TABLE B-8
PELLET PRESSES AND COOLERS - VOC, HAP, AND TAP EMISSIONS (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Calculation Inputs:

Annual Composition and Throughput

Throughput ODT/yr	341,819
Hardwood Composition	90%
Softwood Composition	10%

Emission Calculations:

Pollutant	CAS Number	HAP (Yes/No)	NC TAP (Yes/No)	VOC (Yes/No)	Emission Factor		Emission Factor		Emissions
					Stack Tests				
					Emission Factor (lb/ODT)	Reference	Annual EF (lb/ODT)	EF Source	(tpy)
VOC as alpha-pinene	N/A	N/A	N/A	N/A	0.14	[1]	0.14	stack test	24.23
Acetaldehyde	75-07-0	Yes	Yes	Yes	0.00E+00	[2]	0.00E+00	stack test	0.00E+00
Acrolein	107-02-8	Yes	Yes	Yes	0.00E+00	[2]	0.00E+00	stack test	0.00E+00
Formaldehyde	50-00-0	Yes	Yes	Yes	1.32E-03	[2]	1.32E-03	stack test	2.25E-01
Methanol	67-56-1	Yes	No	Yes	2.64E-03	[2]	2.64E-03	stack test	4.51E-01
Propionaldehyde	123-38-6	Yes	No	Yes	0.00E+00	[2]	0.00E+00	stack test	0.00E+00
								Total VOC	**24.23**
								Total HAPs	**0.68**

Notes:

[1] VOC emissions from Enviva Northampton September 2013 engineering stack test results.

[2] HAP & TAP emission factors obtained from Enviva Northampton September 2013 Stack Testing.

TABLE B-9
BARK HOG VOC, PM, and HAP Emissions (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Annual Throughput of Bark Hog	75,964	tons/year (dry wood)[1]
Dryer Throughput	43.00	tons/hr (dry wood)[1]

Pollutant	Emission Factors (lb/dry wood tons)	(tpy)
THC as Carbon[2]	0.0041	0.16
THC as alpha-Pinene[3]	0.0047	0.18
PM[4]	N/A	N/A
Methanol[2]	0.0010	0.04

[1] The annual throughput used for the bark-hog is obtained from facility operating records. The short-term throughput is based upon the maximum throughput to the dryer.

[2] Emission factor obtained from available emissions factors for chippers in AP-42 Section 10.6.3, Table 7 and Section 10.6.4, Tables 7 and 9. Emission factors for THC and Methanol are the same across all three tables.

[3] The THC/VOC makeup of wood is primarily composed of terpenes $(C_5H_8)_n$ [where n = 2, 3, or 4 typically] but to convert from carbon to the equivalent weight in THC/VOC, the assumption was that alpha-pinene (AP) would be the representative THC/VOC (molecular weight = 136.2 lb/lb-mol).
The following equation shows the conversion:
*lb VOC/ODT = lb C/ODT * (136.2 lb/mol AP / 12 lb/mol C) * (1 mol AP / 10 mol C)*

[4] PM emission factor is not applicable as the bark hog emissions are routed downward to the ground.

TABLE B-10
ELECTRIC POWERED CHIPPER (ES-CHIP1) - VOC, HAP, AND TAP EMISSIONS (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Annual Throughput to ES-CHP1	261,650	tn/yr
Moisture Content:	42%	
Annual Throughput to ES-CHP1	151,757	tons/year (dry wood)[1]
Short-term Throughput of Chipper	43.00	tons/hr (dry wood)[1]

Pollutant	Emission Factors (lb/dry wood tons)	Emissions[5] (tpy)
THC as Carbon[2]	0.0041	0.31
THC as alpha-Pinene[3]	0.0047	0.35
PM[4]	N/A	**N/A**
Methanol[2]	0.0010	**0.08**

[1] The annual throughput used for CHP1 is based on facility throughput records. The annual throughput to CHP2 is conservatively assumed to be the same as the dryer. The short-term throughput is based upon the maximum hourly throughput of the dryer.

[2] Emission factor obtained from available emissions factors for rechippers in AP-42 Section 10.6.3, Table 7 and Section 10.6.4, Tables 7 and 9. Emission factors for THC and Methanol are the same across all three tables.

[3] The THC/VOC makeup of wood is primarily composed of terpenes $(C_5H_8)_n$ [where n = 2, 3, or 4 typically] but to convert from carbon to the equivalent weight in THC/VOC, the assumption was that alpha-pinene (AP) would be the representative THC/VOC (molecular weight = 136.2 lb/lb-mol). The following equation shows the conversion:

*lb VOC/ODT = lb C/ODT * (136.2 lb/mol AP / 12 lb/mol C) * (1 mol AP / 10 mol C)*

[4] PM emission factor is not applicable as rechipper emissions are routed downward to the ground.

[5] Short term emissions were based upon the max short term capacity of the chippers. Emissions are representative of the total combined emissions for both rechippers.

TABLE B-11
GREEN HAMMERMILL (ES-CHP2) - VOC, HAP, AND TAP EMISSIONS (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Annual Throughput to ES-CHP2	517,272	tn/yr
Moisture Content:	42%	
Annual Throughput to ES-CHP2	300,018	tons/year (dry wood)[1]
Short-term Throughput of Green Hammermill	43.00	tons/hr (dry wood)[1]

Pollutant	Emission Factors (lb/dry wood tons)	Emissions[5] (tpy)
THC as Carbon[2]	0.0041	0.62
THC as alpha-Pinene[3]	0.0047	0.70
PM[4]	N/A	N/A
Methanol[2]	0.0010	**0.15**

[1] The annual throughput used for CHP1 is based on facility throughput records. The annual throughput to CHP2 is conservatively assumed to be the same as the dryer. The short-term throughput is based upon the maximum hourly throughput of the dryer.

[2] Emission factor obtained from available emissions factors for rechippers in AP-42 Section 10.6.3, Table 7 and Section 10.6.4, Tables 7 and 9. Emission factors for THC and Methanol are the same across all three tables.

[3] The THC/VOC makeup of wood is primarily composed of terpenes $(C_5H_8)_n$ [where n = 2, 3, or 4 typically] but to convert from carbon to the equivalent weight in THC/VOC, the assumption was that alpha-pinene (AP) would be the representative THC/VOC (molecular weight = 136.2 lb/lb-mol). The following equation shows the conversion:
*lb VOC/ODT = lb C/ODT * (136.2 lb/mol AP / 12 lb/mol C) * (1 mol AP / 10 mol C)*

[4] PM emission factor is not applicable as rechipper emissions are routed downward to the ground.

[5] Short term emissions were based upon the max short term capacity of the chippers. Emissions are representative of the total combined emissions for both rechippers.

TABLE B-12
BAGFILTER AND CYCLONE EMISSIONS (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Emission Unit	Emission Source ID	Filter. Vent -or- Cyclone ID	Flowrate[1] (cfm)	Pollutant Loading[2] (gr/cf)	Annual Operation (hours)	% PM that is PM_{10}	% PM that is $PM_{2.5}$	PM (tpy)	PM_{10}[3] (tpy)	$PM_{2.5}$[3] (tpy)
Dried Wood Day Silo	ES-DWDS	CD-DWS-BV	2186	0.01	8,760	100%	100%	0.82	0.82	0.82
Dry Wood Hammermills 1 & 2	ES-CHM	CD-CHM-FF1	40000	0.01	8,760	100%	100%	15.02	15.02	15.02
Dry Wood Hammermills 3 & 4	ES-CHM	CD-CHM-FF2	40000	0.01	8,760	100%	100%	15.02	15.02	15.02
Hammermill Area and HM-5	ES-HAF	CD-HAF-FF1	32,500	0.01	8,760	100%	100%	12.20	12.20	12.20
Pellet Mill Feed Silo Bin Vent Filter	ES-PMFS	CD-PMFS-BV	2,186	0.01	8,760	100%	100%	0.82	0.82	0.82
Fines Bin	ES-FB	CD-FB-BV	3,600	0.003	8,760	100%	100%	0.41	0.41	0.41
Finished Product Handing	ES-FPH, ES-PL, ES-TLB	CD-FPH-BV	35,500	0.003	8,760	100%	100%	4.00	4.00	4.00
Pellet Coolers Cyclone 1 & 2	ES-CLR-1	CD-CLR-1	27,500	0.022	8,760	100%	100%	22.71	22.71	22.71
Pellet Coolers Cyclone 3 & 4	ES-CLR-2	CD-CLR-2	27,500	0.022	8,760	100%	100%	22.71	22.71	22.71
Pellet Coolers Cyclone 5	ES-CLR-5	CD-CLR-3	13,750	0.022	8,760	100%	100%	11.36	11.36	11.36
Pellet Coolers Cyclone 6	ES-CLR-6	CD-CLR-4	0	0.022	0	100%	100%	-	-	-
							TOTAL	**105.06**	**105.06**	**105.06**

Note:

[1] Filter, Vent, and Cyclone inlet flow rate (cfm) provided by design engineering firm (Mid-South Engineering Co.).

[2] Unless otherisw specidied, pollutant (PM) loading conservatively assumed to be 0.01 gr/dscf.

[3] It was conservatively assumed that PM_{10} and $PM_{2.5}$ equal PM emissions.

TABLE B-13
EMERGENCY GENERATOR AND FIRE PUMP (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Emergency Generator Emissions (ES-EG)

Equipment and Fuel Characteristics

Engine Output	0.26	MW
Engine Power	350	hp (brake)
Hours of Operation	26	hr/yr[1]
Heating Value of Diesel	19,300	Btu/lb
Power Conversion	7,000	Btu/hr/hp
Fuel Usage	17.6	gal/hr

Criteria Pollutant Emissions

Pollutant	Category	Emission Factor	Units	tpy
TSP	PSD	4.41E-04	lb/kW-hr (2)	1.51E-03
PM_{10}	PSD	4.41E-04	lb/kW-hr (2)	1.51E-03
$PM_{2.5}$	PSD	4.41E-04	lb/kW-hr (2)	1.51E-03
NO_x	PSD	8.82E-03	lb/kW-hr (5)	3.02E-02
SO_2	PSD	15	ppmw (3)	4.99E-05
CO	PSD	7.72E-03	lb/kW-hr (2)	2.64E-02
VOC (NMHC)	PSD	2.51E-03	lb/MMBtu (4)	8.06E-05
Toxic/Hazardous Air Pollutant Emissions				
Acetaldehyde	HAP/TAP	5.37E-06	lb/hp-hr (4)	2.46E-05
Acrolein	HAP/TAP	6.48E-07	lb/hp-hr (4)	2.97E-06
Benzene	HAP/TAP	6.53E-06	lb/hp-hr (4)	2.99E-05
Benzo(a)pyrene[6]	HAP/TAP	1.32E-09	lb/hp-hr (4)	6.03E-09
1,3-Butadiene	HAP/TAP	2.74E-07	lb/hp-hr (4)	1.25E-06
Formaldehyde	HAP/TAP	8.26E-06	lb/hp-hr (4)	3.79E-05
Total PAH (POM)	HAP	1.18E-06	lb/hp-hr (4)	5.39E-06
Toluene	HAP/TAP	2.86E-06	lb/hp-hr (4)	1.31E-05
m-,p-Xylene	HAP/TAP	2.00E-06	lb/hp-hr (4)	9.15E-06
Highest HAP (Formaldehyde)		8.26E-06	lb/hp-hr (4)	3.79E-05
Total HAPs				1.24E-04

Note:

[1] Operating hours based on facility operational records.

[2] Emissions factors from NSPS Subpart IIII (or 40 CFR 89.112 where applicable) in compliance with post-2009 construction.

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

[4] Emission factor obtained from AP-42 Section 3.3, Tables 3.3-1 Table 3.3-2.

[5] Emission factor for NOx is listed as NOx and NMHC (Non-Methane Hydrocarbons or VOC) in Table 4 of NSPS Subpart IIII. Conservatively assumed entire limit attributable to NOx.

[6] Benzo(a)pyrene is included as a HAP in Total PAH.

Firewater Pump Emissions (ES-FWP)

Equipment and Fuel Characteristics

Engine Output	0.22	MW
Engine Power	300	hp
Hours of Operation	17	hr/yr[1]
Heating Value of Diesel	19,300	Btu/lb
Power Conversion	7,000	Btu/hr/hp
Fuel Usage	15.1	gal/hr

Criteria Pollutant Emissions

Pollutant	Category	Emission Factor	Units	tpy
TSP	PSD	4.41E-04	lb/kW-hr (2)	8.25E-04
PM_{10}	PSD	4.41E-04	lb/kW-hr (2)	8.25E-04
$PM_{2.5}$	PSD	4.41E-04	lb/kW-hr (2)	8.25E-04
NO_x	PSD	8.82E-03	lb/kW-hr (5)	1.65E-02
SO_2	PSD	15	ppmw (3)	2.73E-05
CO	PSD	7.72E-03	lb/kW-hr (2)	1.44E-02
VOC (NMHC)	PSD	2.51E-03	lb/MMBtu (4)	4.41E-05
Toxic/Hazardous Air Pollutant Emissions				
Acetaldehyde	HAP/TAP	5.37E-06	lb/hp-hr (4)	1.35E-05
Acrolein	HAP/TAP	6.48E-07	lb/hp-hr (4)	1.62E-06
Benzene	HAP/TAP	6.53E-06	lb/hp-hr (4)	1.64E-05
Benzo(a)pyrene[6]	HAP/TAP	1.32E-09	lb/hp-hr (4)	3.30E-09
1,3-Butadiene	HAP/TAP	2.74E-07	lb/hp-hr (4)	6.87E-07
Formaldehyde	HAP/TAP	8.26E-06	lb/hp-ar (4)	2.07E-05
Total PAH (POM)	HAP	1.18E-06	lb/hp-hr (4)	2.95E-06
Toluene	HAP/TAP	2.86E-06	lb/hp-hr (4)	7.18E-06
m-,p-Xylene	HAP/TAP	2.00E-06	lb/hp-hr (4)	5.01E-06
Highest HAP (Formaldehyde)		8.26E-06	lb/hp-hr (4)	2.07E-05
Total HAPs				6.80E-05

Note:

[1] Operating hours based on facility operational records.

[2] Emissions factors from NSPS Subpart IIII (or 40 CFR 89.112 where applicable) in compliance with post-2009 construction.

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

[4] Emission factor obtained from AP-42 Section 3.3, Tables 3.3-1 Table 3.3-2.

[5] Emission factor for NOx is listed as NOx and NMHC (Non-Methane Hydrocarbons or VOC) in Table 4 of NSPS Subpart IIII. Conservatively assumed entire limit attributable to NOx.

[6] Benzo(a)pyrene is included as a HAP in Total PAH.

TABLE B-14
DRIED WOOD HANDLING DROP POINT EMISSIONS (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Annual Dryer Output Throughput (ODT/yr)	300,018	
Annual Pellet Press Throughput (ODT/yr)	341,819	
Dryer Output Moisture Content:	17%	
Pellet Mill Output Moisture Content:	6%	
Amount of Fines Diverted from Hammermills	15.0%	via AHO test for Dry Hammermill pre-screener bypass

ID	Emission Source Group	Description	Control	Control Description	Throughput		PM^3 Emissions	$PM_{10}{}^3$ Emissions	$PM_{2.5}{}^3$ Emissions
					Max. Hourly[2] (tph)	Annual (tpy)	(tpy)	(tpy)	(tpy)
DP1	ES-DWH	Dryer Discharger to Outfeed Conveyor	Enclosed	Reduction to 2 mph mean wind speed	51.81	361,467	6.5E-03	3.1E-03	4.7E-04
DP2	ES-DWH	Dryer Outfeed Conveyors to Silo Feed/Silo Bypass	Enclosed	Reduction to 2 mph mean wind speed	7.77	54,220	9.7E-04	4.6E-04	7.0E-05
DP3	ES-DWH	Silo Bypass/Dryer Silo to Conveyor Hammermill Surge Bin	Enclosed	Reduction to 2 mph mean wind speed	44.04	307,247	5.5E-03	2.6E-03	4.0E-04
DP4	ES-DWH	Conveyor to Hammermill Surge Bin Drop into HM Surge Bin	Enclosed	Reduction to 2 mph mean wind speed	44.04	307,247	5.5E-03	2.6E-03	4.0E-04
DP5	ES-PP	Drop Emissions from Pellet Presses to Pellet Press Collection Conveyors	Enclosed	Reduction to 2 mph mean wind speed	51.06	363,637	2.8E-02	1.3E-02	2.0E-03
						TOTAL	**4.7E-02**	**2.2E-02**	**3.3E-03**

Note:

[1] The listing of open transfer points may not be inclusive of all transfer points downstream of the dryer. Even if a few additional points may exist, the potential emission of the insignificant activity emission source group ES-DWH is well below the 5 tpy threshold for significant emissions. Fugitive emissions are not included in facility-wide PTE because the Northampton Pellet Mill does not belong to one of the listed 28 source categories.

[2] Max hourly rates based upon ODT production rate and moisture content at that part of the process.

[3] Based emission factors calculated per AP-42 Section 13.2.4, September 2006.

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)	2.00	
	Dryer Exit	Pellet Press Exit
M = material moisture content (%)	17	6
E for PM (lb/ton) =	3.6E-05	1.5E-04
E for PM_{10} (lb/ton) =	1.7E-05	7.3E-05
E for $PM_{2.5}$ (lb/ton) =	2.6E-06	1.1E-05

TABLE B-15
GREEN WOOD HANDLING DROP POINT EXAMPLE EMISSIONS (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

ID	Emission Source Group	Transfer Activity	Type of Operation	Number of Drop Points	PM Particle Size Multiplier (dimensionless)	PM_{10} Particle Size Multiplier (dimensionless)	$PM_{2.5}$ Particle Size Multiplier (dimensionless)	Mean Wind Speed (U) (mph)	Material Moisture Content (M)[1] (%)	PM Emission Factor[2] (lb/ton)	PM_{10} Emission Factor[2] (lb/ton)	$PM_{2.5}$ Emission Factor[2] (lb/ton)	Potential Throughput (tpy)	PM Emissions (tpy)	PM_{10} Emissions (tpy)	$PM_{2.5}$ Emissions (tpy)
GDP1	ES-GWH	Purchased Bark Transfer to Outdoor Storage Area	Batch Drop	1	0.74	0.35	0.053	6.3	48%	3.73E-05	1.76E-05	2.67E-06	0	0.00E+00	0.00E+00	0.00E+00
GDP1	ES-GWH	Drop Points via Conveying from Bark Pile to Dryer	Batch Drop	4	0.74	0.35	0.053	6.3	48%	3.73E-05	1.76E-05	2.67E-06	146,084	2.76E-03	1.30E-03	1.97E-04
GDP2	ES-GWH	Transfer Purchased Wood Chips (Wet) to Outdoor Storage	Batch Drop	1	0.74	0.35	0.053	6.3	48%	3.73E-05	1.76E-05	2.67E-06	285,116	1.35E-03	6.35E-04	9.63E-05
GDP2	ES-GWH	Drop Points via Conveying from Chip Pile to Dryer	Batch Drop	5	0.74	0.35	0.053	6.0	48%	3.51E-05	1.66E-05	2.51E-06	576,957	1.28E-02	6.06E-03	9.16E-04
		Total Emissions												**1.69E-02**	**7.99E-03**	**1.21E-03**

1. Average moisture content for logs, bark, and wood chips (wet) based on material balance provided by design engineering firm (Mid-South Engineering).

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) 6.3

M = material moisture content (%)

3. PM_{10} control efficiency of 74.7% applied for three-sided enclosed structure with 50% porosity per Sierra Research *"Final BACM Technological and Economic Feasibility Analysis"*, report prepared for the San Joaquin Valley Unified Air Pollution Control District (3/03). The control efficiency is assumed equivalent for PM_{10} and $PM_{2.5}$ emissions.

4. These green wood handling emissions are representative of the fugitive emissions at the site. Note there may be multiple drop points for each type but as shown these emissions will be negligible.

TABLE B-16
TANKS EMISSIONS (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Tank ID	Tank Description	Volume[1] (gal)	Tank Dimensions		Orientation	Throughput (gal/yr)	Turnovers[(3)]	TANKS 4.0 VOC Emissions	
			Diameter (ft)	Height/Length (ft)				(lb/yr)	(tpy)
TK01	Emergency Generator Fuel Oil Tank[2]	2,500	6	12	Vertical	462	0.185	1.45	7.25E-04
TK02	Fire Water Pump Fuel Oil Tank[2]	500	3	10	Horizontal	253	0.506	0.31	1.55E-04
							TOTAL	**1.76**	**8.80E-04**

Note:

[1] Conservative design specifications.

[2] Throughput based on fuel consumption based on engine horsepower (BHP), conversion to fuel usage (gal/hr), and engine operating hours.

[3] Tanks Program Calculations are performed with a minimum 1 turnover per year as a conservative measure.

TABLE B-17
POTENTIAL GHG EMISSIONS FROM COMBUSTION SOURCES (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Operating Data:

Dryer Heat Input	1227103.83	MMBtu/yr
Emergency Generator Output	350	bhp
Operating Schedule	26	hrs/yr
No. 2 Fuel Input	16.7	gal/hr[1]
Energy Input	2.282	MMBtu/hr[2]
Fire Water Pump Output	300	bhp
Operating Schedule	17	hrs/yr
No. 2 Fuel Input	14.3	gal/hr[1]
Energy Input	1.956	MMBtu/hr[2]

Emission Unit ID	Fuel Type	Emission Factors from Table C-1 (kg/MMBtu)[3]			Tier 1 Emissions (metric tons)				
		CO2	CH4	N2O	CO2	CH4	N2O	Total CO2e biomass deferral[4]	Total CO2e
ES-DRYER	Wood and Wood Residuals	9.38E+01	3.20E-02	4.20E-03	126,877	43	6	2,670	129,547
ES-GN	No. 2 Fuel Oil (Distillate)	7.40E+01	3.00E-03	6.00E-04	5	1.98E-04	3.96E-05	5	5
ES-FWP	No. 2 Fuel Oil (Distillate)	7.40E+01	3.00E-03	6.00E-04	3	1.08E-04	2.16E-05	3	3

[1] Fuel consumption calculated using a factor of 0.0476 gal/hr-hp. Advanced Environmental Interface, Inc. (1998). General Permits for Emergency Engines. INSIGHTS, 98-2, 3.

[2] Energy calculated on a fuel consumption basis, using an energy factor of 0.137 MMBtu/gal.

[3] Emission factors from Table C-1 and C-2 of GHG Reporting Rule. Emission factors for methane and N2O already multiplied by their respective GWPs of 21 and 310.

[4] As per NC DAQ Biomass Deferral Rule 15A NCAC 02D .0544, CO2 emissions from bioenergy and other biogeneic sources are not applicable towards PSD and Title V permitting. Therefore CO2 emissions form the dryer are not included in the Total CO2e biomass deferral column.

TABLE B-18
GREEN WOOD STORAGE PILES FUGITIVE EMISSIONS (12/2013 - 11/2014)
ENVIVA PELLETS AHOSKIE

Emission Unit ID	Description	TSP Emission Factor [1] (lb/day/acre)	TSP Emission Factor [1] (lb/hr/ft^2)	VOC Emission Factor [3] (lb/day/acre)	VOC Emission Factor [3] (lb/hr/ft^2)	Width (ft)	Length (ft)	Height (ft)	Outer Surface Area of Storage Pile (ft^2)	PM Emissions (tpy)	PM_{10} Emissions (tpy)	$PM_{2.5}$ Emissions (tpy)	VOC as Carbon Emissions (tpy)	VOC as alpha-Pinene Emissions[5] (tpy)
GWSP1	Green Wood Pile No. 1	3.71	3.55E-06	3.60	3.44E-06	100	400	10	60,000	0.933	0.467	0.070	0.90	1.03
GWSP2	Green Wood Pile No. 2	3.71	3.55E-06	3.60	3.44E-06	200	400	10	110,400	1.717	0.859	0.129	1.67	1.90
Total										**2.651**	**1.325**	**0.199**	**2.57**	**2.93**

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.

where:

s, silt content of wood chips (%):	4.8	s - silt content(%) for lumber sawmills (minimum), from AP-42 Table 13.2.2-1
p, number of days with rainfall greater than 0.01 inch:	120	Based on AP-42, Section 13.2.2, Figure 13.2.1-2.
f (time that wind exceeds 5.36 m/s - 12 mph) (%):	9.8	Based on meteorological data averaged for 2007-2011 for Northampton, NC.
PM_{10}/TSP ratio:	50%	PM_{10} is assumed to equal 50% of TSP based on U.S. EPA *Control of Open Fugitive Dust Sources* , Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988.

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

$PM_{2.5}$ 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. The surface area is calculated as [2*H*L+2*W*H+L*W] + 20% to consider the sloping pile edges. Length and width based on proposed site design with a conservative height.

3. Emission factors obtained from NCASI document provided by SC DHEC for the calculation of fugitive VOC emissions from Douglas Fir wood storage piles. Emission factors ranged from 1.6 to 3.6 lb C/acre-day. Enviva chose to employ the maximum emission factor for purposes of conservatism.

4. Emissions are calculated in tons of carbon per year by the following formula:

*tons C/year = 5 acres * 365 days * 1.6 lb C/acre-day / 2000 lb/ton*

Emission factor converted from as carbon to as alpha-pinene by multiplying by 1.14.

APPENDIX B.3

Enviva Pellets Ahoskie, LLC

Modified Source Emissions Calculations

TABLE B-1
FACILITY-WIDE CRITERIA POLLUTANT SUMMARY
ENVIVA PELLETS AHOSKIE

Source Description	Unit ID	CO (tpy)	NOx (tpy)	TSP (tpy)	PM-10 (tpy)	PM-2.5 (tpy)	SO2 (tpy)	Total VOC (tpy)	$CO_{2e\ biomass\ defferal}$ (tpy)	CO_{2e} (tpy)
Dryer System	ES-DRYER	44.15	182.91	24.48	24.48	24.48	19.20	164.20	3,341.43	162,118.83
Emergency Generator	ES-EG	0.50	0.58	0.03	0.03	0.03	0.0010	0.0015	93.35	93.35
Fire Water Pump	ES-FWP	0.43	0.49	0.02	0.02	0.02	0.0008	0.0013	80.02	80.02
Dry Wood Hammermills	ES-DHM-1 thru 4	-	-	30.03	30.03	30.03	-	16.62	-	-
Hammermill 5	ES-HAF	-	-	12.20	12.20	12.20	-		-	-
Pellet Mill Feed Silo	ES-PMFS	-	-	0.82	0.82	0.82	-	-	-	-
Dried Wood Day Silo	DWDS	-	-	0.82	0.82	0.82	-	-	-	-
Pellet Fines Bin	ES-FB	-	-	0.41	0.41	0.41	-	-	-	-
Finished Product Handling & Loadout	ES-FPH, TLB, PL1,2	-	-	4.00	4.00	4.00	-	-	-	-
Pellet Presses and Coolers	ES-CLR1 thru -6	-	-	56.78	56.78	56.78	-	110.09	-	-
Dried Wood Handling	ES-DWH, ES-PP	-	-	0.07	0.03	0.00	-	-	-	-
Diesel Storage Tanks	TK1 & TK2	-	-	-	-	-	-	9.10E-04	-	-
	Total PSD Emissions	**45.09**	**183.98**	**129.66**	**129.63**	**129.60**	**19.20**	**290.91**	**3,514.80**	**162,292.20**
Fugitive (Non-PSD Sources)										
Chipper and Re-chipper	ES-CHIP - 1	-	-	-	-	-	-	0.98	-	-
Green Hammermill	ES-CHIP - 2	-	-	-	-	-	-	0.98	-	-
Bark Hog	IES-BARK	-	-	-	-	-	-	0.34	-	-
Green Wood Handling	ES-GWH	-	-	0.02	0.01	0.00	-	-	-	-
Green Wood Piles	ES-GWSP1	-	-	2.65	1.33	0.20	-	2.93	-	-
	Total Facility Emisions:	**45.09**	**183.98**	**132.34**	**130.97**	**129.80**	**19.20**	**296.14**	**3,514.80**	**162,292.20**

TABLE B-2
FACILITYWIDE HAP EMISSIONS SUMMARY
ENVIVA PELLETS AHOSKIE

Description	Dryer (tpy)	ES-HM1 thru 5 (tpy)	ES-CLR1 thru 6 (tpy)	ES-EG (tpy)	ES-FWP (tpy)	ES-BARK (tpy)	ES-CHP-1 (tpy)	ES-CHP-2 (tpy)	Total (tpy)
1,3-Butadiene	-	-	-	2.39E-05	2.05E-05	-	-	-	4.45E-05
Acetaldehyde	5.29E+00	0.00E+00	0.00E+00	4.70E-04	4.03E-04	-	-	-	5.29E+00
Acrolein	0.00E+00	7.24E-01	0.00E+00	5.67E-05	4.86E-05	-	-	-	7.25E-01
Benzene	-	-	-	5.71E-04	4.90E-04	-	-	-	1.06E-03
Formaldehyde	9.88E+00	0.00E+00	1.50E+00	7.23E-04	6.20E-04	-	-	-	1.14E+01
m-,p-Xylene	-	-	-	1.75E-04	1.50E-04	-	-	-	3.24E-04
Methanol	7.76E+00	6.04E-01	2.70E+00	-	-	0.07	0.21	0.21	1.16E+01
Propionaldehyde	9.18E-01	0.00E+00	0.00E+00	-	-	-	-	-	9.18E-01
Toluene	-	-	-	2.51E-04	2.15E-04	-	-	-	4.65E-04
Total PAH (POM)	0.00E+00	-	-	1.03E-04	8.82E-05	-	-	-	1.91E-04
TOTAL HAP	**23.86**	**1.33**	**4.19**	**0.002**	**0.002**	**0.07**	**0.21**	**0.21**	**29.88**

Arsenic
benzo(a) pyrene
cadmium
chlorine
hexachloridibenzo-p-dioxin

HCl
phenol

TABLE B-4
ROTARY DRYER -CRITERIA POLLUTANT EMISSIONS
ENVIVA PELLETS AHOSKIE

Dryer Inputs

Annual Dried Wood Throughput of Dryer	**420,480**	ODT/year
Max. Hourly Dried Wood Throughput of Dryer	48.00	ODT/hr
Burner Heat Input	175.3	MMBtu/hr
Percent Hardwood	70.0%	
Percent Softwood	30.0%	
Max Potential Annual Heat Input:	**1535628**	**MMBtu/yr**

Criteria Pollutant Calculations:

Pollutant	Biomass Emission Factor (lb/ODT)	Units	Emission Factor Source	Emissions (lb/hr)	Emissions (tpy)
CO	0.21	lb/ODT	Title V Application [1]	10.08	44.2
NO_X	0.87	lb/ODT	Stack Testing [2]	41.76	182.9
Total TSP	0.116	lb/ODT	Calculated from Guaranteed WESP Specifications [3]	5.59	24.5
Total PM_{10}	0.116	lb/ODT	Calculated from Guaranteed WESP Specifications [3]	5.59	24.5
Total $PM_{2.5}$	0.116	lb/ODT	Calculated from Guaranteed WESP Specifications [3]	5.59	24.5
SO_2	0.025	lb/MMBtu	AP-42, Section 1.6 [5]	4.38	19.2
VOC as alpha-pinene	0.781	lb/ODT	Stack Testing [4]	37.49	164.2
Lead	0.00	N/A	N/A	0.00	0.0

0.784

Note:

[1] CO emission factor obtained from 2012 Title V Application.

[2] NOx emission factor obtained from 2012 Title V Application.

[3] WESP Outlet Air Flowrate 81,509 dSCF
PM Grain Loading 0.008 gr/dSCF
Emission 652.07 gr/min
0.093 lb/min
5.59 lb/hr
Dryer Capacity Basis: 48.00 ODT/hr
Calculated PM Emission Factor: 0.116 lb/ODT

Although the vendor estimated emissions to include condensibles, additional condensibles from wood combustion AP-42, Section 1.6 were included. The vendor only provided the filterable fraction of particulate matter in the emission factors. Enviva has conservatively calculated the condensible fraction based upon the heat input of the dryer burners using an emission factor for wood combustion from AP-42, Section 1.6.

[4] VOC emission factors for 30% softwood obtained from June 2014 stack testing.

[5] No emission factor is provided in AP-42, Section 10.6.2 for SO_2 for rotary dryers. Enviva has conservatively calculated SO2 emissions based upon the heat input of the dryer burners using an emission factor for wood combustion from AP-42, Section 1.6.

TABLE B-5
ROTARY DRYER -HAP AND TAP WOOD COMBUSTION EMISSIONS
ENVIVA PELLETS AHOSKIE

Calculation Inputs:

Annual Composition and Throughput

Throughput ODT/yr	420,480
Hardwood Composition	70%
Softwood Composition	30%

Short Term Composition and Throughput

ODT/hr	48.00
Hardwood Composition	40%
Softwood Composition	60%

Emission Calculations:

Pollutant	CAS Number	HAP (Yes/No)	NC TAP (Yes/No)	VOC (Yes/No)	Emission Factor Comparison: AP-42 Calculated Direct wood-fired, hardwood factors		Emission Factor Comparison: AP-42 Green, Direct wood-fired softwood factors		Weighted Emission Factor[3]			Emissions	
					Emission Factor (lb/ODT)	Reference	Emission Factor (lb/ODT)	Reference	Short-term EF (lb/ODT)	Annual EF (lb/ODT)	EF Source	(lb/hr)	(tpy)
Acetaldehyde	75-07-0	Yes	Yes	Yes	3.83E-03	1,2	7.50E-02	1	4.65E-02	2.52E-02	AP-42	2.23E+00	5.29E+00
Acrolein	107-02-8	Yes	Yes	Yes	0.00E+00	1,2,4	0.00E+00	1,4	0.00E+00	0.00E+00	AP-42	0.00E+00	0.00E+00
Formaldehyde	50-00-0	Yes	Yes	Yes	7.15E-03	1,2	1.40E-01	1	8.69E-02	4.70E-02	AP-42	4.17E+00	9.88E+00
Methanol	67-56-1	Yes	No	Yes	5.62E-03	1,2	1.10E-01	1	6.82E-02	3.69E-02	AP-42	3.28E+00	7.76E+00
Propionaldehyde	123-38-6	Yes	No	Yes	6.64E-04	1,2	1.30E-02	1	8.07E-03	4.36E-03	AP-42	3.87E-01	9.18E-01
											Total HAPs	**10.07**	**23.86**

- Phenol
- Benzene

Notes:

[1] HAP & TAP emission factors for "Rotary Dryer, green, direct wood-fired, (inlet moisture content >50%, dry basis) softwood were obtained from AP-42, Section 10.6.2, Table 10.6.2-3.

[2] To account for hardwood emissions since no HAP/TAP emission factors are given for direct hardwood-fired, factors were conservatively calculated by multiplying AP-42 Section 10.6.2-3 HAP factors for green, direct softwood fired by the ratio of the VOC emission factors for hardwood to softwood drying (0.24/4.7).

[3] Short-term and annual emissions based on worst case processing of 50% softwood.

[4] Through testing at other Enviva facilities Acrolein and Phenol are typically not evident in the emissions stream.

Benzene ?

TABLE B-7
HAMMERMILLS - VOC, HAP, AND TAP EMISSIONS
ENVIVA PELLETS AHOSKIE

Calculation Inputs:

Total Plant Throughput ODT/yr	420,480
% of Total Throughput to the Hammermills	85%

via AHO test for Dry Hammermill pre-screener bypass

Annual Composition and Throughput

Hammermills Throughput ODT/yr	357,408
Hardwood Composition	70%
Softwood Composition	30%

Short Term Composition and Throughput

ODT/hr	48.00
Hardwood Composition	40%
Softwood Composition	60%

Emission Calculations:

Pollutant	CAS Number	HAP (Yes/No)	NC TAP (Yes/No)	VOC (Yes/No)	Emission Factor – Stack Tests		Emission Factor			Emissions	
					Emission Factor (lb/ODT)	Reference	Short-term EF (lb/ODT)	Annual EF (lb/ODT)	EF Source	(lb/hr)	(tpy)
VOC and Alpha Pinene	N/A	N/A	N/A	N/A	0.093	1	0.09	0.09	Stack Test	4.46	16.62
Acetaldehyde	75-07-0	Yes	Yes	Yes	0.0000	3	0.0000	0.0000	Stack Test	0.00E+00	0.00E+00
Acrolein	107-02-8	Yes	Yes	Yes	0.0041	3	0.0041	0.0041	Stack Test	1.95E-01	7.24E-01
Formaldehyde	50-00-0	Yes	Yes	Yes	0.0000	3	0.0000	0.0000	Stack Test	0.00E+00	0.00E+00
Methanol	67-56-1	Yes	No	Yes	0.0034	3	0.0034	0.0034	Stack Test	1.62E-01	6.04E-01
Propionaldehyde	123-38-6	Yes	No	Yes	0.0000	3	0.0000	0.0000	Stack Test	0.00E+00	0.00E+00
									Total VOC	**4.46**	**16.62**
									Total HAPs	**0.36**	**1.33**

Notes:

[1] VOC emissions from Enviva Ahoskie June 2014 VOC testing using 33% softwood.

[2] HAP & TAP emission factors obtained from Enviva Amory facility October 2013 stack testing. Amory stack testing performed at 60% softwood and therefore, considered conservative for use at Ahoskie.

TABLE B-8
PELLET PRESSES AND COOLERS - VOC, HAP, AND TAP EMISSIONS
ENVIVA PELLETS AHOSKIE

Calculation Inputs:

Annual Composition and Throughput

Throughput ODT/yr	481,800
Hardwood Composition	55%
Softwood Composition	45%

Short Term Composition and Throughput

ODT/hr	55.00
Hardwood Composition	40%
Softwood Composition	60%

Emission Calculations:

Pollutant	CAS Number	HAP (Yes/No)	NC TAP (Yes/No)	VOC (Yes/No)	Emission Factor – Stack Tests		Emission Factor			Emissions	
					Emission Factor (lb/ODT)	Reference	Short-term EF (lb/ODT)	Annual EF (lb/ODT)	EF Source	(lb/hr)	(tpy)
VOC as alpha-pinene	N/A	N/A	N/A	N/A	0.46	1	0.46	0.46	stack test	25.14	110.09
Acetaldehyde	75-07-0	Yes	Yes	Yes	0.00E+00	2	0.00E+00	0.00E+00	stack test	0.00E+00	0.00E+00
Acrolein	107-02-8	Yes	Yes	Yes	0.00E+00	2	0.00E+00	0.00E+00	stack test	0.00E+00	0.00E+00
Formaldehyde	50-00-0	Yes	Yes	Yes	6.22E-03	2	6.22E-03	6.22E-03	stack test	3.42E-01	1.50E+00
Methanol	67-56-1	Yes	No	Yes	1.12E-02	2	1.12E-02	1.12E-02	stack test	6.16E-01	2.70E+00
Propionaldehyde	123-38-6	Yes	No	Yes	0.00E+00	2	0.00E+00	0.00E+00	stack test	0.00E+00	0.00E+00
									Total VOC	**0.00**	**110.09**
									Total HAPs	**0.96**	**4.19**

Notes:

1 VOC emissions from Enviva Ahoskie June 2014 VOC testing using 45% softwood.

2 HAP & TAP emission factors derived from Enviva Northampton's September 2013 stack testing (represents the higher of the measured emission factors obtained from stack testing during the Northampton and Amory October 2013 stack tests). Amory testing performed at 60% softwood.

TABLE B-9
BARK HOG
ENVIVA PELLETS AHOSKIE

Annual Throughput of Bark Hog	145,080	tons/year (dry wood)[1]
Dryer Throughput	48.00	tons/hr (dry wood)[1]

Pollutant	Emission Factors (lb/dry wood tons)	Emissions[6]	
		(lb/hr)	(tpy)
THC as Carbon[2]	0.0041	1.968E-01	0.30
THC as alpha-Pinene[3]	0.0047	**2.234E-01**	0.34
PM[4]	N/A	**N/A**	**N/A**
Methanol[2]	0.0010	**4.800E-02**	0.07

[1] The annual throughput used for the chipper is calculated using the dryer throughput and the Title V air permit application ratio of 145,080 Bark Hog Throughput / of 420,800 Dryer ODT. The short-term throughput is based upon the maximum hourly throughput of the dryer.

[2] Emission factor obtained from available emissions factors for chippers in AP-42 Section 10.6.3, Table 7 and Section 10.6.4, Tables 7 and 9. Emission factors for THC and Methanol are the same across all three tables.

[3] The THC/VOC makeup of wood is primarily composed of terpenes $(C_5H_8)_n$ [where n = 2, 3, or 4 typically] but to convert from carbon to the equivalent weight in THC/VOC, the assumption was that alpha-pinene (AP) would be the representative THC/VOC (molecular weight = 136.2 lb/lb-mol).
The following equation shows the conversion:
*lb VOC/ODT = lb C/ODT * (136.2 lb/mol AP / 12 lb/mol C) * (1 mol AP / 10 mol C)*

[4] PM emission factor is not applicable as the bark hog emissions are routed downward to the ground.

TABLE B-10
ELECTRIC POWERED CHIPPER (ES-CHP1) - VOC, HAP, AND TAP EMISSIONS
ENVIVA PELLETS AHOSKIE

Annual Throughput to ES-CHP1	724,966	tn/yr
Moisture Content:	42%	
Annual Throughput to ES-CHP1	420,480	tons/year (dry wood)[1]
Short-term Throughput of Chipper	48.00	tons/hr (dry wood)[1]

Pollutant	Emission Factors (lb/dry wood tons)	Emissions[5]	
		(lb/hr)	(tpy)
THC as Carbon[2]	0.0041	1.968E-01	0.86
THC as alpha-Pinene[3]	0.0047	**2.234E-01**	0.98
PM[4]	N/A	**N/A**	**N/A**
Methanol[2]	0.0010	**4.800E-02**	**0.21**

[1] The annual throughput used for the chipper is conservatively assumed to be the same as the annual throughput of the dryer; while the short-term throughput is based upon the maximum hourly throughput of the dryer.

[2] Emission factor obtained from available emissions factors for rechippers in AP-42 Section 10.6.3, Table 7 and Section 10.6.4, Tables 7 and 9. Emission factors for THC and Methanol are the same across all three tables.

[3] The THC/VOC makeup of wood is primarily composed of terpenes $(C_5H_8)_n$ [where n = 2, 3, or 4 typically] but to convert from carbon to the equivalent weight in THC/VOC, the assumption was that alpha-pinene (AP) would be the representative THC/VOC (molecular weight = 136.2 lb/lb-mol). The following equation shows the conversion:

*lb VOC/ODT = lb C/ODT * (136.2 lb/mol AP / 12 lb/mol C) * (1 mol AP / 10 mol C)*

[4] PM emission factor is not applicable as rechipper emissions are routed downward to the ground.

[5] Short term emissions were based upon the max short term capacity of the chippers. Emissions are representative of the total combined emissions for both rechippers.

TABLE B-11
GREEN HAMMERMILL (ES-CHP2) - VOC, HAP, AND TAP EMISSIONS
ENVIVA PELLETS AHOSKIE

Annual Throughput to ES-CHP2	724,966	tn/yr
Moisture Content:	42%	
Annual Throughput to ES-CHP2	420,480	tons/year (dry wood)[1]
Short-term Throughput of Green Hammermill	48.00	tons/hr (dry wood)[1]

Pollutant	Emission Factors (lb/dry wood tons)	Emissions[5]	
		(lb/hr)	(tpy)
THC as Carbon[2]	0.0041	1.968E-01	0.86
THC as alpha-Pinene[3]	0.0047	**2.234E-01**	0.98
PM[4]	N/A	**N/A**	**N/A**
Methanol[2]	0.0010	**4.800E-02**	**0.21**

[1] The annual throughput used for the hammermill is conservatively assumed to be the same as the annual throughput of the dryer; while the short-term throughput is based upon the maximum hourly throughput of the dryer.

[2] Emission factor obtained from available emissions factors for rechippers in AP-42 Section 10.6.3, Table 7 and Section 10.6.4, Tables 7 and 9. Emission factors for THC and Methanol are the same across all three tables.

[3] The THC/VOC makeup of wood is primarily composed of terpenes $(C_5H_8)_n$ [where n = 2, 3, or 4 typically] but to convert from carbon to the equivalent weight in THC/VOC, the assumption was that alpha-pinene (AP) would be the representative THC/VOC (molecular weight = 136.2 lb/lb-mol).
The following equation shows the conversion:
*lb VOC/ODT = lb C/ODT * (136.2 lb/mol AP / 12 lb/mol C) * (1 mol AP / 10 mol C)*

[4] PM emission factor is not applicable as rechipper emissions are routed downward to the ground.

[5] Short term emissions were based upon the max short term capacity of the chippers.
Emissions are representative of the total combined emissions for both rechippers.

TABLE B-12
BAGFILTER AND CYCLONE EMISSIONS
ENVIVA PELLETS AHOSKIE

Emission Unit	Emission Source ID	Filter. Vent -or- Cyclone ID	Flowrate[1] (cfm)	Pollutant Loading[2] (gr/cf)	Annual Operation (hours)	% PM that is PM_{10}	% PM that is $PM_{2.5}$	Emissions PM (lb/hr)	Emissions PM (tpy)	Emissions PM_{10}[3] (lb/hr)	Emissions PM_{10}[3] (tpy)	Emissions $PM_{2.5}$[3] (lb/hr)	Emissions $PM_{2.5}$[3] (tpy)
Dried Wood Day Silo	ES-DWDS	CD-DWS-BV	2186	0.01	8,760	100%	100%	0.19	0.82	0.19	0.82	0.19	0.82
Dry Wood Hammermills 1 & 2	ES-CHM	CD-CHM-FF1	40000	0.01	8,760	100%	100%	3.43	15.02	3.43	15.02	3.43	15.02
Dry Wood Hammermills 3 & 4	ES-CHM	CD-CHM-FF2	40000	0.01	8,760	100%	100%	3.43	15.02	3.43	15.02	3.43	15.02
Hammermill Area and HM-5	ES-HAF	CD-HAF-FF1	32,500	0.01	8,760	100%	100%	2.79	12.20	2.79	12.20	2.79	12.20
Pellet Mill Feed Silo Bin Vent Filter	ES-PMFS	CD-PMFS-BV	2,186	0.01	8,760	100%	100%	0.19	0.82	0.19	0.82	0.19	0.82
Fines Bin	ES-FB	CD-FB-BV	3,600	0.003	8,760	100%	100%	0.09	0.41	0.09	0.41	0.09	0.41
Finished Product Handing	ES-FPH, ES-PL, ES-TLB	CD-FPH-BV	35,500	0.003	8,760	100%	100%	0.91	4.00	0.91	4.00	0.91	4.00
Pellet Coolers Cyclone 1 & 2	ES-CLR-1 & 2	CD-CLR-1	27,500	0.022	8,760	100%	100%	5.19	22.71	5.19	22.71	5.19	22.71
Pellet Coolers Cyclone 3 & 4	ES-CLR-3 & 4	CD-CLR-2	27,500	0.022	8,760	100%	100%	5.19	22.71	5.19	22.71	5.19	22.71
Pellet Coolers Cyclone 5	ES-CLR-5	CD-CLR-3	13,750	0.022	8,760	100%	100%	2.59	11.36	2.59	11.36	2.59	11.36
Pellet Coolers Cyclone 6	ES-CLR-6	CD-CLR-4	0	0.022	0	100%	100%	-	-	-	-	-	-
							TOTAL	23.99	105.06	23.99	105.06	23.99	105.06

Note:

[1] Filter, Vent, and Cyclone inlet flow rate (cfm) provided by design engineering firm (Mid-South Engineering Co.).

[2] Unless otherisw specidied, pollutant (PM) loading conservatively assumed to be 0.01 gr/dscf.

[3] It was conservativcly assumed that PM_{10} and $PM_{2.5}$ equal PM emissions.

TABLE B-13
EMERGENCY GENERATOR AND FIRE PUMP
ENVIVA PELLETS AHOSKIE

Emergency Generator Emissions (ES-EG)

Equipment and Fuel Characteristics

Engine Output	0.26	MW
Engine Power	350	hp (brake)
Hours of Operation	500	hr/yr[1]
Heating Value of Diesel	19,300	Btu/lb
Power Conversion	7,000	Btu/hr/hp
Fuel Usage	17.6	gal/hr

260 kw

Criteria Pollutant Emissions

Pollutant	Category	Emission Factor	Units	Emissions lb/hr	Emissions tpy
TSP	PSD	4.41E-04	lb/kW-hr (2)	0.12	2.88E-02
PM_{10}	PSD	4.41E-04	lb/kW-hr (2)	0.12	2.88E-02
$PM_{2.5}$	PSD	4.41E-04	lb/kW-hr (2)	0.12	2.88E-02
NO_x	PSD	8.82E-03	lb/kW-hr (5)	2.30	5.75E-01
SO_2	PSD	15	ppmw (3)	3.81E-03	9.52E-04
CO	PSD	7.72E-03	lb/kW-hr (2)	2.01	5.03E-01
VOC (NMHC)	PSD	2.51E-03	lb/MMBtu (4)	6.15E-03	1.54E-03
Toxic/Hazardous Air Pollutant Emissions					
Acetaldehyde	HAP/TAP	5.37E-06	lb/hp-hr (4)	1.88E-03	4.70E-04
Acrolein	HAP/TAP	6.48E-07	lb/hp-hr (4)	2.27E-04	5.67E-05
Benzene	HAP/TAP	6.53E-06	lb/hp-hr (4)	2.29E-03	5.71E-04
Benzo(a)pyrene[6]	HAP/TAP	1.32E-09	lb/hp-hr (4)	4.61E-07	1.15E-07
1,3-Butadiene	HAP/TAP	2.74E-07	lb/hp-hr (4)	9.58E-05	2.39E-05
Formaldehyde	HAP/TAP	8.26E-06	lb/hp-hr (4)	2.89E-03	7.23E-04
Total PAH (POM)	HAP	1.18E-06	lb/hp-hr (4)	4.12E-04	1.03E-04
Toluene	HAP/TAP	2.86E-06	lb/hp-hr (4)	1.00E-03	2.51E-04
m-,p-Xylene	HAP/TAP	2.00E-06	lb/hp-hr (4)	6.98E-04	1.75E-04
Highest HAP (Formaldehyde)		8.26E-06	lb/hp-hr (4)	2.89E-03	7.23E-04
Total HAPs				9.49E-03	2.37E-03

0.94575
~~0.7275~~

Note:

[1] NSPS allows for only 100 hrs/yr of non-emergency operation of these engines (not the 500 hours shown). The PTE for the emergency generator is based on 500 hr/yr, though, because the regs allow non-emergency operation and EPA guidance is 500 hr/yr for emergency generators.

[2] Emissions factors from NSPS Subpart IIII (or 40 CFR 89.112 where applicable) in compliance with post-2009 construction.

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

[4] Emission factor obtained from AP-42 Section 3.3, Tables 3.3-1 Table 3.3-2.

[5] Emission factor for NOx is listed as NOx and NMHC (Non-Methane Hydrocarbons or VOC) in Table 4 of NSPS Subpart IIII. Conservatively assumed entire limit attributable to NOx.

[6] Benzo(a)pyrene is included as a HAP in Total PAH.

Fire pump engines.

Firewater Pump Emissions (ES-FWP)

Equipment and Fuel Characteristics

Engine Output	0.22	MW
Engine Power	300	hp
Hours of Operation	500	hr/yr[1]
Heating Value of Diesel	19,300	Btu/lb
Power Conversion	7,000	Btu/hr/hp
Fuel Usage	15.1	gal/hr

Criteria Pollutant Emissions

Pollutant	Category	Emission Factor	Units	Emissions	
				lb/hr	tpy
TSP	PSD	4.41E-04	lb/kW-hr (2)	0.10	2.47E-02
PM_{10}	PSD	4.41E-04	lb/kW-hr (2)	0.10	2.47E-02
$PM_{2.5}$	PSD	4.41E-04	lb/kW-hr (2)	0.10	2.47E-02
NO_x	PSD	8.82E-03	lb/kW-hr (5)	1.97	4.93E-01
SO_2	PSD	15	ppmw (3)	3.26E-03	8.16E-04
CO	PSD	7.72E-03	lb/kW-hr (2)	1.73	4.32E-01
VOC (NMHC)	PSD	2.51E-03	lb/MMBtu (4)	5.27E-03	1.32E-03
Toxic/Hazardous Air Pollutant Emissions					
Acetaldehyde	HAP/TAP	5.37E-06	lb/hp-hr (4)	1.61E-03	4.03E-04
Acrolein	HAP/TAP	6.48E-07	lb/hp-hr (4)	1.94E-04	4.86E-05
Benzene	HAP/TAP	6.53E-06	lb/hp-hr (4)	1.96E-03	4.90E-04
Benzo(a)pyrene[6]	HAP/TAP	1.32E-09	lb/hp-hr (4)	3.95E-07	9.87E-08
1,3-Butadiene	HAP/TAP	2.74E-07	lb/hp-hr (4)	8.21E-05	2.05E-05
Formaldehyde	HAP/TAP	8.26E-06	lb/hp-hr (4)	2.48E-03	6.20E-04
Total PAH (POM)	HAP	1.18E-06	lb/hp-hr (4)	3.53E-04	8.82E-05
Toluene	HAP/TAP	2.86E-06	lb/hp-hr (4)	8.59E-04	2.15E-04
m-,p-Xylene	HAP/TAP	2.00E-06	lb/hp-hr (4)	5.99E-04	1.50E-04
Highest HAP (Formaldehyde)		8.26E-06	lb/hp-hr (4)	2.48E-03	6.20E-04
Total HAPs				8.13E-03	2.03E-03

Note:

[1] NSPS allows for only 100 hrs/yr of non-emergency operation of these engines (not the 500 hours shown). The PTE for the emergency generator is based on 500 hr/yr, though, because the regs allow non-emergency operation and EPA guidance is 500 hr/yr for emergency generators.

[2] Emissions factors from ~~NSPS~~ Subpart IIII (or 40 CFR 89.112 where applicable) in compliance with post-2009 construction.

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

[4] Emission factor obtained from AP-42 Section 3.3, Tables 3.3-1 Table 3.3-2.

[5] Emission factor for NOx is listed as NOx and NMHC (Non-Methane Hydrocarbons or VOC) in Table 4 of NSPS Subpart IIII. Conservatively assumed entire limit attributable to NOx.

[6] Benzo(a)pyrene is included as a HAP in Total PAH.

TABLE B-14
DRIED WOOD HANDLING DROP POINTEMISSIONS
ENVIVA PELLETS AHOSKIE

Annual Dryer Output Throughput (ODT/yr)	420,480
Annual Pellet Press Throughput (ODT/yr)	481,800
Max Dryer Short-Term Throughput (ODT/hr)	48.000
Max Pellet Press Throughput (ODT/hr)	55.000
Dryer Output Moisture Content:	17%
Pellet Mill Output Moisture Content:	6%
Amount of Fines Diverted from Hammermills	15.0% via AHO test for Dry Hammermill pre-screener bypass

ID	Emission Source Group	Description	Control	Control Description	Throughput		Potential Uncontrolled Emissions for PM[3]		Potential Uncontrolled Emissions for PM_{10}[3]		Potential Uncontrolled Emissions for $PM_{2.5}$[3]	
					Max. Hourly[2]	Annual						
					(tph)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
DP1	ES-DWH	Dryer Discharger to Outfeed Conveyor	Enclosed	Reduction to 2 mph mean wind speed	57.83	506,602	2.1E-03	9.1E-03	9.8E-04	4.3E-03	1.5E-04	6.5E-04
DP2	ES-DWH	Dryer Outfeed Conveyors to Silo Feed/Silo Bypass	Enclosed	Reduction to 2 mph mean wind speed	8.67	75,990	3.1E-04	1.4E-03	1.5E-04	6.5E-04	2.2E-05	9.8E-05
DP3	ES-DWH	Silo Bypass/Dryer Silo to Conveyor Hammermill Surge Bin	Enclosed	Reduction to 2 mph mean wind speed	49.16	430,612	1.8E-03	7.7E-03	8.4E-04	3.7E-03	1.3E-04	5.5E-04
DP4	ES-DWH	Conveyor to Hammermill Surge Bin Drop into HM Surge Bin	Enclosed	Reduction to 2 mph mean wind speed	49.16	430,612	1.8E-03	7.7E-03	8.4E-04	3.7E-03	1.3E-04	5.5E-04
DP5	ES-PP	Drop Emissions from Pellet Presses to Pellet Press Collection Conveyors	Enclosed	Reduction to 2 mph mean wind speed	58.51	512,553	9.0E-03	4.0E-02	4.3E-03	1.9E-02	6.5E-04	2.8E-03
						TOTAL	1.5E-02	6.6E-02	7.1E-03	3.1E-02	1.1E-03	4.7E-03

Note:

The listing of open transfer points may not be inclusive of all transfer points downstream of the dryer. Even if a few additional points may exist, the potential emissison of the insignificant activity emission source group ES-DWH is well below the 5 tpy threshold for significant emissions. Fugitive emissions are not included in facility-wide PTE because the Northampton Pellet Mill does not belong to one of the listed 28 source categories.

[2] Max hourly rates based upon ODT production rate and moisture content at that part of the process.

[3] Based emission factors calculated per AP-42 Section 13.2.4, September 2006.

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)		2.00	
		Dryer Exit	Pellet Press Exit
M = material moisture content (%)		17	6
E for PM (lb/ton) =		3.6E-05	1.5E-04
E for PM_{10} (lb/ton) =		1.7E-05	7.3E-05
E for $PM_{2.5}$ (lb/ton) =		2.6E-06	1.1E-05

TABLE B-15
GREEN WOOD HANDLING DROP POINT EXAMPLE EMISSIONS
ENVIVA PELLETS AHOSKIE

ID	Emission Source Group	Transfer Activity	Type of Operation	Number of Drop Points	PM Particle Size Multiplier (dimensionless)	PM_{10} Particle Size Multiplier (dimensionless)	$PM_{2.5}$ Particle Size Multiplier (dimensionless)	Mean Wind Speed (U) (mph)	Material Moisture Content (M)[1] (%)	PM Emission Factor[2] (lb/ton)	PM_{10} Emission Factor[2] (lb/ton)	$PM_{2.5}$ Emission Factor[2] (lb/ton)	Potential Throughput (tpy)	PM Emissions (tpy)	PM_{10} Emissions (tpy)	$PM_{2.5}$ Emissions (tpy)
GDP1	ES-GWH	Purchased Bark Transfer to Outdoor Storage Area	Batch Drop	1	0.74	0.35	0.053	6.3	48%	3.73E-05	1.76E-05	2.67E-06	26,409	1.25E-04	5.88E-05	8.92E-06
GDP1	ES-GWH	Drop Points via Conveying from Bark Pile to Dryer	Batch Drop	4	0.74	0.35	0.053	6.3	48%	3.73E-05	1.76E-05	2.67E-06	279,000	5.27E-03	2.48E-03	3.77E-04
GDP2	ES-GWH	Transfer Purchased Wood Chips (Wet) to Outdoor Storage	Batch Drop	1	0.74	0.35	0.053	6.3	48%	3.73E-05	1.76E-05	2.67E-06	277,865	1.31E-03	6.19E-04	9.39E-05
GDP2	ES-GWH	Drop Points via Conveying from Chip Pile to Dryer	Batch Drop	5	0.74	0.35	0.053	6.0	48%	3.51E-05	1.66E-05	2.51E-06	808,615	1.80E-02	8.49E-03	1.28E-03
		Total Emissions												**2.47E-02**	**1.17E-02**	**1.76E-03**

1. Average moisture content for logs, bark, and wood chips (wet) based on material balance provided by design engineering firm (Mid-South Engineering).

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) 6.3

M = material moisture content (%)

3. PM_{10} control efficiency of 74.7% applied for three-sided enclosed structure with 50% porosity per Sierra Research *"Final BACM Technological and Economic Feasibility Analysis"*, report prepared for the San Joaquin Valley Unified Air Pollution Control District (3/03). The control efficiency is assumed equivalent for PM_{10} and $PM_{2.5}$ emissions.

4. These green wood handling emissions are representative of the fugitive emissions at the site. Note there may be multiple drop points for each type but as shown these emissions will be negligible.

TABLE B-16
TANKS EMISSIONS
ENVIVA PELLETS AHOSKIE

Tank ID	Tank Description	Volume[1] (gal)	Tank Dimensions		Orientation	Throughput (gal/yr)	Turnovers[(3)]	TANKS 4.0 VOC Emissions	
			Diameter (ft)	Height/Length (ft)				(lb/yr)	(tpy)
TK01	Emergency Generator Fuel Oil Tank[2]	2,500	6	12	Vertical	8,813	3.53	1.51	7.55E-04
TK02	Fire Water Pump Fuel Oil Tank[2]	500	3	10	Horizontal	7,554	15.11	0.31	1.55E-04
							TOTAL	**1.82**	**9.10E-04**

Note:

[1] Conservative design specifications.

[2] Throughput based on fuel consumption based on engine horsepower (BHP), conversion to fuel usage (gal/hr), and engine operating hours.

[3] Tanks Program Calculations are performed with a minimum 1 turnover per year as a conservative measure.

TABLE B-17
POTENTIAL GHG EMISSIONS FROM COMBUSTION SOURCES
ENVIVA PELLETS AHOSKIE

Operating Data:

Dryer Heat Input	1535628.00	MMBtu/yr
Emergency Generator Output	350	bhp
Operating Schedule	500	hrs/yr
No. 2 Fuel Input	16.7	gal/hr[1]
Energy Input	2.282	MMBtu/hr[2]
Fire Water Pump Output	300	bhp
Operating Schedule	500	hrs/yr
No. 2 Fuel Input	14.3	gal/hr[1]
Energy Input	1.956	MMBtu/hr[2]

Emission Unit ID	Fuel Type	Emission Factors from Table C-1 (kg/MMBtu)[3]			Tier 1 Emissions (metric tons)				
		CO2	CH4	N2O	CO2	CH4	N2O	Total CO2e biomass deferral[4]	Total CO2e
ES-DRYER	Wood and Wood Residuals	9.38E+01	3.20E-02	4.20E-03	158,777	54	7	3,341	162,119
ES-EG	No. 2 Fuel Oil (Distillate)	7.40E+01	3.00E-03	6.00E-04	93	3.77E-03	7.55E-04	93	93
ES-FWP	No. 2 Fuel Oil (Distillate)	7.40E+01	3.00E-03	6.00E-04	80	3.23E-03	6.47E-04	80	80

[1] Fuel consumption calculated using a factor of 0.0476 gal/hr-hp. Advanced Environmental Interface, Inc. (1998). General Permits for Emergency Engines. INSIGHTS, 98-2, 3.

[2] Energy calculated on a fuel consumption basis, using an energy factor of 0.137 MMBtu/gal.

[3] Emission factors from Table C-1 and C-2 of GHG Reporting Rule. Emission factors for methane and N2O already multiplied by their respective GWPs of 21 and 310.

[4] As per NC DAQ Biomass Deferral Rule 15A NCAC 02D .0544, CO2 emissions from bioenergy and other biogeneic sources are not applicable towards PSD and Title V permitting. Therefore CO2 emissions form the dryer are not included in the Total CO2e biomass deferral column.

TABLE B-18
GREEN WOOD STORAGE PILES FUGITIVE EMISSIONS
ENVIVA PELLETS AHOSKIE

Emission Unit ID	Description	TSP Emission Factor [1] (lb/day/acre)	TSP Emission Factor [1] (lb/hr/ft²)	VOC Emission Factor [3] (lb/day/acre)	VOC Emission Factor [3] (lb/hr/ft²)	Width (ft)	Length (ft)	Height (ft)	Outer Surface Area of Storage Pile (ft²)	PM Emissions (lb/hr)	PM Emissions (tpy)	PM_{10} Emissions (lb/hr)	PM_{10} Emissions (tpy)	$PM_{2.5}$ Emissions (lb/hr)	$PM_{2.5}$ Emissions (tpy)	VOC as Carbon Emissions (lb/hr)	VOC as Carbon Emissions (tpy)	VOC as alpha-Pinene Emissions [4] (lb/hr)	VOC as alpha-Pinene Emissions [4] (tpy)
GWSP1	Green Wood Pile No. 1	3.71	3.55E-06	3.60	3.44E-06	100	400	10	60,000	0.213	0.933	0.107	0.467	0.0160	0.070	0.21	0.90	0.24	1.03
GWSP2	Green Wood Pile No. 2	3.71	3.55E-06	3.60	3.44E-06	200	400	10	110,400	0.392	1.717	0.196	0.859	0.0294	0.129	0.38	1.67	0.43	1.90
Total										**0.605**	**2.651**	**0.303**	**1.325**	**0.0454**	**0.199**	**0.59**	**2.57**	**0.67**	**2.93**

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 (%):	4.8	s - silt content(%) for lumber sawmills (minimum), from AP-42 Table 13.2.2-1
p, number of days with rainfall greater than 0.01 inch:	120	Based on AP-42, Section 13.2.2, Figure 13.2.1-2.
f (time that wind exceeds 5.36 m/s - 12 mph) (%):	9.8	Based on meteorological data averaged for 2007-2011 for Northampton, NC.
PM_{10}/TSP ratio:	50%	PM_{10} is assumed to equal 50% of TSP based on U.S. EPA *Control of Open Fugitive Dust Sources*, Research Triangle Park, North Carolina, EPA-450/3-88-008. September 1988.
$PM_{2.5}$/TSP ratio:	7.5%	$PM_{2.5}$ is assumed to equal 7.5 % of TSP U.S. EPA Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors. November 2006.

2. The surface area is calculated as [2*1/4*L+2*W*1/4+L*W] + 20% to consider the sloping pile edges. Length and width based on proposed site design with a conservative height.

3. Emission factors obtained from NCASI document provided by SC DHEC for the calculation of fugitive VOC emissions from Douglas Fir wood storage piles. Emission factors ranged from 1.6 to 3.6 lb C/acre-day. Enviva chose to employ the maximum emission factor for purposes of conservatism.

4. Emissions are calculated in tons of carbon per year by the following formula:

*tons C/year = 5 acres * 365 days * 1.6 lb C/acre-day / 2000 lb/ton*

Emission factor converted from as carbon to as alpha-pinene by multiplying by 1.14.

Table 1 Test Results Summary Enviva Pellets Ahoskie, LLC				
Source	Wood Dryer /Dry Hammermill 2/Pellet Cooler 2			
Permit Number	1012R02			
Dry Hammermill Emissions ES-DHM2	DHM-25A-1	DHM-25A-2	DHM-25A-3	Average
Softwood Content	33	33	33	33
Test Date	6/25/14	6/25/14	6/25/14	N/A
VOC Pounds as Propane per ODT	0.102	0.101	0.098	**0.101**
VOC Pounds as Alpha-Pinene per ODT	0.095	0.094	0.091	**0.093**
Pellet Cooler Emissions ES-CLR2	PC-25A-1	PC-25A-2	PC-25A-3	Average
Softwood Content	45	45	45	45
Date	6/26/14	6/26/14	6/26/14	N/A
VOC Pounds as Propane per ODT	0.476	0.485	0.515	**0.492**
VOC Pounds as Alpha-Pinene per ODT	0.442	0.451	0.476	**0.457**
Dryer Emissions ES-Dryer	D-25A-1	D-25A-2	D-25A-4	Average
Softwood Content	30	30	30	30
Date	7/2/14	7/2/14	7/3/14	NA
VOC Pounds as Propane per ODT	0.858	0.760	0.915	**0.844**
VOC Pounds as Alpha-Pinene per ODT	0.797	0.706	0.850	**0.784**

2. SOURCE AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION

Enviva Pellets Ahoskie produces wood pellets used as fuel. The Ahoskie facility uses wood resources (roundwood chips, bark, sawdust, and tree trunks) to produce the pellets. The wood is milled, dried and pelletized. A flowchart of the process is provided in Figure 2-1.

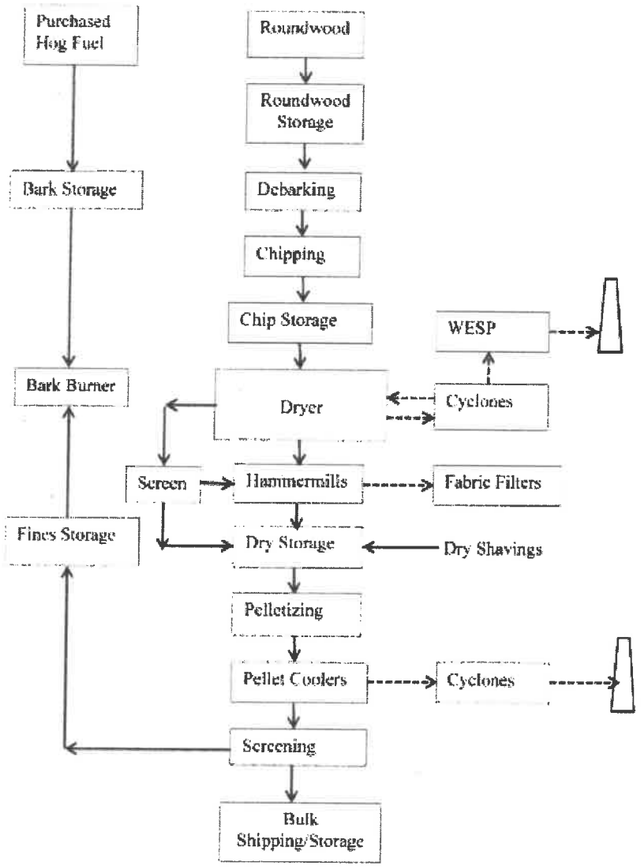


Figure 1. Process Flow Diagram

3. SUMMARY AND DISCUSSIONS OF RESULTS

3.1 OBJECTIVES AND TEST MATRIX

The objective of the test program was to measure volatile organic compounds emission rates from the dryer, dry hammermills, and pellet coolers while processing wood having a 35% by weight softwood content. The information will be used as a basis for a request to modify the plant operation permit. A matrix of the test methods used in this evaluation is provided in Table 3-1.

Table 3-1.
Enviva Pellets Ahoskie
Test Matrix

Source	Method	Target Analyte	# of Runs	Test Time, Minutes	Analytical Measurement
Dry Hammermill	25A	THC	3	60	FID
	2	Gas flow	3	20	Vel. Pressure
	3A	Molecular Wt.	3	60	Electrochemical
	4	Moisture	3	30	Gravimetric
Pellet Cooler	25A	THC	3	60	FID
	2	Gas flow	3	20	Vel. Pressure
	3A	Molecular Wt.	3	60	Electrochemical
	4	Moisture	3	30	Gravimetric
Dryer	25A	THC	3	60	FID
	2	Gas flow	3	20	Vel. Pressure
	3A	Molecular Wt.	3	60	Electrochemical
	4	Moisture	3	30	Gravimetric

3.2 FIELD TEST CHANGES AND PROBLEMS

During June 24th, an upset was caused by a fuel feeding problem in the furnace of the dryer. This condition resulted in excessive wood build-up in both the furnace and the mixing chamber upstream of the dryer. The dryer was taken offline and cleaned to solve this problem. The dryer tests were delayed until the week of July 2.

During the third run of July 2, the wood feed to the mixing chamber/dryer was partially blocked in the fuel chute. This resulted in non-representative operating conditions during most of the test run. A fourth run was conducted on July 3 after the feed chute was cleared of the blockage. The VOC emissions from the dryer have been calculated based on Runs 1, 2, and 4. The data for all four runs are presented in this report.

3.3 SUMMARY AND DISCUSSION OF RESULTS

Dry Hammermill 2—A summary of the test results for Dry Hammermill 2 is provided in Table 3-2. Detailed data for each test run are presented in Appendix E. During these tests, the Dry Hammermill operated in a representative, stable condition. The set of five hammermills at the Ahoskie plant process material that is screened from the dryer outlet. The undersized material is sent directly to the pellet presses.

Table 3-2. Test Results Summary
Enviva Pellets Ahoskie
Dry Hammermill 2 VOC Emissions

Parameter	DHM-25A-1	DHM-25A-2	DHM-25A-3	Average
Test date	6/25/2014	6/25/2014	6/25/2014	N/A
Test time	1340-1440	1608-1708	1828-1928	N/A
ODT, Tons per hour	22.4	22.4	22.4	22.4
Volatile Organic Compound Emissions				
Parts / million, ppmvd	9.83	10.1	9.38	9.77
Pounds / hour (as propane)	1.03	1.02	0.99	1.01
Pounds / hour (as alpha pinene)	0.96	0.95	0.92	0.94
Pounds VOC as propane / ODT	0.102	0.101	0.098	0.101
Pounds VOC as alpha pinene / ODT	0.095	0.094	0.091	0.093
Gas Stream Characteristics				
Flue gas flow, DSCFM	15,252	14,665	15,403	15,107
Flue gas flow, ACFM	17,691	16,920	17,724	17,444
Moisture content, %	7.03	6.87	6.37	6.76
Stack temperature, °F	113.5	111.4	112.9	112.6

The mass emission rates were calculated based on (1) the THC concentrations measured in accordance with Method 25A, (2) the gas stream moisture levels measured in accordance with Method 4, and (3) the gas flow rates and temperatures measured in accordance with Method 2. The oxygen content of the stack gas stream was measured in accordance with Method 3A.

During these tests, the VOC emissions ranged from 0.098 to 0.102 pounds propane per ODT processed. The emissions expressed on an alpha-pinene basis ranged from 0.091 to 0.095 pounds alpha-pinene per ODT.

The mass emission rates were calculated based on (1) the THC concentrations measured in accordance with Method 25A, (2) the gas stream moisture levels measured in accordance with Method 4, and (3) the gas flow rates and temperatures measured in accordance with Method 2. The stack gas stream was not subject to cyclonic flow.

The oxygen content of the stack gas stream was measured in accordance with Method 3A. The oxygen concentrations were consistently 20.9% by volume because the hammermills coolers exhaust air.

Pellet Cooler 2—The VOC emissions from Pellet Cooler 2 are summarized in Table 3-3. These emissions ranged from 0.476 to 0.515 pounds propane per ODT processed. The VOC emissions expressed were 0.442 to 0.476 pounds alpha-pinene per ODT processed.

Table 3-3. Test Results Summary
Enviva Pellets Ahoskie
Pellet Cooler 2 VOC Emissions

Parameter	PC-25A-1	PC-25A-2	PC-25A-3	Average
Test date	6/26/2014	6/26/2014	6/26/2014	N/A
Test time	1109-1208	1228-1329	1340-1439	N/A
Volatile Organic Compound Emissions				
Parts / million, ppmvd	69.6	70.4	75.0	71.7
Pounds / hour (as propane)	10.66	10.87	11.53	11.02
Pounds / hour (as alpha pinene)	9.90	10.10	10.72	10.24
Pounds VOC as propane / ODT	0.476	0.485	0.515	0.492
Pounds VOC as alpha pinene / ODT	0.442	0.451	0.476	0.457
Gas Stream Characteristics				
Flue gas flow, DSCFM	22,297	22,492	22,382	22,390
Flue gas flow, ACFM	26,185	26,241	26,270	26,232
Moisture content, %	6.86	5.97	6.59	6.47
Stack temperature, °F	114.3	115.9	115.6	115.3

The mass emission rates were calculated based on the (1) THC concentrations measured in accordance with Method 25A, (2) the gas stream moisture levels measured in accordance with Method 4, and (3) the gas flow rates and temperatures measured in accordance with Method 2. The stack gas stream was not subject to cyclonic flow. The oxygen content of the stack gas stream was measured in accordance with Method 3A.

The oxygen content of the stack gas stream was measured in accordance with Method 3A. The oxygen concentrations were consistently 20.9% by volume because the pellet coolers exhaust air.

Dryer—The VOC emissions from the dryer stack are summarized in Table 3-4. The VOC emissions ranged from 0.760 to 0.915 pounds propane per ODT processed. The VOC emissions ranged from 0.706 to 0.850 pounds alpha-pinene per ODT processed.

The average emissions have been calculated based on Runs 1, 2, and 4. As indicated in this report, an upset occurred during Run 3. The data for Run 3 are provided in Table 3-5.

The mass emission rates were calculated based on (1) the THC concentrations measured in accordance with Method 25A, (2) the gas stream moisture levels measured in accordance with Method 4, and (3) the gas flow rates and temperatures measured in accordance with Method 2. The stack gas stream was not subject to cyclonic flow. The oxygen content of the stack gas stream was measured in accordance with Method 3A.

Table 3-4. Test Results Summary Enviva Pellets Ahoskie, Dryer VOC Emissions				
Parameter	D-25A-1	D-25A-2	D-25A-4	Average
Test date	7/2/2014	7/2/2014	7/3/2014	N/A
Test time	1235-1335	1354-1454	8:53-9:53	N/A
Volatile Organic Compound Emissions				
Parts / million, ppmvd	159.1	130.9	147.4	145.8
Pounds / hour (as propane)	35.6	31.8	35.8	34.4
Pounds / hour (as alpha pinene)	33.0	29.6	33.2	32.0
Pounds VOC as propane / ODT	0.858	0.760	0.915	0.844
Pounds VOC as alpha pinene / ODT	0.797	0.706	0.850	0.784
Gas Stream Characteristics				
Flue gas flow, DSCFM	32,538	35,466	35,354	34,354
Flue gas flow, ACFM	65,798	65,767	66,413	65,992
Flue gas oxygen, % dry	12.5	13.6	12.5	12.9
Moisture content, %	40.9	36.1	36.8	37.9
Stack temperature, °F	170.2	164.8	165.7	166.9

As indicated in Table 3-5, The upset condition during run 3 (denoted D-25A-3) significantly affected the system gas flow rate, moisture content, oxygen content, and temperature.

Table 3-5. Test Results Summary Enviva Pellets Ahoskie, Dryer VOC Emissions		
Parameter	D-25A-3	Average, D-25A-1, -2, and -4
Test date	7/2/2014	N/A
Test time	1511-1610	N/A
Volatile Organic Compound Emissions		
Parts / million, ppmvd	148.5	145.8
Pounds / hour (as propane)	43.4	34.4
Pounds / hour (as alpha pinene)	40.33	32.0
Pounds VOC as propane / ODT	1.045	0.823
Pounds VOC as alpha pinene / ODT	0.970	0.767
Gas Stream Characteristics		
Flue gas flow, DSCFM	42,569	34,354
Flue gas flow, ACFM	75,446	65,992
Flue gas oxygen, % dry	14.4	12.9
Moisture content, %	33.5	37.9
Stack temperature, °F	161.6	166.9

The VOC emissions from the three sources are summarized in Table 3-6 using both an as-propane and as-alpha-pinene basis. These emission factors can be used to calculate total VOC emissions when processing 33% softwoods for dry hammermills, 30% for dryers, and 45% for pellet coolers.

Table 3-6. Emission Summary

Source	Pounds VOC as Propane per Oven Dried Ton
Dry Hammermill 2	0.101
Pellet Cooler 2	0.492
Dryer	0.844
Source	**Pounds VOC as Alpha-Pinene per Oven Dried Ton**
Dry Hammermill 2	0.093
Pellet Cooler 2	0.457
Dryer	0.784

4. PROCESS PARAMETERS

4.1 SOFTWOOD CONTENT DETERMINATION

Enviva determined the softwood content of the wood feed. The necessary mixture of residual materials such as hardwood chips, hardwood sawdust, and pine sawdust is fed into the hopper shown in Figure 4-1 using a front-end loader. The conveyor shown below moves the material from the hopper at a known speed and a known loading controlled by the height of the opening from the hopper. An indicator vane provides a positive indication of material flow.

Figure 4-1. Residuals Hopper and Discharge Conveyor

Chips from the roundwood chipper are fed to a discharge hopper and conveyor that has a notched plate to control the volume of chips exiting the hopper. The conveyor is shown in Figure 4-2.

Figure 4-2. Roundwood Chipper Conveyor

It is Enviva's standard procedure to operate with the discharge hopper full so that the conveyor provides a fixed, known quantity of chips. Similar to the residuals conveyor, a counter-balanced indicator vane provides a positive indication of material flow.

Enviva operates with the "Mix Control" on as indicated in Figure 4-3. The process control system stops conveying if material is not detected on either the residuals discharge conveyor or the roundwood chipper discharge conveyor. This procedure ensures that the necessary ratio of feed materials is maintained.

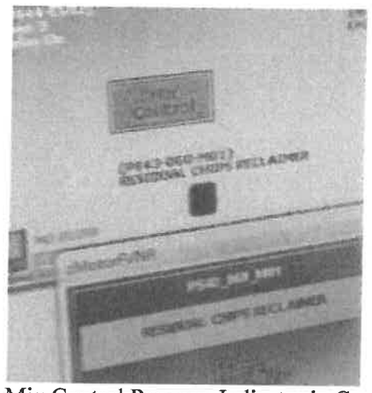


Figure 4-3. Mix Control Program Indicator in Control Room

Dry shavings are added to the wood feed at a maximum rate of 8.5 tons per hour. The actual addition rate is adjusted to maintain a constant proportionality with the residual material and chipped material. The control panel for dry shaving addition is shown in Figure 4-4.

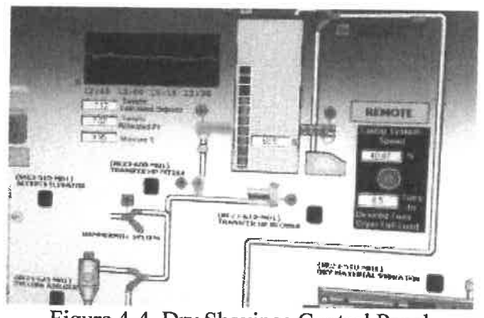


Figure 4-4. Dry Shavings Control Panel

The rate of dry shavings addition is calculated based on the rotational rate of the screw conveyor below the dry shavings hopper. The density of the dry shavings is taken into account to convert the volumetric flow rate to a mass addition rate.

An example calculation helps to explain the procedures used to calculate the softwood content. Based on pellet production of 50 short tons per hour (1200 tons per day), the plant in

this example intends to prepare a mix that consists of 60% roundwood and 40% residuals using the conveyors shown in Figures 4-1 and 4-2. This requires 619 tons per day of roundwood (hardwood) and 413 tons per day of residuals. During these tests the residuals were composed of 83.3% softwood; accordingly, the softwood feed rate was 344 tons per day. After preparing this mix, Enviva added 168 tons per day of dry shavings consisting of 100% of softwood. Using this approach, they control the average moisture content of the feed stream to the dryer. The total quantity of softwood was 344 tons per day plus 168 tons per day of shavings to yield 512 tons of softwood per day. This is 42.7% by wt. of the total feed of 1200 tons per day.

The softwood content data provided by Enviva during this test program were calculated in accordance with this procedure.

4.2 SUMMARY OF PROCESS DATA

Dryer—The dryer operating conditions during the test are summarized in Table 4-1. During Run 3, the Enviva operator observed that the feed chute to the mixing chamber became partially blocked.

Table 4-1. Dryer Operating Conditions
July 2-3, 2014

Parameter	Run 1	Run 2	Run 3	Run 4
Date	July 2	July 2	July 2	July 3
Time, Start	1236	1354	1511	852
Time, Stop	1335	1454	1610	951
Softwood Content, % wt.	30	30	30	30
Dryer Feed Rate, %	66	66	66	65
Dryer Outlet Rate, tons/hour	51.2	52.4	51.6	49.8
Mixing Chamber Temperature, F	617	632	582	614
Dryer Outlet Temperature, F	210	205	202	205
Dryer Inlet Moisture, % wt.	38.8	38.9	40.4	43.9
Dryer Outlet Moisture, % wt.	14.7	15.8	17.1-22.9	19.7
Dryer Production, ODT/Hour	41.5	41.9	41.6	39.3

As indicated in Table 3-4, this upset condition resulted in increased stack gas flow rates, decreased stack gas moisture levels, and decreased stack gas temperatures. Enviva concluded that this run was not representative of normal conditions and notified Ms. Betsy Huddleston immediately following the run. The problem was corrected overnight and a fourth run was conducted on July 3rd.

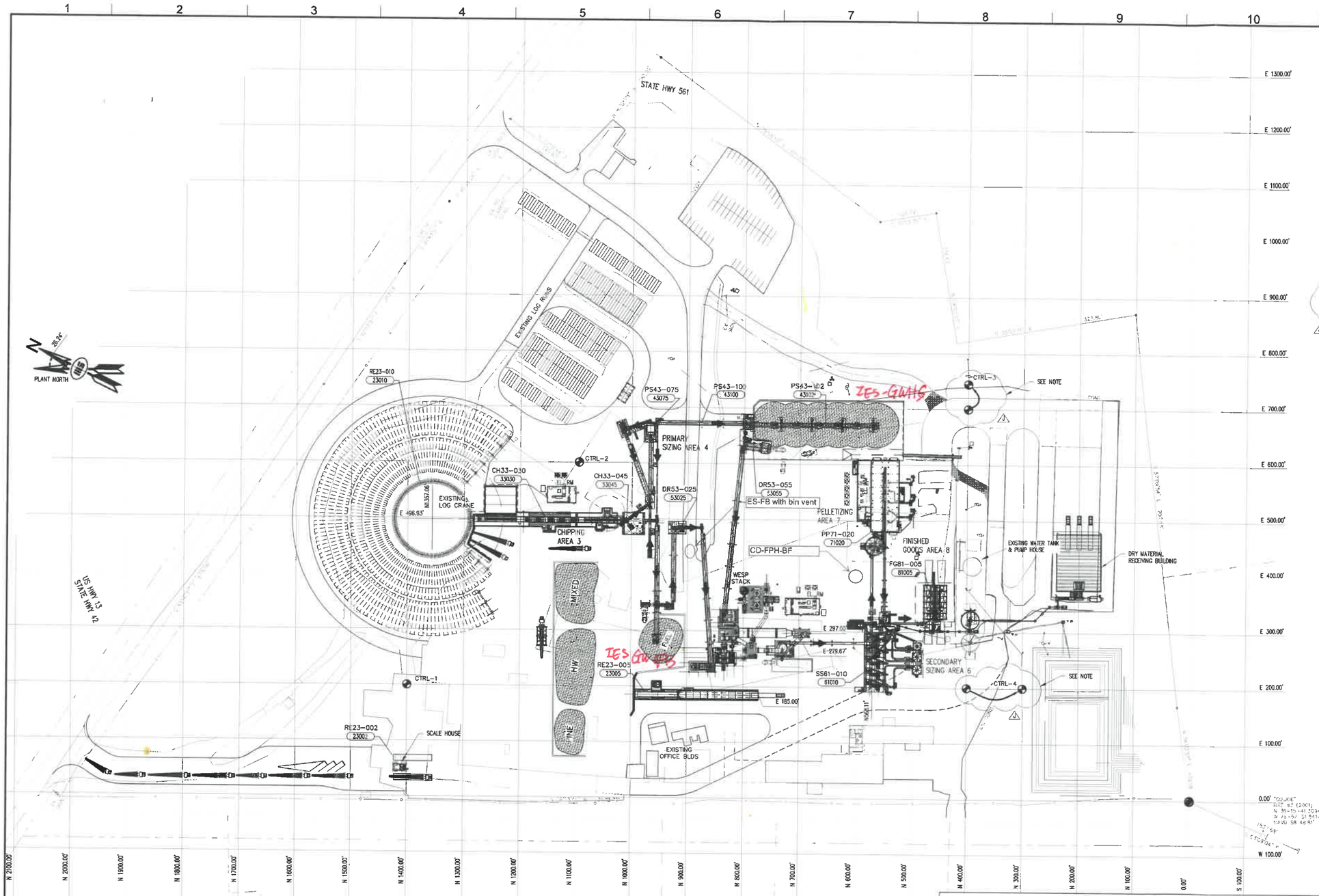
Air Control Techniques, P.C. conducted the VOC emission test on Dry Hammermill 2. This unit was selected by Enviva because it Dry Hammermill 1 and 2 receive the highest throughput of any of the five hammermills. Furthermore, the particle size distribution of the

material processed in this hammermill is smaller and more vulnerable to VOC emissions. The VOC emissions per ODT measured on this unit are similar to or higher than the emissions from the other five hammermills.

Table 4-2. Dry Hammermill 2 Operating Conditions			
Parameter	Run 1	Run 2	Run 3
Date	6/25/2014	6/25/2014	6/25/2014
Time, Start	1540	1709	1828
Time Stop	1640	1809	1928
Softwood Content, % wt.	33	33	33
Production Rate, Oven Dried Tons/Hour	10.1	10.1	10.1
Fabric Filter Pressure Drop, in. w.c.	3.9	3.9	3.9
Fan Motor Current, Amps	83	85.5	84.5

Air Control Techniques, P.C. tested the VOC emissions from the Pellet Cooler 2 system. This unit was chosen by Enviva because the two pellet coolers served by this system have higher throughput than the two pellet coolers served by the Pellet Cooler 1 or single cooler served by Pellet Cooler 3 system. The softwood content of the feed material to the Pellet Cooler 2 system was higher than the tests concerning the dry hammermill and dryer due to the introduction of dry shavings (material dried by suppliers off-site) just prior to the pelleting process.

Table 4-3. Pellet Cooler 2 Operating Conditions			
Parameter	Run 1	Run 2	Run 3
Date	6/26/2014	6/26/2014	6/26/2014
Time, Start	1109	1228	1340
Time Stop	1209	1327	1439
Softwood Constant, % wt	45	45	45
Production Rate, Oven Dried Tons/Hr	22.4	22.4	22.4
Cyclone Pressure Drop, in. w.c.	5.0	5.0	5.0



REFERENCE DRAWINGS

DRAWING NO.	REV	TITLE

Ahoskie Grid Coordinates

POINT	PLANT COORD.	NC STATE PLANE COORD.	ELEVATION
CTRL-1	N1400.00 E200.00	N923413.143 E2599816.027	52.25'
~~CTRL-2~~	N1095.00 E600.00	N923317.760 E2600105.917	52.08'
CTRL-3	N400.00 E745.00	N922739.688 ~~E2600508.457~~	~~51.70'~~
CTRL-4	N300.00 E200.00	~~N922517.391~~ E2600050.581	~~50.21'~~
WESP STACK	~~N798.57~~ E372.00	~~N922980.67~~ E2600037.46	TOP OF STACK 142.00'

Note:
CTRL-3 AND CTRL-4 WERE DESTROYED DURING CONSTRUCTION OF THE PLANT. CONTROL POINTS ARE BEING RELOCATED TO A MORE ISOLATED LOCATION.

EQUIPMENT LIST

MID-SOUTH EQUIPMENT NUMBER	ENVIVA EQUIPMENT NUMBER	DESCRIPTION
23005	RE23-005	TRUCK DUMPER
23010	RE23-010	EXISTING ROTARY LOG CRANE - 125' RADIUS
33030	CH33-030	DEBARKING DRUM
33045	CH33-045	CHIPPER (MOTOR INCLUDED)
43075	PS43-075	CHIP SCREEN
43100	PS43-100	CHIP TRANSFER CONVEYOR
43102	PS43-102	CHIP PILE DISTRIBUTION TRANSFER CONVEYOR
53025	DR53-025	BARK HOG & MOTOR
53055	DR53-055	MINI CHIP RECLAIMER
53145	DR53-145	DRYER #1
61010	SS61-010	DRY HAMMERMILLS BUILDING
71020	PP71-020	PELLETING BUILDING
73050	PP73-510	PELLET SCREEN #1
81005	FG81-005	PELLET LOAD-OUT BUILDING

NO.	DATE	REVISIONS	DWN	CKD	APPD
J	02-03-12	RELOCATED CTRL-3 AND CTRL-4	SLA		
I	01-24-12	ADDED EXPANSION PROJECT	SLA		
H	07-25-11	UPDATED LAYOUT	SLA		
G	06-21-11	UPDATED LAYOUT; GENERAL REV.	SLA		
F	04-20-11	UPDATED LAYOUT; GENERAL REV.	SLA		
E	03-02-11	UPDATED LAYOUT OF MILL, GENERAL	SLA		
D	01-21-11	UPDATED CH, PS, FG & ROADS	SLA		
C	12-14-10	ISSUED FOR REVIEW; GENERAL REV.	SLA		
B	12-07-10	REV'D DRYER & PELLETIZING LINE	SLA		
A	11-15-10	ISSUED FOR REVIEW & SCOPE DEF.	SLA		

SEALS

MID-SOUTH Engineering Co.
1538 Malvern Ave.- P.O. Box 1399
Hot Springs, Arkansas 71901
1149 Executive Circle
Cary, North Carolina 27511

MS DRAWING NO.
5784-10000-G07

DRAWN BY	DATE	CHECKED BY	DATE
SLA	11-05-10		
DESIGNED BY	DATE	APPROVED BY	DATE

ENVIVA PELLETS AHOSKIE, LLC
AHOSKIE, NC

CAVALIER PROJECT
COMMON PLANT SYSTEMS
CO GENERAL
OVERALL PLANT LAYOUT

SCALE	DRAWING NO.	REV.
1" = 80'	CSIT CO 01	J

SAVED: 02/03/12 8:50 AM PLOTTED: 02/03/2012 9:46 AM USERNAME: jspencer FILENAME: 10000007 REV-J.dwg

DIVISION OF AIR QUALITY
October 9, 2015

MEMORANDUM

To: Robert Fisher, Washington Regional Office and
Yuki Puram, Air Quality Permitting Section

From: Shannon Vogel, Stationary Source Compliance Branch

Subject: Emissions Testing Performed in Amory and Wiggins Mississippi
Submitted for Enviva Pellets Ahoskie, LLC
Ahoskie, Hertford County, North Carolina
Facility ID 4600107, Permit No. 10121R03
Performed by Air Control Techniques, Inc. (ACT)

Enviva submitted two reports of emissions testing performed at Enviva facilities in Amory and Wiggins Mississippi in October 2013 in support of requested revisions to the draft permit for the Ahoskie facility. Air Control Techniques, Inc. performed EPA Method 320 sampling for six hazardous air pollutants (HAP) [methanol, acetaldehyde, acrolein, formaldehyde, phenol, and propionaldehyde] and EPA Method 25A for total VOC.

The testing at the Wiggins facility was performed October 10 through 13, 2013 at the following locations: Dryer 1, Dryer 2, secondary hammermill 2, pellet mill, green hammermill, and pellet coolers 1 and 2. The testing at the Amory facility was performed October 14 through 16, 2013 at the following locations: dryer, dry hammermill, green hammermill and aspirators.

The major issue with the test results as reported by Air Control Techniques was the approach to reporting results for non-detected values. The test reports stated "shaded areas indicates a calculated detection limit. Emissions were calculated based on **zero** (emphasis added) for non-detect values." ACT did not calculate a maximum possible emission rate based on the detection limit as required by SSCB for compliance evaluations.

Therefore, the reported results for the following pollutants and locations are NOT acceptable due to the use of "zero" emissions presented and/or zero emissions included in the average reported emission rates. The unacceptable results include any pollutant and location which any run value was below the detection limit and "zero" emissions were included in the reported average emission rate in pounds per hour and pounds per ton oven dried pulp.

The following is a listing of the unacceptable test results for the Wiggins Facility:
Dryer 1 - acetaldehyde, acrolein, phenol; Dryer 2 - phenol; Dry Hammermill 2 - acetaldehyde, acrolein, and phenol; Green Hammermill - phenol, propionaldehyde; Pellet Cooler 1 -phenol; Pellet Cooler 2 - phenol, propionaldehyde; Aspiration System - formaldehyde, phenol, propionaldehyde.

The following is a listing of the unacceptable test results for Amory Facility:
Dryer - acetaldehyde, acrolein, formaldehyde, phenol, propionaldehyde; Green Hammermill - acetaldehyde, acrolein, formaldehyde, phenol, propionaldehyde; Aspiration System - acetaldehyde, acrolein, phenol, propionaldehyde and Dry Hammermill - . acetaldehyde, acrolein, formaldehyde, phenol, propionaldehyde.

Inclusion in these lists does not indicate that all runs were below the detection limit, only that at least 1 run of 3 was below the detection limit and a zero value was included in the reported average.

Additionally, SSCB cannot evaluate the representativeness of the emissions from the Wiggins or Amory facilities with respect to the emissions from the Ahoskie facility. The testing seems to have been performed correctly. However due to the unacceptable calculation of the non-detected values, the results cannot be used to estimate the VOC and HAP emissions for the Enviva Ahoskie facility as reported.

If you have any questions regarding the results of this evaluation, please contact me at 919-707-8416 or shannon.vogel@ncdenr.gov.

cc: Central Files, Hertford County
IBEAM Documents - 4600107

DIVISION OF AIR QUALITY
February 16, 2015

MEMORANDUM

Received
FEB 16 2015
Air Permits Section

TO: Yuki Puram, Engineer, Raleigh Central Office (RCO)

FROM: Alex Zarnowski, Meteorologist I, Air Quality Analysis Branch (AQAB)

THROUGH: Mark Cuilla, Acting Supervisor, AQAB

SUBJECT: Review of Dispersion Modeling Analysis for Enviva Pellets Ahoskie LLC
Facility ID: 4600107 Permit #: 10121-R02
Ahoskie, NC Hertford County

I have completed the dispersion modeling analysis, received January 23, 2015, for the Enviva Pellets facility located in Ahoskie, NC. The purpose for modeling was to demonstrate compliance with guidelines specified in 15A NCAC 2D .1104 for Toxic Air Pollutant (TAP) emitted in excess of the Toxic Permitting Emission Rate (TPER) listed in 15A NCAC 2Q .0711. The modeling adequately demonstrates compliance on a facility-wide basis.

There was multiple emission sources of formaldehyde and acrolein modeled. The application purposes changes to the dryer system to increase production from 43 oven-dried tons per hour (ODT/hr) to the current permitted capacity of 48 ODT/hr. Also, the facility purposes to make modifications to the downstream material handling system to accommodate a throughput of 55 ODT/hr. Emission rates and source parameters are provided in the attached tables.

AERMOD, (14134) using five years (2005-2009) of meteorological data from Elizabeth City (surface) and Newport-Morehead City (upper air) was used to evaluate impacts in both simple and elevated terrain. Direction specific building dimensions, determined using EPA's BPIP program (04274), were used as input to the model for building wake effect determination. Receptors were placed along the property boundary at 25 m intervals. Extending from the property boundary a Cartesian receptor grid with receptors placed at 100 m extended to 2 km from the facility. Table 1 shows the maximum impact as a percentage of the Acceptable Ambient Levels (AAL).

Table 1. Maximum impacts for Enviva Pellets Ahoskie LLC.

Pollutant	Averaging Period	2005 $\mu g/m^3$	2006 $\mu g/m^3$	2007 $\mu g/m^3$	2008 $\mu g/m^3$	2009 $\mu g/m^3$	AAL $\mu g/m^3$	% of AAL
Acrolein	1-hr	58.8	59.1	**79.4**	73.9	77.4	80	99.25%
Formaldehyde	1-hr	52.8	50.0	**69.9**	64.1	68.9	150	46.6%

This compliance demonstration assumes the source parameters and pollutant emission rates used in the analysis are correct.

cc: Mark Cuilla
Alex Zarnowski

Table 2. Modeled emission rates for Enviva Pellets Ahoskie LLC.

Model ID	Acrolein (g/s)	Formaldehyde (g/s)
EP1	3.45E-01	7.48E-01
EP2	2.63E-02	3.43E-02
EP3	2.63E-02	3.43E-02
EP4	1.32E-02	1.71E-02
EP5	0	0
EP6	2.86E-05	3.64E-04
EP7	2.45E-05	3.12E-04
EP8	0	0
EP9	0	0
EP10	0	0
EP11	4.61E-02	3.45E-02
EP12	4.61E-02	3.45E-02
EP13	2.30E-02	1.72E-02
EP14	0	0

Table 3. Pollutant source parameters for Enviva Pellets Ahoskie LLC.

Source ID	Easting (m)	Northing (m)	Base Elev. (m)	Stack Ht. (m)	Temp. (K)	Exit Vel. (m/s)	Stack Dia. (m)
EP1	323540.2	4015565	15.65	27.58	347.59	8.21	3.05
EP2	323542.4	4015462	15.2	15.7	293.15	4.04	2.44
EP3	323548.3	4015465	15.23	15.7	293.15	4.04	2.44
EP4	323553.1	4015468	15.28	15.7	293.15	4.74	2.03
EP5	323593	4015510	15.54	22.68	293.15	3.65	0.6
EP6	323550.6	4015538	15.64	3.05	919.82	78.3	0.13
EP7	323616.1	4015462	15.26	2.44	954	109.19	0.1
EP8	323556.8	4015602	15.41	14.94	293.15	0.01	0.74
EP9	323573.3	4015523	15.61	16.76	310.93	14.33	1.22
EP10	323523.9	4015657	15.77	6.1	310.93	19.81	0.91
EP11	323614.6	4015498	15.5	7.52	293.15	19.95	0.91
EP12	323622.3	4015502	15.53	7.52	293.15	19.95	0.91
EP13	323634.4	4015506	15.58	6.1	293.15	16.39	0.71
EP14	323576.3	4015446	15.01	21.82	293.15	3.65	0.6

Division of Air Quality
Washington Regional Office
October 22, 2015

TO: Yuki Puram, RCO Permits

FROM: Betsy Huddleston

SUBJECT: **Recommendations and Comments on Air Permit Application**
Enviva Pellets Ahoskie, LLC
Hertford County, Facility ID 4600107
Air Permit 10121R02, APP 4600107.15B
Fee Class: Title V

Contact: Joe Harrell, EHS Manager, office (252) 209-6032 ext. 202, cell (252) 370-3181

1. Application Summary:

Enviva submitted a permit renewal application on 10/06/2015. There is one other permit application in-house for the Title V permit, which was submitted on 11/13/2012. An amendment to this application was submitted in June 2015. The amendment requested removal of permit condition 2.2.A.2.c.

2. Facility Compliance Status:

Enviva was most recently inspected on 5/05/2015 with assistance from Mr. Joe Harrell, Enviva EHS Manager. All permitted and insignificant sources were physically inspected. A records review was also performed that day back to June 2014. The inspection was conducted using permit revision R02.

Fugitive dust plan recordkeeping has improved greatly, but there is still some room for improvement in consistency of completion of the logs. The facility appeared to operate in compliance with all applicable air quality regulations and permit conditions at the time of the inspection.

A couple of NODs have been issued to Enviva since mid-2014. One was issued on 7/28/2014 for problems discovered during the annual inspection. The other was issued on 9/03/2014 for a late report.

3. Regional Concerns, Comments and Recommendations:

- As you and I have discussed, another look is needed at toxics with the permit renewal. Enviva has been using some HAPs/TAPs test data from out-of-state facilities to estimate their emissions from the hammermills at Ahoskie. The stack tests for those facilities were submitted to SSCB for review. Shannon Vogel finished the review on 10/09/2015 and found the test results **not** acceptable for use as emissions factors for Ahoskie (I just got the memo on 10/21 after we talked). I'm in the process of deciding what to do for their 2014 inventory. Shannon's review should be in Documents Module.

- If we retain toxics limits that are established based on potential production rates, then I agree it is acceptable to remove 2.2.A.2.c. from the permit. If the Title V permit will require some sort of monitoring, then maybe Enviva could provide a corresponding potential tonnage throughput of softwood that would serve as an easy limit to track.

- Is there any plan to issue the Title V soon after the renewal or as part of the renewal?

- WaRO would like to review the draft permit before it is issued.

(k:\hertford46\00107\permits\20151022p04.doc)

Puram, Yukiko

From: mtdeyo@aol.com
Sent: Thursday, October 22, 2015 11:30 AM
To: Puram, Yukiko
Cc: Michael.Doniger@envivabiomass.com; joe.harrell@envivabiomass.com; amcconnell@kilpatricktownsend.com
Subject: Re: Enviva Ahoskie Frist Title V Permit
Attachments: NOR - Dryer Benzene Testing Report - Summary Pages.pdf

Ms. Puram:

Thank you for taking the time to review our information concerning benzene emissions from the Ahoskie wood pellet manufacturing dryer.

As discussed below, the original Title V Application for the Ahoskie facility included benzene emissions from the facility's dryer. These emission rates were then modeled to demonstrate compliance with the North Carolina Toxic Air Pollutant Standards. Annual emission limits and monitoring requirements were also included in the permit. Dryer benzene emissions were calculated using conservative AP-42 emissions factors from similar industries/operations. However, as detailed in our previous correspondence, we have since determined, through literature searches and stack testing, that benzene is not emitted from the Ahoskie wood pellet manufacturing process (See February 23, 2015 letter, Dr. John Richards (Air Control Techniques, P.C.) to Michael Doniger (Enviva) previously submitted to DAQ.

In addition, attached please find the summary pages of the Enviva Pellets Northampton, LLC, October 2013 stack testing report in which benzene emissions were tested on the Enviva dryer stack using EPA Method 18. Benzene emission measurements are listed as "non-detect" in all three test runs for the facility dryer. Please note that since this testing was performed at the dryer stack, it accounts for emissions associated with both the drying of wood chips, as well as the combustion of wood. in the furnace.

Based on these data, benzene emissions are not present from the Enviva wood pellet manufacturing dryers and we request that the monitoring requirements for benzene emissions be removed from the permit.

If you have any questions or require additional information, please contact me at 804-937-0377.

Sincerely,

Michael T. Deyo
On Behalf of Enviva Pellets Ahoskie, LLC

-----Original Message-----
From: Puram, Yukiko <yuki.puram@ncdenr.gov>
To: mtdeyo <mtdeyo@aol.com>
Cc: joe.harrell <joe.harrell@envivabiomass.com>; michael.doniger <michael.doniger@envivabiomass.com>
Sent: Fri, Oct 2, 2015 8:47 am
Subject: RE: Enviva Ahoskie Frist Title V Permit

Hi Mike;

Thank you for providing me the information. It was very helpful. I agree that the original modeling was based on many uncertainties that they were not aware of at that time. However, I still have concerns with emissions as a result of the wood combustion to fuel the dryer. If I remember correctly, the emissions from the wood combustions and the dryer are emitted from a common stack. I do agree that the benzene emissions from the dryer alone is probably not significant

enough to have monitoring, recordkeeping and reporting requirements. However, I cannot find any information regards to emissions from wood combustion.

According to EPA's AP-42 Chapter 1.6, benzene emissions from the wood combustion is 4.2E-3 lb/MMBtu. The heat input of the dryer is 175. 3 mmBtu/hr. Based on these numbers, the PTE of benzene is 0.74 lb/hr, or 6400 lb/yr, which is well above the TPER of 8.1 lb/yr.

I believe this question arose during our conversation over the phone last time. I am wondering if you had a chance to review that issue. Please let me know when you have a chance.

Thank you.

Yuki

Yuki Puram
Permits Section, Environmental Engineer
NC DENR, Division of Air Quality
1641 Mail Service Center, Raleigh NC, 27699-1641
Phone/Fax: 919-707-8470
www.ncair.org
yuki.puram@ncdenr.gov

From: mtdeyo@aol.com [mailto:mtdeyo@aol.com]
Sent: Friday, September 11, 2015 10:46 AM
To: Puram, Yukiko <yuki.puram@ncdenr.gov>
Cc: joe.harrell@envivabiomass.com; michael.doniger@envivabiomass.com
Subject: Re: Enviva Ahoskie Frist Title V Permit

Ms. Puram:

Thank you for taking time to discuss Enviva's 2015 Amended Title V Application and request to remove State Operating Permit Condition 2.2.A.2.a. We are providing the following information in response to your question/comment in the email string below.

The benzene emissions as calculated in the original application were based on the processing of wood pellet material in the dryer, and not the combustion of the wood waste material (as previously indicated). As detailed in the original permit application, the maximum annual benzene emission rate at the facility's maximum production (and 10% softwood) was only 464 lb/year (see attached page of Title V application emissions calculations showing a maximum annual emission rate of 0.232 tons per year).

However, the air dispersion modeling analysis that was performed as part of the facility's initial Title V Air Permit Application was performed using an annual dryer benzene emission rate of 2,864.52 lb/year (See attached page of Title V Application modeling demonstration where benzene modeled at 4.12e-2 grams/second). This higher annual emission rate became, and remains, the permitted benzene emission limit for the dryer.

In other words, the modeling was conservatively run at a significantly higher rate than the calculated maximum potential emissions.

As detailed in our June 2015 Amended Title V Application, we do not believe that benzene is emitted from the facility dryer. However, even if Enviva were to calculate the theoretical benzene emissions for the increased softwood content of 30%, at the maximum permitted capacities, the maximum annual benzene emissions only increases to 1,072.92

lb/yr. This emission rate remains well below the facility's permitted dryer emission rate of 2,864.52 lb/yr. A copy of these theoretical emissions calculations are provided as an attachment to this email.

Since the facility can not exceed this permitted emission rate, even while operating at the maximum operating throughputs and maximum allowable softwood contents, we believe that the removal of the monitoring requirements at Condition 2.2.A.2.a is appropriate.

Also, I will continue to follow up on your other questions discussed during our call today and will contact you to discuss in the near future.

If you have any questions or require additional information, please contact me at 804-937-0377.

Sincerely,

Michael T. Deyo
On Behalf of Enviva Pellets Northampton, LLC

-----Original Message-----
From: Puram, Yukiko <yuki.puram@ncdenr.gov>
To: mtdeyo <mtdeyo@aol.com>
Cc: Joe Harrell (joe.harrell@envivabiomass.com) <joe.harrell@envivabiomass.com>
Sent: Tue, Sep 8, 2015 2:52 pm
Subject: Enviva Ahoskie Frist Title V Permit

Hi Mike;

Hope you had a nice weekend.

We have received a request to remove the monitoring conditions for acrolein, formaldehyde and benzene. I have a question regarding the statement made in Attachment 2 of the permit application. The footnote (2) indicated:

> (2) Benzene emissions limit for dryer reports benzene emission rate modeled as part of initial air permit application and calculated using maximum dryer burning rates and emission factors associated with wood waste combustion. Enviva does not believe that benzene is emitted from the wood pellet manufacturing facility and therefore, emissions from the dryer are considered zero. However, maximum potential benzene emissions from the dryer using the wood waste combustion factors would be equal to the permitted emission rate.

When the original permit (R00) was issued, the calculation was based on the incorrect maximum heat input (125 mmBtu/hr) of the dryer. Now that we know the heat input is actually 175.3 mmBtu/hr, I don't think we can use the previous modeling analysis. If you can show us the facility-wide benzene emissions (including emissions from wood combustion and the dryer) being lower than the TPER (8.1 lb/yr), I can take the monitoring requirement from the permit. Otherwise, the facility is required to conduct a modeling analysis on benzene, which was not included in the toxic analysis report submitted in January 2015.

If you have further questions, please let me know.
Thanks.

Yuki

Yuki Puram
Permits Section, Environmental Engineer
NC DENR, Division of Air Quality
1641 Mail Service Center, Raleigh NC, 27699-1641
Phone/Fax: 919-707-8470
www.ncair.org
yuki.puram@ncdenr.gov

****
Email correspondence to and from this address is subject to the North Carolina Public Records Law and may be disclosed to third parties unless the content is exempt by statute or other regulation.
****

Division of Air Quality
Washington Regional Office
October 22, 2015

TO: Yuki Puram, RCO Permits

FROM: Betsy Huddleston

SUBJECT: **Recommendations and Comments on Air Permit Application**
Enviva Pellets Ahoskie, LLC
Hertford County, Facility ID 4600107
Air Permit 10121R02, APP 4600107.15B
Fee Class: Title V

Contact: Joe Harrell, EHS Manager, office (252) 209-6032 ext. 202, cell (252) 370-3181

1. Application Summary:

Enviva submitted a permit renewal application on 10/06/2015. There is one other permit application in-house for the Title V permit, which was submitted on 11/13/2012. An amendment to this application was submitted in June 2015. The amendment requested removal of permit condition 2.2.A.2.c.

2. Facility Compliance Status:

Enviva was most recently inspected on 5/05/2015 with assistance from Mr. Joe Harrell, Enviva EHS Manager. All permitted and insignificant sources were physically inspected. A records review was also performed that day back to June 2014. The inspection was conducted using permit revision R02.

Fugitive dust plan recordkeeping has improved greatly, but there is still some room for improvement in consistency of completion of the logs. The facility appeared to operate in compliance with all applicable air quality regulations and permit conditions at the time of the inspection.

A couple of NODs have been issued to Enviva since mid-2014. One was issued on 7/28/2014 for problems discovered during the annual inspection. The other was issued on 9/03/2014 for a late report.

3. Regional Concerns, Comments and Recommendations:

- As you and I have discussed, another look is needed at toxics with the permit renewal. Enviva has been using some HAPs/TAPs test data from out-of-state facilities to estimate their emissions from the hammermills at Ahoskie. The stack tests for those facilities were submitted to SSCB for review. Shannon Vogel finished the review on 10/09/2015 and found the test results **not** acceptable for use as emissions factors for Ahoskie (I just got the memo on 10/21 after we talked). I'm in the process of deciding what to do for their 2014 inventory. Shannon's review should be in Documents Module.

- If we retain toxics limits that are established based on potential production rates, then I agree it is acceptable to remove 2.2.A.2.c. from the permit. If the Title V permit will require some sort of monitoring, then maybe Enviva could provide a corresponding potential tonnage throughput of softwood that would serve as an easy limit to track.

- Is there any plan to issue the Title V soon after the renewal or as part of the renewal?

- WaRO would like to review the draft permit before it is issued.

(k:\hertford46\00107\permits\20151022p04.doc)

From: Evans, John
Sent: Monday, February 23, 2015 5:53 PM
To: Mceachern, Charles
Cc: Pullen, Booker; Puram, Yukiko; Patnaik, Gautam
Subject: RE: Found It!

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Red Category

Charlie Mac – outstanding. Thanks

John C. Evans
General Counsel
N.C. Department of Environment and Natural Resources

Telephone: 919-707-8474

Mailing Address:
1601 Mail Service Center
Raleigh, NC 27699-1601

Physical Address:
217 W. Jones Street
Raleigh, NC 27603

From: Mceachern, Charles
Sent: Monday, February 23, 2015 5:52 PM
To: Evans, John
Cc: Pullen, Booker; Puram, Yukiko; Patnaik, Gautam
Subject: Found It!

John, I think NCGS 150B-3(a) is what allows the Permittee to continue operating under an expired permit as long as a renewal application has been filed and not acted upon. What do you think?

§ 150B-3. Special provisions on licensing.

(a) When an applicant or a licensee makes a timely and sufficient application for issuance or renewal of a license or occupational license, including the payment of any required license fee, the existing license or occupational license does not expire until a decision on the application is finally made by the agency, and if the application is denied or the terms of the new license or occupational license are limited, until the last day for applying for judicial

review of the agency order. This subsection does not affect agency action summarily suspending a license or occupational license under subsections (b) and (c) of this section.

(b) Before the commencement of proceedings for the suspension, revocation, annulment, withdrawal, recall, cancellation, or amendment of any license other than an occupational license, the agency shall give notice to the licensee, pursuant to the provisions of G.S. 150B-23. Before the commencement of such proceedings involving an occupational license, the agency shall give notice pursuant to the provisions of G.S. 150B-38. In either case, the licensee shall be given an opportunity to show compliance with all lawful requirements for retention of the license or occupational license.

(c) If the agency finds that the public health, safety, or welfare requires emergency action and incorporates this finding in its order, summary suspension of a license or occupational license may be ordered effective on the date specified in the order or on service of the certified copy of the order at the last known address of the licensee, whichever is later, and effective during the proceedings. The proceedings shall be promptly commenced and determined.

Nothing in this subsection shall be construed as amending or repealing any special statutes, in effect prior to February 1, 1976, which provide for the summary suspension of a license.

(d) This section does not apply to the following:

(1) Revocations of occupational licenses based solely on a court order of child support delinquency or a Department of Health and Human Services determination of child support delinquency issued pursuant to G.S. 110-142, 110-142.1, or 110-142.2.

(2) Refusal to renew an occupational license pursuant to G.S. 87-10.1, 87-22.2, 87-44.2, or 89C-18.1, based solely on a Department of Revenue determination that the licensee owes a delinquent income tax debt. (1973, c. 1331, s. 1; 1985, c. 746, s. 1; 1995, c. 538, s. 2(i); 1997-443, s. 11A.118(a); 1998-162, s. 8.)

Charles M. McEachern, III, P.E.
Environmental Engineer/Permits Coordinator
NC DENR, Division of Air Quality
Raleigh Regional Office
3800 Barrett Drive, Raleigh, NC 27609
E-mail: charles.mceachern@ncdenr.gov
Phone: (919)791-4276
FAX: (919)881-2261
DAQ Web Site: www.ncair.org

Enviva Pellets Ahoskie, LLC
142 NC Route 561 East
Ahoskie, NC 27910

+1 (252) 209 6032
fax (252) 209 6039

www.envivabiomass.com

April 4, 2013

Kevin Godwin, Engineer
Permits
NC DENR, Division of Air Quality
1641 MSC
Raleigh, NC 27699-1641

Subject: Application No. 4600107.12B Installation of Pellet Presses (No. 11 and 12) and 6th Pellet Cooler with One Simple Cyclone

Dear Mr. Godwin:

Enviva Pellets Ahoskie, LLC (Facility ID. 4600107) submitted application No. 4600107.12B dated November 16, 2012 to expand production capacity via installation of two additional pellet presses (No. 11 and 12) and a 6th pellet cooler, through which the pellet presses exhaust. Due to new information, Enviva is reconsidering the expansion plans and requests rescission of this application.

Please feel free to contact Joe Harrell at (252) 370-3181 with any questions or comments. Thank you for your time and attention.

Sincerely,

Peter Najera
VP, Operations

Comprehensive Application Report for 4600107.12A

Enviva Pellets Ahoskie, LLC - Ahoskie (4600107)

Hertford County

11/14/2012

General Information:	Permit/Latest Revision: 10121/ R01
Permit code:	TV-1st Time
Application type:	Modification
Engineer/Rev. location:	Kevin Godwin/RCO
Regional Contact:	Yongcheng Chen
Facility location:	Washington Regional Office
Facility classification:	Title V
Clock is ON	Application is COMPLETE
Status is :	In progress

Application Dates

Received	Completeness Due	Clock Start	Calculated Issue Due
11/13/2012	01/12/2013	11/13/2012	

Fee Information

Initial amount:	Date received:	Amount Due:	Add. Amt Rcv'd:	Date Rcv'd:
$867.00	11/13/2012	0.00		

Fund type:	Deposit Slip #:	Location rec'd:	Location deposited:
2333			

Contact Information

Type	Name	Address	City State ZIP	Telephone
Technical/Permit	Joseph Harrell, EHS Manager	142 NC Route 561 East	Ahoskie, NC 27910	(252) 209-6032
Authorized	Peter Najera, VP of Operations	7200 Wisconsin Ave. Suite 1100	Bethsesda, MD 20814	(301) 357-5560

Acceptance Criteria

Received?	Acceptance Criteria Description
N/A	Application fee
Yes	Appropriate number of apps submitted
N/A	Zoning Addressed
N/A	Source recycling/reduction form
Yes	Authorized signature
N/A	PE Seal
N/A	Application contains toxic modification(s)

Completeness Criteria

Received?	Complete Item Description

Comprehensive Application Report for 4600107.12A 11/14/2012

Enviva Pellets Ahoskie, LLC - Ahoskie (4600107)

Hertford County

Application Events

Event	Start	Due	Complete	Comments	Staff
TV - Acknowledgment/Complete	11/13/2012	11/23/2012	11/14/2012		kmhash

Regulations Pertaining to this Permit

Reference Rule		Regulation Description
2D	.0515	Particulates Miscellaneous Industrial Processes
2D	.0516	Sulfur Dioxide Emissions Combustion Sources
2D	.0521	Control of Visible Emissions

Audit Information Pertaining to this Application

Column Name	Date Changed	Old Value	New Value	Editor

North Carolina Department of Environment and Natural Resources
Division of Air Quality

Beverly Eaves Perdue
Governor

Sheila C. Holman
Director

Dee Freeman
Secretary

November 14, 2012

Mr. Peter Najera
VP of Operations
Enviva Pellets Ahoskie, LLC
7200 Wisconsin Ave. Suite 1100
Bethsesda, MD 20814

SUBJECT: Receipt of Permit Application
Modification of Permit No. 10121R01
Application No. 4600107.12A
Enviva Pellets Ahoskie, LLC
Facility ID: 4600107, Ahoskie, Hertford County

Dear Mr. Najera:

Your air permit application (4600107.12A) for Enviva Pellets Ahoskie, LLC, located in Hertford County, North Carolina was received by this Division on November 13, 2012.

This application submittal **did** contain all the required elements as indicated and has been accepted for processing. Your application will be considered complete as of November 13, 2012, unless informed otherwise by this office within 60 days.

Should you have any questions concerning this matter, please contact Kevin Godwin at (919) 707-8480.

Sincerely,

Donald van der Vaart, Ph.D., P.E., J.D.
Chief, Permits Section

cc: Washington Regional Office Files

Permitting Section
1641 Mail Service Center, Raleigh, North Carolina 27699-1641
217 West Jones Street, NC 27603
Phone: 919-707-8405 \ FAX: 919-715-0717 \ Internet: www.ncair.org