Enviva Pellets - Hamlet - PSD

7700096 Jan. 2015

ANALYSIS REVIEW LOG

Date	Activity	Facility ID	Region	Reviewer
1/15/14	PSD Modeling Demonstration Recd	7100096	FRO	Godwin
–	protocol recd & processed 1-6-14			
~~***~~ 1/6/14	Lgr FLM contact data for record			TA
1/23	INW			TA
2/6	Complete			TA

DIVISION OF AIR QUALITY
June 3, 2015

MEMORANDUM

TO: Kevin Godwin, Environmental Engineer, Air Quality Permitting Section

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

THROUGH: Tom Anderson, Supervisor, AQAB

SUBJECT: Review of Modeling Analysis – Enviva Pellets Hamlet, LLC
Hamlet, NC Richmond County

Attached is a discussion of the modeling analysis for Enviva Pellets Hamlet, LLC that was conducted in support of the construction and operation of a new facility near Faison, NC. The modeling was conducted in accordance with current PSD directives and modeling guidance. A summary of the modeling results is presented in Table 7.

cc: Tom Anderson
Alex Zarnowski

ENVIVA PELLETS HAMLET LLC, PREVENTION OF SIGNIFICANT DETERIORATION (PSD) AIR DISPERSION MODELING ANALYSIS

Introduction

The PSD modeling analysis described in this section was conducted in accordance with current PSD directives and modeling guidance. References are made to the Draft October 1990 EPA New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting which will herein be referred to as the NSR Workshop Manual. A summary of the modeling results is presented in the last topic, PSD Air Quality Modeling Results Summary. A detailed description of the modeling and modeling methodology is described below.

Project Description / Significant Emission Rate (SER) Analysis

Enviva Pellets Hamlet, LLC (Enviva) plans to construct and operate a wood pellet manufacturing plant in Richmond County near Hamlet, NC. Operations are expected to occur 24 hours per day, 7 days per week and 52 weeks per year. A facility-wide pollutant netting analysis was accomplished and documented in Table 3-1 of the Enviva permit application. Five pollutants were declared to exceed their PSD Significant Emission Rate (SER) and thus require a PSD analysis. These emission rates are provided in the table below.

Table 1. Pollutant Netting Analysis.

Pollutant	Annual Emission Rate (tons/yr)	Significant Emission Rate (tons/yr)	PSD Review Required?
NO_2	164.61	40	Yes
PM_{10}	72.86	15	Yes
$PM_{2.5}$	53.62	15	Yes
TSP*	179.46	25*	Yes*
SO_2	17.57	40	No
CO	75.88	100	No
VOC's	2,219	40	Yes

*N.C. requirement only.

Preliminary Impact Air Quality Modeling Analysis

An air quality preliminary impact analysis was conducted for the pollutants exceeding the corresponding SER. The modeling results were then compared to applicable Significant Impact Levels (SILs) as defined in the NSR Workshop Manual to determine if a full impact air quality analysis would be required for that pollutant.

The Enviva facility will be located near Hamlet, NC, in Richmond County. The facility area is in the southern piedmont region with gently rolling terrain and is generally agricultural, industrial, and forest land. For modeling purposes, the area, including and surrounding the site, is classified rural, based on the land use type scheme established by Auer 1978.

Enviva evaluated the pollutants' significant emissions using the EPA AERMOD model and five years (2008-2012) of National Weather Service (NWS) surface (Maxton) and upper air (Greensboro) meteorological data. Full terrain elevations were included, as were normal regulatory defaults. Sufficient receptors were placed in ambient air beginning at the fenceline to establish maximum impacts. Emission rates for this specific project were used and the maximum impacts were then compared to the SIL. Since the results showed impacts above the SILs for PM_{10}, $PM_{2.5}$, and NO_2, further modeling was required for those pollutants. The SIL results are shown in Table 2.

Table 2. Class II Significant Impact Results (ug/m^3).

Pollutant	Averaging Period	Facility maximum Impact	Class II Significant Impact Level	Significant Impact Distance (km)
PM_{10}	annual	**3.5**	1	1.2
	24-hour	**35**	5	1.9
$PM_{2.5}$	annual	**1.0**	.3	1.2
	24-hour	**6.6**	1.2	1.9
NO_2	annual	**2.1**	1	0.75
	1-hour	**69.2**	10	2.4

Class II Area Full Impact Air Quality Modeling Analysis

A Class II Area NAAQS and PSD increment analysis was performed for PM_{10}, $PM_{2.5}$, and NO_2 to include offsite source emissions and background concentrations (NAAQS). Enviva used AERMOD with the modeling methodology as described above. Off-site source inventories for both increment and NAAQS modeling were obtained from NCDAQ and then refined by Enviva using the NCDAQ approved "Q/D=20" guideline. For the NO_2 NAAQS analysis, 10 offsite sources (from four different facilities) were used; the same sources were also used for the increment analysis. These sources, along with their emission rates, are provided in the attachments. For the PM_{10} and $PM_{2.5}$ NAAQS and increment analyses, 7 additional offsite sources (all from the same facility) were included.

Enviva used an appropriate array of receptors beginning at the declared fenceline and extending outward to 30 kilometers. PM_{10} and $PM_{2.5}$ background concentrations were obtained from the Cumberland County PM_{10} monitoring station. The Duplin County monitor was used for $PM_{2.5}$ background concentrations. NO_2 background concentrations were obtained from a monitor located in Paulding County, GA since it was judged to be most representative of the rural NO_2 background concentrations for the Richmond County region. The modeling results are shown in Table 3 and indicate compliance with the NAAQS for PM_{10}, $PM_{2.5}$, and NO_2.

Table 3. Class II Area NAAQS Modeling Results.

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (ug/m^3)	Background Concentration (ug/m3)	Total Impact (ug/m3)	NAAQS (ug/m3)	% NAAQS
PM_{10}	24-hour	29.7	25.00	54.7	150	37
$PM_{2.5}$	24-hour	4.6	17.3	21.9	35	63
	annual	2.1	8.87	10.97	12	91
NO_2	1-hour	69.2	32.10	101.3	188	54
	annual	2.1	5.30	7.4	100	7

In the CLASS II increment analysis, Enviva used the same onsite sources, fenceline, and receptors as in the NAAQS analysis. The emission rates modeled are provided in the attachments. The Class II Area increment modeling results are shown in Table 4 and indicate compliance with the Class II Area increments.

Table 4. Class II area PSD increment modeling results.

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (ug/m^3)	PSD Increment (ug/m3)	% Increment
PM_{10}	24-hour	29.67	30	99
	annual	4.40	17	26
$PM_{2.5}$	24-hour	7.5	9	83
	annual	1.3	4	33
NO_2	annual	2.4	25	10

Non Regulated Pollutant Impact Analysis (North Carolina Toxics)

Enviva also modeled TSP and fourteen toxics using AERMOD with the same receptor array and meteorology as used in the NAAQS analysis. A list of the facility sources and emission rates used are attached to this document. All pollutants demonstrated compliance on a source-by-source basis with the NC's AAQS or Acceptable Ambient Level (AAL). The maximum concentrations as shown in Table 5 occurred along the fenceline.

Table 5. Non-regulated pollutants modeling results.

Pollutant	Averaging Period	Max Facility Impact (µg/m3)	AAL (µg/m3)	Percent of AAL
TSP	annual	12.6	75	17%
	24-hr	87.4	150	58%
Arsenic	annual	9.3E-06	2.3E-04	4%
Benzo(a)pyrene	annual	1.5E-05	3.3E-02	<1%
Cadmium	annual	1.7E-06	5.5E-03	<1%
Chlorine	1-hour	2.2E-08	900	<1%
	24-hour	6.6E-02	37.5	<1%
Formaldehyde	1-hour	9.1	150	6%
Hexachlor.dioxin	annual	9.3E-06	7.6E-05	12%
Vinyl chloride	annual	1.1E-04	0.38	<1%

Additional Impacts Analysis

Additional impact analyses were conducted for growth, soils and vegetation, and visibility impairment.

Growth Impacts

Enviva is expected to employ approximately 80 full-time people, most of which are expected to come from the existing local population. Therefore, this project is not expected to cause a significant increase in growth in the area.

Soils and Vegetation

The facility is located in the southern piedmont area of North Carolina. The local geography is gently rolling terrain with a mix of forests, agricultural crops, and herbaceous vegetation. By way of the NAAQS analyses of this submission, Enviva demonstrated that the impacts were below the established standards – both the primary and secondary NAAQS. The impacts were also below EPA established thresholds for soil and vegetation effects (described in detail in Section 6.3 and Table 6-1 of the modeling report). Thus, the Enviva project is not expected to cause any detrimental impacts to soils or vegetation in the area.

CLASS II Visibility Impairment Analysis

A Class II visibility impairment analysis was not conducted since there are not any visibility sensitive areas with the Class II Significant Impact Area.

Class I Area - Additional Requirements

There are five Federal Class I Areas within 300 km of the Enviva project – Swanquarter NWR, James River Face Wilderness, Linville Gorge Wilderness Area, Shining Rock Wilderness Area, and Cape Romain National Wildlife Refuge. The Federal Land Manager for each of those areas was contacted and none of them required any analysis; therefore, no analysis was conducted by the applicant.

CLASS 1 SIL Analysis

AERMOD was also used to estimate impacts for the Class 1 SIL analysis. Even though the distance to the closest Class 1 area, Cape Romain NWR, exceeds 50 km, the threshold distance at which a long-range transport model is typically used, receptors were conservatively placed at 50 km from the Enviva facility. NO_2, $PM_{2.5}$, and PM_{10} all modeled below the EPA-established, CLASS 1 SILs, and thus no CLASS 1 increment modeling was required. Table 6 provides the results of SIL modeling.

Table 6. Class 1 Significant Impact Results (ug/m^3).

Pollutant	Averaging Period	Max. Impact at 50 km	EPA SIL	% SIL
NO_2	Annual	0.012	0.1	12
PM_{10}	24-hr	0.086	0.32	27
	Annual	0.003	0.20	1.5
$PM_{2.5}$	24-hr	0.049	0.07	70
	Annual	0.002	0.06	3

PSD Air Quality Modeling Result Summary

Based on the PSD air quality ambient impact analysis performed the proposed Enviva Pellets Hamlet, LLC facility will not cause or contribute to any violation of the Class 1 NAAQS, PSD increments, Class 1 Increments, or any FLM AQRVs. A summary of the modeling results is presented in Table 7. Note: Tables follow below.

Table 7. Enviva Pellets Hamlet, LLC PSD air quality modeling results.

Pollutant	Annual E/R (Tons)	SER (Tons/yr)
NO_2	**164.61**	40
PM_{10}	**72.86**	15
$PM_{2.5}$	**53.62**	15
TSP	**179.46**	25
SO_2	**17.57**	40
CO	**75.88**	100
VOC's	**2,219**	40

Class II Area SIL Analysis

Pollutant	Averaging Period	Maximum Impact (ug/m^3)	SIL (ug/m^3)	SIL Exceeded
PM_{10}	annual	**3.5**	1	1.2
	24-hour	**35**	5	1.9
$PM_{2.5}$	annual	**1.0**	.3	1.2
	24-hour	**6.6**	1.2	1.9
NO_2	annual	**2.1**	1	0.75
	1-hour	**69.2**	10	2.4

Class II NAAQS Analysis

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (ug/m^3)	Back Ground Conc (ug/m^3)	Total Impact (ug/m^3)	NAAQS (ug/m^3)	% NAAQS
PM_{10}	24-hour	29.7	25.00	54.7	150	37
$PM_{2.5}$	24-hour	4.6	17.3	21.9	35	63
	annual	2.1	8.87	10.97	12	91
NO_2	1-hour	69.2	32.10	101.3	188	54
	annual	2.1	5.30	7.4	100	7

Class II Increment Analysis

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (µg/m3)	PSD Increment (µg/m3)	% Increment		
PM_{10}	24-hour	29.67	30	99		
	annual	4.40	17	26		
$PM_{2.5}$	24-hour	7.5	9	83		
	annual	1.3	4	33		
NO_2	annual	2.4	25	10		

Class I Area SIL Analysis

Pollutant	Averaging Period	Max. Impact at 50 km	EPA SIL	% SIL			
NO_2	Annual	0.012	0.1	12			
PM_{10}	24-hr	0.086	0.32	27			
	Annual	0.003	0.20	1.5			
$PM_{2.5}$	24-hr	0.049	0.07	70			
	Annual	0.002	0.06	3			

Non-Regulated Pollutant Analysis

Pollutant	Averaging Period	Max Facility Impact (µg/m3)	AAL (µg/m3)	Percent of AAL	
TSP	annual	12.6	75	17%	
	24-hr	87.4	150	58%	
Arsenic	annual	9.3E-06	2.3E-04	4%	
Benzo(a)pyrene	annual	1.5E-05	3.3E-02	<1%	
Cadmium	annual	1.7E-06	5.5E-03	<1%	
Chlorine	1-hour	2.2E-08	900	<1%	
	24-hour	6.6E-02	37.5	<1%	
Formaldehyde	1-hour	9.1	150	6%	
Hexachlor.dioxin	annual	9.3E-06	7.6E-05	12%	
Vinyl chloride	annual	1.1E-04	0.38	<1%	
Formaldehyde	1-hour	116.62	150	78	

Table 8. Source parameters and emission rates for NOx at the Enviva Pellets facility located in Hamlet, NC.

Source ID	Easting (m)	Northing (m)	Base Elev. (m)	Stack Ht. (m)	Temp. (K)	Exit Vel. (m/s)	Stack Dia. (m)	NOx (g/s)
EP1	624530.9	3866742	124.21	24.38	350.93	10.59	3.05	6.31
EP2	624488.8	3866665	125.28	16.46	310.93	18.95	0.98	0
EP3	624483.5	3866660	125.3	16.46	310.93	18.95	0.98	0
EP4	624476.8	3866654	125.35	16.46	310.93	18.95	0.98	0
EP5	624471.5	3866650	125.39	16.46	310.93	18.95	0.98	0
EP6	624427.4	3866625	125.6	23.77	305.37	0.01	0.4	0
EP7	624419.5	3866608	126.24	24.38	316.48	18.34	0.7	0
EP8	624415.3	3866605	126.33	24.38	316.48	18.34	0.7	0
EP9	624411.1	3866601	126.51	24.38	316.48	18.34	0.7	0
EP10	624406.9	3866597	126.69	24.38	316.48	18.34	0.7	0
EP11	624402.7	3866594	126.82	24.38	316.48	18.34	0.7	0
EP12	624398.5	3866590	127	24.38	316.48	18.34	0.7	0
EP13	624454.3	3866734	123.95	4.57	919.82	78.3	0.09	0.1035
EP14	624362.8	3866593	126.82	4.57	954	109.18	0.06	0.1035
EP15	624454.8	3866641	125.38	20.42	293	6.87	0.93	0
EP16	624217.5	3866624	123.95	7.62	310.93	16.97	0.55	0
EP17	624531.6	3866778	123.73	12.19	293	18.34	0.7	0
EP18	624525.9	3866773	123.78	12.19	293	18.34	0.7	0
EP19	624494.2	3866697	124.79	4.57	293	0.01	0.4	0
EP20	624478	3866685	124.9	15.85	293	0.01	0.4	0
EP21	624375.4	3866585	127.18	4.57	293	0.01	0.4	0
TCP1	621195	3864837	129.56	13.41	410.93	4.88	0.7	0.03711
TCP2	621195	3864837	129.56	3.66	344.26	7.62	0.09	0.003164
UNIM1	627422	3868719	116.49	9.14	338.71	6.43	1.6	0.1326
UNIM2	627422	3868719	116.49	8.53	338.71	5.39	1.83	0.1637
SRM1	618025	3862730	98.6	7.01	352.59	6.38	0.51	0.0256
SRM2	618025	3862730	98.6	2.63	753.71	0.01	0.15	0.002877
HUD1	622632	3857359	114.3	9.45	408.15	11.25	1.19	0.02877
HUD2	622632	3857359	114.3	3.66	477.59	91.44	0.15	0.03452
HUD3	622632	3857359	114.3	9.45	408.15	27.46	1.19	0.03452
HUD4	622632	3857359	114.3	2.59	477.59	91.44	0.3	0.01726

Table 9. Source parameters and emissions rates for PM_{10} and $PM_{2.5}$ at the Enviva Pellets facility located in Hamlet, NC.

Source ID	Easting (m)	Northing (m)	Base Elev. (m)	Stack Ht. (m)	Temp. (K)	Exit Vel. (m/s)	Stack Dia. (m)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)
EP1	624530.9	3866742	124.21	24.38	350.93	10.59	3.05	1.483	1.483
EP2	624488.8	3866665	125.28	16.46	310.93	18.95	0.98	0.1296	0.002203
EP3	624483.5	3866660	125.3	16.46	310.93	18.95	0.98	0.1296	0.002203
EP4	624476.8	3866654	125.35	16.46	310.93	18.95	0.98	0.1296	0.002203
EP5	624471.5	3866650	125.39	16.46	310.93	18.95	0.98	0.1296	0.002203
EP6	624427.4	3866625	125.6	23.77	305.37	0.01	0.4	0.01056	0.01056
EP7	624419.5	3866608	126.24	24.38	316.48	18.34	0.7	0.09284	0.01138
EP8	624415.3	3866605	126.33	24.38	316.48	18.34	0.7	0.09284	0.01138
EP9	624411.1	3866601	126.51	24.38	316.48	18.34	0.7	0.09284	0.01138
EP10	624406.9	3866597	126.69	24.38	316.48	18.34	0.7	0.09284	0.01138
EP11	624402.7	3866594	126.82	24.38	316.48	18.34	0.7	0.09284	0.01138
EP12	624398.5	3866590	127	24.38	316.48	18.34	0.7	0.09284	0.01138
EP13	624454.3	3866734	123.95	4.57	919.82	78.3	0.09	0.01035	0.01035
EP14	624362.8	3866593	126.82	4.57	954	109.18	0.06	0.01035	0.01035
EP15	624454.8	3866641	125.38	20.42	293	6.87	0.93	0.04234	0.04234
EP16	624217.5	3866624	123.95	7.62	310.93	16.97	0.55	0.03342	6.24E-04
EP17	624531.6	3866778	123.73	12.19	293	18.34	0.7	0.09284	0.01138
EP18	624525.9	3866773	123.78	12.19	293	18.34	0.7	0.09284	0.01138
EP19	624494.2	3866697	124.79	4.57	293	0.01	0.4	0.00432	0.00432
EP20	624478	3866685	124.9	15.85	293	0.01	0.4	0.00432	0.0043
EP21	624375.4	3866585	127.18	4.57	293	0.01	0.4	0.00432	0.00432
DC03	627422	3868719	116.49	13.11	338.71	0.01	0.52	0.001726	0.001726
FUG	627422	3868719	116.49	3.05	295.37	0.06	0.3	0.03452	0.03452
WS01	627422	3868719	116.49	9.14	338.71	6.43	1.6	0.02359	0.02359
WS02	627422	3868719	116.49	8.53	338.71	5.39	1.83	0.02905	0.02905
WS03	627422	3868719	116.49	3.66	338.71	25.87	0.46	0.001151	0.001151
WS04	627422	3868719	116.49	5.03	338.71	25.87	0.46	5.75E-04	5.75E-04
WS05	627422	3868719	116.49	9.14	338.71	9.31	0.76	5.75E-04	5.75E-04

Table 10. Emission rates for TSP and CO at the Enviva Pellets facility located in Hamlet, NC.

Source ID	CO (g/s)	TSP (g/s)
EP1	6.63	1.483
EP2	0	0.1296
EP3	0	0.1296
EP4	0.0905	0.1296
EP5	0.0905	0.1296
EP6	0	0.01056
EP7	0	0.3564
EP8	0	0.3564
EP9	0	0.3564
EP10	0	0.3564
EP11	0	0.3564
EP12	0	0.3564
EP13	0	0.01035
EP14	0	0.01035
EP15	0	0.04234
EP16	0	0.03672
EP17	0	0.3564
EP18	0	0.3564
EP19	0	0.00432
EP20	0	0.00432
EP21	0	0.00432
HAULRDS	0	7.75E-07

ANALYSIS REVIEW LOG

Date	Activity	Facility ID	Region	Reviewer
1/20/15	Applicant submitted updated and revised air quality application - initial app submitted 1/15/14 - original modeling memo 2/6/14	7700096	FRO	K. Godwin
6/2/15	Modeling Analysis Complete To Tom for Signature		RCO	Zasowski

DIVISION OF AIR QUALITY
February 6, 2014

MEMORANDUM

TO: Kevin Godwin, Environmental Engineer, Air Quality Permitting Section

FROM: Tom Anderson, Meteorologist II, Air Quality Analysis Branch (AQAB)

THROUGH: Mark Cuilla, Supervisor, AQAB

SUBJECT: Review of Modeling Analysis – Enviva Pellets Hamlet, LLC
Hamlet, NC Richmond County

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c: Mark Cuilla
Tom Anderson

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corresponding SER. The modeling results were then compared to applicable Significant Impact Levels (SILs) as defined in the NSR Workshop Manual to determine if a full impact air quality analysis would be required for that pollutant.

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Table 2 - Class II Significant Impact Results (ug/m^3)

Pollutant	Averaging Period	Facility maximum Impact	Class II Significant Impact Level	Significant Impact Distance (km)
PM_{10}	annual	**4.4**	1	1.3
	24-hour	**22.8**	5	2.0
$PM_{2.5}$	annual	**1.0**	.3	1.3
	24-hour	**6.0**	1.2	2.3
NO_2	annual	**5.7**	1	1.7
	1-hour	**117.6**	10	29.5

Class II Area Full Impact Air Quality Modeling Analysis

A Class II Area NAAQS and PSD increment analysis was performed for PM_{10}, $PM_{2.5}$, and NO_2 to include offsite source emissions and background concentrations (NAAQS). Enviva used

AERMOD with the modeling methodology as described above. Off-site source inventories for both increment and NAAQS modeling were obtained from NCDAQ and then refined by Enviva using the NCDAQ approved "Q/D=20" guideline. For the NO_2 NAAQS analysis, 10 offsite sources (from four different facilities) were used; the same sources were also used for the increment analysis. These sources, along with their emission rates, are provided in the attachments. For the PM_{10} and $PM_{2.5}$ NAAQS and increment analyses, 7 additional offsite sources (all from the same facility) were included.

Enviva used an appropriate array of receptors beginning at the declared fenceline and extending outward to 30 kilometers. PM_{10} and $PM_{2.5}$ background concentrations were obtained from the Cumberland County PM_{10} monitoring station. The Duplin County monitor was used for $PM_{2.5}$ background concentrations. NO_2 background concentrations were obtained from a monitor located in Paulding County, GA since it was judged to be most representative of the rural NO_2 background concentrations for the Richmond County region. The modeling results are shown in Table 3 and indicate compliance with the NAAQS for PM_{10}, $PM_{2.5}$, and NO_2.

Table 3 - Class II Area NAAQS Modeling Results

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (ug/m^3)	Background Concentration (ug/m3)	Total Impact (ug/m3)	NAAQS (ug/m3)	% NAAQS
PM_{10}	24-hour	21.62	25.00	46.62	150	31
$PM_{2.5}$	24-hour	3.65	17.3	20.95	35	23
	annual	1.01	8.87	9.88	15	66
NO_2	1-hour	95.74	32.10	127.84	188	68
	annual	5.68	5.30	10.98	100	11

In the CLASS II increment analysis, Enviva used the same onsite sources, fenceline, and receptors as in the NAAQS analysis. The emission rates modeled are provided in the attachments. The Class II Area increment modeling results are shown in Table 4 and indicate compliance with the Class II Area increments.

Table 4 - Class II Area PSD Increment Modeling Results

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (ug/m^3)	PSD Increment (ug/m3)	% Increment
PM_{10}	24-hour	21.62	30	72
	annual	4.45	17	26
$PM_{2.5}$	24-hour	5.92	9	66
	annual	1.16	4	29
NO_2	annual	5.68	25	23

Non Regulated Pollutant Impact Analysis (North Carolina Toxics)

Enviva also modeled TSP and fourteen toxics using AERMOD with the same receptor array and meteorology as used in the NAAQS analysis. A list of the facility sources and emission rates used are attached to this document. All pollutants demonstrated compliance on a source-by-source basis with the NC's AAQS or Acceptable Ambient Level (AAL). The maximum concentrations as shown in Table 5 occurred along the fenceline.

Table 5 – Non-Regulated Pollutants Modeling Results

Pollutant	Averaging Period	Max Facility Impact (µg/m3)	AAL (µg/m3)	Percent of AAL
TSP	annual	21.13	75	28
	24-hr	114.58	150	76
Acetaldehyde	1-hour	59.75	27,000	< 1
Acrolein	1-hour	18.32	80	23
Arsenic	annual	1.00e-5	2.3e-4	4
Benzene	annual	0.0193	0.12	16
Benzo(a)pyrene	annual	1.00e-5	3.3e-2	< 1
Cadmium	annual	1.22e-6	5.5e-3	< 1
Chlorine	1-hour	0.14	900	< 1

Chlorine	24-hour	8.54e-02	37.5	< 1
Formaldehyde	1-hour	116.62	150	78
Hexachlor.dioxin	annual	1.0e-5	7.6e-5	13
Hydrogen chloride	1-hour	0.33	700	< 1
Mercury	24-hour	3.8e-4	0.6	< 1
Nickel	24-hour	3.6e-3	6	< 1
Phenol	1-hour	22.3	950	2
Vinyl chloride	annual	7.00e-5	0.38	< 1

Additional Impacts Analysis

Additional impact analyses were conducted for growth, soils and vegetation, and visibility impairment.

Growth Impacts

Enviva is expected to employ approximately 80 full-time people, most of which are expected to come from the existing local population. Therefore, this project is not expected to cause a significant increase in growth in the area.

Soils and Vegetation

The facility is located in the southern piedmont area of North Carolina. The local geography is gently rolling terrain with a mix of forests, agricultural crops, and herbaceous vegetation. By way of the NAAQS analyses of this submission, Enviva demonstrated that the impacts were below the established standards – both the primary and secondary NAAQS. The impacts were also below EPA established thresholds for soil and vegetation effects (described in detail in Section 6.3 and Table 6-1 of the modeling report). Thus, the Enviva project is not expected to cause any detrimental impacts to soils or vegetation in the area.

CLASS II Visibility Impairment Analysis

A Class II visibility impairment analysis was not conducted since there are not any visibility sensitive areas with the Class II Significant Impact Area.

Class I Area - Additional Requirements

There are five Federal Class I Areas within 300 km of the Enviva project – Swanquarter NWR, James River Face Wilderness, Linville Gorge Wilderness Area, Shining Rock Wilderness Area, and Cape Romain National Wildlife Refuge. The Federal Land Manager for each of those areas was contacted and none of them required any analysis; therefore, no analysis was conducted by the applicant.

CLASS 1 SIL Analysis

AERMOD was also used to estimate impacts for the Class 1 SIL analysis. Even though the distance to the closest Class 1 area, Cape Romain NWR, exceeds 50 km, the threshold distance at which a long-range transport model is typically used, receptors were conservatively placed at 50 km from the Enviva facility. NO_2, $PM_{2.5}$, and PM_{10} all modeled below the EPA-established, CLASS 1 SILs, and thus no CLASS 1 increment modeling was required. Table 6 provides the results of SIL modeling.

Table 6 - Class 1 Significant Impact Results (ug/m^3)

Pollutant	Averaging Period	Max. Impact at 50 km	EPA SIL	% SIL
NO_2	Annual	0.0	0.1	20
PM_{10}	24-hr	0.069	0.32	22
	Annual	0.004	0.20	2
$PM_{2.5}$	24-hr	0.069	0.07	99
	Annual	0.004	0.06	7

PSD Air Quality Modeling Result Summary

Based on the PSD air quality ambient impact analysis performed the proposed Enviva Pellets Hamlet, LLC facility will not cause or contribute to any violation of the Class 1I NAAQS, PSD increments, Class 1 Increments, or any FLM AQRVs. A summary of the modeling results is presented in Table 7. Note: Tables follow below.

TABLE 7 – Enviva Pellets Hamlet, LLC PSD AIR QUALITY MODELING RESULTS

SER Evaluation

Pollutant	Annual E/R (Tons)	SER (Tons/yr)
NO_2	**164.61**	40
PM_{10}	**72.86**	15
$PM_{2.5}$	**53.62**	15
TSP	**179.46**	25
SO_2	**17.57**	40
CO	**75.88**	100
VOC's	**2,219**	40

Class II Area SIL Analysis

Pollutant	Averaging Period	Maximum Impact (ug/m^3)	SIL (ug/m^3)	SIL Exceeded
PM_{10}	annual	**4.4**	1	**Yes**
	24-hour	**22.8**	5	**Yes**
$PM_{2.5}$	annual	**1.0**	.3	**Yes**
	24-hour	**6.0**	1.2	**Yes**
NO_2	annual	**5.7**	1	**Yes**
	1-hour	**117.6**	10	**Yes**

Class II NAAQS Analysis

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (ug/m^3)	Back Ground Conc (ug/m^3)	Total Impact (ug/m^3)	NAAQS (ug/m^3)	% NAAQS
PM_{10}	24-hour	21.62	25.00	46.62	150	31
$PM_{2.5}$	24-hour	3.65	17.3	20.95	35	23
	annual	1.01	8.87	9.88	15	66
NO_2	1-hour	95.74	32.10	127.84	188	68
	annual	5.68	5.30	10.98	100	11

Class II Increment Analysis

Pollutant	Averaging Period	Maximum Onsite & Offsite Source Impacts (µg/m3)	PSD Increment (µg/m3)	% Increment		
PM_{10}	24-hour	21.62	30	72		
	annual	4.45	17	26		
$PM_{2.5}$	24-hour	5.92	9	66		
	annual	1.16	4	29		
NO_2	annual	5.68	25	23		

Class I Area SIL Analysis

Pollutant	Averaging Period	Max. Impact at 50 km	EPA SIL	% SIL			
NO_2	Annual	0.0	0.1	20			
PM_{10}	24-hr	0.069	0.32	22			
	Annual	0.004	0.20	2			
$PM_{2.5}$	24-hr	0.069	0.07	99			
	Annual	0.004	0.06	7			

Non-Regulated Pollutant Analysis

Pollutant	Averaging Period	Max Facility Impact (µg/m3)	AAL (µg/m3)	Percent of AAL	
TSP	annual	21.13	75	28	
	24-hr	114.58	150	76	
Acetaldehyde	1-hour	59.75	27,000	< 1	
Acrolein	1-hour	18.32	80	23	
Arsenic	annual	1.00e-5	2.3e-4	4	
Benzene	annual	0.0193	0.12	16	
Benzo(a)pyrene	annual	1.00e-5	3.3e-2	< 1	
Cadmium	annual	1.22e-6	5.5e-3	< 1	
Chlorine	1-hour	0.14	900	< 1	
Chlorine	24-hour	8.54e-02	37.5	< 1	

Formaldehyde	1-hour	116.62	150	78	
Hexachlor.dioxin	annual	1.0e-5	7.6e-5	13	
Hydrogen chloride	1-hour	0.33	700	< 1	
Mercury	24-hour	3.8e-4	0.6	< 1	
Nickel	24-hour	3.6e-3	6	< 1	
Phenol	1-hour	22.3	950	2	
Vinyl chloride	annual	7.00e-5	0.38	< 1	

TABLE 5-3. MODELED SOURCE LOCATIONS

Model ID	Description	UTM-E (m)	UTM-N (m)	Elevation (m)
EP1	Dryer/WESP	624,362.8	3,866,547.6	128.12
EP2	Hammermill Common Stk	624,264.1	3,866,627.3	124.86
EP3	Pellet Press Silo	624,236.4	3,866,687.2	122.68
EP4	EmGen	624,322.6	3,866,541.8	127.64
EP5	Fire Pump	624,566.9	3,866,296.2	127.64
EP6	Rechipper Air Assist	624,443.2	3,866,595.9	126.74
EP7	Fines Bin Vent	624,248.8	3,866,651.4	123.60
EP8	Loadout Filter	624,164.8	3,866,823.2	121.01
EP9	Portable Greenwood Chipper	624,485.4	3,866,702.2	124.67
EP10	Pellet Cooler 1	624,195.4	3,866,717.2	122.06
EP11	Pellet Cooler 2	624,197.6	3,866,713.5	122.10
EP12	Pellet Cooler 3	624,199.1	3,866,707.7	122.16
EP13	Pellet Cooler 4	624,202.0	3,866,701.1	122.23
EP14	Pellet Cooler 5	624,205.7	3,866,695.3	122.29
EP15	Pellet Cooler 6	624,208.6	3,866,689.4	122.37
PAVEDRDS	Paved Roadway Areas	625,084.6	3,866,512.4	123.14
UNPVDRDS	Unpaved Road Areas	624,555.6	3,866,321.7	128.11

Note that EP6, identified above as the Rechipper Air Assist stack, is referred to as the Greenwood Hammermill in the permit application.

TABLE 5-4. MODELED STACK PARAMETERS

Model ID	Stack Height (m)	Stack Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
EP1	36.58	355.37	7.57	3.05
EP2	36.58	310.93	17.82	2.13
EP3	22.86	305.37	0.01	0.61
EP4	4.57	919.82	78.30	0.09
EP5	4.57	954.00	109.18	0.06
EP6	6.10	310.93	19.80	0.91
EP7	14.02	293.15	13.78	0.40
EP8	16.76	310.93	14.35	1.22
EP9	6.10	310.93	19.81	0.91
EP10	18.29	316.48	21.73	0.76
EP11	18.29	316.48	21.73	0.76
EP12	18.29	316.48	21.73	0.76
EP13	18.29	316.48	21.73	0.76
EP14	18.29	316.48	21.73	0.76
EP15	18.29	316.48	21.73	0.76

TABLE 5-5. MODELED EMISSION RATES

Model ID	Modeled Emission Rates (g/s)			
	TSP	PM_{10}	$PM_{2.5}$	NO_x
EP1	1.04E+00	1.04E+00	1.04E+00	5.04E+00
EP2	4.37E-01	4.37E-01	4.37E-01	-
EP3	8.10E-03	8.10E-03	8.10E-03	-
EP4	1.04E-02	1.04E-02	1.04E-02	1.04E-01
EP5	1.04E-02	1.04E-02	1.04E-02	1.04E-01
EP6	7.44E-01	5.21E-02	5.95E-03	-
EP7	1.17E-02	1.17E-02	1.17E-02	-
EP8	1.15E-01	1.05E-01	6.33E-02	-
EP9	5.38E-02	5.38E-02	5.38E-02	1.72E+00
EP10	4.54E-01	7.94E-02	9.07E-03	-
EP11	4.54E-01	7.94E-02	9.07E-03	-
EP12	4.54E-01	7.94E-02	9.07E-03	-
EP13	4.54E-01	7.94E-02	9.07E-03	-
EP14	4.54E-01	7.94E-02	9.07E-03	-
EP15	4.54E-01	7.94E-02	9.07E-03	-
PAVEDRDS*	5.09E-07	1.02E-07	2.50E-08	-
UNPVDRDS*	2.41E-06	6.14E-07	6.14E-08	-

* Area source emission rates expressed per unit area ($g/s/m^2$)