-06	lb/MMscf	7	1.06E-07	4.66E-07
Arsenic & Compounds	Y	Y	N	2.00E-04	lb/MMscf	7	8.86E-06	3.88E-05
Benz(a)anthracene	Y	N	Y	1.80E-06	lb/MMscf	7	7.98E-08	3.49E-07
Benzene	Y	Y	Y	7.10E-04	lb/MMBtu	8	3.21E-02	1.41E-01
Benzo(a)pyrene	Y	Y	Y	1.20E-06	lb/MMscf	7	5.32E-08	2.33E-07
Benzo(b)fluoranthene	Y	N	Y	1.80E-06	lb/MMscf	7	7.98E-08	3.49E-07
Benzo(g,h,i)perylene	Y	N	Y	1.20E-06	lb/MMscf	7	5.32E-08	2.33E-07
Benzo(k)fluoranthene	Y	N	Y	1.80E-06	lb/MMscf	7	7.98E-08	3.49E-07
Beryllium	Y	Y	N	1.20E-05	lb/MMscf	7	5.32E-07	2.33E-06
Cadmium	Y	Y	N	1.10E-03	lb/MMscf	7	4.87E-05	2.14E-04
Chromium VI	Y	N	N	1.40E-03	lb/MMscf	7	6.20E-05	2.72E-04
Chrysene	Y	N	Y	1.80E-06	lb/MMscf	7	7.98E-08	3.49E-07
Cobalt	Y	N	N	8.40E-05	lb/MMscf	7	3.72E-06	1.63E-05
Dibenzo(a,h)anthracene	Y	N	Y	1.20E-06	lb/MMscf	7	5.32E-08	2.33E-07
Dichlorobenzene	Y	Y	Y	1.20E-03	lb/MMscf	7	5.32E-05	2.33E-04
Fluoranthene	Y	N	Y	3.00E-06	lb/MMscf	7	1.33E-07	5.82E-07
Fluorene	Y	N	Y	2.80E-06	lb/MMscf	7	1.24E-07	5.43E-07
Formaldehyde	Y	Y	Y	1.51E-03	lb/MMBtu	8	6.83E-02	2.99E-01
Hexane	Y	Y	Y	1.8	lb/MMscf	7	7.98E-02	3.49E-01
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.80E-06	lb/MMscf	7	7.98E-08	3.49E-07
Lead	Y	N	N	5.00E-04	lb/MMscf	7	2.22E-05	9.70E-05
Manganese	Y	Y	N	3.80E-04	lb/MMscf	7	1.68E-05	7.38E-05
Mercury	Y	Y	N	2.60E-04	lb/MMscf	7	1.15E-05	5.05E-05
Naphthalene	Y	N	Y	6.10E-04	lb/MMscf	7	2.70E-05	1.18E-04
Nickel	Y	Y	N	2.10E-03	lb/MMscf	7	9.31E-05	4.08E-04
Polycyclic Organic Matter	Y	Y	Y	4.00E-05	lb/MMBtu	8,9	1.81E-03	7.92E-03
Phenanthrene	Y	N	Y	1.70E-05	lb/MMscf	7	7.53E-07	3.30E-06
Pyrene	Y	N	Y	5.00E-06	lb/MMscf	7	2.22E-07	9.70E-07
Selenium	Y	N	N	2.40E-05	lb/MMscf	7	1.06E-06	4.66E-06
Toluene	Y	Y	Y	3.40E-03	lb/MMscf	7	1.51E-04	6.60E-04
						Total HAP Emissions:	**0.18**	**0.80**
						Total TAP Emissions:	**0.32**	**1.42**

Notes:

1. Emission factors derived based on Sampson December 2019 compliance test, process information, and an appropriate contingency based on engineering judgement. Emission factors represent controlled emissions.
2. Emission factors 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 chromium compounds, which is accounted for separately as a HAP. As such, Chromium VI is only calculated as a TAP.
6. The WESP employs a caustic solution in its operation in which hydrochloric acid will have high water solubility. This caustic solution will neutralize the acid and effectively control it by 90%, per conversation on October 18, 2011 with Steven A. Jaasund, P.E. of Lundberg Associates, a manufacturer of WESPs.
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.
8. Propane is worst-case for these HAP emissions. Emission factors for propane combustion from SCAQMD's AER Reporting Tool for external combustion equipment fired with LPG.
9. The PAH emission factor for propane combustion was used to estimate emissions of Polycyclic Organic Matter.

ATTACHMENT 1
Emission Calculations

Potential Emissions from Furnace and Dryer Bypass (Cold Start-up) [1]
ES-FBYPASS and ES-DBYPASS
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Basis

Hourly Heat Input Capacity	37.6	MMBtu/hr
Annual Heat Input Capacity	1,878	MMBtu/yr
Hours of Operation[1]	50	hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions

Pollutant	Emission Factor	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	22.5	0.56
NO_X	0.22	lb/MMBtu[2]	8.26	0.21
SO_2	0.025	lb/MMBtu[2]	0.94	0.023
VOC	0.017	lb/MMBtu[2]	0.64	0.016
Total PM	0.58	lb/MMBtu[2]	21.7	0.54
Total PM_{10}	0.52	lb/MMBtu[2]	19.4	0.49
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	16.8	0.42
CO_2	93.8	kg/MMBtu[3]	7,767	194
CH_4	0.0072	kg/MMBtu[3]	0.596	0.015
N_2O	0.0036	kg/MMBtu[3]	0.298	0.0075
CO_2e			7,871	197

Notes:

1. During cold start-ups, the furnace bypass stack is used until the refractory is sufficiently heated and can sustain operations at a low level (approximately 15% of the maximum heat input rate). The furnace bypass stack is then closed, and the furnace is slowly brought up to a normal operating rate.
2. CO, NO_X, SO_2, PM, PM_{10}, $PM_{2.5}$, and VOC emission rates based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. PM, PM_{10}, and $PM_{2.5}$ factors equal to the sum of the filterable and condensible factors from Table 1.6-1.
3. Emission factors for biomass combustion from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-1.

ATTACHMENT 1
Emission Calculations

Potential Emissions from Furnace and Dryer Bypass (Cold Start-up) [1]
ES-FBYPASS and ES-DBYPASS
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Potential HAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor[1]	Units	Potential Emissions	
						Hourly (lb/hr)	Annual (tpy)
Acetaldehyde	Y	Y	Y	8.30E-04	lb/MMBtu	3.12E-02	7.79E-04
Acrolein	Y	Y	Y	4.00E-03	lb/MMBtu	1.50E-01	3.76E-03
Formaldehyde	Y	Y	Y	4.40E-03	lb/MMBtu	1.65E-01	4.13E-03
Phenol	Y	Y	Y	5.10E-05	lb/MMBtu	1.92E-03	4.79E-05
Propionaldehyde	Y	N	Y	6.10E-05	lb/MMBtu	2.29E-03	5.73E-05
Acetophenone	Y	N	Y	3.20E-09	lb/MMBtu	1.20E-07	3.00E-09
Antimony & Compounds	Y	N	N	7.90E-06	lb/MMBtu	2.97E-04	7.42E-06
Arsenic & Compounds	Y	Y	N	2.20E-05	lb/MMBtu	8.26E-04	2.07E-05
Benzene	Y	Y	Y	4.20E-03	lb/MMBtu	1.58E-01	3.94E-03
Benzo(a)pyrene	Y	Y	Y	2.60E-06	lb/MMBtu	9.77E-05	2.44E-06
Beryllium	Y	Y	N	1.10E-06	lb/MMBtu	4.13E-05	1.03E-06
Cadmium	Y	Y	N	4.10E-06	lb/MMBtu	1.54E-04	3.85E-06
Carbon tetrachloride	Y	Y	Y	4.50E-05	lb/MMBtu	1.69E-03	4.23E-05
Chlorine	Y	Y	N	7.90E-04	lb/MMBtu	2.97E-02	7.42E-04
Chlorobenzene	Y	Y	Y	3.30E-05	lb/MMBtu	1.24E-03	3.10E-05
Chloroform	Y	Y	Y	2.80E-05	lb/MMBtu	1.05E-03	2.63E-05
Chromium VI	-[2]	Y	N	3.50E-06	lb/MMBtu	1.31E-04	3.29E-06
Chromium–Other compds	Y	N	N	1.75E-05	lb/MMBtu	6.57E-04	1.64E-05
Cobalt compounds	Y	N	N	6.50E-06	lb/MMBtu	2.44E-04	6.10E-06
Dichloroethane, 1,2-	Y	Y	Y	2.90E-05	lb/MMBtu	1.09E-03	2.72E-05
Dichloropropane, 1,2-	Y	N	Y	3.30E-05	lb/MMBtu	1.24E-03	3.10E-05
Dinitrophenol, 2,4-	Y	N	Y	1.80E-07	lb/MMBtu	6.76E-06	1.69E-07
Di(2-ethylhexyl)phthalate	Y	Y	Y	4.70E-08	lb/MMBtu	1.77E-06	4.41E-08
Ethyl benzene	Y	N	Y	3.10E-05	lb/MMBtu	1.16E-03	2.91E-05
Hexachlorodibenzo-p-dioxin	N	Y	Y	1.60E-06	lb/MMBtu	6.01E-05	1.50E-06
Hydrochloric acid	Y	Y	N	1.90E-02	lb/MMBtu	7.14E-01	1.78E-02
Lead and Lead compounds	Y	N	N	4.80E-05	lb/MMBtu	1.80E-03	4.51E-05
Manganese & compounds	Y	Y	N	1.60E-03	lb/MMBtu	6.01E-02	1.50E-03
Mercury	Y	Y	N	3.50E-06	lb/MMBtu	1.31E-04	3.29E-06
Methyl bromide	Y	N	Y	1.50E-05	lb/MMBtu	5.63E-04	1.41E-05
Methyl chloride	Y	N	Y	2.30E-05	lb/MMBtu	8.64E-04	2.16E-05
Methyl ethyl ketone	N	Y	Y	5.40E-06	lb/MMBtu	2.03E-04	5.07E-06
Methylene chloride	Y	Y	Y	2.90E-04	lb/MMBtu	1.09E-02	2.72E-04
Naphthalene	Y	N	Y	9.70E-05	lb/MMBtu	3.64E-03	9.11E-05
Nickel	Y	Y	N	3.30E-05	lb/MMBtu	1.24E-03	3.10E-05
Nitrophenol, 4-	Y	N	Y	1.10E-07	lb/MMBtu	4.13E-06	1.03E-07
Pentachlorophenol	Y	Y	N	5.10E-08	lb/MMBtu	1.92E-06	4.79E-08
Perchloroethylene	Y	Y	N	3.80E-05	lb/MMBtu	1.43E-03	3.57E-05
Phosphorus Metal, Yellow or White	Y	N	N	2.70E-05	lb/MMBtu	1.01E-03	2.54E-05
Polychlorinated biphenyls	Y	Y	Y	8.15E-09	lb/MMBtu	3.06E-07	7.65E-09
Polycyclic Organic Matter	Y	N	N	1.25E-04	lb/MMBtu	4.69E-03	1.17E-04
Selenium compounds	Y	N	N	2.80E-06	lb/MMBtu	1.05E-04	2.63E-06
Styrene	Y	Y	Y	1.90E-03	lb/MMBtu	7.14E-02	1.78E-03
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	Y	Y	8.60E-12	lb/MMBtu	3.23E-10	8.08E-12
Toluene	Y	Y	Y	9.20E-04	lb/MMBtu	3.46E-02	8.64E-04
Trichloroethane, 1,1,1-	Y	Y	N	3.10E-05	lb/MMBtu	1.16E-03	2.91E-05
Trichloroethylene	Y	Y	Y	3.00E-05	lb/MMBtu	1.13E-03	2.82E-05
Trichlorofluoromethane	N	Y	Y	4.10E-05	lb/MMBtu	1.54E-03	3.85E-05
Trichlorophenol, 2,4,6-	Y	N	Y	2.20E-08	lb/MMBtu	8.26E-07	2.07E-08
Vinyl chloride	Y	Y	Y	1.80E-05	lb/MMBtu	6.76E-04	1.69E-05
Xylene	Y	Y	Y	2.50E-05	lb/MMBtu	9.39E-04	2.35E-05
		Total HAP Emissions (biomass combustion)				**1.45**	**0.036**
		Total TAP Emissions (biomass combustion)				**1.44**	**0.036**

Notes:

1. Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
2. Chromium VI is a subset of chromium compounds, which is accounted for separately as a HAP. As such, Chromium VI is only calculated as a TAP.

ATTACHMENT 1
Emission Calculations

Potential Emissions from Furnace and Dryer Bypass (Idle Mode)[1]
ES-FBYPASS and ES-DBYPASS
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Basis

Hourly Heat Input Capacity	10	MMBtu/hr
Annual Heat Input Capacity	5,000	MMBtu/yr
Hours of Operation[1]	500	hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions

Pollutant	Emission Factor	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	6.00	1.50
NO_X	0.22	lb/MMBtu[2]	2.20	0.55
SO_2	0.025	lb/MMBtu[2]	0.25	0.063
VOC	0.017	lb/MMBtu[2]	0.17	0.043
Total PM	0.58	lb/MMBtu[2]	5.77	1.44
Total PM_{10}	0.52	lb/MMBtu[2]	5.17	1.29
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	4.47	1.12
CO_2	93.8	kg/MMBtu[3]	2,068	517
CH_4	0.0072	kg/MMBtu[3]	0.16	0.040
N_2O	0.0036	kg/MMBtu[3]	0.079	0.020
CO_2e			2,096	524

Notes:

1. The furnace can operate up to 500 hours per year in "idle mode" using the furnace bypass stack. Idle mode is defined as operation at up to a maximum heat input rate of 10 MMBtu/hr.
2. CO, NO_X, SO_2, PM, PM_{10}, $PM_{2.5}$, and VOC emission rates based on AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. PM, PM_{10}, and $PM_{2.5}$ factors equal to the sum of the filterable and condensable factors from Table 1.6-1.
3. Emission factors for biomass combustion (dryer) from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-

ATTACHMENT 1
Emission Calculations

Potential Emissions from Furnace and Dryer Bypass (Idle Mode)[1]
ES-FBYPASS and ES-DBYPASS
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Potential HAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor[1]	Units	Potential Emissions Hourly (lb/hr)	Potential Emissions Annual (tpy)
Acetaldehyde	Y	Y	Y	8.30E-04	lb/MMBtu	8.30E-03	2.08E-03
Acrolein	Y	Y	Y	4.00E-03	lb/MMBtu	4.00E-02	1.00E-02
Formaldehyde	Y	Y	Y	4.40E-03	lb/MMBtu	4.40E-02	1.10E-02
Phenol	Y	Y	Y	5.10E-05	lb/MMBtu	5.10E-04	1.28E-04
Propionaldehyde	Y	N	Y	6.10E-05	lb/MMBtu	6.10E-04	1.53E-04
Acetophenone	Y	N	Y	3.20E-09	lb/MMBtu	3.20E-08	8.00E-09
Antimony & Compounds	Y	N	N	7.90E-06	lb/MMBtu	7.90E-05	1.98E-05
Arsenic & Compounds	Y	Y	N	2.20E-05	lb/MMBtu	2.20E-04	5.50E-05
Benzene	Y	Y	Y	4.20E-03	lb/MMBtu	4.20E-02	1.05E-02
Benzo(a)pyrene	Y	Y	Y	2.60E-06	lb/MMBtu	2.60E-05	6.50E-06
Beryllium	Y	Y	N	1.10E-06	lb/MMBtu	1.10E-05	2.75E-06
Cadmium	Y	Y	N	4.10E-06	lb/MMBtu	4.10E-05	1.03E-05
Carbon tetrachloride	Y	Y	Y	4.50E-05	lb/MMBtu	4.50E-04	1.13E-04
Chlorine	Y	Y	N	7.90E-04	lb/MMBtu	7.90E-03	1.98E-03
Chlorobenzene	Y	Y	Y	3.30E-05	lb/MMBtu	3.30E-04	8.25E-05
Chloroform	Y	Y	Y	2.80E-05	lb/MMBtu	2.80E-04	7.00E-05
Chromium VI	-[2]	Y	N	3.50E-06	lb/MMBtu	3.50E-05	8.75E-06
Chromium–Other compds	Y	N	N	1.75E-05	lb/MMBtu	1.75E-04	4.38E-05
Cobalt compounds	Y	N	N	6.50E-06	lb/MMBtu	6.50E-05	1.63E-05
Dichloroethane, 1,2-	Y	Y	Y	2.90E-05	lb/MMBtu	2.90E-04	7.25E-05
Dichloropropane, 1,2-	Y	N	Y	3.30E-05	lb/MMBtu	3.30E-04	8.25E-05
Dinitrophenol, 2,4-	Y	N	Y	1.80E-07	lb/MMBtu	1.80E-06	4.50E-07
Di(2-ethylhexyl)phthalate	Y	Y	Y	4.70E-08	lb/MMBtu	4.70E-07	1.18E-07
Ethyl benzene	Y	N	Y	3.10E-05	lb/MMBtu	3.10E-04	7.75E-05
Hexachlorodibenzo-p-dioxin	N	Y	Y	1.60E-06	lb/MMBtu	1.60E-05	4.00E-06
Hydrochloric acid	Y	Y	N	1.90E-02	lb/MMBtu	1.90E-01	4.75E-02
Lead and Lead compounds	Y	N	N	4.80E-05	lb/MMBtu	4.80E-04	1.20E-04
Manganese & compounds	Y	Y	N	1.60E-03	lb/MMBtu	1.60E-02	4.00E-03
Mercury	Y	Y	N	3.50E-06	lb/MMBtu	3.50E-05	8.75E-06
Methyl bromide	Y	N	Y	1.50E-05	lb/MMBtu	1.50E-04	3.75E-05
Methyl chloride	Y	N	Y	2.30E-05	lb/MMBtu	2.30E-04	5.75E-05
Methyl ethyl ketone	N	Y	Y	5.40E-06	lb/MMBtu	5.40E-05	1.35E-05
Methylene chloride	Y	Y	Y	2.90E-04	lb/MMBtu	2.90E-03	7.25E-04
Naphthalene	Y	N	Y	9.70E-05	lb/MMBtu	9.70E-04	2.43E-04
Nickel	Y	Y	N	3.30E-05	lb/MMBtu	3.30E-04	8.25E-05
Nitrophenol, 4-	Y	N	Y	1.10E-07	lb/MMBtu	1.10E-06	2.75E-07
Pentachlorophenol	Y	Y	N	5.10E-08	lb/MMBtu	5.10E-07	1.28E-07
Perchloroethylene	Y	Y	N	3.80E-05	lb/MMBtu	3.80E-04	9.50E-05
Phosphorus Metal, Yellow or White	Y	N	N	2.70E-05	lb/MMBtu	2.70E-04	6.75E-05
Polychlorinated biphenyls	Y	Y	Y	8.15E-09	lb/MMBtu	8.15E-08	2.04E-08
Polycyclic Organic Matter	Y	N	N	1.25E-04	lb/MMBtu	1.25E-03	3.13E-04
Selenium compounds	Y	N	N	2.80E-06	lb/MMBtu	2.80E-05	7.00E-06
Styrene	Y	Y	Y	1.90E-03	lb/MMBtu	1.90E-02	4.75E-03
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	Y	Y	Y	8.60E-12	lb/MMBtu	8.60E-11	2.15E-11
Toluene	Y	Y	Y	9.20E-04	lb/MMBtu	9.20E-03	2.30E-03
Trichloroethane, 1,1,1-	Y	Y	N	3.10E-05	lb/MMBtu	3.10E-04	7.75E-05
Trichloroethylene	Y	Y	Y	3.00E-05	lb/MMBtu	3.00E-04	7.50E-05
Trichlorofluoromethane	N	Y	Y	4.10E-05	lb/MMBtu	4.10E-04	1.03E-04
Trichlorophenol, 2,4,6-	Y	N	Y	2.20E-08	lb/MMBtu	2.20E-07	5.50E-08
Vinyl chloride	Y	Y	Y	1.80E-05	lb/MMBtu	1.80E-04	4.50E-05
Xylene	Y	Y	Y	2.50E-05	lb/MMBtu	2.50E-04	6.25E-05
		Total HAP Emissions (biomass combustion)				**0.39**	**0.097**
		Total TAP Emissions (biomass combustion)				**0.38**	**0.096**

Notes:
1. Emission factors for wood combustion in a stoker boiler from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
2. Chromium VI is a subset of chromium compounds, which is accounted for separately as a HAP. As such, Chromium VI is only calculated as a TAP.

ATTACHMENT 1
Emission Calculations

Potential Emissions from Double Duct Burners
IES-DDB-1 and -2
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Duct Burner Inputs

Hourly Heat Input Capacity	2.5	MMBtu/hr
Number of Duct Burners	2	
Annual Heat Input Capacity	43,800	MMBtu/yr
Annual Operation	8,760	hr/yr

Potential Criteria Pollutant and Greenhouse Gas Emissions - Natural Gas Combustion

Pollutant	Emission Factor	Units	Footnote	Potential Emissions Hourly (lb/hr)	Potential Emissions Annual (tpy)
CO	84.0	lb/MMscf	1	0.41	1.80
NO_X	50.0	lb/MMscf	2	0.25	1.07
SO_2	0.60	lb/MMscf	1	0.0029	0.013
VOC	5.50	lb/MMscf	1	0.027	0.12
$PM/PM_{10}/PM_{2.5}$ Condensable	5.70	lb/MMscf	1	0.028	0.12
$PM/PM_{10}/PM_{2.5}$ Filterable	1.90	lb/MMscf	1	0.0093	0.041
Total $PM/PM_{10}/PM_{2.5}$				0.037	0.16
CO_2	53.1	kg/MMBtu	3	585	2,562
CH_4	0.0010	kg/MMBtu	3	0.011	0.048
N_2O	0.0001	kg/MMBtu	3	0.0011	0.0048
CO_2e			3	585	2,564

Potential Criteria Pollutant and Greenhouse Gas Emissions - Propane Combustion

Pollutant	Emission Factor	Units	Footnote	Potential Emissions Hourly (lb/hr)	Potential Emissions Annual (tpy)
CO	7.50	lb/Mgal	4	0.41	1.80
NO_X	6.50	lb/Mgal	5	0.36	1.56
SO_2	0.054	lb/Mgal	4,6	0.0030	0.013
VOC	1.00	lb/Mgal	4	0.055	0.24
$PM/PM_{10}/PM_{2.5}$ Condensable	0.50	lb/Mgal	4	0.027	0.12
$PM/PM_{10}/PM_{2.5}$ Filterable	0.20	lb/Mgal	4	0.011	0.048
Total $PM/PM_{10}/PM_{2.5}$				0.038	0.17
CO_2	62.9	kg/MMBtu	3	693	3,035
CH_4	0.0030	kg/MMBtu	3	0.033	0.14
N_2O	0.0006	kg/MMBtu	3	0.0066	0.029
CO_2e			3	696	3,048

Notes:

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

ATTACHMENT 1
Emission Calculations

Potential Emissions from Double Duct Burners
IES-DDB-1 and -2
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions Hourly (lb/hr)	Potential Emissions Annual (tpy)
Duct Burners - Natural Gas/Propane Combustion								
2-Methylnaphthalene	Y	N	Y	2.40E-05	lb/MMscf	1	1.18E-07	5.15E-07
3-Methylchloranthrene	Y	N	Y	1.80E-06	lb/MMscf	1	8.82E-09	3.86E-08
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.60E-05	lb/MMscf	1	7.84E-08	3.44E-07
Acenaphthene	Y	N	Y	1.80E-06	lb/MMscf	1	8.82E-09	3.86E-08
Acenaphthylene	Y	N	Y	1.80E-06	lb/MMscf	1	8.82E-09	3.86E-08
Acetaldehyde	Y	Y	Y	1.52E-05	lb/MMscf	1	7.45E-08	3.26E-07
Acrolein	Y	Y	Y	1.80E-05	lb/MMscf	1	8.82E-08	3.86E-07
Ammonia	N	Y	N	3.2	lb/MMscf	1	1.57E-02	6.87E-02
Anthracene	Y	N	Y	2.40E-06	lb/MMscf	1	1.18E-08	5.15E-08
Arsenic & Compounds	Y	Y	N	2.00E-04	lb/MMscf	1	9.80E-07	4.29E-06
Benz(a)anthracene	Y	N	Y	1.80E-06	lb/MMscf	1	8.82E-09	3.86E-08
Benzene	Y	N	Y	7.10E-04	lb/MMBtu	2	3.55E-03	1.55E-02
Benzo(a)pyrene	Y	Y	Y	1.20E-06	lb/MMscf	1	5.88E-09	2.58E-08
Benzo(b)fluoranthene	Y	N	Y	1.80E-06	lb/MMscf	1	8.82E-09	3.86E-08
Benzo(g,h,i)perylene	Y	N	Y	1.20E-06	lb/MMscf	1	5.88E-09	2.58E-08
Benzo(k)fluoranthene	Y	N	Y	1.80E-06	lb/MMscf	1	8.82E-09	3.86E-08
Beryllium	Y	Y	N	1.20E-05	lb/MMscf	1	5.88E-08	2.58E-07
Cadmium	Y	Y	N	1.10E-03	lb/MMscf	1	5.39E-06	2.36E-05
Chromium VI	Y	N	N	1.40E-03	lb/MMscf	1	6.86E-06	3.01E-05
Chrysene	Y	N	Y	1.80E-06	lb/MMscf	1	8.82E-09	3.86E-08
Cobalt compounds	Y	N	N	8.40E-05	lb/MMscf	1	4.12E-07	1.80E-06
Dibenzo(a,h)anthracene	Y	N	Y	1.20E-06	lb/MMscf	1	5.88E-09	2.58E-08
Dichlorobenzene	Y	Y	Y	1.20E-03	lb/MMscf	1	5.88E-06	2.58E-05
Fluoranthene	Y	N	Y	3.00E-06	lb/MMscf	1	1.47E-08	6.44E-08
Fluorene	Y	N	Y	2.80E-06	lb/MMscf	1	1.37E-08	6.01E-08
Formaldehyde	Y	Y	Y	1.50E-03	lb/MMBtu	2	7.50E-03	3.29E-02
Hexane	Y	Y	Y	1.8	lb/MMscf	1	8.82E-03	3.86E-02
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.80E-06	lb/MMscf	1	8.82E-09	3.86E-08
Lead and Lead Compounds	Y	N	N	5.00E-04	lb/MMscf	1	2.45E-06	1.07E-05
Manganese & Compounds	Y	Y	N	3.80E-04	lb/MMscf	1	1.86E-06	8.16E-06
Mercury	Y	Y	N	2.60E-04	lb/MMscf	1	1.27E-06	5.58E-06
Naphthalene	Y	N	Y	6.10E-04	lb/MMscf	1	2.99E-06	1.31E-05
Nickel	Y	Y	N	2.10E-03	lb/MMscf	1	1.03E-05	4.51E-05
Polycyclic Organic Matter	Y	N	N	4.00E-05	lb/MMBtu	2	2.00E-04	8.76E-04
Phenanthrene	Y	N	Y	1.70E-05	lb/MMscf	1	8.33E-08	3.65E-07
Pyrene	Y	N	Y	5.00E-06	lb/MMscf	1	2.45E-08	1.07E-07
Selenium compounds	Y	N	N	2.40E-05	lb/MMscf	1	1.18E-07	5.15E-07
Toluene	Y	Y	Y	3.40E-03	lb/MMscf	1	1.67E-05	7.30E-05
						Total HAP Emissions:	**0.020**	**0.088**
						Total TAP Emissions:	**0.032**	**0.14**

Notes:

1. Emission factors for natural gas combustion are from NCDAQ Natural Gas Combustion Spreadsheet and AP-42, Fifth Edition, Volume 1, Chapter 1.4 - Natural Gas Combustion, 07/98. The emission factors for acetaldehyde, acrolein, and ammonia are cited in the NCDAQ spreadsheet as being sourced from the USEPA's WebFIRE database.
2. The duct burners can fire either natural gas or propane. Propane is worst-case for these HAP emissions. Emission factors for propane combustion from the South Coast Air Quality Management District's Air Emissions Reporting Tool for external combustion equipment fired with LPG.

ATTACHMENT 1
Emission Calculations

Pellet Cooler and Pellet Mill Potential Emissions at Outlet of RTO/RCO Stack
ES-CLR-1 through -6 (CD-RCO)
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Basis

Hourly Throughput	120	ODT/hr
Annual Throughput	657,000	ODT/yr
Hours of Operation	8,760	hr/yr
Total RTO/RCO Heat Input	19.8	MMBtu/hr
RTO/RCO control efficiency	95%	

Total Potential Emissions at RTO/RCO Stack

Pollutant	Potential Emissions[1]	
	(lb/hr)	(tpy)
CO	2.04	8.26
NO_X	3.30	13.7
SO_2	0.012	0.051
VOC	13.6	37.7
Total PM	69.8	191
Total PM_{10}	17.1	47.2
Total $PM_{2.5}$	4.37	12.2
CO_2e	2,755	12,069
Total HAP	2.28	6.36
Total TAP	0.82	2.45

Notes:

1. Total emissions from the pellet mills, pellet coolers, and natural gas/propane combustion by the RTO/RCO (gas injection and burner fuel). Detailed calculations are provided below.

Potential PM, VOC, HAP, and TAP Emissions from Pellet Mills and Pellet Coolers

Pollutant	HAP	NC TAP	VOC	Controlled Emission Factor[1]	Potential Emissions[2,3]	
				(lb/ODT)	(lb/hr)	(tpy)
Acetaldehyde	Y	Y	Y	4.2E-04	0.050	0.14
Acrolein	Y	Y	Y	2.5E-03	0.30	0.83
Formaldehyde	Y	Y	Y	1.6E-03	0.19	0.51
Methanol	Y	N	Y	1.2E-02	1.44	3.94
Phenol	Y	Y	Y	1.3E-03	0.15	0.41
Propionaldehyde	Y	N	Y	5.4E-04	0.065	0.18
				Total HAP Emissions	2.20	6.01
				Total TAP Emissions	0.69	1.89
Total VOC	--	--	--	0.11	13.4	36.7
PM (Filterable + Condensable)	--	--	--	0.58	69.6	191
PM_{10} (Filterable + Condensable)	--	--	--	0.14	17.0	46.5
$PM_{2.5}$ (Filterable + Condensable)	--	--	--	0.035	4.22	11.6

Notes:

1 Emission factors derived based on Sampson December 2019 compliance test, process information, and an appropriate contingency based on engineering judgement. The emission factors represent post-control emissions.

2 A 95.0% control efficiency is applied to the potential emissions for the RTO/RCO.

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

ATTACHMENT 1
Emission Calculations

Pellet Cooler and Pellet Mill Potential Emissions at Outlet of RTO/RCO Stack
ES-CLR-1 through -6 (CD-RCO)
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Thermally Generated Potential Criteria Pollutant Emissions from Pellet Mills and Pellet Coolers[1]

Maximum high heating value of VOC constituents	0.018	MMBtu/lb
Uncontrolled VOC emissions	735	tons/yr
Uncontrolled VOC emissions	268	lb/hr
Heat input of uncontrolled VOC emissions	27,189	MMBtu/yr
Heat input of uncontrolled VOC emissions	4.97	MMBtu/hr

Pollutant	Emission Factor[2]	Units	Potential Emissions Hourly (lb/hr)	Potential Emissions Annual (tpy)
CO	0.082	lb/MMBtu	0.41	1.12
NO_X	0.10	lb/MMBtu	0.49	1.33

Notes:

1. Emissions of CO and NO_X will be generated during combustion of VOC emissions by the RTO/RCO.
2. Emission factors from AP-42, Section 1.4 - Natural Gas Combustion, 07/98. Emission factors converted from lb/MMscf to lb/MMBtu based on assumed heating value of 1,020 Btu/scf for natural gas per AP-42 Section 1.4.

Potential Criteria Pollutant Emissions and Greenhouse Gas Emissions - Natural Gas Combustion

Pollutant	Emission Factor[1]	Units	Potential Emissions Hourly (lb/hr)	Potential Emissions Annual (tpy)
CO	0.082	lb/MMBtu	1.63	7.14
NO_X	0.10	lb/MMBtu	1.94	8.50
SO_2	5.88E-04	lb/MMBtu	0.012	0.051
VOC	5.39E-03	lb/MMBtu	0.107	0.47
Total PM	7.45E-03	lb/MMBtu	0.15	0.65
Total PM_{10}	7.45E-03	lb/MMBtu	0.15	0.65
Total $PM_{2.5}$	7.45E-03	lb/MMBtu	0.15	0.65
CO_2	53.1	kg/MMBtu[2]	2,316	10,145
CH_4	1.00E-03	kg/MMBtu[2]	0.044	0.19
N_2O	1.00E-04	kg/MMBtu[2]	0.0044	0.019
CO_2e			2,319	10,155

Potential Criteria Pollutant and Greenhouse Gas Emissions - Propane Combustion

Pollutant	Emission Factor[3]	Units	Potential Emissions Hourly (lb/hr)	Potential Emissions Annual (tpy)
CO	7.50	lb/Mgal	1.62	7.11
NO_X	13.0	lb/Mgal	2.81	12.3
SO_2	0.054	lb/Mgal	0.012	0.051
VOC	1.00	lb/Mgal	0.22	0.95
$PM/PM_{10}/PM_{2.5}$ Condensable	0.50	lb/Mgal	0.11	0.47
$PM/PM_{10}/PM_{2.5}$ Filterable	0.20	lb/Mgal	0.043	0.19
Total $PM/PM_{10}/PM_{2.5}$			0.15	0.66
CO_2	62.9	kg/MMBtu[2]	2,744	12,020
CH_4	0.0030	kg/MMBtu[2]	0.13	0.57
N_2O	0.0006	kg/MMBtu[2]	0.026	0.11
CO_2e			2,755	12,069

ATTACHMENT 1
Emission Calculations

Pellet Cooler and Pellet Mill Potential Emissions at Outlet of RTO/RCO Stack
ES-CLR-1 through -6 (CD-RCO)
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Natural Gas Combustion Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							Hourly (lb/hr)	Annual (tpy)
Natural Gas Source								
2-Methylnaphthalene	Y	N	Y	2.40E-05	lb/MMscf	4	4.66E-07	2.04E-06
3-Methylchloranthrene	Y	N	Y	1.80E-06	lb/MMscf	4	3.49E-08	1.53E-07
7,12-Dimethylbenz(a)anthracene	Y	N	Y	1.60E-05	lb/MMscf	4	3.11E-07	1.36E-06
Acenaphthene	Y	N	Y	1.80E-06	lb/MMscf	4	3.49E-08	1.53E-07
Acenaphthylene	Y	N	Y	1.80E-06	lb/MMscf	4	3.49E-08	1.53E-07
Acetaldehyde	Y	Y	Y	1.52E-05	lb/MMscf	4	2.95E-07	1.29E-06
Acrolein	Y	Y	Y	1.80E-05	lb/MMscf	4	3.49E-07	1.53E-06
Ammonia	N	Y	N	3.2	lb/MMscf	4	6.21E-02	2.72E-01
Anthracene	Y	N	Y	2.40E-06	lb/MMscf	4	4.66E-08	2.04E-07
Arsenic & Compounds	Y	Y	N	2.00E-04	lb/MMscf	4	3.88E-06	1.70E-05
Benz(a)anthracene	Y	N	Y	1.80E-06	lb/MMscf	4	3.49E-08	1.53E-07
Benzene	Y	N	Y	7.10E-04	lb/MMBtu	5	1.41E-02	6.16E-02
Benzo(a)pyrene	Y	Y	Y	1.20E-06	lb/MMscf	4	2.33E-08	1.02E-07
Benzo(b)fluoranthene	Y	N	Y	1.80E-06	lb/MMscf	4	3.49E-08	1.53E-07
Benzo(g,h,i)perylene	Y	N	Y	1.20E-06	lb/MMscf	4	2.33E-08	1.02E-07
Benzo(k)fluoranthene	Y	N	Y	1.80E-06	lb/MMscf	4	3.49E-08	1.53E-07
Beryllium	Y	Y	N	1.20E-05	lb/MMscf	4	2.33E-07	1.02E-06
Cadmium	Y	Y	N	1.10E-03	lb/MMscf	4	2.14E-05	9.35E-05
Chromium VI	Y	N	N	1.40E-03	lb/MMscf	4	2.72E-05	1.19E-04
Chrysene	Y	N	Y	1.80E-06	lb/MMscf	4	3.49E-08	1.53E-07
Cobalt Compounds	Y	N	N	8.40E-05	lb/MMscf	4	1.63E-06	7.14E-06
Dibenzo(a,h)anthracene	Y	N	Y	1.20E-06	lb/MMscf	4	2.33E-08	1.02E-07
Dichlorobenzene	Y	Y	Y	1.20E-03	lb/MMscf	4	2.33E-05	1.02E-04
Fluoranthene	Y	N	Y	3.00E-06	lb/MMscf	4	5.82E-08	2.55E-07
Fluorene	Y	N	Y	2.80E-06	lb/MMscf	4	5.44E-08	2.38E-07
Formaldehyde	Y	Y	Y	1.50E-03	lb/MMBtu	5	2.97E-02	1.30E-01
Hexane	Y	Y	Y	1.8	lb/MMscf	4	3.49E-02	1.53E-01
Indeno(1,2,3-cd)pyrene	Y	N	Y	1.80E-06	lb/MMscf	4	3.49E-08	1.53E-07
Lead and Lead Compounds	Y	N	N	5.00E-04	lb/MMscf	4	9.71E-06	4.25E-05
Manganese & Compounds	Y	Y	N	3.80E-04	lb/MMscf	4	7.38E-06	3.23E-05
Mercury	Y	Y	N	2.60E-04	lb/MMscf	4	5.05E-06	2.21E-05
Naphthalene	Y	N	Y	6.34E-04	lb/MMscf	4	1.23E-05	5.39E-05
Nickel	Y	Y	N	2.10E-03	lb/MMscf	4	4.08E-05	1.79E-04
Polycyclic Organic Matter	Y	N	N	4.00E-05	lb/MMBtu	5,6	7.92E-04	3.47E-03
Phenanthrene	Y	N	Y	1.70E-05	lb/MMscf	4	3.30E-07	1.45E-06
Pyrene	Y	N	Y	5.00E-06	lb/MMscf	4	9.71E-08	4.25E-07
Selenium compounds	Y	N	N	2.40E-05	lb/MMscf	4	4.66E-07	2.04E-06
Toluene	Y	Y	Y	3.40E-03	lb/MMscf	4	6.60E-05	2.89E-04
Total HAP Emissions (natural gas combustion)							**0.080**	**0.35**
Total TAP Emissions (natural gas combustion)							**0.127**	**0.56**

Notes:

1. Emission factors from AP-42, Section 1.4 - Natural Gas Combustion, 07/98. Emission factors converted from lb/MMscf to lb/MMBtu based on assumed heating value of 1,020 Btu/scf for natural gas per AP-42 Section 1.4.
2. Emission factors for natural gas or propane combustion from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-1.
3. Emission factors for propane combustion obtained from AP-42 Section 1.5 - Liquefied Petroleum Gas Combustion, 07/08. Heat content of propane was assumed to be 91.5 MMBtu/gal per AP-42 Section 1.5.
4. Emission factors for natural gas combustion are from NCDAQ Natural Gas Combustion Spreadsheet and AP-42, Fifth Edition, Volume 1, Chapter 1.4 - Natural Gas Combustion, 07/98 for small boilers. The emission factors for acetaldehyde, acrolein, and ammonia are cited in the NCDAQ spreadsheet as being sourced from the USEPA's WebFIRE database.
5. The RCO burner can fire either natural gas or propane. Propane is worst-case for these HAP emissions. Emission factors for propane combustion from the South Coast Air Quality Management District's Air Emissions Reporting Tool for external combustion equipment fired with LPG.

ATTACHMENT 1
Emission Calculations

Summary of Baghouse and Cyclone Potential Emissions
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Emission Unit ID	Source Description	Control Device ID	Control Device Description	Exhaust Flow Rate	Exit Grain Loading			Potential Emissions					
								PM		PM_{10}		$PM_{2.5}$	
				(cfm)	PM (gr/cf)	PM_{10} (gr/cf)	$PM_{2.5}$ (gr/cf)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
ES-HMC	Hammermill Conveying System	CD-HMC-BH	Baghouse[2, 3, 4]	1,500	0.004	0.004	0.004	0.051	0.23	0.051	0.23	0.051	0.23
ES-PMFS	Pellet Mill Feed Silo	CD-PMFS-BH	Baghouse[1, 2, 3]	2,444	0.004	0.004	0.004	0.084	0.37	0.084	0.37	0.084	0.37
ES-PCHP	Pellet Cooler HP Fines Relay System	CD-PCHP-BH	Baghouse[1, 2, 3]	3,102	0.004	0.004	0.004	0.106	0.47	0.106	0.47	0.106	0.47
ES-FPH	Finished Product Handling	CD-FPH-BH	Baghouse[1, 5, 6]	8,500	0.004	0.004	0.0016	0.29	1.28	0.27	1.16	0.12	0.51
ES-PB-1 through 4	Four (4) Pellet Loadout Bins												
ES-PL-1 and 2	Two (2) Pellet Mill Loadouts												
ES-DWH	Dried Wood Handling Operations (conveyors)	CD-DWH-BH-1	Baghouse[1, 2, 3]	1,000	0.004	0.004	0.004	0.034	0.15	0.034	0.15	0.034	0.15
		CD-DWH-BH-2	Baghouse[1, 2, 3]	1,000	0.004	0.004	0.004	0.034	0.15	0.034	0.15	0.034	0.15
							Total:	**0.60**	**2.63**	**0.58**	**2.52**	**0.43**	**1.87**

Notes:

1. Control device flow rate (cfm) provided by design engineering firm (Mid-South Engineering Co.).
2. No speciation data is available for PM_{10}. Therefore, it is conservatively assumed to be equal to total PM.
3. No speciation data is available for $PM_{2.5}$. Therefore, it is conservatively assumed to be equal to total PM.
4. Exhaust flow rate provided by the vendor (WPI).
5. Finished product handling PM_{10} speciation (91% of total PM) 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.
6. Finished Product Handling $PM_{2.5}$ speciation (40% of total PM) based on a review of NCASI particle size distribution data for similar baghouses used in the wood products industry.

ATTACHMENT 1
Emission Calculations

Green Wood Handling
IES-GWH
Enviva Pellets Sampson, LLC
Faison, Sampson 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		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-GWH	Purchased Bark/Fuel Chips Transfer to Outdoor Storage Area	1	48%	4.97E-05	2.35E-05	3.56E-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%	6.00E-05	2.84E-05	4.30E-06	69	328,500	1.7E-02	3.9E-02	7.8E-03	1.9E-02	1.2E-03	2.8E-03
	Processed Wood Chips to Outdoor Storage Area	2	42%	6.00E-05	2.84E-05	4.30E-06	138	328,500	1.6E-02	2.0E-02	7.8E-03	9.3E-03	1.2E-03	1.4E-03
	Chip Truck Dump to Hoppers	2	42%	6.00E-05	2.84E-05	4.30E-06	69	328,500	8.3E-03	2.0E-02	3.9E-03	9.3E-03	5.9E-04	1.4E-03
							Total Emissions:		**4.3E-02**	**8.1E-02**	**2.0E-02**	**3.8E-02**	**3.0E-03**	**5.8E-03**

Notes:

1. These green wood handling emissions are representative of the fugitive emissions at the site. Note there may be multiple drop points for each type but as shown these emissions will be negligible.
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.
5. PM_{10} control efficiency of 74.7% applied for three-sided enclosed structure with 50% porosity per Sierra Research "Final BACM Technological and Economic Feasibility Analysis", report prepared for the San Joaquin Valley Unified Air Pollution Control District (3/03). The control efficiency is assumed equivalent for PM_{10} and $PM_{2.5}$ emissions. Control efficiency is not applied to chip truck dump to dumpers because the top of the truck dumpers are open.

ATTACHMENT 1
Emission Calculations

Dry Shavings Material Handling
IES-DRYSHAVE
Enviva Pellets Sampson, LLC
Faison, Sampson 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 Shavings 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 Shavings 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 of 25 ton/hr transfer rate pounds of dry shaving material.
4. Annual throughput based on maximum daily throughput of 600 tons/day and 365 day/yr of operation.
5. Bucket elevator to silo material handling transfer point emissions associate a 90% control efficiency due to the enclosed nature of the silo (San Diego County, 1993).

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

ATTACHMENT 1
Emission Calculations

Storage Pile Wind Erosion
IES-GWSP-1 through 4, and IES-BFSP-1 and 2
Enviva Pellets Sampson, LLC
Faison, Sampson 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/ft^2)	(lb/day/acre)	(lb/hr/ft^2)	(ft)	(ft)	(ft)	(ft^2)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
IES-GWSP-1	Green Wood Storage Pile No. 1	9.8	9.4E-06	3.6	3.4E-06	100	310	30	66,720	0.63	2.7	0.31	1.4	4.7E-02	0.21	0.28	1.2
IES-GWSP-2	Green Wood Storage Pile No. 2	9.8	9.4E-06	3.6	3.4E-06	100	310	30	66,720	0.63	2.7	0.31	1.4	4.7E-02	0.21	0.28	1.2
IES-GWSP-3	Green Wood Storage Pile No. 3	9.8	9.4E-06	3.6	3.4E-06	220	310	30	120,000	1.1	4.9	0.56	2.5	8.5E-02	0.37	0.50	2.2
IES-GWSP-4	Green Wood Storage Pile No. 4	9.8	9.4E-06	3.6	3.4E-06	220	310	30	120,000	1.1	4.9	0.56	2.5	8.5E-02	0.37	0.50	2.2
IES-BFSP-1	Bark Fuel Storage Pile No. 1	9.8	9.4E-06	3.6	3.4E-06	60	100	15	12,960	0.12	0.53	6.1E-02	0.27	9.1E-03	4.0E-02	5.4E-02	0.24
IES-BFSP-2	Bark Fuel Storage Pile No. 2	9.8	9.4E-06	3.6	3.4E-06	25	25	15	2,550	2.4E-02	0.10	1.2E-02	5.2E-02	1.8E-03	7.9E-03	1.1E-02	4.7E-02
									Total Emissions:	**3.7**	**16**	**1.8**	**8.0**	**0.27**	**1.2**	**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:	120	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) (%):	14.8	Based on meteorological data averaged for 2007-2011 for Sampson, NC.
	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
ft^2 - 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

Reference:

Conversions

43,560	ft^2 = 1 acre
24	hr = 1 day
1.22	conversion from "as carbon" to "as propane"

ATTACHMENT 1
Emission Calculations

Debarker Potential Emissions
IES-DEBARK-1
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Basis

Hourly Throughput[1]	275	ton/hr
Annual Throughput[1]	1,133,325	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	0.62

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).

ATTACHMENT 1
Emission Calculations

Bark Hog Potential Emissions
IES-BARKHOG
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Basis

Hourly Throughput[1]	50	ton/hr, wet
	25	ODT/hr
Annual Throughput[2]	119,455	ODT/yr
	238,909	ton/yr, wet
Approx. Moisture Content[1]	50%	of total weight

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor		Potential Emissions	
			(lb/hr)	(tpy)
THC as carbon[3]	4.1E-03	lb/ODT	0.10	0.24
VOC as propane[4]	5.0E-03	lb/ODT	0.13	0.30
Methanol[3]	1.0E-03	lb/ODT	2.5E-02	6.0E-02
TSP[5]	2.0E-02	lb/ton	0.10	0.24
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 similar bark hog usage is proportional to the amount of log chipping that occurs for maximum pellet ODT and maximum 75% purchase of greenwood 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. VOC as propane = (1.22 x THC) + formaldehyde - (acetone+methane+methylene chloride). A value of zero is used for specified compounds where no emission factor is available or where the emission factor is reported only as "BDL" as indicated in AP-42, Section 10.6.3.
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).

Log Chipping Potential Emissions
IES-CHIP-1
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Basis

Hourly Throughput[1]	275	ton/hr, wet
	138	ODT/hr
Maximum Pellet Production	657,000	ODT/yr

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor		Potential Emissions	
			(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	0.33

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, Tables 7 and 9. Emission factors for THC and Methanol are the same across all three tables.
3. Emission factor for VOC as propane is from AP-42, Section 10.6.3., Medium Density Fiberboard, 08/02, Table 7. VOC as propane = (1.22 x THC) + formaldehyde - (acetone+methane+methylene chloride). A value of zero is used for specified compounds where no emission factor is available or where the emission factor is reported only as "BDL" as indicated in AP-42, Section 10.6.3.

Dried Wood Handling Potential Emissions
ES-DWH
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Basis

Hourly Throughput[1]	120	ODT/hr
Annual Throughput[1]	657,000	ODT/yr

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor[2] (lb/ODT)	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Formaldehyde	2.16E-04	0.026	0.071
Propionaldehyde	2.10E-04	0.025	0.069
Methanol	4.92E-04	0.059	0.16
Total HAP Emissions		**0.11**	**0.30**
Total VOC	0.044	5.22	14.3

Notes:

1. Hourly and annual throughputs assumed to be the same as dryer
2. Emission factors are based on Sampson December 2019 compliance test average results plus 20% contingency. The VOC emission factor was adjusted to account for the difference in pine percentage during testing and the maximum allowable.

ATTACHMENT 1
Emission Calculations

Emergency Generator Potential Emissions
IES-EG
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Basis

Engine Output	0.45	MW
Horsepower Rating	713	brake hp
Diesel Density[1]	7.1	lb/gal
Hours of Operation	500	hr/yr
Hourly Fuel Consumption[2]	34.8	gal/hr
Energy Input[3]	4.99	MMBtu/hr

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. Fuel consumption obtained from generator's spec sheet, assuming 100% load.
3. Energy calculated on a brake-specific fuel consumption of 7,000 Btu/hp-hr.

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor	Units	Potential Emissions[1]	
			(lb/hr)	(tpy)
CO	3.50	g/kW-hr (2)	4.10	1.03
NO_X	4.00	g/kW-hr (2)	4.69	1.17
SO_2	15	ppmw (3)	7.41E-03	1.85E-03
VOC	6.4E-04	lb/hp-hr (4)	0.46	0.11
PM	0.20	g/kW-hr (2)	0.23	0.06
PM_{10}	0.20	g/kW-hr (2)	0.23	0.06
$PM_{2.5}$	0.20	g/kW-hr (2)	0.23	0.06
CO_2	74.0	kg/MMBtu(5)	814	203
CH_4	3.0E-03	kg/MMBtu(5)	3.3E-02	8.3E-03
N_2O	6.0E-04	kg/MMBtu(5)	6.6E-03	1.7E-03
CO_2e			817	204

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 at 100% load.
2. Emissions standards from NSPS Subpart IIII for emergency engines with a maximum power rating greater than 50 horsepower [§60.4202(a)(2)]. NO_X emissions are based on combined emission standard for NMHC+NO_X.
3. Sulfur content in accordance with Year 2010 standards of 40 CFR 80.510(c) as required by NSPS Subpart IIII.
4. TOC emission factor from AP-42 Section 3.4, Large Stationary Diesel and All Stationary Dual-Fuel Engines and assumes 91% is nonmethane hydrocarbons per footnote f of Table 3.4-1.
5. 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/MMBtu)	(lb/hr)	(tpy)
Acetaldehyde	75-07-0	Y	Y	2.52E-05	1.26E-04	3.14E-05
Acrolein	107-02-8	Y	Y	7.88E-06	3.93E-05	9.83E-06
Benzene	71-43-2	Y	Y	7.76E-04	3.87E-03	9.68E-04
Benzo(a)pyrene	50-32-8	Y	Y	2.57E-07	1.28E-06	3.21E-07
Formaldehyde	50-00-0	Y	Y	7.89E-05	3.94E-04	9.84E-05
Naphthalene	91-20-3	N	Y	1.30E-04	6.49E-04	1.62E-04
Total PAH (POM)[3]	--	N	Y	2.12E-04	1.06E-03	2.65E-04
Toluene	108-88-3	Y	Y	2.81E-04	1.40E-03	3.51E-04
Xylene	1330-20-7	Y	Y	1.93E-04	9.63E-04	2.41E-04
				Total HAP Emissions	**0.0079**	**0.0020**

Notes:
1. Emission factor obtained from AP-42 3.4: Large Stationary Diesel and All Stationary Dual-Fuel Engines Table 3.4-3 and Table 3.4-4.
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. 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.

ATTACHMENT 1
Emission Calculations

Fire Pump Potential Emissions
IES-FWP
Enviva Pellets Sampson, LLC
Faison, Sampson 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
Energy Input[2]	1.23	MMBtu/hr

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 emergency generator 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 2010 standards of 40 CFR 80.510(c) 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] (lb/hp-hr)	Potential Emissions[2] (lb/hr)	Potential Emissions[2] (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
Butadiene, 1,3-	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	1.18E-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**

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 emergency generator 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.

ATTACHMENT 1
Emission Calculations

Diesel Storage Tanks
IES-TK-1 through 3
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Calculation Constants

Description	IES-TK-1	IES-TK-2	IES-TK-3	Units	Notes
α - Tank Paint Solar Absorptance	0.25			dimensionless	AP-42, Chapter 7 - Table 7.1-6 for White Tank, Average Condition
I - Annual Avg Total Solar Insolation Factor	1,395			dimensionless	AP-42, Chapter 7 - Table 7.1-7 for Charlotte, NC
T_{AX} - Annual Avg Maximum Ambient Temperature	530.5			R	AP-42, Chapter 7 - Table 7.1-7 for Charlotte, NC
T_{AN} - Annual Avg Minimum Ambient Temperature	510.8			R	AP-42, Chapter 7 - Table 7.1-7 for Charlotte, NC
R - Ideal Gas Constant	10.731			psia*ft^3/lb-mole R	AP-42, Chapter 7 - Page 7.1-23
Kp - Product Factor	1			dimensionless	Assume conservative value of 1
P_{VX} - Vapor Pressure at T_{AX}	0.0092			psia	AP-42, Chapter 7 - Equation 1-25 (exp[A-(B/T_{LA})])
P_{VN} - Vapor Pressure at T_{AN}	0.0048			psia	AP-42, Chapter 7 - Equation 1-25 (exp[A-(B/T_{LA})])
ΔP_V - Daily Vapor Pressure Range	0.0044			psia	AP-42, Chapter 7 - Equation 1-9
ΔP_B - Breather Vent Pressure Setting Range	0.06			psia	AP-42, Chapter 7 - Page 7.1-19 Note 3 (default)
P_A - Atmospheric Pressure	14.32			psia	AP-42, Chapter 7 - Table 7.1-7 for Charlotte, NC

Calculation Inputs

Description	IES-TK-1	IES-TK-2	IES-TK-3	Units	Notes
Tank Diameter	5.3	3.3	5.3	ft	Dimensions were provided by Enviva
Tank Length	6.0	3.3	18.0	ft	Dimensions were provided by Enviva
Tank Design Volume	1,000	185	3,000	gal	Conservative design specifications
Tank Working Volume	500	92.5	1,500	gal	50% of tank design volume because tanks will not be full at all times
Tank Throughput	17,400	4,500	200,000	gal/yr	Throughput for IES-TK-1 and IES-TK-2 based on fuel consumption provided by Enviva and 500 hours of operation per year for the fire pump and emergency generator. Throughput for IES-TK-3 provided by Enviva.
Equivalent Tank Diameter (D_E)	6.4	3.7	11.1	ft	AP-42, Chapter 7 - Equation 1-14 (SQRT(LD/(PI/4)))
Effective Height (H_E)	4.2	2.6	4.2	ft	AP-42, Chapter 7 - Equation 1-15 (PI/4*D)
V_v - Vapor Space Volume	66.2	13.8	201.1	ft^3	AP-42, Chapter 7 - Equation 1-3 (PI/4*D^2*H_{VO}), substitute D_E for D for horizontal tanks
H_{vo} - Vapor Space Outage	2.1	1.3	2.1	ft	AP-42, Chapter 7 - H_{VO} = 0.5*H_E for horizontal tanks
P_{VA} - Vapor Pressure	0.009	0.009	0.009	psia	Vapor pressure for Distillate Fuel Oil No. 2 at 70°F
M_v - Vapor Molecular Weight	130	130	130	lb/lb-mole	AP-42, Chapter 7 - Table 7.1-2 for diesel
Q - Throughput	414.3	107.1	4,762	bbl/yr	

Calculated Values

Description	IES-TK-1	IES-TK-2	IES-TK-3	Units	Notes
K_e - Vapor Space Expansion Factor	0.036	0.036	0.036	dimensionless	AP-42, Chapter 7 - Equation 1-5 ($\Delta T_V/T_{LA}$ + ((ΔP_V - ΔP_B)/(P_A - ΔP_{VA}))
ΔT_v - Daily Vapor Temperature Range	20.77	20.77	20.77	R	AP-42, Chapter 7 - Equation 1-7 (0.7*ΔT_A + 0.02*α*I)
ΔT_A - Daily Ambient Temperature Range	19.7	19.7	19.7	R	AP-42, Chapter 7 - Equation 1-11 (T_{AX} - T_{AN})
K_S - Vented Vapor Saturation Factor	1.00	1.00	1.00	dimensionless	AP-42, Chapter 7 - Equation 1-21 (1/(1 + 0.053P_{VA}*H_{VO}))
W_v - Stock Vapor Density	0.00021	0.00021	0.00021	lb/ft^3	AP-42, Chapter 7 - Equation 1-22 (Mv * P_{VA}) / (R * T_V)
T_V - Average Vapor Temperature	524.1	524.1	524.1	R	AP-42, Chapter 7 - Equation 1-33 (0.7*T_{AA} + 0.3T_B + 0.009α*I)
T_{AA} - Daily Average Ambient Temperature	520.7	520.7	520.7	R	AP-42, Chapter 7 - Equation 1-30 ((T_{AX} + T_{AN})/2)
T_B - Liquid Bulk Temperature	521.7	521.7	521.7	R	AP-42, Chapter 7 - Equation 1-31 (T_{AA} + 0.003αI)
T_{LA} - Daily Average Liquid Surface Temperature	523.0	521.7	521.7	R	AP-42, Chapter 7 - Equation 1-28 (0.4*T_{AA} + 0.6T_B + 0.005*α*I)
N - Number of Turnovers	34.8	48.6	133.3	dimensionless	
K_N - Working Loss Turnover (Saturation) Factor	1	0.78	0.39	dimensionless	AP-42, Chapter 7 - Page 7.1-28 (For N>36, K_N = (180 + N)/6N; For N≤36, K_N = 1)
V_Q - Net Working Loss Throughput	2,326	602	26,733	ft^3/yr	AP-42 Chapter 7 - Equation 1-39 (5.614*Q)
K_p - Working Loss Product Factor	1	1	1	dimensionless	AP-42 Chapter 7 - Page 7.1-28
K_B - Vent Setting Correction Factor	1	1	1	dimensionless	AP-42 Chapter 7 - Page 7.1-28

Potential VOC Emissions

Description	IES-TK-1	IES-TK-2	IES-TK-3	Units	Notes
L_s - Standing Loss	0.18	0.038	0.55	lbs/yr	AP-42, Chapter 7 - Equation 1-2 (365 * Vv * Wv * Ke * Ks)
L_w - Working Loss	0.48	0.098	2.2	lbs/yr	AP-42, Chapter 7 - Equation 1-35 (V_Q * K_N * K_p * W_V * K_B)
L_t - Total Loss	0.66	0.14	2.7	lbs/yr	AP-42, Chapter 7 - Equation 1-1 (Ls + Lw)
Contingency Factor	1.00	1.00	1.00	dimensionless	Assumed contingency factor to account for unaccounted variables.
Total VOC Emissions per Tank	0.66	0.14	2.7	lbs/yr	
Total VOC Emissions	**3.3E-04**	**6.8E-05**	**0.0014**	**tons/yr**	

Reference:

U.S. AP-42, Section 7.1 - Organic Liquid Storage Tanks, 07/2020

ATTACHMENT 1
Emission Calculations

Potential Emissions from Propane Vaporizers

IES-PV-1 and 2

Enviva Pellets Sampson, LLC

Faison, Sampson County, North Carolina

Calculation Basis[1]

Propane Heating Value[2]	91.5	MMBtu/Mgal
Hours of Operation	8,760	hr/yr
No. of Vaporizers	2	
Maximum Heat Input Rate	1.0	MMBtu/hr
Hourly Fuel Consumption	0.011	Mgal/hr

Notes:

1. The propane vaporizers are considered insignificant activities per 15A NCAC 02Q .0503 .
2. Propane heat content from AP-42 Section 1.5 - Liquefied Petroleum Gas Production, 7/08.

Potential Criteria Pollutant and Greenhouse Gas Emissions

Pollutant	Emission Factor[1]	Units	Potential Emissions	
			(lb/hr)	(tpy)
CO	7.5	lb/Mgal	0.16	0.72
NO_X	13.0	lb/Mgal	0.28	1.24
SO_2[2]	0.054	lb/Mgal	0.0012	0.0052
VOC	1.0	lb/Mgal	0.022	0.096
$PM/PM_{10}/PM_{2.5}$ Condensable	0.50	lb/Mgal	0.011	0.048
$PM/PM_{10}/PM_{2.5}$ Filterable	0.20	lb/Mgal	0.0044	0.019
Total $PM/PM_{10}/PM_{2.5}$			0.015	0.067
CO_2	12,500	lb/Mgal	273	1,197
CH_4	0.20	lb/Mgal	0.0044	0.019
N_2O	0.90	lb/Mgal	0.020	0.086
CO_2e			279	1,223

Notes:

1. Emission factors obtained from AP-42 1.5- Liquefied Petroleum Gas Combustion, 07/08, Table 1.5-1.
2. SO_2 emissions are based on an assumed fuel sulfur content of 0.54 grains/100 ft^3 per *A National Methodology and Emission Inventory for Residential Fuel Combustion* .

Potential HAP Emissions

Pollutant	CAS No.	VOC	Emission Factor[1]	Potential Emissions	
			(lb/MMBtu)	(lb/hr)	(tpy)
Benzene	71-43-2	Y	7.1E-04	0.0014	0.0062
Formaldehyde	50-00-0	Y	0.0015	0.0030	0.013
PAHs	--	N	4.0E-05	8.0E-05	3.5E-04
			Total HAP Emissions	**0.0044**	**0.020**

Notes:

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

References:

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

U.S. EPA. AP-42, Chapter 1.5 - Liquid Petroleum Gas Combustion, 07/08.

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

ATTACHMENT 1
Emission Calculations

Additive Handling
IES-ADD
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Source	Transfer Activity	Number of Drop Points	Material Moisture Content	PM Emission Factor[1]	PM_{10} Emission Factor[1]	$PM_{2.5}$ Emission Factor[1]	Potential Throughput[2,3]		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-ADD	Transfer from Supersacks to Hopper	1	10%	4.47E-04	2.12E-04	3.20E-05	0.19	1,643	8.64E-05	3.67E-04	4.09E-05	1.74E-04	6.19E-06	2.63E-05

Notes:

1. 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	0.74
	k = particle size multiplier (dimensionless	0.35
	k = particle size multiplier (dimensionless	0.053
	U = mean wind speed (mph)	7.85

2. Hourly and annual additive throughputs based on expected maximum usage.

Abbreviations:

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

References:

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

ATTACHMENT 1
Emission Calculations

Potential Fugitive PM Emissions from Paved Roads
Enviva Pellets Sampson, LLC
Faison, Sampson County, North Carolina

Vehicle Activitiy	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[4] (lb/day)	Potential PM Emissions[4] (tpy)	Potential PM_{10} Emissions[4] (lb/day)	Potential PM_{10} Emissions[4] (tpy)	Potential $PM_{2.5}$ Emissions[4] (lb/day)	Potential $PM_{2.5}$ Emissions[4] (tpy)
Logs Delivery to Crane	9,102	60	103.4	365	31,700	87,380	30	37,753	2.2	0.44	0.11	23	4.2	4.5	0.83	1.1	0.20
Logs Delivery to Log Storage Area	9,102	60	103.4	365	31,700	87,380	30	37,753	2.2	0.44	0.11	23	4.2	4.5	0.83	1.1	0.20
Chips Delivery	7,660	95	138	365	30,080	90,060	30	50,305	2.2	0.44	0.11	31	5.6	6.1	1.1	1.5	0.27
Hog Fuel Delivery	7,660	12	17.4	365	30,080	90,060	30	6,354	2.2	0.44	0.11	3.9	0.70	0.77	0.14	0.19	3.5E-02
Pellet Delivery	3,654	66	45.7	365	25,460	87,980	28	16,671	2.1	0.42	0.10	9.6	1.7	1.9	0.35	0.47	8.6E-02
Employee Car Parking	2,400	37	16.8	365	4,000	4,000	2	6,139	0.14	2.8E-02	6.9E-03	0.24	4.3E-02	4.7E-02	8.6E-03	1.2E-02	2.1E-03
											Total Emissions:	**90**	**16**	**18**	**3.27**	**4.4**	**0.80**

Notes:

1. Distance traveled per round trip was estimated based measuring wheel values. Data provided by Joe Harrell (Enviva) via email on May 16, 2017.
2. Daily trip counts provided by Joe Harrell (Enviva) via email on May 16, 2017. Log delivery trips updated assuming a maximum of 75% of greenwood is from logs.
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 (Sampson 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. Use of dry shavings would replace log or chip delivery and thus, dry shaving paved road emissions are assumed to equal those of log or chip delivery if Enviva opts to use dry shavings instead; thus, separate emissions calculations for dry shaving vehicle activity is not needed.

ATTACHMENT 2
Requirements under NSPS Subpart IIII (and MACT Subpart ZZZZ)

689 hp diesel-fired emergency generator (ID No. IES-EG)

Applicability

a. For this engine, the Permittee shall comply with all applicable provisions, including the requirements for emission standards, notification, testing, reporting, record keeping, and monitoring, contained in Environmental Management Commission Standard 15A NCAC 02D .0524 "New Source Performance Standards (NSPS)" as promulgated in 40 CFR Part 60 Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines," including Subpart A "General Provisions." [40 CFR 60.4200(a)(2)(i)]

General Provisions

b. Pursuant to 40 CFR 60.4218, The Permittee shall comply with the General Provisions of 40 CFR 60 Subpart A as presented in Table 8 of 40 CFR 60 Subpart IIII.

Emission Standards

c. The Permittee shall comply with the emission standards 40 CFR 60.4202 for all pollutants, for the same model year and maximum engine power for this engine. [40 CFR 60.4205(b)]

Fuel Requirements

d. The Permittee shall use diesel fuel in the engine that meets the requirements of 40 CFR 1090.305 including:
   i. a maximum sulfur content of 15 ppm; and
   ii. a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.
   [40 CFR 60.4207(b)]

Monitoring

e. The engine has the following monitoring requirements:
   i. The engines shall be equipped with a non-resettable hour meter prior to startup. [40 CFR 60.4209(a)]
   ii. The engine, if equipped with a diesel particulate filter, must be installed with a backpressure monitor that notifies the owner or operator when the high backpressure limit of the engine is approached.
   [40 CFR 60.4209(b)]

Compliance Requirements

f. The Permittee shall:
   i. operate and maintain the engine according to the manufacturer's emission related-written instructions over the entire life of the engine;
   ii. change only those emission-related settings that are permitted by the manufacturer; and
   iii. meet the requirements of 40 CFR 89, 94 and/or 1068 as applicable.
   [40CFR 60.4206 and 60.4211(a)]

g. The Permittee shall comply with the emission standards in Paragraph c above, by purchasing an engine certified to the emission standards in condition c for the same model year and maximum engine power. The engine shall be installed and configured according to the manufacturer's emission-related specifications. [40CFR 60.4211(c)]

h. In order for the engine to be considered an emergency stationary ICE under this condition, any operation other than emergency operation, maintenance and testing, and operation in non- emergency situations for 50 hours per year, as described below, is prohibited.
   i. There is no time limit on the use of emergency stationary ICE in emergency situations.
   ii. The Permittee may operate the emergency stationary ICE for any combination of the purposes specified in Paragraph (A) below for a maximum of 100 hours per calendar year. Any operation for non-emergency situations as allowed by Paragraph (iii) of this condition counts as part of the 100 hours per calendar year allowed by this Paragraph (ii).
      (A) Emergency stationary ICE may be operated for maintenance checks and readiness testing, provided that the tests are recommended by federal, state or local government, the manufacturer, the vendor, the regional transmission organization or equivalent balancing authority and transmission operator, or the insurance company associated with the engine. The owner or operator may petition the Administrator for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the owner or operator maintains records indicating that federal, state, or local standards require maintenance and testing of emergency ICE beyond 100 hours per calendar year.
   iii. Emergency stationary ICE may be operated for up to 50 hours per calendar year in non-emergency situations. The 50 hours of operation in non-emergency situations are counted as part of the 100 hours per calendar year

for maintenance and testing provided in paragraph (ii) above. Except as provided in Paragraph (A) below, the 50 hours per calendar year for non- emergency situations cannot be used for peak shaving or non-emergency demand response, or to generate income for a facility to an electric grid or otherwise supply power as part of a financial arrangement with another entity.

(A) The 50 hours per year for non-emergency situations can be used to supply power as part of a financial arrangement with another entity if all of the following conditions are met:
  (1) The engine is dispatched by the local balancing authority or local transmission and distribution system operator;
  (2) The dispatch is intended to mitigate local transmission and/or distribution limitations so as to avert potential voltage collapse or line overloads that could lead to the interruption of power supply in a local area or region.
  (3) The dispatch follows reliability, emergency operation or similar protocols that follow specific NERC, regional, state, public utility commission or local standards or guidelines.
  (4) The power is provided only to the facility itself or to support the local transmission and distribution system.
  (5) The owner or operator identifies and records the entity that dispatches the engine and the specific NERC, regional, state, public utility commission or local standards or guidelines that are being followed for dispatching the engine. The local balancing authority or local transmission and distribution system operator may keep these records on behalf of the engine owner or operator.

[40 CFR 60.4211(f)]

<u>Recordkeeping</u>

i. The Permittee shall keep records of the following:
  i. All notifications submitted to comply with this subpart and all documentation supporting any notification. [§60.4214(a)(2)(i)]
  ii. any maintenance performed on the engine [§60.4214(a)(2)(ii)];
  iii. documentation from the manufacturer that the engine is certified to meet the emission standards in Paragraph c above. [§60.4214(a)(2)(iii)]; and
  iv. the hours of operation of the engine in emergency and non-emergency service that are recorded through the non-resettable hour meter. [§60.4214(b)]

<u>Reporting</u>

j. If the Permittee owns or operates an emergency stationary CI ICE with a maximum engine power more than 100 HP that operates for the purposes specified in Paragraph h.iii(A), the Permittee shall submit an annual report according to the requirements at 40 CFR 60.4214(d). Thus report must be submitted to the Regional Supervisor and the EPA. [40 CFR60.4214(d)]

ATTACHMENT 2
Requirements under NSPS Subpart IIII (and MACT Subpart ZZZZ)

131 hp diesel-fired fire water pump (ID No. IES-FWP)

Applicability

a. For this fire pump engine, the Permittee shall comply with all applicable provisions, including the requirements for emission standards, notification, testing, reporting, record keeping, and monitoring, contained in Environmental Management Commission Standard 15A NCAC 02D .0524 "New Source Performance Standards (NSPS)" as promulgated in 40 CFR Part 60 Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines," including Subpart A "General Provisions." [40 CFR 60.4200(a)(2)(ii)]

General Provisions

b. Pursuant to §60.4218, the Permittee shall comply with the General Provisions of 40 CFR 60 Subpart A as presented in Table 8 of 40 CFR 60 Subpart IIII.

Emission Standards]

c. The Permittee shall comply with the emission standards in Table 4 of NSPS subpart IIII for all pollutants, for the same model year and maximum engine power for this engine. [§60.4205(c)]

Fuel Requirements

d. The Permittee shall use diesel fuel in the engine with:
   i. a maximum sulfur content of 15 ppm; and
   ii. a minimum cetane index of 40 or a maximum aromatic content of 35 volume percent.

   [§60.4207(b) and 40 CFR 80.510(b)]

Monitoring

e. The engine has the following monitoring requirements:
   i. The engines shall be equipped with a non-resettable hour meter prior to startup. [§60.4209(a)]
   ii. The engine, if equipped with a diesel particulate filter, must be installed with a backpressure monitor that notifies the owner or operator when the high backpressure limit of the engine is approached.

   [§60.4209(b)]

Compliance Requirements

f. The Permittee shall:
   i. operate and maintain the engine according to the manufacturer's emission related-written instructions over the entire life of the engine;
   ii. change only those emission-related settings that are permitted by the manufacturer; and
   iii. meet the requirements of 40 CFR 89, 94 and/or 1068 as applicable.

   [§60.4206 and §60.4211(a)]

g. The Permittee shall comply with the emission standards by purchasing an engine certified to the emission standards in Paragraph c above. The engine shall be installed and configured according to the manufacturer's specifications. [§60.4211(c)]

h. In order for the engine to be considered an emergency stationary ICE as defined in 40 CFR 60.4218, any operation other than emergency operation, maintenance and testing, and operation in non- emergency situations for 50 hours per year, as described in Paragraphs i thorugh iii below, is prohibited.
   i. There is no time limit on the use of emergency stationary ICE in emergency situations.
   ii. The Permittee may operate the emergency stationary ICE for any combination of the purposes specified in following Paragraph (A) below for a maximum of 100 hours per calendar year. Any operation for non-emergency situations as allowed by Paragraph iii. below counts as part of the 100 hours per calendar year allowed by this Paragraph ii.
      (A) Emergency stationary ICE may be operated for maintenance checks and readiness testing, provided that the tests are recommended by federal, state or local government, the manufacturer, the vendor, the regional transmission organization or equivalent balancing authority and transmission operator, or the insurance company associated with the engine. The owner or operator may petition the Administrator for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the owner or operator maintains records indicating that federal, state, or local standards require maintenance and testing of emergency ICE beyond 100 hours per calendar year.
   iii. Emergency stationary ICE may be operated for up to 50 hours per calendar year in non-emergency situations. The 50 hours of operation in non-emergency situations are counted as part of the 100 hours per calendar year

for maintenance and testing provided in Paragraph (ii) above. Except as provided in Paragraph (A) below, the 50 hours per calendar year for non- emergency situations cannot be used for peak shaving or non-emergency demand response, or to generate income for a facility to an electric grid or otherwise supply power as part of a financial arrangement with another entity.

(A) The 50 hours per year for non-emergency situations can be used to supply power as part of a financial arrangement with another entity if all of the following conditions are met:
   (1) The engine is dispatched by the local balancing authority or local transmission and distribution system operator;
   (2) The dispatch is intended to mitigate local transmission and/or distribution limitations so as to avert potential voltage collapse or line overloads that could lead to the interruption of power supply in a local area or region.
   (3) The dispatch follows reliability, emergency operation or similar protocols that follow specific NERC, regional, state, public utility commission or local standards or guidelines.
   (4) The power is provided only to the facility itself or to support the local transmission and distribution system.
   (5) The owner or operator identifies and records the entity that dispatches the engine and the specific NERC, regional, state, public utility commission or local standards or guidelines that are being followed for dispatching the engine. The local balancing authority or local transmission and distribution system operator may keep these records on behalf of the engine owner or operator.

[§60.4211(f)]

Recordkeeping

i. The Permittee shall keep records of the following:
   i. All notifications submitted to comply with this subpart and all documentation supporting any notification. [§60.4214(a)(2)(i)]
   ii. any maintenance performed on the engine [§60.4214(a)(2)(ii)];
   iii. documentation from the manufacturer that the engine is certified to meet the emission standards in Paragraph c above. [§60.4214(a)(2)(iii)]; and
   iv. the hours of operation of the engine in emergency and non-emergency service that are recorded through the non-resettable hour meter. [§60.4214(b)]

Reporting

j. If the Permittee owns or operates an emergency stationary CI ICE with a maximum engine power more than 100 HP that operates for the purposes specified in Paragraph h.iii(A) above, the Permittee shall submit an annual report according to the requirements at §60.4214(d). This report must be submitted to the Regional Supervisor and directly to the EPA pursuant to §60.4214(d)(3). [§60.4214(d)]