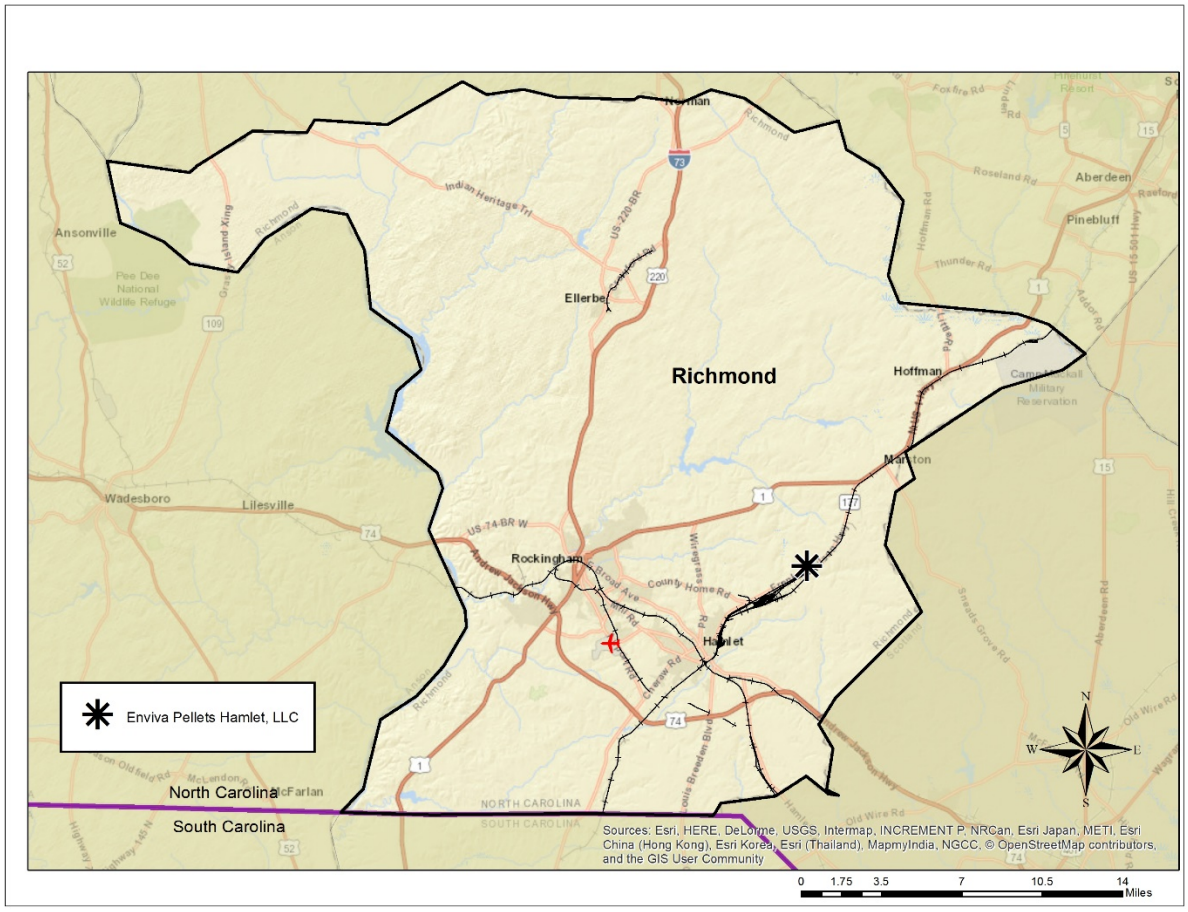
State of Air Quality

Surrounding the

Enviva Pellets Hamlet Facility in Richmond County

Facility ID: 7700096

Permit #: 10365R02



North Carolina Department of Environmental Quality
Division of Air Quality
Planning Section

January 8, 2019

PREFACE

This document contains the Division of Air Quality's (DAQ) review of the state of air quality, the sources of air pollution, and other relevant information surrounding the Enviva Pellets Hamlet Facility in Richmond County. We are providing this information to help the reader better understand the type and quantity of air emissions releases, the overall state of air quality and other demographic and environmental statistics as reported or compiled by the DAQ, the Environmental Protection Agency, and other local, state and federal groups. For the purpose of presenting these data, the area of interest is defined as Richmond County.

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1 Air Quality Monitoring Data

"Ambient air" is the outside air that we all breathe. This term is specifically defined by the U.S. Environmental Protection Agency (EPA) as "that portion of the atmosphere, external to buildings, to which the public has access."

In the early 1970s, EPA listed six major air pollutants that affected the quality of ambient air and established concentration limits for these pollutants. These limits are known as the National Ambient Air Quality Standards (NAAQS). Primary limits or standards were established to protect human health and secondary standards were established to protect human welfare and the quality of life. Through the years, the NAAQS have been revised and amended to account for evolving scientific understanding of air pollution and its impacts. Currently, the six criteria pollutants are:

- Ozone (O_3)
- Particulate Matter ($PM_{2.5}$ and PM_{10})
- Carbon Monoxide (CO)
- Sulfur Dioxide (SO_2)
- Nitrogen Dioxide (NO_2)
- Lead (Pb)

These six pollutants can cause serious human health problems (including premature mortality) and damage the environment and property. Common sources of these pollutants are coal-fired power plants, industrial manufacturing sources, and on-road and off-road vehicles. In Table 1.1, we have listed the current NAAQS for each of the six criteria pollutants and their attainment designation status in Richmond County.

Tables 1.2 and 1.3 contain design value data, a statistic that describes the air quality status of a given location relative to the level of the NAAQS for both ozone and $PM_{2.5}$ as recorded by the Candor Monitor located in Montgomery County, NC and the Chesterfield Monitor located in Chesterfield County, SC, respectively. These monitors were selected based on their close proximity to the study area (Richmond County) for both ozone and $PM_{2.5}$.

Table 1.1 Current National Ambient Air Quality Standards and Designations

Pollutant	Standard*	Form of Standard	Designations**
			Richmond County
2008 8-Hour Ozone	75 ppb	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 consecutive years	Unclassifiable/ Attainment
2015 8-Hour Ozone	70 ppb	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 consecutive years	Unclassifiable/ Attainment
2011 1-Hour CO	35 ppm	Not to be exceeded more than once per year	Unclassifiable/ Attainment
2011 8-Hour CO	9 ppm	Not to be exceeded more than once per year	Unclassifiable/ Attainment
2008 Rolling 3-Month Average Lead	0.15 $\mu g/m^3$	Not to be exceeded	Unclassifiable/ Attainment
2010 1-Hour NO_2	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 consecutive years	Unclassifiable/ Attainment
2012 24-hour $PM_{2.5}$	35 $\mu g/m^3$	98th percentile, averaged over 3 years	Unclassifiable/ Attainment
2012 Annual $PM_{2.5}$	12 $\mu g/m^3$	Annual mean, averaged over 3 years	Unclassifiable/ Attainment
2012 24-Hour PM_{10}	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years	Unclassifiable/ Attainment
2010 1-Hour SO_2	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years	Unclassifiable/ Attainment

* ppm = parts per million, ppb = parts per billion, $\mu g/m^3$ = micrograms per cubic meter.

** Unclassifiable/Attainment means that a monitor for an area is meeting the NAAQS or – in the absence of a monitor, there is no reason to believe that the area is violating the NAAQS or contributing to a NAAQS violation elsewhere.

Table 1.2 Ozone and $PM_{2.5}$ Design Values for Candor Monitor, Montgomery County, North Carolina

Pollutant	Design Value										
	Current NAAQS	**06-08**	**07-09**	**08-10**	**09-11**	**10-12**	**11-13**	**12-14**	**13-15**	**14-16**	**15-17**
Ozone 8-Hour Average (ppb)*	70	N/A	N/A	N/A	N/A	N/A	66	63	60	61	INC†
PM2.5 24-Hour Average ($\mu g/m^3$)**	35	26	22	21	20	20	18	17	16	15	15
PM2.5 Annual Average ($\mu g/m^3$)**	12	11.8	10.6	9.9	9.3	9.0	8.4	8.0	7.7	7.2	6.5

* ppb = parts per billion, $\mu g/m^3$ = micrograms per cubic meter.

** Data obtained from collocated Candor FRO site.

†Data completeness issues in 2017 prevented an annual or daily ozone design value from being computed for any year in which 2017 was a part of the calculation.

Table 1.3 Ozone and $PM_{2.5}$ Design Values for Chesterfield Monitor, Chesterfield County, South Carolina

Pollutant	Design Value										
	Current NAAQS	**06-08**	**07-09**	**08-10**	**09-11**	**10-12**	**11-13**	**12-14**	**13-15**	**14-16**	**15-17**
Ozone 8-Hour Average (ppb)*	70	73	70	68	66	65	62	60	58	60	60
PM2.5 24-Hour Average ($\mu g/m^3$)	35	25	22	20	20	20	19	17	16	15	15
PM2.5 Annual Average ($\mu g/m^3$)	12	12.0	10.9	10.3	9.7	9.4	8.7	8.4	8.2	7.8	7.2

* ppb = parts per billion, $\mu g/m^3$ = micrograms per cubic meter.

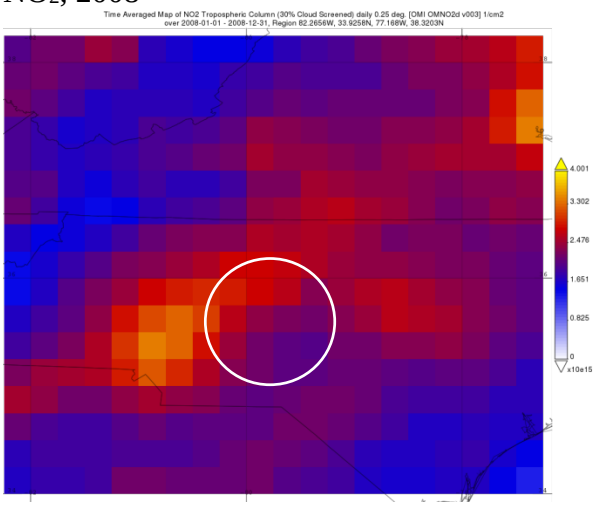
1.1 Satellite Imagery Data

There is more than one way to gather data on air pollution. The most accurate and reliable way is by using surface monitors to specifically measure a given pollutant (see Tables 1.2 and 1.3). In addition, satellite-derived pollutant data is a great approximation of inter-year pollution trends, especially for areas where monitoring data is sparse.

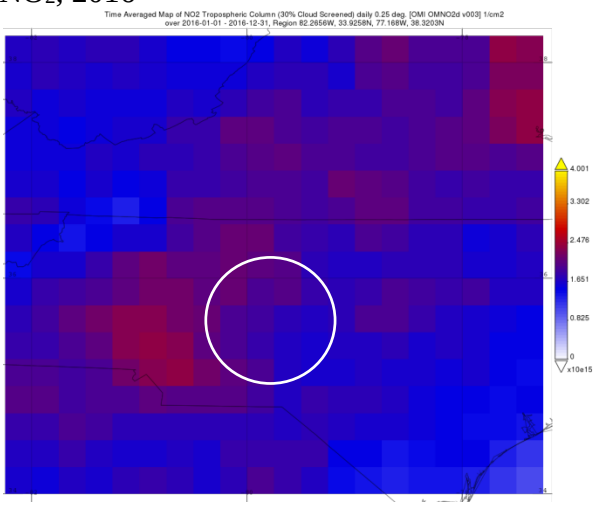
Satellites measure air pollution by averaging the depth of a given pollutant within a column of air that comprises the entire troposphere, or bottom layer of the atmosphere. The following images show satellite-derived pollutant concentrations for NO_2, SO_2, CO, and Aerosol Optical Depth (AOD) spanning Virginia and the Carolinas for 2008 and 2016.[1] A circle on each image identifies the area of the proposed location for the Enviva Pellets Hamlet Facility. For each of the four pollutants, the image on the left represents the average of daily satellite readings across the entire calendar year of 2008, while the image on the right represents the same for the calendar year of 2016. All of the images come from satellites operated by NASA, and the data is freely available at the link: https://giovanni.gsfc.nasa.gov/giovanni/. Units of measurement vary by pollutant, but the scale for each pollutant has been kept the same for the 2008 and 2016 images to show the satellite-derived evolution of the given pollutant over recent years. Warmer colors represent higher pollutant concentrations, while cooler colors represent lower pollutant concentrations.

As the following maps show, pollutant concentrations have decreased across the board between 2008 and 2016, both in the immediate area of Richmond County and across the rest of the Carolinas. The satellite data is consistent with surface monitor readings over Virginia and the Carolinas, which also show significant decreases during this time. While AOD does suggest an increase in the immediate Richmond County vicinity between 2008-2016, overall AOD values have decreased in the area during this time and observed particle pollution readings in the area (see Table 1.2) also show a decrease during this time. Therefore, the Division is confident that particle pollution conditions have improved in Richmond County during this time.

NO_2, 2008

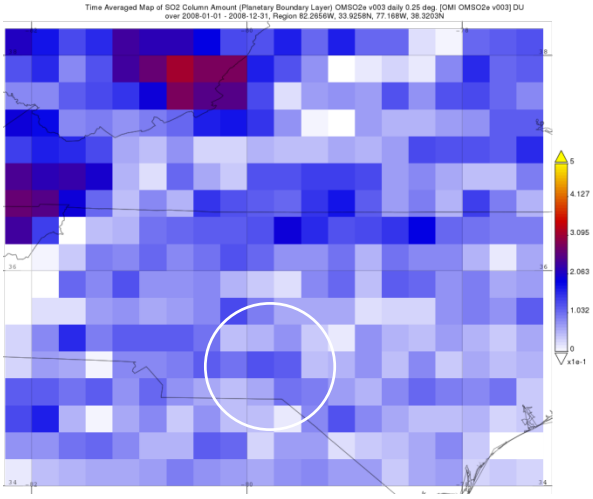


NO_2, 2016

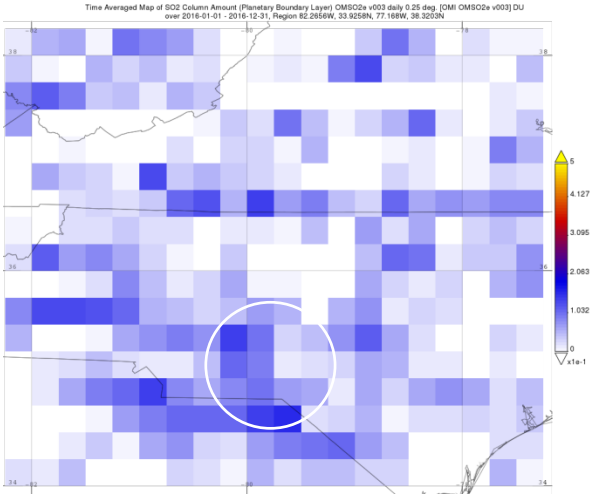


[1] Aerosol Optical Depth (AOD) is a collection of a number of particle pollutants, and serves as a general indicator of overall particle pollution.

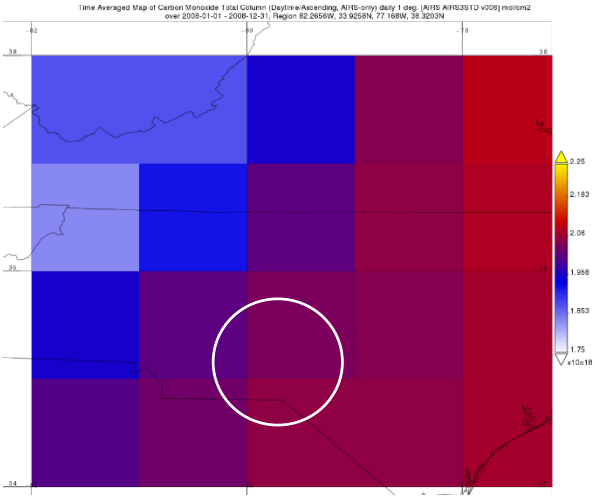
SO_2, 2008



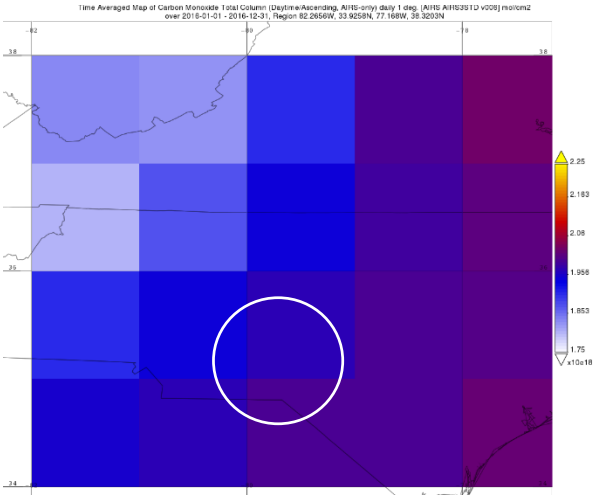
SO_2, 2016



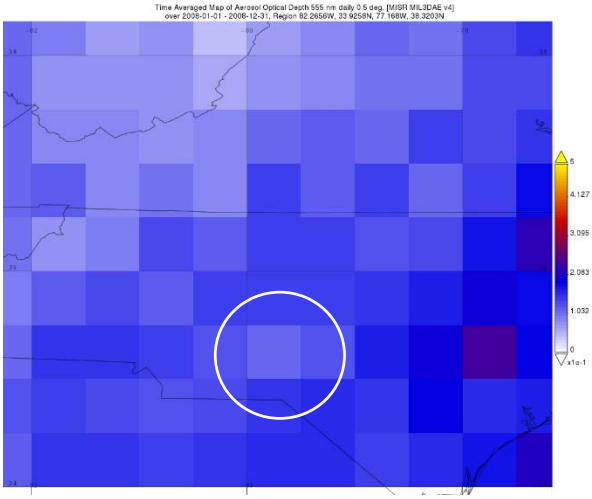
CO, 2008



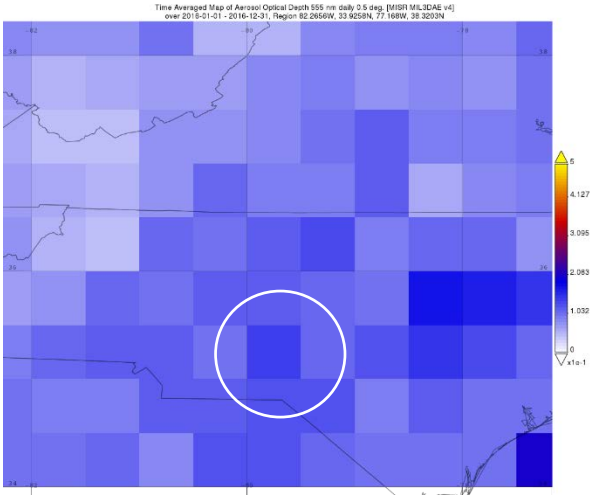
CO, 2016



AOD, 2008



AOD, 2016



2 Air Emissions Source Categorization

This section displays maps showing sources of air pollution reported by permitted facilities in Richmond County, North Carolina.

The section also shows estimates of oxides of nitrogen (NOx), particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$), sulfur dioxide (SO_2), carbon monoxide (CO), volatile organic compound (VOC), ammonia (NH_3), federal hazardous air pollutant (HAP), state toxic air pollutant (TAP), and greenhouse gas (GHG) emissions for Richmond County as well as expected emissions from the proposed Enviva Pellets Hamlet Facility.

The facility's reported emissions data are the expected emissions contained in the facility's application for permit modification for classification as a PSD Minor source.[2] Although the specific source of the emissions data for each pollutant is identified in the individual pollutant sections, the most common source is Version 2 of the 2014 National Emissions Inventory (2014 NEIv2)[3] for Richmond County and Statewide emissions. Each pollutant is broken down by sector and individual sectors are defined below.

Point – permitted, stationary industrial, commercial, and institutional facilities, and electricity generating unit (EGU) facilities (i.e., such as boilers and turbines that generate electricity for sale on the power grid).

Nonpoint – stationary sources that individually are too small in magnitude/too numerous to inventory as individual point sources.

Fires – includes both prescribed burning and wildfires.

Onroad – all motor vehicles that are licensed to use public roads. Onroad vehicles include passenger cars, motorcycles, and various classes of trucks and buses categorized according to vehicle weight and drive cycle characteristics.

Nonroad – mobile vehicles and equipment that are not licensed to use public roads, which includes aircraft, commercial and recreational marine vessels, locomotives, and lawn and garden, construction, and recreational equipment as well as many other types of equipment.

Biogenics – natural sources, such as vegetation (plants and trees) and microbial activity in soils.

[2] Proposed Application Review for Enviva Pellets Hamlet, LLC, North Carolina Division of Air Quality, accessed December 4, 2018

[3] United States Environmental Protection Agency, "Air Emissions Inventories, 2014 National Emissions Inventory (NEI) Data," available from https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data, accessed December 2018.

2.1 Nitrogen Oxide (NOx) Emissions

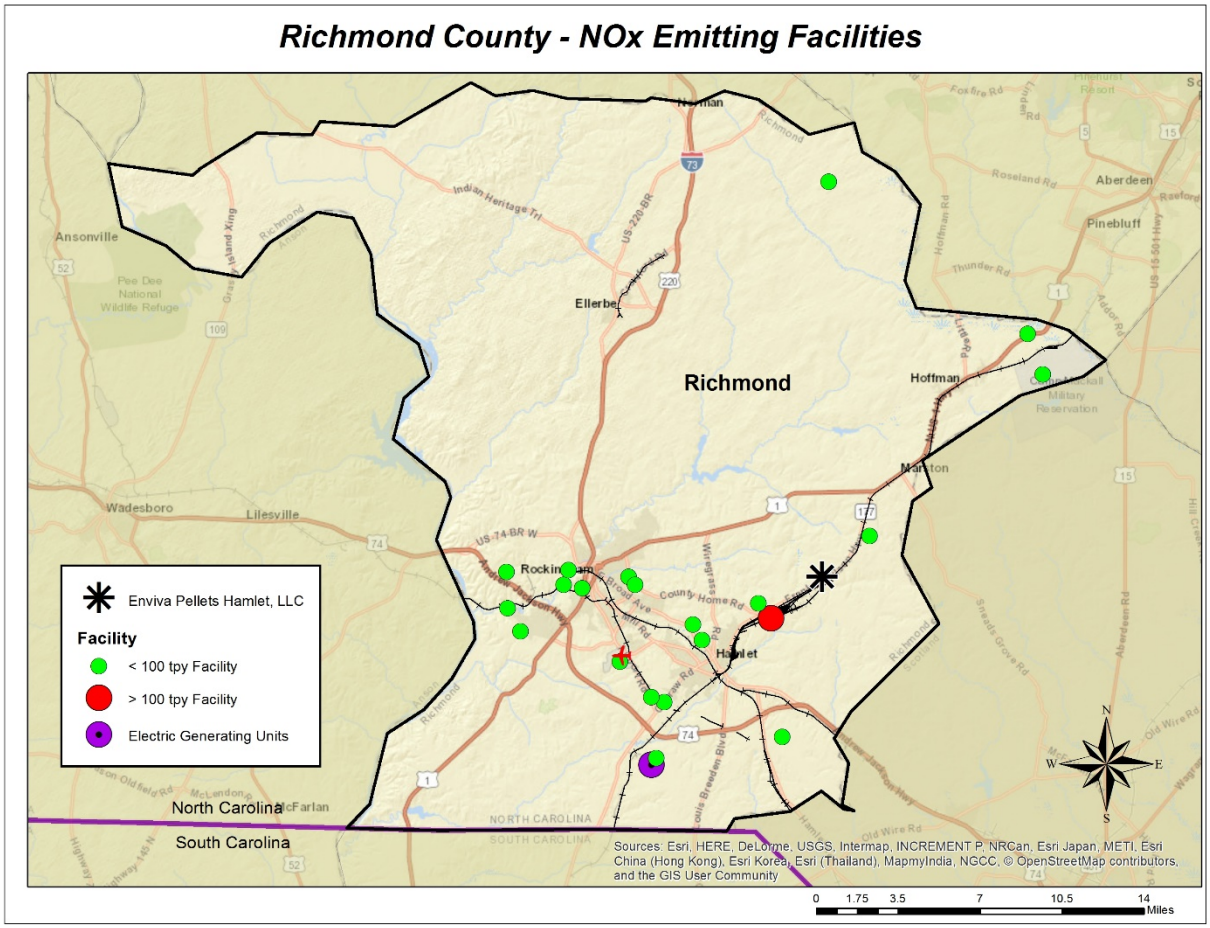


Figure 2.1 Enviva Pellets Hamlet Facility Area – NOx Emitting Facilities

Table 2.1 2014 NEI v2 Nitrogen Oxide Emissions (tons)

Sector	Richmond	North Carolina	% of State Total
Point	429	73,254	1%
Nonpoint	104	16,645	1%
Fires	47	2,212	2%
Onroad	990	159,301	1%
Nonroad	352	56,473	1%
Biogenics	117	14,026	1%
Total	**2,039**	**321,911**	**1%**
Enviva Pellets Hamlet Facility	236	236	
Total with Enviva	**2,275**	**322,147**	**1%**

Source of Data: EPA 2014 NEIv2; Enviva emissions from "Application Review," DAQ, December 4, 2018.

2.2 Fine Particulate Matter ($PM_{2.5}$) Emissions

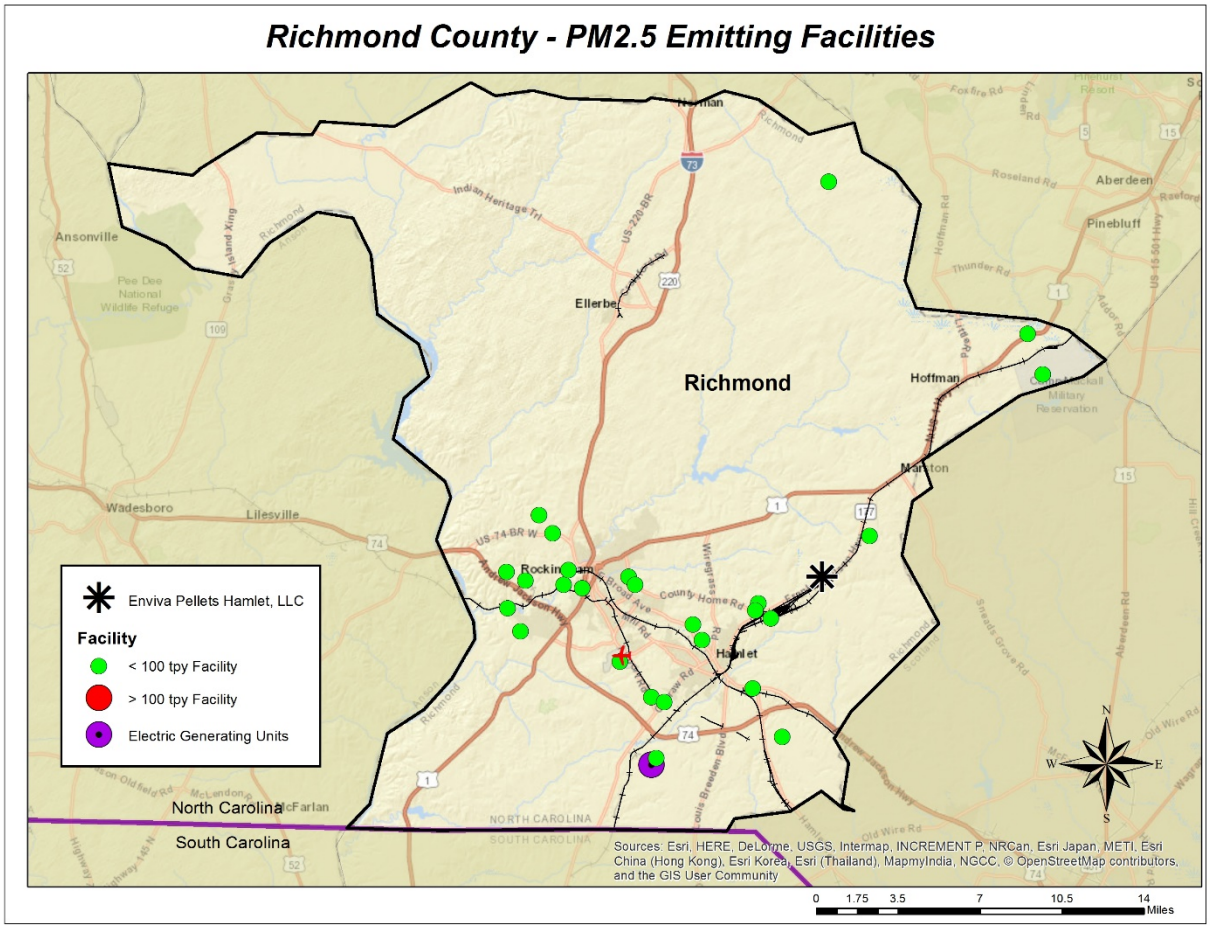


Figure 2.2 Enviva Pellets Hamlet Facility Area – $PM_{2.5}$ Emitting Facilities

Table 2.2 2014 NEI v2 $PM_{2.5}$-Primary Emissions (tons)

Sector	Richmond	North Carolina	% of State Total
Point	180	12,922	1%
Nonpoint	287	44,169	1%
Fires	235	13,881	2%
Onroad	23	4,591	1%
Nonroad	21	4,345	0%
Biogenics	0	0	
Total	**746**	**79,908**	**1%**
Enviva Pellets Hamlet Facility	39	39	
Total with Enviva	**785**	**79,947**	**1%**

Source of Data: EPA 2014 NEIv2; Enviva emissions from "Application Review," DAQ, December 4, 2018.

2.3 Sulfur Dioxide (SO_2) Emissions

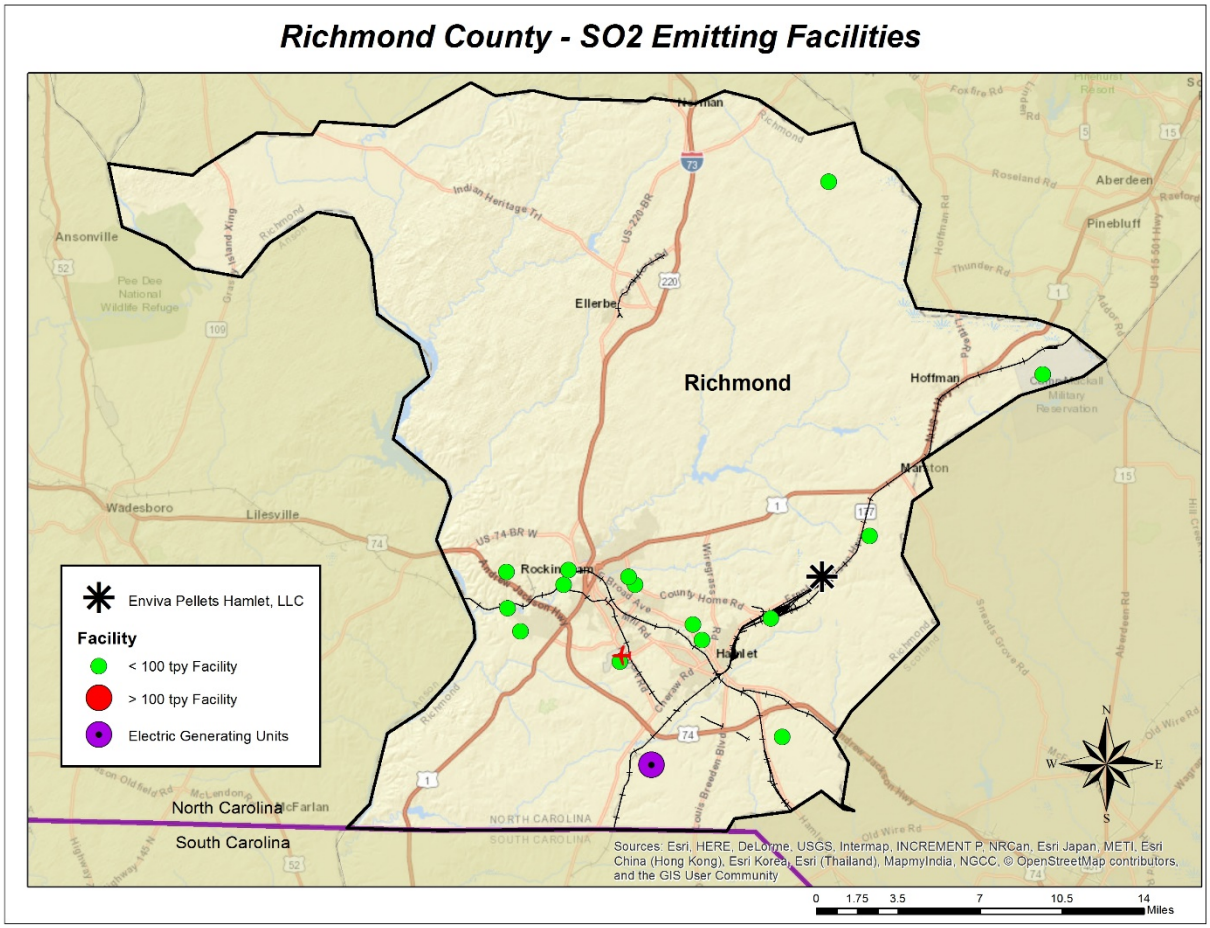


Figure 2.3 Enviva Pellets Hamlet Facility Area – SO_2 Emitting Facilities

Table 2.3 2014 NEIv2 SO_2 Emissions (tons)

Sector	Richmond	North Carolina	% of State Total
Point	57	64,199	0%
Nonpoint	12	2,002	1%
Fires	23	1,214	2%
Onroad	6	1,108	1%
Nonroad	1	2,759	0%
Biogenics	0	0	
Total	**99**	**71,282**	**0%**
Enviva Pellets Hamlet Facility	28	28	
Total with Enviva	**127**	**71,310**	**0%**

Source of Data: EPA 2014 NEIv2; Enviva emissions from "Application Review," DAQ, December 4, 2018.

2.4 Carbon Monoxide (CO) Emissions

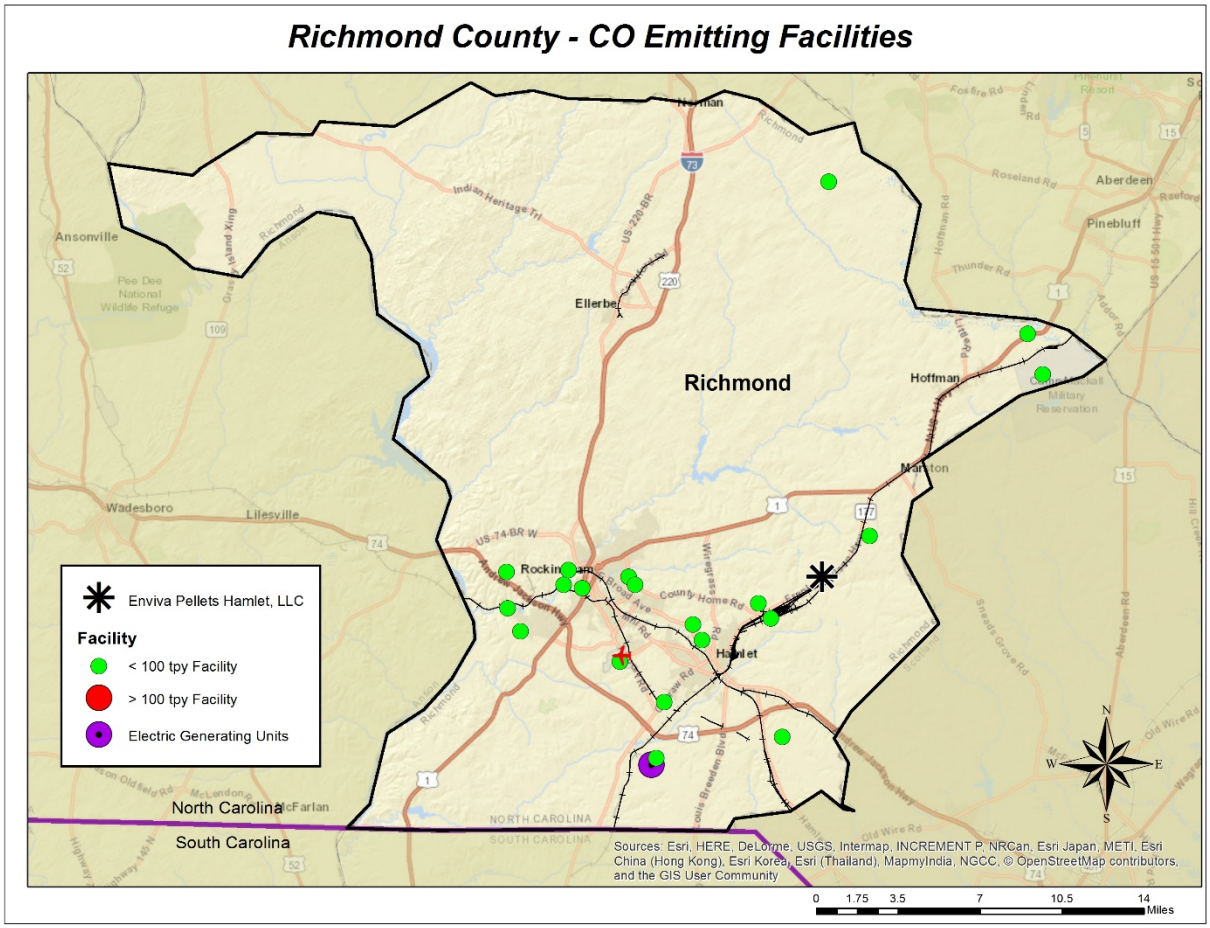


Figure 2.4 Enviva Pellets Hamlet Facility Area – CO Emitting Facilities

Table 2.4 2014 NEIv2 Carbon Monoxide Emissions (tons)

Sector	Richmond	North Carolina	% of State Total
Point	616	42,102	1%
Nonpoint	671	85,681	1%
Fires	2,624	160,860	2%
Onroad	5,611	920,988	1%
Nonroad	1,699	427,054	0%
Biogenics	1,703	134,205	1%
Total	**12,924**	**1,770,890**	**1%**
Enviva Pellets Hamlet Facility	231	231	
Total with Enviva	**13,155**	**1,771,121**	**1%**

Source of Data: EPA 2014 NEIv2; Enviva emissions from "Application Review," DAQ, December 4, 2018.

2.5 Volatile Organic Compounds (VOC) Emissions

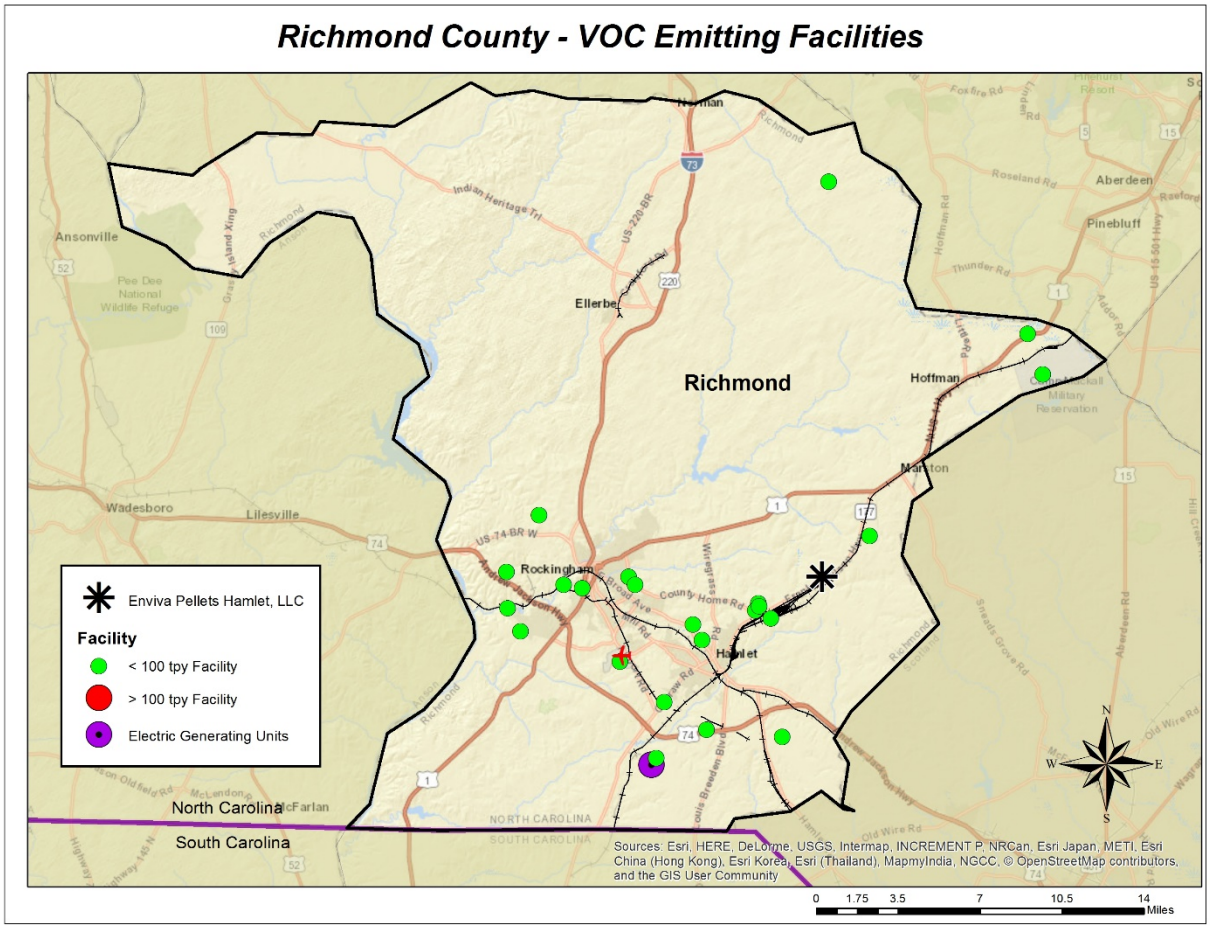


Figure 2.5 Enviva Pellets Hamlet Facility Area – VOC Emitting Facilities

Table 2.5 2014 NEIv2 VOC Emissions (tons)

Sector	Richmond	North Carolina	% of State Total
Point	109	39,682	0%
Nonpoint	1,049	144,842	1%
Fires	622	37,957	2%
Onroad	530	84,601	1%
Nonroad	136	49,431	0%
Biogenics	13,677	1,086,369	1%
Total	**16,123**	**1,442,882**	**1%**
Enviva Pellets Hamlet Facility	248	248	
Total with Enviva	**16,371**	**1,443,130**	**1%**

Source of Data: EPA 2014 NEIv2; Enviva emissions from "Application Review," DAQ, December 4, 2018.

2.6 Ammonia Emissions

Table 2.6 2014 NEIv2 Ammonia Emissions (lbs)

Sector	Richmond	North Carolina	% of State Total
Point	214,938	2,881,712*	7%
Nonpoint	3,833,440	328,358,734	1%
Fires	86,579	5,280,903	2%
Onroad	43,830	8,189,080	1%
Nonroad	647	125,419	1%
Biogenics	0	0	
Total	**4,179,434**	**344,835,848**	**1%**
Enviva Pellets Hamlet Facility	1,759	1,759	
Total with Enviva	**4,181,193**	**344,837,607**	**1%**

Source of Data: EPA 2014 NEIv2; Enviva emissions from "Application Review," DAQ, December 4, 2018.

*Ammonia emissions associated with NOx controls for two combined-cycle EGUs were revised between the release of 2014 NEIv1 and 2014 NEIv2, however the revised ammonia emissions are not reflected in NEIv2. These revisions would increase State total 2014-year ammonia emissions by 123,100 lbs (48,780 lbs for the Dan River Combined Cycle Facility and 74,320 lbs for the Buck Combined Cycle Facility).

2.7 Federal Hazardous Air Pollutants (HAPs) and State Toxic Air Pollutants (TAPs)

Federal Hazardous Air Pollutants

The Clean Air Act amendments of 1990 originally identified 189 Hazardous Air Pollutants, or HAPs, for regulation. HAPs are pollutants "known to cause or may reasonably be anticipated to cause adverse effects to human health or adverse environmental effects" [Section 112 (b)]. There are currently 187 federal HAPs following the delisting of caprolactam in 1996 and methyl ethyl ketone in 2005.

HAPs may be emitted from stationary sources (industrial processes) or mobile sources (cars, trucks and other vehicles).

Table 2.7 2014 NEIv2 Total HAP Emissions (lbs)

Sector	Richmond	North Carolina	% of State Total
Point	116,479	18,773,877	1%
Nonpoint	218,463	31,106,196	1%
Fires	253,330	12,847,545	2%
Onroad	291,619	46,524,795	1%
Nonroad	83,093	31,847,769	0%
Biogenics	2,758,604	208,685,994	1%
Total	**3,721,588**	**349,786,176**	**1%**
Enviva Pellets Hamlet Facility	66,202	66,202	
Total with Enviva	**3,787,790**	**349,852,378**	**1%**

Source of Data: EPA 2014 NEIv2; Enviva emissions from "Application Review," DAQ, December 4, 2018.

Table 2.8 HAP Emissions from Air Permitted Sources

CAS	Pollutant Name	HAP Emissions from Air Permitted Sources	
		Richmond County (lbs/yr)	Enviva Pellets (lbs/yr)
100-02-7	Nitrophenol, 4-		0.01
100-41-4	Ethyl benzene	2,100.49	3.40
100-42-5	Styrene	42,714.76	208.38
100-44-7	Benzyl chloride	0.70	
106-51-4	Quinone	17.40	
106-99-0	Butadiene, 1,3-	31.25	0.11
107-02-8	Acrolein	397.22	9,319.18
107-06-2	Ethylene Dichloride (1,2-dichloroethane)		3.18
107-21-1	Ethylene glycol	80.00	
108-88-3	Toluene	9,066.03	6.31
108-90-7	Chlorobenzene		3.62
108-95-2	Phenol	0.44	5,505.09
110-54-3	Hexane, n-	1,300.45	989.36
111-42-2	Diethanolamine	142.50	
117-81-7	DI(2-ethylhexyl)phthalate (DEHP)		0.01
123-38-6	Propionaldehyde	14.50	11,250.56
127-18-4	Perchloroethylene (tetrachloroethylene)	0.03	83.35
131-11-3	Dimethyl phthalate	1.64	
1330-20-7	Xylene (mixed isomers)	3,745.12	3.54
1336-36-3	PCB (polychlorinated biphenyls)		0.00
1746-01-6	Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		0.00
50-00-0	Formaldehyde	41,842.53	7,665.83
50-32-8	Benzo(a)pyrene	0.00220	0.29
51-28-5	Dinitrophenol, 2, 4-		0.02
540-84-1	Trimethylpentane, 2,2,4-	4.36	
56-23-5	Carbon Tetrachloride		4.94
60-34-4	Methyl hydrazine	0.18	
62-53-3	Aniline	0.29	
67-56-1	Methanol (methyl alcohol)	831.20	16,309.92
67-66-3	Chloroform		3.07
71-43-2	Benzene	815.91	464.41
71-55-6	Methyl chloroform	5.21	68.00
74-83-9	Methyl bromide (bromomethane)	0.28	1.65
74-87-3	Methyl chloride (chloromethane)	0.63	2.52
75-00-3	Ethyl chloride (chloroethane)	0.001	
75-01-4	Vinyl chloride		1.97
75-07-0	Acetaldehyde	2,319.01	8,683.94

CAS	Pollutant Name	HAP Emissions from Air Permitted Sources	
		Richmond County (lbs/yr)	Enviva Pellets (lbs/yr)
75-09-2	Methylene chloride	2.03	31.81
75-15-0	Carbon disulfide	0.41	
75-25-2	Bromoform	0.04	
75-56-9	Propylene oxide	1,677.22	
7647-01-0	Hydrogen chloride (hydrochloric acid)	1,465.32	4,167.66
7664-39-3	Hydrogen fluoride	160.00	
7723-14-0	Phosphorus Metal, Yellow or White	3.22	4.29
7738-94-5	Chromic acid (VI)	4.70	1.33
7782-50-5	Chlorine	28.83	1,732.87
78-59-1	Isophorone	0.61	
78-87-5	Propylene dichloride (1,2-dichloropropane)		3.62
79-01-6	TCE (trichloroethylene)		3.29
80-62-6	Methyl methacrylate	6,148.00	
87-86-5	Pentachlorophenol		0.11
88-06-2	Trichlorophenol, 2,4,6-		0.00
91-20-3	Naphthalene	170.62	
95-47-6	Xylene, o-	17.12	
98-82-8	Cumene	29.50	
95-50-1	Dichlorobenzene		0.66
ASC (7778394)	Arsenic & Compounds (total mass of elemental AS, arsine and all inorganic compounds)	37.35	3.61
BEC	Beryllium & compounds (Total mass)	2.25	0.18
CDC	Cadmium & compounds (total mass includes elemental metal)	66.40	1.26
COC	Cobalt & compounds	5.31	1.08
CRC	Chromium - All/Total (includes Chromium (VI) categories, metal and others)	88.55	2.78
GLYET	Glycol ethers (total all individual glycol ethers)	20.00	
HGC	Mercury & Compounds - all total mass includes Hg Vapor	15.84	0.70
MNC	Manganese & compounds	412.39	254.66
NIC	Nickel & Compounds, sum total mass includes elemental	162.79	6.40
PBC	Lead & compounds	49.33	7.91
POM	Polycyclic Organic Matter	253.38	285.92
SBC	Antimony & Compounds (total mass, inc elemental SB)	0.06	1.26
SEC	Selenium Compounds	3.71	0.46

State Toxic Air Pollutants

North Carolina has a health-based toxic air pollutant control program that regulates 97 Toxic Air Pollutants or TAPs. The North Carolina Air Toxics program focuses on chemicals emitted by stationary point sources. Twenty (20) of the 97 North Carolina TAPs are not classified as HAPs while 77 pollutants are common to both lists. The six TAPs listed in Table 2.9 are the only TAPs emitted by point source facilities in Richmond County for the 2014 inventory year.

Table 2.9 Summary of Toxic Air Pollutant Emissions for Point Source Facilities

	Total for 6 TAPs (lbs/yr)	% State Total for 6 TAPs*
Richmond County	215,590.81	2.30%
State totals	9,383,119.11*	
Eviva Pellets Hamlet	1,759.47	0.02%
State total with Enviva	9,384,878.58*	

	Ethylene glycol monoethyl ether (Cellusolve) 110-80-5 (lbs/yr)	Fluorides 16984-48-8 (lbs/yr)	Sulfuric acid 7664-93-9 (lbs/yr)	Hydrogen sulfide 7783-06-4 (lbs/yr)	MEK (methyl ethyl ketone, 2-butanone) 78-93-3 (lbs/yr)	Ammonia (as NH3) 7664-41-7 (lbs/yr)
Richmond County	20.00	0.99	0.01	5.94	626.57	214,937.30
Eviva Pellets Hamlet					0.60	1,758.87
State totals	509.49	666,384.73	2,472,453.46	2,319,813.41	1,042,245.85	2,881,712.17*
% of State Total	3.93%	0.00%	0.00%	0.00%	0.06%	7.52%

Notes:
Listed TAP only emissions are the TAP emissions reported for Richmond County that are not also HAPs.
% Statewide TAP-only emissions includes only the TAP emissions that are not also HAPs that are reported in this county.
Enviva Pellets is also estimated to emit an additional 2 TAPs that are not also HAPs, trichlorofluoromethane (4.4 lbs) and Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8- (1.96E-06 lbs).
*Ammonia emissions associated with NOx controls for two combined-cycle EGUs were revised between the release of 2014 NEIv1 and 2014 NEIv2; however, the revised ammonia emissions are not reflected in NEIv2. These revisions would increase State total 2014-year ammonia emissions by 123,100 lbs (48,780 lbs for the Dan River Combined Cycle Facility and 74,320 lbs for the Buck Combined Cycle Facility).

Hazardous Air Pollutants and Toxic Air Pollutants

The following two figures show HAP and TAP emissions trends from 1993 to 2016 for point source facilities statewide and for Richmond County. The figure for Richmond County includes the potential impact of the emissions of Enviva Pellets Hamlet in the county. For Richmond County, the sharp rise in HAP and TAP emissions beginning in 2010 is due to (1) ammonia (TAP) emissions from natural gas combined-cycle EGUs equipped with selective catalytic reduction (SCR) NOx controls at Duke Energy Progress, LLC – Richmond County Turbines, and (2) increases in HAP emissions associated with point sources in the county.

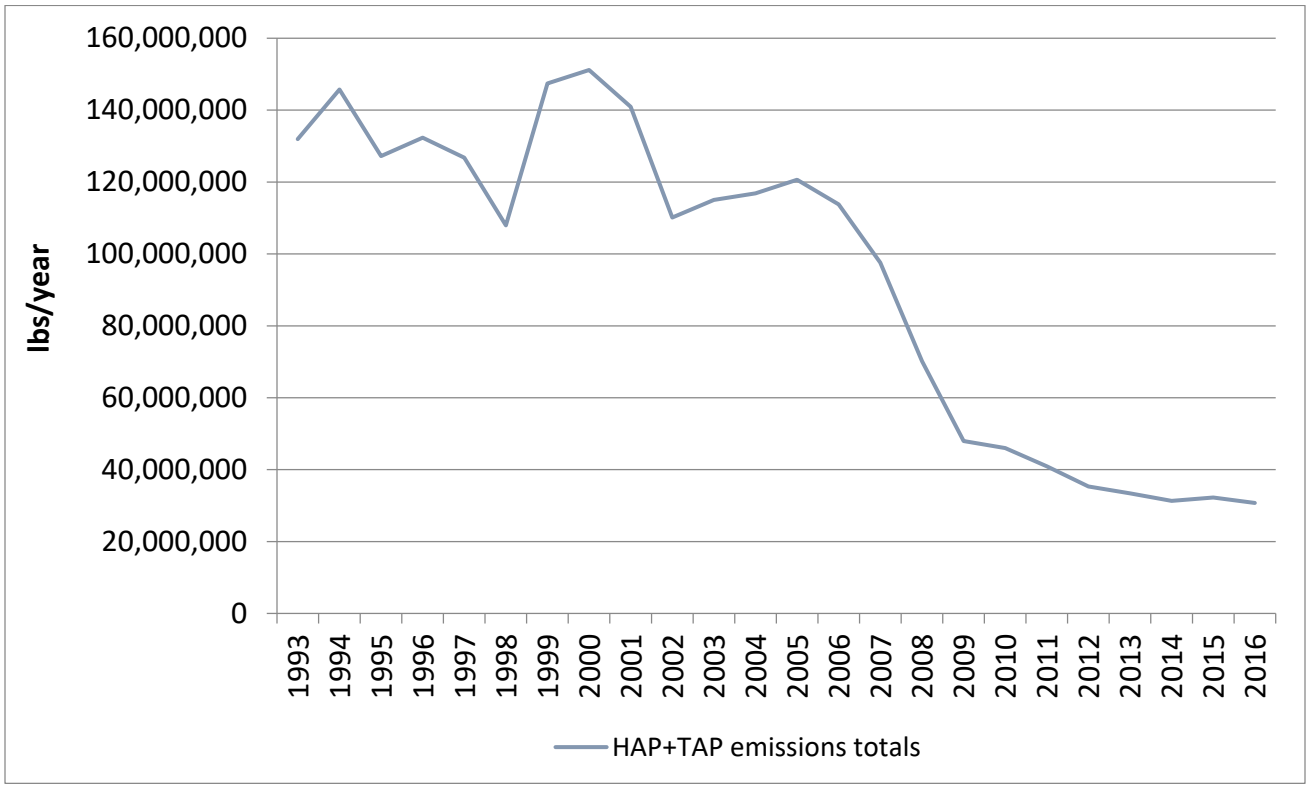


Figure 2.6 Statewide Hazardous and Toxic Air Pollutant Emissions Trends for Point Source Facilities (1993-2016)

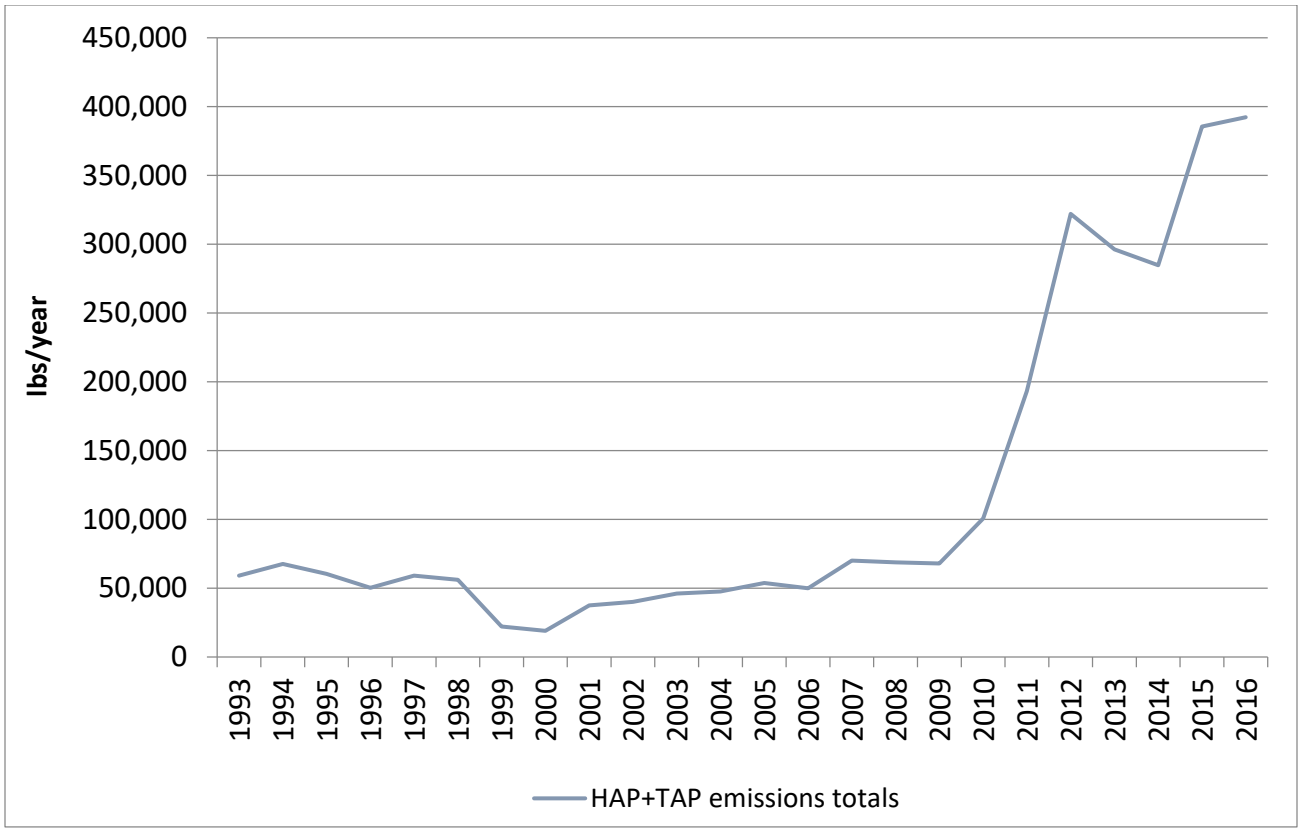


Figure 2.7 Richmond County Hazardous and Toxic Air Pollutant Emissions Trends for Point Source Facilities (1993-2016)

2.8 North Carolina Power Plant Emissions Data

The following charts show calendar year 2014 daily emissions of NOx, SO_2 and CO_2 in short tons from the two electricity generating facilities in Richmond County. The North Carolina Electric Membership Corporation (NCEMC) Hamlet Plant began operating in 2007. It operates twelve 35 megawatt (MW) single cycle combustion turbines that combust natural gas as a primary fuel and diesel as a secondary fuel. These units operate primarily to provide power during peak electricity demand hours and are referred to as "peaking units". The second plant is the Richmond County Plant owned by Duke Energy Progress and began operating in 2001. This power plant operates five 175 MW single cycle combustion turbines that fire natural gas as a primary fuel and diesel as a secondary fuel and four 300 MW combined cycle combustion turbines that combust primarily natural gas. The five single cycle turbines provide peaking power while the four larger combined cycle turbines provide base load power to the electrical grid.

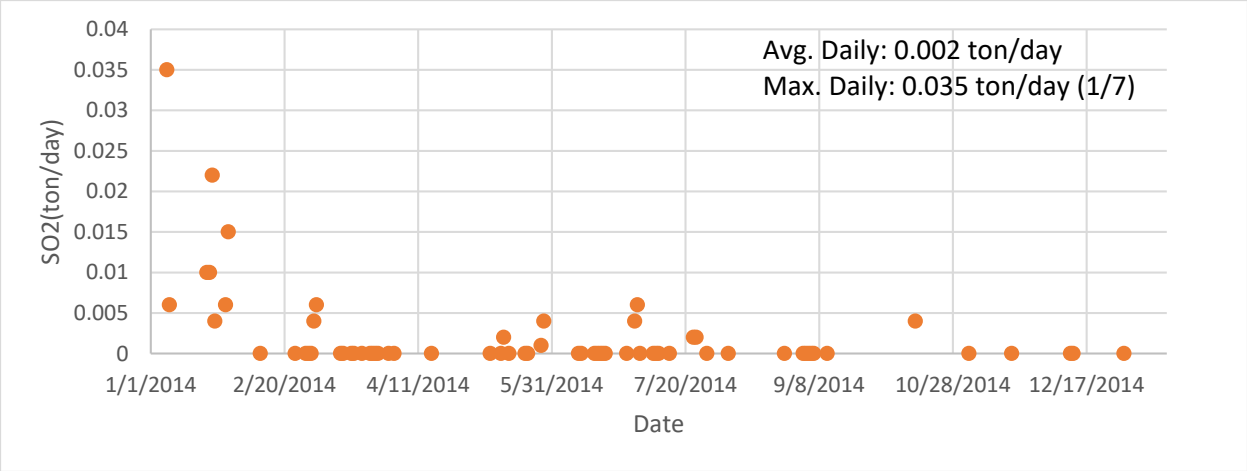


Figure 2.8 NCEMC Hamlet Plant Facility-wide 2014 Daily SO_2 Emissions (tons)

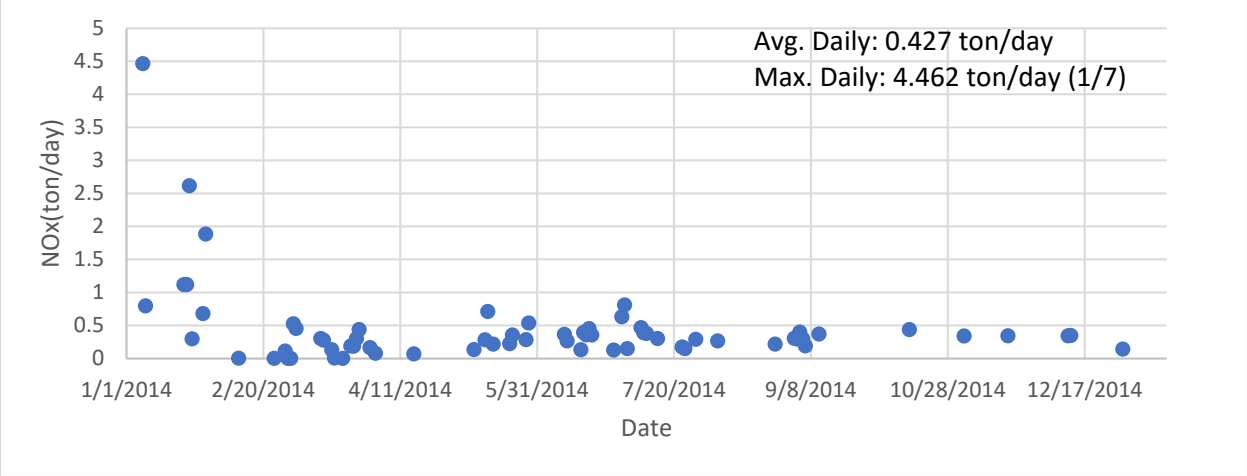


Figure 2.9 NCEMC Hamlet Plant Facility-wide 2014 Daily NOx Emissions (tons)

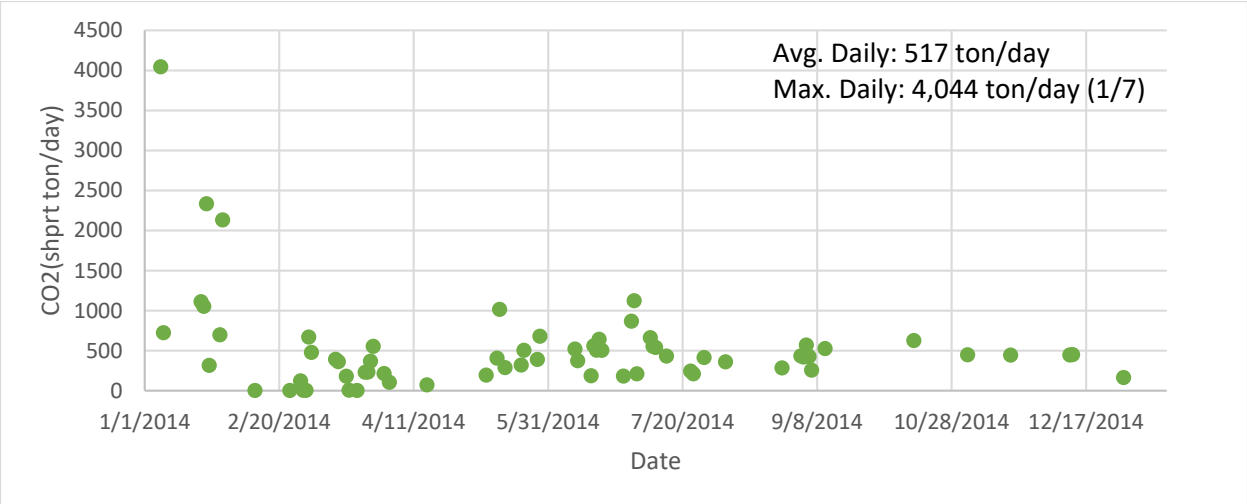


Figure 2.10 NCEMC Hamlet Plant Facility-wide 2014 Daily CO_2 Emissions (tons)

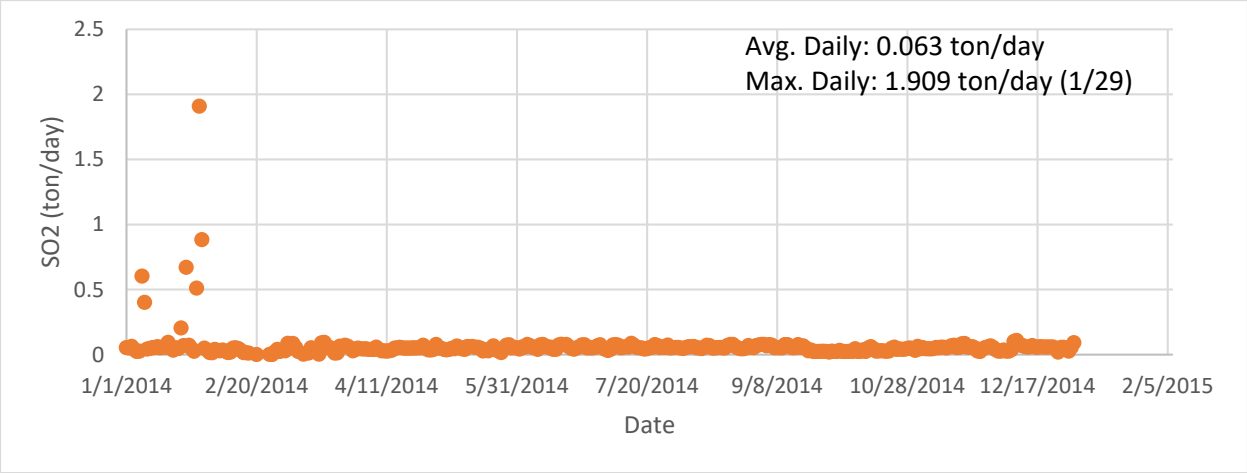


Figure 2.11 Richmond County Plant Facility-wide 2014 Daily SO_2 Emissions (tons)

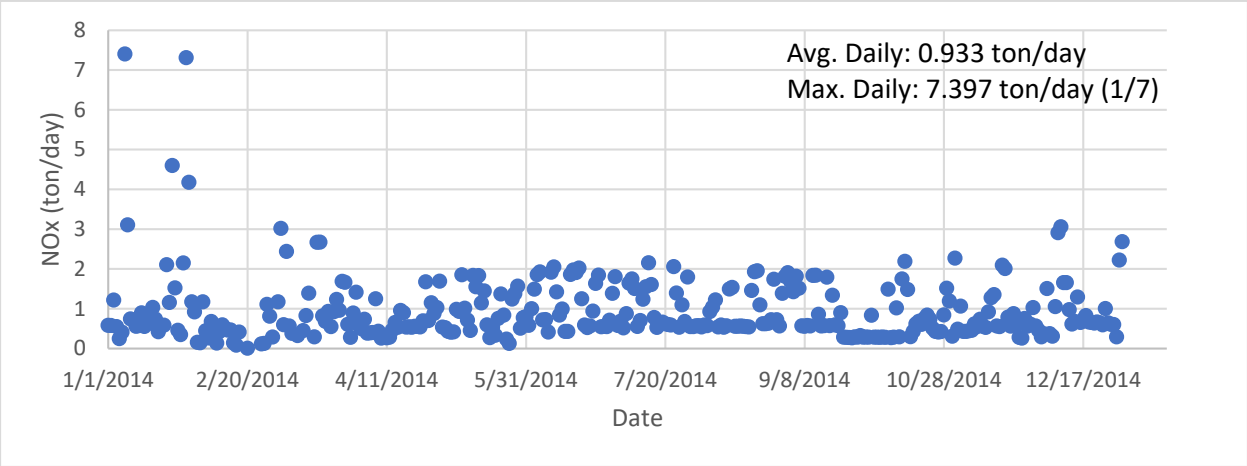


Figure 2.12 Richmond County Plant Facility-wide 2014 Daily NOx Emissions (tons)

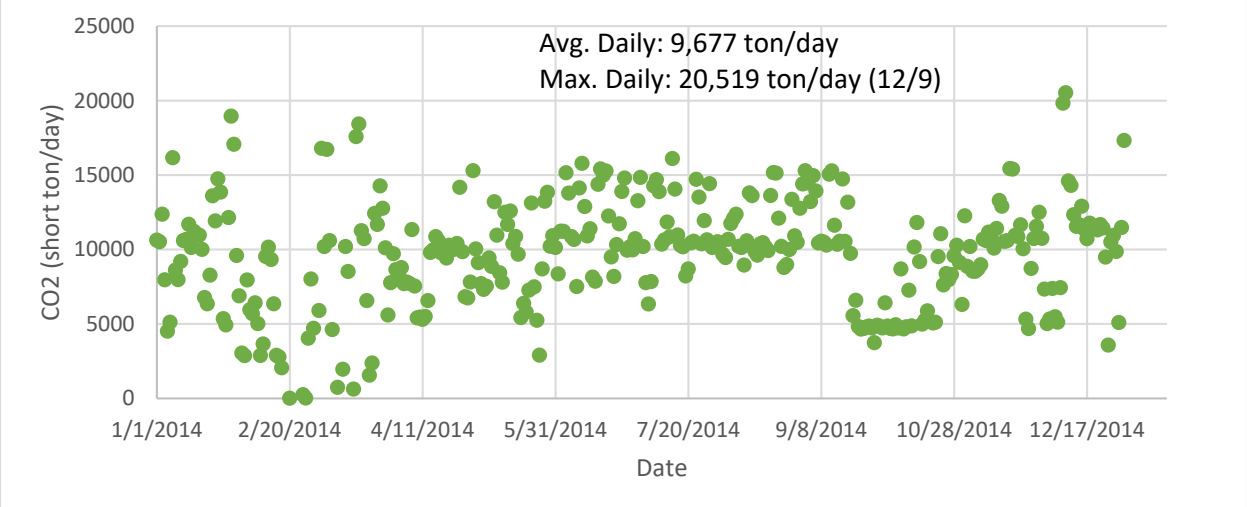


Figure 2.13 Richmond County Plant Facility-wide 2014 Daily CO_2 Emissions (tons)

2.9 Prescribed Fires and Wildfire Events

Prescribed fires are fires that are intentionally ignited to meet specific management objectives such as ecosystem restoration and wildfire hazard reduction. Wildfires are fires started by an unplanned ignition caused by, for example, lightning or other acts of nature, accidental human-caused actions, or a prescribed fire that has developed into a wildfire. These fire events generate air pollutants ($PM_{2.5}$, NOx, CO, VOC) that are tracked by North Carolina and EPA annually to understand their overall contribution to total emissions in the state and locally.

The following maps and tables show the total number of fires and total acres burned by prescribed fires and wildfires in Richmond County for 2014. Data for NC for 2014 were obtained from the 2014 NEIv2.

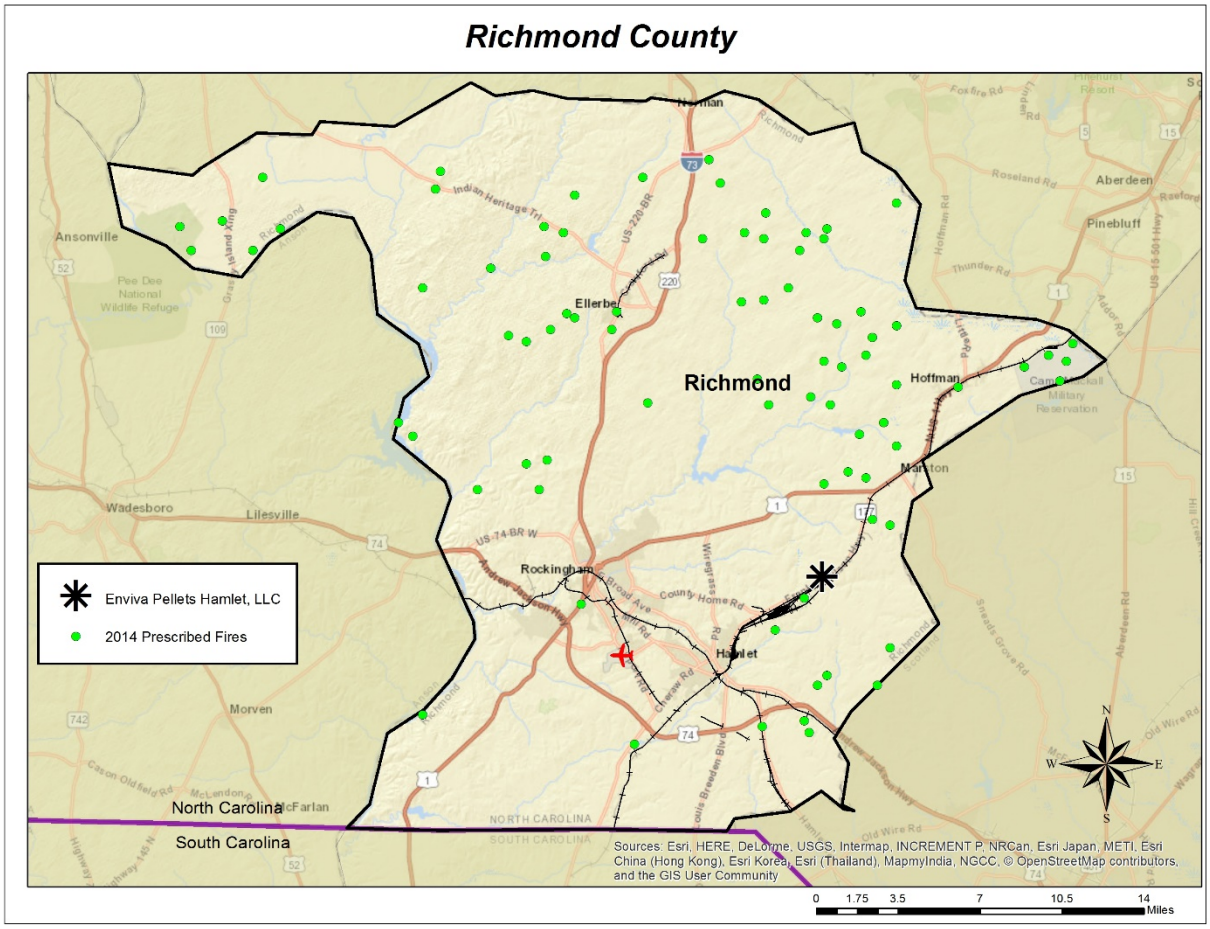


Figure 2.14 Richmond County 2014 Prescribed Fire Locations

Table 2.10 Number and Acres Burned for 2014 Prescribed Fires

2014	Prescribed Fires	Acres Burned
North Carolina State Total	10,927	128,547
Richmond County	88	7,845
Percent of Total	0.8%	6.1%

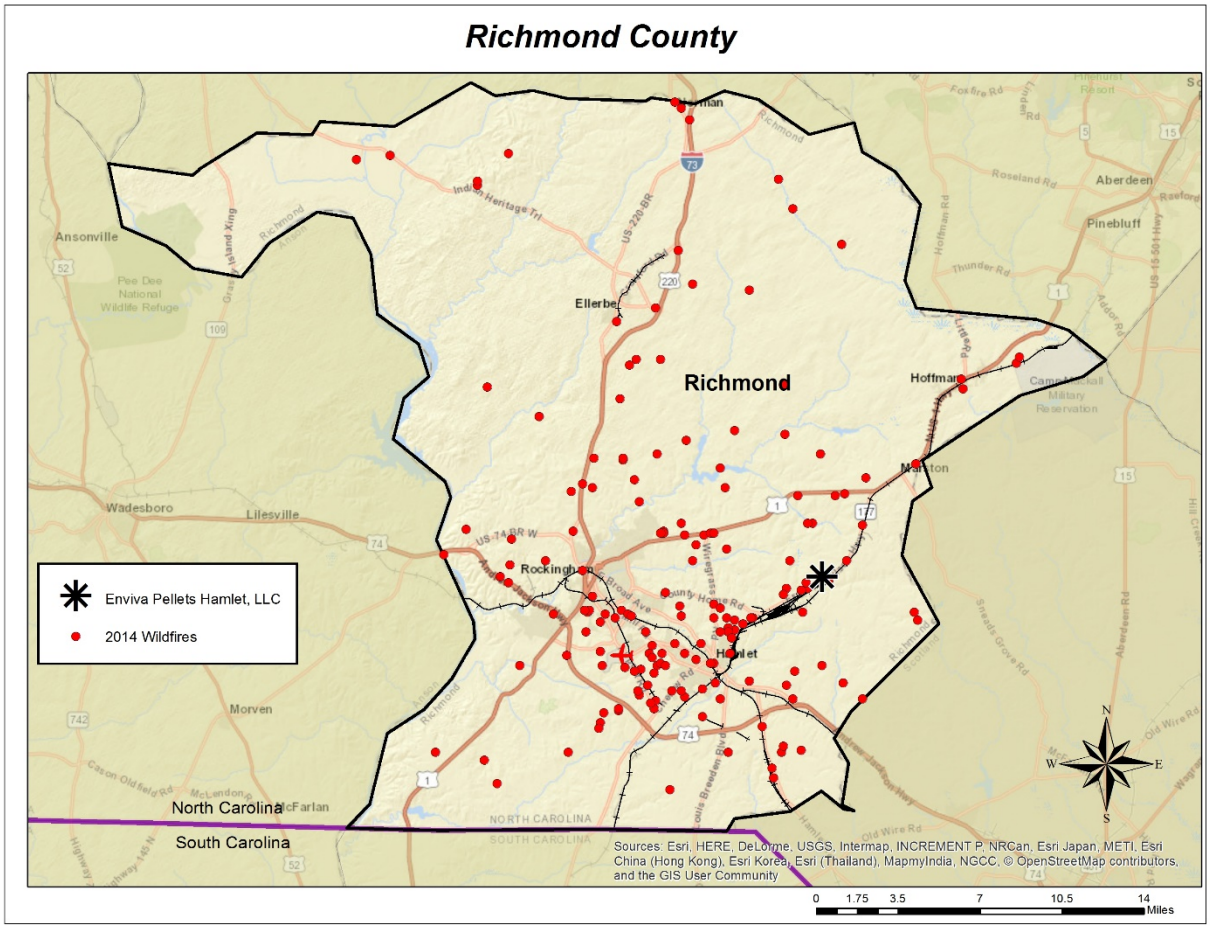


Figure 2.15 Richmond County 2014 Wildfire Locations

Table 2.11 Number and Acres Burned for 2014 Wildfires

2014	Wild Fires	Acres Burned
North Carolina State Total	2,658	25,053
Richmond County	176	361
Percent of Total	6.6%	1.4%

2.10 Greenhouse Gases

Greenhouse gases (GHGs) are air pollutants that trap heat in the atmosphere. The three primary GHGs emitted by fossil and biomass fuel combustion are CO_2, methane (CH_4) and nitrous oxide (N_2O). Methane is also emitted by landfills and agricultural sources due to the decomposition of biomass. Lastly, fluorinated gases including hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes. The source of these gases in this inventory; however, is from the production of fluorinated gases for use by industry.

Each gas has a different atmospheric lifetime and different ability to absorb heat. Therefore, it is common to calculate the tons of emissions of CH_4 and N_2O on the basis of CO_2. This basis is termed "as CO_2 equivalent" (CO_2e). Note that fluorinated gases are generally emitted in small amounts but have a high global warming potential.

In addition, CO_2 that is emitted from the combustion of biomass material is considered "carbon neutral". This means that the emitted CO_2 is offset by an equivalent amount that is re-sequestered by re-growing the biomass, making the net carbon emissions equal to zero. Although many factors influence the carbon sequestration process, a scientific consensus has not been fully developed regarding the best approach for addressing carbon neutrality. For the purpose of this emissions inventory, we have assumed that biomass related CO_2 emissions are not included in the total GHG emissions as CO_2e.

The GHG emissions for the proposed Enviva Pellet Hamlet Plant were obtained from the latest air quality permit application and are presented in the following table.[4]

Table 2.12 Proposed Enviva Pellets Hamlet Facility Project Potential Emissions in tons per year as CO_2e

Source	CO_2	CH_4*	N_2O*	Total GHG as CO_2e	Biogenic CO_2
Dryer and Green Wood Hammermills- wood	0.00	0.00	0.00	0.00	268,692.72
Pellet Press and Coolers - Natural Gas	22,780.36	8.54	10.18	22,799.09	0.00
Emergency Generator - Diesel	196.21	0.20	0.46	196.87	0.00
Fire Water Pump - Diesel	55.12	0.06	0.13	55.31	0.00
Total	**23,031.69**	**8.80**	**10.78**	**23,051.26**	**268,692.72**

*Calculated using a global warming potential of 25 for CH_4 and 298 for N_2O.

[4] Enviva Pellets Hamlet, LLC, Application for Permit Modification for Classification as a PSD Minor Source, Prepared by Ramboll US Corporation, Project 1690006061, May 2018.

Emissions data for each sector was obtained from several sources:

- EGU and Non-EGU point source data for facilities reporting 25,000 metric tons CO_2e per year or greater obtained from EPA's 2014 Facility Level Information on Greenhouse Gases Tool (FLIGHT)[5]
- GHG emissions data submitted voluntarily by Non-EGU point sources to the DAQ through the Internet-based Enterprise Application Management (IBEAM) data system and obtained from the internal 2014 North Carolina Multi-Pollutant Inventory Database.
- EPA 2014 NEIv2 for onroad and nonroad mobile sources and wildfires and prescribed burning.[6]

The following table presents the GHG emissions from the various sectors in Richmond County and the proposed Enviva Pellet Hamlet facility in tons as CO_2e.

Note that only a small number of facilities are required to report GHG emissions to EPA or opt to voluntarily report GHG emissions to North Carolina. In Richmond County, only five out of 26 facilities reported GHG emissions for 2014. Therefore, actual GHG emissions in Richmond County are higher than shown in the table below.

Table 2.13 2014 Total GHG Emissions in Richmond County (tons CO_2e)

Sector	CO_2	CH_4	N_2O	Total GHG	Biogenic CO_2e
Point*	3,504,666	1,658	2,024	3,508,348	
Nonpoint	N/A	N/A	N/A	N/A	
Fires		3,272	0	3,272	37,406
Onroad	275,507	369	3,238	279,113	
Nonroad	25,780	252	0	26,032	
Total	**3,805,953**	**5,551**	**5,262**	**3,816,765**	**37,406**
Enviva Plant	23,032	9	11	23,051	268,693**
Percent Increase				**0.6%**	

* Point source GHG data is not complete. Only a small number of facilities are required to report GHG emissions to EPA or opt to voluntarily report GHG emissions to North Carolina.
** Carbon neutral emissions associated with wood burning.
N/A: Not Available.

[5] United States Environmental Protection Agency, "Facility Level Information on Greenhouse Gases Tool" (FLIGHT), 2014 Data for NC, available from https://ghgdata.epa.gov/ghgp/main.do, accessed on April 3, 2018.
[6] United States Environmental Protection Agency, "Air Emissions Inventories, 2014 National Emissions Inventory (NEI) Data," available from https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data, accessed January 2018.

3 Wind Rose

A wind rose is a graphical tool used to show wind speed and wind direction for a particular location over a specified period of time. The wind rose is divided into a number of spokes, which represent the frequency of winds blowing from a particular direction. For example, the longest spoke on the wind rose represents the greatest frequency of winds blowing from that particular direction over the specified time frame.

To get the most representative wind rose for a given location, a sufficiently long period of data is needed. After a careful review of the data from the weather stations in closest proximity to Richmond County, we found that the Sandhills Research Station (JACK) -- an ECONet station installed and maintained by the State Climate Office of NC -- was the most representative for the area as it contains a near-continuous data history through 1985.

In examining the JACK wind rose, there are essentially two dominant wind directions: west to southwesterly and north to northeasterly, evidenced by the spokes that extend furthest out beyond the 5%+ frequency for the 30-year monitoring period.

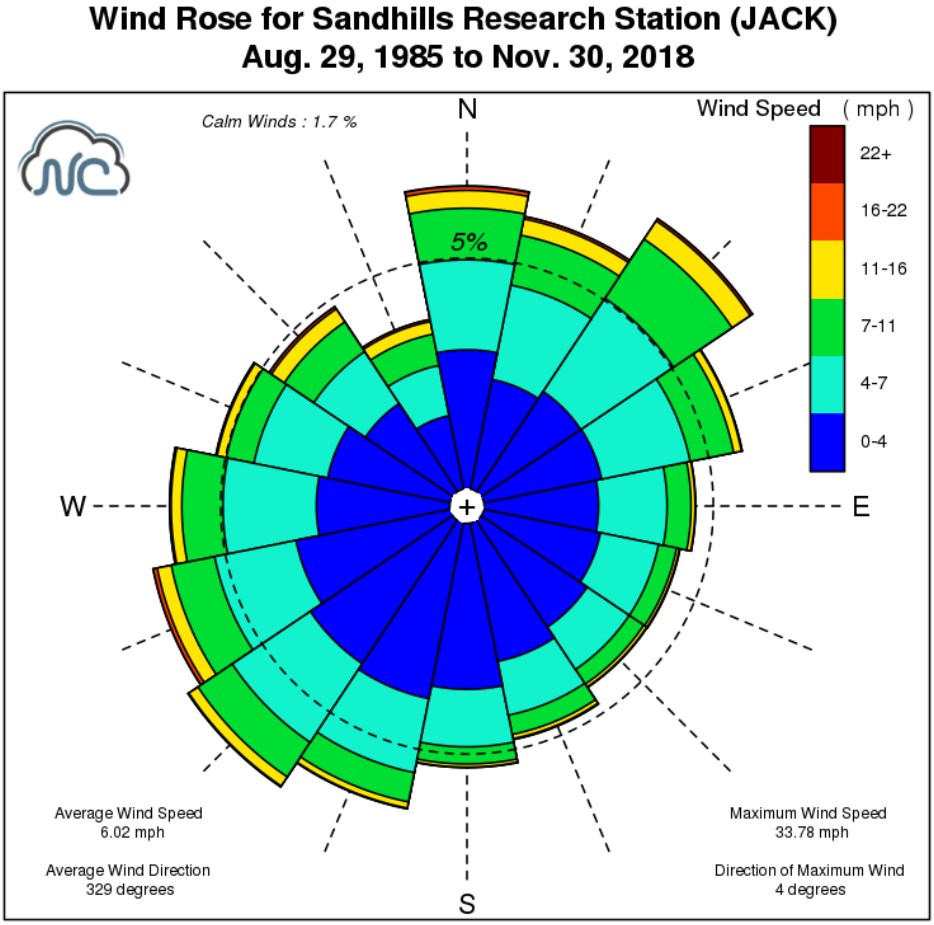
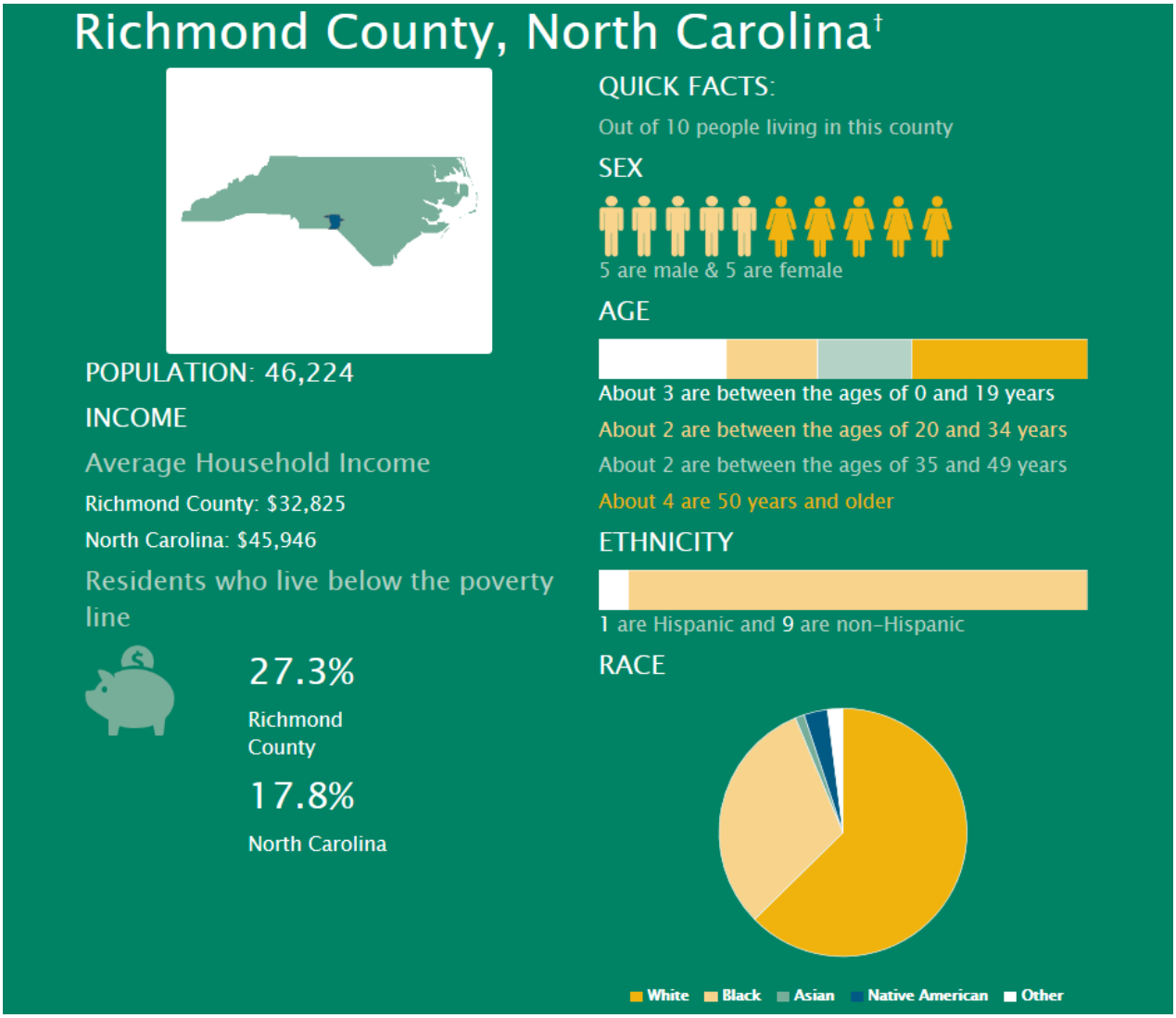


Figure 3.1 Wind Rose for Upper Coastal Plain Res Stn

Source: ECONet station installed and maintained by the State Climate Office of NC.

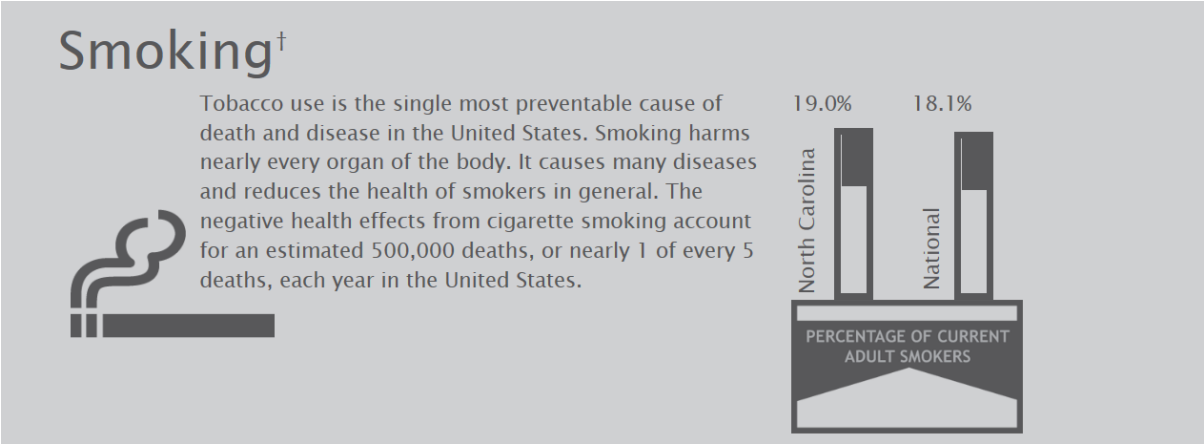
4 Demographic and Socioeconomic Data

4.1 CDC Statistics for Richmond County

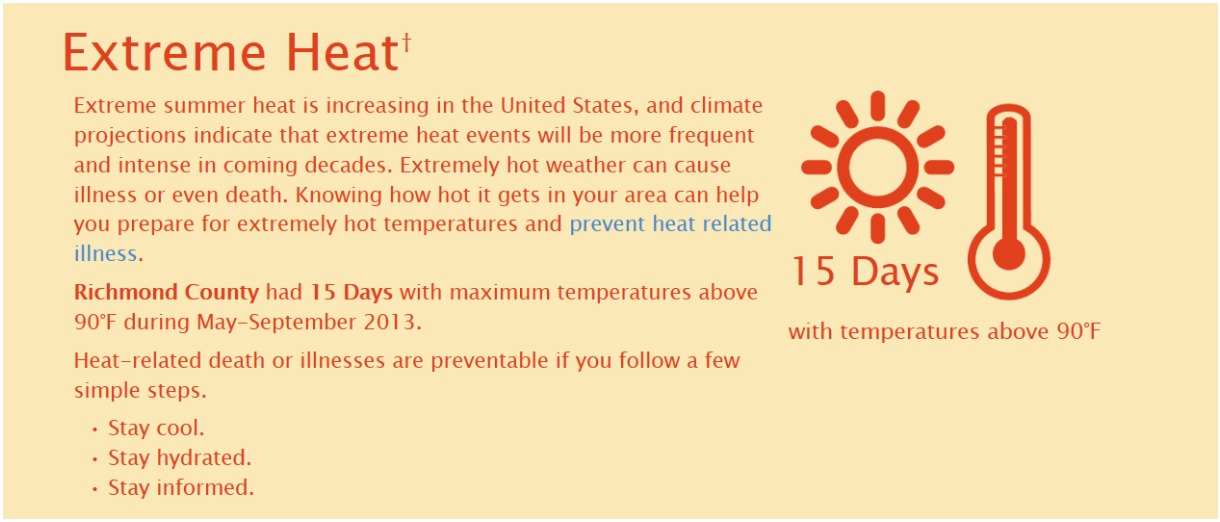


Source: Centers for Disease Control

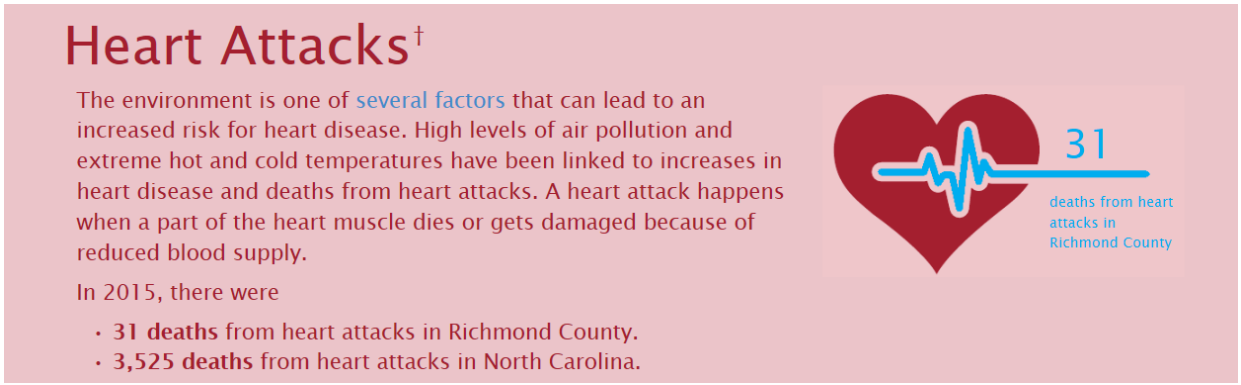
Richmond County



Source: Centers for Disease Control



Source: Centers for Disease Control



Source: Centers for Disease Control

5 National Air Toxics Assessment (NATA)

The National Air Toxics Assessment (NATA) was developed by EPA as a comprehensive evaluation of air toxics across the U.S.[7] NATA provides information about risks of cancer and other serious health effects from breathing air toxics. Assessments are based on chronic exposure from ambient air sources. NATA results provide answers to questions about emissions, ambient air concentrations, exposures and risks across broad geographic areas (such as counties, states and the Nation) at a moment in time. These assessments are based on assumptions and methods that limit the range of questions that can be answered reliably. The results cannot be used to identify exposures and risks for specific individuals, or even to identify exposures and risks in small geographic regions such as a specific census block, i.e., hotspots.

The DAQ may use these data to provide insights into cancer risks for a given area, as shown for Richmond County, ranked against the nation; however, a more thorough assessment is conducted where key regulatory and environmental decisions are needed.

Caveats and Limitations

The broad **NATA summary categories** are **point**, **nonpoint**, **onroad**, **nonroad**, **fires**, **biogenics**, and **secondary**. Some of these categories are named the same as the NEI data categories but they are not identical. For example, the NATA nonpoint category is not the same as the NEI nonpoint category because the NEI nonpoint category includes CMVs and locomotives, while the NATA nonpoint category does not.

Further limitations of the assessment include:

- gaps in data
- limitations in computer models used
- default assumptions used routinely in any risk assessment
- limitations in the overall design of the assessment (intended to address some questions but not others).
- variations in detail and completeness of inventories from different geographical regions

Definitions:

"N" in 1 million cancer risk - A risk level of “N”-in-1 million implies a likelihood that up to “N” people, out of one million equally exposed people would contract cancer if exposed continuously (24 hours per day) to the specific concentration over 70 years (an assumed lifetime). This would be in addition to those cancer cases that would normally occur in an unexposed population of one million people. Note that this assessment looks at lifetime cancer risks, which should not be confused with or compared to annual cancer risk estimates. If you would like to compare an annual cancer risk estimate with the results in this assessment, you would need to multiply that annual estimate by a factor of 70 or alternatively divide the lifetime risk by a factor of 70.

[7] https://www.epa.gov/national-air-toxics-assessment Accessed Dec 2017.

Secondary formation - The process by which chemicals are transformed in the air into other chemicals. When a chemical is transformed, the original HAP no longer exists; it is replaced by one or more chemicals. Compared to the original chemical, the newer reaction products can have more, less, or the same toxicity. Transformations and removal processes affect both the fate of the chemical and its atmospheric persistence. Persistence is important because human exposure to chemical is influenced by the length of time the chemical remains in the atmosphere. Certain HAPs (i.e., formaldehyde, acetaldehyde, and acrolein) are formed in the atmosphere through photochemical reactions, and these "secondary" contributions are included in NATA through the photochemical air quality modeling platform.

Biogenic emissions – Emissions of formaldehyde, acetaldehyde and methanol from vegetation (plants and trees) as estimated by EPA models.

Point Sources – sources that are stationary and fixed and can be located using latitude and longitude data. These sources include large industrial facilities and EGUs. Airports and railyards are excluded from this category, as they are included in the Nonroad category.

Nonpoint Sources – sources which individually are too small in magnitude or too numerous to inventory as individual point sources. Modeling excludes emissions from locomotives, commercial marine vessels, biogenic and agricultural fires.

Onroad sources – sources include car, truck and bus emissions as estimated by EPA models.

Nonroad sources – sources include lawn and garden equipment, and construction and recreational equipment emissions as estimated by EPA models. This category includes commercial marine vessels, locomotives and aircraft engine emissions associated with landing and take-off, and airport ground support vehicles.

Fires – sources include wildfire, prescribed burning, and agricultural burning emissions as estimated by EPA models.

Background concentrations - The contributions to outdoor air toxics concentrations resulting from natural sources, persistence in the environment of past years' emissions, and long-range transport from distant sources. The vast majority of risk from the NATA background concentrations is from *carbon tetrachloride*, a ubiquitous pollutant that has few sources of emissions but is persistent due to its long half-life. Background sources, also included in NATA, can include natural sources and anthropogenic air toxics emitted in prior years that persist in the environment, or air toxics emitted from distant sources, including (for those HAPs modeled in HEM-3 but not the Community Multiscale Air Quality [CMAQ]) air toxics transported farther than 50 kilometers.

5.1 National Air Toxics Assessment (NATA) for Richmond County (Source: EPA Draft)

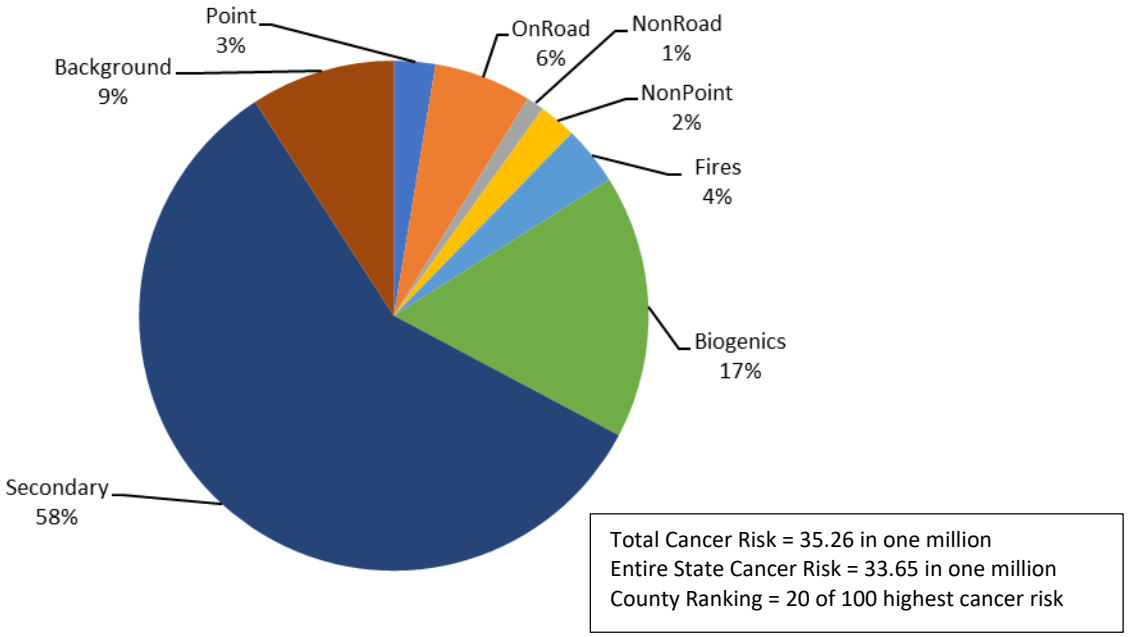


Figure 5.1 Richmond County Cancer Risk, 2014NATA

Data Source – 2014v2 National Emissions Inventory, EPA

Table 5.1 Air Toxic Pollutants Included in NATA

Air Toxic (Clean Air Act Name)	NEI Pollutant Code (CAS Number)[a]	Notes
1,1,2,2-Tetrachloroethane	79345	
1,1,2-Trichloroethane	79005	
1,1-Dimethyl hydrazine	57147	
1,2,4-Trichlorobenzene	120821	
1,2-Dibromo-3-chloropropane	96128	
1,2-Diphenylhydrazine	122667	Not in NATA because there were no emissions
1,2-Epoxybutane	106887	
1,2-Propylenimine (2-methyl aziridine)	75558	
1,3-Butadiene	106990	
1,3-Dichloropropene	542756	
1,3-Propane sultone	1120714	
1,4-Dichlorobenzene(p)	106467	
1,4-Dioxane	123911	
2,2,4-Trimethylpentane	540841	
2,4,5-Trichlorophenol	95954	
2,4,6-Trichlorophenol	88062	
2,4-D, salts and esters	94757	
2,4-Dinitrophenol	51285	
2,4-Dinitrotoluene	121142	
2,4-Toluene diamine	95807	
2,4-Toluene diisocyanate	584849	
2- Acetylaminofluorene	53963	
2-Chloroacetophenone	532274	
2-Nitropropane	79469	
3,3'-Dichlorobenzidine	91941	
3,3'-Dimethoxybenzidine	119904	
3,3'-Dimethylbenzidine	119937	
4,4'-Methylene bis(2-chloroaniline)	101144	
4,4'-Methylenedianiline	101779	
4,6-Dinitro-o-cresol, and salts	534521	
4-Aminobiphenyl	92671	
4-Nitrobiphenyl	92933	
4-Nitrophenol	100027	
Acetaldehyde	75070	
Acetamide	60355	
Acetonitrile	75058	
Acetophenone	98862	
Acrolein	107028	
Acrylamide	79061	
Acrylic acid	79107	
Acrylonitrile	107131	
Allyl chloride	107051	
Aniline	62533	
Antimony Compounds	7440360	
Arsenic Compounds (inorganic including arsine)	7440382	

Air Toxic (Clean Air Act Name)	NEI Pollutant Code (CAS Number)[a]	Notes
Benzene (including benzene from gasoline)	71432	
Benzidine	92875	
Benzotrichloride	98077	
Benzyl chloride	100447	
Beryllium Compounds	7440417	
Beta-Propiolactone	57578	Not in NATA because there were no emissions
Biphenyl	92524	
Bis(2-ethylhexyl)phthalate (DEHP)	117817	
Bis(chloromethyl)ether	542881	
Bromoform	75252	
Cadmium Compounds	7440439	
Calcium cyanamide	156627	
Captan	133062	
Carbaryl	63252	
Carbon disulfide	75150	
Carbon tetrachloride	56235	
Carbonyl sulfide	463581	
Catechol	120809	
Chloramben	133904	Not in NATA because there were no emissions
Chlordane	57749	
Chlorine	7782505	
Chloroacetic acid	79118	
Chlorobenzene	108907	
Chlorobenzilate	510156	
Chloroform	67663	
Chloromethyl methyl ether	107302	
Chloroprene	126998	
Chromium Compounds	multiple	NATA includes only hexavalent chromium
Cobalt Compounds	7440484	
Coke Oven Emissions	140	
Cresols/Cresylic acid (isomers and mixture)	1319773	Modeled as cresols
Cumene	98828	
Cyanide Compounds	multiple	
Diazomethane	334883	
Dibenzofurans	132649	
Dibutylphthalate	84742	
Dichloroethyl ether (Bis(2-chloroethyl)ether)	111444	
Dichlorvos	62737	
Diethanolamine	111422	
Diethyl sulfate	64675	
Dimethyl aminoazobenzene	60117	
Dimethyl carbamoyl chloride	79447	
Dimethyl formamide	68122	
Dimethyl phthalate	131113	
Dimethyl sulfate	77781	

Air Toxic (Clean Air Act Name)	NEI Pollutant Code (CAS Number)[a]	Notes
Epichlorohydrin (l-Chloro-2,3-epoxypropane)	106898	
Ethyl acrylate	140885	
Ethyl benzene	100414	
Ethyl carbamate (Urethane)	51796	
Ethyl chloride (Chloroethane)	75003	
Ethylene dibromide (Dibromoethane)	106934	
Ethylene dichloride (1,2-Dichloroethane)	107062	
Ethylene glycol	107211	
Ethylene imine (Aziridine)	151564	
Ethylene oxide	75218	
Ethylene thiourea	96457	
Ethylidene dichloride (1,1-Dichloroethane)	75343	
Formaldehyde	50000	
Glycol Ethers	N/A	
Heptachlor	76448	
Hexachlorobenzene	118741	
Hexachlorobutadiene	87683	
Hexachlorocyclopentadiene	77474	
Hexachloroethane	67721	
Hexamethylene- 1,6-diisocyanate	822060	
Hexamethylphosphoramide	680319	Not in NATA because there were no emissions
Hexane	110543	
Hydrazine	302012	
Hydrochloric acid	7647010	
Hydrogen fluoride (Hydrofluoric acid)	7664393	
Hydroquinone	123319	
Isophorone	78591	
Lead Compounds	7439921	
Lindane (all isomers)	58899	
Maleic anhydride	108316	
Manganese Compounds	7439965	
m-Cresol m	108394	
Mercury Compounds	7439976	
Methanol	67561	
Methoxychlor	72435	
Methyl bromide (Bromomethane)	74839	
Methyl chloride (Chloromethane)	74873	
Methyl chloroform (1,1,1-Trichloroethane)	71556	
Methyl hydrazine	60344	
Methyl iodide (Iodomethane)	74884	
Methyl isobutyl ketone (Hexone)	108101	
Methyl isocyanate	624839	
Methyl methacrylate	80626	
Methyl tert butyl ether	1634044	

Air Toxic (Clean Air Act Name)	NEI Pollutant Code (CAS Number)[a]	Notes
Methylene chloride (Dichloromethane)	75092	
Methylene diphenyl diisocyanate (MDI)	101688	
m-Xylenes	108383	Modeled as xylenes
N,N-Dimethylaniline	121697	
Naphthalene	91203	
Nickel Compounds	7440020	
Nitrobenzene	98953	
N-Nitrosodimethylamine	62759	
N-Nitrosomorpholine	59892	
N-Nitroso-N-Methylurea	684935	Not in NATA because there were no emissions
o-Anisidine	90040	
o-Cresol	95487	Modeled as cresols
o-Toluidine	95534	
o-Xylenes	95476	Modeled as xylenes
Parathion	56382	Not in NATA because there were no emissions
p-Cresol	106445	Modeled as cresols
Pentachloronitrobenzene (Quintobenzene)	82688	
Pentachlorophenol	87865	
Phenol	108952	
Phosgene	75445	
Phosphine	7803512	
Phosphorus	7723140	
Phthalic anhydride	85449	
Polychlorinated biphenyls (Aroclors)	1336363	
Polycyclic Organic Matter	N/A	About 50 specific compounds are in the NEI. They were modeled as 9 discrete PAH groups representing different upper-bound risk estimate “bins“ since specific compounds have a wide range of upper-bound risk estimates.
p-Phenylenediamine	106503	
Propionaldehyde	123386	
Propoxur (Baygon)	114261	
Propylene dichloride (1,2-Dichloropropane)	78875	
Propylene oxide	75569	
p-Xylenes	106423	Modeled as xylenes
Quinoline	91225	
Quinone	106514	
Selenium Compounds	7782492	
Styrene	100425	
Styrene oxide	96093	
Tetrachloroethylene (Perchloroethylene)	127184	
Titanium tetrachloride	7550450	
Toluene	108883	
Toxaphene (chlorinated camphene)	8001352	
Trichloroethylene	79016	
Triethylamine	121448	

Air Toxic (Clean Air Act Name)	NEI Pollutant Code (CAS Number)[a]	Notes
Trifluralin	1582098	
Vinyl acetate	108054	
Vinyl bromide	593602	
Vinyl chloride	75014	
Vinylidene chloride (1,1-Dichloroethylene)	75354	
Xylenes (isomers and mixture)	1330207	Modeled as xylenes
Diesel PM		Diesel PM is not a HAP and not on the Clean Air Act list but it is modeled in NATA for Nonroad sources

[a] In most cases, the NEI pollutant code is the same as the CAS number. In a few cases (e.g., coke oven emissions) a CAS number has not been assigned, and NEI uses a unique pollutant code.

Table 5.2 Pollutants Excluded from NATA

Air Toxic (Clean Air Act Name)	NEI Pollutant Code (CAS Number)[a]	Exclusion reason
2,3,7,8-Tetrachlorodibenzo-p- dioxin	1746016	Not included in NATA due to uncertainty in reporting to NEI and exposure route for dioxins is ingestion
Other dioxins/furans	multiple	
Radionuclides		Not included in NATA due to uncertainty in reporting to NEI and emissions not compatible with NATA modeling
Dichlorodiphenyldichloroethylene (DDE)	72559 incorrectly referred to in the Section 112(b) list as 3547-04-4	Compound not reported to NEI
Fine mineral fibers (including rockwool and slag wool and fine mineral fibers)	Fine mineral fibers: 383 Rockwool:617 Slagwool:616	Not in NATA because there were no emissions
Asbestos	1332214	Inhalation exposures not typically expressed in mass units
Diazomethane	334883	Not in NATA because there were no emissions
Hexamethylphosphoramide	680319	Not in NATA because there were no emissions

[a] In most cases, the NEI pollutant code is the same as the CAS number. In a few cases (e.g., coke oven emissions) a CAS number has not been assigned, and NEI uses a unique pollutant code.