NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date: June 9, 2021

Region: Fayetteville Regional Office
County: Sampson
NC Facility ID: 8200152
Inspector's Name: Gregory Reeves
Date of Last Inspection: 02/27/2020
Compliance Code: 3 / Compliance - inspection

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

Permit Applicability (this application only)

SIP: 02D .0515, 02D .0516, 02D .0521, 02D .0530, 02D .0540, 02D .1111, 02D .1112, 02Q .0711, 02Q .0504, and 02Q .0317 for 02D .0530 and 02D .1100
NSPS: No
NESHAP: 112(g) Case-by-Case MACT
PSD: Yes, until after 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 federally enforceable 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	Ken McBride Plant Manager (919) 820-9693 5 Connector Road, US 117 Faison, NC 28341	Kai Simonsen Air Permit Engineer (919) 428-0289 4242 Six Forks Road, Suite 1050 Raleigh, NC 27609

Application Data

Application Number: 8200152.20B
Date Received: 04/07/2020
Application Type: Modification
Application Schedule: State

Existing Permit Data
Existing Permit Number: 10386/R04
Existing Permit Issue Date: 10/02/2019
Existing Permit Expiration Date: 09/30/2027

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP
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 06/09/2021

Comments / Recommendations:
Issue 10386/R05
Permit Issue Date: 06/09/2021
Permit Expiration Date: 09/30/2027

1. Purpose of Application

Enviva Pellets Sampson, LLC (Enviva) currently holds Air Permit No. 10386R04 with an expiration date of September 30, 2027 for a wood pellets manufacturing plant near Faison in Sampson County, North Carolina. The facility began operation on October 3, 2016 and is permitted to produce up to 657,000 oven-dried tons (ODT) per year of wood pellets utilizing up to 100% softwood on a 12-month rolling basis. However, the permit requires the facility to demonstrate compliance with a series of performance tests before the facility can operate at the maximum throughput or softwood percentage. The facility consists of a log chipper, green wood hammermills, bark hog, wood-fired rotary dryer, dry hammermills, pellet presses and coolers, product loadout operations, and other ancillary activities.

This permit application was submitted as a 15A NCAC 02Q .0300 modification in accordance with Section 2.1 A.4.a of Air Permit No. 10386R04 for compliance with 15A NCAC 02D .1112, "Case-By-Case Maximum Achievable Control Technology" (aka 112(g) MACT) and Section 2.2 A.1.f for compliance with 15A NCAC 02D .0530, "Prevention for Significant Deterioration." An addendum to the permit application was submitted on December 11, 2020. The following summarizes the proposed physical changes and changes in the method of operation associated with this permit modification:

- Install a regenerative catalytic oxidizer (RCO)/regenerative thermal oxidizer (ID No. CD-RCO) to control emissions from the pellet presses and pellet coolers (ID Nos. ES-CLR-1 through ES-CLR-6);
- Route exhaust from the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8) to either the existing dryer furnace (ID No. ES-DRYER) in series with the wet electrostatic precipitator (WESP) in series with the RTO (ID No. CD-RTO) OR directly to the WESP (ID No. CD-WESP) in series with the RTO (ID No. CD-RTO) for emissions control;
- Remove the current throughput limitation on the dry hammermills (Section 2.2 A.1.j of Air Permit No. 10386R04);
- Add two (2) natural gas/propane-fired duct burners (ID Nos. IES-DDB-1 and IES-DDB-2), each with a heat input capacity of 2.5 million British thermal units per hour (MMBtu/hr) to heat the dryer system ducts;
- Optimize operation of the RTO (ID No. CD-RTO) on the dryer line and increase the permitted heat input of the RTO to allow for injection of natural gas;
- Revise the potential emissions for dried wood handling (ID No. ES-DWH) and the dryer (ID No. ES-DRYER) and green hammermills (ID Nos. ES-GHM-1, ES-GHM-2, ES-GHM-3) (both controlled by CD-RTO) to reflect the results from the December 2019 compliance testing;
- Increase the heat input of furnace idle mode from 5 MMBtu/hr to 10 MMBtu/hr (ID No. ES-FBYPASS);
- Combine the furnace bypass (ID No. ES-FBYPASS) and the dryer bypass (ID No. ES-DBYPASS) into one emission source (ID No. ES-F/DBYPASS), as potential to emit emission estimates for ES-FBYPASS reflect emission from both bypasses;
- Clarify that diesel fuel may be used as an accelerant for cold start-up of the furnace; and
- Increase the fraction of particulate matter (PM) that is PM2.5 for the finished product handling baghouse (ID No. CD-FPH-BH). Emissions of PM2.5 are estimated as 0.35% of PM emissions as provided in permit application Nos. 8200152.14B and 8200152.18A. This fraction results in an exit grain loading rate that is cleaner than ambient air, which is not realistic.

On January 11, 2021, NCDAQ received a 15A NCAC 02Q .0318 Notification letter from Enviva to add two (2) electric boilers to the facility. The two electric boilers (ID Nos. TBD) will be added to the list of insignificant activities as part of this permit modification.

Enviva is currently classified as a major source under Prevention of Significant Deterioration (PSD) rules because emissions of volatile organic compounds (VOCs) exceed 250 tons per year (tpy). The facility is also currently considered a major source of hazardous air pollutants (HAPs) due to total HAP emissions and maximum individual HAP emissions exceeding the major source thresholds of 25 tpy and 10 tpy, respectively. Upon implementation of the proposed changes noted above, the facility will no longer be a major source with respect to PSD or a major source of HAPs.

2. Application Chronology

April 7, 2020	Received permit application.
April 7, 2020	E-payment received.
April 8, 2020	NCDAQ sent acknowledgment letter via email indicating the application was incomplete because no zoning consistency determination was received.
April 8, 2020	Michael Carbon, consultant for Enviva, provided documentation that the zoning consistency determination was submitted to the local town/zoning authority. The permit application was deemed administratively complete at that point.
May 5, 2020	NCDAQ issued a Notice of Violation (NOV) to Enviva for exceeding Best Achievable Control Technology (BACT) emission limits for particulate matter (PM) and PM10 from the pellet presses and coolers during source testing occurring in December 2019.
May 13, 2020	NCDAQ sent a letter to Enviva pursuant to 15A NCAC 02Q .0312(a)(l)(B) and (C) indicating the permit application was technically incomplete.
May 29, 2020	Enviva submitted a response to the NOV on May 29, 2020. In its response letter, Enviva proposed to enter into Special Order by Consent (SOC) with NCDAQ to install additional controls on the facility's pellet presses and coolers and to reduce potential emissions from the Sampson facility to below PSD applicability thresholds.
June 11, 2020	Response to the letter was received and permit application was deemed technically complete at that point.
June 24, 2020	Updated air dispersion modeling from Enviva was received by NCDAQ.
August 3, 2020	Betty Gatano discussed control of the dry hammermills with Michael Carbon via phone. Michael Carbon provided an updated description of the controls via e-mail on August 5, 2020.

August 10, 2020	Matt Porter of the Air Quality Analysis Branch (AQAB) issued a memorandum approving the air dispersion modeling for hexachlorodibenzo-p-dioxin.
June – Nov. 2020	Negotiations between NCDAQ and Enviva regarding the proposed SOC occurred throughout this period.
November 6, 2020	Draft permit and permit review forwarded internally for comments.
November 9, 2020	Comments received from Heather Carter, Supervisor of the Fayetteville Regional Office (FRO) and Greg Reeves, Permitting Coordinator of the FRO.
November 12, 2020	SOC resolving violations of exceeding the BACT emission limits for PM and PM10 from the pellet presses and coolers forwarded to public notice.
November 16, 2020	Comments received from Steve Hall, Chief of the Technical Services Branch.
November 19, 2020	Betty Gatano addressed internal comments and forwarded drafts to NCDAQ staff for final review. Review of the drafts were halted because NCDAQ learned the bypass scenarios presented in the permit application (8200152.20B) for Enviva were incorrect.
November 20, 2020	NCDAQ learned that the bypass scenarios presented in the permit application (8200152.20B) for Enviva were incorrect. Betty Gatano e-mailed Michael Carbon and requested an amendment to the permit application correcting the bypass scenarios.
December 11, 2020	Addendum to permit application was received. The addendum addressed use of the furnace and dryer bypass stacks during cold start-up, shutdown, and furnace idle mode. Enviva also clarified that diesel fuel may be used as an accelerant for cold start-up of the furnace. The amount of fuel used per event will typically be 15-30 gallons and 100-200 gallons per year.
December 14, 2020	Public comment period for SOC resolving violations of exceeding the BACT emission limits for PM and PM10 from the pellet presses and coolers ended. No comments received.
December 16, 2020	SOC (2020-004) between NCDAQ and Enviva finalized.
December 17, 2020	Betty Gatano sent an e-mail to Michael Carbon requesting more information about combining the dryer and furnace bypasses into one emission source. Michael Carbon responded that same day.
December 21, 2020	Betty Gatano sent another e-mail to Michael Carbon requesting more information about emissions from the dryer bypass and its location in relation to the furnace bypass. Michael Carbon responded to the e-mail on December 22, 2020.

December 29, 2020	Betty Gatano sent an e-mail to Tom Anderson, Supervisor of the AQAB, requesting guidance on the need for additional air dispersion modeling to account for the use of diesel fuel during startup and combining the furnace and dryer bypasses. Tom Anderson responded that same day and indicated that these scenarios are not expected to result in an increase in the maximum modeled impacts, and, in his professional opinion, additional air dispersion modeling is not warranted.
January 8, 2021	NCDAQ conducted internal discussion to discuss bypass scenarios.
January 11, 2021	Betty Gatano sent an e-mail to Michael Carbon regarding questions about the bypass scenarios. Aubrey Jones responded to the e-mail on January 14, 2021.
January 11, 2021	NCDAQ received a 15A NCAC 02Q .0318 Notification letter from Enviva to add two (2) electric boilers to the facility. The letter also served as notification under 15A NCAC 02D .0530(u) and included an analysis of the Projected Actual Emissions (PAE) for this project. The PAE were revised and resubmitted to NCDAQ on February 4 and 12, 2021, in response to questions from NCDAQ.
January 12, 2021	Second draft permit and permit review forwarded internally for comments.
January 22, 2021	Comments on second draft received from Booker Pullen, Permitting Supervisor, and FRO.
January 27, 2021	Drafts forwarded to Enviva for comments.
February 2, 2021	Comments received from Enviva on draft permit and permit review. Response to comments is addressed in Section 11 below.
February 12, 2021	NCDAQ staff participated in a call and presentation with Enviva to discuss consistency issues among all Enviva permits in North Carolina.
February 12, 2021	NCDAQ received a Notice of Intent to Construct (NOI) via e-mail on February 12, 2021, with hard copy and check received on February 17, 2021.
February 18, 2021	NCDAQ issued a letter indicating the installation of the two electric boilers meets the requirements of 15A NCAC 02Q .0318, "Changes Not Requiring Permit Revisions." The letter also indicated the project emission increase is less than 50 percent of the significant emission rates for all pollutants, provided Enviva operates in accordance with assumptions used in its PAE calculations. Provided these operational parameters are followed, no monitoring, recordkeeping, and reporting are required under 15A NCAC 02D .0530(u) for the installation of the electric boilers at Enviva.

February 23, 2021	NCDAQ issued a letter granting permission for the construction, alteration or expansion of the following projects listed in Enviva's NOI: • Increase in capacity of the existing RTO (ID No. CD-RTO); • Modify the exhaust of the dry hammermills; • Install an RTO/RCO (ID No. CD-RCO) on the pellet presses and coolers; and • Add duct burners (ID Nos. IES-DDB-1 and IES-DDB-2) to the dryer system. As indicated in the letter, operation of this equipment is not allowed prior to receipt of the revised air permit.
Feb. and March 2021	NCDAQ held several internal meetings to discuss Enviva's concerns over consistency in permits. NCDAQ's response to these consistency issues is addressed in Section 11 below, as NCDAQ's decisions impact this permit application.
March 11 & 15, 2021	Betty Gatano and Michael Carbon discussed the completion of the Soft Wood Expansion Project (SWEP).
March 16, 2021	Revised drafts addressing Enviva's comments forwarded internally for comments.
March 17, 2021	Michael Carbon provided clarification on Enviva's comments related to the permitted TAP emission limits.
April 7, 2021	Received comments for Booker Pullen. Mark Cuilla, Permitting Section Chief, and Greg Reeves indicated they had no additional comments.
April 9, 2021	Drafts forwarded to Enviva for comments.
April 16, 2021	Comments from Enviva received.
April & May 2021	NCDAQ reviewed Enviva comments and addressed them in the permit review) and permit, if deemed applicable. A summary of Enviva's comments and NCDAQ's responses are provided below in Section 11.
May 5, 2021	Draft permit and permit review forwarded to public notice.
June 4, 2021	Public comment period ends. Several comments were received. A summary of the public comments and NCDAQ's responses are provided below in Section 12.
June 9, 2021	Permit issued.

3. Permit Modifications/Changes and ESM 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	• Added two duct burners (ID Nos. IES-DDB-1 and IES-DDB-2). • Added two electric boilers (ID Nos. TBD). • Added description noting that the debarker (ID No. IES-DEBARK-1) is partially enclosed. • Added footnotes stating the Permittee will not be subject to 15A NCAC 02D .0530 or 15A NCAC 02D .1112 upon operation of all control devices in Section 1.0.
3 – 4	Section 1 – Equipment Table	• Modified the description of the regenerative thermal oxidizer (ID No. CD-RTO). • Modified the description of the dryer (ID No. ES-DRYER) and the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8). • Combined the furnace and dryer bypasses (ID No. ES-F/DBYPASS) into one emission source. • Added the existing dryer furnace (ID No. ES-DRYER) in series with the wet electrostatic precipitator (WESP) in series with the RTO (ID No. CD-RTO) AND the WESP (ID No. CD-WESP) in series with the RTO (ID No. CD-RTO) as control options for the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8). • Added regenerative catalytic oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) as control for the pellet presses and coolers (ID No. ES-CLR-1 through ES-CLR-6). • Added footnotes stating the Permittee will not be subject to 15A NCAC 02D .0530 or 15A NCAC 02D .1112 upon operation of all control devices in Section 1.0. • Added footnote stating that diesel fuel as a startup accelerant for the furnace (ID No. ES-F/DBYPASS) is limited to 30 gallons per startup and 200 gallons per year. • Added footnote explaining the routing of the exhaust from the dry hammermills through the baghouses (ID Nos. CD-HM-BH1 through CD-HM-BH8), the dryer furnace (ID No. ES-DRYER), the WESP (ID No. CD-WESP), and the RTO (ID No. CD- RTO).
5	2.1 A – Emission Sources	• Combined the furnace and dryer bypasses (ID No. ES-F/DBYPASS) into one emission source. • Added control device options for the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8). • Added regenerative catalytic oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) as control for the pellet presses and coolers (ID No. ES-CLR-1 through ES-CLR-6).

Pages	Section	Description of Changes
6	2.1 A – Regulations Table	• Added the regenerative thermal oxidizer (ID No. CD-RTO) and the catalytic oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) as subject to 15A NCAC 02D .0516. • Added references to avoidance conditions for 15A NCAC 02D .0530 and 15A NCAC 02D .1112. • Added references to 15A NCAC 02D .1100 and 15A NCAC 02Q .0711.
6 – 8	2.1 A.1	• Added reference to the control options on the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8) throughout permit condition. • Added reference to the regenerative catalytic oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) as control for the pellet presses and coolers (ID No. ES-CLR-1 through ES-CLR-6) throughout permit condition.
6	2.1 A.1.c	Added requirement for Permittee to submit documentation for the minimum number of grids operating during testing and the minimum average secondary voltage and minimum average current for the wet electrostatic precipitator **(ID No. CD-WESP)** to the DAQ as part of the initial compliance test report. These parameters will be added to the permit once established.
8	2.1 A.1.h	Added monitoring and recordkeeping requirements for the regenerative catalytic oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) to ensure compliance with 15A NCAC 02D .0515.
9	2.1 A.2	Added the regenerative thermal oxidizer (ID No. CD-RTO) and the catalytic oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) as subject to 15A NCAC 02D .0516.
9	2.1 A.3.c	Added requirement to reestablish "normal" visible emission in the first 30 days following the commencement of operation for the control options on the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8) and for the regenerative catalytic oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) on the pellet presses and coolers (ID No. ES-CLR-1 through ES-CLR-6).
9	2.1 A.3.d	Added requirement for Permittee to make a visible observation of the furnace/dryer bypass (ID No. ES-F/DBYPASS) while operating in idle mode.
10	2.1 A.4.a	• Added condition indicating requirements under 15A NCAC 02D .1112, 112(g) Case-by-Case Maximum Achievable Control Technology, will no longer be enforceable when the Permittee becomes minor for HAPs. • Renumbered the permit accordingly.
10	2.1 A.4.b	Revised schedule for installing controls on the dry hammermills and pellet presses and coolers.
12	2.2 A – Regulations Table	Added references to 15A NCAC 02D .1100 and 15A NCAC 02Q .0711.
12	2.2 A.1.a	• Added condition indicating the Permittee would no longer be subject to 15A NCAC 02D .0530 after all controls have been constructed and are operational to reduce facility-wide emissions to below PSD major source thresholds. • Renumbered the permit accordingly.
15	2.2 A.1.e.v.(D)	Added statement indicating initial testing was completed with the exception of particulate matter emission testing from the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8).
16	2.2 A.1.f(xii)	Modified permit condition to require submittal of test report no later than 30 days after sample collection, unless an alternative date is approved in advance by DAQ in accordance with 15A NCAC 02D .2602(f).

Pages	Section	Description of Changes
17	2.2 A.1.g.iii	Added statement indicating permit application was submitted as required by permit condition.
--	2.2 A.1.k (old numbering)	• Removed condition limiting throughput of the dry hammermills (ID Nos .ES-HM-1 through ES-HM-8) to 85% of the permitted capacity. • Renumbered permit accordingly.
17	2.2 A.1.k and l (new numbering)	Added monitoring and recordkeeping requirements for the furnace and dryer bypass scenarios.
18	2.2 A.1.q (new numbering)	Clarified monitoring and recordkeeping requirements for the RTO (ID No. CD-RTO).
18 - 23	2.2 A.2	• Added permit condition for avoidance of 15A NCAC 02D .0530, Prevention of Significant Deterioration. • Renumbered permit accordingly.
23 – 25	2.2 A.3	• Added permit condition for avoidance of 15A NCAC 02D .1112, 112(g) Case-by-Case MACT. • Renumbered permit accordingly.
25 – 26	2.2 A.4	• Added permit condition for 15A NCAC 02D .1100, Control of Toxic Air Pollutants. • Renumbered permit accordingly.
26 – 27	2.2 A.5	• Added permit condition for 15A NCAC 02Q .0711, Emission Rates Requiring a Permit. • Renumbered permit accordingly.
--	2.2 A.7 (old numbering)	Removed the permit condition for 15A NCAC, 02Q .0504, Option for Obtaining Construction and Operation Permit, requiring submittal of a revised initial Title V permit application. The revised application was submitted on October 1, 2020, fulfilling this permit requirement.
30	2.3 A	Added a Schedule of Compliance allowing the Permittee to operate until the facility is a minor source under PSD and BACT emission limits are no longer applicable.

The following changes were made to the Emission Source Module (ESM) as part of this modification.

- Added two natural gas/propane-fired duct burners (ID No. IES-DDB-1 and IES-DDB-2) as insignificant activities.
- Added two electric boilers (ID Nos. TBD) as insignificant activities.
- Modified the heat input of the regenerative thermal oxidizer (ID No. CD-RTO).
- Added "integral transfer cyclones" to the description of the dryer (ID No. ES-DRYER) and the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8).
- Combined the furnace bypass (ID No. ES-FBYPASS) and the dryer bypass (ID No. ES-DBYPASS) into one emission source (ID No. ES-F/DBYPASS).
- Added the existing dryer furnace (ID No. ES-DRYER) in series with the wet electrostatic precipitator (WESP) in series with the RTO (ID No. CD-RTO) AND the WESP (ID No. CD-WESP) in series with the RTO (ID No. CD-RTO) as control options for the dry hammermills (ID Nos. ES-HM-1 through ES-HM-8).
- Added a RCO/RTO (ID No. CD-RCO) as control for the pellet presses and pellet coolers (ID Nos. ES-CLR-1 through ES-CLR-6).

4. Description of Proposed Changes

Equipment, process changes, and emissions associated with this modification are discussed in this section. Figure 1 below provides a schematic of the wood pellets manufacturing process at Enviva after modification.

Control VOC, HAPs, and PM emissions from the dry hammermills

Enviva proposes to implement an air flow recirculation process to route a portion of the exhaust from each dry hammermill back to the front end of the respective dry hammermill to reduce fresh intake air and thus decrease the volume of air that is 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 to either the dryer furnace in series with the WESP (ID No. CD-WESP) in series with the RTO (ID No. CD-RTO) or directly to the WESP (or a combination of the two) in series with the RTO (ID No. CD-RTO) for emissions control. As designed, all exhaust gas from the dry hammermill baghouses will be exhausted to the dryer furnace, unless the required combustion air is less than the dry hammermill exhaust. In that case, the surplus of air supplied by the dry hammermills would be diverted directly to the dryer WESP and RTO. This scenario results in reduced production rates of the furnace, dryer, and dry hammermills. At all times during normal operations 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.

Control VOC and HAP emissions from the pellet presses and pellet coolers

Enviva proposes to install a dedicated RTO/RCO (ID No. CD-RCO) to control VOC and HAP emissions from the pellet presses and pellet coolers. Exhaust from the six (6) existing pellet cooler cyclones will be routed to a quench duct and then to an RTO/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, as discussed above.

With control of VOC and HAP emissions from the pellet presses and pellet coolers and the dry hammermills, Enviva will become a minor source under PSD and an area source of HAP emissions. The modified permit will include federally enforceable avoidance conditions for both PSD and 112(g) Case-by-Case MACT.

Remove the current dry hammermill throughput limitation

Enviva requests to remove the current throughput limitation of 558,450 oven dried tons (ODT) on the dry hammermills. This value represents 85% of the facility's maximum production rate of 657,000

ODT per consecutive 12-month period. With this application, Enviva is proposing to increase the dry hammermill throughput to 657,000 ODT per consecutive 12-month period.

Add duct burners

Enviva proposes to add two (2) natural gas/propane-fired burners, each with a maximum heat input of 2.5 MMBtu/hr, to heat the dryer system ducts (ID Nos. IES-DDB-1 and IES-DDB-2). 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. To prevent condensation from occurring, and thus reduce the fire risk, the two ducts (herein referred to as double ducts) on the dryer system will be heated. The duct from the cyclone outlet to the ID fan will be 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 will be used to heat the duct used for exhaust gas recirculation and the WESP. The burners will combust natural gas, with propane as back-up, and will exhaust directly to the atmosphere. Potential emissions from the duct burners are below the thresholds in 15A NCAC 02Q. 0503(8), and they are thus considered insignificant activities.

Optimize operation of existing RTO

Enviva is proposing several modifications to optimize operation of the existing RTO (ID No. CD-RTO) following the WESP (ID No. CD-WESP), including changing the media to decrease the differential pressure, enlarging the ductwork and poppet valves to allow for more air flow, addition of two (2) canisters with combustion zone (i.e., firebox), and additional burners. Enviva is also requesting authorization for injection of natural gas into the RTO, which will reduce the amount of combustion air added to the RTO, thereby increasing fuel efficiency and reducing generation of nitrogen oxides (NOx). The heat input of the RTO will be increased from 32 MMBtu/hr to 45.2 MMBtu/hr as a result of the additional burners and natural gas injection.

Revise emission data

Enviva proposes to revise the potential emissions for dried wood handling (ID No. ES-DWH) and the dryer and green hammermills (both controlled by CD-RTO) to reflect results from the December 2019 compliance testing.

Modify bypass scenarios

Enviva proposes to increase the heat input of furnace idle mode from 5 MMBtu/hr to 10 MMBtu/hr (ID No. ES-FBYPASS). The facility has determined that 5 MMBtu/hr is insufficient for maintaining a flame in the furnace. Enviva also clarified that diesel fuel may be used as an accelerant for cold start-up of the furnace. The amount of fuel used per event will typically be 15-30 gallons and 100-200 gallons per year.

Enviva's permit application submitted on April 7, 2020, included a request to remove the bypass from the permit (ID No. ES-DBYPASS) because it only operated during malfunction. In discussions and e-mails with Enviva regarding its other facilities in NC, NCDAQ learned the dryer bypass at the Sampson facility operates in situations other than malfunction. NCDAQ requested Enviva to amend its permit application to clarify the operation of the dryer bypass. The addendum was submitted on December 11, 2020 and includes the following description of the dryer bypass operations:

- *Cold Start-ups and Transition from Furnace Idle*: The dryer bypass stack is used when the furnace is started up from a cold shutdown and when the furnace transitions from idle mode to normal operation. Emissions are vented through the dryer bypass stack for approximately

10 minutes as exhaust flow is transitioned from the furnace bypass stack to the WESP and RTO. The dryer is not operational during this time and emissions are due solely to combustion of fuel in the furnace.

- *Planned Shutdown*: During planned shutdowns, as the remaining fuel is combusted by the furnace, the Operator reduces the chip input to the dryer. When only a small amount of chips remains, the dryer drum is emptied. The dryer bypass stack is then opened, and a purge air fan is used to ensure no explosive build-up occurs in the drum. Emissions during this time are negligible and have not been quantified, as the furnace is directed to its abort stack and the dryer is no longer operating.

- *Malfunction:* The dryer system automatically aborts due to power failure, equipment failure, or furnace abort. For example, if the RTO goes offline because of an interlock failure, the dryer will immediately abort. Dryer abort may also occur if the dryer temperature is out of range, or if a spark is detected.

  Malfunctions are infrequent, unpredictable, and minimized to the maximum extent possible. They cannot be permitted, as they are by definition, unplanned events. These emissions cannot reasonably be quantified and are not included in the facility-wide potential emissions. As described above, emissions during cold start-ups, planned shutdowns, and furnace idle are due solely to combustion of fuel in the furnace. The dryer is not operational during these periods.

The potential emissions included in the April 7, 2020 application for the furnace bypass stack (ID No. ES-FBYPASS) accurately reflect emissions from fuel combustion in the furnace during each of these operating modes and thus fully account for emissions from the dryer bypass stack. In the addendum, Enviva also requests that the furnace bypass (ID No. ES-FBYPASS) and the dryer bypass (ID No. ESDBYPASS) be combined and referred to as ES-F/DBYPASS as the potential to emit emission estimates for the furnace bypass used in the 2019 air dispersion modeling reflect emission from both furnace bypass and dryer bypass. More discussion about the bypass scenarios and the air dispersion modeling is provided below in Section 8.

<u>Modify PM2.5 from finished product handling</u>

Enviva proposes to increase the fraction of PM that is PM2.5 for the finished product handling baghouse (ID No. CD-FPH-BH). The permit application submitted in August of 2014 incorrectly calculated PM2.5 emissions as 0.35% of PM emissions. This fraction results in an exit grain loading rate that is cleaner than ambient air and would require a sampling run of over 100 hours to quantify [0.000014 grains per standard cubic feet (gr/scf)]. The facility has not been able to find any documentation to support a value of 0.35% and, given that this results in a concentration that is cleaner than ambient air, Enviva believes this value was used in error. Based on a review of National Council for Air and Stream Improvement, Inc. (NCASI) particle size distribution data for similar baghouses used in the wood products industry, Enviva has determined the correct fraction of PM that is PM2.5 is 40%. As such, Enviva is revising the potential emissions for the finished production handling baghouse to reflect an exit grain loading rate of 0.0016 gr/scf (filterable only).

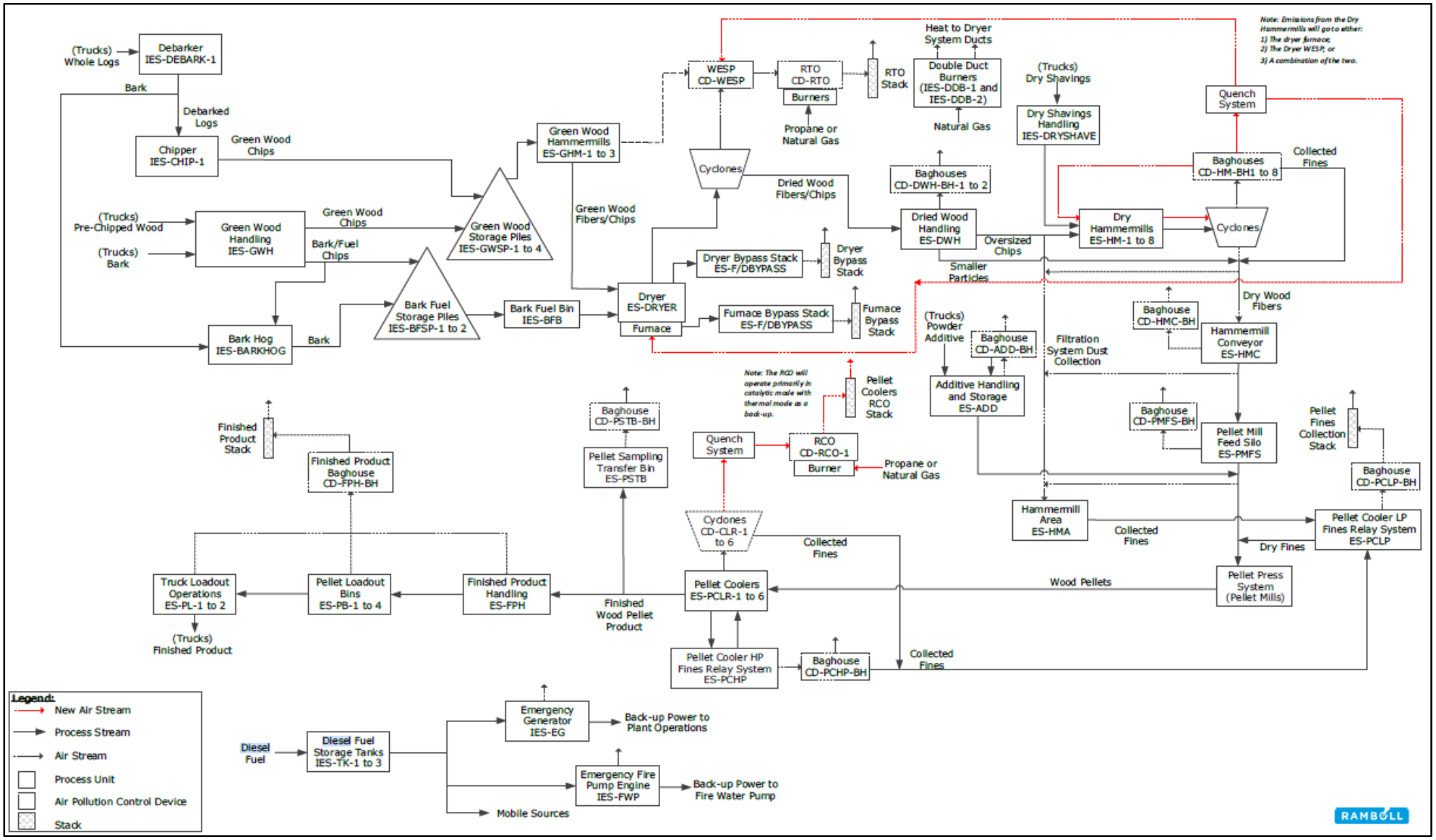

Figure 1. Flow Diagram of Wood Pellet Process after Modification

5. Emissions Associated with Permit Modification

As noted above, Enviva is currently classified as a major source under PSD and a major source of HAPs. The facility proposes to control 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) as part of this modification. Federally enforceable limits on emissions will be also incorporated into the permit as part of this modification. Upon permit issuance with these limits and installation and operation of the control devices, the facility will no longer be a major source with respect to PSD or a major source of HAP.

Emissions associated with this permit modification as documented in the permit application are provided in the table below. Emission calculations are provided in Attachment 1 to this document.

Pollutant	Potential Emissions before Modification (tpy)	Potential Emissions after Modification (tpy)	Change in Potential Emissions (tpy)
PM (TSP)	205	234	29
PM10	93	87.1	-6.2
PM2.5	40	48.1	8.2
CO	219	107	-112
NO_x	221	111	-110
SO_2	27.6	27.6	0
VOC	831	113	-718
Largest HAP	83 (methanol)	6.8 (methanol)	-76.7
Total HAP	149	22.9	-126.4
CO2e	256,475	272,322	15,846

Notes:

- Potential emissions for before modification provided in Appendix C of Permit Application No. 8200152.18A.
- Potential emissions for this modification provided in updated emission spreadsheet received on 06/18/2020.
- The potential emissions 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 remains a minor source under PSD.

As part of the permit application addendum received on December 11, 2020, Enviva clarified that diesel fuel may be used as an accelerant for cold start-up of the furnace. The amount of fuel used per event will typically be 15-30 gallons and 100-200 gallons per year. Emissions from the diesel fuel were estimated and as shown in the table below are considered negligible.

Pollutant	Emission Factor	Emissions from Diesel Fuels	
	($lb/10^3$ gal)	lb/yr	ton/yr
PM (TSP)	3.30E+00	6.60E-01	3.30E-04
PM10	1.08E+00	2.16E-01	1.08E-04
PM2.5	8.30E-01	1.66E-01	8.30E-05
CO	5.00E+00	1.00E+00	5.00E-04
NO_x	2.00E+01	4.00E+00	2.00E-03
SO_2	7.10E+01	1.42E+01	7.10E-03
VOC	3.40E-01	6.80E-02	3.40E-05
Largest HAP (Toluene)	8.0E-02	1.59E-02	7.97E-06
Total HAP	1.43E-01	2.87E-02	1.43E-05

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.

Below is a sample calculation for NOx demonstrating how the potential emissions in the above tables were derived. The emissions of NOx are generated during the combustion of VOCs and fuel by the RTO and RCO, as well as fuel combustion by the furnace, emergency generator, and the firewater pump.

- **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 mm Btu/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

- **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

  Facility-Wide NOx Emissions = 111.2 tons/yr

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

6. Regulatory Review

Although the facility is requesting emission limits to become a PSD and HAP minor source as part of this permit modification, these limits will not be applicable until the RCO/RTO (ID No. CD-RCO) on the pellet presses and coolers is operational and the exhaust from baghouses on the dry hammermills has been re-routed the existing dryer furnace (ID No. ES-DRYER), in series with the WESP (ID No. CD-WESP) and RTO (ID No. CD-RTO) OR directly to the WESP (ID No. CD-WESP) in series with the RTO (ID No. CD-RTO). Enviva will remain a major source under PSD and HAP until that time. This section discusses regulations applicable for both scenarios (i.e., PSD/HAP major and PSD/HAP minor). Regulations are applicable to both scenarios unless noted in the text below.

- 15A NCAC 02D .0515, Particulates from Miscellaneous Industrial Processes – Numerous emission sources at Enviva are subject to 02D .0515. Allowable emissions of PM 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

  The facility conducted testing for compliance with BACT emission limits from December 16 through 20, 2019. Shannon Vogel of the Stationary Source Compliance Branch (SSCB) reviewed and approved the testing results in a memorandum dated March 11, 2020. The results of the test 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. Instead, Enviva requested and was granted an extension for testing PM from the dry hammermills until September 30, 2020 due to the small BACT PM2.5 emission limit for this emission source. The BACT emission limit for PM2.5 was 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. Enviva has submitted Permit Application No. 8200152.20A to revise this BACT limit.

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, 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 will also be required to conduct inspection and maintenance of the WESP and the RTO in accordance with the manufacturers' recommendations.

- 15A NCAC 02D .0516, Sulfur Dioxide Emissions from Combustion Sources – The wood-fired direct heat drying system (ID No. ES-DRYER), new duct burners (ID Nos. IES-DDB-1 and IES-DDB-2), the existing RTO (ID No. CD-RTO), and the proposed 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, 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.

- 15A NCAC 02D .0530, Prevention of Significant Deterioration – This regulation is applicable until the installation and operation of the RCO/RTO on the pellet presses and coolers, the rerouting of the dry hammermill exhaust to the dryer or WESP, and the issuance of a permit with federally enforceable emission limits. 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
Dried 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	1.44 lb/ODT	1.74 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 dried wood handling operations (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. Enviva was issued 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 DAQ to address this violation, and a schedule of compliance incorporating requirements of the SOC is included in the permit to enable the facility to operate until the facility becomes a PSD minor pursuant to this permit.

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. Instead, Enviva requested and was granted an extension for testing PM from the dry hammermills until September 30, 2020, and a further extension was granted on October 7, 2020 to require compliance testing in accordance with the terms of this permit, due to the small BACT PM2.5 emission limit for this emission source. The BACT emission limit for PM2.5 was 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. Enviva has submitted Permit Application No. 8200152.20A to revise this BACT limit.

- 15A NCAC 02D .0540, Particulates from Fugitive Dust Emissions – This condition is applicable facility-wide. No changes are required for this permit modification, and continued compliance is anticipated.

- 15A NCAC 02D .1100, Control of Toxic Air Pollutants – When Enviva becomes a minor source of HAPs, the facility will no longer be subject to 112(g) Case-by-Case MACT and will become subject to NC Air Toxics. The facility submitted air dispersion modeling to demonstrate

compliance with NC Air Toxics when it becomes a HAP minor. See Section 8 below for more discussion of NC Air Toxics.

- 15A NCAC 02D .1112, 112(g) Case-by-Case Maximum Achievable Control Technology – This regulation is applicable 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 or WESP and the issuance of a permit with a federally enforceable emission limit on HAP emissions. 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 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 (aka the 2019 Settlement Agreement) resolving the dispute between Enviva and NCDAQ and as incorporated into Section 2.1 A.4 of Air Permit No. 10386R04, Enviva must complete the following:

  - Within six months of issuance of Air Permit No. 10386R04, 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 this permit application (8200152.20B) fulfills this requirement.

  - Installation and startup of the control on the pellet presses and coolers 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 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 permit issuance (10386R05).

  - Within six months of issuance of Air Permit No. 10386R04, 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 this permit application (8200152.20B) fulfills this requirement. In the permit application, Enviva has proposed to route emissions from the dry hammermills 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.

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

- 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 installation and operation of the RCO/RTO within 12 months of permit issuance (10386R05).

Air Permit No. 10386R04 also required Enviva to conduct emission testing under 112(g) to establish HAP emission factors from the dryer system and green wood hammermills, the pellet presses and coolers, the dry hammermills, and the dried wood handling operations. The initial testing was conducted in December of 2019, and the test results were used to develop the HAP emission factors provided in this permit application.

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

  PSD Avoidance
  The permit will include PSD avoidance conditions for CO, NOx, PM/PM10/PM2.5, and VOCs to limit emissions of these pollutants to below 250 tons per year. Once the facility becomes a PSD minor source, Enviva will be required to verify controlled emissions via testing.

  The emissions shall be calculated in a manner consistent with the calculation methodologies in the air permit 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. Emissions must be calculated monthly and reported semiannually to ensure compliance with the PSD avoidance limit. The permit condition for PSD avoidance is provided in Attachment 2 to this permit review.

  HAP Avoidance
  The permit will include an avoidance condition to limit HAP emissions to no more than 10 tons per year of any one HAP and 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 HAP emissions monthly, and report emissions semiannually to ensure compliance with the HAP avoidance limit. The permit condition for HAP avoidance is provided in Attachment 3 to this permit review.

- 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). The facility is expected to be in compliance with NSPS Subpart IIII for these engines. 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, the rerouting of the dry hammermill exhaust to the dryer or WESP, and the issuance of a permit with federally enforceable emission limits. 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 an RCO/RTO (ID No. CD-RCO) and the case-by-Case MACT for the dry hammermills is an RTO by either routing emissions to the dryer in series with the WESP and RTO or directly to the WESP in series with the RTO. These emission control options are being added to the permit as part of this modification.

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 they were constructed on or after June 12, 2006. Per 40 CFR 63.590(c)(7), a new engine located at an area source of HAPs complies with MACT Subpart ZZZZ by meeting the applicable requirements of NSPS Subpart IIII. Compliance is anticipated.

With the installation and operation of the RCO/RTO on the pellet presses and coolers, the rerouting of the dry hammermill exhaust to the dryer or WESP, and the issuance of a permit with federally enforceable emission limits, 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. Per 40 CFR 63.590(c)(1), a new engine located at an area

source of HAPs complies with GACT Subpart ZZZZ by meeting the applicable requirements of NSPS Subpart IIII. Compliance is anticipated.

NSR/PSD

Enviva will remain a major source under PSD until the installation and operation of the RCO/RTO on the pellet presses and coolers; the rerouting of the dry hammermill exhaust from the baghouses to either the dryer, followed by the WESP and RTO OR directly to the WESP and the RTO; and the issuance of a permit with federally enforceable emission limits. As a PSD major facility, the facility must comply with BACT emission limits, follow all MRR, 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. The PSD avoidance limit is provided in Attachment 2 to this permit review.

NCDAQ will not require PM testing for the dried 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 A1-17 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)

Enviva currently holds a non-Title V permit, and the modified permit to be issued will also be a non-Title V permit. CAM will be addressed at the time the Title V permit is developed.

8. Facility Wide Air Toxics

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 associate 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 ($\mu g/m^3$)	AAL ($\mu g/m^3$)	% of AAL
Acrolein	1-hour	Normal and Furnace Idle	66.9	80	84 %
Arsenic	Annual	Furnace Cold Start-Up	0.00021	0.0021	10 %

Pollutant	Averaging Period	Scenario	Maximum Impact ($\mu g/m^3$)	AAL ($\mu g/m^3$)	% of AAL
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 %
	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 the memo, but it 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.

Because of control of pellet presses and coolers and dry hammermills, overall TAP emissions will decrease under this permit modification, while some TAP emission increase. 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 demonstrates compliance on a source-by-source basis for hexachlorodibenzo-p-dioxin. Therefore, this modification will not present an "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 %

[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.

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).

Enviva will become a minor source of HAPs after installation and operation of the RCO/RTO on the pellet presses and coolers; the rerouting of the dry hammermill exhaust from the baghouses to either the dryer, followed by the WESP and RTO OR directly to the WESP and the RTO; and the issuance of a permit with federally enforceable emission limits. At that time, the facility will lose this exemption and will become subject to NC Air Toxics. A condition will be added to the permit as part of this modification for applicability of NC Air Toxics 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 will not be included in the NC Air Toxics permit condition.

Discussion of TAPs from Furnace and Dryer Bypasses (ID No. ES-F/DBYPASS)

The permit application addendum received on December 11, 2020 requested, in part, to add diesel fuel as an accelerant for cold-start and to combine the furnace and dryer bypasses into one emission source. These scenarios were evaluated to determine if additional air modeling of the bypass scenarios is required to ensure compliance with NC Air Toxics.

Combining Dryer and Furnace Bypasses

Enviva has requested to combine the furnace and dryer bypass stacks for permitting. As noted previously, emissions from the dryer bypass during cold startup and idle modes are accounted for in emissions from the furnace bypass. The dryer bypass is located approximately 30 feet apart from the furnace bypass. Additionally, the dryer abort stack has a more favorable stack height of 100 feet verses the stack height of the furnace bypass stack, which is only 75.5 feet. Therefore, including emissions from the dryer bypass with the furnace bypass may result in more conservative air dispersion modeling due to the lower height of the furnace bypass stack.

Diesel Fuel Used during Startup

In the December 2020 permit application addendum, Enviva clarified that diesel fuel may be used as an accelerant for cold start-up of the furnace. The amount of fuel used per event will typically be 15-30 gallons and 100-200 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, and for all TAPs, the emissions are below their TPERs.

Toxic Air Pollutant	Emission Factor ($lb/10^3$ gal)	Emissions			TPERS		
		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

Toxic Air Pollutant	Emission Factor ($lb/10^3$ gal)	Emissions			TPERS		
		lb/hr	lb/day	lb/yr	lb/hr	lb/day	lb/yr
Benzene	2.75E-03	5.50E-04	5.50E-04	5.50E-04			8.1
Beryllium Metal (unreacted)	4.20E-04	8.40E-05	8.40E-05	8.40E-05			0.28
Cadmium Metal (elemental unreacted)	4.20E-04	8.40E-05	8.40E-05	8.40E-05			0.37
Soluble chromate compounds, as chromium (VI) equivalent	4.20E-04	8.40E-05	8.40E-05	8.40E-05		0.013	
Fluorides (sum fluoride compounds)	3.73E-02	7.46E-03	7.46E-03	7.46E-03	0.064	0.34	
Formaldehyde	4.80E-02	9.60E-03	9.60E-03	9.60E-03	0.04		
Manganese Unlisted Compounds	8.40E-04	1.68E-04	1.68E-04	1.68E-04		0.63	
Mercury, vapor	4.20E-04	8.40E-05	8.40E-05	8.40E-05		0.013	
Methyl chloroform	2.36E-04	4.72E-05	4.72E-05	4.72E-05	64	250	
Nickle Metal	4.20E-04	8.40E-05	8.40E-05	8.40E-05		0.13	
Toluene	7.97E-02	1.59E-02	1.59E-02	1.59E-02	14.4	98	
Xylene	1.40E-03	2.80E-04	2.80E-04	2.80E-04	16.4	57	

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.

Comparing Emissions in Previous Air Dispersion Modeling

The 2019 air dispersion modeling was evaluated to determine the impact of the bypass scenarios on the modeling results. The table below compares emissions associated with the bypass scenarios to the overall emissions for each TAP modeled. As shown in the table, the only TAP with a maximum impact approaching its AAL is acrolein, with a modeled impact of 84% of its AAL. Emissions from the bypass (in idle mode) account for only 0.27% of the acrolein emissions used in the model. For some TAPs, emissions from the bypass scenario (furnace cold startup) account for 100% of the emissions used in the air dispersion modeling. However, the maximum impacts for these TAPs are 10% or less of the AAL. The evaluation of the 2019 air dispersion modeling demonstrates that the bypass scenarios are not a significant contributor to modeled impacts.

For the reasons noted above, no additional air dispersion modeling of the bypass scenarios is required for this permit application and the dryer and furnace bypasses can be combined for the purposed of permitting.

Pollutant	2019 Air Dispersion Modeling Results						Emissions from Bypass Scenarios Used in 2019 Air Dispersion Modeling		
	Averaging Period	Scenario with Maximum Impact	Scenario Emissions (lb/hr)	Maximum Impact ($\mu g/m^3$)	AAL ($\mu g/m^3$)	% of AAL	Emissions from Furnace Cold Start Up (lb/hr)	Idle Emissions (lb/hr)	% of Emissions
Acrolein	1-hour	Normal and Furnace Idle	7.5E+00	66.9	80	84%	1.5E-01	2.0E-02	0.27%
Arsenic	Annual	Furnace Cold Start-Up	8.3E-04	0.00021	0.0021	10%	8.3E-04	1.1E-04	100.00%
Benzene	Annual	Normal	8.1E-02	0.0053	0.12	5 %			
Cadmium	Annual	Furnace Cold Start-Up	1.5E-04	0.0000392	0.0055	1%	1.5E-04	2.1E-05	100.00%
Chlorine	1-hour	Furnace Cold Start-Up	3.0E-02	0.17	900	<1 %	3.0E-02	4.0E-03	100.00%
	24-hour	Furnace Cold Start-Up	3.0E-02	0.065	37.5	<1 %	3.0E-02	4.0E-03	100.00%
Formaldehyde	1-hour	Normal and Furnace Idle	5.1E+00	42.4	150	28%	1.7E-01	2.2E-02	0.43%
Hydrogen Chloride	1-hour	Furnace Cold Start-Up	7.1E-01	4.1	700	1%	7.1E-01	9.5E-02	100.00%
Manganese	24-hour	Furnace Cold Start-Up	6.0E-02	0.13	31	<1 %	6.0E-02	8.0E-03	100.00%
Phenol	1-hour	Normal and Furnace Idle	3.9E+00	33.3	950	4%		2.6E-04	0.01%

Notes:

- The highlighted cells represent the bypass emissions included in the scenario with the maximum impact. For example, idle emissions of Acrolein (0.02 lb/hr) account for only 0.27% of the acrolein emissions from the scenario with the maximum impact (7.5 lb/hr).
- No benzene emissions from the Furnace Cold Startup OR the Furnace Idle Mode were included in the 2019 air dispersion modeling. NCDAQ questioned the reasoning behind this decision. The following response was received from Enviva: *"It is expected that benzene emissions from wood combustion in the furnace would be below detection levels if ever tested. As such, in the 2019 application (consistent with previous applications) no benzene emissions were quantified for furnace cold start-up or idle. Given the magnitude of benzene emissions from furnace cold start-up and idle and the previous modeling results from 2019 for normal operation (4.45% of the AAL), we don't believe that modeling these emissions would change the conclusions of the ambient impact analysis." NCDAQ* concurs that no additional air dispersion modeling is required.
- No phenol emission from the Furnace Cold Startup were included in the 2019 air dispersion modeling. NCDAQ questioned the reasoning behind this decision. The following response was received from Enviva: *"This was an oversight. Given the magnitude of phenol emissions during cold start-up and the previous modeling results for normal operation and furnace idle, we don't believe modeling these emissions would change the conclusions of the ambient impact analysis. Modeled concentrations for normal operation and furnace idle were only 3.5% of the AAL." NCDAQ* concurs that no additional air dispersion modeling is required.

9. Facility-wide Emissions

Facility-wide potential emissions after this modification to become a PSD and HAP minor source are provided in the table below. Actual emissions from Enviva from 2016 to 2018 are reported in the header of this permit review.

Pollutant	TV Potential Emissions Including Fugitives (tpy)	TV Potential Emissions without Fugitives (tpy)
PM (TSP)	268	234
PM10	99.1	87.1
PM2.5	50.8	48.1
CO	107	107
NO_x	111	111
SO_2	27.6	27.6
VOC	122	113
Largest HAP	6.8 (methanol)	6.8 (methanol)
Total HAP	22.9	22.9
CO2e	272,322	272,322

Notes:

- Potential emissions for this modification provided in updated emission spreadsheet received on 06/18/2020.
- The potential emissions do not include fugitive emissions from the storage piles. 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 remains a minor source under PSD.

10. Compliance Status

NCDAQ has reviewed the compliance status of Enviva. Greg Reeves of FRO conducted the most recent compliance inspection at the facility on February 27, 2020. The Permittee appeared to be operating in compliance during the inspection. Subsequent to the inspection, Enviva was found to be in violation of an emission limit as discussed in the compliance history below.

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 an 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 temperature established during the source testing in December 2019.

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

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

- Completion of SWEP - Enviva requests removal of notification requirements and initial testing triggered off completion of the SWEP because "the SWEP has been completed and this notification was submitted in 2020."

  Response
  DAQ discussed this request with Michael Carbon, consultant for the facility. According to Mr. Carbon, the facility has replaced five pellet presses (dyes), but it was unclear to Enviva (the company) if these replacements would allow the facility to reach 657,000 ODT, which, in part, defines completion of the SWEP.

  After further internal discussions, Enviva concluded the SWEP has not been completed. Thus, Enviva has not submitted notification of SWEP completion. December 2020 testing conducted at the facility represented periodic annual testing as required by the permit and not initial testing required upon SWEP completion. Enviva's intent is to replace additional presses (dyes) as needed prior to the annual testing in December 2021. That testing would then represent initial testing upon completion of the SWEP.

  Because the SWEP has not been completed, notification and initial testing requirements will remain in the permit.

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

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

- Removal of CO and NOx from testing requirements – Enviva requests to remove CO and NOx from RCO/RTO (ID No. CD-RCO) testing requirements. As justification, Enviva states that these pollutants were not required for testing at Northampton and potential emissions are well below the major source threshold for CO and NOx.

  Response
  The Sampson facility is currently a major facility under PSD, and the current permit (No. 10386R04) includes BACT emission limits for NOx and CO. Therefore, comparison with Northampton, a minor source under PSD, is not applicable in this regard. The current permit allows Enviva to reduce testing frequency if test results for at least 3 consecutive years show compliance with emission limits. Once compliance has been demonstrated for 3 consecutive years, NCDAQ will consider removing this requirement. No change will be made to the permit at this time.

- Monitoring operation of the dryer/furnace – The draft permit requires Enviva to monitor and record the date, time, and duration of normal dryer/furnace operation, reduced dryer/furnace operation, and dryer/furnace shutdown. Enviva contends that monitoring during these events would be difficult because operation through the WESP/RTO is short term during process shutdown; is not representative of normal operation; and is not of sufficient duration to allow for performance testing. Furthermore, destruction efficiency of the furnace is not included in emission estimates, and the worst-case emissions scenario is the dryer receiving 100% of dry hammermill emissions.

  Response
  DAQ concurs and will remove the required monitoring. Control of the dryer/furnace during reduced operating and shutdown is specified in Section 2.2 A.2.c.ii.(A) and (B).

- Modification of emission tracking under PSD avoidance - Enviva requests to remove CO, NOx, PM10, and PM2.5 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. 10386R04) includes BACT emission limits for all these pollutants. The current modification (8200152.20B) proposes controls on the pellet presses and coolers and dry hammermills that will reduce emission to 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.

- Testing of the dried wood handling – Enviva requests to remove testing for HAP emissions from dried wood handling operations (ID No. ES-DWH). Initial testing has already been completed for this source, and no modifications to this emission source are being made.

  Response
  Enviva conducted source testing at the Sampson facility to determine HAP emission factors from dried wood handling operations (ID No. ES-DWH) 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 for dried wood handling operations are shown in the table below for one of the two baghouses (ID No. CD-DWH-BH-1) on the dried wood handling operations.

HAP	Test Results for CD-DWH-BH-1	
Formaldehyde	0.012 lb/hr	0.00018 lb/ODT
Methanol	0.028 lb/hr	0.00041 lb/ODT
Acetaldehyde	0.00 lb/hr	0.00 lb/ODT
Propionaldehyde	0.0079 lb/hr	0.00012 lb/ODT
Acrolein	0.00 lb/hr	0.00 lb/ODT
Phenol	0.00 lb/hr	0.00 lb/ODT
Total HAP measured during testing	0.0479 lb/hr	0.00071 lb/ODT
Maximum throughput	657,000 ODT/yr	
Estimated HAP emissions	0.233 ton/yr	

Because no changes are being made to the dried wood handling operations and because the HAP emissions from this emission source are minimal, the NCDAQ concurs that no additional HAP testing is needed, and this requirement will be removed.

- Update TAP permitted limits – The limits do not account for the increase the heat input of furnace idle mode from 5 MMBtu/hr to 10 MMBtu/hr.

  Response
  NCDAQ concurs and will make these corrections.

- Requirements for monitoring diesel fuel usage and bypass events – Enviva requests that requirements for monitoring diesel fuel usage during startup and for monitoring furnace bypass events (startup and idle mode) be removed from the 15A NCAC 02D .1100 permit condition. Enviva states "these conditions are redundant and not consistent with the Northampton or other Enviva permits."

  Response
  The bypass scenarios were included as part of the air dispersion modeling for Enviva. Therefore, including the MRR requirement for the bypass scenarios under the 15A NCAC 02D .1100 permit condition is the most appropriate location in the permit.

  Further, Enviva is unique in that the facility is currently a major source of HAPs and major source under PSD regulations. Enviva will become a minor source under these regulations after the proposed modifications in application No. 8200152.20B are completed. As a result in this change of status, the MRR requirements for fuel usage and bypass events must be included in two places in the permit – under the new NC Air Toxic condition (Section 2.2 A.4) and under the existing BACT condition (Section 2.2 A.1).

  The facility is currently subject to Case-by-Case MACT 112(g) requirements, and sources subject to MACTs are exempt from NC Air Toxics pursuant to 15A NCAC 02Q .0702(a)(27). Thus, 15A NCAC 02D .1100 rules do not apply to the Sampson facility until all controls associated with this permit modification (8200152.20B) have been constructed and are operational. To bridge this gap, the MRR requirements for the bypass scenarios will also be included under the BACT condition. When the facility becomes minor for PSD after all controls associated with

this permit modification (8200152.20B) have been constructed and are operational, the BACT condition will no longer be enforceable.

- Submittal of a Title V application – Enviva requests removal of the requirement to submit an initial Title V application. Enviva submitted a revised Title V permit application on October 1, 2020, which reflected modifications in this permit application (8200152.20B).

  Response
  NCDAQ concurs that the revised Title V permit application fulfills the submittal requirements and will remove this requirement from the permit.

Consistency Issues Discussed during Call on February 12, 2021

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

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

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

- Method of Average Firebox Determination Requirements – Enviva proposes use of a 3-hour block average temperature for RTOs and RCOs rather than a 3-hour rolling average. This averaging period is consistent with Enviva's permits in other states and with 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
  DAQ will continue to research this issue, including reviewing how other states handle 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. 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.

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

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

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

  Response
  DAQ maintains "shell conditions" for regulations common in most permits. (Regulation 15A NCAC 02D .0521 is one example). These conditions can be modified to reduce or increase monitoring given the circumstances at a given facility. The Sampson facility has no extensive compliance history of dust complaints or other issues related to PM emissions. Thus, monthly visible emission observation will remain in the permit.

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

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

12. Public Notice

The NCDAQ Director has determined this permit application will be forwarded to public notice based "on public interest relevant to air quality," pursuant to 15A NCAC 02Q .0306(a)(1). A notice of the DRAFT Permit shall be made pursuant to 15A NCAC 02Q .0307. The notice shall allow a 30-day comment period for the public and the EPA, in accordance with 15A NCAC 02Q .0307(d).

The draft permit was published for public comment on May 5, 2021, and the public comment period ended on June 4, 2021. Eight (8) commenters submitted comments on the draft permit during the public comment period. An overview of the comments and NCDAQ's responses are provided below.

- Support of Permit Issuance – Five commenters supported issuance of the permit, in part, because the new control equipment will improve emissions from the facility. The commenters also noted the creation of both direct and indirect jobs created by the Enviva facility and the benefit of the facility to forest landowners.

  Response
  No response to this comment is needed. No changes to the air permit are deemed necessary to address this comment.

- Impact of logging on air quality – One commenter expressed concerns about Enviva's impacts on forests in NC. According to the commenter, logging associated with the wood pellet industry destroys forests and is the third major cause of carbon emissions in North Carolina. The commenter requests that NC DEQ update the carbon accounting methodology of the land use and forestry sector in the state's greenhouse gas emissions inventory and catalog the emissions of the forestry industry separate from any net-growth benefits.

  Response
  The following information on forests in North Carolina was obtained from "Hearing Officer's Report and Recommendations for Enviva Pellets Sampson, LLC (2019)":

  > Healthy trees and forests are an important part of the environment, and it is important to protect and manage this resource. Information provided by the United States Department of Agriculture (USDA) indicates the forests in North Carolina are stable. The Forest Inventory and Analysis program shows that approximately 55% of the state land area is forest and the diversity and mix is steady. The North Carolina Forestry Service (NCFS) indicates the forest size and mix has been steady since the early 2000s. The growth to removal rate of softwood is 1.61 and hardwood is 2.36 which indicates that inventory levels are expected to increase over time.
  >
  > The North Carolina Greenhouse Gas Inventory (1990-2030) published January 2019 indicates that carbon sinks are primarily due to carbon sequestered in above ground biomass and storage of carbon in wood products. There has been a 4% increase in the annual carbon sequestered between 2005 and 2017. This annual sequestration of carbon reflects North Carolina's sustainable management of its forests and their economic uses.
  >
  > Properly managed forests provide many benefits to the environment. An unmanaged stand of trees may have high density with too many trees crowded together. This means the trees grow more slowly as they must compete for a limited amount of soil nutrients, water and light and this stress makes trees more susceptible to disease and pests. The NCFS is ultimately charged with overseeing the sustainability of timber crops. The NCFS is familiar with

Enviva's operation and believes the suppliers are operating within generally accepted forest management practices.[3]

The commenter also requested changes in methodology for estimating carbon emissions from forests. The methodology for determining carbon emissions from the forest industry is beyond the purview of NCDAQ permitting and will not be addressed as part of this permit modification.

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

- Questions about controls and construction before permit issuance – One commenter raised questions about the NOI approval issued on February 23, 2021. The questions and NCDAQ's responses are provided below:

  Question 1
  Confirm that the controls at issue in this pending permit are the same controls that were required pursuant to the 2019 Settlement Agreement.

  Response 1
  These controls are the same controls required pursuant to the 2019 Settlement Agreement. The agreement required Enviva to submit a permit application for installation of a regenerative catalytic oxidizer or regenerative thermal oxidizer (RCO/RTO) to control HAP emissions from the pellet presses and pellet coolers (ID Nos. ES-CLR-1 through ES-CLR-6). This requirement was accomplished with submittal of Permit Application No. 8200152.20B on April 20, 2020 in which Enviva Sampson requested to control emissions from the pellet coolers with an RCO/RTO (ID No. CD-RCO).

  The 2019 Settlement Agreement also required Enviva to submit a permit application for either of the following 1) 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 2) an engineering solution that will result in an equivalent or greater reduction in VOC and HAP emissions from the dry hammermills. Enviva submitted Permit Application No. 8200152.20B on April 20, 2020, which requested exhaust from the dry hammermills to be routed directly to the Dryer /WESP /RTO (ID Nos. ES-DRYER, CD-WESP, CD-RTO) or directly to the WESP/RTO. This control schematic is considered an appropriate engineering solution as required by the settlement agreement.

  Question 2
  Provide an update on the construction status of these controls.

  Response 2
  Stephen Allen of the FRO contacted Enviva regarding construction status. The following information was provided by the facility:
  - Dry Hammermill modification of exhaust/recirculation - Project is currently in the engineering and planning phase

  - Pellet Cooler RTO/RCO installation - Project is currently in the engineering and planning phase

[3] Hearing Officer's Report and Recommendations for Enviva Pellets Sampson, LLC (2019). Obtained from https://files.nc.gov/ncdeq/Air%20Quality/permits/hearings/Hearing_Officer_Report_Sampson.pdf

Question 3
Explain why NCDAQ has authorized the construction but not the operation of the controls until after obtaining the permit.

Response 3
Enviva submitted a NOI letter on February 12, 2021. The request was evaluated in accordance with the North Carolina General Statute (NCGS) 143-215.108A and NCDAQ guidance[4] and was approved on February 23, 2021. The NCGS specifically prohibits facilities from operating equipment approved under a NOI until after issuance of a permit, as noted in the following:

> *The permittee may not operate the altered, expanded, or additional air contaminant source, equipment, or associated air cleaning device in a manner that alters the emission of any air contaminant without obtaining a permit modification under G.S. 143-215.108.*

No changes to the air permit are deemed necessary to address these questions and comments.

- Comments from Enviva – Enviva submitted additional comments on the draft permit during the public comment period. Their comments and NCDAQ's responses are provided below:

Comment 1
Method of Average Firebox Determination Requirements – Enviva proposes use of a 3-hour block average temperature for RTOs and RCOs rather than a 3-hour rolling average.

Response 1
This comment was addressed above in Section 11. No changes to the draft permit are deemed necessary to address these comments.

Comment 2
Listing of Parameter in Permit Condition – Enviva requests the permit not include specific parametric values for control device monitoring.

Response 2
This comment was addressed above in Section 11. No changes to the draft permit are deemed necessary to address these comments.

Comment 3
Removal of language - Enviva requests the statement "*(the second half of the oxidizer away from the flame zone)*," which describes the location of the RTO's temperature probe, be removed from the permit. Enviva contends that the language is not consistent with the equipment configuration as specified by the vendor design specifications and that it contradicts Sections 2.2 A.1.e.iv and 2.2 A.2.e.vi of the draft permit, which accurately reflect the location of the thermocouples.

Response 3
The NCDAQ concurs and this statement "*(the second half of the oxidizer away from the flame zone)*" will be removed from Section 2.2 A.2.i of the permit.

[4] NC DEQ, NCDAQ, Guidelines for Intent to Construct (Revised 02/13/2021). Obtained from https://files.nc.gov/ncdeq/Air%20Quality/permits/ConstBill/Guidance_2021.pdf

Comment 4
Removal of CO and NOx from testing requirements – Enviva requests to remove CO and NOx from RCO/RTO (ID No. CD-RCO) testing requirements.

Response 4
This comment was addressed above in Section 11. No changes to the draft permit are deemed necessary to address this comment.

Comment 5
Changes to 15A NCAC 02D .0521 permitting language – Enviva requests the statement "(two 6-minute averages)" be added to monitoring condition for 15A NCAC 02D .0521 in Sections 2.1 A.3.c and d of the permit.

Response 5
The NCDAQ has established standard permitting language (aka "shell language") for requirements included in most permits. The language for MRR requirements for 15A NCAC .0521 as provided in Sections 2.1 A.3.c and d of the permit is such language. Enviva provided no justification for modifying the shell language in Sections 2.1 A.3.c and d. Thus, deviating from shell language is not warranted, and no changes to the draft permit are deemed necessary to address this comment.

13. Other Regulatory Considerations

- A zoning consistency determination is required and documentation that the zoning information was appropriately forwarded to the city/county was provided via e-mail on April 8, 2020.
- A permit fee of $988 was submitted via e-pay on April 7, 2020.
- A P.E. seal was required and was submitted with the permit application.

14. Recommendations

The 15A NCAC 02Q .0300 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. 10386R05.

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-HMA	Hammermill Area	CD-PCLP-BH	One (1) baghouse	--	--	0.47	0.47	0.47	--	--	--
ES-PCLP	Pellet Cooler LP Fines Relay System										
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);	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	--	--	0.15	0.15	0.15	--	--	--
ES-PSTB	Pellet Sampling Transfer Bin	CD-PSTB-BH	One (1) baghouse	--	--	0.15	0.15	0.15	--	--	--
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	--
ES-ADD	Additive Handling and Storage	CD-ADD-BH	One (1) baghouse	--	--	0.15	0.15	0.15	--	--	--
IES-GWH	Green wood handling operations	--	--	--	--	0.081	0.038	0.0058	--	--	--
IES-TK-1	2,500 gal diesel storage tank	--	--	--	--	--	--	--	--	5.85E-04	--
IES-TK-2	500 gal diesel storage tank	--	--	--	--	--	--	--	--	1.60E-04	--
IES-TK-3	3,000 gal diesel storage tank	--	--	--	--	--	--	--	--	0.0022	--
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	713 hp diesel-fired emergency generator	--	--	1.03	1.17	0.059	0.059	0.059	0.0019	0.11	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	--	--	--
			Total Emissions:	**107**	**111**	**268**	**99.1**	**50.8**	**27.6**	**122**	**272,322**
			Total Excluding Fugitives[2]:	**107**	**111**	**234**	**87.1**	**48.1**	**27.6**	**113**	**272,322**
			PSD Major Source Threshold:	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**--**

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)	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	--	--	--	0.46
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	--	--	2.73
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	--	--	--	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**	**22.9**
Maximum Individual HAP (tpy)	**--**	**--**	**Methanol**	**Hydrochloric acid**	**Hexane**	**Methanol**	**Benzene**	**Formaldehyde**	**Methanol**	**Methanol**	**Methanol**	**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**	**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.

Abbreviations:

HAP - hazardous air pollutant

tpy - tons per year

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-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)	Potential Emissions[1] (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)	Potential Emissions[1] (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.

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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. Exhaust 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.

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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-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)	Potential Emissions (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**	**10.7**

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.

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ES-DRYER, ES-GHM-1 through -3, and ES-HM-1 through -8 (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)	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 Dryer Furnace Bypass (Cold Start-up) [1]

ES-FBYPASS

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.

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Emission Calculations

Potential Emissions from Dryer Furnace Bypass (Cold Start-up) [1]
ES-FBYPASS
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 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.

Abbreviations:

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

Reference:

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

Attachment 1
Emission Calculations

Potential Emissions from Dryer Furnace Bypass (Idle Mode)[1]
ES-FBYPASS
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-1.

Attachment 1
Emission Calculations

Potential Emissions from Dryer Furnace Bypass (Idle Mode)[1]
ES-FBYPASS
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 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	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.

Abbreviations:

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

Reference:

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

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)	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)	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 factors in AP-42 Section 1.4.
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

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 HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions	
							Hourly (lb/hr)	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.

Abbreviations:

CO - carbon monoxide
HAP - hazardous air pollutant
hr - hour
lb - pound
LPG - liquified petroleum gas
Mgal - thousand gallons
MMBtu - Million British thermal units
MMscf - Million standard cubic feet
NCDAQ - North Carolina Divison of Air Quality
NO_X - nitrogen oxides
ODT - oven dried tons
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
SO_2 - sulfur dioxide
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
yr - year

Reference:

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

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

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%	

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)	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)	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)	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

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%	

Natural Gas Combustion Potential HAP and TAP Emissions

Pollutant	HAP	NC TAP	VOC	Emission Factor	Units	Footnote	Potential Emissions Hourly (lb/hr)	Potential Emissions 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)	**0.13**	**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.
6. The PAH emission factor for propane combustion was used to estimate emissions of Polycyclic Organic Matter.

Abbreviations:

cf - cubic feet	NCDAQ - North Carolina Division of Air Quality
cfm - cubic feet per minute	ODT - oven dried tons
gr - grain	PAH - polycyclic aromatric hydrocarbons
HAP - hazardous air pollutant	RCO - regenerative catalytic oxidizer
hr - hour	RTO - regenerative thermal oxidizer
kg - kilogram	TAP - toxic air pollutant
lb - pound	tpy - tons per year
LPG - liquified petroleum gas	USEPA - U.S. Environmental Protection Agency
MMBtu - million British thermal units	VOC - volatile organic compound
MMscf - million standard cubic feet	yr - year

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)	(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.

Abbreviations:

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

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-HMA	Hammermill Area	CD-PCLP-BH	Baghouse[1, 2, 3]	3,102	0.004	0.004	0.004	0.11	0.47	0.11	0.47	0.11	0.47
ES-PCLP	Pellet Cooler LP Fines Relay System												
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]	1,000	0.004	0.004	0.004	0.034	0.15	0.034	0.15	0.034	0.15
ES-PSTB	Pellet Sampling Transfer Bin	CD-PSTB-BH	Baghouse[1, 2, 3]	1,000	0.004	0.004	0.004	0.034	0.15	0.034	0.15	0.034	0.15
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
ES-ADD	Additive Handling and Storage	CD-ADD-BH	Baghouse[2, 3]	1,000	0.004	0.004	0.004	0.034	0.15	0.034	0.15	0.034	0.15

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 2
PSD Avoidance Condition

Section 2.2 A.2

2. 15A NCAC 02Q .0317: AVOIDANCE CONDITIONS for 15A NCAC 02D .0530: PREVENTION OF SIGNIFICANT DETERIORATION

a. The following conditions in this section are enforceable after all controls have been constructed and are operational to reduce facility-wide emissions to below PSD major source thresholds, in accordance with the schedule specified in Section 2.3 A.1. Following the applicability of this condition (Section 2.2 A.2), the facility will be classified as a PSD minor source.

b. In order to avoid applicability of 15A NCAC 2D .0530(g), the above emission sources shall discharge into the atmosphere less than 250 tons of PM, PM10, PM2.5, volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) per consecutive 12-month period.

c. To ensure compliance with limits established in Section 2.2 A.2.b above after the construction and operation of the proposed control devices, the Permittee shall meet the following:
   i. The green hammermills **(ID Nos. ES-GHM-1, ES-GHM-2, and ES-GHM-3)** and the dryer **(ID No. ES-DRYER)** shall be controlled by a wet electrostatic precipitator **(ID No. CD-WESP)** and regenerative thermal oxidizer **(ID No. CD-RTO)**;
   ii. The dry hammermills **(ID Nos. ES-HM1 through ES-HM-8)** shall be controlled by baghouses **(ID Nos. CD-HM-BH1 through CD-HM-BH8)** in series with either a wet electrostatic precipitator **(ID No. CD-WESP)** in series with a regenerative thermal oxidizer **(ID No. CD-RTO)** or 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)**;
      (A) In the event of reduced furnace/dryer operation, a portion of the air flow from the baghouses on the dry hammermills is ducted directly to the WESP **(ID No. CD-WESP)** in series with the RTO (ID No. CD-RTO).
      (B) In the event of the shutdown of the furnace/dryer system, all air flow from the baghouse on the dry hammermills is ducted directly to the WESP **(ID No. CD-WESP)** and the RTO **(ID No. CD-RTO)**.
   iii. The pellet presses and pellet coolers **(ID Nos. ES-CLR-1 through ES-CLR-6)** shall be 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)**;
   iv. Other particulate matter emission sources shall be controlled with baghouses as specified the Equipment List in Section 1.0; and
   v. The Permittee shall not process more than 657,000 oven dried tons per year (ODT/year) on a rolling 12-month average basis.

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

d. The completion of the modification to become a PSD minor source is defined as the following:
   i. the rerouting of the exhaust from the dry hammermills **(ID Nos. ES-HM-1 to ES-HM-8),** associated integral cyclones and baghouses **(ID Nos. CD-HM-BH1 through CD-HM-BH8)**, to the wood-fired direct heat drying system furnace **(ID No. ES-DRYER)**, wet electrostatic precipitator **(ID No. CD-**

WESP-1), and regenerative thermal oxidizer **(ID No. CD-RTO)**.

ii. the rerouting of the exhaust from the dry hammermills **(ID Nos. ES-HM-1 to ES-HM-8),** associated integral cyclones and baghouses **(ID Nos. CD-HM-BH1 through CD-HM-BH3)** to the wet electrostatic precipitator **(ID No. CD-WESP)** and regenerative thermal oxidizer **(ID No. CD-RTO)**.

iii. the installation of the regenerative catalytic oxidizer/regenerative thermal oxidizer **(ID No. CD-RCO)** on the exhaust of the pellet presses and pellet coolers **(ID Nos. ES-CLR-1 through ES-CLR-6)** after control by cyclones **(ID Nos. CD-CLR-1 through CD-CLR-6).**

The Permittee shall notify the DAQ of the actual completion date of the modification postmarked within 15 days after such date.

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

e. Initial Performance Tests – Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall demonstrate compliance with PSD avoidance limits in Section 2.2 A.2.b above by conducting an initial performance test on the wood-fired direct heat drying system **(ID No. ES-DRYER)**, the green hammermills **(ID Nos. ES-GHM-1, ES-GHM-2, and ES-GHM-3)**, 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)**. Initial testing shall be conducted in accordance with the following:

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

Emission Sources	Pollutant
Dryer system, green hammermills, dry hammermills controlled via a WESP and CD-RTO	VOC
	PM/PM10/PM2.5
	NOx
	CO
Pellet presses and pellet coolers controlled via cyclones and CD-RCO/RTO	VOC
	PM/PM10/PM2.5
	NOx
	CO
Dried wood handling operations	VOC

ii. The Permittee shall utilize EPA reference methods contained in 40 CFR 60, Appendix A, 40 CFR Part 63, and OTM 26 AND in accordance with a testing protocol (using testing protocol submittal form) approved by the DAQ.

iii. The Permittee shall submit a protocol to the DAQ at least 45 days prior to compliance testing and shall submit a notification of initial compliance testing at least 15 days in advance of the testing.

iv. The Permittee shall be responsible for ensuring, within practicable limits, that the equipment or processes being tested are operated at or near the maximum normal production rate or at a lesser rate if specified by the Director or his delegate.

v. To the extent possible, testing shall be conducted at the maximum normal operating softwood percentage.

vi. The regenerative thermal oxidizer **(ID No. CD-RTO)** and regenerative catalytic oxidizer/ regenerative thermal oxidizer **(ID No. CD-RCO)** are each comprised of fireboxes, with each firebox containing two temperature probes. During the initial compliance test, the Permittee shall establish the minimum average firebox temperature for each of the fireboxes comprising the regenerative thermal oxidizer and the minimum average firebox temperature (same as the inlet temperature of the catalyst) of the regenerative catalytic oxidizer/regenerative thermal oxidizer. "Average firebox temperature" means the average temperature of the two temperature probes in each firebox. The minimum average firebox temperature for each firebox shall be based upon the average temperature of the two temperature probes over the span of the test runs. Documentation

for the minimum average firebox temperature for each firebox shall be submitted to the DAQ as part of the initial compliance test report.

vii. Initial testing shall be completed within 180 days of commencement of operation of completion of the modification to become a PSD minor source unless an alternate date is approved in advance by DAQ.

viii. The Permittee shall submit a written report of the performance test results to the Regional Supervisor, DAQ, no later than 30 days following sample collection test in accordance with 15A NCAC 02D .2602(f), unless an alternative date is approved in advance by DAQ.

f. Periodic Performance Tests – Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall demonstrate compliance with the PSD avoidance limits in Section 2.2 A.2.b above by conducting periodic performance tests on the wood-fired direct heat drying system **(ID No. ES-DRYER)**, the green hammermills **(ID Nos. ES-GHM-1, ES-GHM-2, and ES-GHM-3)**, the dry hammermills **(ID Nos. ES-HM-1 to ES-HM-8)**, and the pellet presses and coolers **(ID Nos. ES-CLR-1 through ES-CLR-6)**. Periodic testing shall be conducted in accordance with the following:

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

Emission Sources	Pollutant
Dryer system, green hammermills, dry hammermills controlled via a WESP and CD-RTO	VOC
	PM/PM10/PM2.5
	NOx
	CO
Pellet presses and pellet coolers controlled via cyclones and CD-RCO/RTO	VOC
	PM/PM10/PM2.5
	NOx
	CO

ii. Testing shall be conducted in accordance with Section 2.2 A.2.e.ii through vi above.

iii. The Permittee shall conduct periodic performance tests when the following conditions are met:
(A) The monthly average softwood content exceeds the average softwood percentage documented during prior performance testing by more than 10 percentage points, or
(B) The monthly production rate exceeds the average production rate documented during prior performance testing by more than 10 percentage points, or
(C) At a minimum testing shall be conducted annually. Annual performance tests shall be completed no later than 13 months after the previous performance test.

iv. The Permittee shall conduct the periodic performance test and submit a written report of the test results to the Regional Supervisor, DAQ, within 90 days from the date the monthly softwood content or overall production rate increased as described in Section 2.2 A.2.f.iii (A) and (B) above unless an alternate date is approved in advance by DAQ.

v. When performance testing has occurred at 90 percent softwood AND 90 percent of the maximum permitted throughput, subsequent periodic performance testing shall occur on an annual basis and shall be completed no later than 13 months after the previous performance test. The Permittee shall submit a written report of the performance test results to the Regional Supervisor, DAQ, no later than 30 days following sample collection test in accordance with 15A NCAC 02D .2602(f), unless an alternative date is approved in advance by DAQ.

vi. The Permittee may request that the performance tests be conducted less often for a given pollutant if the performance tests for at least 3 consecutive years show compliance with the emission limit. If the request is granted, the Permittee shall conduct a performance test no more than 36 months after the previous performance test for the given pollutant.

vii. If a performance test shows noncompliance with an emission limit for a given pollutant, the Permittee shall return to conducting annual performance tests (no later than 13 months after the previous performance test) for that pollutant.

viii. Except as specified in Section 2.2 A.2.f.iv above, the Permittee shall submit a written report of the performance test results to the Regional Supervisor, DAQ, no later than 30 days following sample collection test in accordance with 15A NCAC 02D .2602(f), unless an alternative date is approved in advance by DAQ.

ix. The Permittee may re-establish any parametric operating value during periodic testing. Compliance with previously approved parametric operating values is not required during periodic required testing or other tests undertaken to re-establish parametric operating values by the Permittee. If the new parametric operating values re-established during periodic testing are more stringent, the Permittee shall submit a request to revise the value(s) in the permit at the same time the test report required pursuant to General Condition 17 is submitted. The permit revision will be processed pursuant to 15A NCAC 02Q .0514. If, during performance testing, the new parametric operating values are less stringent, the Permittee may request to revise the value(s) in the permit pursuant to 15A NCAC 02Q .0515.

x. The Permittee shall comply with applicable emission standards at all times, including during periods of testing.

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

g. The Permittee shall calculate the facility-wide emissions of PM, PM10, PM2.5, CO, NOx, and VOC emissions monthly

i. Monthly PM, PM10, PM2.5 emissions, in tons, shall be calculated by the following equations and emission factors:

$$E_{\text{PM(total)}} = \sum E_{\text{PM(CD-RTO)}} + \sum E_{\text{PM(CD-RCO)}} + \sum E_{\text{PM(furnace bypass)}} + PM\ Constant$$

$$E_{\text{PM10(total)}} = \sum E_{\text{PM10(CD-RTO)}} + \sum E_{\text{PM10(CD-RCO)}} + \sum E_{\text{PM10(furnace bypass)}} + PM10\ Constant$$

$$E_{\text{PM2.5(total)}} = \sum E_{\text{PM2.5(CD-RTO)}} + \sum E_{\text{PM2.5(CD-RCO)}} + \sum E_{\text{PM2.5(furnace bypass)}} + PM2.5\ Constant$$

Where:

$E_{\text{PM, PM10, PM2.5(Total)}}$	=	total tons of PM, PM0, and PM2.5 emissions per month from the facility
$E_{\text{PM, PM10, PM2.5(CD-RTO)}}$	=	total tons of PM, PM0, and PM2.5 emissions from the outlet of the thermal regenerative oxidizer (ID No. CD-RTO) per month
$E_{\text{PM, PM10, PM2.5(CD-RCO)}}$	=	total tons of PM, PM0, and PM2.5 emissions from the outlet of the catalytic regenerative oxidizer / regenerative thermal oxidizer (ID No. CD-RTO) per month
$E_{\text{PM, PM10, PM2.5(furnace bypass)}}$	=	total tons of PM, PM0, and PM2.5 emissions per month from the furnace/dryer bypass **(ID No. ES-F/DBYPASS)** per month
PM Constant = 0.30	=	monthly PTE tons for the miscellaneous sources including emergency generator, fire water pump, baghouses, non-fugitive woodyard sources, and double duct burners
PM10 Constant = 0.28	=	monthly PTE tons for the miscellaneous sources including emergency generator, fire water pump, and double duct burners
PM2.5 Constant = 0.22	=	monthly PTE tons for the miscellaneous sources including emergency

generator, fire water pump, and double duct burners

ii. Monthly CO emissions, in tons, shall be calculated by the following equations and emission factors:

$$E_{\text{CO(total)}} = \sum E_{\text{CO(CD-RTO)}} + \sum E_{\text{CO(CD-RCO)}} + \sum E_{\text{CO(furnace bypass)}} + CO\ Constant$$

Where:

$E_{CO(Total)}$	=	total tons of CO emissions per month from the facility
$E_{CO(CD-RTO)}$	=	total tons of CO emissions from the outlet of the thermal regenerative oxidizer (ID No. CD-RTO) per month
$E_{CO(CD-RCO)}$	=	total tons of CO emissions from the outlet of the catalytic regenerative oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) per month
$E_{CO(furnace\ bypass)}$	=	total tons of CO emissions per month from the furnace/dryer bypass **(ID No. ES-F/DBYPASS)** per month
CO Constant = 0.24	=	monthly PTE tons of CO from miscellaneous sources including emergency generator, fire water pump, and double duct burners

iii. Monthly NOx emissions, in tons, shall be calculated by the following equations and emission factors:

$$E_{\text{NOx (total)}} = \sum E_{\text{NOx (CD-RTO)}} + \sum E_{\text{NOx(CD-RCO)}} + \sum E_{\text{NOx (furnace bypass)}} + NOx\ Constant$$

Where:

$E_{NOx(Total)}$	=	total tons of NOx emissions per month from the facility
$E_{NOx(CD-RTO)}$	=	total tons of NOx emissions from the outlet of the thermal regenerative oxidizer (ID No. CD-RTO) per month
$E_{NOx(CD-RCO)}$	=	total tons of NOx emissions from the outlet of the catalytic regenerative oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) per month
$E_{NOx(furnace\ bypass)}$	=	total tons of NOx emissions per month from the furnace/dryer bypass **(ID No. ES-F/DBYPASS)** per month
NOx Constant = 0.24	=	monthly PTE tons of NOx from miscellaneous sources including emergency generator, fire water pump, and double duct burners tanks

iv. Monthly VOC emissions, in tons, shall be calculated by the following equations and emission factors:

$$E_{\text{VOC (total)}} = \sum E_{\text{VOC (CD-RTO)}} + \sum E_{\text{VOC (CD-RCO)}} + \sum E_{\text{VOC (furnace bypass)}} + VOC\ Constant$$

Where:

$E_{VOC(Total)}$	=	total tons of VOC emissions per month from the facility
$E_{VOC(CD-RTO)}$	=	total tons of VOC emissions from the outlet of the thermal regenerative oxidizer (ID No. CD-RTO) per month
$E_{VOC(CD-RCO)}$	=	total tons of VOC emissions from the outlet of the catalytic regenerative oxidizer / regenerative thermal oxidizer (ID No. CD-RCO) per month

$E_{VOC(furnace\ bypass)}$	=	total tons of VOC emissions per month from the furnace/dryer bypass **(ID No. ES-F/DBYPASS)** per month
VOC Constant = 1.25	=	monthly PTE tons of VOC from miscellaneous sources including emergency generator, fire water pump, dried wood handling, bark hog, double duct burners, and storage tanks

h. The monthly emissions shall be recorded in a logbook (written or electronic format) and made available to an authorized representative upon request.

Regenerative Thermal Oxidizer and Regenerative Catalytic Oxidizer

i. The Permittee shall install, calibrate, operate, maintain, and inspect a continuous temperature monitoring, and recording system, in accordance with manufacturer's recommendations for the regenerative thermal oxidizer **(ID No. CD-RTO)** and the regenerative catalytic oxidizer/regenerative thermal oxidizer **(ID No. CD-RCO)** to monitor the temperature in the combustion chamber to ensure the average combustion temperature does not drop below the temperature range established during the performance test. To ensure compliance and effective operation of the RTO **(ID No. CD-RTO)** and RTO/RCO **(ID No. CD-RCO)**, the Permittee shall:
   i. maintain a 3-hour rolling average firebox temperature for each of the two fireboxes comprising the RTO and RTO/RCO at or above the minimum average temperatures established during the most recent performance testing. For the RTO **(ID No. CD-RTO),** the minimum 3-hour average firebox temperature for Chambers A/B is 1,601°F and the minimum 3-hour average firebox temperature for Chambers C/D is 1,601°F, as measured during the initial performance tests on December 16 through 20, 2019.

i. maintain records of the 3-hour rolling average temperatures for each firebox.

ii. perform inspections and maintenance on the regenerative thermal oxidizer **(ID No. CD-RTO)** and the regenerative catalytic oxidizer/regenerative thermal oxidizer **(ID No. CD-RCO),** as specified above in Section 2.1 A.1.h.

j. The Permittee shall develop and maintain a written malfunction plan for the temperature monitoring and recording system that describes, in detail, the operating procedures for periods of malfunction and a protocol to address malfunctions so that corrective actions can immediately be implemented. The plan shall be submitted to the DAQ regional office for approval and maintained on site. The malfunction plan shall identify malfunctions, as described by the manufacturer, and ensure the operators are prepared to correct such malfunctions as soon as practical. The Permittee shall keep any necessary parts for routine repairs of the temperature monitoring and recording system readily available.

k. The Permittee shall perform periodic inspection and maintenance for the oxidizers as recommended by the manufacturer. The Permittee shall perform periodic catalyst activity checks for the regenerative catalytic oxidizer as recommended by the manufacturer. At a minimum, the Permittee shall perform an annual (not to exceed 12-month) internal inspection of the primary heat exchanger and associated inlet/outlet valves of the control device to ensure structural integrity, as specified above in Section 2.1 A.1.h.

l. The monthly pellet production in oven dried tons (ODT), the rolling 12-month total pellet production in ODT, monthly average softwood content, and 12-month rolling average softwood content shall be recorded in a monthly logbook (written or electronic format) and made available to an authorized representative upon request.

m. At all times, including periods of startup, shutdown, and malfunction, the Permittee shall, to the extent practicable, maintain and operate all emission sources including associated control devices in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.

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

n. The Permittee shall submit a semi-annual summary report of monitoring and recordkeeping activities given in Section 2.2 A.2.g through l above postmarked on or before January 30 of each calendar year for the preceding six-month period between July and December, and July 30 of each calendar year for the preceding six-month period between January and June. The report shall contain the following:
   i. The monthly facility-wide PM, PM10, PM2.5, VOC, NOx, and CO emissions for the previous 17 months. The emissions must be calculated for each of the 12-month periods over the previous 17 months.
   ii. A report indicating and explaining all instances of the average minimum regenerative thermal oxidizer and regenerative catalytic oxidizer/ regenerative thermal oxidizer combustion chamber temperature falling below the temperature range established during the performance test or noting that no such instances have occurred.
   iii. The monthly and 12-month facility-wide total pellet production, and
   iv. The monthly and 12-month rolling hardwood/softwood mix.
   v. All instances of deviations from the requirements of this permit must be clearly identified.

Attachment 3
HAP Avoidance Condition

Section 2.2 A.3

3. 15A NCAC 02Q .0317: AVOIDANCE CONDITIONS for 15A NCAC 02D .1112: 112(g) Case-by-Case Maximum Available Control Technology (MACT) Standards

a. The following conditions in this section are enforceable after all controls have been constructed and are operational to reduce facility-wide HAP emissions to below the major source thresholds, in accordance with the schedule specified in Section 2.3 A.1. Following the applicability of this condition (Section 2.2 A.3), the facility will be classified as a HAP minor source.

b. In order to remain classified a minor source for hazardous air pollutants (HAP) and avoid applicability of 15A NCAC 02D .1112, "112(g) Case-by-Case Maximum Achievable Control Technology," facility-wide HAP emissions shall be less than the following limitations:
   i. 25 tons per consecutive 12-month period of total, combined HAP; and,
   ii. 10 tons per consecutive 12-month period of any individual HAP.

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

c. Initial Performance Tests – Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall establish emission factors for HAPs by conducting an initial performance test on the wood-fired direct heat drying system **(ID No. ES-DRYER)**, the green wood hammermills **(ID Nos. ES-GHM-1, ES-GHM-2, and ES-GHM-3)**, the dry hammermills **(ID Nos. ES-HM-1 through ES-HM-8)**, and the pellet presses and coolers **(ID Nos. ES-CLR-1 through ES-CLR-6)**. Initial testing shall be conducted in accordance with the following:
   i. The pollutants and emission sources to be tested during the initial performance test are listed in the following table:

Emission Source	Pollutant
Dryer system/green wood hammermills/ dry hammermills controlled via WESP and RTO	Acetaldehyde Acrolein Formaldehyde Methanol Phenol Propionaldehyde
Pellet presses and pellet coolers controlled via cyclones and CD-RCO/RTO	

   ii. The Permittee shall utilize EPA reference methods contained in 40 CFR 60, Appendix A, 40 CFR Part 63, and OTM 26 AND in accordance with a testing protocol (using testing protocol submittal form) approved by the DAQ.
   iii. The Permittee shall submit a protocol to the DAQ at least 45 days prior to compliance testing.
   iv. The Permittee shall be responsible for ensuring, within practicable limits, that the equipment or processes being tested are operated at or near the maximum normal production rate or at a lesser rate if specified by the Director or his delegate.
   v. To the extent possible, testing shall be conducted at the maximum normal operating softwood percentage.
   vi. The regenerative thermal oxidizer **(ID No. CD-RTO)** and the regenerative catalytic/regenerative thermal oxidizer **(ID No. CD-RCO)** are comprised of fireboxes, with each firebox containing two temperature probes. During the initial compliance test, the Permittee shall establish the minimum average firebox temperature (same as the inlet temperature of the catalyst) for each of the fireboxes comprising the regenerative thermal oxidizer and regenerative catalytic/regenerative thermal oxidizer. "Average firebox temperature" means the average temperature of the two temperature

probes in each firebox. The minimum average firebox temperature for each firebox shall be based upon the average temperature of the two temperature probes over the span of the test runs. Documentation for the minimum average firebox temperature for each firebox shall be submitted to the DAQ as part of the initial compliance test report.

vii. Initial testing shall be completed within 180 days of commencement of operation of completion of the modification to become a minor source of HAPs unless an alternate date is approved in advance by DAQ.

iii. The Permittee shall submit a written report of the performance test results to the Regional Supervisor, DAQ, no later than 30 days following sample collection test in accordance with 15A NCAC 02D .2602(f), unless an alternative date is approved in advance by DAQ.

d. Periodic Performance Tests – Under the provisions of North Carolina General Statute 143-215.108, the Permittee shall establish emission factors for HAPs by conducting periodic performance tests on the emission points consistent with Section 2.1.A.4.d.

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

Emission Source	Pollutant
Dryer system/green wood hammermills/ dry hammermills controlled via WESP and RTO	Acetaldehyde Acrolein Formaldehyde Methanol Phenol Propionaldehyde
Pellet presses and pellet coolers controlled via cyclones and CD-RCO/RTO	

ii. Periodic testing shall be conducted in accordance with Section 2.2 A.2.f.iii through x above.

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

e. The Permittee shall calculate HAP emissions from the wood-fired direct heat drying system **(ID No. ES-DRYER)**, the green wood hammermills **(ID Nos. ES-GHM-1, ES-GHM-2, and ES-GHM-3)**, the dry hammermills **(ID Nos. ES-HM-1 through ES-HM-8)**, the dried wood handling operations **(ID Nos. ES-DWH),** and the pellet presses and coolers **(ID Nos. ES-CLR-1 through ES-CLR-6)** using emission factors developed from the most recent stack tests.

f. The Permittee shall calculate HAP emissions from the furnace/dryer bypass **(ID No. ES-F/DBYPASS)**, the diesel-fired fire pump **(ID Nos. IFWP),** the diesel-fired emergency **(ID No. IES-EG)**, the duct burners **(ID Nos. IES-DDB1 and IES-DDB-2)**, log chipping **(ID No. IES-CHIP-1)** and the bark hog **(ID No. IES-BARKHOG)** using HAP emission factors as provided in Air Permit Application No. 8200152.20B.

g. Calculations of HAP emissions as specified in Sections 2.2 A.3.f and g above shall be made at the end of each month. Calculations and the total amount of HAP emissions shall be recorded monthly in a logbook (written or electronic format) and made available to an authorized representative upon request.

h. The Permittee shall keep a record of the applicability determination on site at the source for a period of five years after the determination, or until the source becomes an affected source. The determination must include the analysis demonstrating why the Permittee believes the source is unaffected pursuant to 40 CFR Part 63.10(b)(3).

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

i. The Permittee shall submit a summary report of monitoring and recordkeeping activities given in Sections 2.2 A.3.e through g above. The report shall summarize emissions of hazardous air pollutants containing the following:

i. greatest quantity in pounds of an individual hazardous air pollutant used:

(A) for each month during the semiannual period, and
(B) for each 12-month period ending on each month during the semiannual period using a 12-month rolling total.

ii. pounds of all hazardous air pollutants used:
(A) for each month during the semiannual period, and
(B) for each 12-month period ending on each month during the semiannual period using a 12-month rolling total.

iii. All instances of deviations from the requirements of this permit must be clearly identified.