FINAL

Appendix A

On-road Mobile Source

Emission Inventory Documentation

Noninterference Demonstration for Removing 26 Counties from the Inspection and Maintenance (I&M) Program

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1.0 INTRODUCTION AND SCOPE

This appendix presents the data sources, methods, and results used to develop ozone season day emission estimates for nitrogen oxides (NOx) and volatile organic compounds (VOC) associated with on-road mobile sources in 2018. The on-road mobile source inventories contain emissions from all motor vehicles that are licensed to use public roads. On-road vehicles include passenger cars, motorcycles, and various classes of trucks and buses categorized according to vehicle weight and drive cycle characteristics.

2.0 SUMMARY OF EMISSIONS

For 2018, Tables A-1 and A-2 summarize the on-road mobile source NO_x and VOC ozone season day emissions modeling results, respectively, for the 26 counties that have been removed from the emissions inspection and maintenance program (I&M) program. Each table also shows the emissions reductions provided by I&M program requirements.

Table A-1. On-road Source Ozone Season Day NOx Emissions in 2018 (Tons/Day)

County	Total On-road NOx Emissions with I&M (TPD)	Total On-road NOx Emissions without I&M (TPD)	NOx Emissions Increases due to I&M Changes (TPD)
Brunswick	2.473	2.647	0.174
Burke	2.715	2.890	0.175
Caldwell	2.134	2.281	0.147
Carteret	1.184	1.277	0.093
Catawba	3.283	3.527	0.244
Chatham	2.140	2.275	0.135
Cleveland	3.250	3.452	0.202
Craven	1.802	1.931	0.129
Edgecombe	1.015	1.096	0.081
Granville	2.149	2.257	0.108
Harnett	2.438	2.598	0.160
Haywood	3.036	3.195	0.159
Henderson	2.484	2.645	0.161
Lenoir	1.329	1.428	0.099
Moore	1.926	2.065	0.139
Nash	3.250	3.443	0.193
Orange	4.068	4.278	0.210
Pitt	2.458	2.648	0.190
Robeson	4.276	4.525	0.249
Rutherford	1.645	1.758	0.113
Stanly	1.623	1.733	0.110
Stokes	1.197	1.278	0.081
Surry	2.841	3.009	0.168
Wayne	2.202	2.359	0.157
Wilkes	2.075	2.213	0.138
Wilson	2.168	2.302	0.134
Total	**61.161**	**65.11**	**3.949**

Table A-2. On-road Source Ozone Season Day VOC Emissions in 2018 (Tons/Day)

County	Total On-road VOC Emissions with I&M (TPD)	Total On-road VOC Emissions without I&M (TPD)	NOx Emissions Increases due to I&M Changes (TPD)
Brunswick	1.655	1.801	0.146
Burke	1.831	1.971	0.140
Caldwell	1.725	1.858	0.133
Carteret	1.023	1.115	0.092
Catawba	2.611	2.834	0.223
Chatham	1.357	1.466	0.109
Cleveland	2.021	2.177	0.156
Craven	1.319	1.431	0.112
Edgecombe	0.777	0.847	0.070
Granville	1.166	1.252	0.086
Harnett	1.755	1.903	0.148
Haywood	1.491	1.596	0.105
Henderson	1.713	1.853	0.140
Lenoir	0.980	1.062	0.082
Moore	1.623	1.750	0.127
Nash	1.750	1.890	0.140
Orange	2.013	2.172	0.159
Pitt	1.887	2.057	0.170
Robeson	2.291	2.473	0.182
Rutherford	1.298	1.402	0.104
Stanly	1.202	1.298	0.096
Stokes	0.994	1.073	0.079
Surry	1.750	1.883	0.133
Wayne	1.745	1.893	0.148
Wilkes	1.538	1.661	0.123
Wilson	1.291	1.400	0.109
Total	**40.806**	**44.118**	**3.312**

3.0 METHODOLOGY

The MOtor Vehicle Emissions Simulator (MOVES) model was used to develop emissions inventories for each of the 26 counties by running the model with and without the emissions inspection program requirements. The differences between the model run results were used to calculate the county-level and overall emissions reduction benefits associated with the emissions inspection program. Emissions from all on-road mobile sources were modeled, including light duty gasoline vehicles subject to I&M requirements as well as those exempt from the program, to allow evaluation of I&M emissions reductions relative to county-level emissions from all source categories. The 2018 on-road inventories for each county also reflect the emissions reductions due to implementation of the Federal Tier 3 Motor Vehicle Emissions and Fuel Standards, especially the gasoline sulfur standard which went into effect on January 1, 2017. The MOVES

Modeling Parameters listed in Table A-3 were selected for developing the emissions inventories for each county.

Table A-3. MOVES Modeling Parameters

MOVES Model Version	MOVES2014
Pollutants	NOx, VOC
Modeled Spatial Domains	Whole counties subject to I&M
Modeled Year	2018
Temporal Emissions Time Period	Typical summer weekday (July weekday)
Vehicle Types	All on-road vehicles
Inspection and Maintenance Program Applicability	26 counties to be removed from the emissions inspection program

3.1 EMISSIONS MODELING APPROACH

Mobile source emissions were estimated by the methodologies suggested in the following EPA guidance documents: draft Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations, draft, December 2016 (EPA encourages states to follow the recommendations in this draft guidance until an updated version is released); Policy Guidance on the Use of MOVES2014 for State Implementation Plan Development, Transportation Conformity, and Other Purposes (EPA-420-B-14-008, July 2014); and *Technical Guidance on the Use of MOVES2010 for Emission Inventory Preparation in State Implementation Plans and Transportation Conformity* (EPA-420-B-10-023, April 2010).

The EPA guidance requires the use of the latest approved mobile source emissions model. The DAQ used MOVES2014 (released on October 23, 2014), which was the latest available version of the model at the time the modeling was performed. The guidance also recommends using local input data in lieu of the MOVES2014 default data to more accurately represent local vehicle fleet and emissions characteristics. The DAQ used local data wherever possible as described in Section 3.2.

3.2 MOVES MODEL INPUTS

All input data for MOVES modeling was first compiled into county-level MySQL databases which include separate tables for each type of input data needed. Output data from MOVES modeling runs were also created as MySQL databases. Due to their size and complexity, the MOVES input and output database files are provided electronically.

3.2.1 ON-ROAD SPEEDS

Emissions modeling using MOVES requires vehicle speed input data formatted as fractions of vehicle hours traveled (VHT) in each of sixteen speed ranges, called "speed bins", for each combination of clock hour/day type (week day or weekend day), vehicle type, and road type. Speed Bin 1 represents speeds from 0 to 2.5 mph, and Speed Bin 16 represents speeds of 72.5 mph and greater. Speed Bins 2 through 15 each represent 5 mph speed ranges between 2.5 mph and 72.5 mph. The fractions for each combination of vehicle type, road type, and hour/day type sum to one. To generate these average speed distribution input tables, the DAQ used spreadsheet-based data converters developed by the EPA to process the speed and vehicle miles traveled (VMT) data provided by the Metropolitan Planning Organizations (MPOs) and North Carolina Department of Transportation (NCDOT).

<u>Raw Speed Data</u>

Raw speed data from the latest available travel demand modeling (TDM) and Highway Performance Monitoring System (HPMS) datasets were used. Speed data for 2018 were derived by interpolation or extrapolation from the datasets listed below. Table A-4 lists the sources for raw speed and VMT input data for all 26 counties.

Table A-4. Speed and VMT Data Sources

Data Source	Area (Counties)	Project	Years
Charlotte Department of Transportation (CDOT)	Metrolina (Cleveland, Stanly)	Metrolina 2040 MTP TDM Modeling	2015, 2025, 2030, 2040
Capital Area Metropolitan Planning Organization (CAMPO) in coordination with Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC-MPO)	Triangle (Granville, Harnett, Orange)	Triangle 2040 MTP TDM Modeling	2015, 2017, 2020, 2030, 2035, 2040
North Carolina Department of Transportation (Transportation Planning Branch)	Hickory (Catawba)	Hickory 2040 MTP TDM Modeling	2011, 2021, 2030, 2040
	Rocky Mount (Edgecombe, Nash)	Rocky Mount 2040 TDM Modeling	2017, 2020, 2030, 2040
	Remaining Non -TDM Counties (Brunswick, Burke, Caldwell, Carteret, Chatham, Craven, Haywood, Henderson, Lenoir, Moore, Pitt, Robeson, Rutherford, Stokes, Surry, Wayne, Wilkes, and Wilson)	North Carolina 2012 HPMS Data	2012 and prior

Speeds and VMT data, depending on whether data are generated from TDM or provided by NCDOT, is compiled by roadway functional class and travel periods. Table A-5 lists the travel periods for specific areas.

Table A-5. Speed and VMT Modeled Travel Periods

Area (Counties)	AM Peak Period	Midday Period	PM Peak Period	Off-peak Period
Metrolina (Cleveland, Stanly)	06:00-09:00	09:00-15:00	15:00-18:00	00:00-06:00, 18:00-23:59
Triangle (Granville, Harnett, Orange)	06:00-10:00	Included as off-peak	15:00-18:00	00:00-06:00, 10:00-15:00, 18:00-23:59
Hickory, Rocky Mount, and Remaining Non-TDM Counties (Brunswick, Burke, Caldwell, Carteret, Catawba, Chatham, Craven, Edgecombe, Haywood, Henderson, Lenoir, Moore, Nash, Pitt, Robeson, Rutherford, Stokes, Surry, Wayne, Wilkes, Wilson)	No peak or off-peak travel periods specified – VMT and speeds provided apply to entire day			

Average Speed Distribution Calculations

Average speed distribution tables were developed for each county from the speed and VMT data provided, using spreadsheet-based tools (developed by DAQ and EPA) to perform the calculation procedures described below. The average speed distribution tables were included in the MOVES input databases.

MOVES uses four different roadway type categories that are affected by the average speed distribution input: rural restricted access, rural unrestricted access, urban restricted access, and urban unrestricted access (these road types are discussed in more detail in Section 3.2.5). In MOVES, local roadways are included with arterials and collectors in the urban and rural unrestricted access roads category. In MOVES, the EPA recommends that the average speed distribution for local roadway activity be included as part of a weighted distribution of average speed across all unrestricted roads along with the distribution of average speeds for arterials and connectors.

When only a single average speed is available for a specific road type and that average speed is not identical to the average speed in a particular speed bin, MOVES guidance stipulates that users should apply the following formula for creating the appropriate speed distribution among two adjacent speed bins.

The general formula is:

VHT Fraction A in Speed Bin with closest average speed lower than observed average speed + VHT Fraction B in Speed Bin with closest average speed higher that observed average speed = 1

VHT Fraction $A_{(low\ bin)}$ = 1 – [(observed average speed – average speed of lower speed bin) / (average speed of higher speed bin – average speed of lower speed bin)]

VHT Fraction $B_{(high\ bin)}$ = 1- [(average speed of higher speed bin – observed average speed) / (average speed of higher speed bin – average speed of lower speed bin)]

Or more simply: VHT Fraction B = 1 – VHT fraction A

The following is an example of applying the above equations. If the single average speed for a roadway is 58 miles per hour, the average speed distribution will be split between the 55 and 60 mph speed bins. The appropriate VHT fractions are found with the following equations:

VHT fraction $A_{(low\ bin)}$ = 1 – [(58 mph Avg. Speed – 55 mph (Bin Speed)) / (60 mph (Bin Speed) – 55 mph (Bin Speed)] = 0.4

VHT fraction $B_{(high\ bin)}$ = 1 – [(60 mph (Bin Speed) – 58 mph Avg. Speed) / (60 mph (Bin Speed) – 55 mph (Bin Speed)] = 0.6

VHT Fraction $A_{(low\ bin)}$	+	VHT Fraction $B_{(high\ bin)}$	= 1
0.4	+	0.6	= 1

As stated above, MOVES uses only four different roadway types: rural restricted access, rural unrestricted access, urban restricted access and urban unrestricted access. This means that the speeds for multiple roadway types need to be combined into the appropriate speed bins. To create the speed bin fractions for combined roadways, the VMT for each roadway is used to weight the speed bin fraction. For example, below are speeds and VMT for urban restricted access road types:

Road type	Speed (miles/hour)	VMT (hourly miles)
Urban Interstate	63	250,000
Urban Freeway	56	100,000

The first step is to determine the speed bin fractions for each road type separately. For the urban interstate road type, the speed 63 is split between the MOVES speed bins of 60 and 65 as described above, which results in the VHT fractions of 0.4 and 0.6 for speed bins 60 and 65, respectively. Similarly, the speed for the urban freeway road type (56 miles/hour) is split between the MOVES speed bins of 55 and 60 and results in the VHT fractions of 0.8 and 0.2, respectively.

The next step requires road type VMT to weigh the VHT fractions so that the final MOVES speed bin fractions can be developed. The VHT Fraction, specific to the road type and speed bin, are multiplied by the corresponding hourly VMT. These hourly totals are divided by the total VMT for that hour for the road type category (in this example, urban restricted access includes urban interstate and urban freeway). The following equation is used to calculate the combined speed bin fractions:

$$VHT_{(Speed\ Bin\ X)} = \left[\sum (VHT\ Fraction_{(RT)} \times hourly\ VMT_{(RT)})\right] \div \left[\sum hourly\ VMT_{(RT)}\right]$$

where:

RT = the HPMS road type

In this example, the HPMS road types are urban interstate (UI) and urban freeway (UF) and the speed bins are 55, 60 and 65. The table below summarizes the speed bin fractions for this example.

HPMS Road Type	Speed Bin 55	Speed Bin 60	Speed Bin 65
Urban Interstate	0.0	0.4	0.6
Urban Freeway	0.8	0.2	0.0

Using the equation below, the final MOVES speed bin fractions are calculated for the urban restricted access road type.

$$\text{VHT}_{(\text{Speed Bin X})} = \frac{[(\text{VHT Fraction}_{(\text{UI})} * \text{hourly VMT}_{(\text{UI})}) + (\text{VHT Fraction}_{(\text{UF})} * \text{hourly VMT}_{(\text{UF})})]}{(\text{hourly VMT}_{(\text{UI})} + \text{hourly VMT}_{(\text{UF})})}$$

$$\text{VHT}_{(\text{Speed Bin 55})} = \frac{[(0.0 * 250{,}000) + (0.8 * 100{,}000)]}{(250{,}000 + 100{,}000)}$$

$$\text{VHT}_{(\text{Speed Bin 55})} = 0.2286$$

$$\text{VHT}_{(\text{Speed Bin 60})} = \frac{[(0.4 * 250{,}000) + (0.2 * 100{,}000)]}{(250{,}000 + 100{,}000)}$$

$$\text{VHT}_{(\text{Speed Bin 60})} = 0.3428$$

$$\text{VHT}_{(\text{Speed Bin 65})} = \frac{[(0.6 * 250{,}000) + (0.0 * 100{,}000)]}{(250{,}000 + 100{,}000)}$$

$$\text{VHT}_{(\text{Speed Bin 65})} = 0.4286$$

The sum of the VHT fractions for all speed bins within a road type category must add up to 1.0. The hourly VHT fractions by speed bin and road type are then processed through a MOVES supplied converter to develop the speed distribution file by hour and road type.

3.2.2 VEHICLE AGE DISTRIBUTION

Local vehicle age distributions were developed from county-level annual registration data obtained from the NCDOT. For this analysis, the age distribution was generated based on 2013 data. The data includes the number of registered vehicles categorized by nine vehicle types and by model year, with individual model years listed from 2013 through 1974 and a combined listing for all vehicles of model year 1973 and older. The vehicle count information is provided for nine vehicle types; light duty gas vehicles (LDGV), light duty diesel vehicles (LDDV), light duty gas trucks 1 (LDGT1), light duty gas trucks 2 (LDGT2), light duty diesel trucks 1 (LDDT1), light duty diesel trucks 2 (LDDT2), heavy duty gas vehicles (HDGV), heavy duty diesel vehicles (HDDV) and motorcycles (MC). LDDT1 and LDDT2 are combined and labeled as light duty diesel trucks (LDDT). The DAQ used a customized version of an EPA vehicle age distribution data converter tool to convert the local county-level data to the appropriate age distribution input tables for MOVES.

3.2.3 VEHICLE ACTIVITY BY ROAD TYPE

Vehicle activity by functional classification (road type) data are used calculate the distribution of VMT by vehicle type and by road type. The NCDOT compiles these data annually on a statewide basis, based on traffic survey and HPMS data collected throughout the year. Table A-6 shows the vehicle activity summary by functional classification for 2013. The data are provided as the fractional distribution of VMT by vehicle type on each of the 12 FHWA road types.

These data were further processed to 1) transform the distributions to different vehicle type categories and 2) to project the data from 2013 to 2018, providing the "VMT mix" required to generate the necessary MOVES input tables. This was done according to the guidance document EPA420-R-04-013, <u>Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation</u>. Table A-7 and Table A-8 show the vehicle type and facility (roadway) type ID numbers and descriptions for the resulting statewide North Carolina 2018 VMT mix table, which is show in Table A-9. These data were used in VMT converter applications provided by the EPA to create the VMT by HPMS class, VMT fractions by hour, and VMT by road type distribution input tables required for the MOVES model.

3.2.4 VEHICLE/EQUIPMENT: ON-ROAD VEHICLE EQUIPMENT

For MOVES emissions modeling, vehicle fleet characteristics must be specified from among 13 source use types and 4 different fuel types (gasoline, diesel, compressed natural gas (CNG), and electricity).

As per EPA guidance for state implementation plans and regional conformity analyses, the DAQ selected the appropriate fuel and vehicle type combinations that reflect the full range of vehicles that will operate in each county. All valid diesel, gasoline, CNG, ethanol, and electric vehicle and fuel combinations were selected.

Table A-6. North Carolina Vehicle Activity Summary by Functional Classification - 2013

FC Code	Functional Classification	Samples	MC	Cars	2A4T	Bus	2ASU	3ASU	4ASU	4AST	5AST	6AST	5AMT	6AMT	7AMT
1	Rural Principal Arterial – Interstate	24	0.0038	0.6953	0.1464	0.0059	0.0211	0.0062	0.0003	0.0095	0.1067	0.0019	0.0019	0.0008	0.0002
2	Rural Principal Arterial – Other	247	0.0065	0.6968	0.1914	0.0064	0.0278	0.0071	0.0007	0.0106	0.0493	0.0018	0.0009	0.0004	0.0003
6	Rural Minor Arterial	322	0.0058	0.7111	0.2005	0.0055	0.0267	0.0056	0.0005	0.0087	0.0335	0.0016	0.0001	0.0000	0.0003
7	Rural Major Collector	677	0.0072	0.6992	0.2142	0.0058	0.0286	0.0065	0.0006	0.0083	0.0282	0.0013	0.0000	0.0000	0.0002
8	Rural Minor Collector	15	0.0118	0.6818	0.2436	0.0040	0.0261	0.0062	0.0004	0.0057	0.0187	0.0015	0.0000	0.0000	0.0000
9	Rural Local System	49	0.0086	0.7178	0.2046	0.0090	0.0351	0.0103	0.0010	0.0055	0.0069	0.0011	0.0000	0.0000	0.0000
11	Urban Principal Arterial - Interstate	38	0.0042	0.7577	0.1567	0.0047	0.0176	0.0055	0.0003	0.0041	0.0471	0.0005	0.0010	0.0005	0.0001
12	Urban Principal Arterial - Other Freeways or Expressways	104	0.0054	0.7418	0.1722	0.0054	0.0214	0.0066	0.0007	0.0092	0.0348	0.0012	0.0008	0.0003	0.0002
14	Urban Principal Arterial - Other	430	0.0054	0.7719	0.1685	0.0048	0.0208	0.0057	0.0009	0.0054	0.0145	0.0015	0.0002	0.0001	0.0003
16	Urban Minor Arterial	305	0.0057	0.7736	0.1756	0.0042	0.0215	0.0044	0.0006	0.0049	0.0085	0.0008	0.0001	0.0000	0.0002
17	Urban Collector	28	0.0050	0.7878	0.1674	0.0049	0.0194	0.0052	0.0003	0.0044	0.0051	0.0004	0.0000	0.0000	0.0001
19	Urban Local System	20	0.0108	0.7175	0.1976	0.0099	0.0296	0.0130	0.0003	0.0055	0.0151	0.0006	0.0000	0.0002	0.0001

*MC - motorcycles
Cars – passenger cars
2A4T – trucks with two axles, 4 tires
Bus – intercity, transit, and school buses
2ASU – two-axle single unit trucks
2ASU – three-axle single unit trucks
4ASU – four-axle single unit trucks

4AST – four-axle single trailer truck
5AST – five-axle single trailer truck
6AST – six-axle single trailer truck
5MST – five-axle multi-trailer truck
6AMT – six-axle multi-trailer truck
7AMT – seven-axle multi-trailer truck

Table A-7. Vehicle Type Descriptions

ID#	Vehicle Type	Description
1	LDV	Light-Duty Vehicles (Passenger Cars)
2	LDT1	Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW)
3	LDT2	Light-Duty Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)
4	LDT3	Light-Duty Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW)
5	LDT4	Light-Duty Trucks 4 (6,001-8,500 lbs. GVWR, 5,751 lbs. and greater ALVW)
6	HDV2	Class 2b Heavy-Duty Vehicles (8,501-10,000 lbs. GVWR)
7	HDV3	Class 3 Heavy-Duty Vehicles (10,001-14,000 lbs. GVWR)
8	HDV4	Class 4 Heavy-Duty Vehicles (14,001-16,000 lbs. GVWR)
9	HDV5	Class 5 Heavy-Duty Vehicles (16,001-19,500 lbs. GVWR)
10	HDV6	Class 6 Heavy-Duty Vehicles (19,501-26,000 lbs. GVWR)
11	HDV7	Class 7 Heavy-Duty Vehicles (26,001-33,000 lbs. GVWR)
12	HDV8A	Class 8a Heavy-Duty Vehicles (33,001-60,000 lbs. GVWR)
13	HDV8B	Class 8b Heavy-Duty Vehicles (>60,000 lbs. GVWR)
14	HDBS	School Buses
15	HDBT	Transit and Urban Buses
16	MC	Motorcycles

Table A-8. Facility (Roadway) Type Descriptions

Facility Type	Description	Facility Type	Description
11	Rural Interstate	23	Urban Interstate
13	Rural Other Principal Arterial	25	Urban Other Freeways and Expressways
15	Rural Minor Arterial	27	Urban Other Principal Arterial
17	Rural Major Collector	29	Urban Minor Arterial
19	Rural Minor Collector	31	Urban Collector
21	Rural Local	33	Urban Local

Table A-9. 2018 North Carolina Vehicle Mix Data

	Fraction of VMT on Facility Type by Vehicle Type (each column should sum to 1)											
Vehicle Type	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**	**33**
1	0.2768	0.295	0.3024	0.3036	0.309	0.3068	0.3027	0.3029	0.3116	0.3147	0.3163	0.305
2	0.0958	0.1021	0.1047	0.105	0.1069	0.1062	0.1047	0.1049	0.1079	0.109	0.1095	0.1056
3	0.3189	0.3399	0.3484	0.3495	0.3559	0.3536	0.3487	0.3492	0.3591	0.3627	0.3646	0.3516
4	0.0983	0.1048	0.1074	0.1077	0.1097	0.109	0.1075	0.1076	0.1107	0.1118	0.1124	0.1084
5	0.0452	0.0481	0.0494	0.0495	0.0504	0.0501	0.0494	0.0495	0.0509	0.0514	0.0516	0.0498
6	0.0513	0.0336	0.0264	0.0255	0.0201	0.0221	0.0262	0.0258	0.0174	0.0144	0.0128	0.0238
7	0.0051	0.0033	0.0026	0.0025	0.002	0.0022	0.0026	0.0026	0.0017	0.0014	0.0013	0.0024
8	0.0043	0.0028	0.0022	0.0021	0.0017	0.0019	0.0022	0.0022	0.0015	0.0012	0.0011	0.0020
9	0.0031	0.0021	0.0016	0.0016	0.0012	0.0013	0.0016	0.0016	0.0011	0.0009	0.0008	0.0015
10	0.0115	0.0075	0.0059	0.0057	0.0045	0.0049	0.0059	0.0058	0.0039	0.0032	0.0029	0.0053
11	0.0136	0.0089	0.007	0.0067	0.0053	0.0058	0.0069	0.0068	0.0046	0.0038	0.0034	0.0063
12	0.0148	0.0097	0.0076	0.0073	0.0058	0.0064	0.0075	0.0074	0.005	0.0041	0.0037	0.0068
13	0.0525	0.0344	0.0271	0.0261	0.0206	0.0226	0.0268	0.0264	0.0178	0.0147	0.0131	0.0243
14	0.0026	0.0017	0.0013	0.0013	0.001	0.0011	0.0013	0.0013	0.0009	0.0007	0.0006	0.0012
15	0.0013	0.0009	0.0007	0.0006	0.0005	0.0006	0.0007	0.0007	0.0004	0.0004	0.0003	0.0006
16	0.0049	0.0052	0.0053	0.0053	0.0054	0.0054	0.0053	0.0053	0.0055	0.0056	0.0056	0.0054
Sum	1	1	1	1	1	1	1	1	1	1	1	1

3.2.5 ROAD TYPE

The MOVES model defines five different road types used to characterize vehicle activity. The five road types are:

- Off-Network (road type 1) – all locations where the predominant activities are vehicle starts, parking and idling (parking lots, truck stops, rest areas, freight or bus terminals)
- Rural Restricted Access (2) – rural highways that can only be accessed by an on-ramp
- Rural Unrestricted Access (3) – all other rural roads (arterials, connectors, and local streets)
- Urban Restricted Access (4) – urban highways or freeways that can only be accessed by an on-ramp
- Urban Unrestricted Access (5) – all other urban roads (arterials, connectors, and local streets).

All five road types were included in each modeling run as per EPA guidance.

3.2.6 POLLUTANTS AND PROCESSES

On-road mobile source emissions of NOx and VOC for a typical summer day, specifically a July weekday, were modeled for 2018. The modeling results included emissions from all vehicular processes that generate NOx or VOC, such as running exhaust, start exhaust, and evaporative processes.

3.2.7 TEMPERATURE AND RELATIVE HUMIDITY DATA

Local temperature and humidity data are required inputs for the MOVES model. The latest available (2013) average July 24-hour temperature and humidity profiles, based on data from the Automated Surface Observing Systems at the airports listed in Table A-10, were used to best represent the meteorological conditions for each county. The data were provided by the State Climate Office of North Carolina (http://www.nc-climate.ncsu.edu), and are included in each MOVES input database.

Table A-10. Weather Stations and Counties

Weather Station	Station ID	Counties
Asheville Airport	KAVL	Haywood, Henderson
Charlotte/Douglas International Airport	KCLT	Cleveland, Stanly
Craven County Airport	KEWN	Carteret, Craven
Fayetteville Regional Airport	KFAY	Harnett, Moore, Robeson
Greenville Airport	KPGV	Lenoir, Pitt, Wayne
Hickory Airport	KHKY	Burke, Caldwell, Catawba
Piedmont Triad International Airport	KGSO	Stokes
Raleigh-Durham International Airport	KRDU	Chatham, Granville, Orange
Rocky Mount-Wilson Regional Airport	KRWI	Edgecombe, Nash, Wilson
Rutherford County Airport	KFQD	Rutherford
Wilkes County Airport	KUKF	Surry, Wilkes
Wilmington International Airport	KILM	Brunswick

3.2.8 SOURCE TYPE POPULATION

Source type (i.e., vehicle type) population data are used within MOVES to calculate off-network emissions, which include exhaust emissions from vehicle starts and evaporative emissions from parked vehicles. Off-network emissions are based on both the number and type of vehicles in the modeling domain. MOVES source type population input data consists of the number of each of 13 types of vehicles within the modeled area, which is typically a single county. Descriptions of the categories, which are subsets of the six HPMS vehicle classes, are shown in Table A-11. The DAQ developed source type population input tables from the latest available (2013) county-level vehicle registration dataset described in Section 3.2.2. The original data were processed in three steps to provide source type population data to accurately represent the correct source types, geographic areas, and future years as described below.

Converting Source Type Categories

The DAQ used a customized spreadsheet tool, based on the EPA source type distribution tools and data, to convert the local county-level source type population data from nine vehicle types to the required 13 MOVES source types. This is the same process that was used for the source type age distribution data processing described in Section 3.2.2.

Table A-11. MOVES Source Types and HPMS Vehicle Types

Source Type ID	Source Types used in MOVES	HPMS Vehicle Class
11	Motorcycle	Motorcycles
21	Passenger Car	Passenger Cars
31	Passenger Truck	Other 2-axle, 4-tire vehicles
32	Light Commercial Truck	Other 2-axle, 4-tire vehicles
41	Intercity Bus	Buses
42	Transit Bus	Buses
43	School Bus	Buses
51	Refuse Truck	Single Unit Trucks
52	Single Unit Short-haul Truck	Single Unit Trucks
53	Single Unit Long-haul Truck	Single Unit Trucks
54	Motor Home	Single Unit Trucks
61	Combination Short-haul Truck	Combination Trucks
62	Combination Long-haul Truck	Combination Trucks

Projecting Source Type Population Data to Future Years

For future year MOVES runs, it was necessary to project the source type population data from 2013 to 2018 for each county. The DAQ has determined that growth in human population is a suitable indicator of growth in vehicle ownership. This is illustrated in the FHWA Highway Statistics graph of Licensed Drivers, Vehicle Registrations, and Resident Population shown in Figure A-1.

The USEPA has approved the use of human population growth as a surrogate to project vehicle population growth for previous inventories used in state implementation plans and transportation conformity analyses. Projected annual county population estimates obtained from the North Carolina Office of State Budget and Management (OSBM) were used to adjust future year county vehicle populations. An example of how a 2013 vehicle population was grown to 2018 based on this surrogate of projected county population follows:

$$\text{Vehicle Pop}_{2018} = \text{Vehicle Pop}_{2013} * (\text{Human Pop}_{2018} / \text{Human Pop}_{2013})$$

Scaling Source Type Population Data for Counties Partially Covered by TDM Modeling

Scaling of source type population is needed to consolidate raw input data for counties partially covered by a TDM model. To accurately reflect the source type populations, the total county source type populations were scaled based on the ratio of the human population within the TDM area of the county to the whole county population, as shown in the following equation:

$$\text{Vehicle Pop}_{\text{partial county}} = \text{Vehicle Pop}_{\text{whole county}} * (\text{Human Pop}_{\text{partial county}} / \text{Human Pop}_{\text{whole county}})$$

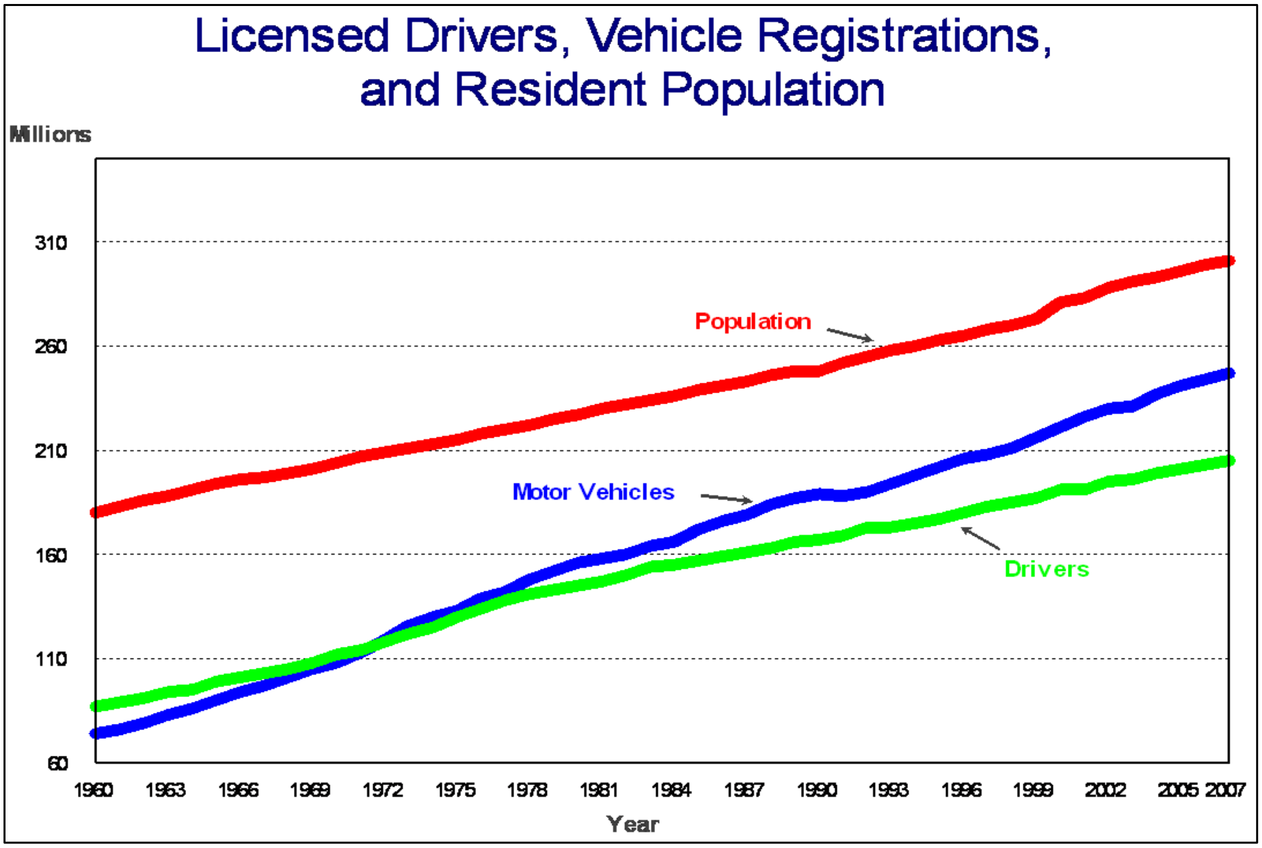

Figure A-1. Federal Highway Association Statistics Graph

3.2.9 VEHICLE INSPECTION AND MAINTENANCE PROGRAM PARAMETERS

In 2002, North Carolina implemented a new vehicle emissions I&M program based on vehicle onboard diagnostics (OBDII). The program was initially implemented in 9 counties and was expanded to include a total of 48 counties between July 2002 and January 2006. This program covers all light duty gasoline powered vehicles (designated in MOVES as source type IDs 21, 31, and 32) that are model year 1996 and newer, with an exemption for vehicles from the three newest model years having less than 70,000 odometer miles.

All MOVES modeling runs were executed with the appropriate I&M program parameters to properly account for the emissions reductions resulting from implementation of the program. Within the MOVES model, the magnitude of the reductions is scaled by the I&M compliance factor parameters, which are calculated based on I&M program compliance rates and waiver rates. Also, the MOVES model allows for the exclusion of specified model years of vehicles from the I&M program coverage. This typically is applied to the newest vehicles in the fleet. Table A-12 lists the current applicable I&M program parameters, which were used for all MOVES modeling runs.

Table A-12. Inspection and Maintenance Program Parameters

Model Years Covered	Compliance Rate	Waiver Rate	Number of Latest Model Years Exempted
1996 and later	96%	5%	3

3.2.10 REID VAPOR PRESSURE SPECIFICATIONS

Reid Vapor Pressure (RVP) is a measurement of gasoline volatility. The use of lower RVP gasoline leads to lower VOC emissions from gasoline handling and evaporative VOC emissions from motor vehicles. Gasoline with an RVP of 9.0 pounds per square inch (psi) is required during May through September for all North Carolina counties.

3.2.11 DIESEL SULFUR CONTENT

All diesel fuel formulations used the default diesel fuel sulfur content values, which are within the ultra-low sulfur diesel (ULSD) limit of 15 ppm.

3.2.12 FUEL SUPPLY AND FUEL FORMULATION

MOVES default fuel supply and fuel formulation data are categorized by fuel region ID – counties with the same fuel region ID have the same fuel supply and formulation for a given year. The state of North Carolina is covered by a single fuel region ID (100000000) for all counties. The default fuel supply and fuel formulations for fuel region ID 100000000 were used for all model runs.

3.2.13 VMT DATA

Daily VMT data from the latest available TDM and HPMS datasets were used to develop estimated VMT for 2018. The VMT data were derived by interpolation or extrapolation from the datasets listed in Table A-4 for all 26 counties.

4.0 QUALITY ASSURANCE MEASURES

The detailed quality assurance and quality control procedures and measures, as outlined in the DAQ's Emissions Inventory Quality Assurance Project Plan (QAPP) and approved by EPA, were applied to ensure the data meets specific data indicator goals and objectives. All raw data used to generate MOVES model inputs, such as speed and VMT values, were checked for reasonableness against historical data from the same data category and geographic area (county or state). All manual data entries were checked by a second party. All automated calculations and data processing operations performed by spreadsheet macros and database queries were validated by comparison to hand calculated results. All MOVES input file development and QA activities were logged in a project design spreadsheet.

5.0 MOVES MODELING DATA FILES

Due to their size, format, and complexity, all MOVES data files were provided in electronic format. Three types of files are included:

- MOVES run specification (RunSpec) files – flat text files named in the format <cFIPSyYYYY_I&M>.mrs
- MOVES input databases – compressed archives of MOVES MySQL input databases with file names in the format <cFIPSyYYYY_I&M>_cdb.zip
- MOVES output databases – compressed archives of MOVES MySQL output databases with file names in the format <cFIPSyYYYY_I&M>_out.zip,

The file name < cFIPSyYYYY_I&M > describes the county, year modeled, and I&M parameters used for the MOVES model run as follows:

- FIPS - the 5 digit state-county Federal Information Processing Standard (FIPS) number for the county modeled
- YYYY – calendar year modeled
- I&M – the I&M compliance rate, waiver rate, and number of latest model years exempted, or if no I&M program is modeled

For example, c37019y2018_9653 specifies a model run for Brunswick County, NC (FIPS 37019) for 2018 with 96% I&M compliance rate, 5% waiver rate, and the 3 latest model year vehicles exempted from I&M requirements. A file name with c37023y2018_noim specifies a model run for Burke County, NC (FIPS 37023) for 2018 with no I&M requirements. Table A-13 lists the files provided.

Table A-13. MOVES Modeling Files Provided

County	Run Spec File	MOVES Input Database	MOVES Output Database
Brunswick	c37019y2018_9653.mrs	c37019y2018_9653_cdb.zip	c37019y2018_9653_out.zip
Brunswick	c37019y2018_noim.mrs	c37019y2018_noim_cdb.zip	c37019y2018_noim_out.zip
Burke	c37023y2018_9653.mrs	c37023y2018_9653_cdb.zip	c37023y2018_9653_out.zip
Burke	c37023y2018_noim.mrs	c37023y2018_noim_cdb.zip	c37023y2018_noim_out.zip
Caldwell	c37027y2018_9653.mrs	c37027y2018_9653_cdb.zip	c37027y2018_9653_out.zip
Caldwell	c37027y2018_noim.mrs	c37027y2018_noim_cdb.zip	c37027y2018_noim_out.zip
Carteret	c37031y2018_9653.mrs	c37031y2018_9653_cdb.zip	c37031y2018_9653_out.zip
Carteret	c37031y2018_noim.mrs	c37031y2018_noim_cdb.zip	c37031y2018_noim_out.zip
Catawba	c37035y2018_9653.mrs	c37035y2018_9653_cdb.zip	c37035y2018_9653_out.zip
Catawba	c37035y2018_noim.mrs	c37035y2018_noim_cdb.zip	c37035y2018_noim_out.zip
Chatham	c37037y2018_9653.mrs	c37037y2018_9653_cdb.zip	c37037y2018_9653_out.zip
Chatham	c37037y2018_noim.mrs	c37037y2018_noim_cdb.zip	c37037y2018_noim_out.zip
Cleveland	c37045y2018_9653.mrs	c37045y2018_9653_cdb.zip	c37045y2018_9653_out.zip
Cleveland	c37045y2018_noim.mrs	c37045y2018_noim_cdb.zip	c37045y2018_noim_out.zip
Craven	c37049y2018_9653.mrs	c37049y2018_9653_cdb.zip	c37049y2018_9653_out.zip
Craven	c37049y2018_noim.mrs	c37049y2018_noim_cdb.zip	c37049y2018_noim_out.zip
Edgecombe	c37065y2018_9653.mrs	c37065y2018_9653_cdb.zip	c37065y2018_9653_out.zip

County	Run Spec File	MOVES Input Database	MOVES Output Database
Edgecombe	c37065y2018_noim.mrs	c37065y2018_noim_cdb.zip	c37065y2018_noim_out.zip
Granville	c37077y2018_9653.mrs	c37077y2018_9653_cdb.zip	c37077y2018_9653_out.zip
Granville	c37077y2018_noim.mrs	c37077y2018_noim_cdb.zip	c37077y2018_noim_out.zip
Harnett	c37085y2018_9653.mrs	c37085y2018_9653_cdb.zip	c37085y2018_9653_out.zip
Harnett	c37085y2018_noim.mrs	c37085y2018_noim_cdb.zip	c37085y2018_noim_out.zip
Haywood	c37087y2018_9653.mrs	c37087y2018_9653_cdb.zip	c37087y2018_9653_out.zip
Haywood	c37087y2018_noim.mrs	c37087y2018_noim_cdb.zip	c37087y2018_noim_out.zip
Henderson	c37089y2018_9653.mrs	c37089y2018_9653_cdb.zip	c37089y2018_9653_out.zip
Henderson	c37089y2018_noim.mrs	c37089y2018_noim_cdb.zip	c37089y2018_noim_out.zip
Lenoir	c37107y2018_9653.mrs	c37107y2018_9653_cdb.zip	c37107y2018_9653_out.zip
Lenoir	c37107y2018_noim.mrs	c37107y2018_noim_cdb.zip	c37107y2018_noim_out.zip
Moore	c37125y2018_9653.mrs	c37125y2018_9653_cdb.zip	c37125y2018_9653_out.zip
Moore	c37125y2018_noim.mrs	c37125y2018_noim_cdb.zip	c37125y2018_noim_out.zip
Nash	c37127y2018_9653.mrs	c37127y2018_9653_cdb.zip	c37127y2018_9653_out.zip
Nash	c37127y2018_noim.mrs	c37127y2018_noim_cdb.zip	c37127y2018_noim_out.zip
Orange	c37135y2018_9653.mrs	c37135y2018_9653_cdb.zip	c37135y2018_9653_out.zip
Orange	c37135y2018_noim.mrs	c37135y2018_noim_cdb.zip	c37135y2018_noim_out.zip
Pitt	c37147y2018_9653.mrs	c37147y2018_9653_cdb.zip	c37147y2018_9653_out.zip
Pitt	c37147y2018_noim.mrs	c37147y2018_noim_cdb.zip	c37147y2018_noim_out.zip
Robeson	c37155y2018_9653.mrs	c37155y2018_9653_cdb.zip	c37155y2018_9653_out.zip
Robeson	c37155y2018_noim.mrs	c37155y2018_noim_cdb.zip	c37155y2018_noim_out.zip
Rutherford	c37161y2018_9653.mrs	c37161y2018_9653_cdb.zip	c37161y2018_9653_out.zip
Rutherford	c37161y2018_noim.mrs	c37161y2018_noim_cdb.zip	c37161y2018_noim_out.zip
Stanly	c37167y2018_9653.mrs	c37167y2018_9653_cdb.zip	c37167y2018_9653_out.zip
Stanly	c37167y2018_noim.mrs	c37167y2018_noim_cdb.zip	c37167y2018_noim_out.zip
Stokes	c37169y2018_9653.mrs	c37169y2018_9653_cdb.zip	c37169y2018_9653_out.zip
Stokes	c37169y2018_noim.mrs	c37169y2018_noim_cdb.zip	c37169y2018_noim_out.zip
Surry	c37171y2018_9653.mrs	c37171y2018_9653_cdb.zip	c37171y2018_9653_out.zip
Surry	c37171y2018_noim.mrs	c37171y2018_noim_cdb.zip	c37171y2018_noim_out.zip
Wayne	c37191y2018_9653.mrs	c37191y2018_9653_cdb.zip	c37191y2018_9653_out.zip
Wayne	c37191y2018_noim.mrs	c37191y2018_noim_cdb.zip	c37191y2018_noim_out.zip
Wilkes	c37193y2018_9653.mrs	c37193y2018_9653_cdb.zip	c37193y2018_9653_out.zip
Wilkes	c37193y2018_noim.mrs	c37193y2018_noim_cdb.zip	c37193y2018_noim_out.zip
Wilson	c37195y2018_9653.mrs	c37195y2018_9653_cdb.zip	c37195y2018_9653_out.zip
Wilson	c37195y2018_noim.mrs	c37195y2018_noim_cdb.zip	c37195y2018_noim_out.zip

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FINAL

Appendix B

Nonroad Mobile Sources

Emission Inventory Documentation

Noninterference Demonstration for Removing 26 Counties from the Inspection and Maintenance (I&M) Program

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1.0 INTRODUCTION AND SCOPE

This appendix presents the data sources, methods, and results used to develop ozone season day emission estimates for nitrogen oxides (NOx) and volatile organic compounds (VOC) associated with nonroad mobile sources in 2018. The nonroad mobile source inventory contains emissions from mobile vehicles and equipment that are not licensed to use public roads. Nonroad mobile source equipment covers a diverse set of items including lawn mowers, chain saws, tractors, all-terrain vehicles, forklifts, and construction equipment. Freight and passenger railroads and commercial marine vessels (CMV) are the types of vehicles included in the nonroad mobile source category. Aircraft emissions, traditionally a nonroad category, are reported as point sources (see Appendix C) in keeping with EPA's practice for the National Emissions Inventory (NEI) where they are reported to occur at the locations of the airports where they are generated. Emissions from railroad locomotives operating at rail yards are also reported as point sources since they occur at a fixed location (see Appendix C).

2.0 SUMMARY OF EMISSIONS

For 2018, Table B-1 displays total nonroad mobile source typical ozone season day NOx and VOC emissions by county.

Table B-1. Nonroad Source Ozone Season Day NOx and VOC Emissions in 2018 (Tons/Day)

County	Nonroad Model Categories		Freight and Passenger Railways		Class 1 & 2 Commercial Marine Vessels		Class 3 Commercial Marine Vessels		Totals	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Brunswick	0.987	1.645	0.074	0.003	2.094	0.049	1.782	0.081	4.937	1.778
Burke	0.425	0.453	0.181	0.008					0.606	0.461
Caldwell	0.507	0.734	0.037	0.001					0.544	0.735
Carteret	1.951	5.510	0.010	0.000	3.040	0.071	0.387	0.016	5.388	5.597
Catawba	1.299	1.370	0.166	0.007					1.465	1.377
Chatham	0.609	0.571	0.052	0.002					0.661	0.573
Cleveland	0.595	0.617	0.324	0.013					0.919	0.630
Craven	0.718	1.061	0.066	0.003	0.017				0.801	1.064
Edgecombe	0.570	0.312	0.256	0.010					0.826	0.322
Granville	0.553	0.426	0.037	0.001					0.590	0.427
Harnett	0.551	0.681	0.260	0.010					0.811	0.691
Haywood	0.409	1.227	0.010	0.000					0.419	1.227
Henderson	0.780	2.860	0.001	0.000					0.781	2.860
Lenoir	0.510	0.499	0.028	0.001					0.538	0.500
Moore	0.556	0.713	0.211	0.008					0.767	0.721
Nash	0.662	0.523	0.513	0.019					1.175	0.542
Orange	0.956	1.664	0.102	0.005					1.058	1.669

County	Nonroad Model Categories		Freight and Passenger Railways		Class 1 & 2 Commercial Marine Vessels		Class 3 Commercial Marine Vessels		Totals	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Pitt	1.176	0.817	0.046	0.002	0.093	0.002			1.315	0.821
Robeson	1.044	0.553	0.975	0.036					2.019	0.589
Rutherford	0.370	0.687	0.728	0.027					1.098	0.714
Stanly	0.497	0.887	0.125	0.005					0.622	0.892
Stokes	0.229	0.473	0.085	0.004					0.314	0.477
Surry	0.575	0.818	0.102	0.004					0.677	0.822
Wayne	0.872	0.711	0.129	0.005					1.001	0.716
Wilkes	0.400	0.570	0.036	0.001					0.436	0.571
Wilson	0.751	0.746	0.804	0.030					1.555	0.776
Total	**18.552**	**27.128**	**5.358**	**0.205**	**5.244**	**0.122**	**2.169**	**0.097**	**31.323**	**27.552**

3.0 METHODOLOGY

The overall approach to preparing the nonroad mobile source emissions inventory was to use the most recent data available for representing emissions for 2018. Therefore, emissions for a few source categories reflect estimates for 2017. As discussed below, separate methodologies were used to estimate 2018 emissions for nonroad equipment and nonroad vehicles. Each sub-section below first provides an overview of the sources for which emissions were estimated, and then provides a description of the emissions estimation methodologies.

3.1 NONROAD EQUIPMENT

The EPA includes more than 80 different types of equipment in the MOVES2014a Nonroad model that was used to estimate nonroad equipment emissions. To facilitate analysis and reporting, EPA groups the equipment types into the following categories:

Agricultural equipment
Commercial equipment
Construction and mining equipment
Industrial equipment
Lawn and garden equipment, residential
Lawn and garden equipment, commercial
Logging equipment
Pleasure craft (recreational marine)
Railroad maintenance equipment
Recreational equipment

Additionally, the model estimates emissions for five different engine types: 2-stroke and 4-stroke spark ignition engines, diesel engines, liquid propane gas, and compressed natural gas fueled engines.

Ozone season day emissions of NOx and VOC were estimated by running MOVES2014a Nonroad model. Model runs were performed for each county for 2018. The model runs were developed for a typical July weekday using meteorological data from 2014. Default data were used for the input files used in the MOVES2014a Nonroad model. The MOVES RunSpec file (MRS) (wherein all the modeling variables are set) used in the MOVES2014a Nonroad model were tailored to reflect North Carolina specific information. For reporting purposes, the resulting emissions from the MOVES2014a Nonroad model were totaled for each equipment category by county. The summary of the model results by equipment category, expressed in tons emitted per typical July weekday, are tabulated in Tables B-1 and B-2 for NOx and VOC emissions, respectively.

Table B-2. Nonroad Model Categories: 2018 NOx Emissions (Tons/Day)

	Agriculture	Airport Support	Commercial	Construction	Industrial	Lawn and Garden	Logging	Oil Field	Pleasure Craft	Railway Maintenance	Recreational	County Total
Brunswick	0.066	0.000	0.036	0.524	0.047	0.100	0.009	0.000	0.167	0.001	0.037	0.987
Burke	0.036	0.000	0.047	0.085	0.172	0.064	0.004	0.000	0.015	0.001	0.001	0.425
Caldwell	0.028	0.000	0.058	0.120	0.214	0.062	0.004	0.000	0.005	0.000	0.016	0.507
Carteret	0.145	0.000	0.044	0.236	0.037	0.064	0.004	0.000	1.353	0.000	0.068	1.951
Catawba	0.088	0.000	0.200	0.315	0.521	0.131	0.002	0.001	0.024	0.001	0.017	1.300
Chatham	0.080	0.000	0.036	0.296	0.083	0.055	0.012	0.000	0.047	0.000	0.000	0.609
Cleveland	0.105	0.000	0.082	0.172	0.164	0.050	0.003	0.000	0.007	0.001	0.011	0.595
Craven	0.178	0.000	0.045	0.187	0.080	0.058	0.010	0.000	0.150	0.000	0.010	0.718
Edgecombe	0.313	0.000	0.034	0.047	0.129	0.035	0.005	0.000	0.003	0.002	0.002	0.570
Granville	0.068	0.000	0.020	0.290	0.095	0.062	0.007	0.000	0.010	0.000	0.001	0.553
Harnett	0.173	0.000	0.038	0.140	0.061	0.118	0.006	0.000	0.011	0.003	0.001	0.551
Haywood	0.036	0.000	0.033	0.184	0.046	0.062	0.003	0.000	0.001	0.000	0.044	0.409
Henderson	0.073	0.000	0.069	0.296	0.118	0.110	0.003	0.000	0.002	0.000	0.109	0.780
Lenoir	0.281	0.000	0.046	0.047	0.077	0.044	0.003	0.000	0.004	0.000	0.008	0.510
Moore	0.058	0.000	0.053	0.244	0.056	0.109	0.011	0.001	0.014	0.000	0.010	0.556
Nash	0.279	0.003	0.084	0.146	0.071	0.065	0.007	0.000	0.004	0.001	0.002	0.662
Orange	0.063	0.000	0.057	0.622	0.049	0.115	0.003	0.000	0.003	0.001	0.043	0.956
Pitt	0.404	0.010	0.105	0.390	0.148	0.104	0.006	0.000	0.006	0.001	0.002	1.176
Robeson	0.677	0.000	0.048	0.116	0.122	0.066	0.005	0.000	0.004	0.003	0.003	1.044
Rutherford	0.050	0.000	0.035	0.094	0.103	0.059	0.008	0.000	0.003	0.002	0.016	0.370
Stanley	0.175	0.000	0.045	0.092	0.087	0.057	0.002	0.000	0.017	0.001	0.021	0.497
Stokes	0.068	0.000	0.013	0.075	0.029	0.016	0.005	0.000	0.007	0.001	0.015	0.229
Surry	0.130	0.000	0.058	0.115	0.125	0.128	0.005	0.001	0.002	0.000	0.011	0.575
Wayne	0.384	0.000	0.093	0.193	0.122	0.051	0.012	0.000	0.008	0.000	0.009	0.872
Wilkes	0.099	0.000	0.043	0.077	0.091	0.069	0.007	0.000	0.005	0.000	0.009	0.400
Wilson	0.262	0.000	0.078	0.181	0.123	0.086	0.004	0.000	0.006	0.003	0.008	0.751
Grand Total	4.319	0.013	1.500	5.284	2.970	1.940	0.150	0.003	1.878	0.022	0.474	18.553

Table B-3. Nonroad Model Categories: 2018 VOC Emissions (Tons/Day)

	Agriculture	Airport Support	Commercial	Construction	Industrial	Lawn and Garden	Logging	Oil Field	Pleasure Craft	Railway Maintenance	Recreational	County Total
Brunswick	0.008	0.000	0.039	0.111	0.005	0.454	0.025	0.000	0.377	0.000	0.626	1.645
Burke	0.005	0.000	0.051	0.018	0.026	0.290	0.010	0.000	0.048	0.000	0.005	0.453
Caldwell	0.004	0.000	0.063	0.025	0.033	0.278	0.010	0.000	0.016	0.000	0.305	0.734
Carteret	0.018	0.000	0.046	0.050	0.004	0.292	0.011	0.000	3.631	0.000	1.458	5.510
Catawba	0.011	0.000	0.223	0.067	0.081	0.584	0.005	0.000	0.084	0.000	0.314	1.369
Chatham	0.010	0.000	0.041	0.063	0.012	0.243	0.031	0.000	0.169	0.000	0.002	0.571
Cleveland	0.013	0.000	0.092	0.037	0.024	0.255	0.008	0.000	0.024	0.000	0.164	0.617
Craven	0.022	0.000	0.051	0.040	0.010	0.284	0.027	0.000	0.466	0.000	0.161	1.061
Edgecombe	0.039	0.000	0.039	0.010	0.020	0.176	0.012	0.000	0.010	0.000	0.006	0.312
Granville	0.009	0.000	0.023	0.062	0.014	0.262	0.018	0.000	0.035	0.000	0.003	0.426
Harnett	0.022	0.000	0.044	0.030	0.007	0.516	0.015	0.000	0.041	0.001	0.005	0.681
Haywood	0.004	0.000	0.034	0.039	0.006	0.257	0.007	0.000	0.004	0.000	0.876	1.227
Henderson	0.009	0.000	0.074	0.063	0.017	0.459	0.007	0.000	0.007	0.000	2.224	2.860
Lenoir	0.035	0.000	0.052	0.010	0.011	0.213	0.008	0.000	0.015	0.000	0.155	0.499
Moore	0.007	0.000	0.061	0.052	0.007	0.474	0.029	0.000	0.050	0.000	0.033	0.713
Nash	0.035	0.000	0.096	0.031	0.009	0.310	0.019	0.000	0.015	0.000	0.008	0.523
Orange	0.008	0.000	0.065	0.133	0.004	0.514	0.009	0.000	0.010	0.000	0.921	1.664
Pitt	0.050	0.001	0.120	0.083	0.020	0.498	0.017	0.000	0.020	0.000	0.008	0.817
Robeson	0.085	0.000	0.054	0.025	0.016	0.333	0.013	0.000	0.015	0.001	0.011	0.553
Rutherford	0.006	0.000	0.039	0.020	0.015	0.266	0.022	0.000	0.012	0.000	0.307	0.687
Stanley	0.022	0.000	0.052	0.020	0.013	0.255	0.005	0.000	0.059	0.000	0.461	0.887
Stokes	0.008	0.000	0.015	0.016	0.003	0.091	0.012	0.000	0.024	0.000	0.304	0.473
Surry	0.016	0.000	0.063	0.025	0.018	0.514	0.012	0.000	0.007	0.000	0.163	0.818
Wayne	0.048	0.000	0.106	0.041	0.017	0.277	0.032	0.000	0.028	0.000	0.162	0.711
Wilkes	0.012	0.000	0.046	0.016	0.013	0.294	0.019	0.000	0.016	0.000	0.154	0.570
Wilson	0.033	0.000	0.089	0.039	0.018	0.379	0.010	0.000	0.020	0.001	0.157	0.746
Grand Total	0.539	0.001	1.678	1.126	0.423	8.768	0.393	0.000	5.203	0.003	8.993	27.127

3.2 NONROAD VEHICLES

Version 2 of the 2011 NEI (NEIv2) reports two major types of nonroad vehicle emissions in North Carolina: CMV and railroad locomotives. Table B-4 displays a list of the nonroad vehicle source categories for which the 2011 NEIv2 reports emissions in the state. Railroad companies are categorized by size (Class I, Class II/Class III) and passenger service. Class I railroad companies are long haul operations, consisting of Norfolk Southern Corporation and CSX Corporation. Class II and Class III railroad companies are short lines serving localized markets.

Amtrak and the North Carolina Department of Transportation's Rail Division provide passenger service in the state.

Table B-4. Nonroad Vehicle Source Categories in 2011 NEIv2 for North Carolina

SCC	SCC Description
2280002100	Marine Vessels, Commercial /Diesel /Port emissions
2280002200	Marine Vessels, Commercial /Diesel /Underway emissions
2280003100	Marine Vessels, Commercial /Residual /Port emissions
2280003200	Marine Vessels, Commercial /Residual /Underway emissions
2285002006	Railroad Equipment /Diesel /Line Haul Locomotives: Class I Operations
2285002007	Railroad Equipment /Diesel /Line Haul Locomotives: Class II / III Operations
2285002008	Railroad Equipment /Diesel /Line Haul Locomotives: Passenger Trains (Amtrak)

Annual emissions for nonroad vehicles were obtained from MARAMA's 2017 Beta 2 air quality modeling platform.[1] The following are the MARAMA Beta 2 files from which annual emissions were compiled:

- *2017_NONPOINT_c1c2rail_27jun2016.csv*; and
- *2017_NONPOINT_c3marine_28jun2016.csv*.

The 2017 MARAMA Beta 2 air quality modeling platform was projected from EPA's 2011 base year air quality modeling platform (referred to as version 6.2eh, or 2011v6.2eh).[2] The EPA's 2011v6.2eh modeling platform was developed from the 2011 NEI v2.[3] The two modeling platforms and the 2011 NEI v2 all have undergone extensive stakeholder reviews and, for this reason, are considered to be the most comprehensive and accurate inventories available at the time that the inventory for this noninterference demonstration was prepared. Annual NOx and VOC emissions from the 2017 MARAMA Beta 2 inventory were divided by 365 days to estimate ozone season day emissions. The DAQ believes that dividing annual emissions by 365 days per year provides a reasonable estimate of typical ozone season day nonroad vehicle emissions.

MARAMA's Beta 2 inventory applied year 2017 growth factors to the 2011 EPA's 2011v6.2eh modeling platform emissions to estimate 2017 year emissions for Railroad Diesel Locomotive source categories (Class I, II/III, and Passenger Locomotives). These growth factors reflect the combined effects of projected emissions activity and emissions rate changes. For Class I and Class II/III (freight) Locomotives, projected emissions activity changes are based on 2011 and 2017 national freight rail distillate fuel consumption estimates from the Energy Information

[1] Technical Support Document, Emission Inventory Development for 2011 and 2017 for the Northeastern U.S. BETA2 Version, prepared by Julie R. McDill, P.E. and Susan McCusker, MARAMA, and Edward Sabo, CSRA International, Inc., December 21, 2016, http://www.marama.org/technical-center/emissions-inventory/2011-2017-beta-regional-emissions-inventory.

[2] *Technical Support Document (TSD), Preparation of Emissions Inventories for the Version 6.2, 2011 Emissions Modeling Platform*, August, 2015, https://www.epa.gov/air-emissions-modeling/2011-version-62-technical-support-document.

[3] *2011 National Emissions Inventory, version 2, Technical Support Document* which can be downloaded from https://www.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-documentation.

Administration (EIA)'s Annual Energy Outlook. Emissions rate changes for Class I and Class II/III Locomotives are based on EPA 2011 and 2017 NOx and hydrocarbon (HC) emission factors for Large Line-Haul and Small Railroads, respectively.[4] For Passenger Locomotives, growth factors reflect the combined effect of county-level 2011-2017 population estimates from the NC Office of State Budget and Management and EPA's 2011 and 2017 NOx and HC emission factors for Passenger/Commuter Locomotives. Based on a review of these North Carolina nonroad mobile source categories, 2017 emissions are unlikely to change significantly in 2018.

The Category 1 and 2 CMV Residual fuel emissions in MARAMA's Beta 2 inventory reflect application of growth factors from EPA's 2011v6.2 modeling platform to 2011 NEIv2 emissions. The Category 1 and 2 CMV growth factors reflect EPA's 2018 emission projections for these categories (see Table 4-6 in Section 4.2.3.3 of EPA's 2011v6.2 Technical Support Document (TSD).[5] The Category 3 CMV growth factors reflect EPA's 2017 emission projections for these categories (see Table 4-8 in Section 4.2.3.4 of EPA's 2011v6.2 TSD). Based on a review of these North Carolina nonroad mobile source categories, 2017 emissions are unlikely to change significantly in 2018.

4.0 QUALITY ASSURANCE MEASURES

For the nonroad model runs, the MOVES RunSpecs (MRS) files (files that display the inputs used in a model run) and calculations were reviewed by a second person who did not perform the actual runs. The model results were also evaluated by comparing one county to another to see that the results were reasonable taking into consideration the differences between the counties.

The 2017 MARAMA Beta 2 inventory underwent extensive quality assurance and stakeholder review prior to the inventory being finalized to support ozone transport modeling. In addition, MARAMA used EPA's 2011v6.2eh modeling platform as the base year from which to forecast emissions because this platform underwent extensive quality assurance review by EPA, the states, and other stakeholders. The detailed quality assurance and quality control procedures and measures, as outlined in the DAQ's Emissions Inventory Quality Assurance Project Plan (QAPP) and approved by EPA, were applied to ensure the data meets specific data indicator goals and objectives.

5.0 MOVES2014a NONROAD MRS FILES

The following are the MRS files that were used in the MOVES Nonroad model. There is one MRS file for each county.

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[4] U.S. EPA, "Technical Highlights: Emission Factors for Locomotives," Office of Transportation and Air Quality EPA-420-F-09-025, April 2009.

[5] *Technical Support Document (TSD), Preparation of Emissions Inventories for the Version 6.2, 2011 Emissions Modeling Platform*, August, 2015, https://www.epa.gov/air-emissions-modeling/2011-version-62-technical-support-document.

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processname="Crankcase Running Exhaust"/>
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processname="Evap Hose Permeation"/>
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processname="HotSoak Fuel Vapor Venting"/>
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		<sourceusetype selected="false"/>
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keepSampledData="false" keepIterations="false"/>
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		<hpclass selected="false"/>
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processname="Refueling Spillage Loss"/>
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processname="Evap Hose Permeation"/>
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      </onroadvehicleselections>
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fueltypedesc="Gasoline" sectorid="10" sectorname="Oil Field"/>
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```
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sectorname="Airport Support"/>
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		<onroadoffroad selected="true"/>
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keepSampledData="false" keepIterations="false"/>
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fueltypedesc="Gasoline" sectorid="10" sectorname="Oil Field"/>
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Appendix C

Point Sources

Emission Inventory Documentation

Noninterference Demonstration for Removing 26 Counties from the Inspection and Maintenance (I&M) Program

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1.0 INTRODUCTION AND SCOPE

This appendix presents the data sources, methods, and results used to develop typical ozone season day emissions for point sources for 2018. The point source inventory consists of emissions from individual facilities (point sources), airports, rail yards, and wild and prescribed fires.

Industrial or commercial facilities having equipment that emits air pollutants have always been classified as point sources by air quality regulatory programs and are generally required to have permits issued by the North Carolina Division of Air Quality (DAQ) and the three local programs located in Buncombe, Forsyth and Mecklenburg Counties. A subcategory of these permitted sources are combustion sources such as boilers and turbines that generate electricity for sale on the electric grid. Emissions for these electricity generating units (EGUs) are developed separately from the other point sources due to differences in how they operate compared to industrial and commercial sources. In the following discussion, these two categories of point sources are referred to as "EGU" and "Non-EGU Point."

Airports or rail yards are not required to have air quality permits for construction and operation as airports or rail yards (although they could have equipment such as a boiler or generator that requires a permit). They do have fixed and known locations and their emissions quantities can be comparable to industrial sources so, for purposes of the United States Environmental Protection Agency's (EPA) National Emission Inventory (NEI), they are included in the point source inventory even though they are traditionally considered nonroad mobile sources.

In addition, EPA includes wild and prescribed fires in the point source inventory because the extent of the fire-event activity is defined by geographic coordinates.

2.0 SUMMARY OF EMISSIONS

Table C-1 shows point source typical ozone season day NOx and VOC emissions by county for 2018.

Table C-1. Point Source Ozone Season Day NOx and VOC Emissions in 2018 (Tons/Day)

	Electricity Generating Units (EGUs)		Non-EGU Point		Aircraft		Rail Yards		Wildfires and Prescribed Burning		Totals	
County	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Brunswick	2.397	0.020	3.549	1.884	0.009	0.023	0.168	0.012	0.327	0.699	6.450	2.638
Burke			0.207	1.644	0.004	0.009			0.049	0.092	0.260	1.745
Caldwell			0.287	2.966	0.002	0.004			0.021	0.039	0.310	3.009
Carteret			0.043	0.099	0.006	0.013	0.000	0.000	0.065	0.122	0.114	0.234
Catawba	34.606	0.254	0.894	4.695	0.001	0.001			0.000	0.000	35.501	4.950
Chatham			1.490	2.174	0.002	0.005			0.020	0.039	1.512	2.218
Cleveland	8.707	0.021	0.420	0.449	0.002	0.004			0.002	0.004	9.131	0.478
Craven	2.711	0.074	2.490	2.831	0.017	0.015	0.000	0.000	0.110	0.208	5.328	3.128

County	Electricity Generating Units (EGUs)		Non-EGU Point		Aircraft		Rail Yards		Wildfires and Prescribed Burning		Totals	
	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC	NOx	VOC
Edgecombe	2.905	0.003	0.070	0.234	0.001	0.002	0.516	0.036	0.003	0.005	3.495	0.280
Granville			0.105	0.865	0.002	0.006			0.008	0.015	0.115	0.886
Harnett			0.016	0.110	0.005	0.016			0.046	0.088	0.067	0.214
Haywood			8.139	4.627	0.000	0.000			0.006	0.011	8.145	4.638
Henderson			0.277	0.958	0.002	0.005			0.001	0.002	0.280	0.965
Lenoir			0.250	0.867	0.006	0.012			0.026	0.050	0.282	0.929
Moore			0.099	0.019	0.001	0.002			0.027	0.050	0.127	0.071
Nash			0.553	0.651	0.005	0.008			0.006	0.012	0.564	0.671
Orange	0.515	0.004	0.058	0.471	0.001	0.001			0.004	0.007	0.578	0.483
Pitt			0.432	1.646	0.029	0.020			0.001	0.001	0.462	1.667
Robeson	0.992	0.001	0.329	0.276	0.003	0.007			0.241	0.460	1.565	0.744
Rutherford		0.035	0.179	0.347	0.003	0.007	0.109	0.008	0.018	0.034	0.309	0.431
Stanly	0.004	0.000	0.536	1.178	0.002	0.009			0.011	0.022	0.553	1.209
Stokes	20.241	0.377	0.021	0.200	0.001	0.003			0.002	0.003	20.265	0.583
Surry			0.167	1.193	0.003	0.007			0.024	0.046	0.194	1.246
Wayne	4.527	0.069	1.021	1.325	0.004	0.008			0.003	0.005	5.555	1.407
Wilkes			0.779	1.983	0.001	0.002			0.004	0.008	0.784	1.993
Wilson			1.306	1.445	0.001	0.003			0.004	0.008	1.311	1.456
Total	**77.605**	**0.858**	**23.717**	**35.137**	**0.113**	**0.192**	**0.793**	**0.056**	**1.029**	**2.030**	**103.257**	**38.273**

3.0 METHODOLOGY

The section discusses the methodologies applied to develop the emissions inventory for the EGU, non-EGU point, airports, rail yards, and wildfire and prescribed burning source categories. Emissions for 2018 were not available for any of these categories. Therefore, the overall approach was to use the most recent data available for representing 2018 year emissions. For the majority of the categories, 2017 was the closest year of emissions available from the Mid-Atlantic Regional Air Management Association, Inc. (MARAMA) Beta 2 air quality modeling platform used to support ozone transport modeling.[1] The 2017 MARAMA Beta 2 air quality modeling platform was projected from EPA's 2011 base year air quality modeling platform (referred to as version 6.2eh, or 2011v6.2eh).[2] The EPA's 2011v6.2eh modeling platform was developed from Version 2 of the 2011 NEI (NEI v2).[3] The two modeling platforms and the 2011

[1] Technical Support Document, Emission Inventory Development for 2011 and 2017 for the Northeastern U.S. BETA2 Version, prepared by Julie R. McDill, P.E. and Susan McCusker, MARAMA, and Edward Sabo, CSRA International, Inc., December 21, 2016, http://www.marama.org/technical-center/emissions-inventory/2011-2017-beta-regional-emissions-inventory.

[2] *Technical Support Document (TSD), Preparation of Emissions Inventories for the Version 6.2, 2011 Emissions Modeling Platform*, August, 2015, https://www.epa.gov/air-emissions-modeling/2011-version-62-technical-support-document.

[3] *2011 National Emissions Inventory, version 2, Technical Support Document* which can be downloaded from https://www.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-documentation.

NEI v2 all have undergone extensive stakeholder reviews and, for this reason, are considered to be the most comprehensive and accurate inventories available at the time that the inventory for this noninterference demonstration was prepared. Based on a review of North Carolina sources covered by the non-EGU sectors, the emissions for 2017 are unlikely to change significantly in 2018. The DAQ modified this approach for the EGU subcategory since actual NOx and VOC emissions were available for year 2015 and the DAQ believes these data are more representative of EGU NOx emissions in 2018 than the MARAMA 2017 projection.

3.1 ELECTRICITY GENERATING UNITS

The DAQ used two separate approaches for developing emissions for this category. This approach is due to the availability of 2015 actual emissions data reported by EGU facilities which the DAQ believes is more representative of EGU emissions in the 2018 projection year. The two approaches are discussed below.

The EGU sources were broken into two categories. The first category contains EGUs that combust fossil, biomass or mixed fuel, are less than 25 Megawatts (MW) generation capacity, and periodically report *annual* NOx and VOC emissions to EPA. The second category contains EGUs that combust fossil, biomass or mixed fuel, are greater than 25 MW in generating capacity, and report *hourly* NOx emissions to EPA's Air Markets Program Data (AMPD). The majority of these EGUs also report annual VOC emissions each year. Table C-2 lists the sources that report to EPA's AMPD. The methods for calculating emissions from each of these two groups are discussed below.

Table C-2. EGU Sources Reporting Hourly NOx Emissions to EPA AMPD

County	Facility	Boiler ID
Brunswick	CPI USA North Carolina - Southport	BLR01A, B, and C; BLR02A, B, and C
Catawba	Marshall	1, 2, 3, 4
Cleveland	Cleveland County Generation	ES1, ES2, ES3, ES4
Craven	Craven County Wood Energy	ES5A
Edgecombe	Edgecombe Genco, LLC	BLR01B, BLR02B
Orange	University of NC at Chapel Hill	ES001, ES002, ES003
Robeson	W H Weatherspoon	4, 5, 6, 7
Rutherford	Cliffside	5, 6
Stokes	Belews Creek	1, 2
Wayne	H F Lee Steam Electric Plant	10, 11, 12, 13, 14, 1A, 1B, 1C

The EGUs that are less than 25 MW only report annual emissions periodically. These sources do not necessarily have recent annual NOx and VOC emissions available for use in this inventory. Therefore, the DAQ used projected NOx and VOC emissions obtained from the MARAMA Beta 2 air quality modeling platform for the year 2017. The MARAMA file used for this inventory is *2017_POINT_PTNONERTAC_IPM_20jun2016.csv*. These emissions are the most representative NOx and VOC emissions data for the 2018 inventory year. The DAQ calculated July daily averages by dividing the MARAMA 2017 annual NOx and VOC emissions by 365 days to estimate typical summer day emissions.

For the EGU sources that report hourly NOx emissions to EPA, the DAQ used 2015 actual emissions data. Note that although NOx emissions for 2016 are available from EPA, 2016 VOC emissions that facilities report to their states will not be available until November 2017. Therefore, 2015 was selected to be representative of 2018 emissions because this is the most recent year for which both actual NOx and VOC emissions were available.

For NOx emissions, the DAQ downloaded 2015 daily NOx emissions for the month of July from EPA's AMPD, which is available via EPA website.[4] The daily average NOx emissions were calculated for each EGU by dividing the total emissions for the month of July by the number of days the unit operated in July. For VOC emissions, the DAQ obtained 2015 annual VOC emissions reported by the facilities to the DAQ.[5] The DAQ calculated July daily average VOC by dividing the annual data by 365.

The DAQ believes that the actual July 2015 daily emissions reported by EGUs greater than 25 MW are the most representative data for this source category for several reasons. First, North Carolina has undergone a rapid change between 2011 and 2014 from coal-fired boilers generating most of the electricity in the state to natural gas-fired combined cycle turbines generating a large portion of the electricity. This rapid change has been difficult to capture using EGU emissions projection models from EPA or MARAMA. The DAQ evaluated forecast data produced by EPA's Integrated Planning Model and the Eastern Regional Technical Advisory Committee (ERTAC) EGU Forecasting Tool for 2017/2018. When these modeling results were compared to actual NOx emissions, the model projections over-predict NOx emissions for North Carolina's EGUs in 2018. Secondly, North Carolina has no planned changes to its EGU fleet between 2015 and 2018 (i.e., no retirements, fuel switching or new units). Lastly, the expected growth in peak day electricity generation between 2015 and 2018 is negligible. Therefore, the daily average of July 2015 actual NOx emissions reported to EPA's AMPD was used as representative of the 2018 NOx emissions for this demonstration.

3.2 NON-EGU POINT

The 2017 MARAMA Beta 2 inventory for non-EGU point sources contains only annual emissions. Therefore, annual NOx and VOC emissions were divided by 365 days to estimate typical ozone season day emissions. The inventory includes information on the percentage of time each emissions unit operated during each quarter, and, within a quarter, the number of week and weekend days each emissions unit operated within each quarter. For the vast majority of emissions units for which this information was provided, the units operate consistently across each quarter of each year and for each week. Therefore, the DAQ believes that dividing annual emissions by 365 days per year provides a reasonable estimate of typical ozone season day emissions for non-EGU point sources.

The 2017 MARAMA Beta 2 inventory files that were used to develop the inventory for the non-EGU point source sector are named *2017_POINT_ptnonipm_25jul2016.csv*, *2017_POINT_refueling_15jul2016.csv*, and *2017_POINT_oilgas_23jul2016.csv*. The third file contains a small amount of emissions associated with the transmission and distribution of natural gas in North Carolina.

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[4] EPA Air Markets Program Data, 2015 July Daily NOx Emissions for North Carolina, https://ampd.epa.gov/ampd/.
[5] North Carolina Division of Air Quality IBEAM Point Source Emissions Inventory Reports for 2015.

The 2017 MARAMA inventory was developed by applying growth and control factors and facility closure information to EPA's 2011v6.2eh modeling platform. Table C-3 summarizes the assignment of growth indicators to point source categories. The growth and control factors and facility closure information was developed by the DAQ and submitted to MARAMA to develop the 2017 emissions inventory, and then the DAQ reviewed the results to ensure that the growth and control factors and facility closure information was applied correctly. Based on a review of 2017 and 2018 growth and control factors and facility closure information, the emissions for 2017 are unlikely to change significantly in 2018. Therefore, the DAQ concluded that the 2017 MARAMA inventory is representative of 2018 year emissions.

Table C-3. Assignment of Growth Indicators to Point Source Categories

Source Category(ies)	Growth Indicator	Growth Indictor Source
Fuel Combustion, Storage, and Transport	South Atlantic region energy consumption projections for sector/fuel type related to SCC	Energy Information Administration (EIA)'s Annual Energy Outlook (see http://www.eia.gov/outlooks/archive/aeo15/)
Railyards	National freight rail distillate fuel consumption and EPA emissions factor projections	EIA's Annual Energy Outlook (see http://www.eia.gov/outlooks/archive/aeo15/) and EPA's "Technical Highlights: Emission Factors for Locomotives," 420-F-09-025, April 2009.
Chemical Storage/Transfer; Miscellaneous Manufacturing; Hospitals; Human and Animal Cremation; Miscellaneous Surface Coating; General and Misc. Surface Coating; Auto and Light Truck Surface Coating; Solvent Evaporation, Other Not Classified; Misc. Solvent Evaporation; and Waste Disposal	County-level population projections	NC Office of State Budget and Management 2010-2019 projections (see https://ncosbm.s3.amazonaws.com/s3fs-public/demog/countytotals_2010_2019.html)
Gasoline Storage and Transport	County fuel consumption projections for onroad motor vehicles	DAQ fuel projections calculated by dividing DAQ county-level VMT projections by EIA Annual Energy Outlook projections of fleet miles per gallon (see http://www.eia.gov/outlooks/archive/aeo15/)
Open Burning	Value of "1.0"	Assumed no change in emissions activity
All Other Point Sources	Average of South Atlantic region's constant dollar output growth factor and employment growth factor for industry sector most related to SCC	EIA's Annual Energy Outlook (filename: *MC_REGIONAL_AEO2015.csv*)

The EPA's 2011v6.2eh modeling platform is based on permitted sources of emissions that are required to periodically submit their emissions inventory to either the DAQ or local programs. All large permitted sources are required to report emissions annually. Smaller permitted sources are required to submit an emissions inventory every five years. Additionally, EPA requires the DAQ and the local programs to submit emissions data for large stationary point sources to them on an annual basis. For the smaller sources that report emissions every five years, the most recent emissions inventory available was used and was assumed to be equivalent to 2011 emissions since these smaller sources' emissions do not vary much from year to year. The emissions data upon which EPA's 2011v6.2eh modeling platform is based are from files maintained by the DAQ and the local programs. Thus, EPA's 2011v6.2eh modeling platform provides comprehensive coverage of North Carolina's non-EGU point source inventory.

3.3 AIRCRAFT OPERATIONS

This sector only includes exhaust emissions from aircraft landing and take-off operations, aircraft auxiliary power units (APUs), and airport ground support equipment (GSE). The 2017 MARAMA Beta 2 inventory file used to develop the inventory aircraft operations is named *2017_POINT_ptnonipm_25jul2016.csv*. Annual NOx and VOC emissions were divided by 365 days to estimate ozone season emissions because there were no other data available to more accurately characterize daily emissions during a typical July day. The 2017 MARAMA inventory for aircraft operations categories relies on EPA 2011v6.2eh modeling platform inventory for 2011.

Aircraft emissions were estimated for the following four types of aircraft based on data collected for each airport:[6]

- Commercial aircraft tend to be larger aircraft powered with jet engines and are used for transporting passengers, freight, or both.
- Air Taxi aircraft carry passengers, freight, or both, but usually are smaller and operate on a more limited basis than the commercial aircraft; aircraft in this category are further sub-categorized as is turbine- or piston-driven, which allows the emissions estimation model to assign the fuel used, jet fuel or aviation gas, respectively; also, activity data are determined by the fraction of turbine- and piston-driven aircraft.
- General Aviation aircraft includes most other aircraft used for recreational flying and personal transportation aircraft in this category are further sub-categorized as is turbine- or piston-driven, which allows the emissions estimation model to assign the fuel used, jet fuel or aviation gas, respectively; also, activity data are determined by the fraction of turbine- and piston-driven aircraft.
- Military aircraft are associated with military installations, but they sometimes have activity at non-military airports.

The EPA developed emissions estimates associated with the landing and takeoff (LTO) cycle of aircraft as well as the APU and GSE operations used to service the aircraft at the airport. The LTO cycle includes the following five modes: (1) Approach, (2) Taxi/idle-in, (3) Taxi/idle-out, (4) Takeoff, and (5) Climbout. The EPA used the FAA's Emissions and Dispersion Modeling System (EDMS, Version 5.1) to calculate 2011 emissions by aircraft type using actual LTO activity data by airport and the latest aircraft engine emission factors from the International Civil Aviation Organization (ICAO) Engine Exhaust Emissions Data Bank.

The 2011 emissions were projected to future years by applying activity growth factors developed from data on itinerant (ITN) operations at airports. The ITN operations are defined as aircraft

[6] *Technical Support Document, Emission Inventory Development for 2011 and 2017 for the Northeastern U.S. Beta Version*, prepared by MARAMA and CSRA International, Inc., June 10, 2016, http://www.marama.org/technical-center/emissions-inventory/2011-2017-beta-regional-emissions-inventory

take-offs whereby the aircraft leaves the airport vicinity and lands at another airport, or aircraft landings whereby the aircraft has arrived from outside the airport vicinity. MARAMA used projected ITN information available from the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) System.[7] This information is available for approximately 3,300 individual airports, for all years up to 2040.

None of MARAMA's aircraft emission projections account for any control programs. The EPA considered the NOx standard adopted by the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) in February 2004, which is expected to reduce NOx by approximately 3 percent by 2020. However, this rule has not yet been adopted as an EPA (or U.S.) rule when the inventory was developed; therefore, its effects were not included in the future-year emissions projections.

3.4 RAIL YARDS

Rail yards include switcher locomotives engaged in splitting and joining rail cars. Base year rail yard emissions were grown from the 2008 to the 2011 NEI v2 by EPA. The 2008 emissions were developed by ERTAC with data provided by the railroad companies. Additional information may be found in the locomotive chapter of the *2011 National Emissions Inventory, Technical Support Document,*[8] and in a memorandum titled *Development of 2011 Railroad Component for National Emissions Inventory.*[9] The DAQ developed growth factors for rail yards using the combined effect of the projected 2011-2017 change in national freight rail distillate fuel consumption from the Annual Energy Outlook (2014 version for the 2011-2012 change and 2015 version for the 2012-2017 change) and EPA emission factor projections for switching engines.[10] The 2017 MARAMA Beta 2 inventory file containing annual emissions for rail yards is named *2017_POINT_ptnonipm_25jul2016.csv*. Annual NOx and VOC emissions were divided by 365 days to estimate ozone season emissions because there were no other data available to more accurately characterize daily emissions during a typical July day.

3.5 WILDFIRES AND PRESCRIBED BURNING

The 2017 MARAMA inventory for these categories relies on EPA 2011v6.2eh inventory files for both 2011 and 2017. Because of the difficulty with predicting wild and prescribed fire activity in the future, EPA held 2011 emissions constant in the 2017v6.2eh modeling platform inventory.[11]

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[7] MARAMA used a TAF System forecast downloaded from the FAA's website in March 2014 which is no longer available on the FAA's website. The FAA website is provided here as it summarizes its forecasting process. Methods that the FAA used for developing the ITN data in the TAF are documented in: http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_Summary_Report_FY2013-2040.pdf

[8] *2011 National Emissions Inventory, version 2, Technical Support Document* which can be downloaded from https://www.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-documentation.

[9] *Development of 2011 Railroad Component for National Emissions Inventory*, Memorandum from Heather Perez, Susan McClutchey, and Richard Billings, Eastern Research Group (ERG) to Laurel Driver, USEPA, September 5, 2012, found in file name *2011nei_Locomotive.pdf* located at ftp://ftp.epa.gov/EmisInventory/2011/doc.

[10] *Emission Factors for Locomotives*, USEPA, Office of Transportation and Air Quality, EPA-420-F-09-025, April 2009, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100500B.pdf.

[11] *2011 National Emissions Inventory, version 2, Technical Support Document* which can be downloaded from https://www.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-documentation, page 79.

The 2017 MARAMA Beta 2 inventory files containing annual emissions for wild and prescribed fires are named *Annual Wild 2011 Data.xlsx* and *Annual Prescribed 2011 Data.xlsx*, respectively. Annual 2011 NOx and VOC emissions for these two categories were divided by 365 days to estimate typical ozone season emissions.

4.0 QUALITY ASSURANCE MEASURES

The 2017 MARAMA Beta 2 inventory underwent extensive quality assurance and stakeholder review prior to the inventory being finalized to support ozone transport modeling. In addition, MARAMA used EPA's 2011v6.2eh modeling platform as the base year from which to forecast emissions because this platform underwent extensive quality assurance review by EPA, the states, and other stakeholders. The detail quality assurance and quality control procedures and measures that are outlined in the DAQ's Emissions Inventory Quality Assurance Project Plan (QAPP) and approved by EPA, were applied to ensure the data meets specific data indicator goals and objectives.

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Appendix D

Area Sources

Emission Inventory Documentation

Noninterference Demonstration for Removing 26 Counties from the Inspection and Maintenance (I&M) Program

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1.0 INTRODUCTION AND SCOPE

This appendix presents the data sources, methods, and results used to develop the area source emissions inventory for 2018. Area sources represent a collection of many small, stationary sources of air pollution emissions within a specified geographical area that individually emit less than the minimum emission levels prescribed for point sources. Because these sources are too small and/or too numerous to be surveyed and characterized individually, all area source activities are collectively estimated. The county is the geographic area for which emissions from area sources are compiled, primarily because counties are the smallest areas for which data used for estimating emissions is readily available. The following sections explain the methodology for developing typical ozone season day emissions for area sources.

2.0 SUMMARY OF EMISSIONS

Table D-1 shows total area source NOx and VOC emissions for 2018 by county. The remainder of this section discusses the approach for developing ozone season day emissions for the area source sector.

Table D-1. Area Source Ozone Season Day NOx and VOC Emissions in 2018 (Tons/Day)

County	NOx	VOC
Brunswick	0.513	3.497
Burke	0.229	3.406
Caldwell	0.287	4.423
Carteret	0.303	1.853
Catawba	0.682	12.832
Chatham	0.217	1.771
Cleveland	0.285	3.905
Craven	0.314	3.355
Edgecombe	0.233	2.659
Granville	0.158	1.649
Harnett	0.473	3.865
Haywood	0.302	1.611
Henderson	0.402	3.756
Lenoir	0.304	3.075
Moore	0.422	2.748
Nash	0.551	4.321
Orange	0.499	3.089
Pitt	0.728	5.451
Robeson	0.573	5.427
Rutherford	0.242	2.215
Stanly	0.204	2.584

County	NOx	VOC
Stokes	0.149	1.346
Surry	0.308	3.427
Wayne	0.622	4.833
Wilkes	0.205	2.728
Wilson	0.340	3.331
Total	**9.545**	**93.157**

3.0 METHODOLOGY

The area source emissions inventory is based on the Mid-Atlantic Regional Air Management Association, Inc. (MARAMA) Beta 2 air quality modeling platform for the year 2017. The 2017 MARAMA Beta 2 air quality modeling platform was projected from EPA's 2011 base year air quality modeling platform (referred to as version 6.2eh, or 2011v6.2eh).[1] The EPA's 2011v6.2eh modeling platform was developed from the 2011 NEI v2.[2] The two modeling platforms and the 2011 NEI v2 all have undergone extensive stakeholder reviews and, for this reason, are considered to be the most comprehensive and accurate inventories available at the time that the inventory for this noninterference demonstration was prepared. Table D-2 displays the list of area source categories with NOx and/or VOC emissions in North Carolina.

Table D-2. Area Source Categories with NOx and/or VOC Emissions in North Carolina

SCC	Description	NOx	VOC
2102004000	Stationary Source Fuel Combustion; Industrial; Distillate Oil; Total: Boilers and IC Engines	√	√
2102006000	Stationary Source Fuel Combustion; Industrial; Natural Gas; Total: Boilers and IC Engines	√	√
2102007000	Stationary Source Fuel Combustion; Industrial; Liquefied Petroleum Gas (LPG); Total: All Boiler Types	√	√
2102008000	Stationary Source Fuel Combustion; Industrial; Wood; Total: All Boiler Types	√	√
2102011000	Stationary Source Fuel Combustion; Industrial; Kerosene; Total: All Boiler Types	√	√
2103002000	Stationary Source Fuel Combustion; Commercial/Institutional; Bituminous/Subbituminous Coal; Total: All Boiler Types	√	√
2103004000	Stationary Source Fuel Combustion; Commercial/Institutional; Distillate Oil; Total: Boilers and IC Engines	√	√
2103005000	Stationary Source Fuel Combustion; Commercial/Institutional; Residual Oil; Total: All Boiler Types	√	√
2103006000	Stationary Source Fuel Combustion; Commercial/Institutional; Natural Gas; Total: Boilers and IC Engines	√	√
2103007000	Stationary Source Fuel Combustion; Commercial/Institutional; Liquefied Petroleum Gas (LPG); Total: All Combustor Types	√	√

[1] *Technical Support Document (TSD), Preparation of Emissions Inventories for the Version 6.2, 2011 Emissions Modeling Platform*, August, 2015, https://www.epa.gov/air-emissions-modeling/2011-version-62-technical-support-document.
[2] *2011 National Emissions Inventory, version 2, Technical Support Document* which can be downloaded from https://www.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-documentation.

SCC	Description	NOx	VOC
2103008000	Stationary Source Fuel Combustion; Commercial/Institutional; Wood; Total: All Boiler Types	√	√
2103011000	Stationary Source Fuel Combustion; Commercial/Institutional; Kerosene; Total: All Combustor Types	√	√
2104002000	Stationary Source Fuel Combustion; Residential; Bituminous/Subbituminous Coal; Total: All Combustor Types	√	√
2104004000	Stationary Source Fuel Combustion; Residential; Distillate Oil; Total: All Combustor Types	√	√
2104006000	Stationary Source Fuel Combustion; Residential; Natural Gas; Total: All Combustor Types	√	√
2104007000	Stationary Source Fuel Combustion; Residential; Liquefied Petroleum Gas (LPG); Total: All Combustor Types	√	√
2104008100	Stationary Source Fuel Combustion; Residential; Wood; Fireplace: general	√	√
2104008210	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; non-EPA certified	√	√
2104008220	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; EPA certified; non-catalytic	√	√
2104008230	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; EPA certified; catalytic	√	√
2104008310	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, non-EPA certified	√	√
2104008320	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, EPA certified, non-catalytic	√	√
2104008330	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, EPA certified, catalytic	√	√
2104008400	Stationary Source Fuel Combustion; Residential; Wood; Woodstove: pellet-fired, general (freestanding or FP insert)	√	√
2104008510	Stationary Source Fuel Combustion; Residential; Wood; Furnace: Indoor, cordwood-fired, non-EPA certified	√	√
2104008610	Stationary Source Fuel Combustion; Residential; Wood; Hydronic heater: outdoor	√	√
2104008700	Stationary Source Fuel Combustion; Residential; Wood; Outdoor wood burning device, NEC (fire-pits, chimneas, etc.)	√	√
2104009000	Stationary Source Fuel Combustion; Residential; Firelog; Total: All Combustor Types	√	√
2104011000	Stationary Source Fuel Combustion; Residential; Kerosene; Total: All Heater Types	√	√
2302002100	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Charbroiling; Conveyorized Charbroiling		√
2302002200	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Charbroiling; Under-fired Charbroiling		√
2302003000	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Frying; Deep Fat Frying		√
2302003100	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Frying; Flat Griddle Frying		√
2302003200	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking - Frying; Clamshell Griddle Frying		√
2401001000	Solvent Utilization; Surface Coating; Architectural Coatings; Total: All Solvent Types		√
2401005000	Solvent Utilization; Surface Coating; Auto Refinishing: SIC 7532; Total: All Solvent Types		√
2401008000	Solvent Utilization; Surface Coating; Traffic Markings; Total: All Solvent Types		√

SCC	Description	NOx	VOC
2401015000	Solvent Utilization; Surface Coating; Factory Finished Wood: SIC 2426 thru 242; Total: All Solvent Types		√
2401020000	Solvent Utilization; Surface Coating; Wood Furniture: SIC 25; Total: All Solvent Types		√
2401025000	Solvent Utilization; Surface Coating; Metal Furniture: SIC 25; Total: All Solvent Types		√
2401030000	Solvent Utilization; Surface Coating; Paper: SIC 26; Total: All Solvent Types		√
2401040000	Solvent Utilization; Surface Coating; Metal Cans: SIC 341; Total: All Solvent Types		√
2401055000	Solvent Utilization; Surface Coating; Machinery and Equipment: SIC 35; Total: All Solvent Types		√
2401060000	Solvent Utilization; Surface Coating; Large Appliances: SIC 363; Total: All Solvent Types		√
2401065000	Solvent Utilization; Surface Coating; Electronic and Other Electrical: SIC 36 - 363; Total: All Solvent Types		√
2401070000	Solvent Utilization; Surface Coating; Motor Vehicles: SIC 371; Total: All Solvent Types		√
2401075000	Solvent Utilization; Surface Coating; Aircraft: SIC 372; Total: All Solvent Types		√
2401080000	Solvent Utilization; Surface Coating; Marine: SIC 373; Total: All Solvent Types		√
2401085000	Solvent Utilization; Surface Coating; Railroad: SIC 374; Total: All Solvent Types		√
2401090000	Solvent Utilization; Surface Coating; Miscellaneous Manufacturing; Total: All Solvent Types		√
2401100000	Solvent Utilization; Surface Coating; Industrial Maintenance Coatings; Total: All Solvent Types		√
2401200000	Solvent Utilization; Surface Coating; Other Special Purpose Coatings; Total: All Solvent Types		√
2420000000	Solvent Utilization; Dry Cleaning; All Processes; Total: All Solvent Types		√
2460100000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Personal Care Products; Total: All Solvent Types		√
2460200000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Household Products; Total: All Solvent Types		√
2460400000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Automotive Aftermarket Products; Total: All Solvent Types		√
2460500000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Coatings and Related Products; Total: All Solvent Types		√
2460600000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Adhesives and Sealants; Total: All Solvent Types		√
2460800000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All FIFRA Related Products; Total: All Solvent Types		√
2460900000	Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; Miscellaneous Products (Not Otherwise Covered); Total: All Solvent Types		√
2461022000	Solvent Utilization; Miscellaneous Non-industrial: Commercial; Emulsified Asphalt; Total: All Solvent Types		√
2461850000	Solvent Utilization; Miscellaneous Non-industrial: Commercial; Pesticide Application: Agricultural; All Processes		√
2501011011	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Permeation		√
2501011012	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Evaporation (includes Diurnal losses)		√
2501011013	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Spillage During Transport		√
2501011014	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refilling at the Pump - Vapor Displacement		√

SCC	Description	NOx	VOC
2501011015	Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Refilling at the Pump - Spillage		√
2501012011	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Permeation		√
2501012012	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Evaporation (includes Diurnal losses)		√
2501012013	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Spillage During Transport		√
2501012014	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refilling at the Pump - Vapor Displacement		√
2501012015	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial Portable Gas Cans; Refilling at the Pump - Spillage		√
2501050120	Storage and Transport; Petroleum and Petroleum Product Storage; Bulk Terminals: All Evaporative Losses; Gasoline		√
2501055120	Storage and Transport; Petroleum and Petroleum Product Storage; Bulk Plants: All Evaporative Losses; Gasoline		√
2501060051	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Submerged Filling		√
2501060052	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Splash Filling		√
2501060053	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Balanced Submerged Filling		√
2501060201	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Underground Tank: Breathing and Emptying		√
2501080050	Storage and Transport; Petroleum and Petroleum Product Storage; Airports: Aviation Gasoline; Stage 1: Total		√
2501080100	Storage and Transport; Petroleum and Petroleum Product Storage; Airports: Aviation Gasoline; Stage 2: Total		√
2505030120	Storage and Transport; Petroleum and Petroleum Product Transport; Truck; Gasoline		√
2505040120	Storage and Transport; Petroleum and Petroleum Product Transport; Pipeline; Gasoline		√
2610000100	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Yard Waste - Leaf Species Unspecified	√	√
2610000400	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Yard Waste - Brush Species Unspecified	√	√
2610000500	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories; Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)	√	√
2610030000	Waste Disposal, Treatment, and Recovery; Open Burning; Residential; Household Waste (use 26-10-000-xxx for Yard Wastes)	√	√
2630020000	Waste Disposal, Treatment, and Recovery; Wastewater Treatment; Public Owned; Total Processed		√
2801500000	Agriculture - Crops /Field Burning - whole field set on fire /Unspecified	√	√
2810060100	Miscellaneous Area Sources; Other Combustion; Cremation; Humans	√	√

Annual emissions for area sources were obtained from the 2017 MARAMA Beta 2 air quality modeling platform.[3] The following are the MARAMA Beta 2 files from which annual NOx and VOC emissions were compiled:

- *2017_NONPOINT_nonpt_29jun2016.csv*;
- *2017_NONPOINT_pfc_29jun2016.csv*;
- *2017_NONPOINT_refueling_20jun2016.csv*;
- *2017_NONPOINT_RWC_20Jun2016.csv*; and
- *agburn_monthly_2011NEIv2_NONPOINT_20141108_11nov2014_v0.csv*.

MARAMA's Beta 2 inventory applied year 2017 growth and control factors to the 2011 EPA's 2011v6.2eh modeling platform emissions to estimate 2017 year emissions for most area source categories. The growth and control factors were developed by the DAQ and submitted to MARAMA to develop the 2017 emissions inventory, and then the DAQ reviewed the results to ensure that the growth and control factors were applied correctly. The DAQ developed growth factors from available projections data for growth indicators identified to be most closely related to the emissions activity for each source category. Table D-3 summarizes the assignment of growth indicators to area source categories.

Table D-3. Assignment of Growth Indicators to Area Source Categories

Source Category(ies)	Growth Indicator	Growth Indictor Source
Fuel Combustion and Aviation Gasoline: Stage 1 and Stage 2	South Atlantic region energy consumption projections for sector/fuel type related to SCC	Energy Information Administration (EIA)'s Annual Energy Outlook (see http://www.eia.gov/outlooks/archive/aeo15/)
Residential Wood Combustion	Growth factors applied in EPA's 2011 base year air quality modeling platform (2011v6.2eh)[4]	EPA filename: *PROJECTION_2011_2017_RWC_ 2011v6.2_03mar2015.txt*
Charbroiling and Frying; Other Special Purpose Coatings; Dry Cleaning; Consumer & Commercial Solvent Utilization; Public Owned Wastewater Treatment; and Human Cremation	County-level population projections	NC Office of State Budget and Management 2010-2019 projections (see https://ncosbm.s3.amazonaws.com/s3fs-public/demog/countytotals_2010_2019.html)
Auto Refinishing and Traffic Markings	County-level vehicle miles traveled (VMT) projections	DAQ VMT projections. See Section 4.0 of Appendix A for details.
Gasoline Bulk Terminals; Gasoline Bulk Plants; Gasoline Service Stations: Stage I and Underground Storage Tanks;	County fuel consumption projections for on-road motor vehicles	DAQ fuel projections calculated by dividing DAQ county-level VMT projections by EIA Annual Energy Outlook projections of fleet miles per gallon (see http://www.eia.gov/outlooks/archive/aeo15/)

[3] Technical Support Document, Emission Inventory Development for 2011 and 2017 for the Northeastern U.S. BETA2 Version, prepared by Julie R. McDill, P.E. and Susan McCusker, MARAMA, and Edward Sabo, CSRA International, Inc., December 21, 2016, http://www.marama.org/technical-center/emissions-inventory/2011-2017-beta-regional-emissions-inventory.

[4] Reflecting assumed growth of wood burning appliances based on sales data, equipment replacement rates and change outs. These changes include the New Source Performance Standards for Residential Wood Heaters, resulting in growth in lower-emitting stoves and a reduction in higher emitting stoves.

Source Category(ies)	Growth Indicator	Growth Indictor Source
Gasoline Trucks; and Gasoline Pipelines		
Portable Gas Cans: Spillage; Open Burning, and Agricultural Burning	Value of "1.0"	Assumed no change in emissions activity
All Other Area Sources	Average of South Atlantic region's constant dollar output growth factor and employment growth factor for industry sector most related to SCC	EIA's Annual Energy Outlook (filename: *MC_REGIONAL_AEO2015.csv*)

Consistent with EPA's 2011v6.2eh modeling platform, MARAMA incorporated EPA's 2018 North Carolina emissions inventory for Portable Gas Cans (filename: *pfc_2018_2011v6.2_ff10_28jan2015_v0.csv*) into the 2017 Beta 2 inventory. This inventory was developed and modeled for EPA's Mobile Source Air Toxics rule, and covers permeation, evaporation, and vapor displacement emissions from portable gas cans. In addition, MARAMA applied control factors reflecting the estimated impacts of the Boiler Maximum Achievable Control Technology (MACT) standard on the following area source fuel combustion categories:

- Industrial/Distillate Oil; Total: Boilers and IC Engines;
- Industrial/Wood; Total: All Boiler Types;
- Industrial/Kerosene; Total: All Boiler Types;
- Commercial-Institutional/Bituminous and Subbituminous Coal; Total: All Boiler Types;
- Commercial-Institutional/Distillate Oil; Total: Boilers and IC Engines;
- Commercial-Institutional/Residual Oil; Total: All Boiler Types;
- Commercial-Institutional/Wood; Total: All Boiler Types; and
- Commercial-Institutional/Kerosene; Total: All Combustor Types.

Annual NOx and VOC emissions from the 2017 MARAMA Beta 2 inventory were divided by 365 days to estimate ozone season day emissions. The DAQ believes that dividing annual emissions by 365 days per year provides a reasonable estimate of typical ozone season day nonroad vehicle emissions. Based on a review of North Carolina area sources, the emissions for 2017 are unlikely to change significantly in 2018.

4.0 QUALITY ASSURANCE MEASURES

The 2017 MARAMA Beta 2 inventory underwent extensive quality assurance and stakeholder review prior to the inventory being finalized to support ozone transport modeling. In addition, MARAMA used EPA's 2011v6.2eh modeling platform as the base year from which to forecast emissions because this platform underwent extensive quality assurance review by EPA, the states, and other stakeholders. The detailed quality assurance and quality control procedures and measures, as outlined in the DAQ's Emissions Inventory Quality Assurance Project Plan (QAPP) and approved by EPA, were applied to ensure the data meets specific data indicator goals and objectives.

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