

## Enviva Greenwood - Response to Major Source Status

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 1 attachments (39 KB)

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Jo Anna and Mike,

Please find the attached document which addresses the major source status questions for CO and NOx. Contact me with any additional questions.

Sincerely,



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**Enviva Pellets Greenwood, LLC**  
**Response to Statements Regarding Carbon Monoxide (CO) and Nitrogen Oxide (NOx) PSD Major Source Status**

**1. Summary**

This memo compares the Original Colombo Permit and Potential Emission Calculation Summary with Draft Permit Number 1240-0133-CC (“Draft Permit”) to demonstrate that the Greenwood facility never exceeded Prevention of Significant (PSD) major source thresholds for Carbon Monoxide (CO) or Nitrogen Oxide (NOx) on a potential or actual emissions basis. Factors presented in this memo include potential/designed production rates, emission factors, and calculation methodologies.

One can easily confirm that the Greenwood facility is, and has always been, a minor PSD source of NOx and CO emissions by reviewing the pending NOx and CO potential to emit (PTE) emission rates of 125.0 tpy and 100.3 tpy presented in the application that serves as the basis for the Draft Permit. No emission reductions of CO and NOx emissions have occurred at the facility since initial construction and operation of the facility. As documented in the Draft Permit, Enviva is proposing to increase the facility’s permitted capacity resulting in additional NOx and CO emissions from combustion in from RTO1 as it controls the new Dry Hammermills and Green Hammermills, and from RTO3/RTO2 as it controls emissions from the new pellet cooler and pelletizers. As the proposed new and higher PTE emission rates of NOx and CO in the Draft Permit are well below the PSD major source threshold of 250 tpy, it would be impossible for the facility to have ever exceeded the major source threshold as originally constructed and operated. This conclusion is supported by compliance testing of RTO1 and the RTO/RCOs at the facility as discussed below.

**2. Emissions Rates Provided in Form D-2569**

In response to a request from the South Carolina Department of Health and Environmental Control (SCDHEC) during review of the permit application that serves as the basis for the Draft Permit, Enviva submitted Table 1 below as part of a revised Form D-2569. The table included the following three sets of emission rates:

1. Emission Rates Prior to Construction / Modification (tons/yr) Colombo Basis
  - a. Colombo Permitted Rates
2. Emission Rates Prior to Construction / Modification (tons/yr) Colombo Permitted Plus Existing Unpermitted Emissions
  - a. Colombo Permitted Rates **plus** previously unquantified emissions from: furnace bypass cold startups, furnace bypass idle mode, dryer duct burner, unpaved roads, and paved roads
3. Emission Rates After Construction / Modification (tons/yr) Enviva Basis
  - a. These values reflect submitted application and Draft Permit 1240-0133-CC

*Table 1. Comparison of Facility-wide Potential Emissions*

Pollutants	1. Emission Rates Prior to Construction / Modification (tons/year) Colombo Basis			2. Emission Rates Prior to Construction / Modification (tons/year) Colombo Permitted Emissions Plus Existing Unpermitted Emissions			3. Emission Rates After Construction / Modification (tons/year) Enviva Basis		
	Uncontrol.	Control.	Limited	Uncontrol.	Control.	Limited	Uncontrol.	Control.	Limited
PM	13,948	151	148	14,289	281	174	12,684	283	168
PM10	13,948	151	148	14,109	253	157	9,667	206	103
PM2.5	11,958	132	128	12,047	215	131	9,102	179	89

Pollutants	1. Emission Rates Prior to Construction / Modification (tons/year) Colombo Basis			2. Emission Rates Prior to Construction / Modification (tons/year) Colombo Permitted Emissions Plus Existing Unpermitted Emissions			3. Emission Rates After Construction / Modification (tons/year) Enviva Basis		
	Uncontrol.	Control.	Limited	Uncontrol.	Control.	Limited	Uncontrol.	Control.	Limited
SO <sub>2</sub>	22.5			27.1	27.1	22.6	27	27	22.1
NO <sub>x</sub>	249			292	292	252	158	166	125
CO	249			361	361	253	173	216	100
VOC	2,906	305	247	2,909	308	247	2,491	138	120
Pb	0	0	0	5.10E-02	1.20E-02	3.34E-03	5.10E-02	1.20E-02	3.34E-03
Formaldehyde	17.2	1.60	1.33	18.0	2.41	1.35	91.39	5.67	4.40
Total HAP Emissions	52.1	5.10	4.22	57.9	10.9	4.38	416.35	29.18	22.40

As previously discussed with SCDHEC, column 2 of Table 1 consists simply of the sum of Colombo's emissions estimates plus the addition of Enviva's estimates for units not accounted for by Colombo in their application. These numbers did not reflect any revisions or corrections to Colombo's estimates, and were never intended to represent facility PTE emission rates. An explanation of the basis for Colombo's estimated NO<sub>x</sub> and CO emissions, as well as Enviva's estimated emissions resulting from the addition of previously unaccounted for sources, is provided below. These sections focus on the controlled and limited emission rates only as these are the rates that represent the facility's PTE.

#### 2.1 Colombo's NO<sub>x</sub> and CO Emission Rate Calculations

Emissions of CO and NO<sub>x</sub> from fuel combustion in the Dryer/Furnace and RTO1 in Colombo's original submittal were based on emission factors back-calculated from proposed annual CO and NO<sub>x</sub> facility-wide emission limits of 249 tpy. Colombo back-calculated and assigned 245 tpy and 241 tpy, respectively, to CO and NO<sub>x</sub> from the Dryer/Furnace and RTO1. Other sources of CO and NO<sub>x</sub> quantified by Colombo include fuel combustion in RTO2/RCO1 and RTO3/RCO2 (the pellet cooler RTO/RCOs), E44 (Engine 1 Generator), and E45 (Engine 2 Fire Pump). Emissions from the Dryer/Furnace and RTO1, when added to emissions from these other sources of CO and NO<sub>x</sub> at the facility, resulted compliance with the proposed facility-wide emissions of 249 tpy for both CO and NO<sub>x</sub>.

Colombo's calculation methodology for CO and NO<sub>x</sub> emissions from the Dryer/Furnace, RTO1, RTO2/RCO1, and RTO3/RCO2 are described below (the engines are not significant sources of these pollutants and emission calculations for these units are, therefore, not described in detail).

- Table 28. Process 2: Dryer/Furnace
  - Design Basis
    - Furnace: 200 MMBtu/hr
    - RTO: 5 MMBtu/hr

- Emission Factors<sup>1</sup>
  - $CO = 245 \frac{\text{tons}}{\text{yr}} \times \frac{\text{hr}}{(200+5) \text{ MMBtu}} \times 2000 \frac{\text{lb}}{\text{ton}} \times \frac{\text{yr}}{8760 \text{ hr}} = 0.273 \frac{\text{lb}}{\text{MMBtu}}$
  - $NO_x = 241 \frac{\text{tons}}{\text{yr}} \times \frac{\text{hr}}{(200+5) \text{ MMBtu}} \times 2000 \frac{\text{lb}}{\text{ton}} \times \frac{\text{yr}}{8760 \text{ hr}} = 0.268 \frac{\text{lb}}{\text{MMBtu}}$
- Annual Emissions
  - $CO = 205 \frac{\text{MMBtu}}{\text{hr}} \times 8760 \frac{\text{hr}}{\text{yr}} \times 0.273 \frac{\text{lb CO}}{\text{MMBtu}} \times \frac{\text{ton}}{2000 \text{ lb}} = 245 \text{ ton CO/yr}$
  - $NO_x = 205 \frac{\text{MMBtu}}{\text{hr}} \times 8760 \frac{\text{hr}}{\text{yr}} \times 0.269 \frac{\text{lb NO}_x}{\text{MMBtu}} \times \frac{\text{ton}}{2000 \text{ lb}} = 241 \text{ ton NO}_x/\text{yr}$
- Tables 32 and 33. Process 4: Pellet Coolers 1, 2, and 3, and Pellet Coolers 4 and 5
  - Design Basis
    - RTO/RCO: 5 MMBtu/hr
    - Higher heating value of natural gas = 1,000 MMBtu/MMscf
  - Emission Factors (AP-42, Section 1.4)
    - CO = 84 lb/MMscf
    - NO<sub>x</sub> = 100 lb/MMscf
  - Annual Emissions per RTO/RCO
    - $CO = 5 \frac{\text{MMBtu}}{\text{hr}} \times 84 \frac{\text{lb}}{\text{MMscf}} \times \frac{\text{MMscf}}{1000 \text{ MMBtu}} \times \frac{8760 \text{ hr}}{\text{yr}} \times \frac{\text{ton}}{2000 \text{ lb}} = 1.84 \text{ tons CO / year}$
    - $NO_x = 5 \frac{\text{MMBtu}}{\text{hr}} \times 100 \frac{\text{lb}}{\text{MMscf}} \times \frac{\text{MMscf}}{1000 \text{ MMBtu}} \times \frac{8760 \text{ hr}}{\text{yr}} \times \frac{\text{ton}}{2000 \text{ lb}} = 2.19 \text{ tons NO}_x / \text{year}$

## 2.2 Enviva’s Estimates of NO<sub>x</sub> and CO Emissions from Previously Unpermitted Sources

There are several additional existing sources of CO and NO<sub>x</sub> emissions which were not included in Colombo’s original potential emissions estimates. In order to accurately represent PTE emissions from the Greenwood facility, Enviva also quantified NO<sub>x</sub> and CO emissions associated with furnace bypass cold start-ups, furnace bypass idle mode operation, and a dryer duct burner. These emission rates are summarized in Table 2 below and are the same rates that were supplied to SCDHEC in the Draft Permit application *Enviva GRE Emission for SCDHEC (rev1 2020-0626).xlsx* tabs 5-Dryer 1 (F Bypass Startup), 6-Dryer 1 (F Bypass Idle) and 7-Dryer DB.

Table 2. Additional Unpermitted Emissions – Controlled & Limited

Emission Source/Process	CO (tpy)	NO <sub>x</sub> (tpy)
Dryer 1 (F Bypass Startup)	0.45	0.17
Dryer 1 (F Bypass Idle)	1.80	0.66
Dryer DB	1.80	2.15
<b>Controlled &amp; Limited Total</b>	<b>4.05</b>	<b>2.98</b>

## 2.3 Calculation of Total Emissions Rates Prior to Construction

The calculation of the emission rates presented column 2 of Table 1, which again are not intended to represent the facility’s PTE emission rates, but include Colombo’s permitted emission rates plus Enviva’s emission rates for sources not quantified by Colombo, is summarized in Table 3 below.

<sup>1</sup> Note, although the Colombo application references AP-42, Section 1.6 as the basis for the NO<sub>x</sub> and CO emission factors, these factors are not AP-42 factors and, as noted above, were back-calculated to obtain facility-wide emissions of 249 tpy for CO and NO<sub>x</sub>.

Table 3. Total Emission Rates Prior to Construction – Controlled & Limited

Emission Source/Process	Colombo Emission Rates for Originally Permitted Sources		Enviva Emission Rates for Unpermitted Sources		Total Emission Rates	
	CO (tpy)	NOx (tpy)	CO (tpy)	NOx (tpy)	CO (tpy)	NOx (tpy)
Dryer/Furnace and RTO1	245	241	--	--	245	241
Pellet Coolers 1, 2, and 3 RTO2/RCO1	1.84	2.19	--	--	1.84	2.19
Pellet Coolers 4 and 5 RTO3/RCO2	1.84	2.19	--	--	1.84	2.19
Engine 1	0.19	2.74	--	--	0.19	2.74
Engine 2	0.07	0.96	--	--	0.07	0.96
Dryer 1 (F Bypass Startup)	--	--	0.45	0.17	0.45	0.17
Dryer 1 (F Bypass Idle)	--	--	1.80	0.66	1.80	0.66
Dryer DB	--	--	1.80	2.15	1.80	2.15
<b>Controlled &amp; Limited Total</b>					<b>253</b>	<b>252</b>

### 3. Corrections to Colombo's Original Estimates

As discussed above, Colombo did not quantify Dryer/Furnace and RTO1 NOx and CO emissions based on either published emission factors or stack test-based emission factors. Rather, potential emissions from these units were assumed by Colombo to not exceed 245 tpy for CO and 241 tpy for NO<sub>x</sub>, solely in order to limit facility-wide emissions of these pollutants to 249 tpy each. In addition, Enviva determined that NO<sub>x</sub> and CO emissions from the pellet cooler RTO/RCOs were based on AP-42 factors for natural gas combustion and, therefore, did not account for additional thermally generated emissions resulting from the combustion of VOC-containing exhaust in the RTO/RCOs. As such, these numbers clearly do not accurately represent the facility's PTE emission rates. What follows is a far more accurate estimate of CO and NO<sub>x</sub> emissions for these units, prepared by Enviva, which is based on site-specific stack test data with added contingency factors based on engineering judgement to account for the inherent variability in stack test results.

- Dryer/Furnace
  - Design Basis (currently permitted throughput)
    - 521,000 ODT/yr
  - Emission Factors (site-specific stack test results with contingency)
    - CO = 0.181 lb/ODT
    - NO<sub>x</sub> = 0.340 lb/OT
  - Annual Emissions
    - $CO = 521,000 \frac{ODT}{yr} \times 0.181 \frac{lb\ CO}{ODT} \times \frac{ton}{2000\ lb} = 47.15\ tons\ CO / yr$
    - $NO_x = 521,000 \frac{ODT}{yr} \times 0.340 \frac{lb\ NO_x}{ODT} \times \frac{ton}{2000\ lb} = 88.57\ ton\ NO_x / yr$
  
- Pellet Cooler RTO/RCOs
  - Design Basis (currently permitted throughput)
    - Pellet Coolers 1, 2, and 3 (RTO2/RCO1) = 313,500 ODT/yr
    - Pellet Coolers 4 and 5 (RTO3/RCO2) = 209,000 ODT/yr
  - Emission Factors (site-specific stack test results with contingency)
    - CO = 0.107 lb/ODT
    - NO<sub>x</sub> = 0.018 lb/ODT

○ Annual Emissions

- $RTO2, RCO1 CO = 313,500 \frac{ODT}{yr} \times 0.107 \frac{lb CO}{ODT} \times \frac{ton}{2000 lb} = 16.77 tons CO / yr$
- $RTO2, RCO1 NOx = 313,500 \frac{ODT}{yr} \times 0.018 \frac{lb NOx}{ODT} \times \frac{ton}{2000 lb} = 2.82 tons NOx / yr$
- $RTO3, RCO2 CO = 209,000 \frac{ODT}{yr} \times 0.107 \frac{lb CO}{ODT} \times \frac{ton}{2000 lb} = 11.18 tons CO / yr$
- $RTO3, RCO2 NOx = 209,000 \frac{ODT}{yr} \times 0.018 \frac{lb NOx}{ODT} \times \frac{ton}{2000 lb} = 1.88 tons NOx / yr$

A comparison of the original Colombo emission rates to the corrected rates described above, as well as the additional sources not originally addressed by Colombo (see Table 2 above), is provided in Table 4 below. As shown below, when emissions are corrected to reflect true PTE emission rates as opposed to simply backing into an assumed emission rate based on a proposed synthetic minor limit, the facility-wide PTE emissions rates are well below the major source threshold of 250 tpy for both CO and NOx.

Table 4. Comparison of Original Colombo Emission Rates with Corrected Rates – Controlled & Limited

Emission Source/Process	Original Colombo Emission Rates		Corrected Colombo Emission Rates	
	CO (tpy)	NOx (tpy)	CO (tpy)	NOx (tpy)
Dryer/Furnace	245	241	47.15	88.57
Pellet Coolers 1, 2, and 3 RTO2/RCO1	1.84	2.19	16.77	2.82
Pellet Coolers 4 and 5 RTO3/RCO2	1.84	2.19	11.18	1.88
Engine 1	0.19	2.74	0.19	2.74
Engine 2	0.07	0.96	0.07	0.96
Dryer 1 (F Bypass Startup)	--	--	0.45	0.17
Dryer 1 (F Bypass Idle)	--	--	1.80	0.66
Dryer DB	--	--	1.80	2.15
<b>Total/Permitted</b>	<b>249</b>	<b>249</b>	<b>79.41</b>	<b>99.95</b>

**4. Conclusion**

When correctly calculated as presented in Table 4 above, at no time did emissions from the Greenwood facility exceed PSD thresholds, on either a PTE basis or on an actual production basis, since actual production was always significantly lower than PTE. Furthermore, even following the increase in permitted capacity and increase in NOx and CO emissions associated with the Draft Permit the facility remains well below the PSD major source thresholds.