FINAL

Appendix A

On-Road Mobile Source

Emission Inventory Documentation

Clean Air Act Section 110(l) Noninterference Demonstration to Remove Lee, Onslow, and Rockingham Counties from North Carolina’s Motor Vehicle Emissions 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 2022. 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

Tables A-1 and A-2 summarize the 2022 ozone season day on-road mobile source NOx and VOC emissions modeling results for Lee, Onslow, and Rockingham counties. Emissions with and without coverage under the North Carolina emissions inspection and maintenance (I&M) program are shown, along with the emissions changes that would result from removing the three counties from the program.

Table A-1. On-road Source Ozone Season Day NOx Emissions in 2022 (Tons/Day)

<table>
<thead>
<tr>
<th>County</th>
<th>Total On-road NOx Emissions – with I&amp;M Program Coverage (TPD)</th>
<th>Total On-road NOx Emissions - without I&amp;M Program Coverage (TPD)</th>
<th>NOx Emission Changes due to I&amp;M Program Change (TPD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>1.40</td>
<td>1.44</td>
<td>0.04</td>
</tr>
<tr>
<td>Onslow</td>
<td>2.27</td>
<td>2.35</td>
<td>0.08</td>
</tr>
<tr>
<td>Rockingham</td>
<td>2.43</td>
<td>2.49</td>
<td>0.06</td>
</tr>
<tr>
<td>Totals</td>
<td>6.10</td>
<td>6.28</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Table A-2. On-road Source Ozone Season Day VOC Emissions in 2022 (Tons/Day)

<table>
<thead>
<tr>
<th>County</th>
<th>Total On-road VOC Emissions – with I&amp;M Program Coverage (TPD)</th>
<th>Total On-road VOC Emissions - without I&amp;M Program Coverage (TPD)</th>
<th>VO Emission Changes due to I&amp;M Program Change (TPD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>1.01</td>
<td>1.06</td>
<td>0.05</td>
</tr>
<tr>
<td>Onslow</td>
<td>1.92</td>
<td>2.02</td>
<td>0.10</td>
</tr>
<tr>
<td>Rockingham</td>
<td>1.86</td>
<td>1.92</td>
<td>0.06</td>
</tr>
<tr>
<td>Totals</td>
<td>4.79</td>
<td>5.00</td>
<td>0.21</td>
</tr>
</tbody>
</table>

3.0 METHODOLOGY

For Lee, Onslow, and Rockingham counties, the MOtor Vehicle Emissions Simulator (MOVES) model was used to develop emissions inventories that represent 1) the I&M program coverage in effect for 2022, and 2) no I&M coverage. The differences between the model run results were used to calculate the county-level and overall changes in NOx and VOC emissions resulting from removing the counties from the I&M program. Emissions from all on-road mobile sources were modeled, including light-duty gasoline vehicles (LDGV) subject to I&M requirements as well as those exempt from the program, to allow evaluation of I&M related emissions changes relative to county-level emissions from all source categories. The 2022 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

<table>
<thead>
<tr>
<th>MOVES Model Version</th>
<th>MOVES2014b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollutants</td>
<td>NOx, VOC</td>
</tr>
<tr>
<td>Modeled Spatial Domains</td>
<td>Whole counties subject to I&amp;M</td>
</tr>
<tr>
<td>Modeled Year</td>
<td>2022</td>
</tr>
<tr>
<td>Temporal Emissions Time Period</td>
<td>Typical summer weekday (July weekday)</td>
</tr>
<tr>
<td>Vehicle Types</td>
<td>All on-road vehicles</td>
</tr>
<tr>
<td>Inspection and Maintenance Program Applicability</td>
<td>As per the North Carolina Inspection and Maintenance SIP, effective for July 2022</td>
</tr>
</tbody>
</table>

3.1 EMISSIONS MODELING APPROACH


The EPA guidance requires the use of the latest approved mobile source emissions model. The North Carolina Division of Air Quality (DAQ) used MOVES2014b (version MOVES2014b-20181203), 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 MOVES2014b 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 miles per hour (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. The DAQ typically uses spreadsheet-based data converters developed by the EPA to process the speed data into the required format. However, in this instance, due to the lack of detailed local speed data from travel demand modeling (TDM), the default MOVES2014b speed data were used.

### 3.2.2 VEHICLE AGE DISTRIBUTION

Local vehicle age distributions were developed from county-level annual registration data obtained from the North Carolina Department of Transportation (NCDOT). For this analysis, the age distribution was generated based on 2019 data. The data includes the number of registered vehicles categorized by nine vehicle types and by model year, with individual model years listed from 2019 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; 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 to calculate the distribution of vehicle miles traveled (VMT) by vehicle type and by road type. The NCDOT compiles these data annually on a statewide basis, based on traffic survey and Highway Performance Management System (HPMS) data collected throughout the year. Table A-4 shows the vehicle activity summary by functional classification for 2019. The data are provided as the fractional distribution of VMT by vehicle type on each of the 12 Federal Highway Administration (FHWA) road types.

These data were further processed to transform the distributions to different vehicle type categories, providing the “VMT mix” required to generate the necessary MOVES input tables. This was done according to the guidance document, Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation (EPA 420-R-04-013, August 2004). Table A-5 and Table A-6 show the vehicle type and facility (roadway) type ID numbers and descriptions for the resulting statewide North Carolina 2019 VMT mix table, which is show in Table A-7. 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 (see Section 3.1), 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.

3.2.5 ROAD TYPE

The MOVES model defines five different road types to categorize the roadways used in a particular MOVES modeling run. 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).

The DAQ included all five road types in each modeling run as per EPA guidance. Including the Off-Network road type was necessary to account for emissions from vehicle starts, extended idle activity, and VOC emissions from evaporative processes.

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 2022. The modeling results included emissions from all vehicular processes that generate NOx or VOC, such as running exhaust, start exhaust, and evaporative processes.
Table A-4. North Carolina Vehicle Activity Summary by Functional Classification - 2019

<table>
<thead>
<tr>
<th>FC Code</th>
<th>Functional Classification</th>
<th>Samples</th>
<th>MC</th>
<th>Cars</th>
<th>2A4T</th>
<th>Bus</th>
<th>2ASU</th>
<th>3ASU</th>
<th>4ASU</th>
<th>4AST</th>
<th>5AST</th>
<th>6AST</th>
<th>5AMT</th>
<th>6AMT</th>
<th>7AMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rural Principal Arterial – Interstate</td>
<td>47</td>
<td>0.0040</td>
<td>0.6865</td>
<td>0.1415</td>
<td>0.0054</td>
<td>0.0201</td>
<td>0.0063</td>
<td>0.0003</td>
<td>0.0102</td>
<td>0.1205</td>
<td>0.0013</td>
<td>0.0026</td>
<td>0.0012</td>
<td>0.0003</td>
</tr>
<tr>
<td>2</td>
<td>Rural Principal Arterial – Other</td>
<td>299</td>
<td>0.0047</td>
<td>0.6713</td>
<td>0.2142</td>
<td>0.0078</td>
<td>0.0330</td>
<td>0.0073</td>
<td>0.0008</td>
<td>0.0134</td>
<td>0.0434</td>
<td>0.0022</td>
<td>0.0009</td>
<td>0.0003</td>
<td>0.0005</td>
</tr>
<tr>
<td>6</td>
<td>Rural Minor Arterial</td>
<td>365</td>
<td>0.0056</td>
<td>0.6850</td>
<td>0.2191</td>
<td>0.0066</td>
<td>0.0323</td>
<td>0.0064</td>
<td>0.0006</td>
<td>0.0112</td>
<td>0.0312</td>
<td>0.0015</td>
<td>0.0001</td>
<td>0.0000</td>
<td>0.0003</td>
</tr>
<tr>
<td>7</td>
<td>Rural Major Collector</td>
<td>816</td>
<td>0.0065</td>
<td>0.6667</td>
<td>0.2370</td>
<td>0.0071</td>
<td>0.0343</td>
<td>0.0071</td>
<td>0.0008</td>
<td>0.0111</td>
<td>0.0277</td>
<td>0.0015</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0002</td>
</tr>
<tr>
<td>8</td>
<td>Rural Minor Collector</td>
<td>22</td>
<td>0.0130</td>
<td>0.6525</td>
<td>0.2435</td>
<td>0.0067</td>
<td>0.0339</td>
<td>0.0066</td>
<td>0.0003</td>
<td>0.0087</td>
<td>0.0320</td>
<td>0.0020</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0009</td>
</tr>
<tr>
<td>9</td>
<td>Rural Local System</td>
<td>55</td>
<td>0.0087</td>
<td>0.6771</td>
<td>0.2305</td>
<td>0.0111</td>
<td>0.0388</td>
<td>0.0097</td>
<td>0.0012</td>
<td>0.0072</td>
<td>0.0141</td>
<td>0.0013</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0003</td>
</tr>
<tr>
<td>11</td>
<td>Urban Principal Arterial – Interstate</td>
<td>92</td>
<td>0.0044</td>
<td>0.7516</td>
<td>0.1551</td>
<td>0.0047</td>
<td>0.0174</td>
<td>0.0054</td>
<td>0.0003</td>
<td>0.0046</td>
<td>0.0544</td>
<td>0.0006</td>
<td>0.0010</td>
<td>0.0005</td>
<td>0.0001</td>
</tr>
<tr>
<td>12</td>
<td>Urban Principal Arterial - Other Freeways or Expressways</td>
<td>141</td>
<td>0.0050</td>
<td>0.7336</td>
<td>0.1818</td>
<td>0.0057</td>
<td>0.0231</td>
<td>0.0061</td>
<td>0.0006</td>
<td>0.0081</td>
<td>0.0332</td>
<td>0.0014</td>
<td>0.0007</td>
<td>0.0003</td>
<td>0.0003</td>
</tr>
<tr>
<td>14</td>
<td>Urban Principal Arterial - Other</td>
<td>568</td>
<td>0.0052</td>
<td>0.7635</td>
<td>0.1760</td>
<td>0.0057</td>
<td>0.0231</td>
<td>0.0058</td>
<td>0.0010</td>
<td>0.0057</td>
<td>0.0119</td>
<td>0.0016</td>
<td>0.0002</td>
<td>0.0001</td>
<td>0.0004</td>
</tr>
<tr>
<td>16</td>
<td>Urban Minor Arterial</td>
<td>342</td>
<td>0.0055</td>
<td>0.7566</td>
<td>0.1853</td>
<td>0.0051</td>
<td>0.0249</td>
<td>0.0056</td>
<td>0.0006</td>
<td>0.0057</td>
<td>0.0090</td>
<td>0.0012</td>
<td>0.0001</td>
<td>0.0000</td>
<td>0.0003</td>
</tr>
<tr>
<td>17</td>
<td>Urban Collector</td>
<td>33</td>
<td>0.0036</td>
<td>0.7828</td>
<td>0.1725</td>
<td>0.0049</td>
<td>0.0210</td>
<td>0.0041</td>
<td>0.0005</td>
<td>0.0045</td>
<td>0.0047</td>
<td>0.0011</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0002</td>
</tr>
<tr>
<td>19</td>
<td>Urban Local System</td>
<td>24</td>
<td>0.0095</td>
<td>0.7343</td>
<td>0.1786</td>
<td>0.0155</td>
<td>0.0294</td>
<td>0.0101</td>
<td>0.0006</td>
<td>0.0057</td>
<td>0.0130</td>
<td>0.0023</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0008</td>
</tr>
</tbody>
</table>

*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-5. Vehicle Type Descriptions

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

* Gross Vehicle Weight Rating (GVWR), Loaded Vehicle Weight (LVW), Adjusted Loaded Vehicle Weight (ALVW)

Table A-6. Facility (Roadway) Type Descriptions

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Description</th>
<th>Facility Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Rural Interstate</td>
<td>23</td>
<td>Urban Interstate</td>
</tr>
<tr>
<td>13</td>
<td>Rural Other Principal Arterial</td>
<td>25</td>
<td>Urban Other Freeways and Expressways</td>
</tr>
<tr>
<td>15</td>
<td>Rural Minor Arterial</td>
<td>27</td>
<td>Urban Other Principal Arterial</td>
</tr>
<tr>
<td>17</td>
<td>Rural Major Collector</td>
<td>29</td>
<td>Urban Minor Arterial</td>
</tr>
<tr>
<td>19</td>
<td>Rural Minor Collector</td>
<td>31</td>
<td>Urban Collector</td>
</tr>
<tr>
<td>21</td>
<td>Rural Local</td>
<td>33</td>
<td>Urban Local</td>
</tr>
</tbody>
</table>
### Table A-7. 2019 North Carolina Vehicle Mix Data

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Fraction of VMT on Facility Type by Vehicle Type (each column should sum to 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11</td>
</tr>
<tr>
<td>1</td>
<td>0.2891</td>
</tr>
<tr>
<td>2</td>
<td>0.1023</td>
</tr>
<tr>
<td>3</td>
<td>0.3408</td>
</tr>
<tr>
<td>4</td>
<td>0.1051</td>
</tr>
<tr>
<td>5</td>
<td>0.0483</td>
</tr>
<tr>
<td>6</td>
<td>0.0335</td>
</tr>
<tr>
<td>7</td>
<td>0.0033</td>
</tr>
<tr>
<td>8</td>
<td>0.0028</td>
</tr>
<tr>
<td>9</td>
<td>0.0021</td>
</tr>
<tr>
<td>10</td>
<td>0.0075</td>
</tr>
<tr>
<td>11</td>
<td>0.0088</td>
</tr>
<tr>
<td>12</td>
<td>0.0096</td>
</tr>
<tr>
<td>13</td>
<td>0.0343</td>
</tr>
<tr>
<td>14</td>
<td>0.0052</td>
</tr>
<tr>
<td>15</td>
<td>0.0026</td>
</tr>
<tr>
<td>16</td>
<td>0.0047</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>1</td>
</tr>
</tbody>
</table>

### 3.2.7 TEMPERATURE AND RELATIVE HUMIDITY DATA

Local temperature and humidity data are required inputs for the MOVES model. The 2019 average July 24-hour temperature and humidity profiles, based on data from the Automated Surface Observing Systems at the airports listed in Table A-8 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-8. Weather Stations and Counties

<table>
<thead>
<tr>
<th>Weather Station</th>
<th>Station ID</th>
<th>Counties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fayetteville Regional Airport</td>
<td>KFAY</td>
<td>Lee</td>
</tr>
<tr>
<td>Piedmont Triad International Airport</td>
<td>KGSO</td>
<td>Rockingham</td>
</tr>
<tr>
<td>Wilmington International Airport</td>
<td>KILM</td>
<td>Onslow</td>
</tr>
</tbody>
</table>
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-9. The DAQ developed source type population input tables from the 2019 county-level vehicle registration dataset described in Section 3.2.2. The original data were processed as described below to provide source type population data to accurately represent the correct source types.

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 3.3.2.

Table A-9. MOVES Source Types and HPMS Vehicle Types

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

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. Program coverage was subsequently reduced to 22 counties. All LDGV (designated in MOVES as source type IDs 21, 31, and 32) are subject to the program. For the emissions inventory period modeled (2022 July weekday), the vehicle model years covered included vehicles from the latest 20 model years (i.e., 2003 - 2022), with an exemption for vehicles from the three newest model years (i.e., 2020, 2021, and 2022) 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 is typically applied to the newest vehicles in the fleet. Table A-10 lists the current applicable I&M program parameters, which were used for all MOVES modeling runs.

Table A-10. Inspection and Maintenance Program Parameters

<table>
<thead>
<tr>
<th>I&amp;M Parameter</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Years Covered</td>
<td>20 latest model years (2003 \text{–} 2022)</td>
</tr>
<tr>
<td>Compliance Rate</td>
<td>96%</td>
</tr>
<tr>
<td>Waiver Rate</td>
<td>5%</td>
</tr>
<tr>
<td>Number of Latest Model</td>
<td>3</td>
</tr>
<tr>
<td>Years Exempted</td>
<td>(2020 \text{–} 2022)</td>
</tr>
</tbody>
</table>

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 parts per million (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

County-level annual average daily VMT (AADVMT) data from North Carolina HPMS datasets were used to develop MOVES VMT input data. The 2022 VMT data for each county were derived from 2019 VMT data, using growth factors developed by linear regression analysis of county-level HPMS AADVMT datasets from 2009 through 2019.
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, were applied to ensure the data meet 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 quality assurance 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 <ProjectName_cFIPSyYYYY_HPMS_I&M>.mrs
- MOVES input databases – compressed archives of MOVES MySQL input databases with file names in the format <ProjectName_cFIPSyYYYY_I&M>_cdb.zip
- MOVES output databases – compressed archives of MOVES MySQL output databases with file names in the format <ProjectName_cFIPSyYYYY_I&M>_out.zip

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

- ProjectName – internal name used to identify the MOVES modeling project
- FIPS - the 5-digit state-county Federal Information Processing Standard (FIPS) number for the county modeled
- YYYY – calendar year modeled
- HPMS – indicates HPMS as source of VMT data
- 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, “IMProgramChangesHB85_c37133y2022_HPMS_9653_20MY” specifies MOVES model run within the project labelled “IMProgramChangesHB85” for Onslow County, NC (FIPS 37133) for CY 2022, with HPMS VMT data, with 96% I&M compliance rate, 5% waiver rate, and the 3 latest model year vehicles exempted from I&M requirements, and with I&M coverage of the 20 latest model year vehicles. Similarly, a file name with “IMProgramChangesHB85_c37157y2022_HPMS_NOIM” specifies a model run for Rockingham County, NC (FIPS 37157) for 2022 with no I&M requirements. Table A-11 lists the files provided.
## Table A-11. MOVES Modeling Files Provided

<table>
<thead>
<tr>
<th>County</th>
<th>Modeling Scenario</th>
<th>File Type</th>
<th>File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>With I&amp;M Program</td>
<td>Run Spec File</td>
<td>IMPROgramChangesHB85_c37105y2022_HPMS_9653_20MY.mrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Input</td>
<td>IMPROgramChangesHB85_c37105y2022_HPMS_9653_20MY_cdb.zip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Output</td>
<td>IMPROgramChangesHB85_c37105y2022_HPMS_9653_20MY_out.zip</td>
</tr>
<tr>
<td>Lee</td>
<td>Without I&amp;M Program</td>
<td>Run Spec File</td>
<td>IMPROgramChangesHB85_c37105y2022_HPMS_NOIM_90.mrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Input</td>
<td>IMPROgramChangesHB85_c37105y2022_HPMS_NOIM_cdb.zip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Output</td>
<td>IMPROgramChangesHB85_c37105y2022_HPMS_NOIM_out.zip</td>
</tr>
<tr>
<td>Onslow</td>
<td>With I&amp;M Program</td>
<td>Run Spec File</td>
<td>IMPROgramChangesHB85_c37133y2022_HPMS_9653_20MY.mrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Input</td>
<td>IMPROgramChangesHB85_c37133y2022_HPMS_9653_20MY_cdb.zip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Output</td>
<td>IMPROgramChangesHB85_c37133y2022_HPMS_9653_20MY_out.zip</td>
</tr>
<tr>
<td>Onslow</td>
<td>Without I&amp;M Program</td>
<td>Run Spec File</td>
<td>IMPROgramChangesHB85_c37133y2022_HPMS_NOIM.mrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Input</td>
<td>IMPROgramChangesHB85_c37133y2022_HPMS_NOIM_cdb.zip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Output</td>
<td>IMPROgramChangesHB85_c37133y2022_HPMS_NOIM_out.zip</td>
</tr>
<tr>
<td>Rockingham</td>
<td>With I&amp;M Program</td>
<td>Run Spec File</td>
<td>IMPROgramChangesHB85_c37157y2022_HPMS_9653_20MY.mrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Input</td>
<td>IMPROgramChangesHB85_c37157y2022_HPMS_9653_20MY_cdb.zip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Output</td>
<td>IMPROgramChangesHB85_c37157y2022_HPMS_9653_20MY_out.zip</td>
</tr>
<tr>
<td>Rockingham</td>
<td>Without I&amp;M Program</td>
<td>Run Spec File</td>
<td>IMPROgramChangesHB85_c37157y2022_HPMS_NOIM.mrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Input</td>
<td>IMPROgramChangesHB85_c37157y2022_HPMS_NOIM_cdb.zip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOVES Output</td>
<td>IMPROgramChangesHB85_c37157y2022_HPMS_NOIM_out.zip</td>
</tr>
</tbody>
</table>
FINAL

Appendix B

Nonroad Mobile Sources

Emission Inventory Documentation

Clean Air Act Section 110(l) Noninterference Demonstration to Remove Lee, Onslow, and Rockingham Counties from North Carolina’s Motor Vehicle Emissions 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 2022. 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 the United States Environmental Protection Agency (EPA)’s practice for the National Emissions Inventory (NEI) where they are reported at the airports where they are generated.

2.0 SUMMARY OF EMISSIONS

For 2022, Table B-1 displays total nonroad mobile source typical ozone season day NOx and VOC emissions by county.

<table>
<thead>
<tr>
<th>County</th>
<th>Nonroad Model Categories</th>
<th>Freight and Passenger Railways</th>
<th>Class 1 &amp; 2 Commercial Marine Vessels</th>
<th>Class 3 Commercial Marine Vessels</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOx</td>
<td>VOC</td>
<td>NOx</td>
<td>VOC</td>
<td>NOx</td>
</tr>
<tr>
<td>Lee</td>
<td>0.411</td>
<td>0.345</td>
<td>0.126</td>
<td>0.006</td>
<td>-</td>
</tr>
<tr>
<td>Onslow</td>
<td>0.711</td>
<td>1.286</td>
<td>0.000</td>
<td>0.000</td>
<td>0.926</td>
</tr>
<tr>
<td>Rockingham</td>
<td>0.413</td>
<td>0.522</td>
<td>0.486</td>
<td>0.021</td>
<td>-</td>
</tr>
<tr>
<td>Totals</td>
<td>1.535</td>
<td>2.153</td>
<td>0.612</td>
<td>0.027</td>
<td>0.926</td>
</tr>
</tbody>
</table>

Note that "0.000" indicates that emissions are less than this value while "-" indicates that the source category does not exist in the county.

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 2022. As discussed below, separate methodologies were used to estimate 2022 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 methodology.
3.1 NONROAD EQUIPMENT

The EPA includes more than 80 different types of equipment in the MOtor Vehicle Emission Simulator (MOVES) model that was used to estimate nonroad equipment emissions.\(^1\) To facilitate analysis and reporting, EPA groups the equipment types into the following categories:

- Agricultural equipment
- Lawn and garden equipment, commercial
- Airport support equipment
- Logging equipment
- Commercial equipment
- Oil field equipment
- Construction and mining equipment
- Pleasure craft
- Industrial equipment
- Railway maintenance equipment
- Lawn and garden equipment, residential
- Recreational equipment

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

Ozone season day emissions of NOx and VOC were estimated by running the nonroad mobile source module of MOVES2014b. Model runs were performed for each county for 2022. The model runs were developed for a typical July weekday. Default data were used for the input files used in the MOVES2014b Nonroad model. The MOVES RunSpec (MRS) file (wherein all the modeling variables are set) used in the MOVES2014b Nonroad model was tailored to reflect North Carolina-specific information. For reporting purposes, the resulting emissions from the MOVES2014b 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-2 and B-3 for NOx and VOC emissions, respectively.

\footnotesize
Table B-2. Nonroad Equipment: 2022 NOx Emissions (Tons/Day)

<table>
<thead>
<tr>
<th>County</th>
<th>Agriculture</th>
<th>Airport Support</th>
<th>Commercial</th>
<th>Construction</th>
<th>Industrial</th>
<th>Lawn and Garden</th>
<th>Logging</th>
<th>Oil Field</th>
<th>Pleasure Craft</th>
<th>Railway Maintenance</th>
<th>Recreational</th>
<th>County Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>0.047</td>
<td>0.000</td>
<td>0.030</td>
<td>0.135</td>
<td>0.149</td>
<td>0.041</td>
<td>0.002</td>
<td>0.000</td>
<td>0.000</td>
<td>0.001</td>
<td>0.002</td>
<td>0.411</td>
</tr>
<tr>
<td>Onslow</td>
<td>0.129</td>
<td>0.000</td>
<td>0.028</td>
<td>0.185</td>
<td>0.077</td>
<td>0.062</td>
<td>0.003</td>
<td>0.000</td>
<td>0.004</td>
<td>0.000</td>
<td>0.204</td>
<td>0.711</td>
</tr>
<tr>
<td>Rockingham</td>
<td>0.091</td>
<td>0.000</td>
<td>0.029</td>
<td>0.069</td>
<td>0.152</td>
<td>0.045</td>
<td>0.003</td>
<td>0.000</td>
<td>0.013</td>
<td>0.001</td>
<td>0.012</td>
<td>0.413</td>
</tr>
<tr>
<td>Totals</td>
<td>0.267</td>
<td>0.000</td>
<td>0.087</td>
<td>0.389</td>
<td>0.378</td>
<td>0.148</td>
<td>0.008</td>
<td>0.000</td>
<td>0.221</td>
<td>0.001</td>
<td>0.036</td>
<td>1.535</td>
</tr>
</tbody>
</table>

\footnotesize
Table B-3. Nonroad Equipment: 2022 VOC Emissions (Tons/Day)

<table>
<thead>
<tr>
<th>County</th>
<th>Agriculture</th>
<th>Airport Support</th>
<th>Commercial</th>
<th>Construction</th>
<th>Industrial</th>
<th>Lawn and Garden</th>
<th>Logging</th>
<th>Oil Field</th>
<th>Pleasure Craft</th>
<th>Railway Maintenance</th>
<th>Recreational</th>
<th>County Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>0.005</td>
<td>0.000</td>
<td>0.045</td>
<td>0.026</td>
<td>0.030</td>
<td>0.212</td>
<td>0.006</td>
<td>0.000</td>
<td>0.013</td>
<td>0.000</td>
<td>0.008</td>
<td>0.345</td>
</tr>
<tr>
<td>Onslow</td>
<td>0.013</td>
<td>0.000</td>
<td>0.040</td>
<td>0.036</td>
<td>0.008</td>
<td>0.360</td>
<td>0.007</td>
<td>0.000</td>
<td>0.462</td>
<td>0.000</td>
<td>0.359</td>
<td>1.286</td>
</tr>
<tr>
<td>Rockingham</td>
<td>0.009</td>
<td>0.000</td>
<td>0.042</td>
<td>0.013</td>
<td>0.028</td>
<td>0.253</td>
<td>0.007</td>
<td>0.000</td>
<td>0.036</td>
<td>0.000</td>
<td>0.133</td>
<td>0.522</td>
</tr>
<tr>
<td>Totals</td>
<td>0.027</td>
<td>0.000</td>
<td>0.127</td>
<td>0.075</td>
<td>0.066</td>
<td>0.825</td>
<td>0.020</td>
<td>0.000</td>
<td>0.511</td>
<td>0.000</td>
<td>0.500</td>
<td>2.153</td>
</tr>
</tbody>
</table>

3.2 NONROAD VEHICLES

Version 1 of the EPA’s 2016 Emissions Modeling Platform (2016v1) 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 2016v1 platform reports annual emissions in the state. Railroad line-haul locomotives are categorized by size (Class I, Class II/Class III) and by use for passenger service. Class I line-haul railroads are larger in size (consisting of Norfolk Southern Corporation and CSX Corporation in North Carolina) compared to Class II and Class III railroads, which serve more localized markets. Amtrak and the North Carolina Department of Transportation’s Rail Division provide passenger service in the state.


<table>
<thead>
<tr>
<th>SCC</th>
<th>SCC Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2280002101</td>
<td>Marine Vessels, Commercial/Diesel/C1C2 Port emissions: Main Engine</td>
</tr>
<tr>
<td>2280002102</td>
<td>Marine Vessels, Commercial/Diesel/C1C2 Port emissions: Auxiliary Engine</td>
</tr>
<tr>
<td>2280002103</td>
<td>Marine Vessels, Commercial/Diesel/C3 Port emissions: Main Engine</td>
</tr>
<tr>
<td>2280002104</td>
<td>Marine Vessels, Commercial/Diesel/C3 Port emissions: Auxiliary Engine</td>
</tr>
<tr>
<td>2280002201</td>
<td>Marine Vessels, Commercial/Diesel/C1C2 Underway emissions: Main Engine</td>
</tr>
<tr>
<td>2280002202</td>
<td>Marine Vessels, Commercial/Diesel/C1C2 Underway emissions: Auxiliary Engine</td>
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For the CMV and railroad locomotive source categories, the 2016v1 emissions modeling platform represents July emissions estimates for 2023. The 2023 emissions are deemed representative of 2022-year conditions given the uncertainties associated with projecting emissions. The 2016v1 platform underwent extensive reviews and, for this reason, is considered to be the most comprehensive and accurate inventories available at the time that the inventory for this noninterference demonstration was prepared. Documentation of the emissions estimation methods for these categories are available from the Intermountain West Data Warehouse website.\(^3\) July NOx and VOC emissions from the 2016v1 platform were divided by 31 days to estimate average ozone season day emissions. The North Carolina Division of Air Quality (DAQ) believes that dividing July emissions by 31 days provides a reasonable estimate of typical ozone season day nonroad vehicle emissions.

### 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 DAQ staff 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 2016v1 platform underwent extensive quality assurance review prior to the inventory being finalized to support air quality modeling. The detailed quality assurance and quality control procedures and measures, outlined in the DAQ’s Emissions Inventory Quality Assurance Project Plan, were applied to ensure the data meets data quality indicator acceptance criteria.

### 5.0 MOVES2014b 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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</tr>
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<td>Refueling Spillage Loss</td>
</tr>
<tr>
<td>Non-Methane Hydrocarbons</td>
<td>Evap Tank Permeation</td>
</tr>
<tr>
<td>Non-Methane Hydrocarbons</td>
<td>Evap Hose Permeation</td>
</tr>
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</tr>
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Final
Appendix B. Nonroad Mobile Sources Emissions Inventory Documentation
Noninterference Demonstration for Removing Lee, Onslow, and Rockingham Counties from the I&M Program
December 14, 2020
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    sectorname="Airport Support"/>
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    fueltypedesc="Liquefied Petroleum Gas (LPG)"
    sectorid="6"
    sectorname="Commercial"/>
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<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="19" processname="Refueling Spillage Loss"/>
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<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="21" processname="Evap Hose Permeation"/>
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   <distancefactors selected="true" units="Miles"/>
   <massfactors selected="true" units="U.S. Ton"
   energyunits="Joules"/>
</outputfactors>
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</savedata>
<donotexecute>
</donotexecute>
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truncateactivity="true" truncatetablerates="true"/>
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FINAL

Appendix C

Point Sources

Emission Inventory Documentation

Clean Air Act Section 110(l) Noninterference Demonstration to Remove Lee, Onslow, and Rockingham Counties from North Carolina’s Motor Vehicle Emissions 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 2022. The point source inventory consists of emissions from individual facilities (point sources), airports, railyards, and wild and prescribed fires.¹

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 are not required to have air quality permits for construction and aircraft operations (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 the United States Environmental Protection Agency (EPA)’s includes these emissions 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 fire-event activity is defined by geographic coordinates.

2.0 SUMMARY OF EMISSIONS

Table C-1 shows point source typical ozone season day nitrogen oxide (NOx) and volatile organic compound (VOC) emissions by county for 2022.

<table>
<thead>
<tr>
<th>County</th>
<th>Electricity Generating Units (EGUs)</th>
<th>Non-EGU Point</th>
<th>Aircraft</th>
<th>Wild and Prescribed Fires</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOx</td>
<td>VOC</td>
<td>NOx</td>
<td>VOC</td>
<td>NOx</td>
</tr>
<tr>
<td>Lee</td>
<td>-</td>
<td>-</td>
<td>0.110</td>
<td>0.721</td>
<td>0.007</td>
</tr>
<tr>
<td>Onslow</td>
<td>-</td>
<td>-</td>
<td>0.620</td>
<td>0.412</td>
<td>0.127</td>
</tr>
<tr>
<td>Rockingham</td>
<td>2.043</td>
<td>0.136</td>
<td>1.182</td>
<td>1.333</td>
<td>0.002</td>
</tr>
<tr>
<td>Totals</td>
<td>2.043</td>
<td>0.136</td>
<td>1.912</td>
<td>2.466</td>
<td>0.136</td>
</tr>
</tbody>
</table>

¹ Note that railyards are another source category that EPA includes in their platform as a point source that is traditionally considered a nonroad mobile source. Because there are no railyards in the counties that are the subject of this noninterference demonstration, this category is not otherwise addressed in the document.
3.0 METHODOLOGY

The section discusses the methodologies applied to develop the emissions inventory for the EGU, non-EGU point, airports, and wild and prescribed fires source categories.

3.1 ELECTRICITY GENERATING UNITS

Two EGUs are located in Rockingham County (see Table C-2). No EGUs are located in Lee or Onslow Counties. For the purpose of this inventory, EGUs are defined as those with a generating capacity greater than or equal to 25 megawatts (MW) and report hourly NOx emissions to EPA’s Air Markets Program Data (AMPD). These EGUs also report annual criteria pollutant emissions (including NOx and VOC) to the DAQ annually. Table C-2 lists the EGUs in Rockingham County. The methods for projecting 2023 emissions for these sources are discussed below.

### Table C-2. EGUs in Rockingham County

<table>
<thead>
<tr>
<th>Facility</th>
<th>Boiler ID</th>
<th>Fuel Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dan River</td>
<td>8C, 9C</td>
<td>Combined Cycle Gas</td>
</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT1, CT2, CT3, CT4, CT5</td>
<td>Simple Cycle Gas</td>
</tr>
</tbody>
</table>

Year 2022 emissions were not readily available for EGUs. However, the Eastern Regional Technical Advisory Committee (ERTAC) has developed NOx emissions projections using 2016 continuous emissions monitoring (CEM) data as the base year to develop a 2023 projection year inventory (ERTAC v16.1). The DAQ reviewed the 2023 projections for the Dan River and Rockingham County Combustion Turbine facilities and determined that the 2023 NOx projections are representative of 2022 ozone season day emissions for the two facilities. The DAQ downloaded 2016 daily NOx emissions for the month of July from EPA’s AMPD, which is available via EPA website, and counted the number of days each unit operated in July 2016. The 2023 daily average NOx emissions were calculated for each EGU by dividing the total 2023 ERTAC v16.1 projected NOx emissions for the month of July by the number of days the unit operated in July of 2016. See table C-3 for details on these calculations.

---

Table C-3. EGU Source NOx Emissions Calculation

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>unit id</th>
<th>ERTAC v16.1 2023 July NOx Emissions (Tons)</th>
<th>Operating Days</th>
<th>2023 Avg. July Daily NOx Emissions (Tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dan River</td>
<td>8C</td>
<td>5.190</td>
<td>31</td>
<td>0.168</td>
</tr>
<tr>
<td>Dan River</td>
<td>9C</td>
<td>5.192</td>
<td>31</td>
<td>0.167</td>
</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT1</td>
<td>7.862</td>
<td>24</td>
<td>0.328</td>
</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT2</td>
<td>6.376</td>
<td>19</td>
<td>0.336</td>
</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT3</td>
<td>7.088</td>
<td>21</td>
<td>0.338</td>
</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT4</td>
<td>5.634</td>
<td>15</td>
<td>0.376</td>
</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT5</td>
<td>5.975</td>
<td>18</td>
<td>0.332</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>2.043*</td>
</tr>
</tbody>
</table>

*The unit-level values do not sum to the total due to rounding.

For VOC emissions, the 2023 daily average VOC emission were calculated for each EGU by dividing the total 2023 ERTAC v16.1 projected annual emissions by 365. The DAQ believes that dividing annual VOC emissions by 365 days per year provides a reasonable estimate of typical ozone season day emissions since the affected units operate consistently across the year. See table C-4 for details on these calculations.

Table C-4. EGU Sources VOC Emission Calculation

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>unit id</th>
<th>ERTAC v16.1 2023 Annual VOC Emissions (ton)</th>
<th>Operating days</th>
<th>2023 Avg. July Daily VOC Emissions (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dan River</td>
<td>8C</td>
<td>18.359</td>
<td>365</td>
<td>0.050</td>
</tr>
<tr>
<td>Dan River</td>
<td>9C</td>
<td>18.331</td>
<td>365</td>
<td>0.050</td>
</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT1</td>
<td>2.596</td>
<td>365</td>
<td>0.007</td>
</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT2</td>
<td>2.602</td>
<td>365</td>
<td>0.007</td>
</tr>
<tr>
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<td>CT3</td>
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<td>365</td>
<td>0.007</td>
</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT4</td>
<td>2.588</td>
<td>365</td>
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</tr>
<tr>
<td>Rockingham County Combustion Turbine</td>
<td>CT5</td>
<td>2.614</td>
<td>365</td>
<td>0.007</td>
</tr>
<tr>
<td>Total</td>
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<td></td>
<td></td>
<td>0.136*</td>
</tr>
</tbody>
</table>

*The unit-level values do not sum to the total due to rounding.

3.2 NON-EGU POINT SOURCES, AIRPORTS, AND WILD/PRESCRIBED FIRES

Emissions estimates for 2022 are not available for the non-EGU point source categories. Therefore, the overall approach was to use 2023-year emissions for these source categories, as well as for the airports and wild and prescribed fires source categories. For all of these source categories, 2023 was the closest year of emissions available from EPA’s 2016v1 Emissions
Modeling Platform. The 2016v1 platform was created from a collaboration between more than 245 employees of state and regional air agencies, EPA, and Federal Land Management agencies utilizing the most up-to-date modeling and data sources. The platform is generally considered to provide the most comprehensive and accurate inventories available at the time that this noninterference demonstration was prepared. Because of the difficulty with predicting wild and prescribed fires activity in the future, EPA held 2016 emissions constant to represent 2023 emissions in the 2016v1 modeling platform inventory. Year 2023 July NOx and VOC emissions from EPA’s platform inventory were divided by 31 days to estimate typical ozone season day emissions. The DAQ believes that dividing July emissions by the 31 days in the month provides a reasonable estimate of typical ozone season day emissions for non-EGU point sources.

4.0 QUALITY ASSURANCE MEASURES

The 2016v1 modeling platform inventory and ERTAC v16.1 modeling underwent extensive quality assurance and review prior to the inventory being finalized. The detailed quality assurance and quality control procedures and measures, as outlined in the DAQ’s Emissions Inventory Quality Assurance Project Plan, were applied to ensure the data meets data quality indicator acceptance criteria.

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4 Details on the methods used to develop this platform are available from the Inventory Collaborative 2016v1 Emissions Modeling Platform Wiki website: http://views.cira.colostate.edu/wiki/wiki/10202.
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Appendix D

Area Sources

Emission Inventory Documentation

Clean Air Act Section 110(l) Noninterference Demonstration to Remove Lee, Onslow, and Rockingham Counties from North Carolina’s Motor Vehicle Emissions Inspection and Maintenance (I&M) Program
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Table D-2. Area Source Categories with NOx and/or VOC Emissions in Lee, Onslow, and Rockingham Counties.............................................................. 2
1.0 INTRODUCTION AND SCOPE

This appendix presents the data sources, methods, and results used to develop the area source emissions inventory for 2022. 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 are 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 nitrogen oxide (NOx) and volatile organic compound (VOC) emissions for 2022 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 2022 (Tons/Day)

<table>
<thead>
<tr>
<th>County</th>
<th>NOx</th>
<th>VOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee</td>
<td>0.464</td>
<td>2.820</td>
</tr>
<tr>
<td>Onslow</td>
<td>0.171</td>
<td>4.360</td>
</tr>
<tr>
<td>Rockingham</td>
<td>0.358</td>
<td>4.265</td>
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<td><strong>Total</strong></td>
<td><strong>0.993</strong></td>
<td><strong>11.445</strong></td>
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</table>

3.0 METHODOLOGY

The 2022 area source emissions inventory is based on 2023 projected emissions the United States Environmental Protection Agency (EPA)’s 2016 2016v1 Emissions Modeling Platform. The 2023 emissions are deemed representative of 2022-year conditions given the uncertainties associated with projecting area source emissions. The 2016v1 modeling platform has undergone extensive reviews and, for this reason, is considered to be the most comprehensive and accurate emissions data 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 the 2016v1 modeling platform for Lee, Onslow, and Rockingham Counties.

---

<table>
<thead>
<tr>
<th>SCC</th>
<th>DESCRIPTION</th>
<th>Lee NOx</th>
<th>Lee VOC</th>
<th>Onslow NOx</th>
<th>Onslow VOC</th>
<th>Rockingham NOx</th>
<th>Rockingham VOC</th>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2102006000</td>
<td>Stationary Source Fuel Combustion; Industrial; Natural Gas; Total: Boilers and IC Engines</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2102008000</td>
<td>Stationary Source Fuel Combustion; Industrial; Wood; Total: All Boiler Types</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2102011000</td>
<td>Stationary Source Fuel Combustion; Industrial; Kerosene; Total: All Boiler Types</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2103002000</td>
<td>Stationary Source Fuel Combustion; Commercial/Institutional; Bituminous/Subbituminous Coal; Total: All Boiler Types</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2103004001</td>
<td>Stationary Source Fuel Combustion; Commercial/Institutional; Distillate Oil; Boilers</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2103004002</td>
<td>Stationary Source Fuel Combustion; Commercial/Institutional; Distillate Oil; IC Engines</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2103005000</td>
<td>Stationary Source Fuel Combustion; Commercial/Institutional; Residual Oil; Total: All Boiler Types</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>2103007000</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2103008000</td>
<td>Stationary Source Fuel Combustion; Commercial/Institutional; Wood; Total: All Boiler Types</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2103011000</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
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<td>Stationary Source Fuel Combustion; Residential; Distillate Oil; Total: All Combustor Types</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2104006000</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2104007000</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>2104008100</td>
<td>Stationary Source Fuel Combustion; Residential; Wood; Fireplace: general</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2104008210</td>
<td>Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; non-EPA certified</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2104008220</td>
<td>Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; EPA certified; non-catalytic</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>2104008230</td>
<td>Stationary Source Fuel Combustion; Residential; Wood; Woodstove: fireplace inserts; EPA certified; catalytic</td>
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<td>Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, non-EPA certified</td>
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<td>Stationary Source Fuel Combustion; Residential; Wood; Woodstove: freestanding, EPA certified, catalytic</td>
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<td>Stationary Source Fuel Combustion; Residential; Wood; Woodstove: pellet-fired, general (freestanding or FP insert)</td>
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<td>2104008510</td>
<td>Stationary Source Fuel Combustion; Residential; Wood; Furnace: Indoor, cordwood-fired, non-EPA certified</td>
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<td>Rockingham NOx</td>
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<td>2104008610</td>
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<td>2401025000</td>
<td>Solvent Utilization; Surface Coating; Metallic Coatings; Total: All Solvent Types</td>
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<td>Solvent Utilization; Degreasing; All Processes/All Industries; Total: All Solvent Types</td>
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<td>2420000000</td>
<td>Solvent Utilization; Dry Cleaning; All Processes; Total: All Solvent Types</td>
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<td>2460100000</td>
<td>Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; All Personal Care Products; Total: All Solvent Types</td>
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<td>Lee VOC</td>
<td>Onslow NOx</td>
<td>Onslow VOC</td>
<td>Rockingham NOx</td>
<td>Rockingham VOC</td>
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<td>2460200000</td>
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<td>Solvent Utilization; Miscellaneous Non-industrial: Consumer and Commercial; Miscellaneous Products (Not Otherwise Covered); Total: All Solvent Types</td>
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<td>Storage and Transport; Petroleum and Petroleum Product Storage; Residential Portable Gas Cans; Evaporation (includes Diurnal losses)</td>
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<td>Lee VOC</td>
<td>Onslow NOx</td>
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<td>2805009100</td>
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<td>Miscellaneous Area Sources; Agriculture Production - Livestock; Horses and Ponies Waste Emissions; Not Elsewhere Classified</td>
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<td>Miscellaneous Area Sources; Agriculture Production - Livestock; Sheep and Lambs Waste Emissions; Total</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>2805025000</td>
<td>Miscellaneous Area Sources; Agriculture Production - Livestock; Swine production composite; Not Elsewhere Classified (see also 28-05-039,-047,-053)</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>2805010100</td>
<td>Miscellaneous Area Sources; Agriculture Production - Livestock; Poultry production - turkeys; Confinement</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>2810025000</td>
<td>Miscellaneous Area Sources; Other Combustion; Charcoal Grilling - Residential (see 23-02-002-xxx for Commercial); Total</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>2810060100</td>
<td>Miscellaneous Area Sources; Other Combustion; Cremation; Humans</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>
Monthly emissions for area sources were obtained from the 2016v1 modeling platform from the file “2016fh_county_monthly_report_CAPs_PEC_POC_22jan2020.xlsx.” The July NOx and VOC emissions from the 2016v1 modeling platform were divided by 31 days to estimate ozone season day emissions. The North Carolina Division of Air Quality (DAQ) believes that average July day area source emissions provide a reasonable estimate of typical ozone season day area source emissions.

4.0 QUALITY ASSURANCE MEASURES

The 2016v1 modeling platform emissions underwent extensive quality assurance and stakeholder review prior to the inventory being finalized. The detailed quality assurance and quality control procedures and measures, as outlined in the DAQ’s Emissions Inventory Quality Assurance Project Plan, were applied to ensure the data meets data quality indicator acceptance criteria.

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FINAL

Appendix E

North Carolina Department of Environmental Quality
Public Notice and EPA No Comment Letter

Clean Air Act Section 110(l) Noninterference
Demonstration to Remove Lee, Onslow, and
Rockingham Counties from North Carolina’s Motor
Vehicle Emissions Inspection and Maintenance (I&M)
Program
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The North Carolina Department of Environmental Quality, Division of Air Quality (DAQ), hereby gives notice regarding its Pre-hearing Draft of the State Implementation Plan (SIP) Revision and Clean Air Act (CAA) Section 110(l) Noninterference Demonstration to Remove Lee, Onslow, and Rockingham Counties from North Carolina’s Motor Vehicle Emissions Inspection and Maintenance (I&M) Program. Session Law 2020-5 amended North Carolina General Statute (NCGS) §143-215.107A(c) to remove Lee, Onslow, and Rockingham Counties from North Carolina’s I&M Program. Based on a technical study of county-level emissions increases associated with the proposed I&M program change, and current ambient air quality data, the DAQ concludes that removing the three counties from the I&M SIP will not interfere with continued attainment or maintenance of any applicable NAAQS. With these submittals, the DAQ is requesting EPA’s approval to remove Lee, Onslow, and Rockingham Counties from North Carolina’s I&M SIP, which is a required before North Carolina can officially remove the counties from the I&M program. Persons wishing to submit comments or request a public hearing are invited to do so.

Any person wishing to comment may submit a written statement for inclusion in the record of proceedings regarding the Pre-hearing Draft of the SIP Revision and CAA Section 110(l) Noninterference Demonstration to remove Lee, Onslow, and Rockingham Counties from North Carolina’s I&M Program. Written comments should be submitted electronically or postmarked no later than Monday, December 7, 2020.

Requests for a public hearing must be in writing and include a statement supporting the need for such a hearing, an indication of your interest in the subject, and a brief summary of the information intended to be offered. In order to address current guidance to help minimize the spread of COVID-19, a digital public hearing via Cisco’s WebEx teleconferencing service will be scheduled if a public hearing is requested. A separate notice will be announced for the hearing including the date, time, and methods to access the WebEx meeting. Written requests for a public hearing should be postmarked or submitted electronically no later than Wednesday, November 18, 2020.

Copies of the Pre-hearing Draft of the State Implementation Plan (SIP) Revision and Clean Air Act (CAA) Section 110(l) Noninterference Demonstration to Remove Lee, Onslow, and Rockingham Counties from North Carolina’s Motor Vehicle Emissions Inspection and Maintenance (I&M) Program may be downloaded from the DAQ website at https://deq.nc.gov/about/divisions/air-quality/air-quality-planning/state-implementation-plans-sips/inspection-and. Comments or requests for a public hearing can be submitted to: daq.publiccomments@ncdenr.gov (Please type “Remove 3 Counties from I&M Program” in the subject line)

Alternatively, comments or requests for a public hearing can be mailed or faxed to:
Randy Strait Fax: (919) 715-0718
NC Division of Air Quality
1641 Mail Service Center
Raleigh, NC 27699-1641

Based on the current guidance to minimize the spread of COVID-19, all DAQ office locations are limiting public access to appointments only. As such, the Pre-Hearing Draft of the demonstration may only be reviewed in person after making an appointment at the following DAQ offices:

- Raleigh Central Office, Planning Section (919) 707-8403
- Raleigh Regional Office (919) 791-4274
- Wilmington Regional Office (910) 796-7215
- Winston-Salem Regional Office (336) 776-9800

Date: 11/3/20

Michael A. Abraczinskas, DAQ Director
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December 7, 2020

Mr. Michael Abraszinskas, Director  
Division of Air Quality  
North Carolina Department of Environmental Quality  
1641 Mail Service Center  
Raleigh, North Carolina 27699-1641  

Dear Mr. Abraszinskas:  

Thank you for your letter dated November 4, 2020, transmitting a prehearing package regarding the Pre­hearing Draft SIP Revision and Clean Air Act 110(l) Noninterference Demonstration to Remove Lee, Onslow, and Rockingham Counties from North Carolina’s I&M Program. If requested, these revisions will be the subject of a public hearing via Cisco’s WebEx teleconference. We have completed our review of the submittal and offer no comments at this time.  

We look forward to continuing to work with you and your staff. If you have any questions, please contact Ms. Jane Spann, Acting Chief, Air Regulatory Management Section at (404) 562-9029, or your staff contact Mr. Evan Adams at (404) 562-9009.  

Sincerely,  

Lynorae Benjamin  
Acting Chief  
Air Planning and Implementation Branch  

cc: Randy Strait, DAQ  
Patrick Knowlson, DAQ