Ms. Karen Hays
Branch Chief, Air Protection Branch
Georgia Environmental Protection Division
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Atlanta, GA 30354

Email: Karen.Hays@dnr.ga.gov

RE: ENVIVA PELLETS WAYCROSS, LLC – WAYCROSS, GA
APPLICATION FOR SIGNIFICANT PERMIT MODIFICATION WITHOUT CONSTRUCTION

Date October 30, 2021

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Dear Ms. Hays,

Ramboll US Consulting, Inc. (Ramboll) is submitting this application for significant permit modification without construction on behalf of the Enviva Pellets Waycross, LLC (Enviva) plant located near Waycross, Georgia (GA) in Ware County (Waycross plant.) The Waycross plant currently operates under Air Quality Permit No. 2499-299-0053-V-04-0 issued by the Georgia Department of Natural Resources, Environmental Protection Division (EPD) on July 7, 2021. The plant consists of the following processes: Log Chipping and Rechipping, Bark Hog, Bark and Wood Chip screening, Rotary Dryers, Dry Hammermills, Pellet Mills and Coolers, Railcar Loadout operations and other ancillary activities. These processes are classified under Standard Industrial Classification (SIC) code 2499, Wood Products – Not Elsewhere Classified. The current permit basis for the Waycross Plant is 826,733 tons per year of wood pellets and the plant is authorized to operate continuously (8,760 hours per year).

Enviva purchased the Waycross plant from Georgia Biomass in 2020 and is submitting this application for significant modification of Air Quality Permit No. 2499-299-0053-V-04-0 to include emissions which were not previously quantified, to update emission factors for specific equipment based on recent compliance testing and engineering reviews, and to update the overall production capacity of the facility to 920,000 ODT per year of pellets using up to 95% softwood feedstock. No new equipment is being proposed as part of this application and no construction is required to make any proposed changes.

Following the changes requested in this application, the Waycross plant will remain a major source with respect to the Title V Operating Permit Program because facility-wide potential emissions of one or more criteria pollutants exceed the major source threshold of 100 tons per year (tpy). Furthermore, the Waycross plant will be reclassified as a major source of hazardous air pollutants (HAP) due to potential total HAP emissions and maximum individual HAP emissions above the major source thresholds of 25 tpy and 10 tpy. This reclassification results from emission factor updates based on recent engineering reviews. The Waycross plant will remain a synthetic minor source with respect to the New Source Review (NSR) permitting programs because facility-wide potential emissions of all regulated pollutants are below the major source threshold of 250 tpy.

Updated potential emissions calculations and a complete air toxics impact assessment are included as part of this application. Required application forms were submitted electronically via the Georgia EPD Online System (GEOS) (Submittal ID 610193). Payment of the Title V significant permit modification without construction agency review fee will be made following agency notification.

If you have any questions regarding the information presented in this permit application, please contact me at (225) 408-2691.

Yours sincerely,

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Prepared for
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Prepared By
Ramboll US Consulting, Inc.
Baton Rouge, Louisiana

Date
October 2021

APPLICATION FOR TITLE V PERMIT SIGNIFICANT MODIFICATION WITHOUT CONSTRUCTION

ENVIVA PELLETS WAYCROSS, LLC

CONTENTS

APPENDIX

ACRONYMS AND ABBREVIATIONS

AAC	Acceptable Ambient Concentration
AP-42	Compilation of Air Pollutant Emission Factors
bhp	brake horsepower
BMP	Best Management Practice
CAA	Clean Air Act
CAM	Compliance Assurance Monitoring
CFR	Code of Federal Regulations
CI	Compression Ignition
CISWI	Commercial and Industrial Solid Waste Incineration
CO	Carbon Monoxide
CO_2	Carbon Dioxide
EPD	Environmental Protection Division
FSC	Forest Stewardship Council
GHG	Greenhouse Gases
gr	Grains
HAP	Hazardous Air Pollutant
hr	Hour
IRIS	Integrated Risk Information System
kW	Kilowatt
lb	Pound
MACT	Maximum Achievable Control Technology
MER	Minimum Emission Rate
MMBtu	Million British thermal units
NAAQS	National Ambient Air Quality Standards
NCASI	National Council for Air and Stream Improvement
NESHAP	National Emission Standards for Hazardous Air Pollutants
NNSR	Nonattainment New Source Review
NO_X	Nitrogen Oxides (NO + NO_2)
NSPS	New Source Performance Standards
NSR	New Source Review
ODT	Oven Dried short Tons

OEHHA	California Office of Environmental Health Hazard Assessment
PEFC	Programme for the Endorsement of Forest Certifications
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter Less Than 2.5 Micrometers in Aerodynamic Diameter
PM_{10}	Particulate Matter Less Than 10 Micrometers in Aerodynamic Diameter
ppm	Parts per million
PSD	Prevention of Significant Deterioration
PSEU	Pollutant Specific Emission Unit
psi	Pounds per square inch
RCO	Regenerative Catalytic Oxidizer
REL	Reference Exposure Level
RfC	Reference Concentration
RTO	Regenerative Thermal Oxidizer
Scf	Standard Cubic Feet
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SFI	Sustainable Forestry Initiative
TAP	Toxic Air Pollutant
tph	tons per hour
tpy	tons per year
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
WESP	Wet Electrostatic Precipitator
yr	year

1. INTRODUCTION

Enviva Pellets Waycross, LLC (Enviva) owns and operates a wood pellet manufacturing plant (referred to herein as "the Waycross plant", "the plant", or "the facility") located in Waycross, Ware County, Georgia. The plant currently operates under Air Quality Permit No. 2499-299-0053-V-04-0 issued by the Georgia Department of Natural Resources, Environmental Protection Division (EPD) on July 7, 2021. The plant consists of the following processes: Log Chipping and Rechipping, Bark Hog, Bark and Wood Chip screening, Rotary Dryers, Dry Hammermills, Pellet Mills and Coolers, Railcar Loadout operations and other ancillary activities. These processes are classified under Standard Industrial Classification (SIC) code 2499, *Wood Products – Not Elsewhere Classified.* The current permit basis for the Waycross Plant is 826,733 tons per year of wood pellets and the plant is authorized to operate continuously (8,760 hours per year).

Enviva purchased the Waycross plant in 2020 and is submitting this application for a significant modification without construction to update the current permit basis to include emissions which were not previously quantified, to update emission factors for specific equipment based on recent compliance testing and engineering reviews, and to update the overall production rate of the facility to 920,000 ODT per year of pellets using up to 95% softwood feedstock. No new equipment is being proposed as part of this application and no construction is required. This permit application also satisfies the requirement in Conditions 4.2.2 and 4.2.3 of the Title V permit which require submittal of a permit application within 180 days of compliance testing requesting the use of new emission factors.[1]

Following the requested changes outlined in this application, the Waycross plant will remain a major source with respect to the Title V Operating Permit Program because facility-wide potential emissions of one or more criteria pollutants exceed the major source threshold of 100 tons per year (tpy). Furthermore, as part of this application, the Waycross plant will be reclassified as a major source of hazardous air pollutants (HAP) due to potential total HAP emissions and maximum individual HAP emissions above the major source thresholds of 25 tpy and 10 tpy, respectively. This reclassification is the result of emission factor updates based on recent compliance testing and engineering reviews. Finally, the Waycross plant will remain a synthetic minor source with respect to the New Source Review (NSR) permitting programs because facility-wide potential emissions of carbon monoxide (CO), nitrogen oxides (NO_X), and volatile organic compounds (VOC) will remain limited below the major source threshold of 250 tpy.

A detailed description of all requested changes is provided in Section 2. Section 3 includes a process description. Methodologies used to quantify potential emissions are summarized in Section 4. Section 5 describes the applicability of federal and state permitting programs. Section 6 includes a detailed applicability analysis of both federal and state regulations. Section 7 includes an Air Toxics Impact Assessment to demonstrate compliance with allowable ambient concentrations (AAC) and details all methodologies and data sources used in the dispersion modeling analysis. An area map and process flow diagram are included in Appendices A and B, respectively. Detailed potential emissions calculations are provided in Appendix C. Electronic files supporting the Air Toxics Impact Assessment are being provided

[1] Compliance testing was conducted in accordance with Conditions 4.2.1 through 4.2.3 on May 4-7, 2021.

via SharePoint site and a link is provided in Appendix D.[2] A site layout identifying the location of the modeled sources, downwash structures, and ambient boundary are provided in Appendix E.

[2] Please contact Aubrey Jones (Ramboll) to request access to the SharePoint site (ajones@ramboll.com).

2. REQUESTED PERMIT REVISIONS

Enviva is submitting this permit application for a significant modification without construction to reflect updates to potential emissions for various existing sources and to include emissions which were not previously quantified. The following summarizes proposed changes requested as part of this application:

1. Update the facility-wide pellet production from 826,733 tpy of wood pellets per year to 920,000 ODT of pellets per year utilizing up to 95% softwood feedstock.
2. Update the maximum hourly throughput for both Rotary Dryers (DRY1 and DRY2) to 52.5 ODT/hr. The annual throughput for each dryer will remain unchanged at 390,000 ODT/yr.
3. Update the maximum hourly throughput for the Dry Hammermills (HML), Pellet Mills (PML), and Pellet Coolers (PCL) to 135 ODT/hr and the annual throughput to 920,000 ODT/yr.
4. Update potential emissions to include emissions associated with the Bark Sand Shaker (BSS1), including all associated material transfer points and fugitive dust from truck and front-end loader movements that were not previously quantified.
5. Update the emission calculation methodology for the Log Debarker (LD01) based on a November 2019 NCASI Whitepaper for a mill debarker and increase the maximum hourly and annual throughputs from 205 tons per hour (tph) and 1,800,000 tpy to 375 tph and 1,998,621 tpy, respectively.
6. Reduce moisture content of bark from 50% to 45% in all calculations to more accurately reflect actual and potential material moisture content.
7. Update the potential emissions to include particulate matter (PM), VOC, and methanol emissions from the Bark Hog (BH01) which were not previously quantified.
8. Update the potential emissions to include PM emissions from the Bark Disc Screener (BS01) which were not previously quantified.
9. Update the potential emissions to include VOC and methanol emissions from the Log Chipper (LC02) which were not previously quantified.
10. Update the potential emissions to include PM and VOC emissions from Green Wood Storage Piles (GWP1 through GWP5), Bark/Fuel Storage Piles (BFP1 and BFP2), Dry Shavings Storage Piles (DSP1 and DSP2), and PM from the Sand Storage Pile (BSS2) which were not previously quantified.
11. Update the potential emissions to include VOC and methanol emissions from the Rechipper (LC03) which were not previously quantified.
12. Update the potential emissions to include PM and VOC emissions from the Green Chip Storage Silos (GCS1 and GCS2) which were not previously quantified.
13. Reduce the wet electrostatic precipitator (WESP) control efficiency applied for metallic HAPs from 97.5% to 95% to be consistent with conservative assumptions made for WESPs at other Enviva facilities.

14. Update the WESP hydrochloric acid control efficiency to 90% for both WESPs (WE01 and WE02) and update the calculation basis to AP-42 Section 1.6 – *Wood Residue Combustion in Boilers* to be consistent with other Enviva facilities.[3]
15. Update the potential emissions for the Dryers (DRY1 and DRY2) and Furnace Heat Energy Systems (FHES1 and FHES2) based on process information and recent engineering reviews.
16. Revise the currently permitted Furnace Heat Energy Systems' cold start-up procedure through removal of the Natural Gas Start-up Burners for both Furnace Heat Energy Systems, as these are not utilized, and allow the use of diesel fuel as an accelerant for cold start-up of the Heat Energy Systems. The amount of diesel fuel used per event will typically be 30 gallons and up to 200 gallons per year.
17. Revise the potential emissions to include emissions from Furnace Heat Energy System Idle and Cold Start-ups which are uncontrolled. Enviva is also providing further clarification on the situations in which the bypass stacks are used.
18. Revise the potential emissions to exclude the Fines Storage Silo (SS) which does not exist.
19. Revis surface silt loading for paved roads based on sampling data from an Enviva plant.
20. Update potential emission calculations for Emergency Generator 1 (EG01) to use emission factors for large diesel engines [>500 horsepower (HP)] from AP-42 Section 3.4 - *Large Stationary Diesel and All Stationary Dual-Fuel Engines* instead of the factors from AP-42 Section 3.3 – *Stationary Internal Combustion Engines*.[4,5]
21. Update the potential emissions for the Dry Hammermills (HML), Pellet Mills (PML), and Pellet Coolers (PCL) based on process information and recent engineering reviews.
22. Update the emissions calculation methodology for diesel storage tanks from EPA TANKS 4.0 to AP-42 Section 7.1, *Organic Liquid Storage Tanks* because the TANKS software is no longer supported by EPA.[6]
23. Update wind speeds utilized in potential emissions calculations based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website. Calculations were previously based on wind speed data for Savanah, GA from TANKS 4.09d.
24. Revise distance traveled and trips per day for Log delivery and Sawdust/Shavings delivery included in the Paved Roads calculations based on updated site data.
25. Update the potential PM emissions for the baghouse that controls the conveying equipment aspiration system for the dry hammermill lines (CBH1) to reflect the exhaust flow rate on the equipment specification sheet and an assumed conservative

[3] U.S. EPA. AP-42, Section 1.6 - *Wood Residue Combustion in Boilers*, (09/03).

[4] U.S. EPA. AP-42, Section 3.4 – *Large Stationary Diesel and All Stationary Dual-Fuel Engines*, (10/96).

[5] U.S. EPA. AP-42, Section 3.3 - *Stationary Internal Combustion Engines*, (10/96).

[6] U.S. EPA. AP-42, Section 7.1 - *Organic Liquid Storage Tanks* (06/20).

maximum exit grain loading rate [0.02 grains (gr) per dry standard cubic feet per minute (dscfm)].

26. Update potential emissions to include HAP emissions from natural gas combustion by the Regenerative Thermal Oxidizer (RTO) and Regenerative Catalytic Oxidizer (RCO) burners which were not previously quantified.
27. Removal of the current synthetic minor limits for individual and total HAP emissions in Condition 2.1.2 of the Title V permit. An analysis of case-by-case Maximum Achievable Control Technology (MACT) is included in Section 6.
28. Update the emission factors in Condition 6.2.2 of the current Title V permit to reflect the results of compliance testing conducted in May 2021 and remove HAP emissions factors as the facility is no longer a synthetic minor source of HAP emissions. See Section 5.2.

3. PROCESS DESCRIPTION

Enviva manufactures wood pellets for use as a renewable fuel for energy generation and industrial customers. Enviva's customers use wood pellets in place of coal, significantly reducing emissions of pollutants such as lifecycle carbon dioxide (CO_2)/greenhouse gases (GHGs), mercury, arsenic and lead. The company is dedicated to improving the environmental profile of energy generation while promoting sustainable forestry in the Southeast United States. Enviva holds certifications from the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), Programme for the Endorsement of Forest Certification (PEFC), and Sustainable Biomass Program (SBP). Enviva requires that all suppliers adhere to state-developed "Best Management Practices" (BMPs) in their activities to protect water quality and sensitive ecosystems. In addition, Enviva is implementing an industry leading "track and trace" system to further ensure that all fiber resources come from responsible harvests. Enviva pays particular attention to: land use change, use and effectiveness of BMPs, wetlands, biodiversity, and certification status. All of this combined ensures that Enviva's forestry activities contribute to healthy forests both today and in the future. A detailed description of Enviva's Responsible Wood Supply Program can be found at: https://www.envivabiomass.com/sustainability/responsible-sourcing/responsible-sourcing-policy/

The following sections provide a description of the sources that will be impacted by this application. An area map and process flow diagram are provided in Appendices A and B, respectively.

3.1 Wood Fiber Receiving and Storage Area

Wood fiber is delivered by truck to the Waycross facility as tree-length pulpwood logs, green chips, and sawmill residuals. The trucks travel on paved roadways to the wood fiber receiving area and are weighed upon arrival at the Waycross facility. Log trucks are unloaded via log tractors to the on-site log storage area with a storage capacity of 65,000 tons. The logs are stacked in piles and remain in the concrete storage area to promote air drying before entering the process. Received logs have a moisture content of approximately 50%. Similarly, green chips and other sawmill residuals are trucked to the facility, weighed upon arrival, and unloaded via a truck dumper or live-bottom trailers and stored in piles. The Waycross facility maintains outdoor roundwood (log) piles, four (4) outdoor green wood storage piles, one (1) outdoor bark storage pile, two (2) dry shavings piles, and one (1) outdoor sand storage pile.

A log loader transfers logs from the log storage area according to the first-in first-out principle. The log loader transfers the load onto the in-feed deck of the Log Debarker (ID No. LD01), which removes the tree bark from the logs processed in the drum. Removed bark passes through slots in the drum shell and falls onto a conveyor underneath. Separated bark is transported to the conditioning unit where it is screened and sized by the Bark Hog (ID No. BH01) to yield particles suitable for burning in Heat Energy Systems (biomass furnaces, ID Nos. HES1 and HES2) of the green wood chip drying process.

Bark from the Log Debarker is transported via enclosed conveyor to the Bark Disc Screener (ID No. BS01) for sorting bark pieces by size. The larger pieces are transferred to the Bark Hog for resizing and are then recombined on the conveyor where the material is then transported to the bark storage area via an enclosed conveyor. The A-frame bark storage building has a retention time of 1.5 days (2,500-ton capacity) and is partially enclosed. The distribution of bark inside the storage area is completed by an overhead shuttle conveyor. Reclaiming of the bark is completed by an auger in the bottom of the bark pile that feeds bark to a conveyor along the side of the storage building. The conveyor transfers bark to a Bark Sand Screener (ID No. BSS1) which removes sand from the bark fuel. Removal of sand from the furnace fuel supply reduces slagging in the furnace and provides other operational efficiencies. The clean bark fuel is transferred via closed conveyor to the biomass furnace's feed bins. Sand is stored in an outdoor storage pile and is removed from the facility by truck.

A truck dumper (ID No. TD) is used to provide make-up bark fuel to the furnaces, as bark from the logs is not sufficient to fuel the drying process. After unloading via the truck dumper, purchased bark is transported on a closed conveyor to the main bark stream at the inlet of the Bark Disc Screener. If necessary, the bark is stored in the outdoor bark storage pile until additional fuel is needed for the Furnace Heat Energy System.

The truck dumper system is also utilized for receiving sawmill residuals (dry chips and sawdust). Sawmill residuals received on dead-bottom trailers are unloaded via the truck dumper and placed onto the enclosed chip conveyor which transports the materials to the A-frame chip storage building. Sawmill residuals received in live-bottom trailers are unloaded onto the ground and then reclaimed by a front-end loader and placed onto the chip conveyor via a feed hopper system. Dry chips may also be stored in two (2) piles within a partially enclosed building prior to entering the process.

3.2 Green Wood Processing

A green wood chipping system chips processes tree-length logs into wood chips. Debarked logs are transferred from the debarking drum to the Log Chipper (LC02) via a variable speed conveyor that controls the flow to the chipper inlet chute. The Log Chipper is a multi-knife disc chipper and is configured to produce chips.

The chips are transferred to a Wood Chip Screen system (LC01) in a duct via air flow created by rotation of the chipper. In the Wood Chip Screener, properly sized chips pass to the accepts chip conveyor belt. Over-sized chips are separated in the chip screener and are directed to two (2) chip resizers, herein referred to as Rechippers (ID No. LC03). The Wood Chip Screener utilizes a cyclone (CYC1) for material recovery and control of particulates produced from the wood chipping and screening operations. Oversized chips are resized by the Rechippers and returned to the accepts chip conveyor belt stream. Fines are discharged to the bark conveyor if sand or grit are present. The chip accepts conveyor belt transports the chips to a partially enclosed A-frame storage building. Distribution of the chips in the storage building is accomplished by an overhead shuttle conveyor. Chips storage provides approximately 2.5-3 days of stored feedstock for processing. The chips in the pile area have an average moisture content of 50%. Reclaimed chips are then conveyed to the two (2) Green Chip Silos (ID Nos. GCS1 and GCS2) for storage prior to the drying process.

3.3 Dryer Lines

Two (2) rotary drum Dryers (DRY1 and DRY2) reduce the moisture content of the wood chips to approximately 10-11% in preparation for further processing and pelletizing. The two (2) Green Chip Silos are equipped with variable speed outfeed augers to feed a constant flow of chips into the feed chamber of each dryer drum, where the chips are mixed with hot gases from the Furnace Heat Energy Systems (FHES1 and FHES2). The hot gas enters the feed chamber of the dryers which are designed to ensure adequate mixing of chips with hot gases and sufficient residence time to reach the desired final moisture content.

The reduction in moisture content in the drum dryers results in the hot gas temperature decreasing at the drum outlet. Moisture rich gases and dried chips are transferred to the Dryer Cyclones to separate the chips from the exhaust gas.[7] The hot chips are fed to a common conveyor for transport to the Dry Chip Silo (DCS) before being sent to the Dry Hammermilling process. The gases are exhausted to the WESPs (WE01 and WE02) and RTOs (RTO1 and RTO2) for control of PM and VOC.

Heat for the chip dryers is provided by two (2) 193 million British Thermal Units per hour (MMBtu/hr) bark-fueled Furnace Heat Energy Systems, also referred to as biomass furnaces. The Furnace Heat Energy Systems are supplied with clean bark fuel transferred via covered conveyor from the enclosed bark storage area. The refractory-type furnaces are equipped with reciprocating sloping (step) grates for optimal fuel spreading and controlled combustion. Clean wood residue is fed from the metering bin to the grate floor where the bed is formed and combustion occurs. The upper sections of the furnaces are designed to provide sufficient residence time to ensure complete combustion and low carryover of fly ash. Fly ash escaping with the hot gases is separated in a secondary chamber and combined with the bottom ash for disposal.

A slip stream of hot gases generated from the Furnace Heat Energy Systems is transferred to the steam generating units. Each hot gas slip stream has a maximum heat input capacity of 14 MMBtu/hr based on process design specifications. The steam generation capacity for each unit is 12,125 pounds per hour (lb/hr). The low-pressure steam [150 pounds per square inch (psi)] produced is injected into the pellet presses to assist with formation in the manufacturing process.

The remaining hot exhaust gas from the Furnace Heat Energy Systems enters the front of the Dryers where contact with green wood causes water evaporation thereby reducing the moisture content of the incoming wood. Exhaust gases from the dryers contain PM as well as VOC formed due to the increased temperature experienced during the drying process. The dryer exhaust gas control is completed in two stages: WESPs to control particulate and metallic HAP followed by RTOs for VOC and organic HAP control. Each RTO includes four (4) burners (each with a maximum heat input capacity of 8.0 MMBtu/hr) that combust natural gas to ensure thermal oxidizer combustion zone temperature at or above 1,500°F to oxidize VOCs in the exhaust gas to form CO_2 and water. A continuous opacity monitoring system (COMS) is installed on each RTO exhaust stack.

Bypass Stacks for the Furnace Heat Energy System and dryer are used to exhaust hot gases during start-ups (for temperature control), shutdowns, and malfunctions. Specifically, the Furnace Heat Energy System Bypass Stacks are used in the following situations:

- **Cold Start-ups:** The Furnace Heat Energy System bypass stacks are used when the Furnace Heat Energy Systems are started up from a cold shutdown until the refractory is sufficiently heated and can sustain operations at a low level (approximately 15% of the maximum heat input rate). The bypass stacks are then closed and the Furnace Heat Energy Systems are slowly brought up to a normal operating rate with flue gas routed through the dryer to the WESP and RTO. Diesel fuel may be used as an accelerant for initial bark fuel ignition purposes during cold start-up. The amount used per event will be

[7] The dryer cyclones are inherent process equipment used to recover material and return it to the process and are not control devices.

approximately 30 gallons and the annual usage will be approximately 200 gallons. Emissions resulting from diesel combustion are insignificant.

- **Idle mode:** The Furnace Heat Energy Systems may also operate in idle mode (up to 10 MMBtu/hr) with emissions routed to the Furnace Heat Energy System bypass stacks. The purpose of operation in idle mode is to maintain the temperature of the fire brick lining the furnace which may be damaged if it cools too rapidly. Operation in idle mode also significantly reduces the amount of time required to restart the furnace.
- **Planned Shutdown:** In the event of a planned shutdown, furnace heat input is decreased and the remaining fuel is combusted prior to opening the Furnace Heat Energy System bypass stacks. The Furnace Heat Energy Systems bypass stacks are not utilized until after the furnace achieves an idle state (10 MMBtu/hr or less). Until this time, emissions continue to be controlled by the WESP and RTO.
- **Malfunction:** The Furnace Heat Energy Systems automatically abort to the bypass stacks in the event of a malfunction. This may be caused by failsafe interlocks associated with operation of the furnace or dryer and emissions control systems. Typically interlocks divert flue gas to the bypass stack in the event of loss of utilities (e.g., electricity, water, compressed air), when monitored conditions exceed safe operating ranges (e.g., temperature, pressure, flowrate), or in the event of spark detection within the drying system and flue gas treatment areas. As soon as the furnace aborts, it automatically switches to "idle mode", the fuel feed is stopped, and the heat input rate drops rapidly.

Conditions under which the Dryer Bypass Stacks are used are as follow:

- **Cold Start-ups and Transition from Furnace Idle:** The dryer bypass stacks are used very briefly 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 a short period of time 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. Emissions during these brief transition periods are insignificant and are not separately quantified to avoid double-counting, as these emissions are already accounted for under the furnace cold start-up and idle mode operations.
- **Planned Shutdown:** During planned shutdowns, as the remaining fuel is combusted by the furnace, the Operator stops the green chip input to the dryer. When only a small amount of chips remain in the Dryer, these are 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 (see furnace planned shutdown above) and the dryer is no longer operating.
- **Malfunction:** The dryer system will automatically abort 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.

Use of the Furnace Heat Energy System and Dryer Bypass Stacks for start-up and shutdown will not exceed 50 hours per year per dryer line. Additionally, each furnace may operate up to 500 hours per year in idle mode with emissions routed to the Furnace Heat Energy

System Bypass Stacks. Emissions from furnace start-up, shutdown, and furnace idle mode operations are quantified and included in the facility-wide potential emissions presented in this permit application.

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.

3.4 Dry Hammermill and Pelletizing Lines

Dried chips are conveyed by a partially enclosed belt conveyor to a Dry Chip Storage Silo. Dry shavings received by truck are processed by a disc screener prior to transfer to the Dry Chip Storage Silo or to storage. The Dry Chip Storage Silo's storage capacity varies depending on the bulk density of the chips. A baghouse (DCS1) on the Dry Chip Storage Silo is used for dust control and primarily for the return of fine dry material back into the pellet production process. The exhaust from this baghouse is aspirated to the RCO (RCO West, RCO1), controlling VOC and organic HAP. The RCO system is similar to typical RTO units with the addition of a catalyst which allows the unit to maintain high destruction efficiencies while requiring less fuel than a typical RTO.

Dry chips are metered into two Dry Hammermill lines (HML). Sealed chain conveyors transport dry chips from the Dry Chip Storage Silo into the Dry Hammermill building. The elevators and chain conveyors are sealed with continuous air aspiration for dust and fire control. Material handling of the wood chips and fiber is accomplished mechanically with sealed chain conveyors and augers. Wood dust collected from the conveyance system is controlled by the hammermilling aspiration system baghouse (CBH1).

There are two (2) Dry Hammermills lines which utilize a total of ten (10) Dry Hammermills, five (5) on each line. The Dry Hammermills reduce the dried chips to a smaller size prior to pelletization. The Dry Hammermills and pelletizing process equipment require frequent scheduled replacement of machinery parts. The ten (10) dry hammermills allow for continuous production without variation due to scheduled dry hammermill downtime. The dry hammermills grind the chips until they are able to pass through small holes in the second stage hammermill basket. Ten (10) separate aspiration baghouses control PM emissions from each of the dry hammermills. The exhaust from the dry hammermill baghouses and the hammermill conveying equipment aspiration system is routed to RCO1, for VOC and organic HAP control.

From the Dry Hammermills, the processed wood fiber is conveyed to a single Fiber Storage Silo (FS). The storage capacity varies depending on the bulk density of the processed wood fiber and the fill factor. The silo provides equalization time and surge capacity for machinery downtime.

Processed wood fiber from the Fiber Storage Silo is conveyed to the pelletizing area via sealed elevators and chain conveyors with continuous air aspiration for dust and fire control. Wood dust collected from the conveyance system is controlled by the pelletizing aspiration system baghouse (CBH2). Exhaust from the pelletizing aspiration system baghouse is routed to RCO2 (RCO East) for VOC and organic HAP control.

At the pelletizer lines, low-pressure steam is injected to soften the wood fiber. Steam injection also reduces electrical power consumption of the pellet mills and promotes production of a more uniform product. Five (5) separate Pelletizing Lines (PML) receive the wood fiber. Three (3) of the Pelletizing Lines include four (4) separate pellet mills and the remaining two (2) lines include five (5) separate pellet mills for a total of twenty-two (22) pellet mills across all five (5) Pelletizing Lines.

The wood fiber is compressed by two rollers on the inside of a die that feeds the ground material into the holes of the die creating high pressure. The resulting heat of friction activates the wood lignin as the wood is compressed, effectively bonding the wood fiber into a durable pellet and eliminating any need for adhesives or bonding agents.

Pellets exiting the pellet mills are conveyed to a counter-flow pellet cooler (PCL). Each pelletizing line includes one (1) pellet cooler. Pellet cooling is necessary to ensure good pellet structural stability. Each pellet cooler uses counter-flow, ambient air drawn into the bottom of the cooler, to rapidly cool the pellets.

Hot exhaust air from each pellet cooler is ducted to a baghouse to control PM emissions. The exhaust from the pellet cooler baghouses and the pelletizing conveying equipment aspiration system are routed to RCO2, for VOC and organic HAP control. Collected wood dust from the baghouses is discharged via a bottom airlock directly to the sealed chain conveyor, which delivers the wood fiber back to the Fiber Storage Silo for re-use.

A housekeeping vacuum system (PA01) is routed to a baghouse control system (PAB1).

3.5 Pellet Loadout Area

Cooled pellets exit the counter-flow pellet coolers and are transported via a common closed conveyor to the Railcar Loadout hoppers that transfer the pellets into railcars (RL). Each load-out hopper is located above one of the three parallel rail spurs. Each railcar transports approximately 90-100 tons of wood pellets. The maximum potential loadout rate for the railcars is 400 tph. Each of the three (3) load-out hoppers is sealed with a dust aspiration system which is exhausted to the rail loadout compact filter type baghouse(s). Dust collected by the filters is recirculated back to the Railcar Loadout hoppers.

3.6 Miscellaneous Equipment

Two (2) diesel-fired emergency generators are utilized for the operations, one 500-kilowatt (kW) generator for the drying operations (EG01) and a 250-kW generator for the pelletizing operations (EG02). Neither emergency generator operates more than 500 hours per year. A diesel-fired fire pump engine (175 hp) is used for emergency fire water use as well as non-emergency purposes, including cleaning and other facility activities. The facility also includes two (2) diesel storage tanks, one (1) 10,000 gallon tank and one (1) 1,000 gallon tank.

4. POTENTIAL EMISSIONS QUANTIFICATION

This section discusses quantification of potential emissions for all sources of emissions at the Waycross plant. Detailed potential emissions calculations are included in Appendix C.

4.1 Raw Material Handling (MH01 through MH03 and BSS3 through BSS5)

Fugitive PM emissions result from unloading bark from trucks into hoppers and transfer of bark and wood chips via conveyor to the bark screener, bark hog, and the storage building. The bark and wood chip conveyors are completely enclosed; therefore, a 50% control efficiency is conservatively applied. Additionally, fugitive PM emissions result from material transfer to and from the sand shaker. Fugitive PM emissions from chip, bark, and sand transfer operations were calculated based on AP-42 Section 13.2.4, *Aggregate Handling and Storage Piles*.[8] The mean wind speed of 4.87 mph is based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website. Detailed potential emission calculations are included in Appendix C, Table 4.

4.2 Dry Shavings Truck Dumper and Material Transfer (TD)

Fugitive PM emissions result from unloading dry shavings from trucks via a truck dumper and transfer of shavings via conveyor to the disc screener and storage dome. For material transfer points that are enclosed, a 50% control efficiency is conservatively applied. Fugitive PM emissions from dry shavings transfer operations were calculated based on AP-42 Section 13.2.4, *Aggregate Handling and Storage Piles*.[9] Purchased dry shavings have an average moisture content of 8-14%. The mean wind speed of 4.87 mph is based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website. Detailed potential emission calculations are included in Appendix C, Table 5.

4.3 Green Wood Storage Piles (GWP1-GWP5), Bark/Fuel Storage Piles (BFP1 and BFP2), Dry Shavings Storage Piles (DSP1 and DSP2), and Sand Storage Pile (BSS2)

Particulate emission factors used to quantify emissions from storage pile wind erosion for the five (5) Green Wood Storage Piles, two (2) Bark/Fuel Storage Piles, two (2) Dry Shaving Storage Piles, and one (1) Sand Storage Pile were calculated based on EPA's *Control of Open Fugitive Dust Sources*.[10] The number of days with rainfall greater than 0.01 inch was obtained from AP-42 Section 13.2.2, *Unpaved Roads*[11] and the percentage of time that wind speed exceeds 12 miles per hour (mph) was determined based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website. The mean silt content for bark of 0.0094% is based on NCASI Special Report 15-01 with appropriate contingency based on engineering judgement.[12] Exposed surface area of the pile was calculated based on worst-case pile dimensions. For piles located inside of a building, a conservative control efficiency of 75% was applied for PM and particulate matter less than 10 micrometers in aerodynamic diameter (PM_{10}) based on the Western Regional Air

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[8] U.S. EPA. AP-42 Section 13.2.4 - *Aggregate Handling and Storage Piles*, (11/06).

[9] Ibid.

[10] U.S. EPA. *Control of Open Fugitive Dust Sources*, Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988.

[11] U.S. EPA. AP-42 Section 13.2.2 - *Unpaved Roads*, (11/06).

[12] NCASI. *Special Report No. 15-01: Estimating the Potential for $PM_{2.5}$ Emissions from Wood and Bark Handling*. Revised April 2015.

Partnership's (WRAP) Fugitive Dust Handbook (09/06) recommended efficiency for three-sided enclosures.[13]

VOC emissions from Green Wood, Bark, and Dry Shavings Storage Piles were quantified based on the exposed surface area of the pile and emission factors from NCASI.[14] NCASI emission factors range from 1.6 to 3.6 pounds (lb) VOC as carbon/acre-day; however, emissions were conservatively based on the maximum emission factor. Detailed potential emission calculations are included in Appendix C, Table 6.

4.4 Log Debarker (LD01)

PM emissions occur as a result of log debarking. Potential particulate emissions calculations for the Debarker were updated to utilize emission factors developed from a draft NCASI whitepaper based on measurements at a mill debarker, where logs are processed dry (i.e., without water spray).[15] Emission factors for PM and PM_{10} were calculated based on the NCASI emission factor for particulate matter less than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) and the PM and PM_{10} fractions for fresh bark provided in the whitepaper. An appropriate contingency was added to the factors based on engineering judgement. Detailed potential emission calculations are included in Appendix C, Table 7.

4.5 Log Chipper (LC02) and Rechipper (LC03)

The log chipper and two (2) rechippers are enclosed inside of a building; therefore, PM emissions are negligible from both sources and were not quantified. The chipping and rechipping process also results in emissions of VOC and methanol. VOC and methanol emissions were quantified based on emission factors for log chipping from AP-42 Section 10.6.3, *Medium Density Fiberboard Manufacturing* and AP-42 Section 10.6.4, *Hardboard and Fiberboard Manufacturing*.[16,17] Detailed emission calculations are included in Appendix C, Tables 8 and 12.

4.6 Wood Chip Screen (LC01)

The Wood Chip Screen (LC01) utilizes a cyclone (CYC1) for material recovery and control of PM emissions produced during the chipping and screening process. PM emissions from the cyclone were calculated based on an exit grain loading rate and the maximum nominal exhaust flow rate of the cyclone. All PM is conservatively assumed to be less than 2.5 microns in diameter. For detailed emission calculations, refer to Appendix C, Table 9.

4.7 Bark Hog (BH01)

Processing of bark by the bark hog results in emissions of PM, VOC, and methanol. Particulate emission factors were not available for this specific operation; therefore, potential PM emissions were quantified based on emission factors from EPA's *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants* for log

[13] Countess Environmental. *Western Regional Air Partnership (WRAP) Fugitive Dust Handbook*. September 2006.

[14] NCASI. Technical Bulletin No. 700. *Preliminary Investigation of Releases of Volatile Organic Compounds from Wood Residual Storage Piles*. October 1995.

[15] NCASI. Draft Whitepaper. *An Update to the Relationship Between Filterable $PM_{2.5}$ and Filterable PM for Bark, Coal, and Combination Bark Boilers*. November 2019.

[16] U.S. EPA. AP-42 Section 10.6.3 - *Medium Density Fiberboard Manufacturing*, (8/02).

[17] U.S. EPA. AP-42 Section 10.6.4 - *Hardboard and Fiberboard Manufacturing*, (10/02).

debarking (SCC 3-07-008-01).[18] VOC and methanol emissions were quantified based on emission factors for log chipping from AP-42 Section 10.6.3, *Medium Density Fiberboard Manufacturing* and AP-42 Section 10.6.4, *Hardboard and Fiberboard Manufacturing*.[19,20] Detailed potential emission calculations are included in Appendix C, Table 10.

4.8 Bark Disc Screener and Sand Shaker (BS01 and BSS1)

Fugitive PM emissions result from the bark screening and sand shaking processes. For bark disc screening, which is enclosed, a 50% control efficiency is conservatively applied. Fugitive PM emissions were calculated based on AP-42 Section 13.2.4, *Aggregate Handling and Storage Piles*.[21] Bark contains an average moisture content of 45%. The mean wind speed is based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website. Detailed potential emission calculations are included in Appendix C, Table 11.

4.9 Green Chip Storage Silos (GCS1 and GCS2)

PM emissions may occur as air is displaced during silo loading and unloading. Emissions are uncontrolled; therefore, emissions were conservatively quantified using emission factors calculated based on AP-42 Section 13.2.4, *Aggregate Handling and Storage Piles*.[22] Green chips contain an average moisture content of 50%. The mean wind speed is based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website. A control efficiency of 75% for particulate emissions was conservatively assumed due to enclosure based on the WRAP Fugitive Dust Handbook (09/06).[23]

VOC emissions from the Green Chip Storage Silos were quantified based on laboratory studies (He et. Al 2021) for wood chips stored at 30°C (95°F).[24] According to the study, a maximum VOC concentration of 85 parts per million (ppm) at 35°C was reached at the end of the 35-day storage period. VOC emissions were based on the maximum concentration of 85 ppm and the silo exhaust flow rate. A 50% contingency was applied for conservatism. Detailed potential emission calculations are included in Appendix C, Table 13.

4.10 Dryer Line Nos. 1 and 2 (DRY1, FHES1, DRY2, and FHES2)

As described in Section 3.3, aside from normal operation there are several other potential operating conditions for the dryer lines. Emissions were quantified as described in the following subsections. Previously, potential emissions from cold start-ups/planned shutdowns and idle mode were not explicitly quantified.

4.10.1 Normal Operation

During normal operation the exhaust from each Furnace Heat Energy System and dryer is routed to a dedicated WESP in series with an RTO for control of PM, VOC, and HAP.

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

[19] U.S. EPA. AP-42 Section 10.6.3 - *Medium Density Fiberboard Manufacturing*, (8/02).

[20] U.S. EPA. AP-42 Section 10.6.4 - *Hardboard and Fiberboard Manufacturing*, (10/02).

[21] U.S. EPA. AP-42 Section 13.2.4 - *Aggregate Handling and Storage Piles*, (11/06).

[22] Ibid.

[23] Countess Environmental. *Western Regional Air Partnership (WRAP) Fugitive Dust Handbook*. September 2006.

[24] He, X., Lau, A. K., Sokhansanj, S., Lim, C. J., Bi, X. T., & Melin, S. (2012). *Dry Matter Losses in Combination with Gaseous Emissions During the Storage of Forest Residues*. Fuel, 95, 662-664.

Potential emissions of PM, PM_{10}, $PM_{2.5}$, VOC, carbon monoxide (CO) and NO_X from the dryers are based on process information with an appropriate contingency based on engineering judgement, and AP-42 factors where no other data were available. Potential emissions of sulfur dioxide (SO_2) were calculated based on an emission factor from AP-42, Section 1.6, *Wood Residue Combustion in Boilers.*[25] Combustion of biomass by the Furnace Heat Energy Systems and natural gas by the RTOs also result in emissions of GHG. GHG emissions were quantified based on emission factors from Tables C-1 and C-2 of 40 CFR 98 and were converted to carbon dioxide equivalent (CO_2e) based on Global Warming Potentials from Table A-1 of 40 CFR 98.

Potential HAP emissions from the dryer lines were quantified using process information with an appropriate contingency based on engineering judgement and emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers*.[26] HAP emissions from natural gas combustion by the RTOs were calculated based on emission factors from AP-42 Section 1.4, *Natural Gas Combustion*.[27] Detailed potential emission calculations for normal operation are included in Appendix C, Tables 14a and 15a.

4.10.2 Furnace Heat Energy Systems and Dryer Bypass Stacks (Cold Start-up and Planned Shutdown)

Potential criteria pollutant and HAP emissions from combustion of wood by the Furnace Heat Energy Systems during bypass were calculated based on emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers*.[28] PM, PM_{10}, and $PM_{2.5}$ emission factors are estimated based on the sum of filterable and condensable factors from Table 1.6-1. GHG emissions were calculated based on emission factors for biomass combustion from Tables C-1 and C-2 of 40 CFR Part 98 and global warming potentials from Table A-1. Potential emissions were based on 15% of the maximum heat input capacity of the furnaces (15% of 193 MMBtu/hr) and 50 hours per year per dryer line. Emissions from diesel combustion during cold start-ups are insignificant and were not explicitly quantified.

Detailed potential emission calculations are included in Appendix C, Tables 14b and 15b.

4.10.3 Furnace Heat Energy System Bypass (Idle Mode)

Each Furnace Heat Energy System may operate up to 500 hours per year in "idle mode", which is defined as operation up to a maximum heat input rate of 10 MMBtu/hr. During this time, emissions exhaust out of the Furnace Heat Energy Systems bypass stacks. Potential criteria pollutant and HAP emissions from combustion of wood by the FHES during bypass were calculated based on emission factors from AP-42 Section 1.6, *Wood Residue Combustion in Boilers*.[29] PM, PM_{10}, and $PM_{2.5}$ emission factors are estimated based on the sum of filterable and condensable factors from Table 1.6-1. GHG emissions were calculated based on emission factors for biomass combustion from Tables C-1 and C-2 of 40 CFR Part 98 and global warming potentials from Table A-1.

Detailed potential emission calculations are included in Appendix C, Tables 14c and 15c.

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[25] U.S. EPA. AP-42 Section 1.6 - *Wood Residue Combustion in Boilers*, (09/03).

[26] Ibid.

[27] U.S. EPA. AP-42 Section 1.4 - *Natural Gas Combustion,* (07/98).

[28] U.S. EPA, AP-42, Section 1.6 - *Wood Residue Combustion in Boilers,* (09/03).

[29] Ibid.

4.11 Dry Chip Silo (DCS), Dry Hammermills (HML), and Conveyor Aspiration System 1 (CE01)

PM, VOC, and HAP emissions are generated during transfer, storage, and processing of dried wood fiber and dry shavings. Exhaust from the Dry Chip Silo (DCS) is routed to a baghouse (DCS1) for PM control and then to an RCO (RCO1) for VOC and HAP control. Similarly, exhaust from the Conveyor Aspiration System (CE01) is routed to a baghouse (CBH1) for PM control and then to the RCO (RCO1) for VOC and HAP control. Potential PM emissions from both baghouses (DCS1, CBH1) were calculated based on a maximum exit grain loading rate and the maximum exhaust flow rate of the baghouse. No speciation data were available; therefore, all PM is conservatively assumed to be less than 2.5 microns in diameter.

Dry hammermill operations generate particulate matter, HAP, and VOC emissions during sizing of wood fiber. Exhaust from each of the ten (10) dry hammermills is routed to a dedicated baghouse for control of PM emissions (HBH1 through HBH10). Particulate emissions from the baghouses were calculated using an exit grain loading rate and the total maximum nominal exhaust flow rate of the baghouses. No speciation data are available; therefore, all PM is conservatively assumed to be less than 2.5 microns in diameter. Exhaust from the baghouses is then routed to the RCO (RCO1) for VOC and HAP control.

VOC and HAP emission factors for the RCO outlet were derived based on process information and engineering judgement. NO_x and CO emissions resulting from thermal oxidation of VOC in the silo, dry hammermill, and aspiration system exhaust were calculated using emission factors from AP-42 Section 1.4, *Natural Gas Combustion*[30], and the maximum high heating value of the anticipated VOC constituents.

Emissions of criteria pollutants and HAP from natural gas combustion by the RCO burners were estimated using emission factors from AP-42 Section 1.4, *Natural Gas Combustion.*[31] GHG emissions were calculated using emission factors for natural gas and propane combustion from Tables C-1 and C-2 of 40 CFR Part 98 and global warming potentials from Table A-1. Detailed potential emission calculations are provided in Table 16 of Appendix C.

4.12 Pellet Mills (PML), Pellet Coolers (PCL), Fiber Storage Silo (FS), and Conveyor Aspiration System 2 (CE02)

Pellet mill and pellet cooler operations generate PM, VOC, and HAP emissions during the forming and cooling of wood pellets. The twenty-two (22) pellet mills and five (5) pellet coolers are equipped with five (5) baghouses (PBH1 through PBH5) which are vented to an RCO (RCO2) for VOC and HAP control. The baghouses also receive exhaust gas from the Fiber Storage Silo (FS) and the Conveyor Aspiration System 2 (CE02). PM, PM_{10}, and $PM_{2.5}$ emissions from the Pellet Mills, Pellet Coolers, Fiber Storage Silo, and Conveyor Aspiration System were calculated based on an exit grain loading rate and the total exhaust flow rate of the baghouses. No speciation data are available; therefore, all PM is conservatively assumed to be less than 2.5 microns in diameter.

VOC and HAP emissions at the outlet of the RCO were quantified based on process information and engineering judgement. NO_X and CO emissions resulting from thermal oxidation of VOC in the exhaust stream of the Fiber Storage Silo, Pellet Mills, Pellet Coolers,

[30] U.S. EPA. AP-42 Section 1.4 - *Natural Gas Combustion,* (07/98).

[31] Ibid.

and Conveyor Aspiration System were calculated using AP-42 Section 1.4, *Natural Gas Combustion*[32] and the maximum high heating value of the anticipated VOC constituents.

Emissions of criteria pollutants and HAP from natural gas combustion by the RCO burners were calculated using emission factors from AP-42 Section 1.4, *Natural Gas Combustion.*[33] GHG emissions were calculated using emission factors for natural gas and propane combustion from Tables C-1 and C-2 of 40 CFR Part 98 and global warming potentials from Table A-1. Detailed potential emission calculations are provided in Table 17 of Appendix C.

4.13 Railcar Loadout (RL1, RL2, and RL3)

PM emissions occur during transfer of pellets from the railcar loadout bins to railcars. Each of the three (3) loadout bins (RL1, RL2, RL3) are sealed with a dust aspiration air system exhausted to compact filters (RCF1, RCF2, RCF3). Potential PM emissions from the compact filters were calculated based on a maximum exit grain loading rate and the exhaust flow rate of the filter. Detailed potential emissions calculations are provided in Table 18 of Appendix C.

4.14 Pelletizing Area Vacuum System (PA01)

Dust from pelletizing operations is collected by the Pelletizing Area Vacuum System (PA01) and is controlled by a baghouse (PAB1). Potential PM emissions from the baghouse were calculated based on a maximum exit grain loading rate and the maximum exhaust flow rate of the baghouse. No speciation data were available; therefore, all PM is conservatively assumed to be less than 2.5 microns in diameter. Detailed potential emissions calculations are provided in Appendix C, Table 19.

4.15 Emergency Generators (EG01, EG02) and Fire Pump (FP01)

Combustion of diesel fuel by the emergency generators and fire pump generates emissions of criteria pollutants, HAP, and GHG. Potential PM, NO_X, and CO emissions from operation of the emergency generators were calculated based on Tier 3 emission standards applicable under 40 CFR 60, New Source Performance Standards (NSPS) Subpart IIII and the maximum horsepower rating of the engine. NO_X emissions were conservatively based on the emission standard for NO_X + non-methane hydrocarbon (NMHC). Potential SO_2 emissions from each engine were calculated based on the fuel sulfur restriction in NSPS Subpart IIII.[34] Potential VOC and HAP emissions from Emergency Generator 1 (EG01) were quantified based on emission factors from AP-42 Section 3.4, *Large Stationary Diesel and All Stationary Dual-fuel Engines*.[35] Potential VOC and HAP emissions from Emergency Generator 2 (EG02) were quantified based on emission factors from AP-42 Section 3.3, *Stationary Internal Combustion Engines*.[36] Annual potential emissions for each engine were conservatively calculated based on 500 hours per year.

Potential PM, NO_X, and CO emissions from the fire water pump were calculated based on emission factors from 40 CFR 60, NSPS, Subpart IIII and the maximum horsepower rating of the engine. Potential SO_2 emissions from the fire water pump engine were calculated based on the fuel sulfur restriction in NSPS Subpart IIII.[37] Potential VOC and HAP emissions were

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[32] U.S. EPA. AP-42 Section 1.4 - *Natural Gas Combustion,* (07/98).

[33] Ibid.

[34] Sulfur content in accordance with 40 CFR 1090.305 as required by NSPS Subpart IIII.

[35] U.S. EPA. AP-42 Section 3.4 – *Large Stationary Diesel and All Stationary Dual-fuel Engines*, (10/96).

[36] U.S. EPA. AP-42 Section 3.3 - *Stationary Internal Combustion Engines*, (10/96).

[37] Sulfur content in accordance with 40 CFR 1090.305 as required by NSPS Subpart IIII.

quantified based on emission factors from AP-42 Sections 3.3, *Stationary Internal Combustion Engines*.[38] Annual potential emissions for the fire water pump engine were calculated based on continuous operation (8,760 hours per year) since this engine is also used for non-emergency purposes.

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

Detailed potential emissions calculations are provided in Tables 20, 21, and 22 of Appendix C.

4.16 Diesel Storage Tanks (ST1 and ST2)

The storage of diesel in on-site storage tanks generates emissions of VOC. VOC emissions from the two (2) diesel storage tanks were calculated using AP-42, Section 7.1, *Organic Liquid Storage Tanks,* based on the actual tank characteristics (e.g., orientation, dimensions, etc.) and potential annual throughput.[39] Refer to Table 23 of Appendix C for detailed potential emissions calculations.

4.17 Paved Roads (ROADS)

Fugitive PM emissions occur as a result of trucks and front-end loaders traveling on paved roads on the Waycross plant property. Emission factors were calculated based on Equation 2 from AP-42 Section 13.2.1, *Paved Roads*[40] using a mean silt loading based on sampling data from an Enviva wood pellet manufacturing plant (3.6 g/m^2) and 110 days with rainfall greater than 0.01 inch based on Figure 13.2.1-2. Refer to Appendix C, Table 24 for detailed potential emissions calculations.

[38] U.S. EPA. AP-42 Section 3.3 - *Stationary Internal Combustion Engines*, (10/96).

[39] U.S. EPA. AP-42 Section 7.1 – *Organic Liquid Storage Tanks*, (06/20).

[40] U.S. EPA. AP-42 Section 13.2.1 – *Paved Roads*, (01/11).

5. STATE AND FEDERAL PERMITTING APPLICABILITY

The Enviva Waycross plant is subject to federal and state air quality permitting requirements. The following sections summarize the applicability of these requirements to the facility.

5.1 Federal Permitting Programs

The federal New Source Review (NSR) permitting program includes requirements for construction of new sources and modifications to existing sources, while the Title V Operating Permit Program includes requirements for operation of Title V major sources. The following sections discuss the applicability of these requirements to the Waycross plant.

5.1.1 New Source Review

NSR is a federal pre-construction permitting program that applies to certain major stationary sources. The federal NSR permitting program is implemented in Georgia pursuant to the Georgia Rules for Air Quality Control (GRAQC) 391-3-1-.03. The primary purpose of NSR is to support the attainment and maintenance of ambient air quality standards across the country. There are two distinct permitting programs under NSR. The particular program that applies depends on the ambient air quality in the geographic area in which the source is located. The two programs are nonattainment New Source Review (NNSR) (GRAQC 391-3-1-.03(8)(c)) and Prevention of Significant Deterioration (PSD) (GRAQC 391-3-1-.02(7)). Because NNSR and PSD requirements are pollutant-specific, a stationary source can be subject to NNSR requirements for one or more regulated NSR pollutants and to PSD requirements for the remaining regulated NSR pollutants.

NNSR permitting requirements apply to new or existing stationary sources located in an area where concentrations of a "criteria pollutant"[41] exceed the National Ambient Air Quality Standard (NAAQS) for that pollutant. PSD permitting requirements apply to major stationary sources for each criteria pollutant for which the geographic area in which the source is located has been designated as unclassifiable or attainment with respect to relevant NAAQS. PSD permitting requirements also apply to certain stationary sources regardless of location for each regulated NSR pollutant that is not a criteria pollutant (e.g., fluorides, hydrogen sulfide, and sulfuric acid mist).

The Waycross plant is located in Ware County which is designated attainment or unclassifiable for all criteria pollutants.[42] The Waycross plant is a synthetic minor source with respect to PSD permitting requirements, as potential emissions of CO, VOC, and NO_X are limited to 249 tpy. As shown in Table 5-1 below, potential emissions from the Waycross Plant are below the thresholds for all criteria pollutants; therefore, PSD permitting requirements do not apply.[43]

[41] The following are "criteria pollutants" under current NSR regulations: CO, nitrogen dioxide, SO_2, PM_{10}, $PM_{2.5}$, ozone (VOCs and NO_X), and lead.

[42] 40 CFR 81.311

[43] Fugitive emissions are not included in comparison against the major source threshold since wood pellet manufacturing is not on the list of 28 source categories in 40 CFR 52.21.

TABLE 5-1: FACILITY-WIDE POTENTIAL EMISSIONS

Pollutant	PSD Major Source Threshold (tpy)	Total Potential to Emit* (tpy)
CO	250	128
NO_X	250	178
PM	250	231
PM_{10}	250	215
$PM_{2.5}$	250	209
SO_2	250	42.5
Total VOC	250	245
Total HAP	--	79.2

* Excluding fugitive emissions

5.1.2 Title V Operating Permit Program

The federal Title V Operating Permit program is promulgated in 40 CFR Part 70 and is implemented in Georgia via GRAQC 391-3-1-.03(10). The Waycross plant is a major source with respect to the Title V Operating Permit Program because facility-wide potential emissions of one or more criteria pollutants exceed the major source threshold of 100 tpy. The plant is currently considered a synthetic minor source of HAP due to total and maximum individual HAP emissions limited below the major source thresholds of 25 tpy, and 10 tpy, respectively. However, as part of the changes requested in this application, the Waycross plant will be considered a major source of HAP due to total and individual HAP emissions exceeding the major source thresholds.

5.2 Georgia Permitting Program

In addition to federal air regulations, GRAQC 391-3-1 establishes specific requirements at the emission unit level (source-specific) and at the facility level. The rules also contain requirements related to construction and operating permits. Enviva is submitting this application for a significant modification without construction in accordance with GRAQC 391-3-1-.03(10)(e)(5)(iii) and to satisfy the requirement in Conditions 4.2.2 and 4.2.3 of the Title V permit which require submittal of a permit application within 180 days of compliance testing.[44]

As previously discussed in Section 2, Enviva is proposing to remove the synthetic minor limits for individual and total HAP and update the VOC emission factors in Condition 6.2.2 of the current Title V permit to reflect the proposed potential-to-emit emission factors. See below requested changes to Air Quality Permit No. 2499-299-0053-V-04-0.

Condition 6.2.2 should be edited as follows (additions in bold and deletions in strikethrough text):

The Permittee shall calculate the monthly VOC~~, Formaldehyde, Acetaldehyde, Methanol,~~

[44] Compliance testing was conducted in accordance with Conditions 4.2.1 through 4.2.3 on May 4-7, 2021.

~~other HAP, and total HAP~~ emissions from the units controlled by RTO1, RTO2, RCO1, and RCO2 using the records from Condition 4.2.3 and the following equation~~(s)~~. All emission factors and calculations shall be kept as part of the monthly records, readily available for inspection or submittal. VOC emissions shall be calculated using EPA OTM-26: VOC = [Method 25A VOC as propane + Methanol as methanol + Formaldehyde as formaldehyde + Acetaldehyde as acetaldehyde] – [(0.65) Methanol expressed as propane]
[Title III Major Source Avoidance and 391-3-1-.02(6)(b)1]

~~For each pollutant~~ **VOC** per month **shall be calculated** using the following equation.

E~~i~~**voc** = [(ED1*DR1)+(ED2*DR2)+(ERC1*PP)+)(ERC2*PP)]/2000

Where:
E~~i~~**voc** = Monthly **VOC (as propane)** emission in tons ~~of pollutant "i" where "i" is VOC, Formaldehyde, Acetaldehyde, Methanol, other HAP, and Total HAP~~

ED1/ ED2 = Emission Factor lb /ODT at for RTO1 and RTO2 ~~for each pollutant, respectively~~.

DR1/DR2 = Monthly Product from Dryers DRY1 and DRY2 in oven dried tons, respectively

ERC1 = Emission Factor lb /ODT ton for units controlled by the RCO1 (Hammermill lines and associated equipment

PP = Monthly Pellet production from Hammermill lines, pellet mills, pellet coolers, and associated equipment, in oven dried tons (0% moisture, calculated)

ERC2 = Emission Factor lb /ODT ton for units controlled by the RCO2 (pellet mills and pellet coolers and associated equipment)

Table 6.2.2-1						
Emission Point	VOC Emission Factor (lb/ODT)	~~Methanol Emission Factor lb/ODT*~~	~~Formaldehyde Emission Factor lb/ODT*~~	~~Acetaldehyde Emission Factor lb/ODT*~~	~~Other HAPs(1) Emission Factor lb/ODT*~~	~~Total HAP Emission Factor~~
HES1/DRY1 (RTO1) "ED1"	~~0.19~~ **0.26**	~~0.008~~	~~0.015~~	~~0.005~~	~~0.015~~	~~0.043~~
HES2/DRY2 (RTO2) "ED2"	~~0.17~~ **0.26**	~~0.011~~	~~0.012~~	~~0.005~~	~~0.015~~	~~0.040~~
RCO1 "ERC1"	~~0.20~~ **0.17**	~~0.0002~~	~~0.004~~	~~0.0002~~	–	~~0.0008~~
RCO2 "ERC2"	~~0.19~~ **0.13**	~~0.0001~~	~~0.002~~	~~0.0001~~	**-**	~~0.0004~~

The Permittee shall calculate the facility-wide monthly VOC~~, formaldehyde, acetaldehyde, methanol, and Total HAP~~ emissions as follows:

ETvoc = Evoc + **0.19**~~0.21~~
~~ETf = Ef + 0.001~~
~~ETm = Em~~
~~ETa = Ea + 0.001~~
~~ETh = Eh + 0.003~~

Where:
ETvoc = Monthly VOC emission in tons facility-wide
Evoc = Monthly VOC emission in tons from RTO1, RTO2, RCO1, and RCO2, as estimated in this condition
~~ETf = Monthly formaldehyde emission in tons facility-wide~~
~~Ef = Monthly formaldehyde emission in tons from RTO1, RTO2, RCO1, and RCO2, as estimated in this condition~~
~~ETm = Monthly methanol emission in tons facility-wide~~
~~Em = Monthly methanol emission in tons from RTO1, RTO2, RCO1, and RCO2, as estimated in this condition~~
~~ETa = Monthly acetaldehyde emission in tons facility-wide~~
~~Ea = Monthly acetaldehyde emission in tons from RTO1, RTO2, RCO1, and RCO2, as estimated in this condition~~
~~ETh = Monthly total (combined) HAP emission in tons facility-wide~~
~~Eh = Monthly total (combined) HAP emission in tons from RTO1, RTO2, RCO1, and RCO2, as estimated in this condition (sum of 3 listed individual HAP plus "other" HAPs as estimated)~~

0.19~~0.21~~ = tons per month VOC potential emissions from internal combustion engines
~~0.001 = tons per month formaldehyde potential emissions from internal combustion engines~~
~~0.001 = tons per month acetaldehyde potential emissions from internal combustion engines~~
~~0.003 = tons per month total HAP potential emissions from internal combustion engines~~

The Permittee shall notify the Division in writing if facility-wide total VOC emissions exceed 20.7 tons during any calendar month~~, if any facility-wide individual HAP emissions exceed 0.83 tons during any calendar month, or if any facility-wide combined HAP emissions exceed 2.08 tons during any calendar month~~. This notification shall be postmarked by the fifteenth day of the following month.

6. REGULATORY APPLICABILITY

The Waycross plant is subject to federal and state air quality regulations. The following addresses all regulations potentially applicable to the facility.

6.1 New Source Performance Standards

NSPS apply to new and modified sources and require sources to achieve compliance with emission standards set forth at 40 CFR Part 60. NSPS standards in 40 CFR Part 60 have been incorporated by reference in GRAQC 391-3-1-.02(8).

6.1.1 40 CFR 60 Subpart A – General Provisions

All sources subject to a NSPS are subject to the general requirements under Subpart A unless excluded by the source-specific subpart. Subpart A includes requirements for initial notification, performance testing, recordkeeping, monitoring, and reporting. Subpart A is applicable to the emergency generators and fire water pump because they are subject to 40 CFR 60 Subpart IIII. Additionally, Subpart A is applicable to the Heat Energy Systems because they are subject to 40 CFR 60 Subpart Db.

6.1.2 40 CFR 60 Subpart D – Fossil Fuel-Fired Steam Generators

NSPS Subpart D applies to steam generating units with a heat input capacity of 250 MMBtu/hr or greater from fossil fuel combustion for which construction is commenced after August 17, 1971. The maximum heat input capacity of each Heat Energy System is less than 250 MMBtu/hr. Therefore, the Heat Energy Systems are not subject to NSPS Subpart D.

6.1.3 40 CFR 60 Subpart Da – Electric Utility Steam Generators

NSPS Subpart Da applies to electric utility steam generating units (EGUs) with a fossil fuel heat input capacity of 250 MMBtu/hr or greater (alone or in combination with any other fuel) for which construction, modification, or reconstruction began after September 18, 1978. The Heat Energy Systems at the Waycross Facility are not subject to NSPS Subpart Da as they do not meet the definition of electric utility steam generating units.

6.1.4 40 CFR 60 Subpart Db – Industrial, Commercial, and Institutional Steam Generating Units

NSPS Subpart Db, Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units, applies to industrial, commercial, and institutional steam generating units with a heat input greater than 100 MMBtu/hr for which construction, modification, or reconstruction began after June 19, 1984. The Furnace Heat Energy Systems at the Waycross Facility have maximum heat inputs greater than 100 MMBtu/hr, were installed after the applicability date, and meet the definition of a steam generating unit. As such they are subject to requirements within NSPS Subpart Db.

The PM emissions from each heat energy system are limited to 0.030 lb/MMBtu per 40 CFR 60.43b(h)(1). The heat energy systems are also limited to 20% opacity (6-minute average), except for one 6-minute period per hour not exceeding 27% opacity per 40 CFR 60.43b(f). Per 40 CFR 60.46b(g), the PM and opacity standards apply at all times, except during periods of start-up, shutdown, or malfunction. A continuous opacity monitoring system (COMS) is installed on each RTO stack per 40 CFR 60.48b(a) to demonstrate compliance with the opacity standard. The span value for the COMS must be between 60-80% per 40 CFR 60.48b(e)(1).

The Waycross facility limited the Furnace Heat Energy Systems (FHES1 and FHES2) to biomass only in order to avoid having to calculate the annual capacity factor individually for natural gas and wood, as required by 40 CFR 60.49b(d).

The SO_2 standard of this subpart does not apply because the Furnace Heat Energy Systems only fire fuels with a potential SO_2 emission rate of less than 0.32 lb/MMBtu (140 ng/J), meeting the exemption in 40 CFR 60.42b(k)(2).

6.1.5 40 CFR 60 Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

NSPS Subpart Dc applies to owners or operators of steam generating units for which construction, modification, or reconstruction is commenced after June 9, 1989 and that have a maximum design heat input of 100 MMBtu/hr or less but greater than or equal to 10 MMBtu/hr. The Furnace Heat Energy Systems' maximum heat input capacities (193 MMBtu/hr) are greater than 100 MMBtu/hr; therefore, NSPS Subpart Dc does not apply.

6.1.6 40 CFR 60 Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels

NSPS Subpart Kb applies to volatile organic liquid (VOL) storage tanks that were constructed after July 23, 1984, have a maximum storage capacity greater than or equal to 75 m^3 (19,813 gal), and meet the following criteria:[45]

- The storage tank has a storage capacity greater than or equal to 75 m^3 (19,813 gal) but less than 151 m^3 (39,890 gal), and stores a VOL with a maximum true vapor pressure greater than or equal to 15.0 kPa (2.2 psia); or
- The storage tank has a storage capacity greater than or equal to 39,890 gal and stores a VOL with a maximum true vapor pressure greater than or equal to 3.5 kPa (0.51 psia).

The Waycross plant includes two (2) diesel storage tanks, with capacities of 1,000 gallons and 10,000 gallons. These tanks are not subject to NSPS Subpart Kb, as the storage capacity of each tank is less than 19,813 gal, and diesel has a maximum true vapor pressure less than 2.2 psia.

6.1.7 40 CFR 60 Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

NSPS Subpart IIII applies to owners or operators of compression ignition (CI) internal combustion engines (ICE) manufactured after April 1, 2006 that are not fire pump engines, and fire pump engines manufactured after July 1, 2006. The 500 kW dryer emergency generator, 250 kW pelletizing emergency generator, and 175 hp non-emergency fire water pump were all manufactured in 2010, they are considered new engines. Therefore, all three units at the Waycross plant are subject to NSPS Subpart IIII and will continue to comply with all applicable requirements, as detailed below.

6.1.7.1 Emergency Generators

The dryer emergency generator and pelletizing emergency generator meet the definition of an "emergency internal combustion engine" under 40 CFR 60.4219, as they each have a displacement of less than 10 liters per cylinder and are 2007 model year or later units. As

[45] 40 CFR 60.110b(a)-(b)

such, the diesel generator engines are subject to NSPS Subpart IIII and the associated emission standards for CO, PM, and NOx plus NMHC under 40 CFR 60.4205(b) for 2007 model year or later emergency engines. Enviva complies with this regulation by operating certified engines.

Enviva complies with the fuel specification requirements (diesel fuel with a maximum sulfur content of 15 ppm) in 40 CFR 1090.305 as required by 40 CFR 60.4207(b).[46]

Enviva operates and maintains the engine according to the manufacturer's emission related written instructions and only changes emission-related settings that are permitted by the manufacturer [§60.4211(a)]. The emergency generators operate with a non-resettable hour meter as required by 40 CFR 60.4209(a). The engines are operated in accordance with 40 CFR 60.4211(e) to maintain classification as an "emergency engine". Enviva will continue to maintain records of all maintenance performed on the engine. The Waycross facility does not operate a control device on the engine, and no performance testing is required per the rule.

6.1.7.2 Non-Emergency Fire Pump Engine

Per 40 CFR 60.4204(b), the fire pump engine is subject to the emission limitations in 40 CFR 60.4201(a) for 2007 model year and later non-emergency CI ICE with a maximum power output less than or equal to 3,000 hp and a displacement of less than 10 liters per cylinder. Enviva complies with this regulation by operating an engine certified to the Tier 3 emission standards.

Enviva complies with the fuel specification requirements (diesel fuel with a maximum sulfur content of 15 ppm) in 40 CFR 1090.305 as required by 40 CFR 60.4207(b).[47]

Enviva operates and maintains the engine according to the manufacturer's emission related written instructions and only changes emission-related settings that are permitted by the manufacturer [§60.4211(a)]. Enviva will continue to maintain records of all maintenance performed on the engine. The Waycross facility does not operate a control device on the engine, and no performance testing is required per the rule.

6.2 National Emission Standards for Hazardous Air Pollutants

National Emission Standards for Hazardous Air Pollutants (NESHAP) regulate HAP emissions and apply to certain major and area sources of HAP. NESHAP can be found in 40 CFR Part 63 and have been incorporated by reference in GRAQC 391-3-1-.02(9). Currently the Waycross plant is classified as a minor source of HAP; however, following application of the updated emission factors based on process information and recent engineering reviews the plant will be considered a major source of HAP.

6.2.1 40 CFR 63 Subpart A – General Provisions

All sources subject to a NESHAP are subject to the general requirements under Subpart A unless excluded by the source-specific subpart. Subpart A includes requirements for initial notification, performance testing, recordkeeping, monitoring, and reporting. Subpart A is applicable to the emergency generators and the fire water pump because they are subject to

[46] In addition to the limitation on fuel sulfur content, the diesel fuel must also have a minimum centane index of 40, or a maximum aromatic content of 35 percent by volume.

[47] In addition to the limitation on fuel sulfur content, the diesel fuel must also have a minimum centane index of 40, or a maximum aromatic content of 35 percent by volume.

40 CFR 63 Subpart ZZZZ. Subpart A will also be applicable to all sources subject to Subpart B, as detailed below.

6.2.2 40 CFR 63 Subpart B – Requirements for Control Technology Determinations for Major Sources in Accordance with Clean Air Act Section 112(g)

Clean Air Act (CAA) Section 112(g)(2)(B) requires that a new or reconstructed major stationary source that does not belong to a regulated "source category" for which a NESHAP has been promulgated must control emissions to levels that reflect "maximum achievable control technology" (MACT). Although the Waycross plant is not classified as new or reconstructed under this subpart, based on the revised emission factors and inclusion of HAP emissions for sources that were not previously quantified by the former owner[48], the Waycross plant will be considered a major source of HAP. Because Wood Pellet Manufacturing Plants are not a regulated source category under 40 CFR 63, the Waycross plant is subject to 112(g); therefore, Enviva is submitting this case-by-case MACT analysis as required by 40 CFR 63 Subpart B.

As outlined in 40 CFR 63.43(d), there are four (4) general principles for conducting a case-by-case MACT analysis:

1. The MACT emission limitation or requirements cannot be less stringent than the emission control which is achieved in practice by the best controlled similar source.
2. The MACT emission limitation and control technology shall achieve the maximum degree of reduction in emissions of HAP which can be achieved by utilizing those control technologies that can be identified from available information, taking into consideration the costs of achieving such emission reduction and any non-air quality health and environmental impacts and energy requirements associated with the emission reduction.
3. If it is not feasible to have an enforceable emission limit, MACT can instead be chosen as a specific design, equipment, work practice, operational standard, or combination thereof.
4. If EPA has proposed a MACT emission standard or adopted a presumptive MACT determination for the source category, then the MACT analysis must consider this proposed standard or presumptive MACT.

There is no proposed MACT or presumptive MACT established for Wood Pellet Manufacturing Plants; therefore, this analysis relies on a review of those control technologies achieved in practice by other similar sources in the wood pellet industry. Specifically, Enviva performed a review of EPA's RACT/BACT/LAER Clearinghouse (RBLC), issued permits for 125 wood pellet manufacturing facilities across the US, and commercially demonstrated technology in the wood pellet manufacturing industry.

The following emission units at the Waycross plant are sources of HAP emissions: Log Chipper and Rechippers, Bark Hog, Heat Energy Systems/Dryers and associated bypass stacks, Dry Hammermills, Pellet Mills, Pellet Coolers, Emergency Generators, and Fire Water Pump. The Fire Water Pump and Emergency Generators are subject to 40 CFR 63 Subpart

[48] Enviva purchased the Waycross plant from the original owner, Georgia Biomass, LLC in 2020 and the current Title V permit was issued on July 7, 2021.

ZZZZ and the Heat Energy Systems are subject to 40 CFR 63 Subpart DDDDD; therefore, the Emergency Generators, Fire Water Pump, and the Heat Energy Systems are not required to be addressed as part of the case-by-case MACT analysis. A case-by-case MACT analysis has been completed for all other existing and proposed sources of HAP emissions at the Waycross plant.

As discussed in the analysis below, existing controls meet or exceed case-by-case MACT.

6.2.2.1 Chipper and Rechippers

Log chipping and Rechipping result in a small amount of methanol emissions. Based on a review of the RBLC and issued permits for 125 other wood pellet manufacturing facilities, there are no other facilities currently controlling HAP emissions from log chipping. Further, no work practice or operational measures are known that will reduce emissions of HAP from the log chipper or rechippers. Since there are no feasible control options and HAP emissions from the Chipper and Rechippers are inherently low (0.55 tpy of methanol total from both sources), Enviva proposes no control or work practices as MACT for the Chipper and Rechippers.

6.2.2.2 Bark Hog

Processing of purchased bark and bark from the Debarker by the Bark Hog will result in a small amount of fugitive methanol emissions and there are no add-on control technologies that currently exist to capture and control these emissions. Based on a review of the RBLC and issued permits for 125 other wood pellet manufacturing facilities, there are no other facilities currently controlling HAP emissions from bark hogs. Additionally, no work practice standards or operational measures are known that will reduce HAP emissions from the Bark Hog. Due to the inherently low HAP emissions (0.22 tpy of methanol) and the fact there are no feasible control options, Enviva proposes no control or work practices as MACT for the Bark Hog.

6.2.2.3 Rotary Dryers

The Waycross plant utilizes two (2) rotary dryers to reduce the moisture content of green wood chips. Direct contact heat is provided to each dryer via a 193 MMBtu/hr Heat Energy System (furnace). As previously described, a dedicated WESP and RTO for each of the two (2) dryer lines controls PM, VOC, and HAP emissions from the Dryers. As described in more detail below, the use of an RTO to control HAP emissions from the Dryers during normal operation is considered to meet or exceed MACT requirements.

As discussed in Section 3.3, there are several operating modes for each dryer line: Normal Operation, Furnace Heat Energy System Bypass (Cold Start-up/Planned Shutdown), and Furnace Heat Energy System Bypass (“Idle Mode”). Based on a review of the RBLC and issued permits for 125 other wood pellet manufacturing facilities across the US, there are no pellet manufacturing facilities in operation that have utilized add-on controls for HAP from bypass stacks. Given the magnitude of the total annual potential HAP emissions (0.12 tpy per dryer line) from use of the Furnace Heat Energy System and dryer bypass stacks during cold start-up, planned shutdown, and idle, Enviva proposes no controls or work practices as MACT for the furnace and dryer bypass stacks. Use of bypass stacks is necessary for safe operation of the facility but is minimized to the extent possible. Therefore, for the purposes of this MACT analysis, the Furnace Heat Energy System and dryer bypass stacks are not further analyzed.

6.2.2.3.1 Review of Control Technologies

HAP emissions from the Dryers can be reduced through the use of add-on control technologies. Based on a review of EPA's RBLC and commercially demonstrated technology, the following add-on control technologies were considered in this analysis:

- Thermal Oxidation – Thermal Oxidizer (TO), Recuperative Unit, or RTO;
- Catalytic Oxidation - RCO and Thermal Catalytic Oxidation (TCO);
- Wet Scrubber - Packed-Bed/Packed-Tower; and
- Bio-oxidation/Bio-filtration.

Thermal Oxidation

Thermal oxidation reduces organic HAP emissions by oxidizing organic HAP to CO_2 and water vapor (H_2O) at a high temperature with a residency time between one-half second and one second. Thermal oxidizers can be designed as conventional thermal units, recuperative units, or RTOs. A conventional thermal oxidizer does not have heat recovery capability. Therefore, fuel costs are extremely high making conventional thermal oxidizers not suitable for high volume flow applications. In a recuperative unit, the contaminated inlet air is preheated by the combustion exhaust gas stream through a heat exchanger. An RTO can achieve a heat recovery higher than a recuperative oxidizer. Typical thermal recovery efficiency of an RTO ranges from 90% to 99%. RTOs are commonly used to control organic HAP emissions in high-volume low concentration gas streams because of significant savings in fuel costs while still achieving equal HAP emissions control efficiencies; therefore, for purposes of this case-by-case MACT analysis only RTOs will be further discussed.

An RTO uses high-density media such as a ceramic-packed bed still hot from a previous cycle to preheat an incoming HAP-laden waste gas stream. The preheated, partially oxidized gases then enter a combustion chamber where they are heated by auxiliary fuel (propane or natural gas) combustion to a final oxidation temperature typically between 760-820°C (1,400-1,500°F) and maintained at this temperature to achieve maximum organic HAP destruction. The purified, hot gases exit this chamber and are directed to one or more different ceramic-packed beds cooled by an earlier cycle. Heat from the purified gases is absorbed by these beds before the gases are exhausted to the atmosphere. The reheated packed-bed then begins a new cycle by heating a new incoming waste gas stream.

Particulate control must be placed upstream of thermal oxidation controls to remove unwanted particulate matter that may cause plugging of heat exchange media and result in fires and significant operational and maintenance related difficulties. Typical organic HAP control efficiencies range from 95 to 99%.[49] An RTO is considered technically feasible for control of HAP emissions from the Dryers.

Catalytic Oxidation

Similar to an RTO, an RCO and a thermal catalytic oxidizer (TCO) oxidize organic HAP to CO_2 and H_2O. However, an RCO and TCO use catalyst to lower the activation energy required for the oxidation so that the oxidation can be accomplished at a lower temperature than an RTO. As a result, overall fuel consumption is lower than that for an RTO. RCO technology is widely

[49] EPA, *Air Pollution Control Technology Fact Sheet, Regenerative Incinerator*, EPA-452/F-03-021. https://www3.epa.gov/ttn/catc/dir1/fregen.pdf

used in the reduction of organic HAP emissions. An RCO operates in the same fashion as an RTO but requires only moderate reheating to the operating range of the catalyst, approximately 450°F. Similar to thermal oxidation units, particulate control must be placed upstream of an RCO. Even with highly efficient particulate control, there is the risk of catalyst blinding/poisoning and catalyst life guarantees are equal to or shorter than heat recovery packing life. The organic HAP destruction efficiency for an RCO typically ranges from 90 to 99%.[50]

Operating much in the same fashion as an RCO, a TCO passes heated gases through a catalyst without the regenerative properties attributed by the ceramic bed used to recapture heat. Depending on design criteria, a TCO is expected to achieve a similar HAP emission destruction efficiency to that of an RTO though at a much higher operating cost.

Catalytic oxidation is considered technically feasible for controlling HAP emissions from the Dryers.

Wet Scrubber

With packed-bed/packed-tower wet scrubbers (scrubbers), pollutants are removed by reaction with a sorbent or reagent slurry or absorption into a liquid solvent. Removal efficiencies for gas absorbers vary for each pollutant-solvent system and with the type of absorber used. Most absorbers can achieve removal efficiencies in excess of 90%, and packed-tower absorbers may achieve efficiencies as great as 99% for some pollutant-solvent systems. Removal efficiency is highly dependent on the composition of the exhaust stream and how water soluble the constituents are.

Enviva has determined that use of a wet scrubber is technically infeasible for control of organic HAP from the Dryers. The control efficiency would be low given the insolubility of a large portion of the exhaust stream. It should also be noted that use of a scrubber would generate additional environmental impacts and would require on-site or off-site treatment of the scrubber blowdown water to remove/treat the soluble organic HAP components removed from the exhaust stream. Because of the expected low control efficiency and additional environmental impacts, wet scrubbers are not considered technically feasible for control of HAP emissions from the Dryers.

Bio-oxidation/Bio-filtration

Bio-oxidation/Bio-filtration offers an alternative to traditional thermal and catalytic oxidation systems in limited situations. In limited applications this air pollution control technology can provide a reduction in organic HAP emissions of 60 to 99.9%. With this technology, organic HAP are oxidized using living micro-organisms on a media bed (sometimes referred to as a "bioreactor"). A fan is typically used to collect or draw contaminated air from a building or process. If the air is not properly conditioned (heat, humidity, solids), then pre-treatment is a necessary step to obtain optimum gas stream conditions before introducing it into the bioreactor. As emissions flow through the bed media, pollutants are absorbed by moisture on the bed media and come into contact with the microbes. Depending on the volume of air required to be treated, the footprint of a bio-oxidation/bio-filtration system can be excessive and take up significant acreage. The microbes consume and metabolize the excess organic

[50] EPA, *Air Pollution Control Technology Fact Sheet, Regenerative Incinerator*, EPA-452/F-03-021. https://www3.epa.gov/ttn/catc/dir1/fregen.pdf.

pollutants, converting them into CO_2 and water, much like a traditional thermal and catalytic oxidation process.

“Mesophilic” microbes are typically used in these systems. Mesophilic microbes can survive and metabolize organic materials at conditions up to 110°F to 120°F. One company is attempting to develop a commercial-scale technology that employs “thermophilic” microbes, but that technology has only been demonstrated on a single pilot scale installation that has a similar – but not exactly the same – exhaust stream profile as Enviva. Thermophilic microbes live and metabolize organic HAP at higher operating temperatures (~160°F).

Bio-oxidation/Bio-filtration is effective in low temperature ranges and reasonably steady exhaust gas conditions; however, at higher temperatures, cell components can begin to decompose and proteins within the enzymes can become denatured and ineffective. The temperature of the exhaust steam from the proposed Dryers is expected to be 172°F which exceeds the typical operating temperatures of a bio-oxidation/bio-filtration system. Additionally, the primary constituents of the VOC in the exhaust stream are terpenes, which are highly viscous and toxic to biotic microbes and would cause the bio-oxidation/bio-filtration system to foul. Furthermore, the expected footprint of a unit sized to handle the volume of gas needed for treatment would be extensive and impractical. Additionally, the use of this technology has not been demonstrated in practice at a wood pellet manufacturing facility. Due to the temperature limitations and lack of ability to quickly respond to varying process conditions of this control technology, expected fouling, significant land requirements and the undemonstrated nature of this technology at a wood pellet manufacturing facility, bio-oxidation/bio-filtration has been eliminated from consideration as MACT.

6.2.2.3.2 Proposed MACT

Based on a review of EPA’s RBLC, issued permits for 125 wood pellet manufacturing facilities across the US, and commercially demonstrated technology, the use of an RTO to control HAP emissions from the Dryers is considered to meet or exceed MACT requirements. For comparison, 40 CFR 63 Subpart DDDD, *NESHAP for Plywood and Composite Wood Products*, which regulates facilities that manufacture plywood and/or composite wood products by bonding wood materials or agricultural fiber, generally with resin, only requires a HAP reduction of 90%.

Considering the above, Enviva proposes use of RTOs achieving a 95% reduction in HAP emissions (measured as VOC) as MACT for the Dryers.

6.2.2.4 Dry Chip Storage Silo, Dry Hammermills, and Conveying Aspiration System 1

As previously described, the Waycross plant includes ten (10) Dry Hammermills. The Waycross plant is currently utilizing an RCO for control of VOC and coincidentally HAP emissions from the Dry Chip Silo, Dry Hammermills, and Conveying Aspiration System 1. As described in more detail below, the use of an RCO to control HAP emissions from the Dry Chip Silo, Dry Hammermills, and Conveying Aspiration System 1 is considered to meet or exceed MACT requirements.

6.2.2.4.1 Review of Control Technologies

HAP emissions from the Dry Chip Silo, Dry Hammermills, and Conveying Aspiration System 1 can be reduced through the use of add-on control technologies. Based on a review of RBLC searches and commercially demonstrated technology, the following add-on control technologies were considered in this analysis:

- Thermal Oxidation – TO, Recuperative Unit, or RTO;
- Catalytic Oxidation - RCO and TCO;
- Wet Scrubber - Packed-Bed/Packed-Tower; and,
- Bio-oxidation/Bio-filtration.

Refer to Section 6.2.2.3.1 for an overview of each of these control technologies. For the reasons listed above for the Dryers, wet scrubber and bio-oxidation/bio-filtration are not technologically feasible for control of organic HAP emissions from the Dry Chip Silo, Dry Hammermills, and Conveying Aspiration System 1. Thermal oxidation and catalytic oxidation are considered technically feasible options.

6.2.2.4.2 Proposed MACT

As previously described, the facility uses an RCO to control VOC emissions and coincidentally organic HAP emissions from the Dry Chip Silo, Dry Hammermills and Conveying Aspiration System 1. The RCO achieves a 95% reduction in HAP emissions. Based on a review of EPA's RBLC, issued permits for 125 wood pellet manufacturing facilities across the US, and commercially demonstrated technology the use of an RCO to control HAP emissions from the Dry Chip Silo, Dry Hammermills, and Conveying Aspiration System 1 is considered to meet or exceed MACT requirements. For comparison, 40 CFR 63 Subpart DDDD, *NESHAP for Plywood and Composite Wood Products*, which regulates facilities that manufacture plywood and/or composite wood products by bonding wood materials or agricultural fiber, generally with resin, only requires a HAP reduction of 90%.

Considering the above, Enviva proposes use of an RCO achieving a 95% reduction in HAP emissions (measured as VOC) as MACT for the Dry Chip Silo, Dry Hammermills, and Conveying Aspiration System 1.

6.2.2.5 Pellet Mills, Pellet Coolers, Fines Storage Silo, and Conveying Aspiration System 2

As previously described, the Waycross plant includes five (5) pelletizing lines, with a total of twenty-two (22) Pellet Mills and five (5) Pellet Coolers. The Waycross plant is currently utilizing an RCO for control of VOC and coincidentally HAP emissions from the pelletizing lines, Fines Storage Silo, and Conveying Aspiration System 2. As described in more detail below, the use of an RCO to control HAP emissions from the Pellet Mills, Pellet Coolers, Fines Storage Silo, and Conveying Aspiration System 2 is considered to meet or exceed MACT requirements.

6.2.2.6 Review of Control Technologies

HAP emissions from the Pellet Mills and Pellet Coolers can be reduced through the use of add-on control technologies. Based on a review of RBLC searches and commercially demonstrated technology, the following add-on control technologies were considered in this analysis:

- Thermal Oxidation – TO, Recuperative Unit, or RTO;
- Catalytic Oxidation - RCO and TCO;
- Wet Scrubber - Packed-Bed/Packed-Tower; and,
- Bio-oxidation/Bio-filtration.

Refer to Section 6.2.2.3.1 for an overview of each of these control technologies. For the reasons listed above for the Dryers, wet scrubber and bio-oxidation/bio-filtration are not technologically feasible for control of organic HAP emissions from the Pellet Mills, Pellet Coolers, Fines Storage Silo, and Conveying Aspiration System 2. Thermal oxidation and catalytic oxidation are considered technically feasible options.

6.2.2.6.3 Proposed MACT

As previously described, Enviva utilizes an RCO to control VOC emissions and coincidentally organic HAP emissions from the Pellet Mills, Pellet Coolers, Fines Storage Silo, and Conveying Aspiration System 2. The RCO achieves a 95% reduction in HAP emissions. Based on a review of EPA's RBLC, issued permits for 125 wood pellet manufacturing facilities across the US, and commercially demonstrated technology the use of an RCO to control HAP emissions from the Pellet Mills, Pellet Coolers, Fines Storage Silo, and Conveying Aspiration System 2 is considered to meet or exceed MACT requirements. For comparison, 40 CFR 63 Subpart DDDD, *NESHAP for Plywood and Composite Wood Products*, which regulates facilities that manufacture plywood and/or composite wood products by bonding wood materials or agricultural fiber, generally with resin, only requires a HAP reduction of 90%.

Considering the above, Enviva proposes use of an RCO achieving a 95% reduction in HAP emissions (measured as VOC) as MACT for the Pellet Mills, Pellet Coolers, Fines Storage Silo, and Conveying Aspiration System 2.

6.2.3 40 CFR 63 Subpart DDDD – NESHAP for Plywood and Composite Wood Products

Subpart DDDD regulates HAP emissions from plywood and composite wood products (PCWP) manufacturing facilities located at major sources of HAPs. A PCWP manufacturing facility is defined in §63.2292 as one that manufactures plywood and/or composite wood products by bonding wood material or agricultural fiber to form a panel, engineered wood product, or other product defined in §63.2292. Further, an engineered wood product is defined as a product made with wood elements that are bound together with resin, such as laminated strand lumber and glue-laminated beams. The wood pellets manufactured at the Waycross plant do not meet the definition for any of the PCWP products defined in §63.2292 as being subject to Subpart DDDD. Wood pellets are not an engineered wood product, as they are not bound together with resin or other chemical bonding agent. As such, this regulation is not applicable.

6.2.4 40 CFR 63 Subpart ZZZZ – NESHAP for Stationary Reciprocating Internal Combustion Engines

Subpart ZZZZ applies to reciprocating internal combustion engines (RICE) located at major and area source of HAP emissions. Emergency stationary RICE are defined in §63.6675 as any stationary RICE that operates in an emergency situation. These situations include engines used for power generation when a normal power source is interrupted, or when engines are used to pump water in the case of fire or flood. The Waycross plant's emergency generators are both classified as emergency stationary RICE under Subpart ZZZZ. The fire pump is not classified as an emergency engine as it is permitted for continuous operation (8,760 hours per year) and used for other non-emergency purposes (i.e., cleaning and other facility activities). All three engines are classified as new sources, as they were constructed after June 12, 2006 [§63.6590(a)(2)(iii)].

Classification of Emergency Generator 1 under Subpart ZZZZ changes as the facility will be a major source of HAP following the changes proposed in this application. Emergency Generator 1 has a rating of more than 500 bhp and is located at a major source of HAP emissions and is thus subject to limited requirements under Subpart ZZZZ, in accordance with §63.6590(b)(1)(i). Per §63.6590(b)(1)(i), the Emergency Generator 1 does not have to meet the requirements of Subpart ZZZZ or Subpart A except for the initial notification requirements of §63.6645(f).

New CI engines with ratings less than or equal to 500 bhp located at a major source of HAP, including the Emergency Generator 2 and Fire Water Pump Engine, are only subject to the requirement to comply with the applicable provisions of NSPS Subpart IIII, per §63.6590(c)(7), and no further requirements apply under Subpart ZZZZ.

6.2.5 40 CFR 63 Subpart DDDDD – NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters

Subpart DDDDD, also referred to as the Boiler MACT, provides emission standards for boilers and process heaters located at major sources of HAP emissions. The rule defines a boiler in §63.7575 as "*an enclosed device using controlled flame combustion and having the primary purpose of recovering thermal energy in the form of steam or hot water. Controlled flame combustion refers to a steady-state, or near steady-state, process wherein fuel and/or oxidizer feed rates are controlled. A device combusting solid waste, as defined in § 241.3 of this chapter, is not a boiler unless the device is exempt from the definition of a solid waste incineration unit as provided in section 129(g)(1) of the Clean Air Act. Waste heat boilers are excluded from this definition*." Georgia Biomass previously submitted a NESHAP Subpart JJJJJJ applicability determination request to the EPA.[51] EPA determined that the two Furnace Heat Energy Systems meet the definition of a boiler since a small fraction of the heat generated by the heat energy systems is used for steam generation for injection into the pelletizing process. NESHAP Subpart JJJJJJ and Subpart DDDDD have identical definitions for boilers; therefore, it has been determined that Subpart DDDDD applies to the Furnace Heat Energy Systems since the plant will now be classified as a major source of HAP.

The Furnace Heat Energy Systems are classified as existing units because they were constructed prior to June 4, 2010 and fall under the subcategory "stokers/sloped grate/other units designed to burn wet biomass/bio-based solid" in §63.7499. Per §63.7495(c)(2), the Furnace Heat Energy systems must be in compliance with this subpart within 3 years after the source becomes classified as a major source. The Furnace Heat Energy Systems are subject to emission limits for CO, filterable PM or total selected metals (TSM), HCl, and mercury [§63.7500(a)(1)]. [52] Emission standards apply at all times the Furnace Heat Energy Systems are operating except during periods of start-up and shutdown, during which time Enviva will comply with items 5 and 6 in Table 3 to this subpart as required by §63.7500(f) and §63.7505(a). At all times Enviva operates and maintains the Furnace Heat Energy Systems and associated air pollution control equipment and monitoring equipment in a manner consistent with safety and good air pollution control practices for minimizing emissions and will comply with all applicable requirements of Subpart DDDDD [§63.7500(a)(3)].

[51] Applicability Determination Request Letter sent to Mr. Jim Eddinger, U.S. EPA, in February 2012.

[52] Table 2 to Subpart DDDDD of Part 63 - Emission Limits for Existing Boilers and Process Heaters

Initial performance testing is required for CO in accordance with §63.7505(c) and §63.7510(c) since Enviva does not operate Continuous Emissions Monitoring Systems (CEMS) for CO. Compliance must be demonstrated for either filterable PM (stack testing) or alternatively for TSM (stack testing or fuel analysis) [§63.7505(c) and §63.7521(a)]. A site-specific stack test plan must be developed according to the requirements in §63.7(c) per §63.7520(a). Initial compliance must be demonstrated within 180 days of start-up [§63.7510(f)]. A Notification of Intent to conduct a performance test must be submitted at least 60 days prior to the performance test per §63.7545(d). Results of performance tests much be submitted within 60 days of completing the test [§63.7550(h)(1)].

Annual compliance testing is required unless less frequent testing is allowed in accordance with §63.7515(a) through (c). If compliance with the mercury, HCl, or TSM emission limits is demonstrated using fuel analysis, analysis is required on a monthly basis except as allowed under §63.7515(d). Records of the type and amount of fuel combusted must be maintained on a monthly basis [§63.7540(a)(2)]. Enviva is required to maintain the 30-day rolling average operating load at or below 110% of the highest hourly average operating load recorded during the CO performance test [§63.7520(c) and Table 4].

Enviva is required to install, operate, and maintain an oxygen analyzer system, as defined in §63.7575, or install, certify, operate, and maintain continuous emissions monitoring systems (CEMS) for CO and oxygen (or CO_2] per §63.7525(a). Since the RTO stacks are not equipped with CEMS, a site-specific monitoring plan is required for the oxygen analyzer system per §63.7505(d) and data must be monitored and recorded in accordance with this plan [§63.7535(a)].

An initial tune-up was conducted within 13 months after initial start-up and annual tune-ups are required to be conducted no more than 13 months after the previous tune-up [§63.7515(d) and §63.7540(a)(10)]. A one-time energy assessment is also required to be performed by a qualified energy assessor [§63.7500(a)]. An Initial Notification and a Notification of Compliance Status (NOCS) are required per §63.7545(c) and (e), respectively. Compliance reports are required to be submitted semi-annually [§63.7550(b)].

Records must be in a form suitable and readily available for expeditious review for 5 years following the date of each tune-up, maintenance, corrective action, report, or record [§63.7560 and §63.10(b)(1)]. Records must be kept on-site (or must be accessible from on-site) for the first 2 years and can be kept off-site for the remaining 3 years [§63.7560]. A copy of each notification and report, including all supporting documentation must be maintained. Records of performance tests, fuel analyses or other compliance demonstrations and performance evaluations must be maintained [§63.7555(a)(1) and (2)]. Additional records must also be maintained, including but not limited to, all monitoring data and calculated averages for applicable operating limits (such as oxygen and operating load), monthly fuel usage, records of occurrence and duration of each malfunction of the boiler and associated monitoring equipment, actions taken during malfunctions to minimize emissions, and records of date, time, occurrence, and duration of each start-up and shutdown, and quantity of fuel used during each start-up and shutdown [§63.7555].

6.2.6 40 CFR 63 Subpart JJJJJJ – NESHAP for Industrial, Commercial, and Institutional Boilers at Area Sources

Subpart JJJJJJ includes emission standards for boilers located at area sources of HAP emissions. The Furnace Heat Energy Systems were previously subject to this subpart, but because the facility is now classified as a major source of HAP, Subpart JJJJJJ is no longer applicable.

6.3 Compliance Assurance Monitoring

Compliance Assurance Monitoring (CAM) under 40 CFR 64 applies to emission units located at a Title V major source that use a control device to achieve compliance with an emission limit and whose pre-controlled emissions exceed the major source thresholds. CAM has been incorporated by reference in GRAQC 391-3-1-.02(11). A CAM plan is required to be submitted with the initial Title V operating permit application for emission units whose post-controlled emissions exceed the major source thresholds (i.e., large pollutant-specific emission units [PSEU]).[53] For emission units with post-controlled emissions below the major source thresholds, a CAM plan must be submitted with the first Title V permit renewal application.[54] The changes proposed in the application will not impact CAM applicability.

6.4 Chemical Accident Prevention Provisions

The Chemical Accident Prevention Provisions, promulgated in 40 CFR 68, provide requirements for the development of risk management plans (RMP) for regulated substances. Applicability of RMP requirements is based on the types and amounts of chemicals stored at a facility. The Waycross plant does not store any regulated substance under Subpart F of this rule; therefore, an RMP is not required for the Waycross plant.

6.5 Georgia Rules for Air Quality Control

In addition to federal air regulations, the Waycross plant sources are subject to regulations contained within GRAQC 391-3-1. Regulations that are potentially applicable to the sources at the Waycross plant are addressed in the following sections.

6.5.1 GRAQC 391-3-1-.02(2)(a)7 – Excess Emissions, 11 – Start-up and Shutdown, 12 – Malfunction Emissions, and 13 – Start-up, Shutdown, and Malfunction Emissions for Certain Rules

Subsection 7 is a conditional exemption for excess emissions resulting from start-up, shutdown, or malfunction. Such excess emissions are allowed, provided that (i) best operational practices to minimize emissions are followed, (ii) all associated air pollution control equipment is operated in a manner consistent with good air pollution control practice for minimizing emissions, and (iii) the duration of excess emissions is minimized. Excess emissions caused entirely or in part by poor maintenance, poor operation or any other equipment or process failure that may reasonably be prevented during start-up, shutdown or malfunction are prohibited. The exemption applies to all non-NSPS-based limits.

6.5.2 GRAQC 391-3-1-.02(2)(b) – Visible Emissions

This regulation limits the opacity from all sources to 40%, provided that the source is not subject to some other, more restrictive, emission limitation under GRAQC 391-3-1-.02(2). This regulation is applicable to the three engines (emergency generators and non-emergency

[53] §64.5(a)

[54] §64.5(b)

fire pump engine) and the biomass handling and processing operations. The heat energy systems, however, are subject to a more stringent opacity limit under GRAQC 391-3-1-.02(2)(d).

6.5.3 GRAQC 391-3-1-.02(2)(c) – Incinerators

GRAQC 391-3-1-.02(c), *Incinerators*, limits PM emissions from incinerators. An incinerator is defined as all devices intended or used for the reduction or destruction of solid, liquid, or gaseous waste by burning. The RTOs are considered vent gas incineration devices and are used exclusively as air pollution control devices, meeting the exemption under this rule. The Heat Energy Systems are not used to reduce or destroy any waste at the Waycross plant. Therefore, GRAQC 391-3-1-.02(c) does not apply to the RTOs or any equipment at the Waycross facility.

6.5.4 GRAQC 391-3-1-.02(2)(d) – Fuel Burning Equipment

GRAQC 391-3-1-.02(d), *Fuel Burning Equipment*, limits emissions from fuel burning equipment based on heat input capacity. Georgia defines fuel-burning equipment as "*equipment the primary purpose of which is the production of thermal energy from the combustion of any fuel. Such equipment is generally that used for, but not limited to, heating water, generating or superheating steam, heating air as in warm air furnaces, furnishing process heat indirectly, through transfer by fluids or transmissions through process vessel walls*."

The Furnace Heat Energy Systems are subject to this rule as they combust fuel to produce thermal energy. The three engines combust diesel fuel for the purposes of generating electricity, not for the production of thermal energy. As such, the three engines are not classified as fuel-burning equipment and are not subject to this Rule.

Although NO_X limits only apply to units with heat input capacities greater than 250 MMBtu/hr, PM limits apply to all fuel-burning equipment. In addition, opacity is limited to 20% except for one six-minute period per hour, which may be up to 27%. The Furnace Heat Energy Systems are subject to the opacity limit and the PM limit specified by the equation in GRAQC 391-3-1-.02(2)(d)2(ii). Note that the Heat Energy Systems are subject to a more stringent PM emissions limitation under NSPS Subpart Db.

6.5.5 GRAQC 391-3-1-.02(2)(e) – PM Emissions from Manufacturing Processes

This regulation, also referred to as the process weight rule, limits particulate emissions resulting from any source for which no other emission control standards are applicable. Allowable emission rates for new equipment (E) are calculated based on process throughput using the equation $E = 4.10 \times P^{0.67}$, for process rates (P) less than or equal to 30 tons per hour (tph) and $E=55 \times P^{0.11} - 40$ for process rates greater than 30 tph.[55]

This regulation applies to the biomass and pellet processing and handling systems. Since the Furnace Heat Energy Systems are subject to a PM limit under Rule (d), this rule does not apply to the units.

[55] Equipment installed after July 2, 1968 is considered new equipment under GRAQC 391-3-1-.02(2)(e).

6.5.6 GRAQC 391-3-1-.02(2)(g) – Sulfur Dioxide

This regulation establishes SO_2 emission limits for fuel-burning sources, not "fuel-burning equipment".[56] The Furnace Heat Energy Systems are considered fuel-burning equipment and are thus not subject to this rule. The RTO and RCO burners fire pipeline quality natural gas which has inherently low sulfur content (less than 2.5% sulfur by weight). The fire water pump engine, and emergency generator engines have heat input capacities below 100 MMBtu/hr and are subject to a fuel sulfur content limit of 2.5% for any fuel fired. This sulfur limit is subsumed by the more stringent fuel sulfur limitation in 40 CFR 60 Subpart IIII. Thus, by complying with NSPS Subpart IIII, the Waycross plant is in compliance with Rule (g).

6.5.7 GRAQC 391-3-1-.02(2)(n) – Fugitive Dust

This regulation requires facilities to take reasonable precautions to prevent fugitive dust from becoming airborne. Operations at the Waycross facility, including the biomass handling, storage systems, and vehicle movements are covered by this generally applicable rule. The appropriate precautions are taken to prevent fugitive dust from becoming airborne and ensure that opacity from fugitive dust sources is less than 20%, as required by this rule.

6.5.8 GRAQC 391-3-1-.02(2)(ff) - Solvent Metal Cleaning

This regulation provides requirements for design and usage of various types of degreasers. All degreasers used at the Waycross facility are operated under the requirements of this regulation.

6.5.9 GRAQC 391-3-1-.02(2)(111) - NO_X from Fuel-Burning Equipment

This regulation limits NOx emissions from fuel-burning equipment with capacities between 10 and 250 MMBtu/hr that are located in or near the original Atlanta 1-hour ozone nonattainment area. The Waycross facility is located in Ware County which is not part of the geographic area covered by this rule. As such, the facility is not subject to this regulation.

6.5.10 GRAQC 391-3-1-.02(2)(mmm) - NO_X Emissions from Stationary Gas Turbines and Stationary Engines used to Generate Electricity

Rule (mmm) provides NOx emission standards for stationary gas turbines and stationary engines located in certain counties in the Atlanta metropolitan area. The Waycross facility is not located in any of the subject counties; therefore, the engines are not be subject to this regulation.

6.5.11 GRAQC 391-3-1-.02(2)(rrr) - NO_X from Small Fuel Burning Equipment

Rule (rrr) applies to small (i.e., less than 10 MMBtu/hr) fuel burning equipment installed on or after May 1, 1999 that is also located in or near the original Atlanta 1-hour ozone nonattainment area. The Waycross facility is located in Ware County which is not part of the geographic area covered by this rule; therefore, the fuel burning equipment at the Waycross facility is not subject to this regulation.

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[56] Fuel-burning equipment is defined in GRAQC 391-3-1-.01(cc) as equipment the primary purpose of which is the production of thermal energy from the combustion of any fuel. Such equipment is generally used for, but not limited to, heating water, generating or super heating steam, heating air as in warm air furnaces, furnishing process heat indirectly, through transfer of fluids or transmissions through process vessel walls.

6.5.12 GRAQC 391-3-1-.02(3) - Sampling

This regulation requires that any sampling, computation, and analysis to determine compliance with any emission limits or standards established by the Georgia State Implementation Plan (SIP) be completed in accordance with Georgia EPD's Procedures for Testing and Monitoring Sources of Air Pollutants. The Waycross facility complies with the applicable portions of this rule as required.

6.5.13 GRAQC 391-3-1-.02(5) - Open Burning

This regulation imposes restrictions on open burning activities. The regulation specifies what type of burning is permitted, when it is permitted, and limits opacity to 40%. The Waycross facility will comply with the requirements of this regulation in the event of performing open burning.

6.5.14 GRAQC 391-3-1-.02(6)(b) - Source Monitoring

This regulation allows Georgia EPD to require a facility to install, maintain, and use monitoring devices necessary to determine compliance with any emission limits or standards established by the Georgia SIP. Such devices shall be installed, operated, calibrated, maintained, and information reported in accordance with the Georgia EPD' s Procedures for Testing and Monitoring Sources of Air Pollutants. The Waycross facility complies with the applicable portions of this rule as required.

6.5.15 GRAQC 391-3-1-.03(10) - Title V Operating Permits

The potential emissions of certain pollutants exceed the major source thresholds established by Georgia's Title V operating permit program. Therefore, the Waycross facility is a major source and currently operates under Title V Permit No. 2499-299-0053-V-04-0 issued by EPD on July 7, 2021.

7. AIR TOXIC IMPACT ASSESSMENT

The Georgia EPD's Guideline for *Ambient Impact Assessment of Toxic Air Pollutant Emissions (Guideline)* provides requirements for assessing the impacts of toxic air pollutant (TAP) emissions from a facility or proposed project. The Guideline defines a TAP as any substance which may have an adverse effect on public health, excluding any specific substance that is covered by a state or federal ambient air quality standard. If a facility's emissions of a specific TAP are less than the minimum emission rate (MER), no further analysis is required for that pollutant. Otherwise, an air dispersion modeling analysis is required to demonstrate that the facility's emissions of the TAP will not exceed the pollutant's acceptable ambient concentration (AAC). Appendix A of the Guideline provides a list of state TAPs, as well as their respective MERs and AAC.

The proposed production update and other revisions to potential emissions proposed in this application result in an increase in potential TAP emissions. A comparison of the facility-wide potential emissions of each TAP to the MERs is provided in Table 7-1, which indicates that a toxic impact assessment (TIA) is required for twelve (12) individual TAPs.

7.1 Acceptable Ambient Concentrations

Enviva conducted air dispersion modeling for twelve (12) TAPs with potential facility-wide emissions in excess of the MER thresholds to demonstrate compliance with the AAC. The AAC are in place to ensure that emissions from a facility do not adversely affect human health. A comparison of facility-wide potential emissions to the MERs is provided in Table 7-1 below.

Modeling for each TAP was conducted using five years of meteorological data. The maximum concentration (highest-first-high) across the five individual years was compared to the AAC for each modeled TAP. For comparison to 15-minute AAC, 1-hour modeled concentrations were first multiplied by a factor of 1.32 in accordance with EPD guidance.

7.1.1 Annual Acrolein

The EPD annual AAC for acrolein is equal to the inhalation Reference Concentration (RfC) from the EPA Integrated Risk Information System (IRIS). EPA has developed a priority scheme to rank thresholds when multiple values have been published by different agencies. In the case of acrolein, EPA recommends use of the chronic Reference Exposure Level (REL) from the California Office of Environmental Health Hazard Assessment (OEHHA) over the inhalation RfC from the IRIS database.[57] The OEHHA REL is what the EPA Office of Air Quality Planning and Standards (OAQPS) uses for risk assessments of HAP.[58] Based on this, Enviva believes the OEHHA chronic REL for acrolein is more appropriate than the IRIS inhalation RfC for demonstrating no adverse health effects from emissions of acrolein. As such, the OEHHA chronic REL for acrolein was used in this analysis.[59]

[57] https://www.epa.gov/fera/prioritization-data-sources-chronic-exposure

[58] https://www.epa.gov/fera/dose-response-assessment-tables

[59] https://oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary

Table 7-1. Comparison to Georgia MERs

Pollutant	Facility-Wide Potential Emissions (tpy)	Georgia MER (tpy)	Modeling Required?
Acetaldehyde	1.29E+01	5.54E-01	**Yes**
Acetophenone	2.91E-07	2.85E+00	No
Acrolein	4.76E+00	2.43E-03	**Yes**
Antimony & Compounds	7.19E-04	2.92E-02	No
Arsenic & Compounds	2.09E-03	2.83E-05	**Yes**
Benzene	3.90E-01	1.58E-02	**Yes**
Beryllium	1.05E-04	4.87E-04	No
Butadiene, 1,3-	2.33E-04	3.65E-03	No
Cadmium	8.64E-04	6.76E-04	**Yes**
Carbon Tetrachloride	4.09E-03	8.12E-02	No
Chlorine	1.34E+00	8.76E-02	**Yes**
Chlorobenzene	3.00E-03	2.03E+01	No
Chloroform	2.55E-03	5.29E-02	No
Chromium VI	9.44E-04	1.22E-02	No
Chromium–Other compounds	1.59E-03	2.92E-02	No
Cobalt Compounds	6.29E-04	5.84E-03	No
Dichloroethane, 1,2-	2.64E-03	4.68E-02	No
Dichloropropane, 1,2-	3.00E-03	4.87E-01	No
Di(2-ethylhexyl) phthalate	4.28E-06	2.90E-01	No
Ethyl benzene	2.82E-03	1.22E+02	No
Formaldehyde	8.74E+00	1.34E-01	**Yes**
Hexane	8.04E-01	8.52E+01	No
Hydrochloric acid	3.33E+00	2.43E+00	**Yes**
Lead and Lead Compounds	4.59E-03	2.92E-03	**Yes**
Manganese & Compounds	1.46E-01	6.08E-03	**Yes**
Mercury	4.35E-04	3.65E-02	No
Methanol	4.46E+01	1.51E+01	**Yes**
Methyl bromide	1.36E-03	6.08E-01	No
Methyl chloride	2.09E-03	1.09E+01	No
Methylene chloride	2.64E-02	2.59E+00	No
Naphthalene	9.76E-03	3.65E-01	No
Nickel	3.94E-03	1.93E-02	No
Pentachlorophenol	4.64E-06	2.92E-02	No
Perchloroethylene	3.46E-03	3.93E+01	No
Phenol	7.34E-01	1.10E+00	No
Phosphorus Metal, Yellow or White	2.46E-03	5.84E-03	No
Propionaldehyde	1.11E+00	9.73E-01	**Yes**
Selenium Compounds	2.65E-04	1.17E-02	No
Styrene	1.73E-01	1.22E+02	No
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	7.82E-10	3.65E-05	No
Toluene	8.80E-02	6.08E+02	No
Trichloroethane, 1,1,1-	2.82E-03	1.10E+02	No
Trichloroethylene	2.73E-03	2.43E-01	No
Trichlorophenol, 2,4,6-	2.00E-06	3.65E-01	No
Vinyl Chloride	1.64E-03	2.80E-02	No
Xylene	4.20E-03	1.22E+01	No

7.2 Dispersion Model Selection

Although EPD guidance allows for the use of SCREEN3, Enviva elected to bypass the initial screening step and proceed directly to refined modeling using the latest version of the AERMOD model (Version 21112). AERMOD is the EPA-approved air dispersion model for near-field (within 50 km) modeling analyses. AERMOD was run using default regulatory options.

7.3 Receptor Grid and Elevation Data

A resolution of 100 meters was used for receptors along the ambient boundary and a nested Cartesian grid was modeled with the following resolutions:

- 100 meter resolution extending from the ambient boundary to 2,000 meters from the boundary; and
- 250 meter resolution between 2,000 meters and 5 km from the ambient boundary.

Modeled concentrations were reviewed to ensure that the maximum concentration for each TAP was captured within 100 m resolution.

Receptor elevations, in addition to building elevations, were determined using the AERMAP terrain pre-processor (Version 18081). Hill height parameters required by AERMOD were also calculated by AERMAP. Elevations were based on 1 arc-second National Elevation Dataset (NED) from the U.S. Geological Survey (USGS). AERMAP input and output files and a copy of the NED file are provided via SharePoint site. See the SharePoint site link in Appendix D.[60]

7.4 Meteorological Data

Enviva utilized AERMOD-ready meteorological data for 2014, 2016-2019 based on surface data from the Valdosta Regional Airport National Weather Service (NWS) station in Valdosta, GA (KVLD) and upper air data from the Tallahassee Regional Airport NWS station (KTLH) in Tallahassee, Florida obtained from EPD's website.[61] The meteorological files were processed by EPD using version 19191 of AERMET, version 20060 of AERSURFACE, and version 15272 of AERMINUTE. The base elevation was set to 60.3 m.[62] Per EPD's website, 1-minute or 5-minute wind data in 2015 is insufficient to use for KVLD; therefore, EPD provides five non-consecutive years of meteorological data for this station (2014 and 2016-2019) The meteorological data files are provided are provided via SharePoint site (refer to Appendix D).

7.5 Building Downwash

The AERMOD model incorporated Plume Rise Modeling Enhancements (PRIME) to account for downwash. The direction-specific building downwash dimensions used as inputs were determined by the latest version (Version 04274) of the Building Profile Input Program, PRIME (BPIP PRIME.) BPIP PRIME uses building downwash algorithms incorporated into AERMOD to account for the plume dispersion effects of the aerodynamic wakes and eddies produced by buildings and structures. On-site structures at the Waycross plant were evaluated for downwash effects on each modeled point source. BPIP input and output files are provided via SharePoint site. See the SharePoint site link in Appendix D.

[60] Please contact Aubrey Jones (Ramboll) to request access to the SharePoint site (ajones@ramboll.com).

[61] Data obtained from: https://epd.georgia.gov/air-protection-branch-technical-guidance-0/air-quality-modeling/georgia-aermet-meteorological-data

[62] https://epd.georgia.gov/document/document/view-surface-station-height-information/download

7.6 GEP Stack Height Analysis

EPA has promulgated regulations that limit the maximum stack height that may be used in a modeling analysis to no more than Good Engineering Practice (GEP) stack height. The purpose of this requirement is to prevent the use of excessively tall stacks to reduce the modeled concentrations of a pollutant. GEP stack height is impacted by the heights of nearby structures. In general, the minimum value for GEP stack height is 65 meters. The stack heights for all sources at the Waycross plant are less than 65 meters. As such, all point sources were modeled using actual stack heights.

7.7 Modeled Modes of Operation

The following sections describe how emissions from the Dryers were modeled for normal operation, cold start-ups, and furnace idle periods.

7.7.1 Normal Operation

Each of the two (2) dryers (DRY1 and DRY2) use direct contact heat provided to the system via a 193 MMBtu/hr total heat input Furnace Heat Energy System (FHES1 and FHES2) that uses wood residue as fuel. Green wood is fed into the dryer where the moisture content is reduced to the desired level and routed to a cyclone which separates wood fiber from the dryer exhaust gas. Emissions from each dryer cyclone are routed to a WESP (WE01 and WE02) for particulate, metallic HAP, and hydrogen chloride removal. Exhaust from the WESP is then routed to an RTO (RTO1 and RTO2) for VOC control.

During normal operations, emissions from each dryer and Furnace Heat Energy System are controlled by a dedicated WESP and RTO. Normal operation was modeled with all sources at the Waycross plant operating at their maximum capacity. For demonstrating compliance with short-term AAC, the maximum hourly emission rate was modeled for each source. For demonstrating compliance with annual AAC, an annual average emission rate was modeled for each source [i.e., emissions (tpy) divided by 8,760 hr/yr] in accordance with EPD guidance.

7.7.2 Furnace Heat Energy System Bypass – Cold Start-up and Planned Shutdown

The Furnace Heat Energy Systems bypass stacks are used to exhaust hot gases during start-ups (for temperature control), planned shutdowns, and malfunctions. Venting at full capacity only occurs in the event of a malfunction. As soon as the Furnace Heat Energy System aborts during a malfunction, the fuel feed is significantly reduced, and the heat input rate drops rapidly as the Furnace Heat Energy System quickly transitions to “idle mode”. Since malfunctions are, by definition, unplanned events and cannot be permitted, venting at full capacity was not evaluated. Each Furnace Heat Energy System bypass stack is used for no more than 50 hours per year for planned start-up and shutdown.

In the event of a planned dryer shutdown, the Dryer throughput and Furnace Heat Energy System heat input are decreased. Dryer raw material input ceases, and all remaining material is moved through the system to prevent a fire. On shutdown of the Dryer, the Furnace Heat Energy System operating rate quickly approaches idle state. As such, emissions during planned shutdowns are minimal.

During cold start-ups, the Furnace Heat Energy System 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 Heat Energy System bypass stack is then closed, and the Furnace Heat Energy System is slowly brought up to a normal operating rate.

Enviva modeled cold start-up, which is worst-case between start-up and shutdown, given that the Furnace Heat Energy System bypass stack is not utilized during a planned shutdown until after the Furnace Heat Energy System achieves an idle state. Until this time, emissions continue to be controlled by the WESP and RTO. Both dryer lines could be in cold start-up simultaneously; therefore, Enviva evaluated this operating condition. Each dryer line was also evaluated individually in cold start-up.

When a Furnace Heat Energy System is in cold start-up the corresponding dryer will not be operational. All other sources were conservatively modeled consistent with normal operation.

7.7.3 Furnace Heat Energy System Bypass – Idle Mode

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

Enviva conducted modeling to evaluate the impact of the Furnace Heat Energy Systems "idle mode". The maximum hourly emission rate for Furnace Heat Energy System "idle mode" was modeled for each TAP to demonstrate compliance with the short-term AAC. For demonstrating compliance with annual AAC, an annual average emission rate was modeled for each source [i.e., emissions (tpy) divided by 8,760 hr/yr] in accordance with EPD guidance.

Both Furnace Heat Energy Systems could be idling at the same time; therefore, Enviva modeled both dryer lines in idle mode simultaneously. Each dryer line was also evaluated individually in idle mode. When FHES1 is idling, Dryer 1 will not be operational. All other sources could remain operational during furnace idle and were modeled consistent with normal operation. Similarly, when FHES2 is idling, all sources could remain operational except Dryer 2 and were modeled consistent with normal operation.

7.7.4 Dryer Bypass

As previously described in Section 3.3, the dryer bypass stacks are used when the Furnace Heat Energy System is started up from a cold shutdown and when the Furnace Heat Energy System transitions from idle mode to normal operation. Emissions are vented through the dryer bypass stack for a short period of time as exhaust flow is transitioned from the Furnace Heat Energy System 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 Heat Energy System. Emissions during these brief transition periods are insignificant and are not separately quantified or modeled to avoid double-counting, as these emissions are already accounted for under the Furnace Heat Energy System cold start-up and idle mode operations.

Venting of emissions through the dryer bypass stacks also occurs in the event of a malfunction, during which the Furnace Heat Energy System or dryer itself can abort and open the bypass stack. An abort may be caused by failsafe interlocks associated with the Furnace Heat Energy System or dryer and emissions control systems as well as utility supply system (i.e., electricity, compressed air, water/fire protection). Since malfunctions are, by definition, unplanned events and cannot be permitted dryer bypass was not evaluated as part of this analysis.

7.8 Sources and Release Parameters

Tables summarizing the modeled release parameters and emission rates are included in Appendix E. Each modeled source with a defined stack was represented as a point source. All point sources at the Waycross plant have vertical, unobstructed releases.

Log Chipping, Rechipping, and Bark Hog emissions were modeled using volume sources. The log chipper and rechippers are located inside of a building. Initial lateral and vertical dimensions for the volume sources were determined in accordance with the *AERMOD User's Guide*.[63]

A site layout identifying the location of the modeled sources, downwash structures, and ambient boundary are provided in Appendix F.

7.9 Modeling Results

The following summarizes the results of the air quality modeling analysis. A link to a SharePoint site with all supporting AERMOD input and output files is provided in Appendix D. Modeled source groups are abbreviated as follows:

- NORM: All sources operating under normal conditions;
- BYP1: FHES 1 operating in "idle mode" with all other sources operating under normal conditions except for Dryer 1 which will not be operational.
- BYP2: FHES 2 operating in "idle mode" with all other sources operating under normal conditions;
- BYP: Both FHES 1 and 2 operating in "idle mode" with all other sources operating under normal conditions except for the Dryers which will not be operational;
- FBYP1: FHES 1 in cold start-up with all other sources operating under normal conditions except for Dryer 1 which will not be operational;
- FBYP2: FHES 2 in cold start-up with all other sources operating under normal conditions.
- FBYP: Both FHES operating in "Cold Start-up" with all other sources operating under normal conditions except for the Dryers which will not be operational;
- I1_S2: FHES 1 operating in "idle mode" and FHES 2 in cold start-up with all other sources operating under normal conditions except for the Dryers which will not be operational; and
- I2_S1: FHES 2 operating in "idle mode" and FHES 1 in cold start-up with all other sources operating under normal conditions except for the Dryers which will not be operational.

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[63] U.S. EPA. *User's Guide for the AMS/EPA Regulatory Model - AERMOD*. April 2021.

As shown in Table 7-2 below, modeled concentrations of all twelve (12) TAP are well below the respective AAC (and, as discussed, the OEHHA REL for annual acrolein). As such, the Waycross plant will not present an unacceptable risk to human health.

Table 7-2. Summary of Toxics Modeling Results

Pollutant	Averaging Period	Source Group	Year	UTM Easting[1] (m)	UTM Northing[1] (m)	Modeled Concentration[2,3] (µg/m³)	Threshold[4] (µg/m³)
Acetaldehyde	15-Minute	NORM	2017	365,743.56	3,458,664.42	38.7	4,500
		BYP1	2017	365,743.56	3,458,664.42	19.7	
		BYP2	2017	365,743.56	3,458,664.42	19.4	
		BYP	2019	366,059.84	3,458,821.75	1.81	
		FBYP1	2017	365,743.56	3,458,664.42	20.0	
		FBYP2	2017	365,743.56	3,458,664.42	19.6	
		FBYP	2017	365,461.28	3,458,722.00	1.60	
		I1_S2	2016	365,536.52	3,458,764.63	1.55	
		I2_S1	2016	365,536.52	3,458,764.63	1.53	
	Annual	NORM	2016	365,448.88	3,458,805.97	0.55	4.55
		BYP1	2016	365,448.88	3,458,805.97	0.28	
		BYP2	2016	365,448.88	3,458,805.97	0.28	
		BYP	2019	365,536.52	3,458,764.63	0.038	
		FBYP1	2016	365,448.88	3,458,805.97	0.28	
		FBYP2	2016	365,448.88	3,458,805.97	0.28	
		FBYP	2019	365,536.52	3,458,764.63	0.038	
		I1_S2	2019	365,536.52	3,458,764.63	0.038	
		I2_S1	2019	365,536.52	3,458,764.63	0.038	
Acrolein	15-Minute	NORM	2017	365,743.56	3,458,664.42	9.39	23
		BYP1	2017	365,743.56	3,458,664.42	5.54	
		BYP2	2017	365,743.56	3,458,664.42	5.42	
		BYP	2019	366,059.84	3,458,821.75	8.27	
		FBYP1	2017	365,743.56	3,458,664.42	6.71	
		FBYP2	2017	365,743.56	3,458,664.42	6.69	
		FBYP	2014	365,818.64	3,459,035.17	6.81	
		I1_S2	2014	365,889.54	3,458,943.65	6.43	
		I2_S1	2014	365,818.64	3,459,035.17	4.93	
	Annual	NORM	2016	365,448.88	3,458,805.97	0.15	0.35
		BYP1	2016	365,448.88	3,458,805.97	0.082	
		BYP2	2016	365,448.88	3,458,805.97	0.083	
		BYP	2019	365,536.52	3,458,764.63	0.047	
		FBYP1	2016	365,448.88	3,458,805.97	0.082	
		FBYP2	2016	365,448.88	3,458,805.97	0.082	
		FBYP	2019	365,536.52	3,458,764.63	0.046	
		I1_S2	2019	365,536.52	3,458,764.63	0.047	
		I2_S1	2019	365,536.52	3,458,764.63	0.046	

Pollutant	Averaging Period	Source Group	Year	UTM Easting[1] (m)	UTM Northing[1] (m)	Modeled Concentration[2,3] (µg/m³)	Threshold[4] (µg/m³)
Arsenic	15-Minute	NORM	2017	365,743.56	3,458,664.42	0.0056	0.2
		BYP1	2019	366,059.84	3,458,821.75	0.024	
		BYP2	2016	365,778.09	3,459,115.81	0.023	
		BYP	2019	366,059.84	3,458,821.75	0.045	
		FBYP1	2014	365,860.34	3,459,121.00	0.020	
		FBYP2	2014	365,818.64	3,459,035.17	0.021	
		FBYP	2014	365,818.64	3,459,035.17	0.037	
		I1_S2	2014	365,889.54	3,458,943.65	0.035	
		I2_S1	2014	365,818.64	3,459,035.17	0.027	
	Annual	NORM	2016	365,448.88	3,458,805.97	9.13E-05	2.33E-04
		BYP1	2017	365,818.64	3,459,035.17	5.78E-05	
		BYP2	2016	365,448.88	3,458,805.97	5.20E-05	
		BYP	2014	365,778.09	3,459,115.81	5.28E-05	
		FBYP1	2016	365,448.88	3,458,805.97	4.67E-05	
		FBYP2	2016	365,448.88	3,458,805.97	4.72E-05	
		FBYP	2014	365,718.09	3,459,234.16	4.65E-06	
		I1_S2	2014	365,778.09	3,459,115.81	2.54E-05	
		I2_S1	2014	365,778.09	3,459,115.81	3.11E-05	
Benzene	15-Minute	NORM	2017	365,536.52	3,458,764.63	1.56	1,600
		BYP1	2019	366,059.84	3,458,821.75	5.10	
		BYP2	2016	365,778.09	3,459,115.81	5.25	
		BYP	2019	366,059.84	3,458,821.75	9.15	
		FBYP1	2014	365,860.34	3,459,121.00	4.06	
		FBYP2	2014	365,778.09	3,459,115.81	4.48	
		FBYP	2014	365,818.64	3,459,035.17	7.36	
		I1_S2	2014	365,889.54	3,458,943.65	7.01	
		I2_S1	2014	365,818.64	3,459,035.17	5.40	
	Annual	NORM	2016	365,448.88	3,458,805.97	0.021	0.13
		BYP1	2017	365,818.64	3,459,035.17	0.014	
		BYP2	2016	365,448.88	3,458,805.97	0.014	
		BYP	2014	365,778.09	3,459,115.81	0.015	
		FBYP1	2016	365,448.88	3,458,805.97	0.013	
		FBYP2	2016	365,448.88	3,458,805.97	0.013	
		FBYP	2014	365,737.54	3,459,196.46	0.0083	
		I1_S2	2014	365,737.54	3,459,196.46	0.012	
		I2_S1	2014	365,778.09	3,459,115.81	0.011	

Pollutant	Averaging Period	Source Group	Year	UTM Easting[1] (m)	UTM Northing[1] (m)	Modeled Concentration[2,3] (µg/m³)	Threshold[4] (µg/m³)
Cadmium	15-Minute	NORM	2017	365,743.56	3,458,664.42	1.91E-03	30
		BYP1	2019	366,059.84	3,458,821.75	4.51E-03	
		BYP2	2016	365,778.09	3,459,115.81	4.33E-03	
		BYP	2019	366,059.84	3,458,821.75	8.46E-03	
		FBYP1	2014	365,860.34	3,459,121.00	3.67E-03	
		FBYP2	2014	365,818.64	3,459,035.17	3.89E-03	
		FBYP	2014	365,818.64	3,459,035.17	6.97E-03	
		I1_S2	2014	365,889.54	3,458,943.65	6.59E-03	
		I2_S1	2014	365,818.64	3,459,035.17	5.04E-03	
	Annual	NORM	2016	365,448.88	3,458,805.97	3.23E-05	5.56E-03
		BYP1	2016	365,448.88	3,458,805.97	1.76E-05	
		BYP2	2016	365,448.88	3,458,805.97	1.80E-05	
		BYP	2014	365,778.09	3,459,115.81	1.09E-05	
		FBYP1	2016	365,448.88	3,458,805.97	1.70E-05	
		FBYP2	2016	365,448.88	3,458,805.97	1.71E-05	
		FBYP	2019	365,536.52	3,458,764.63	3.42E-06	
		I1_S2	2014	365,778.09	3,459,115.81	5.76E-06	
		I2_S1	2014	365,778.09	3,459,115.81	6.82E-06	
Chlorine	15-Minute	NORM	2017	365,743.56	3,458,664.42	3.94	300
		BYP1	2017	365,743.56	3,458,664.42	2.15	
		BYP2	2017	365,743.56	3,458,664.42	2.10	
		BYP	2019	366,059.84	3,458,821.75	1.63	
		FBYP1	2017	365,743.56	3,458,664.42	2.38	
		FBYP2	2017	365,743.56	3,458,664.42	2.35	
		FBYP	2014	365,818.64	3,459,035.17	1.34	
		I1_S2	2014	365,889.54	3,458,943.65	1.27	
		I2_S1	2014	365,818.64	3,459,035.17	0.97	
	24-Hour	NORM	2018	365,818.64	3,459,035.17	0.67	3.60
		BYP1	2018	365,818.64	3,459,035.17	0.38	
		BYP2	2016	365,448.88	3,458,805.97	0.35	
		BYP	2014	365,818.64	3,459,035.17	0.18	
		FBYP1	2017	365,818.64	3,459,035.17	0.40	
		FBYP2	2016	365,448.88	3,458,805.97	0.40	
		FBYP	2017	365,818.64	3,459,035.17	0.23	
		I1_S2	2014	365,818.64	3,459,035.17	0.18	
		I2_S1	2017	365,818.64	3,459,035.17	0.17	

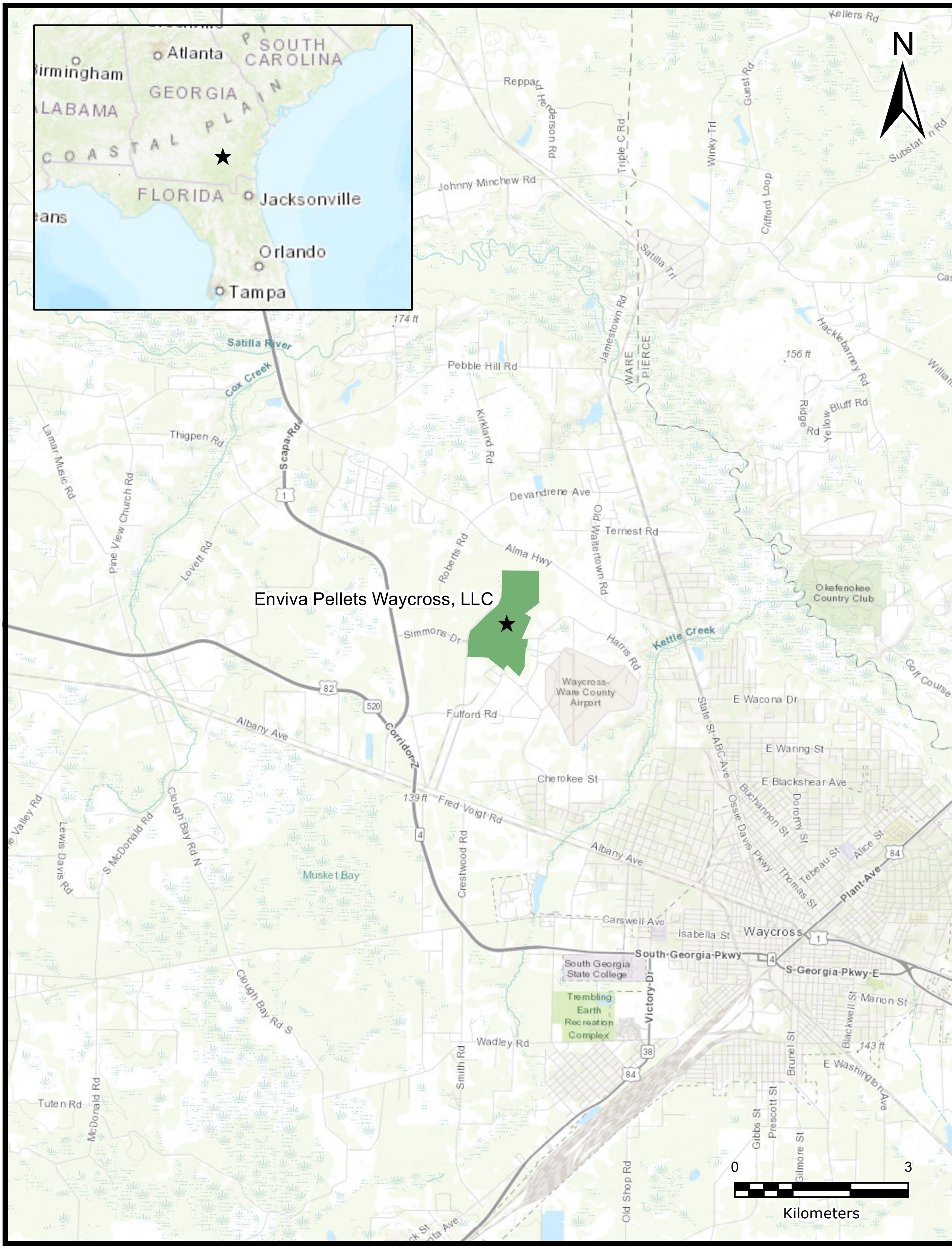
Pollutant	Averaging Period	Source Group	Year	UTM Easting[1] (m)	UTM Northing[1] (m)	Modeled Concentration[2,3] (µg/m³)	Threshold[4] (µg/m³)
Formaldehyde	15-Minute	NORM	2017	365,743.56	3,458,664.42	23.1	245
		BYP1	2017	365,743.56	3,458,664.42	12.5	
		BYP2	2017	365,743.56	3,458,664.42	12.3	
		BYP	2019	366,059.84	3,458,821.75	9.26	
		FBYP1	2017	365,743.56	3,458,664.42	13.8	
		FBYP2	2017	365,743.56	3,458,664.42	13.7	
		FBYP	2014	365,818.64	3,459,035.17	7.61	
		I1_S2	2014	365,889.54	3,458,943.65	7.21	
		I2_S1	2014	365,818.64	3,459,035.17	5.55	
	Annual	NORM	2016	365,448.88	3,458,805.97	0.34	1.10
		BYP1	2016	365,448.88	3,458,805.97	0.18	
		BYP2	2016	365,448.88	3,458,805.97	0.18	
		BYP	2019	365,536.52	3,458,764.63	0.045	
		FBYP1	2016	365,448.88	3,458,805.97	0.18	
		FBYP2	2016	365,448.88	3,458,805.97	0.18	
		FBYP	2019	365,536.52	3,458,764.63	0.043	
		I1_S2	2019	365,536.52	3,458,764.63	0.044	
		I2_S1	2019	365,536.52	3,458,764.63	0.043	
Hydrochloric Acid	15-Minute	NORM	2017	365,743.56	3,458,664.42	9.48	700
		BYP1	2019	366,059.84	3,458,821.75	20.9	
		BYP2	2016	365,778.09	3,459,115.81	20.1	
		BYP	2019	366,059.84	3,458,821.75	39.2	
		FBYP1	2014	365,860.34	3,459,121.00	17.0	
		FBYP2	2014	365,818.64	3,459,035.17	18.1	
		FBYP	2014	365,818.64	3,459,035.17	32.3	
		I1_S2	2014	365,889.54	3,458,943.65	30.5	
		I2_S1	2014	365,818.64	3,459,035.17	23.4	
	Annual	NORM	2016	365,448.88	3,458,805.97	0.15	20
		BYP1	2018	365,818.64	3,459,035.17	0.082	
		BYP2	2016	365,448.88	3,458,805.97	0.082	
		BYP	2014	365,778.09	3,459,115.81	0.045	
		FBYP1	2016	365,448.88	3,458,805.97	0.077	
		FBYP2	2016	365,448.88	3,458,805.97	0.078	
		FBYP	2014	365,718.09	3,459,234.16	0.004	
		I1_S2	2014	365,778.09	3,459,115.81	0.022	
		I2_S1	2014	365,778.09	3,459,115.81	0.027	

Pollutant	Averaging Period	Source Group	Year	UTM Easting[1] (m)	UTM Northing[1] (m)	Modeled Concentration[2,3] (µg/m³)	Threshold[4] (µg/m³)
Manganese	15-Minute	NORM	2017	365,743.56	3,458,664.42	0.40	500
		BYP1	2019	366,059.84	3,458,821.75	1.76	
		BYP2	2016	365,778.09	3,459,115.81	1.69	
		BYP	2019	366,059.84	3,458,821.75	3.30	
		FBYP1	2014	365,860.34	3,459,121.00	1.43	
		FBYP2	2014	365,818.64	3,459,035.17	1.52	
		FBYP	2014	365,818.64	3,459,035.17	2.72	
		I1_S2	2014	365,889.54	3,458,943.65	2.57	
		I2_S1	2014	365,818.64	3,459,035.17	1.97	
	Annual	NORM	2016	365,448.88	3,458,805.97	0.0064	0.05
		BYP1	2017	365,818.64	3,459,035.17	0.0041	
		BYP2	2016	365,448.88	3,458,805.97	0.0037	
		BYP	2014	365,778.09	3,459,115.81	0.0038	
		FBYP1	2014	365,818.64	3,459,035.17	0.0033	
		FBYP2	2016	365,448.88	3,458,805.97	0.0033	
		FBYP	2014	365,718.09	3,459,234.16	0.0003	
		I1_S2	2014	365,778.09	3,459,115.81	0.0018	
		I2_S1	2014	365,778.09	3,459,115.81	0.0022	
Methanol	15-Minute	NORM	2017	365,743.56	3,458,664.42	142	32,800
		BYP1	2017	365,743.56	3,458,664.42	72.1	
		BYP2	2017	365,743.56	3,458,664.42	70.8	
		BYP	2014	365,721.67	3,459,563.21	40.9	
		FBYP1	2017	365,743.56	3,458,664.42	72.1	
		FBYP2	2017	365,743.56	3,458,664.42	70.8	
		FBYP	2014	365,721.67	3,459,563.21	40.9	
		I1_S2	2014	365,721.67	3,459,563.21	40.9	
		I2_S1	2014	365,721.67	3,459,563.21	40.9	
	Annual	NORM	2014	365,721.67	3,459,563.21	2.28	20,000
		BYP1	2014	365,721.67	3,459,563.21	1.76	
		BYP2	2014	365,721.67	3,459,563.21	1.75	
		BYP	2016	365,721.67	3,459,563.21	1.25	
		FBYP1	2014	365,721.67	3,459,563.21	1.76	
		FBYP2	2014	365,721.67	3,459,563.21	1.75	
		FBYP	2016	365,721.67	3,459,563.21	1.25	
		I1_S2	2016	365,721.67	3,459,563.21	1.25	
		I2_S1	2016	365,721.67	3,459,563.21	1.25	

Pollutant	Averaging Period	Source Group	Year	UTM Easting[1] (m)	UTM Northing[1] (m)	Modeled Concentration[2,3,4] (μg/m³)	Threshold[5] (μg/m³)
Lead	24-Hour	NORM	2017	365,818.64	3,459,035.17	0.0021	0.12
		BYP1	2014	365,818.64	3,459,035.17	0.0051	
		BYP2	2014	365,778.09	3,459,115.81	0.0066	
		BYP	2014	365,818.64	3,459,035.17	0.011	
		FBYP1	2017	365,818.64	3,459,035.17	0.0082	
		FBYP2	2014	365,778.09	3,459,115.81	0.0082	
		FBYP	2017	365,818.64	3,459,035.17	0.014	
		I1_S2	2014	365,818.64	3,459,035.17	0.011	
		I2_S1	2014	365,818.64	3,459,035.17	0.011	
Propionaldehyde	Annual	NORM	2016	365,448.88	3,458,805.97	0.038	8
		BYP1	2016	365,448.88	3,458,805.97	0.020	
		BYP2	2016	365,448.88	3,458,805.97	0.020	
		BYP	2019	365,536.52	3,458,764.63	0.0064	
		FBYP1	2016	365,448.88	3,458,805.97	0.020	
		FBYP2	2016	365,448.88	3,458,805.97	0.020	
		FBYP	2019	365,536.52	3,458,764.63	0.0063	
		I1_S2	2019	365,536.52	3,458,764.63	0.0064	
		I2_S1	2019	365,536.52	3,458,764.63	0.0064	

1. Coordinates reflect UTM NAD83, Zone 17.
2. Modeled concentrations reflect the maximum value (H1H) across the five individual years of meteorological data.
3. Modeled 1-hour concentrations were multiplied by a factor of 1.32 prior to comparing to 15-minute AACs.
4. Annual arsenic and cadmium concentrations in the AERMOD output files are in units of nanograms per cubic meter in order to provide enough significant digits to obtain a concentration for comparison to the AAC.
5. Annual acrolein concentrations are compared against the OEHHA REL in lieu of the IRIS RfC as recommended by the U.S. EPA.

APPENDIX A
AREA MAP



RAMBOLL

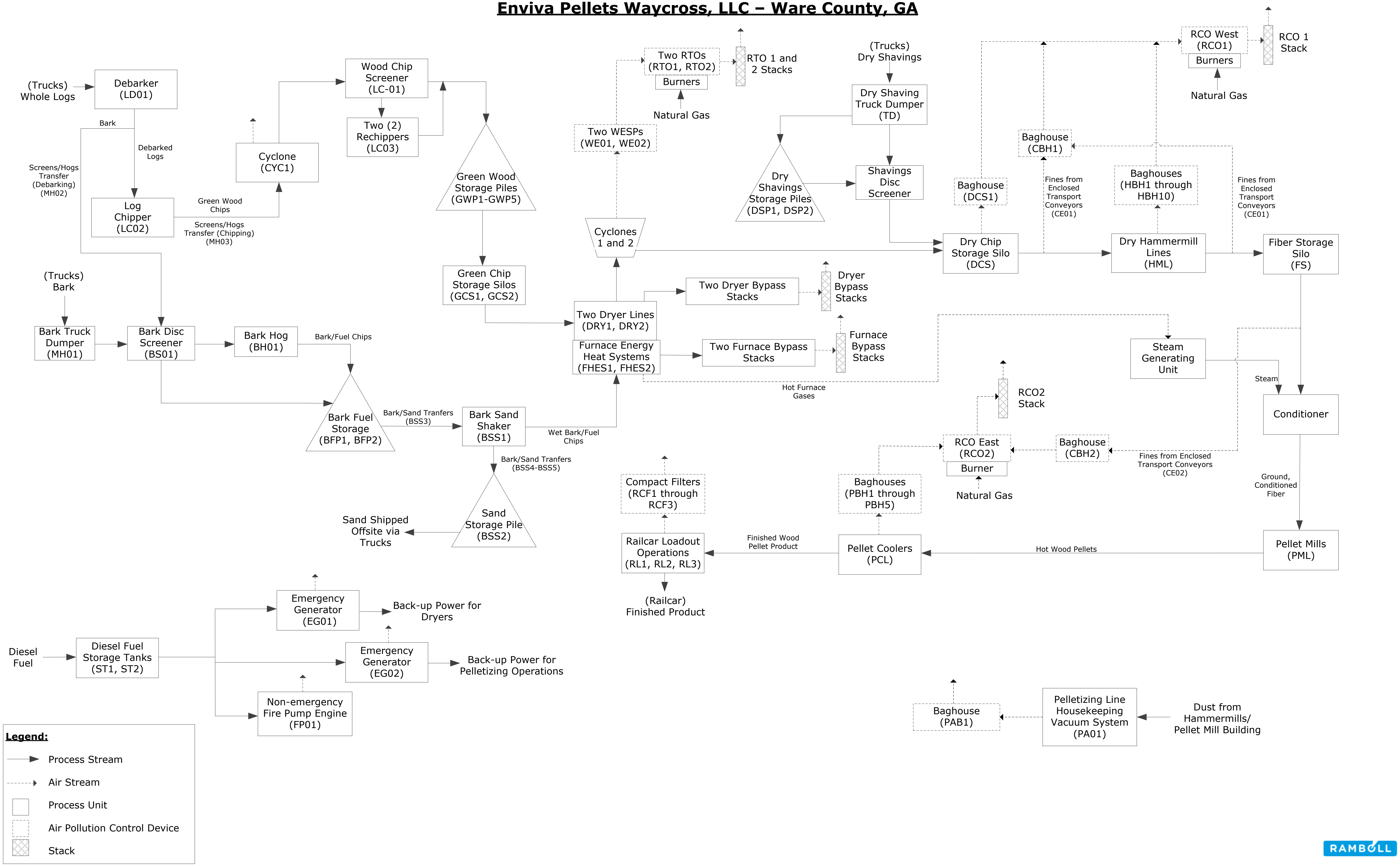
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

FIGURE
A-1

DRAFTED BY: ARJ | DATE: 10/28/2021 | PROJECT: 1690020938

APPENDIX B
PROCESS FLOW DIAGRAM

Figure 1. Process Flow Diagram
Enviva Pellets Waycross, LLC – Ware County, GA



APPENDIX C
POTENTIAL EMISSIONS CALCULATIONS

Table 1
Calculation Inputs
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Operational Data	
Facility-wide	
Production (ODT/yr)	920,000
Moisture Content of Finished Pellets	5.5%
Softwood Composition	95%
Dryers (Per Dryer)	
Number of Dryers	2
Short-Term Throughput (ODT/hr)	53
Annual Throughput (ODT/yr)	390,000
Hourly Heat Input Capacity (MMBtu/hr)	193
Annual Heat Input Capacity (MMBtu/yr)	1,690,680
Hours of Operation (hr/yr)	8,760
Dry Hammermills, Pellet Mills, and Pellet Coolers	
Short-Term Throughput (ODT/hr)	135
Annual Throughput (ODT/yr)	920,000
Hours of Operation (Hr/yr)	8,760
Softwood Composition	95%

Table 2
Summary of Facility-wide Criteria Pollutant and CO_2e Potential Emissions
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

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)
GWP1-GWP5	Green Wood Storage Piles	--	Partial Enclosure[1]	--	--	6.09E-04	3.04E-04	4.56E-05	--	2.29	--
BFP1 and BFP2	Bark Storage Piles	--	Partial Enclosure[2]	--	--	1.74E-04	8.72E-05	1.31E-05	--	0.54	--
DSP1 and DSP2	Dry Shavings Storage Piles	--	Partial Enclosure	--	--	1.20E-04	5.99E-05	8.98E-06	--	0.43	--
LD01	Log Debarking	--	--	--	--	11.7	0.32	0.054	--	--	--
MH01	Bark Unloading/Truck Dump	--	Partial Enclosure	--	--	0.013	0.0061	9.17E-04	--	--	--
MH02	Screens/Hogs Transfer (Debarking)	--	Partial Enclosure	--	--	0.0090	0.0042	6.42E-04	--	--	--
MH03	Screens/Hogs Transfer (Chipping)	--	Partial Enclosure	--	--	0.0061	0.0029	4.36E-04	--	--	--
TD	Dry Shavings Truck Dumper and Associated Transfer Points	--	Partial Enclosure	--	--	0.17	0.078	0.012	--	--	--
BH01	Bark Hog	--	--	--	--	9.66	5.31	--	--	1.33	--
BS01	Bark Disc Screener	--	--	--	--	0.0090	0.0042	0.00064	--	--	--
BSS1	Bark Sand Shaker	--	--	--	--	0.018	0.0085	0.0013	--	--	--
BSS2	Sand Storage Pile	--	--	--	--	0.13	0.066	0.0099	--	--	--
BSS3-BSS5	Bark/Sand Transfers	--		--	--	0.019	0.0092	0.0014	--	--	--
LC02	Chipper	--	--	--	--	--	--	--	--	2.30	--
LC01	Wood Chip Screen	CYC1	Cyclone	--	--	12.3	12.3	12.3	--	--	--
LC03	Two (2) Rechippers	--	--	--	--	--	--	--	--	0.46	--
GCS1	Green Chip Storage Silo 1	--	--	--	--	0.0025	0.0012	1.76E-04	--	0.36	--
GCS2	Green Chip Storage Silo 2	--	--	--	--	0.0025	0.0012	1.76E-04	--	0.36	--
DRY1, HES1	Dryer Line No. 1	WE01, RTO1	WESP; RTO	49.8	73.8	26.7	26.7	26.7	21.1	51.3	152,100
	Dryer Line No. 1 Bypass	--	--	1.93	0.71	1.86	1.67	1.44	0.081	0.055	676
DRY2, HES2	Dryer Line No. 2	WE02, RTO2	WESP; RTO	49.8	73.8	26.7	26.7	26.7	21.1	51.3	152,100
	Dryer Line No. 2 Bypass	--	--	1.93	0.71	1.86	1.67	1.44	0.081	0.055	676
DCS, CE01, HML	Dry Chip Storage Silo, Conveying Aspiration System No. 1, Dry Hammermills 1 through 10	DCS1; CBH1; HBH1-HBH10; RCO1	Baghouses; RCO	8.13	9.68	72.0	72.0	72.0	0.041	77.4	8,206
PA01	Pelletizing Area Vacuum System	PAB1	Baghouse	--	--	0.72	0.72	0.72	--	--	--
FS, CE02, PML, and PCL	Fiber Storage Silo, Conveying Equipment Aspiration System No. 2, Pellet Mill, and Pellet Cooler Lines 1 through 5	CBH2; PBH1-PBH5; RCO2	Baghouses; RCO	10.4	12.4	66.6	66.6	66.6	0.062	57.6	12,309
RL1-3	Railcar Loadout System	RCF1 through RCF3	Compact Filters	--	--	0.64	0.64	0.64	--	--	--
EG01	500 kW Emergency Generator - Dryers	--	--	0.96	1.11	0.055	0.055	0.055	0.0018	0.12	192
EG02	250 kW Emergency Generator - Pelletizing	--	--	0.48	0.55	0.028	0.028	0.028	9.12E-04	0.21	96.0
FP01	175 HP Diesel Fire Water Pump	--	--	4.39	5.07	0.25	0.25	0.25	0.0083	1.92	878
ST1 and ST2	Diesel Storage Tanks	--	--	--	--	--	--	--	--	0.0026	--
ROADS	Haul Road Emissions	--	--	--	--	52.9	10.6	2.60	--	--	--
			Total Emissions:	**128**	**178**	**284**	**226**	**211**	**42.5**	**248**	**327,233**
			Total Excluding Fugitives[3]:	**128**	**178**	**231**	**215**	**209**	**42.5**	**245**	**327,233**

Notes:

1. GWP5 is within the "A-Frame" building; therefore, the pile is enclosed and a conservative control efficiency was applied. GWP1 through GWP4 are not within any enclosure and are uncontrolled.
2. BFP2 is within the "A-Frame" building; therefore, the pile is enclosed and a conservative control efficiency was applied. BFP1 is not within any enclosure and is uncontrolled.
3. Fugitive emissions are not included in comparison against the major source threshold because the facility is not on the list of 28 source categories in 40 CFR 52.21.

Abbreviations:

CO - carbon monoxide
CO_2e - carbon dioxide equivalent
HP - horsepower
kW - kilowatt
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
RCO - regenerative catalytic oxidizer
RTO - regenerative thermal oxidizer
SO_2 - sulfur dioxide
tpy - tons per year
VOC - volatile organic compounds
WESP - wet electrostatic precipitator

Table 3
Summary of Facility-wide HAP Potential Emissions
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Pollutant	CAS Number	HAP	GA TAP	Bark Hog (tpy)	Log Chipper (tpy)	Rechippers (tpy)	RTO1 Outlet (tpy)	Furnace 1 Bypass (tpy)	RTO2 Outlet (tpy)	Furnace 2 Bypass (tpy)	RCO1 Outlet (tpy)	RCO2 Outlet (tpy)	Emergency Generator 1 (tpy)	Emergency Generator 2 (tpy)	Fire Pump Engine (tpy)	Total (tpy)
Acetaldehyde	75070	Y	Y	--	--	--	5.56	2.7E-03	5.56	2.68E-03	0.39	1.34	2.96E-05	4.50E-04	4.12E-03	12.9
Acetophenone	98862	Y	Y	--	--	--	1.4E-07	1.0E-08	1.4E-07	1.03E-08	--	--	--	--	--	2.91E-07
Acrolein	107028	Y	Y	--	--	--	1.35	0.013	1.35	0.013	0.27	1.77	9.25E-06	5.43E-05	4.96E-04	4.76
Antimony & Compounds	7440360	Y	Y	--	--	--	3.3E-04	2.5E-05	3.3E-04	2.55E-05	--	--	--	--	--	7.19E-04
Arsenic & Compounds	7440382	Y	Y	--	--	--	9.6E-04	7.1E-05	9.6E-04	7.09E-05	1.37E-05	2.06E-05	--	--	--	2.09E-03
Benzo(a)pyrene	50328	Y	N	--	--	--	1.1E-04	8.4E-06	1.1E-04	8.38E-06	8.24E-08	1.24E-07	--	1.10E-07	1.01E-06	2.38E-04
Benzene	71432	Y	Y	--	--	--	0.18	0.014	0.18	0.014	1.44E-04	2.16E-04	9.11E-04	5.47E-04	5.01E-03	0.39
Beryllium	7440417	Y	Y	--	--	--	4.8E-05	3.5E-06	4.8E-05	3.55E-06	8.24E-07	1.24E-06	--	--	--	1.05E-04
Butadiene, 1,3-	106990	Y	Y	--	--	--	--	--	--	--	--	--	--	2.29E-05	2.10E-04	2.33E-04
Cadmium	7440439	Y	Y	--	--	--	3.2E-04	1.3E-05	3.2E-04	1.32E-05	7.56E-05	1.13E-04	--	--	--	8.64E-04
Carbon tetrachloride	56235	Y	Y	--	--	--	1.9E-03	1.5E-04	1.9E-03	1.45E-04	--	--	--	--	--	4.09E-03
Chlorine	7782505	Y	Y	--	--	--	0.67	2.5E-03	0.67	2.55E-03	--	--	--	--	--	1.34
Chlorobenzene	108907	Y	Y	--	--	--	1.4E-03	1.1E-04	1.4E-03	1.06E-04	--	--	--	--	--	3.00E-03
Chloroform	67663	Y	Y	--	--	--	1.2E-03	9.0E-05	1.2E-03	9.03E-05	--	--	--	--	--	2.55E-03
Chromium VI	18540299	-[3]	Y	--	--	--	3.4E-04	1.1E-05	3.4E-04	1.13E-05	9.62E-05	1.44E-04	--	--	--	9.44E-04
Chromium–Other compds	7440473	Y	Y	--	--	--	7.4E-04	5.6E-05	7.4E-04	5.64E-05	--	--	--	--	--	1.59E-03
Cobalt Compounds	7440484	Y	Y	--	--	--	2.9E-04	2.1E-05	2.9E-04	2.10E-05	5.77E-06	8.66E-06	--	--	--	6.29E-04
Dichlorobenzene	25321226	Y	N	--	--	--	1.6E-04	--	1.6E-04	--	8.24E-05	1.24E-04	--	--	--	5.36E-04
Dichloroethane, 1,2-	107062	Y	Y	--	--	--	1.2E-03	9.3E-05	1.2E-03	9.35E-05	--	--	--	--	--	2.64E-03
Dichloropropane, 1,2-	78875	Y	Y	--	--	--	1.4E-03	1.1E-04	1.4E-03	1.06E-04	--	--	--	--	--	3.00E-03
Dinitrophenol, 2,4-	51285	Y	N	--	--	--	7.6E-06	5.8E-07	7.6E-06	5.80E-07	--	--	--	--	--	1.64E-05
Di(2-ethylhexyl)phthalate	117817	Y	Y	--	--	--	2.0E-06	1.5E-07	2.0E-06	1.52E-07	--	--	--	--	--	4.28E-06
Ethyl benzene	100414	Y	Y	--	--	--	1.3E-03	1.0E-04	1.3E-03	9.99E-05	--	--	--	--	--	2.82E-03
Formaldehyde	50000	Y	Y	--	--	--	3.30	0.014	3.30	0.014	0.66	1.44	9.26E-05	6.92E-04	6.33E-03	8.74
Hexane	110543	Y	Y	--	--	--	0.25	--	0.25	--	0.12	0.19	--	--	--	0.80
Hydrochloric acid	7647010	Y	Y	--	--	--	1.61	0.061	1.61	0.061	--	--	--	--	--	3.33
Lead and Lead Compounds	7439921	Y	Y	--	--	--	2.1E-03	1.5E-04	2.1E-03	1.55E-04	3.44E-05	5.15E-05	--	--	--	4.59E-03
Manganese & Compounds	7439965	Y	Y	--	--	--	0.068	5.2E-03	0.07	5.16E-03	2.61E-05	3.92E-05	--	--	--	1.46E-01
Mercury	7439976	Y	Y	--	--	--	1.8E-04	1.1E-05	1.8E-04	1.13E-05	1.79E-05	2.68E-05	--	--	--	4.35E-04
Methanol	67561	Y	Y	0.27	0.46	0.09	2.0E+01	--	2.0E+01	--	1.38	1.71	--	--	--	44.6
Methyl bromide	74839	Y	Y	--	--	--	6.3E-04	4.8E-05	6.3E-04	4.84E-05	--	--	--	--	--	1.36E-03
Methyl chloride	74873	Y	Y	--	--	--	9.7E-04	7.4E-05	9.7E-04	7.41E-05	--	--	--	--	--	2.09E-03
Methylene chloride	75092	Y	Y	--	--	--	0.012	9.3E-04	0.012	9.35E-04	--	--	--	--	--	0.026
Naphthalene	91203	Y	Y	--	--	--	4.2E-03	3.1E-04	4.2E-03	3.13E-04	4.36E-05	6.53E-05	1.53E-04	4.98E-05	4.55E-04	9.76E-03
Nickel	7440020	Y	Y	--	--	--	1.7E-03	1.1E-04	1.7E-03	1.06E-04	1.44E-04	2.16E-04	--	--	--	3.94E-03
Nitrophenol, 4-	100027	Y	N	--	--	--	4.6E-06	3.5E-07	4.6E-06	3.55E-07	--	--	--	--	--	1.00E-05
Pentachlorophenol	87865	Y	Y	--	--	--	2.2E-06	1.6E-07	2.2E-06	1.64E-07	--	--	--	--	--	4.64E-06
Perchloroethylene	127184	Y	Y	--	--	--	1.6E-03	1.2E-04	1.6E-03	1.23E-04	--	--	--	--	--	3.46E-03
Phenol	108952	Y	Y	--	--	--	0.047	1.6E-04	0.047	1.64E-04	0.14	0.50	--	--	--	0.73
Phosphorus Metal, Yellow or White	7723140	Y	Y	--	--	--	1.1E-03	8.7E-05	1.1E-03	8.70E-05	--	--	--	--	--	2.46E-03
Polychlorinated Biphenyls	1336363	Y	N	--	--	--	3.4E-07	2.6E-08	3.4E-07	2.63E-08	--	--	--	--	--	7.41E-07
Polycyclic Organic Matter	--	Y	N	--	--	--	5.4E-03	4.0E-04	5.4E-03	4.03E-04	4.96E-05	7.44E-05	2.49E-04	9.86E-05	9.01E-04	0.013
Propionaldehyde	123386	Y	Y	--	--	--	0.37	2.0E-04	0.37	1.97E-04	0.14	0.24	--	--	--	1.11
Selenium Compounds	7782492	Y	Y	--	--	--	1.2E-04	9.0E-06	1.2E-04	9.03E-06	1.65E-06	2.47E-06	--	--	--	2.65E-04
Styrene	100425	Y	Y	--	--	--	0.080	6.1E-03	0.080	6.13E-03	--	--	--	--	--	0.17
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	1746016	Y	Y	--	--	--	3.6E-10	2.8E-11	3.6E-10	2.77E-11	--	--	--	--	--	7.82E-10
Toluene	108883	Y	Y	--	--	--	0.039	3.0E-03	0.039	2.97E-03	2.34E-04	3.50E-04	3.30E-04	2.40E-04	2.19E-03	0.088
Trichloroethane, 1,1,1-	71556	Y	Y	--	--	--	1.3E-03	1.0E-04	1.3E-03	9.99E-05	--	--	--	--	--	2.82E-03
Trichloroethylene	79016	Y	Y	--	--	--	1.3E-03	9.7E-05	1.3E-03	9.67E-05	--	--	--	--	--	2.73E-03
Trichlorophenol, 2,4,6-	88062	Y	Y	--	--	--	9.3E-07	7.1E-08	9.3E-07	7.09E-08	--	--	--	--	--	2.00E-06
Vinyl Chloride	75014	Y	Y	--	--	--	7.6E-04	5.8E-05	7.6E-04	5.80E-05	--	--	--	--	--	1.64E-03
Xylene	1330207	Y	Y	--	--	--	1.1E-03	8.1E-05	1.1E-03	8.06E-05	--	--	2.26E-04	1.67E-04	1.53E-03	4.20E-03
Total HAP Emissions (tpy)	**--**	**--**	**--**	**0.27**	**0.46**	**0.092**	**33.9**	**0.12**	**33.9**	**0.12**	**3.11**	**7.18**	**0.0018**	**0.0023**	**0.021**	**79.2**
Maximum Individual HAP	**--**	**--**	**--**	**Methanol**	**Methanol**	**Methanol**	**Methanol**	**Hydrochloric acid**	**Methanol**	**Hydrochloric acid**	**Methanol**	**Acrolein**	**Benzene**	**Formaldehyde**	**Formaldehyde**	**Methanol**
Maximum Individual HAP Emissions (tpy)	**--**	**--**	**--**	**0.27**	**0.46**	**0.092**	**20.4**	**0.061**	**20.4**	**0.061**	**1.38**	**1.77**	**9.11E-04**	**6.92E-04**	**0.0063**	**44.6**

Notes:

1. Because benzo(a)pyrene and naphthalene emissions were presented individually and as components of total POM 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.

Table 4
Potential Emissions from Raw Material Handling
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Emission Unit ID	Transfer Activity	Control Efficiency[1]	Material Moisture Content[2]	PM Emission Factor[3]	PM_{10} Emission Factor[3]	$PM_{2.5}$ Emission Factor[3]	Potential Throughput[4]		Potential PM Emissions		Potential PM_{10} Emissions		Potential $PM_{2.5}$ Emissions	
		(%)	(%)	(lb/ton)	(lb/ton)	(lb/ton)	(tph)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
MH01	Bark Unloading/Truck Dump	0%	45%	2.92E-05	1.38E-05	2.09E-06	100	876,000	2.92E-03	1.28E-02	1.38E-03	6.06E-03	2.09E-04	9.17E-04
MH02	Screens/Hogs Transfer (Debarking)	50%	45%	2.92E-05	1.38E-05	2.09E-06	140	1,226,400	2.05E-03	8.96E-03	9.68E-04	4.24E-03	1.47E-04	6.42E-04
MH03	Screens/Hogs Transfer (Chipping)	50%	50%	2.52E-05	1.19E-05	1.81E-06	110	965,624	1.39E-03	6.09E-03	6.58E-04	2.88E-03	9.96E-05	4.36E-04
BSS3	Bark to Sand Shaker via Conveyor	0%	45%	2.92E-05	1.38E-05	2.09E-06	140	1,226,400	4.09E-03	1.79E-02	1.94E-03	8.48E-03	2.93E-04	1.28E-03
BSS4	Sand from Fuel Sand Shaker to Conveyor	0%	45%	2.92E-05	1.38E-05	2.09E-06	5.6	49,056	1.64E-04	7.17E-04	7.74E-05	3.39E-04	1.17E-05	5.14E-05
BSS5	Sand to Pile via Conveyor	0%	45%	2.92E-05	1.38E-05	2.09E-06	5.6	49,056	1.64E-04	7.17E-04	7.74E-05	3.39E-04	1.17E-05	5.14E-05
								Total Emissions:	**1.08E-02**	**4.72E-02**	**5.10E-03**	**2.23E-02**	**7.72E-04**	**3.38E-03**

Notes:

1. A control efficiency of 50% was applied for enclosed sources.
2. Approximate moisture content for green chips and bark.
3. Emission factor calculation based on formula from AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, Equation 13.2.1, (11/06).

where: E = emission factor (lb/ton)

k = particle size multiplier (dimensionless) for PM	0.74	
k = particle size multiplier (dimensionless) for PM_{10}	0.35	
k = particle size multiplier (dimensionless) for $PM_{2.5}$	0.053	
U = mean wind speed (mph)	4.87	Based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website.

4. Annual throughputs assume continuous operation at maximum hourly rate (8,760 hr/yr).

Abbreviations:

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

Reference:

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

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Table 5
Potential Emissions from the Dry Shavings Truck Dumper and Material Transfer
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Emission Unit ID	Transfer Activity	Control Efficiency[1]	Material Moisture Content[2]	PM Emission Factor[3]	PM_{10} Emission Factor[3]	$PM_{2.5}$ Emission Factor[3]	Potential Throughput[4]		Potential PM Emissions		Potential PM_{10} Emissions		Potential $PM_{2.5}$ Emissions	
		(%)	(%)	(lb/ton)	(lb/ton)	(lb/ton)	(tph)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
TD	Truck Dumper	0%	8%	3.28E-04	1.55E-04	2.35E-05	120	224,688	3.94E-02	3.69E-02	1.86E-02	1.74E-02	2.82E-03	2.64E-03
	Truck Dumper/Hopper Transfer	50%	8%	3.28E-04	1.55E-04	2.35E-05	120	224,688	1.97E-02	1.84E-02	9.31E-03	8.72E-03	1.41E-03	1.32E-03
	Hopper/Drag Chain Transfer	50%	8%	3.28E-04	1.55E-04	2.35E-05	120	224,688	1.97E-02	1.84E-02	9.31E-03	8.72E-03	1.41E-03	1.32E-03
	Drag Chain/Dry Shavings Disc Screener Transfer	50%	8%	3.28E-04	1.55E-04	2.35E-05	120	224,688	1.97E-02	1.84E-02	9.31E-03	8.72E-03	1.41E-03	1.32E-03
	Dry Shavings Disc Screener/Belt Conveyor Transfer	50%	8%	3.28E-04	1.55E-04	2.35E-05	120	224,688	1.97E-02	1.84E-02	9.31E-03	8.72E-03	1.41E-03	1.32E-03
	Belt Conveyor/Dome Storage Transfer	0%	8%	3.28E-04	1.55E-04	2.35E-05	120	224,688	3.94E-02	3.69E-02	1.86E-02	1.74E-02	2.82E-03	2.64E-03
	Belt Conveyor/Dry Chip Silo Transfer	50%	8%	3.28E-04	1.55E-04	2.35E-05	120	224,688	1.97E-02	1.84E-02	9.31E-03	8.72E-03	1.41E-03	1.32E-03
								Total Emissions:	**0.18**	**0.17**	**0.084**	**0.078**	**0.013**	**0.012**

Notes:
1. A control efficiency of 50% was applied for enclosed sources.
2. Approximate moisture content for dry shavings.
3. Emission factor calculation based on formula from AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, Equation 13.2.1, (11/06).
where: E = emission factor (lb/ton)
k = particle size multiplier (dimensionless) for PM 0.74
k = particle size multiplier (dimensionless) for PM_{10} 0.35
k = particle size multiplier (dimensionless) for $PM_{2.5}$ 0.053
U = mean wind speed (mph) 4.87 Based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website.
4. Hourly throughput represents maximum design capacity as specified by the equipment manufacturer. Annual throughput estimated based on engineering judgement.

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

Reference:
EPA. AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, (11/06).

Table 6
Storage Pile Wind Erosion
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Source	Description	PM Emission Factor[1]		VOC Emission Factor[2]		Pile Length	Pile Width	Pile Height	Control Efficiency[3]	Exposed Surface Area of Pile[4]	Potential PM Emissions		Potential PM_{10} Emissions		Potential $PM_{2.5}$ Emissions		Potential VOC Emissions as propane[5]	
		(lb/day/acre)	($lb/hr/ft^2$)	(lb/day/acre)	($lb/hr/ft^2$)	(ft)	(ft)	(ft)	(%)	(ft^2)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
GWP1	Green Wood Storage Pile 1	1.95E-03	1.87E-09	3.60	3.44E-06	180	90	18	--	16,984	3.17E-05	1.39E-04	1.58E-05	6.94E-05	2.38E-06	1.04E-05	7.14E-02	3.13E-01
GWP2	Green Wood Storage Pile 2	1.95E-03	1.87E-09	3.60	3.44E-06	197	49	18	--	10,896	2.03E-05	8.90E-05	1.02E-05	4.45E-05	1.52E-06	6.68E-06	4.58E-02	2.00E-01
GWP3	Green Wood Storage Pile 3	1.95E-03	1.87E-09	3.60	3.44E-06	223	46	18	--	11,708	2.18E-05	9.57E-05	1.09E-05	4.78E-05	1.64E-06	7.17E-06	4.92E-02	2.15E-01
GWP4	Green Wood Storage Pile 4	1.95E-03	1.87E-09	3.60	3.44E-06	268	63	18	--	18,241	3.40E-05	1.49E-04	1.70E-05	7.45E-05	2.55E-06	1.12E-05	7.66E-02	3.36E-01
GWP5	Green Wood Storage Pile 5	1.95E-03	1.87E-09	3.60	3.44E-06	416	135	60	75%	66,638	3.11E-05	1.36E-04	1.55E-05	6.80E-05	2.33E-06	1.02E-05	2.80E-01	1.23E+00
BFP1	Bark/Fuel Storage Pile 1	1.95E-03	1.87E-09	3.60	3.44E-06	232	77	16	--	18,689	3.49E-05	1.53E-04	1.74E-05	7.63E-05	2.61E-06	1.15E-05	7.85E-02	3.44E-01
BFP2	Bark/Fuel Storage Pile 2	1.95E-03	1.87E-09	3.60	3.44E-06	107	69	43	75%	10,603	4.94E-06	2.17E-05	2.47E-06	1.08E-05	3.71E-07	1.62E-06	4.45E-02	1.95E-01
DSP1	Dry Shavings Storage 1	1.95E-03	1.87E-09	3.60	3.44E-06	163	66	19	75%	11,730	5.47E-06	2.40E-05	2.73E-06	1.20E-05	4.10E-07	1.80E-06	4.93E-02	2.16E-01
DSP2	Dry Shavings Storage 2	1.95E-03	1.87E-09	3.60	3.44E-06	163	66	19	--	11,730	2.19E-05	9.58E-05	1.09E-05	4.79E-05	1.64E-06	7.19E-06	4.93E-02	2.16E-01
BSS2	Sand Storage Pile	0.54	5.16E-07	--	--	363	159	18	--	58,589	3.02E-02	1.32E-01	1.51E-02	6.62E-02	2.27E-03	9.93E-03	--	--
										Total Emissions:	**0.030**	**0.13**	**0.015**	**0.067**	**0.0023**	**0.010**	**0.74**	**3.26**

Notes:

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

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

where:			
	s, silt content of wood chips (%):	0.0094	s - silt content (%) for bark based on NCASI Special Report 15-01 with appropriate contingency based on engineering judgement.
	s, silt content of sand (%):	2.6	s - silt content (%) for sand based on Table 13.2.4-1 of AP-42 Section 13.2.4-2
	p, number of days with rainfall greater than 0.01 inch:	115	Based on AP-42, Section 13.2.2 - Unpaved Roads, 11/06, Figure 13.2.1-2.
	f (time that wind exceeds 5.36 m/s - 12 mph) (%):	2.6	Based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website.
	PM_{10}/TSP ratio:	50%	PM_{10} is assumed to equal 50% of TSP based on U.S. EPA Control of Open Fugitive Dust Sources, Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988.
	$PM_{2.5}$/TSP ratio:	7.5%	$PM_{2.5}$ is assumed to equal 7.5 % of TSP U.S. EPA Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors. November 2006.

2. VOC emission factor obtained from NCASI Technical Bulletin 700. Emission factors ranged from 1.6 to 3.6 lb C/acre-day. The maximum emission factor has conservatively been selected.
3. A PM and PM_{10} control efficiency of 75% was applied to storage piles within three-sided buildings. Control efficiency for three-sided enclosures obtained from the WRAP Fugitive Dust Handbook (09/06).
4. Exposed surface area of the rectangular storage piles is conservatively calculated as the surface area of a rectangular pyramid minus the base area: $A= l*\sqrt{[(w/2)^2+h^2]}+w*\sqrt{[(l/2)^2+H^2]}$
5. Emissions converted from as carbon to as propane by multiplying by 1.22 (ratio of molecular weight of propane to molecular weight of carbon in propane).

Abbreviations:

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

References:

AP-42, Section 13.2.2 - Unpaved Roads, 11/06.
U.S. EPA Control of Open Fugitive Dust Sources, Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988.
U.S. EPA Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors. November 2006.
Countess Environmental. Western Regional Air Partnership (WRAP) Fugitive Dust Handbook. September 2006.

Table 7
Potential Emissions from Log Debarking
LD01
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis

Hourly Throughput[1]	375 ton/hr
Annual Throughput[1]	1,998,621 ton/yr

Potential Criteria Pollutant Emissions

Emission Unit ID	Pollutant	Emission Factor (lb/ton)	Potential Emissions	
			(lb/hr)	(tpy)
LD01	TSP[2]	1.17E-02	4.40	11.7
	PM_{10}[2]	3.17E-04	0.12	0.32
	$PM_{2.5}$[2]	5.40E-05	0.020	0.054

Notes:
1. Hourly throughput represents maximum design capacity as specified by the equipment manufacturer. Annual throughput assumes all pellets could be produced using logs.
2. Emission factor for $PM_{2.5}$ from draft November 2019 NCASI Whitepaper based on measurements at a mill debarker, where logs are processed dry (i.e., without water spray) and engineering judgement. Emission factor for PM was back-calculated based on the $PM_{2.5}$ factor and the $PM_{2.5}$ fraction for fresh bark provided in the Whitepaper. Emission factor for PM_{10} was calculated based on the calculated PM factor and the PM_{10} fraction for fresh bark.

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

Reference:
NCASI Whitepaper. $PM_{2.5}$ from Wood Processing. Draft. November 26, 2019.

Table 8
Log Chipping Potential Emissions
LC02
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis

Hourly Throughput[1]	320	ton/hr, wet
	160	ODT/hr
Annual Throughput[1]	920,000	ODT/yr

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor		Potential Emissions	
			(lb/hr)	(tpy)
VOC as propane[2]	5.00E-03	lb/ODT	0.80	2.30
Methanol[2]	1.00E-03	lb/ODT	0.16	0.46

Notes:

1. Hourly throughput represents maximum design capacity as specified by the equipment manufacturer. Annual throughput conservatively assumes all pellets will be produced from purchased logs.
2. Emission factor obtained from available emissions factors for chippers in AP-42 Section 10.6.3, Medium Density Fiberboard, 08/02, Table 7 and Section 10.6.4, Hardboard and Fiberboard, 10/02, Tables 7 and 9. Emission factors for VOC and methanol are the same across all three tables.

Abbreviations:

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

References:

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

Table 9
Wood Chip Screen Potential Emissions
LC01
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential Criteria Pollutant Emissions

Emission Unit ID	Source Description	Control Device ID	Control Device Description	Exhaust Flow Rate[1]	Exit Grain Loading	Particulate Speciation[2]		Potential Emissions					
								PM		PM_{10}		$PM_{2.5}$	
				(dscfm)	PM (gr/cf)	PM_{10} (% of PM)	$PM_{2.5}$ (% of PM)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
LC01	Wood Chip Screen	CYC1	Cyclone	15,000	0.022	100%	100%	2.81	12.3	2.81	12.3	2.81	12.3

Notes:
1. Exhaust flow rate provided by the control device vendor.
2. No speciation data are available. Therefore, all PM is assumed to be $PM_{2.5}$.

Abbreviations:
cf - cubic feet
dscfm - dry standard cubic feet per minute
gr - grain
hr - hour
lb - pound
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
tpy - tons per year

Table 10
Potential Emissions from Bark Hog
BH01
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis

Hourly Throughput	110 ton/hr, wet
	61 ODT/hr
Annual Throughput	531,093 ODT/yr
	965,624 ton/yr, wet
Approx. Moisture Content	45% of total weight

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor	Potential Emissions	
		(lb/hr)	(tpy)
VOC as propane[1]	5.00E-03 lb/ODT	0.30	1.33
Methanol[1]	1.00E-03 lb/ODT	0.06	0.27
PM[2]	2.00E-02 lb/ton	2.20	9.66
PM_{10}[2]	1.10E-02 lb/ton	1.21	5.31

Notes:

1. Emission factor for log chipper from AP-42 Section 10.6.3, Medium Density Fiberboard, 08/02, Table 10.6.3-7 and Section 10.6.4, Hardboard and Fiberboard, 10/02, Table 10.3.4-9.
2. Particulate matter emission factors from the USEPA document titled *AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants. Source Classification Code 3-07-008-01 (Log Debarking)*. All PM is assumed to be larger than 2.5 microns.

Abbreviations:

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

Reference:

EPA. AP-42, Section 10.6.3 - Medium Density Fiberboard, (08/02).
EPA. AP-42, Section 10.6.4 - Hardboard and Fiberboard, (10/02).
EPA. 1990. AIRS Facility Subsystem Source Classification Codes and Emission Factor Listing for Criteria Air Pollutants. Source Classification Code 3-07-008-01 (Log Debarking).

Table 11

Potential Emissions from Bark Screening and Bark Sand Shaker

BS01 and BSS1

Enviva Pellets Waycross, LLC

Waycross, Ware County, Georgia

Potential Criteria Pollutant Emissions

Emission Unit ID	Source Description	Material Moisture Content[1]	PM Emission Factor[2]	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[2]	Control Efficiency[3]	Hourly Throughput	Annual Throughput	Potential PM Emissions		Potential PM_{10} Emissions		Potential $PM_{2.5}$ Emissions	
		(%)	(lb/ton)	(lb/ton)	(lb/ton)		(ton/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
BS01	Bark Disc Screener	45%	2.92E-05	1.38E-05	2.09E-06	50%	140	1,226,400	2.05E-03	8.96E-03	9.68E-04	4.24E-03	1.47E-04	6.42E-04
BSS1	Bark Sand Shaker	45%	2.92E-05	1.38E-05	2.09E-06	0%	140	1,226,400	4.09E-03	1.79E-02	1.94E-03	8.48E-03	2.93E-04	1.28E-03

Notes:

1. Approximate moisture content of bark.
2. Emission factor calculation based on formula from AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, Equation 13.2.1, (11/06).

$$E = k(0.0032)x\ \frac{(\frac{U}{5})^{1.3}}{(\frac{M}{2})^{1.4}}$$

where:
E = emission factor (lb/ton)
k = particle size multiplier (dimensionless) for PM 0.74
k = particle size multiplier (dimensionless) for PM_{10} 0.35
k = particle size multiplier (dimensionless) for $PM_{2.5}$ 0.053
U = mean wind speed (mph) 4.87 Based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website.
M = material moisture content (%)

3. A 50% control efficiency was applied to emissions from the bark disc screener for enclosure.

Abbreviations:

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

References:

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

Table 12
Rechipping Potential Emissions
LC03
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis

Hourly Throughput[1]	64 ton/hr, wet
	32 ODT/hr
Annual Throughput[1]	184,000 ODT/yr

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor	Potential Emissions (lb/hr)	Potential Emissions (tpy)
VOC as propane[2]	5.00E-03 lb/ODT	0.16	0.46
Methanol[2]	1.00E-03 lb/ODT	0.032	0.092

Notes:

1. Annual and hourly throughput conservatively assumes that 20% of chips that pass through the chipper are processed by the rechipper.
2. Emission factor obtained from available emissions factors for chippers in AP-42 Section 10.6.3, Medium Density Fiberboard, 08/02, Table 7 and Section 10.6.4, Hardboard and Fiberboard, 10/02, Tables 7 and 9. Emission factors for VOC and Methanol are the same across all three tables.

Abbreviations:

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

References:

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

Table 13
Green Chip Silos Potential Emissions
GCS1 and GCS2
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis - Per Silo

Hourly Throughput[1]	130 ton/hr, wet
	65 ODT/hr
Annual Throughput[1]	780,000 tpy, wet

Potential VOC Emissions Per Silo

Pollutant	Potential Emissions	
	(lb/hr)	(tpy)
VOC as propane[2]	0.16	0.71

Notes:
1. Maximum hourly throughput calculated based on maximum silo capacity and material packing density. Annual throughput for each silo assumed equal to the throughput for a single dryer line.
2. Emissions based on laboratory studies (He et. al 2012) for wood chips stored at 30°C (95°F)

Emission Unit ID	Control Efficiency[1]	Material Moisture Content	PM Emission Factor[2]	PM_{10} Emission Factor[2]	$PM_{2.5}$ Emission Factor[2]	Potential Throughput		Potential PM Emissions		Potential PM_{10} Emissions		Potential $PM_{2.5}$ Emissions	
	(%)	(%)	(lb/ton)	(lb/ton)	(lb/ton)	(tph)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
GCS1	75%	50%	2.52E-05	1.19E-05	1.81E-06	130	780,000	8.20E-04	2.46E-03	3.88E-04	1.16E-03	5.87E-05	1.76E-04
GCS2	75%	50%	2.52E-05	1.19E-05	1.81E-06	130	780,000	8.20E-04	2.46E-03	3.88E-04	1.16E-03	5.87E-05	1.76E-04

Notes:
1. A control efficiency of 75% was applied for enclosure. This is based on the control efficiency for three-sided enclosures obtained from the WRAP Fugitive Dust Handbook (09/06).
2. Emission factor calculation based on formula from AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, Equation 13.2.1, (11/06).

where:

E = emission factor (lb/ton)		
k = particle size multiplier (dimensionless) for PM	0.74	
k = particle size multiplier (dimensionless) for PM_{10}	0.35	
k = particle size multiplier (dimensionless) for $PM_{2.5}$	0.053	
U = mean wind speed (mph)	4.87	Based on AERMOD-ready meteorological data for 2014, 2016-2019 for Valdosta, GA obtained from EPD's website.

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

References:

AP-42, Section 13.2.4 - Aggregate Handling and Storage Piles, (11/06)
He, X., Lau, A. K., Sokhansanj, S., Lim, C. J., Bi, X. T., & Melin, S. (2012). Dry matter losses in combination with gaseous emissions during the storage of forest residues. Fuel, 95, 662-664.

Table 14a
Potential Emissions at Outlet of Dryer Line 1 RTO Stack
HES1 and DRY1
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis - Dryer Line 1

Hourly Throughput	53 ODT/hr
Annual Throughput	390,000 ODT/yr
Hourly Heat Input Capacity	193 MMBtu/hr
Annual Heat Input Capacity	1,690,680 MMBtu/yr
Hours of Operation	8,760 hr/yr
RTO Burner Heat Input	32.0 MMBtu/hr
RTO Fuel Type	Natural Gas
RTO Control Efficiency	95%
WESP Metal HAP Control Efficiency	95%

Total Potential Emissions - HES1 and DRY1

Pollutant	Potential Emissions[1]	
	(lb/hr)	(tpy)
CO	13.4	49.8
NO_X	19.9	73.8
SO_2	4.83	21.1
VOC	13.8	51.3
Total PM	7.18	26.7
Total PM_{10}	7.18	26.7
Total $PM_{2.5}$	7.18	26.7
CO_2e	40,950	152,100
Total HAP	9.01	33.9
Total TAP	9.01	33.9

Notes:
1. Total emissions from the furnace heat energy system, dryer, and natural gas combustion by the RTO. Detailed calculations are provided below.

Potential Criteria Pollutant and Greenhouse Gas Emissions from Dryer Line 1 and RTO Fuel Combustion

Pollutant	Emission Factor	Units	Potential Emissions	
			(lb/hr)	(tpy)
CO	0.26	lb/ODT[1]	13.4	49.8
NO_X	0.38	lb/ODT[1]	19.9	73.8
SO_2	0.025	lb/MMBtu[2]	4.83	21.1
VOC as Propane	0.26	lb/ODT[1]	13.8	51.3
PM (Filterable + Condensable)	0.14	lb/ODT[1]	7.18	26.7
PM_{10} (Filterable + Condensable)	0.14	lb/ODT[1]	7.18	26.7
$PM_{2.5}$ (Filterable + Condensable)	0.14	lb/ODT[1]	7.18	26.7
CO_2	780	lb/ODT[3]	40,950	152,100

Notes:
1. Emission factor was derived based on process information and an appropriate contingency based on engineering judgement.
2. 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.
3. 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 Waycross uses a combination of hardwood and softwood and the hardwood emission factor is greater than the softwood emission factor.

Table 14a
Potential Emissions at Outlet of Dryer Line 1 RTO Stack
HES1 and DRY1
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP and TAP Emissions from Furnace Heat Energy System/Dryer

Pollutant	Emission Factor	Units	Footnote	Potential Emissions	
				(lb/hr)	(tpy)
Furnace Heat Energy System/Dryer					
Acetaldehyde	2.85E-02	lb/ODT	1	1.50	5.56
Acrolein	6.91E-03	lb/ODT	1	0.36	1.35
Formaldehyde	1.69E-02	lb/ODT	1	0.89	3.30
Methanol	1.04E-01	lb/ODT	1	5.48	20.4
Phenol	2.43E-04	lb/ODT	1	0.013	0.047
Propionaldehyde	1.89E-03	lb/ODT	1	0.099	0.37
Acetophenone	3.20E-09	lb/MMBtu	2,3	3.09E-08	1.35E-07
Antimony & Compounds	7.90E-06	lb/MMBtu	2,4	7.62E-05	3.34E-04
Arsenic & Compounds	2.20E-05	lb/MMBtu	2,4	2.12E-04	9.30E-04
Benzene	4.20E-03	lb/MMBtu	2,3	4.05E-02	1.78E-01
Benzo(a)pyrene	2.60E-06	lb/MMBtu	2,3	2.51E-05	1.10E-04
Beryllium	1.10E-06	lb/MMBtu	2,4	1.06E-05	4.65E-05
Cadmium	4.10E-06	lb/MMBtu	2,4	3.96E-05	1.73E-04
Carbon tetrachloride	4.50E-05	lb/MMBtu	2,3	4.34E-04	1.90E-03
Chlorine	7.90E-04	lb/MMBtu	2	1.52E-01	6.68E-01
Chlorobenzene	3.30E-05	lb/MMBtu	2,3	3.18E-04	1.39E-03
Chloroform	2.80E-05	lb/MMBtu	2,3	2.70E-04	1.18E-03
Chromium VI	3.50E-06	lb/MMBtu	2,4	3.38E-05	1.48E-04
Chromium–Other compds	1.75E-05	lb/MMBtu	2,4	1.69E-04	7.40E-04
Cobalt compounds	6.50E-06	lb/MMBtu	2,4	6.27E-05	2.75E-04
Dichloroethane, 1,2-	2.90E-05	lb/MMBtu	2,3	2.80E-04	1.23E-03
Dichloropropane, 1,2-	3.30E-05	lb/MMBtu	2,3	3.18E-04	1.39E-03
Dinitrophenol, 2,4-	1.80E-07	lb/MMBtu	2,3	1.74E-06	7.61E-06
Di(2-ethylhexyl)phthalate	4.70E-08	lb/MMBtu	2,3	4.54E-07	1.99E-06
Ethyl benzene	3.10E-05	lb/MMBtu	2,3	2.99E-04	1.31E-03
Hydrochloric acid	1.90E-02	lb/MMBtu	2,5	3.67E-01	1.61E+00
Lead and Lead compounds	4.80E-05	lb/MMBtu	2,4	4.63E-04	2.03E-03
Manganese & compounds	1.60E-03	lb/MMBtu	2,4	1.54E-02	6.76E-02
Mercury	3.50E-06	lb/MMBtu	2,4	3.38E-05	1.48E-04
Methyl bromide	1.50E-05	lb/MMBtu	2,3	1.45E-04	6.34E-04
Methyl chloride	2.30E-05	lb/MMBtu	2,3	2.22E-04	9.72E-04
Methylene chloride	2.90E-04	lb/MMBtu	2,3	2.80E-03	1.23E-02
Naphthalene	9.70E-05	lb/MMBtu	2,3	9.36E-04	4.10E-03
Nickel	3.30E-05	lb/MMBtu	2,4	3.18E-04	1.39E-03
Nitrophenol, 4-	1.10E-07	lb/MMBtu	2,3	1.06E-06	4.65E-06
Pentachlorophenol	5.10E-08	lb/MMBtu	2	4.92E-07	2.16E-06
Perchloroethylene	3.80E-05	lb/MMBtu	2	3.67E-04	1.61E-03
Phosphorus Metal, Yellow or White	2.70E-05	lb/MMBtu	2,4	2.61E-04	1.14E-03
Polychlorinated biphenyls	8.15E-09	lb/MMBtu	2,3	7.86E-08	3.44E-07
Polycyclic Organic Matter	1.25E-04	lb/MMBtu	2	1.21E-03	5.28E-03
Selenium compounds	2.80E-06	lb/MMBtu	2,4	2.70E-05	1.18E-04
Styrene	1.90E-03	lb/MMBtu	2,3	1.83E-02	8.03E-02
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.60E-12	lb/MMBtu	2,3	8.30E-11	3.63E-10
Toluene	9.20E-04	lb/MMBtu	2,3	8.88E-03	3.89E-02
Trichloroethane, 1,1,1-	3.10E-05	lb/MMBtu	2	2.99E-04	1.31E-03
Trichloroethylene	3.00E-05	lb/MMBtu	2,3	2.90E-04	1.27E-03
Trichlorophenol, 2,4,6-	2.20E-08	lb/MMBtu	2,3	2.12E-07	9.30E-07
Vinyl chloride	1.80E-05	lb/MMBtu	2,3	1.74E-04	7.61E-04
Xylene	2.50E-05	lb/MMBtu	2,3	2.41E-04	1.06E-03
			Total HAP Emissions:	**8.95**	**33.7**
			Total TAP Emissions:	**8.95**	**33.7**

Table 14a
Potential Emissions at Outlet of Dryer Line 1 RTO Stack
HES1 and DRY1
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP and TAP Emissions - RTO Burners

Pollutant	Emission Factor	Units	Footnote	Potential Emissions	
				(lb/hr)	(tpy)
Natural Gas Combustion					
2-Methylnaphthalene	2.40E-05	lb/MMscf	6	7.53E-07	3.30E-06
3-Methylchloranthrene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
7,12-Dimethylbenz(a)anthracene	1.60E-05	lb/MMscf	6	5.02E-07	2.20E-06
Acenaphthene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Acenaphthylene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Anthracene	2.40E-06	lb/MMscf	6	7.53E-08	3.30E-07
Arsenic & Compounds	2.00E-04	lb/MMscf	6	6.27E-06	2.75E-05
Benz(a)anthracene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Benzene	2.10E-03	lb/MMscf	6	6.59E-05	2.89E-04
Benzo(a)pyrene	1.20E-06	lb/MMscf	6	3.76E-08	1.65E-07
Benzo(b)fluoranthene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Benzo(g,h,i)perylene	1.20E-06	lb/MMscf	6	3.76E-08	1.65E-07
Benzo(k)fluoranthene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Beryllium	1.20E-05	lb/MMscf	6	3.76E-07	1.65E-06
Cadmium	1.10E-03	lb/MMscf	6	3.45E-05	1.51E-04
Chromium VI	1.40E-03	lb/MMscf	6	4.39E-05	1.92E-04
Chrysene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Cobalt Compounds	8.40E-05	lb/MMscf	6	2.64E-06	1.15E-05
Dibenzo(a,h)anthracene	1.20E-06	lb/MMscf	6	3.76E-08	1.65E-07
Dichlorobenzene	1.20E-03	lb/MMscf	6	3.76E-05	1.65E-04
Fluoranthene	3.00E-06	lb/MMscf	6	9.41E-08	4.12E-07
Fluorene	2.80E-06	lb/MMscf	6	8.78E-08	3.85E-07
Hexane	1.8	lb/MMscf	6	5.65E-02	2.47E-01
Indeno(1,2,3-cd)pyrene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Lead and Lead Compounds	5.00E-04	lb/MMscf	6	1.57E-05	6.87E-05
Manganese & Compounds	3.80E-04	lb/MMscf	6	1.19E-05	5.22E-05
Mercury	2.60E-04	lb/MMscf	6	8.16E-06	3.57E-05
Naphthalene	6.10E-04	lb/MMscf	6	1.91E-05	8.38E-05
Nickel	2.10E-03	lb/MMscf	6	6.59E-05	2.89E-04
Phenanthrene	1.70E-05	lb/MMscf	6	5.33E-07	2.34E-06
Pyrene	5.00E-06	lb/MMscf	6	1.57E-07	6.87E-07
Selenium Compounds	2.40E-05	lb/MMscf	6	7.53E-07	3.30E-06
Toluene	3.40E-03	lb/MMscf	6	1.07E-04	4.67E-04
			Total HAP Emissions:	**0.057**	**0.25**
			Total TAP Emissions:	**0.057**	**0.25**

Notes:

1. Emission factors derived based on process information and engineering judgement. Emission factors represent controlled emissions.
2. Emission factors for wood combustion in a stoker boiler from AP-42 Section 1.6 - Wood Residue Combustion in Boilers, 09/03.
3. A 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 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.
5. 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.
6. 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.

Table 14a
Potential Emissions at Outlet of Dryer Line 1 RTO Stack
HES1 and DRY1
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Abbreviations:

CO - carbon monoxide
CO_2 - carbon dioxide
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
NO_X - nitrogen oxides
NCASI - National Council for Air and Stream Improvement, Inc.
RTO - regenerative thermal oxidizer
ODT - oven dried tons
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
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
yr - year

References:

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

Table 14b
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Cold Start-up/Planned Shutdown) [1]
HES1 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis

Hourly Heat Input Capacity	29.0 MMBtu/hr
Annual Heat Input Capacity	1,448 MMBtu/yr
Hours of Operation[1]	50 hr/yr

Potential Criteria Pollutant and GHG Emissions - Furnace Heat Energy System Bypass Cold Start-up/Planned Shutdown[1]

Pollutant	Emission Factor	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	17.4	0.43
NO_X	0.22	lb/MMBtu[2]	6.37	0.16
SO_2	0.025	lb/MMBtu[2]	0.72	0.018
VOC	0.017	lb/MMBtu[2]	0.49	0.012
Total PM	0.58	lb/MMBtu[2]	16.7	0.42
Total PM_{10}	0.52	lb/MMBtu[2]	15.0	0.37
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	12.9	0.32
CO_2	93.8	kg/MMBtu[3]	5,987	150
CH_4	0.0072	kg/MMBtu[3]	0.46	0.011
N_2O	0.0036	kg/MMBtu[3]	0.23	0.0057
CO_2e			6,067	152

Notes:

1. During startup and shutdown (for temperature control) emissions are vented out of the furnace heat energy system bypass stack. Use of each furnace heat energy system bypass stack during cold start-ups and planned shutdowns will not exceed 50 hours per 12-month rolling period for each dryer line. Emissions are vented through the dryer bypass stack briefly as exhaust flow is transitioned from the furnace heat energy system bypass stack to the WESP and RTO. Emissions during these brief transition periods are insignificant and are not separately quantified to avoid double-counting, as these emissions are accounted for in the table above for the furnace heat energy system cold start-up/planned shutdown. Diesel fuel may be used as an accelerant for cold start-up. The amount used per event will be approximately 30 gallons and the annual usage will be approximately 200 gallons; therefore, emissions resulting from diesel combustion are insignificant and were not explicitly quantified.
2. Emission factor obtained from AP-42, Chapter 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. VOC emission factor excludes formaldehyde.
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.

Table 14b
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Cold Start-up/Planned Shutdown) [1]
HES1 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP Emissions - Furnace Heat Energy System Bypass Cold Start-up/Planned Shutdown

Pollutant	Emission Factor[1]	Units	Potential Emissions Hourly (lb/hr)	Potential Emissions Annual (tpy)
Acetaldehyde	8.30E-04	lb/MMBtu	2.40E-02	6.01E-04
Acrolein	4.00E-03	lb/MMBtu	1.16E-01	2.90E-03
Formaldehyde	4.40E-03	lb/MMBtu	1.27E-01	3.18E-03
Phenol	5.10E-05	lb/MMBtu	1.48E-03	3.69E-05
Propionaldehyde	6.10E-05	lb/MMBtu	1.77E-03	4.41E-05
Acetophenone	3.20E-09	lb/MMBtu	9.26E-08	2.32E-09
Antimony & Compounds	7.90E-06	lb/MMBtu	2.29E-04	5.72E-06
Arsenic & Compounds	2.20E-05	lb/MMBtu	6.37E-04	1.59E-05
Benzene	4.20E-03	lb/MMBtu	1.22E-01	3.04E-03
Benzo(a)pyrene	2.60E-06	lb/MMBtu	7.53E-05	1.88E-06
Beryllium	1.10E-06	lb/MMBtu	3.18E-05	7.96E-07
Cadmium	4.10E-06	lb/MMBtu	1.19E-04	2.97E-06
Carbon tetrachloride	4.50E-05	lb/MMBtu	1.30E-03	3.26E-05
Chlorine	7.90E-04	lb/MMBtu	2.29E-02	5.72E-04
Chlorobenzene	3.30E-05	lb/MMBtu	9.55E-04	2.39E-05
Chloroform	2.80E-05	lb/MMBtu	8.11E-04	2.03E-05
Chromium VI	3.50E-06	lb/MMBtu	1.01E-04	2.53E-06
Chromium–Other compds	1.75E-05	lb/MMBtu	5.07E-04	1.27E-05
Cobalt compounds	6.50E-06	lb/MMBtu	1.88E-04	4.70E-06
Dichloroethane, 1,2-	2.90E-05	lb/MMBtu	8.40E-04	2.10E-05
Dichloropropane, 1,2-	3.30E-05	lb/MMBtu	9.55E-04	2.39E-05
Dinitrophenol, 2,4-	1.80E-07	lb/MMBtu	5.21E-06	1.30E-07
Di(2-ethylhexyl)phthalate	4.70E-08	lb/MMBtu	1.36E-06	3.40E-08
Ethyl benzene	3.10E-05	lb/MMBtu	8.97E-04	2.24E-05
Hydrochloric acid	1.90E-02	lb/MMBtu	5.50E-01	1.38E-02
Lead and Lead compounds	4.80E-05	lb/MMBtu	1.39E-03	3.47E-05
Manganese & compounds	1.60E-03	lb/MMBtu	4.63E-02	1.16E-03
Mercury	3.50E-06	lb/MMBtu	1.01E-04	2.53E-06
Methyl bromide	1.50E-05	lb/MMBtu	4.34E-04	1.09E-05
Methyl chloride	2.30E-05	lb/MMBtu	6.66E-04	1.66E-05
Methylene chloride	2.90E-04	lb/MMBtu	8.40E-03	2.10E-04
Naphthalene	9.70E-05	lb/MMBtu	2.81E-03	7.02E-05
Nickel	3.30E-05	lb/MMBtu	9.55E-04	2.39E-05
Nitrophenol, 4-	1.10E-07	lb/MMBtu	3.18E-06	7.96E-08
Pentachlorophenol	5.10E-08	lb/MMBtu	1.48E-06	3.69E-08
Perchloroethylene	3.80E-05	lb/MMBtu	1.10E-03	2.75E-05
Phosphorus Metal, Yellow or White	2.70E-05	lb/MMBtu	7.82E-04	1.95E-05
Polychlorinated biphenyls	8.15E-09	lb/MMBtu	2.36E-07	5.90E-09
Polycyclic Organic Matter	1.25E-04	lb/MMBtu	3.61E-03	9.03E-05
Selenium compounds	2.80E-06	lb/MMBtu	8.11E-05	2.03E-06
Styrene	1.90E-03	lb/MMBtu	5.50E-02	1.38E-03
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.60E-12	lb/MMBtu	2.49E-10	6.22E-12
Toluene	9.20E-04	lb/MMBtu	2.66E-02	6.66E-04
Trichloroethane, 1,1,1-	3.10E-05	lb/MMBtu	8.97E-04	2.24E-05
Trichloroethylene	3.00E-05	lb/MMBtu	8.69E-04	2.17E-05
Trichlorophenol, 2,4,6-	2.20E-08	lb/MMBtu	6.37E-07	1.59E-08
Vinyl chloride	1.80E-05	lb/MMBtu	5.21E-04	1.30E-05
Xylene	2.50E-05	lb/MMBtu	7.24E-04	1.81E-05
Total HAP Emissions (biomass combustion)			**1.12**	**0.028**
Total TAP Emissions (biomass combustion)			**1.12**	**0.028**

Notes:

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

Table 14b

Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Cold Start-up/Planned Shutdown) [1]

HES1 Bypass Stack

Enviva Pellets Waycross, LLC

Waycross, Ware County, Georgia

Abbreviations:

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

Reference:

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

Table 14c
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Idle Mode)[1]
HES1 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

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 - Furnace Heat Energy System Bypass "Idle Mode"

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. Idle mode is defined as operation of the furnace heat energy system up to a maximum heat input rate of 10 MMBtu/hr. During this time emissions are vented through the furnace heat energy system bypass stack. Emissions are briefly vented through the dryer bypass stack as exhaust flow is transitioned from the furnace heat energy system bypass stack to the WESP and RTO. Emissions during these brief transition periods are insignificant and are not separately quantified to avoid double-counting, as
2. Emission factor obtained from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. VOC emission factor excludes formaldehyde.
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.

Table 14c
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Idle Mode)[1]
HES1 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP Emissions - Furnace Heat Energy System Bypass "Idle Mode"

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

Notes:

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

Table 14c
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Idle Mode)[1]
HES1 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

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

Table 15a
Potential Emissions at Outlet of Dryer Line 2 RTO Stack
HES2 and DRY2
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis - Dryer Line 2

Hourly Throughput	53 ODT/hr
Annual Throughput	390,000 ODT/yr
Hourly Heat Input Capacity	193 MMBtu/hr
Annual Heat Input Capacity	1,690,680 MMBtu/yr
Hours of Operation	8,760 hr/yr
RTO Burner Heat Input	32.0 MMBtu/hr
RTO Fuel Type	Natural Gas
RTO Control Efficiency	95%
WESP Metal HAP Control Efficiency	95%

Total Potential Emissions - HES1 and DRY2

Pollutant	Potential Emissions[1]	
	(lb/hr)	(tpy)
CO	13.4	49.8
NO_X	19.9	73.8
SO_2	4.83	21.1
VOC	13.8	51.3
Total PM	7.18	26.7
Total PM_{10}	7.18	26.7
Total $PM_{2.5}$	7.18	26.7
CO_2e	40,950	152,100
Total HAP	9.01	33.9
Total TAP	9.01	33.9

Notes:
1. Total emissions from the furnace heat energy system, dryer, and natural gas combustion by the RTO. Detailed calculations are provided below.

Potential Criteria Pollutant and Greenhouse Gas Emissions from Dryer Line 2 and RTO Fuel Combustion

Pollutant	Emission Factor	Units	Potential Emissions[1]	
			(lb/hr)	(tpy)
CO	0.26	lb/ODT[1]	13.4	49.8
NO_X	0.38	lb/ODT[1]	19.9	73.8
SO_2	0.025	lb/MMBtu[2]	4.83	21.1
VOC	0.26	lb/ODT[1]	13.8	51.3
PM (Filterable + Condensable)	0.14	lb/ODT[1]	7.18	26.7
PM_{10} (Filterable + Condensable)	0.14	lb/ODT[1]	7.18	26.7
$PM_{2.5}$ (Filterable + Condensable)	0.14	lb/ODT[1]	7.18	26.7
CO_2	780	lb/ODT[3]	40,950	152,100

Notes:
1. Emission factor was derived based on process information and an appropriate contingency based on engineering judgement.
2. 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.
3. 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 Waycross uses a combination of hardwood and softwood and the hardwood emission factor is greater than the softwood emission factor.

Table 15a
Potential Emissions at Outlet of Dryer Line 2 RTO Stack
HES2 and DRY2
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP and TAP Emissions from Furnace Heat Energy System/Dryer

Pollutant	Emission Factor	Units	Footnote	Potential Emissions (lb/hr)	Potential Emissions (tpy)
Furnace Heat Energy System/Dryer					
Acetaldehyde	2.85E-02	lb/ODT	1	1.50	5.56
Acrolein	6.91E-03	lb/ODT	1	0.36	1.35
Formaldehyde	1.69E-02	lb/ODT	1	0.89	3.30
Methanol	1.04E-01	lb/ODT	1	5.48	20.4
Phenol	2.43E-04	lb/ODT	1	0.013	0.047
Propionaldehyde	1.89E-03	lb/ODT	1	0.10	0.37
Acetophenone	3.20E-09	lb/MMBtu	2,3	3.09E-08	1.35E-07
Antimony & Compounds	7.90E-06	lb/MMBtu	2,4	7.62E-05	3.34E-04
Arsenic & Compounds	2.20E-05	lb/MMBtu	2,4	2.12E-04	9.30E-04
Benzene	4.20E-03	lb/MMBtu	2,3	4.05E-02	1.78E-01
Benzo(a)pyrene	2.60E-06	lb/MMBtu	2,3	2.51E-05	1.10E-04
Beryllium	1.10E-06	lb/MMBtu	2,4	1.06E-05	4.65E-05
Cadmium	4.10E-06	lb/MMBtu	2,4	3.96E-05	1.73E-04
Carbon tetrachloride	4.50E-05	lb/MMBtu	2,3	4.34E-04	1.90E-03
Chlorine	7.90E-04	lb/MMBtu	2	1.52E-01	6.68E-01
Chlorobenzene	3.30E-05	lb/MMBtu	2,3	3.18E-04	1.39E-03
Chloroform	2.80E-05	lb/MMBtu	2,3	2.70E-04	1.18E-03
Chromium VI	3.50E-06	lb/MMBtu	2,4	3.38E-05	1.48E-04
Chromium–Other compds	1.75E-05	lb/MMBtu	2,4	1.69E-04	7.40E-04
Cobalt compounds	6.50E-06	lb/MMBtu	2,4	6.27E-05	2.75E-04
Dichloroethane, 1,2-	2.90E-05	lb/MMBtu	2,3	2.80E-04	1.23E-03
Dichloropropane, 1,2-	3.30E-05	lb/MMBtu	2,3	3.18E-04	1.39E-03
Dinitrophenol, 2,4-	1.80E-07	lb/MMBtu	2,3	1.74E-06	7.61E-06
Di(2-ethylhexyl)phthalate	4.70E-08	lb/MMBtu	2,3	4.54E-07	1.99E-06
Ethyl benzene	3.10E-05	lb/MMBtu	2,3	2.99E-04	1.31E-03
Hydrochloric acid	1.90E-02	lb/MMBtu	2,5	3.67E-01	1.61E+00
Lead and Lead compounds	4.80E-05	lb/MMBtu	2,4	4.63E-04	2.03E-03
Manganese & compounds	1.60E-03	lb/MMBtu	2,4	1.54E-02	6.76E-02
Mercury	3.50E-06	lb/MMBtu	2,4	3.38E-05	1.48E-04
Methyl bromide	1.50E-05	lb/MMBtu	2,3	1.45E-04	6.34E-04
Methyl chloride	2.30E-05	lb/MMBtu	2,3	2.22E-04	9.72E-04
Methylene chloride	2.90E-04	lb/MMBtu	2,3	2.80E-03	1.23E-02
Naphthalene	9.70E-05	lb/MMBtu	2,3	9.36E-04	4.10E-03
Nickel	3.30E-05	lb/MMBtu	2,4	3.18E-04	1.39E-03
Nitrophenol, 4-	1.10E-07	lb/MMBtu	2,3	1.06E-06	4.65E-06
Pentachlorophenol	5.10E-08	lb/MMBtu	2	4.92E-07	2.16E-06
Perchloroethylene	3.80E-05	lb/MMBtu	2	3.67E-04	1.61E-03
Phosphorus Metal, Yellow or White	2.70E-05	lb/MMBtu	2,4	2.61E-04	1.14E-03
Polychlorinated biphenyls	8.15E-09	lb/MMBtu	2,3	7.86E-08	3.44E-07
Polycyclic Organic Matter	1.25E-04	lb/MMBtu	2	1.21E-03	5.28E-03
Selenium compounds	2.80E-06	lb/MMBtu	2,4	2.70E-05	1.18E-04
Styrene	1.90E-03	lb/MMBtu	2,3	1.83E-02	8.03E-02
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.60E-12	lb/MMBtu	2,3	8.30E-11	3.63E-10
Toluene	9.20E-04	lb/MMBtu	2,3	8.88E-03	3.89E-02
Trichloroethane, 1,1,1-	3.10E-05	lb/MMBtu	2	2.99E-04	1.31E-03
Trichloroethylene	3.00E-05	lb/MMBtu	2,3	2.90E-04	1.27E-03
Trichlorophenol, 2,4,6-	2.20E-08	lb/MMBtu	2,3	2.12E-07	9.30E-07
Vinyl chloride	1.80E-05	lb/MMBtu	2,3	1.74E-04	7.61E-04
Xylene	2.50E-05	lb/MMBtu	2,3	2.41E-04	1.06E-03
			Total HAP Emissions:	**8.95**	**33.7**
			Total TAP Emissions:	**8.95**	**33.7**

Table 15a
Potential Emissions at Outlet of Dryer Line 2 RTO Stack
HES2 and DRY2
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Pollutant	Emission Factor	Units	Footnote	Potential Emissions	
				(lb/hr)	(tpy)
RTO Burners - Natural Gas Combustion					
2-Methylnaphthalene	2.40E-05	lb/MMscf	6	7.53E-07	3.30E-06
3-Methylchloranthrene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
7,12-Dimethylbenz(a)anthracene	1.60E-05	lb/MMscf	6	5.02E-07	2.20E-06
Acenaphthene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Acenaphthylene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Anthracene	2.40E-06	lb/MMscf	6	7.53E-08	3.30E-07
Arsenic & Compounds	2.00E-04	lb/MMscf	6	6.27E-06	2.75E-05
Benz(a)anthracene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Benzene	2.10E-03	lb/MMscf	6	6.59E-05	2.89E-04
Benzo(a)pyrene	1.20E-06	lb/MMscf	6	3.76E-08	1.65E-07
Benzo(b)fluoranthene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Benzo(g,h,i)perylene	1.20E-06	lb/MMscf	6	3.76E-08	1.65E-07
Benzo(k)fluoranthene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Beryllium	1.20E-05	lb/MMscf	6	3.76E-07	1.65E-06
Cadmium	1.10E-03	lb/MMscf	6	3.45E-05	1.51E-04
Chromium VI	1.40E-03	lb/MMscf	6	4.39E-05	1.92E-04
Chrysene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Cobalt Compounds	8.40E-05	lb/MMscf	6	2.64E-06	1.15E-05
Dibenzo(a,h)anthracene	1.20E-06	lb/MMscf	6	3.76E-08	1.65E-07
Dichlorobenzene	1.20E-03	lb/MMscf	6	3.76E-05	1.65E-04
Fluoranthene	3.00E-06	lb/MMscf	6	9.41E-08	4.12E-07
Fluorene	2.80E-06	lb/MMscf	6	8.78E-08	3.85E-07
Hexane	1.8	lb/MMscf	6	5.65E-02	2.47E-01
Indeno(1,2,3-cd)pyrene	1.80E-06	lb/MMscf	6	5.65E-08	2.47E-07
Lead and Lead Compounds	5.00E-04	lb/MMscf	6	1.57E-05	6.87E-05
Manganese & Compounds	3.80E-04	lb/MMscf	6	1.19E-05	5.22E-05
Mercury	2.60E-04	lb/MMscf	6	8.16E-06	3.57E-05
Naphthalene	6.10E-04	lb/MMscf	6	1.91E-05	8.38E-05
Nickel	2.10E-03	lb/MMscf	6	6.59E-05	2.89E-04
Polycyclic Organic Matter	--	--	6	2.19E-05	9.59E-05
Phenanthrene	1.70E-05	lb/MMscf	6	5.33E-07	2.34E-06
Pyrene	5.00E-06	lb/MMscf	6	1.57E-07	6.87E-07
Selenium Compounds	2.40E-05	lb/MMscf	6	7.53E-07	3.30E-06
Toluene	3.40E-03	lb/MMscf	6	1.07E-04	4.67E-04
Total HAP Emissions:				**0.057**	**0.25**
Total TAP Emissions:				**0.057**	**0.25**

Table 15a
Potential Emissions at Outlet of Dryer Line 2 RTO Stack
HES2 and DRY2
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Notes:

1. Emission factors derived based on process information and 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. A control efficiency of 95% for the RTO is applied to organic 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.
5. 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.
6. 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.

Abbreviations:

CO - carbon monoxide
CO_2 - carbon dioxide
HAP - hazardous air pollutant
hr - hour
lb - pound
MMBtu - Million British thermal units
NO_X - nitrogen oxides
NCASI - National Council for Air and Stream Improvement, Inc.
RTO - regenerative thermal oxidizer
ODT - oven dried tons
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
WESP - wet electrostatic precipitator
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
yr - year

References:

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

Table 15b
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Cold Start-up) [1]
HES2 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis

Hourly Heat Input Capacity	29.0 MMBtu/hr
Annual Heat Input Capacity	1,448 MMBtu/yr
Hours of Operation[1]	50 hr/yr

Potential Criteria Pollutant and GHG Emissions - Furnace Heat Energy System Bypass Cold Start-up/Planned Shutdown[1]

Pollutant	Emission Factor	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
CO	0.60	lb/MMBtu[2]	17.4	0.43
NO_X	0.22	lb/MMBtu[2]	6.37	0.16
SO_2	0.025	lb/MMBtu[2]	0.72	0.018
VOC	0.017	lb/MMBtu[2]	0.49	0.012
Total PM	0.58	lb/MMBtu[2]	16.7	0.42
Total PM_{10}	0.52	lb/MMBtu[2]	15.0	0.37
Total $PM_{2.5}$	0.45	lb/MMBtu[2]	12.9	0.32
CO_2	93.8	kg/MMBtu[3]	5,987	150
CH_4	0.0072	kg/MMBtu[3]	0.46	0.011
N_2O	0.0036	kg/MMBtu[3]	0.23	0.0057
CO_2e			6,067	152

Notes:

1. During startup and shutdown (for temperature control) emissions are vented out of the furnace heat energy system bypass stack. Use of each furnace heat energy system bypass stack during cold start-ups and planned shutdowns will not exceed 50 hours per 12-month rolling period for each dryer line. Emissions are vented through the dryer bypass stack briefly as exhaust flow is transitioned from the furnace heat energy system bypass stack to the WESP and RTO. Emissions during these brief transition periods are insignificant and are not separately quantified to avoid double-counting, as these emissions are accounted for in the table above for the furnace heat energy system cold start-up/planned shutdown. Diesel fuel may be used as an accelerant for cold start-up. The amount used per event will be approximately 30 gallons and the annual usage will be approximately 200 gallons; therefore, emissions resulting from diesel
2. Emission factor obtained from AP-42, Chapter 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. VOC emission factor excludes formaldehyde.
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.

Table 15b
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Cold Start-up) [1]
HES2 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP Emissions - Furnace Heat Energy System Bypass Cold Start-up/Planned Shutdown

Pollutant	Emission Factor[1]	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
Acetaldehyde	8.30E-04	lb/MMBtu	2.40E-02	6.01E-04
Acrolein	4.00E-03	lb/MMBtu	1.16E-01	2.90E-03
Formaldehyde	4.40E-03	lb/MMBtu	1.27E-01	3.18E-03
Phenol	5.10E-05	lb/MMBtu	1.48E-03	3.69E-05
Propionaldehyde	6.10E-05	lb/MMBtu	1.77E-03	4.41E-05
Acetophenone	3.20E-09	lb/MMBtu	9.26E-08	2.32E-09
Antimony & Compounds	7.90E-06	lb/MMBtu	2.29E-04	5.72E-06
Arsenic & Compounds	2.20E-05	lb/MMBtu	6.37E-04	1.59E-05
Benzene	4.20E-03	lb/MMBtu	1.22E-01	3.04E-03
Benzo(a)pyrene	2.60E-06	lb/MMBtu	7.53E-05	1.88E-06
Beryllium	1.10E-06	lb/MMBtu	3.18E-05	7.96E-07
Cadmium	4.10E-06	lb/MMBtu	1.19E-04	2.97E-06
Carbon tetrachloride	4.50E-05	lb/MMBtu	1.30E-03	3.26E-05
Chlorine	7.90E-04	lb/MMBtu	2.29E-02	5.72E-04
Chlorobenzene	3.30E-05	lb/MMBtu	9.55E-04	2.39E-05
Chloroform	2.80E-05	lb/MMBtu	8.11E-04	2.03E-05
Chromium VI	3.50E-06	lb/MMBtu	1.01E-04	2.53E-06
Chromium–Other compds	1.75E-05	lb/MMBtu	5.07E-04	1.27E-05
Cobalt compounds	6.50E-06	lb/MMBtu	1.88E-04	4.70E-06
Dichloroethane, 1,2-	2.90E-05	lb/MMBtu	8.40E-04	2.10E-05
Dichloropropane, 1,2-	3.30E-05	lb/MMBtu	9.55E-04	2.39E-05
Dinitrophenol, 2,4-	1.80E-07	lb/MMBtu	5.21E-06	1.30E-07
Di(2-ethylhexyl)phthalate	4.70E-08	lb/MMBtu	1.36E-06	3.40E-08
Ethyl benzene	3.10E-05	lb/MMBtu	8.97E-04	2.24E-05
Hydrochloric acid	1.90E-02	lb/MMBtu	5.50E-01	1.38E-02
Lead and Lead compounds	4.80E-05	lb/MMBtu	1.39E-03	3.47E-05
Manganese & compounds	1.60E-03	lb/MMBtu	4.63E-02	1.16E-03
Mercury	3.50E-06	lb/MMBtu	1.01E-04	2.53E-06
Methyl bromide	1.50E-05	lb/MMBtu	4.34E-04	1.09E-05
Methyl chloride	2.30E-05	lb/MMBtu	6.66E-04	1.66E-05
Methylene chloride	2.90E-04	lb/MMBtu	8.40E-03	2.10E-04
Naphthalene	9.70E-05	lb/MMBtu	2.81E-03	7.02E-05
Nickel	3.30E-05	lb/MMBtu	9.55E-04	2.39E-05
Nitrophenol, 4-	1.10E-07	lb/MMBtu	3.18E-06	7.96E-08
Pentachlorophenol	5.10E-08	lb/MMBtu	1.48E-06	3.69E-08
Perchloroethylene	3.80E-05	lb/MMBtu	1.10E-03	2.75E-05
Phosphorus Metal, Yellow or White	2.70E-05	lb/MMBtu	7.82E-04	1.95E-05
Polychlorinated biphenyls	8.15E-09	lb/MMBtu	2.36E-07	5.90E-09
Polycyclic Organic Matter	1.25E-04	lb/MMBtu	3.61E-03	9.03E-05
Selenium compounds	2.80E-06	lb/MMBtu	8.11E-05	2.03E-06
Styrene	1.90E-03	lb/MMBtu	5.50E-02	1.38E-03
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	8.60E-12	lb/MMBtu	2.49E-10	6.22E-12
Toluene	9.20E-04	lb/MMBtu	2.66E-02	6.66E-04
Trichloroethane, 1,1,1-	3.10E-05	lb/MMBtu	8.97E-04	2.24E-05
Trichloroethylene	3.00E-05	lb/MMBtu	8.69E-04	2.17E-05
Trichlorophenol, 2,4,6-	2.20E-08	lb/MMBtu	6.37E-07	1.59E-08
Vinyl chloride	1.80E-05	lb/MMBtu	5.21E-04	1.30E-05
Xylene	2.50E-05	lb/MMBtu	7.24E-04	1.81E-05
Total HAP Emissions (biomass combustion)			**1.12**	**0.028**
Total TAP Emissions (biomass combustion)			**1.12**	**0.028**

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

Table 15b
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Cold Start-up) [1]
HES2 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Abbreviations:

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

Reference:

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

Table 15c
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Idle Mode)[1]
HES2 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

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 - Furnace Heat Energy System Bypass "Idle Mode"

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. Idle mode is defined as operation of the furnace heat energy system up to a maximum heat input rate of 10 MMBtu/hr. During this time emissions are vented through the furnace heat energy system bypass stack. Emissions are briefly vented through the dryer bypass stack as exhaust flow is transitioned from the furnace heat energy system bypass stack to the WESP and RTO. Emissions during these brief transition periods are insignificant and are not separately quantified to avoid double-counting, as these emissions are accounted for in the table above for furnace heat energy system idle.
2. Emission factor obtained from AP-42, Section 1.6 - Wood Residue Combustion in Boilers, 09/03 for bark/bark and wet wood/wet wood-fired boilers. VOC emission factor excludes formaldehyde.
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.

Table 15c
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Idle Mode)[1]
HES2 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP Emissions - Furnace Heat Energy System Bypass "Idle Mode"

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

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

Table 15c
Potential Emissions from Furnace Heat Energy System and Dryer Bypass (Idle Mode)[1]
HES2 Bypass Stack
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

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

Table 16
Potential Emissions from Dry Chip Silo, Conveyor Aspiration System 1, and Dry Hammermills
DCS, CE01, and HML Controlled by RCO1
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis

Hourly Throughput	135 ODT/hr
Annual Throughput	920,000 ODT/yr
Hours of Operation	8,760 hr/yr
Total RCO Heat Input	16.0 MMBtu/hr
RCO control efficiency	95%

Total Potential Emissions at RCO1 Stack

Pollutant	Potential Emissions[1]	
	(lb/hr)	(tpy)
CO	2.01	8.13
NO_X	2.39	9.68
SO_2	0.0094	0.041
VOC	22.7	77.4
Total PM	16.4	72.0
Total PM_{10}	16.4	72.0
Total $PM_{2.5}$	16.4	72.0
CO_2e	1,874	8,206
Total HAP	0.90	3.11
Total TAP	0.90	3.11

Notes:
1. Total emissions from the dry chip silo, conveyor aspiration system, dry hammermills, and natural gas combustion by the RCO burners. Detailed calculations are provided below.

Potential Emissions from Dry Chip Silo, Conveyor Aspiration System, and Dry Hammermills

Pollutant	Emission Factor[1]	Potential Emissions[2,3]	
	(lb/ODT)	(lb/hr)	(tpy)
Acetaldehyde	8.52E-04	0.12	0.39
Acrolein	5.95E-04	0.080	0.27
Formaldehyde	1.44E-03	0.19	0.66
Methanol	3.00E-03	0.41	1.38
Phenol	3.01E-04	0.041	0.14
Propionaldehyde	2.98E-04	0.040	0.14
Total HAP Emissions:		0.88	2.98
Total TAP Emissions:		0.88	2.98
Total VOC	0.17	22.7	77.4

Notes:
1 Emission factor was derived based on process information and an appropriate contingency based on engineering judgement.

Table 16

Potential Emissions from Dry Chip Silo, Conveyor Aspiration System 1, and Dry Hammermills

DCS, CE01, and HML Controlled by RCO1

Enviva Pellets Waycross, LLC

Waycross, Ware County, Georgia

Potential Particulate Emissions from Dry Chip Silo, Conveyor Aspiration System, and Dry Hammermills

Source	Particulate Control Device ID	Exhaust Flow Rate[1]	Exit Grain Loading[2,3]	Potential Filterable $PM/PM_{10}/PM_{2.5}$ Emissions[3]	
		(dscfm)	(gr/dscf)	(lb/hr)	(tpy)
Dry Chip Silo	DCS1	1,000	0.01	0.086	0.38
Conveyor Aspiration System	CBH1	7,130	0.02	1.22	5.35
Ten (10) Dry Hammermills	HBH1 to HBH10	138,000	0.013	15.0	65.7

Notes:

1. Total flow rate (dscfm) from all ten (10) dry hammermill baghouses.
2. No speciation data are available.
3. The emission rates are for filterable $PM/PM_{10}/PM_{2.5}$. Condensable PM is negligible for these processes; therefore, filterable $PM/PM_{10}/PM_{2.5}$ equal total $PM/PM_{10}/PM_{2.5}$.

Thermally Generated Emissions from Dry Chip Silo, Conveyor Aspiration System, and Dry Hammermills[1]

Maximum high heating value of VOC constituents	0.018	MMBtu/lb
Uncontrolled VOC emissions	1,549	tons/yr
Uncontrolled VOC emissions	455	lb/hr
Heat input of uncontrolled VOC emissions	57,289	MMBtu/yr
Heat input of uncontrolled VOC emissions	8.41	MMBtu/hr

Pollutant	Emission Factor[2]	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
CO	0.082	lb/MMBtu	0.69	2.36
NO_X	0.10	lb/MMBtu	0.82	2.81

Notes:

1. Emissions of CO and NO_X will be generated during combustion of VOC in the exhaust stream of the dry chip silo, conveyor aspiration system, and dry hammermills by the 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 - RCO Natural Gas Combustion

Pollutant	Emission Factor	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
CO	0.082	lb/MMBtu[1]	1.32	5.77
NO_X	0.10	lb/MMBtu[1]	1.57	6.87
SO_2	5.88E-04	lb/MMBtu[1]	0.0094	0.041
Total PM	7.45E-03	lb/MMBtu[1]	0.12	0.52
Total PM_{10}	7.45E-03	lb/MMBtu[1]	0.12	0.52
Total $PM_{2.5}$	7.45E-03	lb/MMBtu[1]	0.12	0.52
CO_2	53.1	kg/MMBtu[2]	1,872	8,198
CH_4	1.00E-03	kg/MMBtu[2]	0.035	0.15
N_2O	1.00E-04	kg/MMBtu[2]	0.0035	0.015
CO_2e			1,874	8,206

Table 16

Potential Emissions from Dry Chip Silo, Conveyor Aspiration System 1, and Dry Hammermills

DCS, CE01, and HML Controlled by RCO1

Enviva Pellets Waycross, LLC

Waycross, Ware County, Georgia

Potential HAP and TAP Emissions - RCO Natural Gas Combustion

Pollutant	Emission Factor[1]	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
RCO Burners				
2-Methylnaphthalene	2.40E-05	lb/MMscf	3.76E-07	1.65E-06
3-Methylchloranthrene	1.80E-06	lb/MMscf	2.82E-08	1.24E-07
7,12-Dimethylbenz(a)anthracene	1.60E-05	lb/MMscf	2.51E-07	1.10E-06
Acenaphthene	1.80E-06	lb/MMscf	2.82E-08	1.24E-07
Acenaphthylene	1.80E-06	lb/MMscf	2.82E-08	1.24E-07
Anthracene	2.40E-06	lb/MMscf	3.76E-08	1.65E-07
Arsenic & Compounds	2.00E-04	lb/MMscf	3.14E-06	1.37E-05
Benz(a)anthracene	1.80E-06	lb/MMscf	2.82E-08	1.24E-07
Benzene	2.10E-03	lb/MMscf	3.29E-05	1.44E-04
Benzo(a)pyrene	1.20E-06	lb/MMscf	1.88E-08	8.24E-08
Benzo(b)fluoranthene	1.80E-06	lb/MMscf	2.82E-08	1.24E-07
Benzo(g,h,i)perylene	1.20E-06	lb/MMscf	1.88E-08	8.24E-08
Benzo(k)fluoranthene	1.80E-06	lb/MMscf	2.82E-08	1.24E-07
Beryllium	1.20E-05	lb/MMscf	1.88E-07	8.24E-07
Cadmium	1.10E-03	lb/MMscf	1.73E-05	7.56E-05
Chromium VI	1.40E-03	lb/MMscf	2.20E-05	9.62E-05
Chrysene	1.80E-06	lb/MMscf	2.82E-08	1.24E-07
Cobalt Compounds	8.40E-05	lb/MMscf	1.32E-06	5.77E-06
Dibenzo(a,h)anthracene	1.20E-06	lb/MMscf	1.88E-08	8.24E-08
Dichlorobenzene	1.20E-03	lb/MMscf	1.88E-05	8.24E-05
Fluoranthene	3.00E-06	lb/MMscf	4.71E-08	2.06E-07
Fluorene	2.80E-06	lb/MMscf	4.39E-08	1.92E-07
Hexane	1.8	lb/MMscf	2.82E-02	1.24E-01
Indeno(1,2,3-cd)pyrene	1.80E-06	lb/MMscf	2.82E-08	1.24E-07
Lead and Lead Compounds	5.00E-04	lb/MMscf	7.84E-06	3.44E-05
Manganese & Compounds	3.80E-04	lb/MMscf	5.96E-06	2.61E-05
Mercury	2.60E-04	lb/MMscf	4.08E-06	1.79E-05
Naphthalene	6.34E-04	lb/MMscf	9.95E-06	4.36E-05
Nickel	2.10E-03	lb/MMscf	3.29E-05	1.44E-04
Polycyclic Organic Matter	--	--	1.13E-05	4.96E-05
Phenanthrene	1.70E-05	lb/MMscf	2.67E-07	1.17E-06
Pyrene	5.00E-06	lb/MMscf	7.84E-08	3.44E-07
Selenium compounds	2.40E-05	lb/MMscf	3.76E-07	1.65E-06
Toluene	3.40E-03	lb/MMscf	5.33E-05	2.34E-04
		Total HAP Emissions:	**0.028**	**0.12**
		Total TAP Emissions:	**0.028**	**0.12**

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 combustion from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-1.

Table 16
Potential Emissions from Dry Chip Silo, Conveyor Aspiration System 1, and Dry Hammermills
DCS, CE01, and HML Controlled by RCO1
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Abbreviations:

dscf - dry standard cubic feet
dscfm - dry standard cubic feet per minute
gr - grain
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - million British thermal units
MMscf - million standard cubic feet
ODT - oven dried tons
RCO - regenerative catalytic oxidizer
TAP - toxic air pollutant
tpy - tons per year
USEPA - U.S. Environmental Protection Agency
VOC - volatile organic compound
yr - year

Reference:

AP-42, Section 1.4 - Natural Gas Combustion, 07/98

Table 17

Potential Emissions from Fiber Storage Silo, Conveyor Aspiration System 2, Pellet Mills, and Pellet Coolers

FS, CE02, PML, PCL Controlled by RCO2

Enviva Pellets Waycross, LLC

Waycross, Ware County, Georgia

Calculation Basis

Hourly Throughput	135 ODT/hr
Annual Throughput	920,000 ODT/yr
Hours of Operation	8,760 hr/yr
Total RCO Heat Input	24.0 MMBtu/hr
RCO control efficiency	95%

Total Potential Emissions at RCO2 Stack

Pollutant	Potential Emissions[1]	
	(lb/hr)	(tpy)
CO	2.49	10.4
NO_X	2.97	12.4
SO_2	0.014	0.062
VOC	16.9	57.6
Total PM	15.2	66.6
Total PM_{10}	15.2	66.6
Total $PM_{2.5}$	15.2	66.6
CO_2e	2,810	12,309
Total HAP	2.10	7.18

Notes:

1. Total emissions from the pellet mills, pellet coolers, and natural gas combustion by the RCO burners. Detailed calculations are provided below.

Potential VOC, HAP, and TAP Emissions from Fiber Storage Silo, Conveyor Aspiration System, Pellet Mills, and Pellet Coolers

Pollutant	Emission Factor[1]	Potential Emissions[2]	
	(lb/ODT)	(lb/hr)	(tpy)
Acetaldehyde	2.92E-03	0.39	1.34
Acrolein	3.84E-03	0.52	1.77
Formaldehyde	3.12E-03	0.42	1.44
Methanol	3.72E-03	0.50	1.71
Phenol	1.09E-03	0.15	0.50
Propionaldehyde	5.16E-04	0.07	0.24
Total HAP Emissions		2.05	6.99
Total TAP Emissions:		2.05	6.99
Total VOC	0.13	16.9	57.6

Notes:

1 Emission factor was derived based on process information and an appropriate contingency based on engineering judgement.

Table 17

Potential Emissions from Fiber Storage Silo, Conveyor Aspiration System 2, Pellet Mills, and Pellet Coolers

FS, CE02, PML, PCL Controlled by RCO2

Enviva Pellets Waycross, LLC

Waycross, Ware County, Georgia

Potential Particulate Emissions from Fiber Storage Silo, Conveyor Aspiration System, Pellet Mills, and Pellet Coolers

Source	Particulate Control Device ID	Exhaust Flow Rate[1]	Exit Grain Loading[2,3]	Potential Filterable $PM/PM_{10}/PM_{2.5}$ Emissions[3]	
		(dscfm)	(gr/dscf)	(lb/hr)	(tpy)
Fiber Storage Silo and Conveyor Aspiration System	CBH2	24,700	0.02	4.23	18.5
Pellet Mills and Pellet Coolers	PBH1 to PBH5	125,995	0.01	10.8	47.3

Notes:

1. Total flow rate (dscfm) from all five (5) pellet cooler baghouses.
2. No speciation data are available.
3. The emission rates are for filterable $PM/PM_{10}/PM_{2.5}$. Condensable PM is negligible for these processes; therefore, filterable $PM/PM_{10}/PM_{2.5}$ equal total $PM/PM_{10}/PM_{2.}$

Thermally Generated NO_X and CO Emissions - Fiber Storage Silo, Conveyor Aspiration System, Pellet Mills, and Pellet Coolers[1]

Maximum high heating value of VOC constituents	0.018	MMBtu/lb
Uncontrolled VOC emissions	1,151	tons/yr
Uncontrolled VOC emissions	338	lb/hr
Heat input of uncontrolled VOC emissions	42,580	MMBtu/yr
Heat input of uncontrolled VOC emissions	6.25	MMBtu/hr

Pollutant	Emission Factor[2]	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
CO	0.082	lb/MMBtu	0.51	1.75
NO_X	0.10	lb/MMBtu	0.61	2.09

Notes:

1. Emissions of CO and NO_X will be generated during combustion of VOC in the exhaust stream of the fiber storage silo, conveyor aspiration system, pellet mills, and pellet coolers by the 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 - RCO Natural Gas Combustion

Pollutant	Emission Factor	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
CO	0.082	lb/MMBtu[1]	1.98	8.66
NO_X	0.10	lb/MMBtu[1]	2.35	10.3
SO_2	5.88E-04	lb/MMBtu[1]	0.014	0.062
Total PM	7.45E-03	lb/MMBtu[1]	0.18	0.78
Total PM_{10}	7.45E-03	lb/MMBtu[1]	0.18	0.78
Total $PM_{2.5}$	7.45E-03	lb/MMBtu[1]	0.18	0.78
CO_2	53.1	kg/MMBtu[2]	2,807	12,297
CH_4	1.00E-03	kg/MMBtu[2]	0.053	0.23
N_2O	1.00E-04	kg/MMBtu[2]	0.0053	0.023
CO_2e			2,810	12,309

Table 17

Potential Emissions from Fiber Storage Silo, Conveyor Aspiration System 2, Pellet Mills, and Pellet Coolers

FS, CE02, PML, PCL Controlled by RCO2

Enviva Pellets Waycross, LLC

Waycross, Ware County, Georgia

Potential HAP and TAP Emissions - RCO Natural Gas Combustion

Pollutant	Emission Factor[1]	Units	Potential Emissions	
			Hourly (lb/hr)	Annual (tpy)
RCO Burners				
2-Methylnaphthalene	2.40E-05	lb/MMscf	5.65E-07	2.47E-06
3-Methylchloranthrene	1.80E-06	lb/MMscf	4.24E-08	1.86E-07
7,12-Dimethylbenz(a)anthracene	1.60E-05	lb/MMscf	3.76E-07	1.65E-06
Acenaphthene	1.80E-06	lb/MMscf	4.24E-08	1.86E-07
Acenaphthylene	1.80E-06	lb/MMscf	4.24E-08	1.86E-07
Anthracene	2.40E-06	lb/MMscf	5.65E-08	2.47E-07
Arsenic & Compounds	2.00E-04	lb/MMscf	4.71E-06	2.06E-05
Benz(a)anthracene	1.80E-06	lb/MMscf	4.24E-08	1.86E-07
Benzene	2.10E-03	lb/MMscf	4.94E-05	2.16E-04
Benzo(a)pyrene	1.20E-06	lb/MMscf	2.82E-08	1.24E-07
Benzo(b)fluoranthene	1.80E-06	lb/MMscf	4.24E-08	1.86E-07
Benzo(g,h,i)perylene	1.20E-06	lb/MMscf	2.82E-08	1.24E-07
Benzo(k)fluoranthene	1.80E-06	lb/MMscf	4.24E-08	1.86E-07
Beryllium	1.20E-05	lb/MMscf	2.82E-07	1.24E-06
Cadmium	1.10E-03	lb/MMscf	2.59E-05	1.13E-04
Chromium VI	1.40E-03	lb/MMscf	3.29E-05	1.44E-04
Chrysene	1.80E-06	lb/MMscf	4.24E-08	1.86E-07
Cobalt Compounds	8.40E-05	lb/MMscf	1.98E-06	8.66E-06
Dibenzo(a,h)anthracene	1.20E-06	lb/MMscf	2.82E-08	1.24E-07
Dichlorobenzene	1.20E-03	lb/MMscf	2.82E-05	1.24E-04
Fluoranthene	3.00E-06	lb/MMscf	7.06E-08	3.09E-07
Fluorene	2.80E-06	lb/MMscf	6.59E-08	2.89E-07
Hexane	1.8	lb/MMscf	4.24E-02	1.86E-01
Indeno(1,2,3-cd)pyrene	1.80E-06	lb/MMscf	4.24E-08	1.86E-07
Lead and Lead Compounds	5.00E-04	lb/MMscf	1.18E-05	5.15E-05
Manganese & Compounds	3.80E-04	lb/MMscf	8.94E-06	3.92E-05
Mercury	2.60E-04	lb/MMscf	6.12E-06	2.68E-05
Naphthalene	6.34E-04	lb/MMscf	1.49E-05	6.53E-05
Nickel	2.10E-03	lb/MMscf	4.94E-05	2.16E-04
Polycyclic Organic Matter	--	--	1.70E-05	7.44E-05
Phenanthrene	1.70E-05	lb/MMscf	4.00E-07	1.75E-06
Pyrene	5.00E-06	lb/MMscf	1.18E-07	5.15E-07
Selenium compounds	2.40E-05	lb/MMscf	5.65E-07	2.47E-06
Toluene	3.40E-03	lb/MMscf	8.00E-05	3.50E-04
		Total HAP Emissions	**0.043**	**0.19**
		Total TAP Emissions	**0.043**	**0.19**

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 combustion from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-1.

Abbreviations:

dscf - dry standard cubic feet
dscfm - dry standard cubic feet per minute
gr - grain
HAP - hazardous air pollutant
hr - hour
kg - kilogram
lb - pound
MMBtu - million British thermal units
MMscf - million standard cubic feet
ODT - oven dried tons
RCO - regenerative catalytic oxidizer
TAP - toxic air pollutant
tpy - tons per year
USEPA - U.S. Environmental Protection Agency
VOC - volatile organic compound
yr - year

Reference:

AP-42, Section 1.4 - Natural Gas Combustion, 07/98

Table 18
Summary of Potential Emissions from Railcar Loadouts
RL1, RL2, and RL3
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential Particulate Emissions

Emission Unit ID	Source Description	Control Device ID	Exhaust Flow Rate[1]	Exit Grain Loading	Particulate Speciation[2]		Potential Emissions					
							PM		PM_{10}		$PM_{2.5}$	
			(dscfm)	(gr/dscf)	PM_{10} (% of PM)	$PM_{2.5}$ (% of PM)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
RL1	Railcar Loadout No. 1	RCF1	228	0.025	100%	100%	0.049	0.21	0.049	0.21	0.049	0.21
RL2	Railcar Loadout No. 2	RCF2	228	0.025	100%	100%	0.049	0.21	0.049	0.21	0.049	0.21
RL3	Railcar Loadout No. 3	RCF3	228	0.025	100%	100%	0.049	0.21	0.049	0.21	0.049	0.21

Notes:

1. Control device exit flow rates provided by control device equipment manufacturer.
2. No speciation data are available; therefore, all PM is conservatively assumed to be $PM_{2.5}$.

Abbreviations:

dscf - dry standard cubic feet
dscfm - dry standard cubic feet per minute
gr - grain
hr - hour
lb - pound
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
tpy - tons per year

Table 19
Pelletizing Area Vacuum System Potential Emissions
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Emission Unit ID	Source Description	Control Device ID	Control Device Description	Exhaust Flow Rate	Exit Grain Loading			Potential Emissions					
								PM		PM_{10}		$PM_{2.5}$	
				(dscfm)	PM (gr/cf)	PM_{10} (gr/cf)	$PM_{2.5}$ (gr/cf)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
PA01	Pelletizing Area Vacuum System	PAB1	Baghouse	959	0.020	0.020	0.020	0.16	0.72	0.16	0.72	0.16	0.72

Notes:

1. Control device exhaust flow rate provided by control device equipment manufacturer.
2. No speciation data are available; therefore, all PM is conservatively assumed to be $PM_{2.5}$.

Abbreviations:

dscf - dry standard cubic feet
dscfm - dry standard cubic feet per minute
gr - grain
hr - hour
lb - pound
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less than 10 microns
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5 microns or less
tpy - tons per year

Table 20

Emergency Generator 1 Potential Emissions

EG01

Enviva Pellets Waycross, LLC

Waycross, Ware County, Georgia

Calculation Basis

Engine Output	500 kW
Horsepower Rating	671 brake hp
Brake Specific Fuel Consumption	7,000 Btu/hp-hr
Diesel Heating Value	19,300 Btu/lb
Diesel Density[1]	7.1 lb/gal
Hours of Operation	500 hr/yr
Hourly Fuel Consumption	34.3 gal/hr
Heat Input[2]	4.69 MMBtu/hr

Notes:

1. Diesel density from AP-42 Section 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines, 10/96, Table 3.4-1, footnote a.
2. Heat input calculated on a brake-specific fuel consumption of 7,000 Btu/hp-hr per AP-42.

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor	Units	Potential Emissions[1]	
			(lb/hr)	(tpy)
CO	5.73E-03	lb/hp-hr[2]	3.84	0.96
NO_X	6.61E-03	lb/hp-hr[2]	4.43	1.11
SO_2	15	ppmw[3]	0.0073	0.0018
VOC	7.05E-04	lb/hp-hr[4]	0.47	0.12
PM	3.31E-04	lb/hp-hr[2]	0.22	0.055
PM_{10}	3.31E-04	lb/hp-hr[2]	0.22	0.055
$PM_{2.5}$	3.31E-04	lb/hp-hr[2]	0.22	0.055
CO_2	73.96	kg/MMBtu[5]	765	191
CH_4	3.0E-03	kg/MMBtu[5]	0.031	0.0078
N_2O	6.0E-04	kg/MMBtu[5]	0.0062	0.0016
CO_2e			768	192

Notes:

1. NSPS allows for only 100 hr/yr of non-emergency operation of this engine. Potential emissions for the emergency generator are conservatively based on 500 hr/yr.
2. Tier 3 emissions standards from NSPS Subpart IIII for emergency engines with a maximum power rating greater than 50 horsepower [§60.4202(a)(2)]. NO_X emissions are based on combined emission standard for NMHC+NO_X.
3. Sulfur content in accordance with 40 CFR 1090.305 as required by NSPS Subpart IIII.
4. TOC emission factor from AP-42 Section 3.4, Large Stationary Diesel and All Stationary Dual-Fuel Engines and assumes 91% is nonmethane hydrocarbons per footnote f of Table 3.4-1.
5. Emission factors from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-1.

Table 20
Emergency Generator 1 Potential Emissions
EG01
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP Emissions

Pollutant	CAS No.	Emission Factor[1] (lb/MMBtu)	Potential Emissions[2] (lb/hr)	(tpy)
Acetaldehyde	75-07-0	2.52E-05	1.18E-04	2.96E-05
Acrolein	107-02-8	7.88E-06	3.70E-05	9.25E-06
Benzene	71-43-2	7.76E-04	3.64E-03	9.11E-04
Benzo(a)pyrene[4]	50-32-8	2.57E-07	1.21E-06	3.02E-07
Formaldehyde	50-00-0	7.89E-05	3.70E-04	9.26E-05
Naphthalene[4]	91-20-3	1.30E-04	6.10E-04	1.53E-04
Total PAH (POM)[3]	--	2.12E-04	9.95E-04	2.49E-04
Toluene	108-88-3	2.81E-04	1.32E-03	3.30E-04
Xylene	1330-20-7	1.93E-04	9.06E-04	2.26E-04
		Total HAP Emissions:	**0.0074**	**0.0018**
		Total TAP Emissions:	**0.0070**	**0.0018**

Notes:

1. Emission factor obtained from AP-42 Section 3.4, Large Stationary Diesel and All Stationary Dual-Fuel Engines Table 3.4-3 and Table 3.4-4.
2. NSPS allows for only 100 hr/yr of non-emergency operation of this engine. Potential emissions for the emergency generator are conservatively based on 500 hr/yr.
3. The PAH emission factor includes all the PAH compounds listed in AP-42 Section 3.4, Large Stationary Diesel and All Stationary Dual-Fuel Engines Table 3.4-4.
4. Emissions of naphthalene and benzo(a)pyrene are also calculated separately. For the purposes of calculating total HAP emissions, naphthalene and benzo(a)pyrene are not included to avoid double counting these emissions since they are included under POM.

Abbreviations:

Btu - British thermal unit
CAS - chemical abstract service
CH_4 - methane
CO - carbon monoxide
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
gal - gallon
HAP - hazardous air pollutant
hp - horsepower
hr - hour
kg - kilogram
kW - kilowatt
lb - pound
yr - year
MW - megawatt
MMBtu - Million British thermal units
NO_X - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PAH - polycyclic aromatic hydrocarbon
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less th
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5
POM - polycyclic organic matter
SO_2 - sulfur dioxide
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound

Reference:

AP-42, Section 3.4 - Large Stationary Diesel and All Stationary Dual-Fuel Engines

Table 21

Emergency Generator 2 Potential Emissions

EG02

Enviva Pellets Waycross, LLC

Waycross, Ware County, Georgia

Calculation Basis

Engine Output	250	kW
Horsepower Rating	335	brake hp
Brake Specific Fuel Consumptior	7,000	Btu/hp-hr
Diesel Heating Value	19,300	Btu/lb
Diesel Density[1]	7.1	lb/gal
Hours of Operation	500	hr/yr
Hourly Fuel Consumption	17.1	gal/hr
Heat Input[2]	2.35	MMBtu/hr

Notes:

1. Diesel density from AP-42 Section 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines, 10/96, Table 3.4-1, footnote a.
2. Heat input calculated on a brake-specific fuel consumption of 7,000 Btu/hp-hr per AP-42, Section 3.3 - Stationary Internal Combustion Engines, 10/96.

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor	Units	Potential Emissions[1] (lb/hr)	Potential Emissions[1] (tpy)
CO	5.73E-03	lb/hp-hr[2]	1.92	0.48
NO_X	6.61E-03	lb/hp-hr[2]	2.22	0.55
SO_2	15	ppmw[3]	0.0036	9.12E-04
VOC	2.51E-03	lb/hp-hr[4]	0.84	0.21
PM	3.31E-04	lb/hp-hr[2]	0.11	0.028
PM_{10}	3.31E-04	lb/hp-hr[2]	0.11	0.028
$PM_{2.5}$	3.31E-04	lb/hp-hr[2]	0.11	0.028
CO_2	73.96	kg/MMBtu[5]	383	95.7
CH_4	3.0E-03	kg/MMBtu[5]	0.016	0.0039
N_2O	6.0E-04	kg/MMBtu[5]	0.0031	7.8E-04
CO_2e			384	96.0

Notes:

1. NSPS allows for only 100 hr/yr of non-emergency operation of this engine. Potential emissions for the emergency generator are conservatively based on 500 hr/yr.
2. Tier 3 emissions standards from NSPS Subpart IIII for emergency engines with a maximum power rating greater than 50 horsepower [§60.4202(a)(2)]. NO_X emissions are based on combined emission standard for NMHC+NO_X.
3. Sulfur content in accordance with 40 CFR 1090.305 as required by NSPS Subpart IIII.
4. VOC emission factor from AP-42, Section 3.3 - Stationary Internal Combustion Engines, 10/96, Table 3.3-1.
5. Emission factors from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-1.

RAMBOLL

Table 21
Emergency Generator 2 Potential Emissions
EG02
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP Emissions

Pollutant	CAS No.	Emission Factor[1]	Potential Emissions[2]	
		(lb/hp-hr)	(lb/hr)	(tpy)
Acetaldehyde	75-07-0	5.37E-06	1.80E-03	4.50E-04
Acrolein	107-02-8	6.48E-07	2.17E-04	5.43E-05
Benzene	71-43-2	6.53E-06	2.19E-03	5.47E-04
Benzo(a)pyrene	50-32-8	1.32E-09	4.41E-07	1.10E-07
Butadiene, 1,3-	106-99-0	2.74E-07	9.18E-05	2.29E-05
Formaldehyde	50-00-0	8.26E-06	2.77E-03	6.92E-04
Naphthalene	91-20-3	5.94E-07	1.99E-04	4.98E-05
Total PAH (POM)[3]	--	1.18E-06	3.94E-04	9.86E-05
Toluene	108-88-3	2.86E-06	9.60E-04	2.40E-04
Xylene	1330-20-7	2.00E-06	6.69E-04	1.67E-04
		Total HAP Emissions	**0.0091**	**0.0023**
		Total TAP Emissions	**0.0089**	**0.0022**

Notes:

1. Emission factors from AP-42, Section - 3.3, Stationary Internal Combustion Engines, 10/96, Table 3.3-2.
2. NSPS allows for only 100 hr/yr of non-emergency operation of this engine. Potential emissions for the emergency generator are conservatively based on 500 hr/yr.
3. The PAH emission factor includes all the PAH compounds listed in AP-42. Emissions of naphthalene and benzo(a)pyrene are also calculated separately. For the purposes of calculating total HAP emissions, naphthalene and benzo(a)pyrene are not included to avoid double counting these emissions since they are included under POM.

Abbreviations:

Btu - British thermal unit
CAS - chemical abstract service
CH_4 - methane
CO - carbon monoxide
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
gal - gallon
HAP - hazardous air pollutant
hp - horsepower
hr - hour
kg - kilogram
kW - kilowatt
lb - pound
yr - year
MW - megawatt
MMBtu - Million British thermal units
NO_X - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PAH - polycyclic aromatic hydrocarbon
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less th
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.5
POM - polycyclic organic matter
SO_2 - sulfur dioxide
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound

References:

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

Table 22
Fire Pump Potential Emissions
FP01
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Basis

Engine Output	130.5 kW
Horsepower Rating	175 brake hp
Brake Specific Fuel Consumption	7,000 Btu/hp-hr
Diesel Heating Value	19,300 Btu/lb
Diesel Density[1]	7.1 lb/gal
Hours of Operation	8,760 hr/yr
Hourly Fuel Consumption	9 gal/hr
Heat Input[2]	1.23 MMBtu/hr

Notes:
1. Diesel density from AP-42 Section 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines, 10/96, Table 3.4-1, footnote a.
2. Heat input calculated on a brake-specific fuel consumption of 7,000 Btu/hp-hr per AP-42, Section 3.3 - Stationary Internal Combustion Engines, 10/96.

Potential Criteria Pollutant Emissions

Pollutant	Emission Factor	Units	Potential Emissions	
			(lb/hr)	(tpy)
CO	5.73E-03	lb/hp-hr[1]	1.00	4.39
NO_X	6.61E-03	lb/hp-hr[1]	1.16	5.07
SO_2[3]	15	ppmw[2]	0.0019	0.0083
VOC	2.51E-03	lb/hp-hr[3]	0.44	1.92
PM	3.31E-04	lb/hp-hr[1,4]	0.058	0.25
PM_{10}	3.31E-04	lb/hp-hr[1,4]	0.058	0.25
$PM_{2.5}$	3.31E-04	lb/hp-hr[1,4]	0.058	0.25
CO_2	74	kg/MMBtu[5]	200	875
CH_4	3.0E-03	kg/MMBtu[5]	0.0081	0.035
N_2O	6.0E-04	kg/MMBtu[5]	0.0016	0.0071
CO_2e			200	878

Notes:
1. Tier 3 Emission Standards from NSPS Subpart IIII were used for PM, CO, and NO_X.
2. Sulfur content in accordance with 40 CFR 1090.305 as required by NSPS Subpart IIII.
3. Emission factor for VOC is from USEPA AP-42 Section 3.3, Stationary Internal Combustion Engines, 10/96, Table 3.3-
4. All PM is conservatively estimated to be <1 micron in size.
5. Emission factors from Table C-1 and C-2 of 40 CFR Part 98 and Global Warming Potentials from Table A-1.

Table 22
Fire Pump Potential Emissions
FP01
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Potential HAP Emissions

Pollutant	CAS No.	Emission Factor[1]	Potential Emissions	
		(lb/hp-hr)	(lb/hr)	(tpy)
Acetaldehyde	75-07-0	5.37E-06	9.40E-04	4.12E-03
Acrolein	107-02-8	6.48E-07	1.13E-04	4.96E-04
Benzene	71-43-2	6.53E-06	1.14E-03	5.01E-03
Benzo(a)pyrene	50-32-8	1.32E-09	2.30E-07	1.01E-06
Butadiene, 1,3-	106-99-0	2.74E-07	4.79E-05	2.10E-04
Formaldehyde	50-00-0	8.26E-06	1.45E-03	6.33E-03
Naphthalene	91-20-3	5.94E-07	1.04E-04	4.55E-04
Total PAH (POM)[2]	--	1.18E-06	2.06E-04	9.01E-04
Toluene	108-88-3	2.86E-06	5.01E-04	2.19E-03
Xylene	1330-20-7	2.00E-06	3.49E-04	1.53E-03
		Total HAP Emissions	**0.0047**	**0.021**
		Total TAP Emissions	**0.0046**	**0.020**

Notes:
1. Emission factors obtained from AP-42 Section 3.3 - Stationary Internal Combustion Engines, 10/96, Table 3.3-2.
2. The PAH emission factor includes all the PAH compounds listed in AP-42. Emissions of naphthalene and benzo(a)pyrene are also calculated separately. For the purposes of calculating total HAP emissions, naphthalene and benzo(a)pyrene are not included to avoid double counting these emissions since they are included under POM.

Abbreviations:

Btu - British thermal unit
CH_4 - methane
CAS - chemical abstract service
CO - carbon monoxide
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
gal - gallon
HAP - hazardous air pollutant
hp - horsepower
hr - hour
kg - kilogram
kW - kilowatt
lb - pound
MW - megawatt
MMBtu - Million British thermal units
NO_X - nitrogen oxides
N_2O - nitrous oxide
ODT - oven dried tons
PAH - polycyclic aromatic hydrocarbon
PM - particulate matter
PM_{10} - particulate matter with an aerodynamic diameter less t
$PM_{2.5}$ - particulate matter with an aerodynamic diameter of 2.
POM - polycyclic organic matter
SO_2 - sulfur dioxide
TAP - toxic air pollutant
tpy - tons per year
VOC - volatile organic compound
yr - year

References:

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

Table 23
Diesel Storage Tanks
ST1 and ST2
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Calculation Constants

Description	ST1	ST2	Units	Notes
α - Tank Paint Solar Absorptance	0.25		dimensionless	AP-42, Chapter 7 - Table 7.1-6 for White Tank, Average Condition
I - Annual Avg Total Solar Insolation Factor	1,480		dimensionless	AP-42, Chapter 7 - Table 7.1-7 for Jacksonville, FL
T_{AX} - Annual Avg Maximum Ambient Temperature	538		R	AP-42, Chapter 7 - Table 7.1-7 for Jacksonville, FL
T_{AN} - Annual Avg Minimum Ambient Temperature	518		R	AP-42, Chapter 7 - Table 7.1-7 for Jacksonville, FL
R - Ideal Gas Constant	10.731		psia*ft^3/lb-mole R	AP-42, Chapter 7 - Page 7.1-23
Kp - Product Factor	1		dimensionless	Assume conservative value of 1
P_{VX} - Vapor Pressure at T_{AX}	0.0116		psia	AP-42, Chapter 7 - Equation 1-25 (exp[A-(B/T_{LA})])
P_{VN} - Vapor Pressure at T_{AN}	0.0061		psia	AP-42, Chapter 7 - Equation 1-25 (exp[A-(B/T_{LA})])
ΔP_V - Daily Vapor Pressure Range	0.0055		psia	AP-42, Chapter 7 - Equation 1-9
ΔP_B - Breather Vent Pressure Setting Range	0.06		psia	AP-42, Chapter 7 - Page 7.1-19 Note 3 (default)
P_A - Atmospheric Pressure	14.68		psia	AP-42, Chapter 7 - Table 7.1-7 for Jacksonville, FL

Calculation Inputs

Description	ST1	ST2	Units	Notes
Tank Diameter	3.8	7.6	ft	Tank dimensions for corresponding design volume
Tank Length	12	29.9	ft	Tank dimensions for corresponding design volume
Tank Design Volume	1,000	10,000	gal	Conservative design specifications
Tank Working Volume	500	5,000	gal	50% of tank design volume because tanks will not be full at all times
Tank Throughput	20,000	100,000	gal/yr	Engineering estimate
Equivalent Tank Diameter (D_E)	7.6	17.0	ft	AP-42, Chapter 7 - Equation 1-14 (SQRT(LD/(PI/4)))
Effective Height (H_E)	3.0	6.0	ft	AP-42, Chapter 7 - Equation 1-15 (PI/4*D)
V_v - Vapor Space Volume	67.7	675.6	ft^3	AP-42, Chapter 7 - Equation 1-3 (PI/4*D^2*H_{VO}), substitute D_E for D for horizontal tanks
H_{vo} - Vapor Space Outage	1.5	3.0	ft	AP-42, Chapter 7 - H_{VO} = 0.5*H_E for horizontal tanks
P_{VA} - Vapor Pressure	0.009	0.009	psia	Vapor pressure for Distillate Fuel Oil No. 2 at 70°F
M_v - Vapor Molecular Weight	130	130	lb/lb-mole	AP-42, Chapter 7 - Table 7.1-2 for diesel
Q - Throughput	476.2	2,381.0	bbl/yr	

Calculated Values

Description	ST1	ST2	Units	Notes
K_e - Vapor Space Expansion Factor	0.037	0.037	dimensionless	AP-42, Chapter 7 - Equation 1-5 ($\Delta T_V/T_{LA}$ + ((ΔP_V - ΔP_B)/(P_A - ΔP_{VA}))
ΔT_v - Daily Vapor Temperature Range	21.40	21.40	R	AP-42, Chapter 7 - Equation 1-7 (0.7*ΔT_A + 0.02*α*I)
ΔT_A - Daily Ambient Temperature Range	20	20	R	AP-42, Chapter 7 - Equation 1-11 (T_{AX} - T_{AN})
K_S - Vented Vapor Saturation Factor	1.00	1.00	dimensionless	AP-42, Chapter 7 - Equation 1-21 (1/(1 + 0.053P_{VA}*H_{VO}))
W_v - Stock Vapor Density	0.00021	0.00021	lb/ft^3	AP-42, Chapter 7 - Equation 1-22 (Mv * P_{VA}) / (R * T_V)
T_V - Average Vapor Temperature	531.7	531.7	R	AP-42, Chapter 7 - Equation 1-33 (0.7*T_{AX} + 0.3T_B + 0.009α*I)
T_{AA} - Daily Average Ambient Temperature	528.0	528.0	R	AP-42, Chapter 7 - Equation 1-30 ((T_{AX} + T_{AN})/2)
T_B - Liquid Bulk Temperature	529.1	529.1	R	AP-42, Chapter 7 - Equation 1-31 (T_{AA} + 0.003αI)
T_{LA} - Daily Average Liquid Surface Temperature	530.5	530.5	R	AP-42, Chapter 7 - Equation 1-28 (0.4*T_{AA} + 0.6T_B + 0.005*α*I)
N - Number of Turnovers	40.0	20.0	dimensionless	
K_N - Working Loss Turnover (Saturation) Factor	1	1.00	dimensionless	AP-42, Chapter 7 - Page 7.1-28 (For N>36, K_N = (180 + N)/6N; For N≤36, K_N = 1)
V_Q - Net Working Loss Throughput	2,673	13,367	ft^3/yr	AP-42 Chapter 7 - Equation 1-39 (5.614*Q)
K_p - Working Loss Product Factor	1	1	dimensionless	AP-42 Chapter 7 - Page 7.1-28
K_B - Vent Setting Correction Factor	1	1	dimensionless	AP-42 Chapter 7 - Page 7.1-28

Potential VOC Emissions

Description	ST1	ST2	Units	Notes
L_s - Standing Loss	0.19	1.85	lbs/yr	AP-42, Chapter 7 - Equation 1-2 (365 * Vv * Wv * Ke * Ks)
L_w - Working Loss	0.50	2.74	lbs/yr	AP-42, Chapter 7 - Equation 1-35 (V_Q * K_N * K_p * W_V * K_B)
L_t - Total Loss	0.69	4.59	lbs/yr	AP-42, Chapter 7 - Equation 1-1 (Ls + Lw)
Contingency Factor	1.00	1.00	dimensionless	Assumed contingency factor to account for unaccounted variables.
Total VOC Emissions per Tank	0.69	4.59	lbs/yr	
Total VOC Emissions	**3.44E-04**	**2.30E-03**	**tons/yr**	

Reference:

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

Table 24
Potential Fugitive PM Emissions from Paved Roads
Enviva Pellets Waycross, LLC
Waycross, Ware County, Georgia

Vehicle Activity	Distance Traveled per Roundtrip[1] (ft)	Trips Per Day[1]	Daily VMT	Events Per Year (days)	Empty Truck Weight (lb)	Loaded Truck Weight (lb)	Average Truck Weight (ton)	Annual VMT	PM Emission Factor[2] (lb/VMT)	PM_{10} Emission Factor[2] (lb/VMT)	$PM_{2.5}$ Emission Factor[2] (lb/VMT)	Potential PM Emissions (lb/day)	Potential PM Emissions (tpy)	Potential PM_{10} Emissions (lb/day)	Potential PM_{10} Emissions (tpy)	Potential $PM_{2.5}$ Emissions (lb/day)	Potential $PM_{2.5}$ Emissions (tpy)
Log Delivery	7,000	230	305	352	26,000	80,000	26.5	107,333	0.93	0.19	0.046	284	49.9	56.7	10.0	13.9	2.45
Bark Delivery	7,000	6	8.0	352	26,000	80,000	26.5	2,800	0.93	0.19	0.046	7.40	1.30	1.48	0.26	0.36	0.064
Sawdust/Shavings Delivery	750	40	5.7	352	26,000	80,000	26.5	2,000	0.93	0.19	0.046	5.29	0.93	1.06	0.19	0.26	0.046
Misc. Materials Delivery	7,000	1	1.3	352	26,000	80,000	26.5	467	0.93	0.19	0.046	1.23	0.22	0.247	0.043	0.061	0.011
Sand Trucks	500	10	0.9	93	26,000	80,000	26.5	88	0.93	0.19	0.046	0.88	0.04	0.176	0.008	0.043	0.002
Sand Pile Management	4,000	4	3.0	350	--	--	25.0	1,061	0.88	0.18	0.043	2.66	0.46	0.531	0.093	0.130	0.023
											Total Emissions:	**301**	**52.9**	**60.2**	**10.6**	**14.8**	**2.60**

Notes:
1. Roundtrip distances and daily trip counts based on engineering estimates.
2. Emission factors calculated based on Equation 2 from AP-42 Section 13.2.1 - Paved Roads, 01/11.

where:

E = emission factor (lb/ton)

k = particle size multiplier (dimensionless) for PM 0.011

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

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

sL - mean road surface silt loading based on sampling data from a wood pellet manufacturing plant (g/m^2) 3.6

P - No. days with rainfall greater than 0.01 inch 110 Per AP-42, Section 13.2.1, Figure 13.2.1-2 (Ware County, GA).

Abbreviations:

ft - feet
hr - hour
lb - pound
PM - particulate matter
tpy - tons per year
yr - year
VMT - vehicle miles traveled
VOC - volatile organic compound
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

Reference:

AP-42, Section 13.2.1 - Paved Roads, 01/11

APPENDIX D
ELECTRONIC MODELING FILES SHAREPOINT SITE LINK

SHAREPOINT LINK:

HTTPS://RAMBOLL-MY.SHAREPOINT.COM/:F:/R/PERSONAL/AJONES_RAMBOLL_COM/DOCUMENTS/ENVIVA%20WAYCROSS%202021%20TAP%20MODELING?CSF=1&WEB=1&E=ABIR2S

APPENDIX E
MODELED STACK PARAMETERS AND EMISSION RATES

Table E-1. Modeled Point Source Parameters

Model ID	Description	UTM Easting[1] (m)	UTM Northing[1] (m)	Elevation (m)	Stack Height (m)	Stack Temp. (K)	Exit Velocity (m/s)	Stack Diameter (m)
RTO1	Heat Energy System, Dryer No. 1	365722.73	3459038.67	42.98	17.3	408.71	21.4	2.07
FBYP1_I	Furnace 1 Bypass Stack "Idle Mode"	365718.03	3458988.75	42.98	25.3	305.37	0.67	1.37
FBYP1_S	Furnace 1 Bypass Stack - Cold Startup	365718.03	3458988.75	42.98	25.3	588.71	3.76	1.37
RTO2	Heat Energy System, Dryer No. 2	365714.79	3459041.58	42.98	17.3	408.71	21.4	2.07
FBYP2_I	Furnace 2 Bypass Stack "Idle Mode"	365685.97	3459003.02	42.98	25.3	305.37	0.67	1.37
FBYP2_S	Furnace 2 Bypass Stack - Cold Startup	365685.97	3459003.02	42.98	25.3	588.71	3.76	1.37
RCO1	Dry Chips Storage Silo, Conveying Aspiration System No. 1, Hammermill Lines 1 through 10	365615.00	3458888.00	42.67	25.9	392.59	16.4	2.26
RCO2	Conveying Equipment Aspiration System No. 2, Pellet Mill and Pellet Cooler Lines 1 through 5	365675.08	3458831.15	42.67	25.9	398.43	15.7	2.83
EG1	500 kW Diesel Emergency Generator - Dryers	365685.17	3459047.96	42.98	3.41	366.48	14.0	0.15
EG2	250 kW Emergency Generator - Pelletizing	365584.76	3458844.86	42.67	2.38	366.48	14.0	0.15
FP1	175 hp Diesel Fire Water Pump	365644.00	3458965.00	42.98	2.59	366.48	14.0	0.15

1. Coordinates reflect UTM NAD83, Zone 17.

Table E-2. Modeled Volume Source Parameters

Model ID	Description	Source Type	UTM Easting[1] (m)	UTM Northing[1] (m)	Elevation (m)	Release Height (m)	Initial Lateral Dimension (m)	Initial Vertical Dimension (m)
CHIP	Log Chipping	Volume	365940.37	3459716.33	43.89	15.0	0.85	6.97
RECHIP	Rechippers	Volume	365939.80	3459705.44	43.89	15.0	0.99	6.97
BHOG	Bark Hog	Volume	365778.23	3459651.83	42.98	1.70	0.28	0.37

1. Coordinates reflect UTM NAD83, Zone 17.

Table E-3a. Modeled Emission Rates

Model ID	Short-term Acetaldehyde		Annual Acetaldehyde		Short-term Acrolein		Annual Acrolein		Short-term Arsenic		Annual Arsenic	
	(lb/hr)	(g/s)	(tpy)	(g/s)	(lb/hr)	(g/s)	(tpy)	(g/s)	(lb/hr)	(g/s)	(tpy)	(g/s)
RTO1	1.50E+00	1.88E-01	5.56E+00	1.60E-01	3.63E-01	4.57E-02	1.35E+00	3.88E-02	2.19E-04	2.75E-05	9.57E-04	2.75E-05
FBYP1_I	8.30E-03	1.05E-03	2.08E-03	5.97E-05	4.00E-02	5.04E-03	1.00E-02	2.88E-04	2.20E-04	2.77E-05	5.50E-05	1.58E-06
FBYP1_S	2.40E-02	3.03E-03	6.01E-04	1.73E-05	1.16E-01	1.46E-02	2.90E-03	8.33E-05	6.37E-04	8.02E-05	1.59E-05	4.58E-07
RTO2	1.50E+00	1.88E-01	5.56E+00	1.60E-01	3.63E-01	4.57E-02	1.35E+00	3.88E-02	2.19E-04	2.75E-05	9.57E-04	2.75E-05
FBYP2_I	8.30E-03	1.05E-03	2.08E-03	5.97E-05	4.00E-02	5.04E-03	1.00E-02	2.88E-04	2.20E-04	2.77E-05	5.50E-05	1.58E-06
FBYP2_S	2.40E-02	3.03E-03	6.01E-04	1.73E-05	1.16E-01	1.46E-02	2.90E-03	8.33E-05	6.37E-04	8.02E-05	1.59E-05	4.58E-07
RCO1	1.15E-01	1.45E-02	3.92E-01	1.13E-02	8.03E-02	1.01E-02	2.74E-01	7.87E-03	3.14E-06	3.95E-07	1.37E-05	3.95E-07
RCO2	3.94E-01	4.97E-02	1.34E+00	3.87E-02	5.18E-01	6.53E-02	1.77E+00	5.08E-02	4.71E-06	5.93E-07	2.06E-05	5.93E-07
EG1	1.18E-04	1.49E-05	2.96E-05	8.51E-07	3.70E-05	4.66E-06	9.25E-06	2.66E-07	--	--	--	--
EG2	1.80E-03	2.27E-04	4.50E-04	1.29E-05	2.17E-04	2.74E-05	5.43E-05	1.56E-06	--	--	--	--
FP1	9.40E-04	1.18E-04	4.12E-03	1.18E-04	1.13E-04	1.43E-05	4.96E-04	1.43E-05	--	--	--	--
CHIP	--	--	--	--	--	--	--	--	--	--	--	--
BHOG	--	--	--	--	--	--	--	--	--	--	--	--
RECHIP	--	--	--	--	--	--	--	--	--	--	--	--

Table E-3b. Modeled Emission Rates

Model ID	Short-term Benzene		Annual Benzene		Short-term Cadmium		Annual Cadmium		Short-term Chlorine		Short-term Lead	
	(lb/hr)	(g/s)	(tpy)	(g/s)	(lb/hr)	(g/s)	(tpy)	(g/s)	(lb/hr)	(g/s)	(tpy)	(g/s)
RTO1	4.06E-02	5.11E-03	1.78E-01	5.11E-03	7.41E-05	9.33E-06	3.24E-04	9.33E-06	1.52E-01	1.92E-02	4.79E-04	6.03E-05
FBYP1_I	4.20E-02	5.29E-03	1.05E-02	3.02E-04	4.10E-05	5.17E-06	1.03E-05	2.95E-07	7.90E-03	9.95E-04	4.80E-04	6.05E-05
FBYP1_S	1.22E-01	1.53E-02	3.04E-03	8.74E-05	1.19E-04	1.50E-05	2.97E-06	8.54E-08	2.29E-02	2.88E-03	1.39E-03	1.75E-04
RTO2	4.06E-02	5.11E-03	1.78E-01	5.11E-03	7.41E-05	9.33E-06	3.24E-04	9.33E-06	1.52E-01	1.92E-02	4.79E-04	6.03E-05
FBYP2_I	4.20E-02	5.29E-03	1.05E-02	3.02E-04	4.10E-05	5.17E-06	1.03E-05	2.95E-07	7.90E-03	9.95E-04	4.80E-04	6.05E-05
FBYP2_S	1.22E-01	1.53E-02	3.04E-03	8.74E-05	1.19E-04	1.50E-05	2.97E-06	8.54E-08	2.29E-02	2.88E-03	1.39E-03	1.75E-04
RCO1	3.29E-05	4.15E-06	1.44E-04	4.15E-06	1.73E-05	2.17E-06	7.56E-05	2.17E-06	--	--	7.84E-06	9.88E-07
RCO2	4.94E-05	6.23E-06	2.16E-04	6.23E-06	2.59E-05	3.26E-06	1.13E-04	3.26E-06	--	--	1.18E-05	1.48E-06
EG1	3.64E-03	4.59E-04	9.11E-04	2.62E-05	--	--	--	--	--	--	--	--
EG2	2.19E-03	2.76E-04	5.47E-04	1.57E-05	--	--	--	--	--	--	--	--
FP1	1.14E-03	1.44E-04	5.01E-03	1.44E-04	--	--	--	--	--	--	--	--
CHIP	--	--	--	--	--	--	--	--	--	--	--	--
BHOG	--	--	--	--	--	--	--	--	--	--	--	--
RECHIP	--	--	--	--	--	--	--	--	--	--	--	--

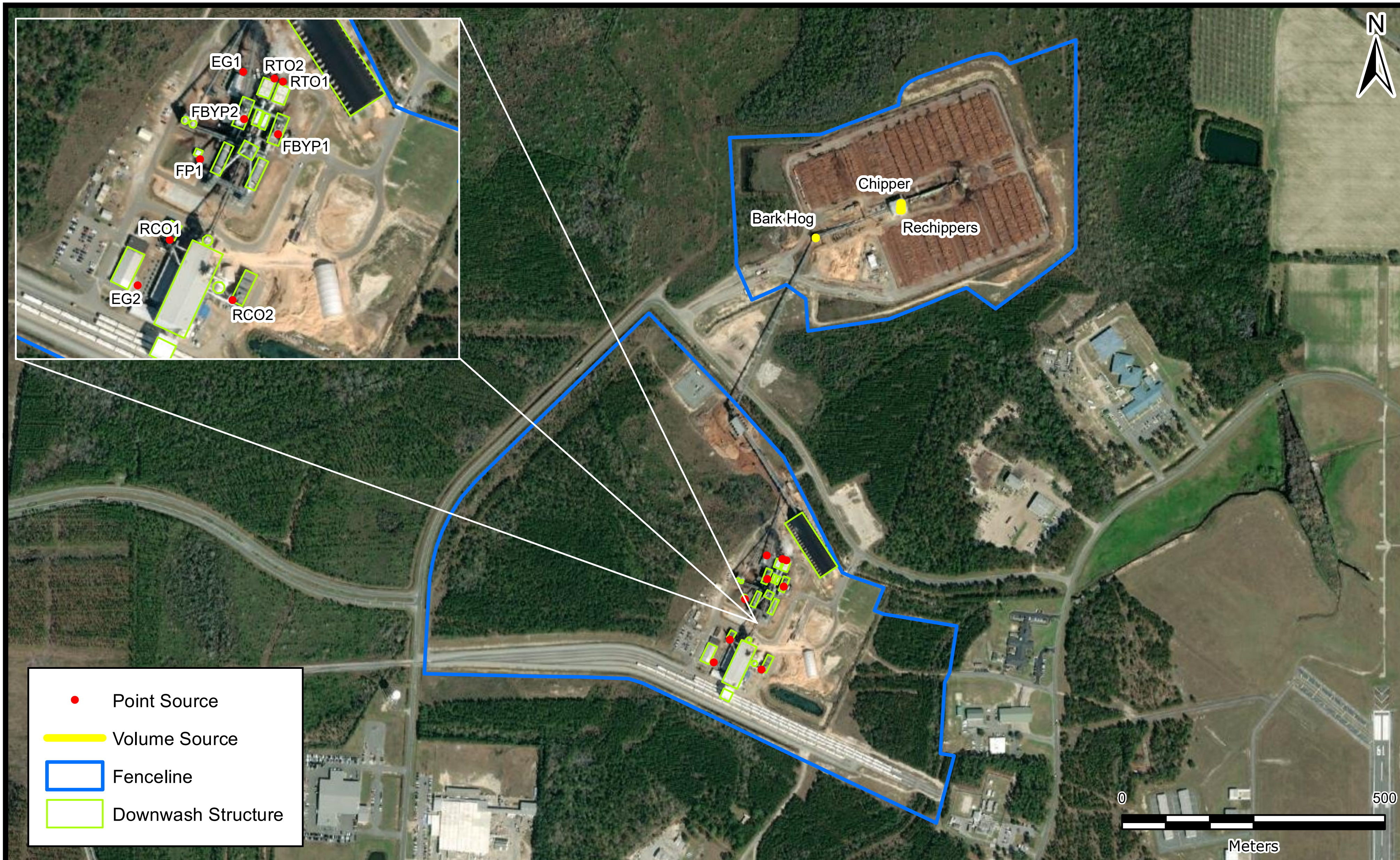
Table E-3c. Modeled Emission Rates

Model ID	Short-term Formaldehyde		Annual Formaldehyde		Short-term HCl		Annual HCl		Short-term Manganese		Annual Manganese	
	(lb/hr)	(g/s)	(tpy)	(g/s)	(lb/hr)	(g/s)	(tpy)	(g/s)	(lb/hr)	(g/s)	(tpy)	(g/s)
RTO1	8.89E-01	1.12E-01	3.30	9.50E-02	3.67E-01	4.62E-02	1.61	4.62E-02	1.55E-02	1.95E-03	6.77E-02	1.95E-03
FBYP1_I	4.40E-02	5.54E-03	1.10E-02	3.16E-04	1.90E-01	2.39E-02	4.75E-02	1.37E-03	1.60E-02	2.02E-03	4.00E-03	1.15E-04
FBYP1_S	1.27E-01	1.60E-02	3.18E-03	9.16E-05	5.50E-01	6.93E-02	1.38E-02	3.96E-04	4.63E-02	5.84E-03	1.16E-03	3.33E-05
RTO2	8.89E-01	1.12E-01	3.30	9.50E-02	3.67E-01	4.62E-02	1.61	4.62E-02	1.55E-02	1.95E-03	6.77E-02	1.95E-03
FBYP2_I	4.40E-02	5.54E-03	1.10E-02	3.16E-04	1.90E-01	2.39E-02	4.75E-02	1.37E-03	1.60E-02	2.02E-03	4.00E-03	1.15E-04
FBYP2_S	1.27E-01	1.60E-02	3.18E-03	9.16E-05	5.50E-01	6.93E-02	1.38E-02	3.96E-04	4.63E-02	5.84E-03	1.16E-03	3.33E-05
RCO1	1.94E-01	2.45E-02	0.66	1.91E-02	--	--	--	--	5.96E-06	7.51E-07	2.61E-05	7.51E-07
RCO2	4.21E-01	5.31E-02	1.44	4.13E-02	--	--	--	--	8.94E-06	1.13E-06	3.92E-05	1.13E-06
EG1	3.70E-04	4.67E-05	9.26E-05	2.66E-06	--	--	--	--	--	--	--	--
EG2	2.77E-03	3.49E-04	6.92E-04	1.99E-05	--	--	--	--	--	--	--	--
FP1	1.45E-03	1.82E-04	6.33E-03	1.82E-04	--	--	--	--	--	--	--	--
CHIP	--	--	--	--	--	--	--	--	--	--	--	--
BHOG	--	--	--	--	--	--	--	--	--	--	--	--
RECHIP	--	--	--	--	--	--	--	--	--	--	--	--

Table E-3d. Modeled Emission Rates

Model ID	Short-term Methanol		Annual Methanol		Annual Propionaldehyde	
	(lb/hr)	(g/s)	(tpy)	(g/s)	(lb/hr)	(g/s)
RTO1	5.48E+00	6.90E-01	20.35	5.86E-01	0.37	1.06E-02
FBYP1_I	--	--	--	--	1.53E-04	4.39E-06
FBYP1_S	--	--	--	--	4.41E-05	1.27E-06
RTO2	5.48E+00	6.90E-01	2.04E+01	5.86E-01	3.68E-01	1.06E-02
FBYP2_I	--	--	--	--	1.53E-04	4.39E-06
FBYP2_S	--	--	--	--	4.41E-05	1.27E-06
RCO1	4.05E-01	5.10E-02	1.38E+00	3.97E-02	1.37E-01	3.94E-03
RCO2	5.02E-01	6.33E-02	1.71E+00	4.92E-02	2.38E-01	6.83E-03
EG1	--	--	--	--	--	--
EG2	--	--	--	--	--	--
FP1	--	--	--	--	--	--
CHIP	--	--	--	--	--	--
BHOG	--	--	--	--	--	--
RECHIP	--	--	--	--	--	--

APPENDIX F
MODELED LAYOUT



RAMBOLL

DRAFTED BY: ARJ | DATE: 10/28/2021

Modeled Layout
Enviva Pellets Waycross, LLC
Ware County, Georgia

FIGURE
F-1

PROJECT: 1690020938