

**Appendix B**

**Emissions Inventory**

**Documentation**

## **Appendix B.2**

### **Area Source**

# **Emissions Inventory Documentation**

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## List of Acronyms

<u>Acronym</u>	<u>Definition</u>
CARB	California Air Resource Board
EIIP	Emissions Inventory Improvement Program
E-GAS 5.0	Economic Growth Analysis System version 5.0
LPG	Liquid Petroleum Gas
MSW	Municipal Solid Waste
NAICS	North American Industry Classification System
NCDAQ	North Carolina Division of Air Quality
NCDFR	North Carolina Division of Forest Resources
NCDOT	North Carolina Department of Transportation
NCSU	North Carolina State University
NG	Natural Gas
NO <sub>x</sub>	Nitrogen Oxides
SAF	Seasonal Adjustment Factor
SIC	Standard Industrial Classification
USEPA	U.S. Environmental Protection Agency
USFA	U.S. Fire Administration
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

## **1.0 INTRODUCTION AND SCOPE**

Area sources represent a collection of many small, unidentified points of air pollution emissions within a specified geographical area, emitting less than the minimum level 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 area sources emissions inventory has been developed in order to meet the requirement of the 1997 8-hour ozone standard implementation rule, which states that areas that were maintenance for the 1-hour ozone standard have to submit a 110(a)(1) maintenance plan within 3-years of being designated as attainment. The Greensboro/Winston-Salem/High Point, North Carolina 1-hour maintenance area, referred to as the Triad area, meets the conditions that require a 110(a)(1) maintenance plan. The Triad area includes Davidson, Forsyth, and Guilford Counties and part of Davie County. For the purpose of this maintenance plan, emissions are estimated for all of Davie County. All emissions are calculated on a ton per summer day basis.

## **2.0 OVERALL METHODOLOGY**

### **2.1 SOURCE CATEGORY IDENTIFICATION**

The area source categories were identified from two U. S. Environmental Protection Agency (USEPA) guidance documents: EPA-450/4-91-016, Procedures for the Preparation of Emission Inventories of Carbon Monoxide and Precursors of Ozone, Vol. 1, hereafter Procedures, and the Emissions Inventory Improvement Program (EIIP) Technical Reports, Vol. 3, Area Sources<sup>1</sup> as of December 2002 (the most current version at the time of the inventory development), hereafter EIIP Tech. Report.

### **2.2 EMISSION ESTIMATION APPROACH**

Area source emissions are estimated by multiplying an emission factor by some known indicator of collective activity for each source category within the inventory area. An indicator is any parameter associated with the activity level of a source that can be correlated with the air pollutant emissions from that source, such as production, number of employees, or population.

In general, one of the following emissions estimation approaches is used to calculate the area source emissions: per capita emission factors, employment-related emission factors, commodity

consumption-related emission factors, and level of activity based emission factors. The emission factors used were obtained from the EIIP Tech. Report, the USEPA’s AP-42 Compilation of Air Pollutant Emission Factors, 5<sup>th</sup> Edition, referred to as AP-42 or the methodologies outlined by E.H. Pechan & Associates, Inc. based on the ongoing emission factor development work conducted by the Eastern Regional Technical Advisory Group (ERTAC) in conjunction with the USEPA.

There are several methods for estimating the activity level for a specific area source category. These are: treating area sources as point sources, surveying local activity levels, apportioning national or statewide activity totals to local inventory areas, or using population and employment data. All of these methods were used to estimate the area source emissions. The base year for the emissions inventory is 2007, the interim year is 2011 and the future year is 2018.

Many of the categories for the area source emissions use population and employment for the activity data. The 2007 population data was obtained from the North Carolina Office of State and Budget Management. The projected population for the interim year, 2011, and the future year, 2018, was also obtained from the North Carolina Office of State and Budget Management.

Table 2.2-1 contains the 2007 population for the Triad maintenance area for 2007, 2011 and 2018.

**Table 2.2-1 Population Data**

COUNTY	2007	2011	2018
Davidson	155,929	163,528	174,869
Davie	40,306	43,075	47,704
Forsyth	337,612	367,093	407,229
Guilford	459,199	490,771	542,623

For creating projected future year emissions for many source categories, the emissions estimations are based on population. The population growth factors are developed based on the ratio of the base year (2007) population to the future years (2011 and 2018) population, see equation 2.2-1.

$$\text{Population Growth Factors} = \frac{\text{FY}_{\text{pop}}}{\text{BY}_{\text{pop}}} \quad 2.2-1$$

where:

$BY_{pop}$  = 2007 population per county

$FY_{pop}$  = future year population per county

These growth factors are listed in Table 2.2-2.

**Table 2.2-2 Population Growth Factors**

COUNTY	2011	2018
Davidson	1.049	1.121
Davie	1.069	1.184
Forsyth	1.087	1.206
Guilford	1.069	1.182

Certain emission categories were adjusted for such things as season or rule effectiveness and rule penetration. These are discussed in the particular source categories descriptions.

For certain categories, there can be overlap between the point source emissions and the area source emissions calculated with emission factors. The 2007 point source emissions in these categories were identified so that they could be subtracted where appropriate.

There are a number of categories where emissions were calculated with emission factors based on employment. These emission factors were developed by the USEPA when employment statistics were organized by Standard Industrial Classification (SIC) code. However, since 1997, employment statistics are organized by the North American Industry Classification System (NAICS). For the solvent cleaning industries, the SIC codes do not directly correspond to single NAICS code. Sometimes several partial NAICS employment values will relate to a SIC code. A crosswalk was used to determine what percentage of a NAICS employment value would correspond to the SIC codes. It should be noted that the crosswalk is based on national totals and is not specific to any particular state.

The employment numbers were obtained from the on-line 2007 County Business Patterns for the various NAICS codes at the county level for North Carolina. In addition to having employment values (or employment ranges due to confidentiality rules) by NAICS, the County Business Patterns breaks down the number of facilities by employment categories. The employment

categories are 1 – 4, 5 – 9, 10 – 19, 20 – 49, 50 – 99, 100 – 249, 250 – 499, 500 – 999, >1000 employees. To account for point sources, it was assumed that facilities with 100 employees or greater were point sources and were not considered in the calculations.

When a NAICS category gave a number of employees and there were no establishments with 100 employees or greater, then the value was used, however, in most cases the US Census Bureau, County Business Patterns gave a range of total employees in the county instead of the actual number. When this occurred, facility sizes were considered and the mid-range of employees was assumed, in accordance with the EIIP Tech. Report. For example, a NAICS category for a county had a range of employment of 100-249 with two establishments with 1-4 employees, one with 20-49 employees, and one with 100-249 employees. Assuming 3 to be the mid-range of 1-4 and 35 to be the mid-range of 20-49, the employment used for the area source calculation was estimated as:

$$(2 \times 3) + (1 \times 35) = 41 \text{ employees}$$

The larger establishment was assumed to be a point source and not taken into consideration for the area source calculation.

If a total number of employees was provided and there were establishments with 100 employees or greater, then the mid-range of the smaller facilities were used as described above. The estimated employment was compared to the value given to ensure that the remainder would account for the large establishment. In cases where the remainder would not be enough employment to account for the larger establishment, the area source employment was adjusted down. For example, a NAICS category had 250 employees with one establishment with 20–49 employees (mid-range 35), two establishments with 50–99 employees (mid-range 75), and one establishment with 100–249 employees. The employment estimated for the area source and the remainder employment was estimated as:

$$(1 \times 35) + (2 \times 75) = 185 \text{ employees}$$

$$250 - 185 = 65 \text{ employees}$$

The remainder of 65 employees is not enough to account for an establishment of 100–249 employees. Therefore, the area source employment was adjusted down by 35 so that there were 100 employees remaining to account for the large establishment.

### **3.0 QUALITY ASSURANCE MEASURES**

The first step in the quality assurance process is to develop a list of area sources applicable to the maintenance area. The Procedures document and the EIIP Tech. Report were the primary references used in preparing this list for the emissions inventory. Next, measures to ensure valid emission estimates were employed were verified using the guidance provided by the document EPA-450/4-88-023, the EPA Quality Assurance Document for Post-1987 SIP Emission Inventories. Since many of the emission estimates are based on the emission factors provided in the AP-42, the Procedures document or the EIIP Tech. Report, sources of error would primarily be associated with the emission factors and the accuracy of the emission calculations.

Under the direction of the quality assurance coordinator, emission sources whose contribution was either at the high or low end of the range of estimates were scrutinized more closely for reasonableness. The accuracy was addressed by performing independent checks of the emissions calculations, verifying the activity data and emission factors as well as plotting all of the area source categories vs. pollutants.

### **4.0 DISCUSSION OF AREA SOURCE CATEGORIES**

There are five major area source categories comprised of a number of individual types of area sources. Sections 4.1 through 4.5 addresses each of these categories and include a number of subsections that correspond to the corresponding category. The objective of each subsection is to describe each category and the emission estimation and/or projection procedures.

#### **4.1 GASOLINE DISTRIBUTION**

The area source emissions attributed to this category are associated with various operations related to gasoline and aircraft fuel handling and distribution. Since tank farms and bulk plants are specifically addressed in the point source inventory, the area source category is limited to fuel handling, storage, and distribution operations associated with the service stations and in the refueling of aircrafts.

##### **4.1.1 Gasoline Dispensing Facilities**

Since service stations are so numerous, they are collectively considered as an area source. The area source emissions that are derived for this subsection involve determining the estimated emissions that occur at each of the following operations: 1) losses during storage tank filling, 2) storage tank breathing and working losses and 3) truck transit losses. The emissions from

vehicle refueling are captured in the on-road mobile source emissions inventory and therefore are not estimated as part of the area sources inventory.

As part of the air toxics program, Stage I controls for gasoline dispensing facilities was adopted by the State, effective May 1990 with final compliance by January 1, 1994. Stage I is the vapor recovery technology on the underground storage tanks and reduces the emissions during the tank filling operations at service stations.

The North Carolina Department of Agriculture, Standards Division is responsible for going to all gasoline dispensing facilities and testing the fuels to ensure that it meets the quality standards of the State. The North Carolina Division of Air Quality (NCDAQ) has worked out an agreement with the Standards Division to also check for Stage I controls. A notice is sent to the NCDAQ for every facility checked by the Standards Division verifying if a facility has properly maintained control equipment. If a facility is found to not be properly maintaining the control equipment, then the NCDAQ sends a notice of violation informing the facility that the controls are required and gives the facility time to correct the violation before fines are assessed. From this information the rule effectiveness and rule penetration can be estimated. The rule effectiveness is the percentage of facilities complying with the rule and the rule penetration is the percentage of facilities requiring Stage I controls. Control efficiency is the expected percent reduction from this control technology. The compliance and rule effectiveness rates for Stage I controls for the Triad maintenance area were obtained from the Winston-Salem region Stage I vapor recovery reports supplied by the Mobile Sources Compliance Branch, North Carolina Division of Air Quality. The control efficiency rate, 0.95, is a conservative estimate used for the entire State. The Stage I compliance factors are listed in Table 4.1.1-1.

**Table 4.1.1-1 Compliance Factors for Stage I Controls**

Rule Effectiveness	Rule Penetration	Control Efficiency
0.99	0.99	0.95

Delivery to Outlets-Underground Storage Tanks-Stage I Balanced Submerged Filling Stage I controls capture the displacement of gasoline vapors from the storage tanks during the transfer of gasoline from tank trucks to storage tanks at the service station. The emissions calculation was obtained from EIIP Tech. Report, Chapter 11-Gasoline Marketing, equation 11.3-5. The emission factor was also obtained from EIIP Tech. Report, Table 11.3-1. According to the EIIP Tech. Report, Table 11.3-5, the daily allocation for the delivery to outlets is 6 days/week.

$$EM = \frac{EF * TGD * [1-(CE)(RP)(RE)] * (1 \text{ yr}/52 \text{ wks}) * (1 \text{ wk}/6 \text{ days})}{2,000 \text{ lbs/ton}} \quad 4.1.1-1$$

where:

EM = total daily emissions in tons/day  
 EF = emission factor, 0.3 lbs/1,000 gallons/year  
 TGD = total gasoline dispensed per county per 1,000 gallons  
 CE = control efficiency  
 RP = rule penetration  
 RE = rule effectiveness

The total gasoline dispensed (TGD) was obtained from the NC Petroleum Marketers Association. The fuel consumption for 2006 was used because it was the latest data available.

### Truck Transit

Truck transit emissions are the emissions that emanate from gasoline trucks in transit. The emissions equation is from the EIIP Tech. Report, Chapter 11-Gasoline Marketing, equation 11.3-3. The daily allocation for truck transit is also 6 days/week.

$$EM = \frac{(TGD * L_{EF} * GTA) + (TGD * U_{EF} * GTA) * (1 \text{ yr}/52 \text{ wks}) * (1 \text{ wk}/6 \text{ dys})}{2,000 \text{ lbs/ton}} \quad 4.1.1-2$$

where:

EM = total daily emissions in tons/day  
 TGD = total gasoline dispensed per county per 1,000 gallons  
 GTA = default value (1.25) obtained from EIIP Tech. Report, Chapter 11, page 11.3-7  
 L<sub>EF</sub> = loaded tank truck EF = 0.005 lbs/1,000 gallons  
 U<sub>EF</sub> = unloaded tank truck EF = 0.055 lbs/1,000 gallons

The L<sub>EF</sub> and the U<sub>EF</sub> factors were obtained from the EIIP Tech. Report, Table 11.3-1.

### Underground Tank Breathing and Emptying

Stage I controls capture the displacement of gasoline vapors from unloading gasoline from tank trucks to storage tanks at gas service stations. The emissions calculation was obtained AP-42, Section 5.2 – Transportation and Marketing of Petroleum Liquids. The emission factor was also obtained from AP-42, equation 1. According to the EIIP Tech. Report, Table 11.3-5, the daily allocation for the delivery to outlets is 6 days/week.

$$EM = \frac{EF * TGD * [1-(CE)(RP)(RE)] * (1 \text{ yr}/52 \text{ wks}) * (1 \text{ wk}/6 \text{ days})}{2,000 \text{ lbs/ton}} \quad 4.1.1-1$$

where:



EM = total daily emissions in tons/day  
 EF = VOC liquid loss during loading in lbs/gallon  
 TGD = total gasoline dispensed per county per gallon in June, July and August  
 CE = control efficiency  
 RP = rule penetration  
 RE = rule effectiveness.

The emission factor is calculated by determining the amount of uncontrolled liquid is loss during loading from the gasoline trucks to the storage tanks. The following equation is used to determine the loading loss.

$$EF = 12.46 * \frac{S * P * M}{T} \quad 4.1.1-2$$

where:

P = true vapor pressure of the liquid loaded, based on the Reid Vapor Pressure (RVP), is determined from equation 4.1.1-3 below.

$$P = \exp\{[0.7553-(413/(T+459.6))](SI)^{0.5}\log_{10}(RVP) - [1.854-(1,042/(T+459.6))](SI)^{0.5} + [(2,416/(T+459.6))-2.013]\log_{10}(RVP) - (8.742/(T+459.6)) + 15.64\} \quad 4.1.1-3$$

S = saturation factor, 1.0 for submerged loading  
 M = molecular weight of vapors, 68 lb/lb-mole for an RVP of 7.8 psi and 67 lb/lb-mole for an RVP of 9.0 psi  
 T = temperature of liquid loaded, 81° F = 541° R  
 SI = slope of ASTM distillation curve at 10% evaporated is 3.0 for gasoline in degrees Fahrenheit per percent  
 RVP = Reid Vapor Pressure, 7.8 psi for 2007, 2011 and 9.0 psi for 2018.

North Carolina plans to petition the USEPA to remove the 7.8 psi RVP requirement in early 2013 and replace it with the less stringent 9.0 psi. Therefore, the emission estimates for 2014 and 2017 for all counties in the Triangle area will be calculated using the emission factors for a RVP of 9.0 psi.

The FORECAST function in Microsoft EXCEL was used to develop the future year gasoline consumption for 2011 and 2018 based on the past consumption for 2003 through 2008. The FORECAST tool uses linear interpolation to project future values based on historic data. By applying this methodology, the 2011 and 2018 growth factors were determined. The 2003 through 2008 gasoline consumption was obtained from the United State’s Federal Highway Administration. The growth factors are shown in Table 4.1.1-2.

**Table 4.1.1-2 Growth Factors for Gasoline Dispensing**

2011	2018
1.0714	1.1594

The projected emissions for the gasoline dispensing facilities are obtained from equation 4.1.1-4.

$$PJEM = EM * GF_a \tag{4.1.1-4}$$

where:

- EM = total daily emissions in tons/day
- PJEM = projected future emissions in tons/day
- GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emissions for underground storage tanks, trucks in transit and underground tank breathing and emptying are in Tables 4.1.1-3 – 4.1.1-4.

**Table 4.1.1-3 VOC Emissions (tpd) from Underground Storage Tanks**

County	2007	2011	2018
Davidson	0.083	0.109	0.118
Davie	0.001	0.001	0.001
Forsyth	0.226	0.295	0.319
Guilford	0.281	0.367	0.397
<b>Total</b>	<b>0.591</b>	<b>0.772</b>	<b>0.835</b>

**Table 4.1.1-4 VOC Emissions from Tank Trucks in Transit (tons/day)**

County	2007	2011	2018
Davidson	0.013	0.014	0.015
Davie	0.003	0.003	0.003
Forsyth	0.024	0.026	0.028
Guilford	0.031	0.033	0.036
<b>Total</b>	<b>0.071</b>	<b>0.076</b>	<b>0.082</b>

**Table 4.1.1-5 VOC Emissions from Storage Tank Breathing Loss (tons/day)**

County	2007	2011	2018
Davidson	0.144	0.154	0.167
Davie	0.038	0.041	0.044
Forsyth	0.268	0.287	0.311
Guilford	0.356	0.381	0.413
<b>Total</b>	<b>0.806</b>	<b>0.863</b>	<b>0.935</b>

#### **4.1.2 Aircraft Refueling**

Like vehicle refueling, aircraft refueling results in VOC. There are two processes that generate VOC emissions. Stage I is the displacement of vapors during the transfer of gasoline from tank trucks to storage tanks and vice versa. The other process is Stage II that involves the transfer of fuel from the tanker trucks into general aviation aircraft. The methodology employed for this category was developed by E.H. Pechan & Associates, Inc. utilizing the emission factors developed by the ERTAC workgroup.

For Stage I and Stage II, the national-level emissions were calculated by multiplying the nationwide aviation gasoline (AvGas) consumption by the VOC emission factors and summing the emissions.

Once the national-level emissions were calculated, they were allocated to the Petroleum Administration for Defense (PAD) Districts based on the amount of gasoline reported for each PAD. The PAD for North Carolina is PAD 1, which comprises 17 states along the Atlantic Coast. The emissions were then allocated to the county-level based on the number of landing-offs (LTOs) for general aviation flights per county. The amount of aviation gasoline consumed nationally and for PAD 1 was obtained from the US Department of Energy, Energy Information

Administration. The number of LTOs was obtained from the US Federal Aviation Administration. The 2008 LTOs were used for PAD 1 District and the counties because that is the only data that was available, therefore, it is assumed the LTOs remain constant between 2007 and 2008. The VOC emission factors are shown in Table 4.1.2-1.

**Table 4.1.2-2 VOC Emission Factors**

Emission Source	VOC Emission Factor (lb/gallon AvGas/year)
<i>Stage I Emission Factors</i>	
Aviation gas unloading/tank filling-tank fill	0.009021383
Aviation gas unloading/tank filling-storage tank working	0.003605215
Aviation gas tank truck filling-composite	0.010306575
Aviation gas storage tank-breathing loss	0.001694117
<i>Stage II Emission Factors</i>	
Fuel transfer from tanker trucks to aircraft	0.0136

The following equation shows the emission estimate for the nationwide aviation gasoline consumption.

$$\text{US AvGas Consumption} = \text{amt of nationwide AvGas consumed} * 42 \text{ gal/barrel} * \text{VOC EF}$$

For Stage I, the US aviation gasoline consumed is generated for each VOC emission factor and the total consumption is calculated by summing the emissions. The emission estimate for the county-level is shown in equation 4.1.2-1.

$$\text{EM} = \text{US VOC Emissions} * (\text{PAD 1 consumption} / \text{US AvGas Consumption}) * (\text{County LTOs} / \text{PAD 1 LTOs}) * (1 \text{ ton} / 2,000 \text{ lbs/year}) * (1 \text{ year} / 365 \text{ days}) \quad 4.1.2-1$$

where:

EM = total daily emissions in tons/day

US VOC Emissions = nationwide annual AvGas VOC emissions, lbs/year

PAD 1consumption = PAD 1 District I total AvGas consumption, barrels/year

PAD 1 LTOs = PAD 1 District I landing-take offs for general aircraft  
 County LTOs = county-level landing-take offs for general aircraft

The growth factors were developed using Microsoft EXCEL FORECAST to linear interpolate the 2011 and 2018 PAD 1 aviation gasoline consumption based on the 2003 – 2008 aviation gasoline consumption. The growth factors for the Triad area are listed in Table 4.1.2-2.

**Table 4.1.2-2 Growth Factors for Aircraft Refueling**

2011	2018
0.9539	0.8113

The projected emissions for the aircraft refueling are calculated by using equation 4.1.2-2.

$$PJEM = EM * GF_a \quad 4.1.2-2$$

where:

PJEM = projected future emissions in tons/day  
 GF<sub>a</sub> = growth factor (a) for projected future years

The following tables show the emissions from Stage I and Stage II.

**Table 4.1.2-3 VOC Emissions from Stage I (tons/day)**

County	2007	2011	2018
Davidson	0.0011	0.0010	0.0009
Davie	0.0028	0.0027	0.0023
Forsyth	0.0027	0.0026	0.0022
Guilford	0.0044	0.0042	0.0036
<b>Total</b>	<b>0.0110</b>	<b>0.0105</b>	<b>0.0090</b>

**Table 4.1.2-4 VOC Emissions from Stage II (tons/day)**

County	2007	2011	2018
Davidson	0.0006	0.0006	0.0005
Davie	0.0016	0.0015	0.0013
Forsyth	0.0015	0.0014	0.0012
Guilford	0.0025	0.0024	0.0020
<b>Total</b>	<b>0.0062</b>	<b>0.0059</b>	<b>0.0050</b>

The total emissions for aircraft refueling, in tons/day, are shown in Table 4.1.2-5.

**Table 4.1.2-5 Total VOC Emissions from Aircraft Refueling (tons/day)**

County	2007	2011	2018
Davidson	0.0017	0.0016	0.0014
Davie	0.0044	0.0042	0.0036
Forsyth	0.0042	0.0040	0.0034
Guilford	0.0069	0.0066	0.0056
<b>Total</b>	<b>0.0172</b>	<b>0.0164</b>	<b>0.0140</b>

### 4.1.3 Portable Fuel Containers

Portable fuel containers (PFCs, or gas cans) are consumer products used to refuel a wide variety of gasoline-powered equipment.

The general approach, developed by the USEPA, to calculate emissions for portable fuel containers is to take the inventories already prepared by the USEPA for 2002 and 2010 and apply linear interpolation using Microsoft EXCEL FORECAST to generate the 2007 emissions. The activity data for the 2002 and 2010 emission inventories were developed using the USEPA's Nonroad Model, which uses a variety of variables like equipment size, equipment population, equipment age, RVP and air temperature to estimate activity.

The base year emissions are calculated using equation 4.1.3-1

$$EM = (m * 2007) + EM_{2002} * (1 \text{ year}/365 \text{ days}) \quad 4.1.3-1$$

where:

EM = total daily emissions in tons/day

$m = (EM_{2010} - 2007) / (2010 - 2002)$

EM<sub>2010</sub> = PFC emissions per county for 2002, tons/year

EM<sub>2010</sub> = PFC emissions per county for 2010, tons/year

For future year emissions, values were also calculated using linear interpolation. The emissions for 2011 and 2018 emissions were determined by applying the Microsoft EXCEL FORECAST tool to the 2002 and 2010 portable fuel emissions supplied by the USEPA. The growth factors were determined by the formula  $FY_{emiss}/BY_{emiss}$ . The growth factors are shown in Table 4.1.3-1.

**Table 4.1.3-1 Growth Factors for Portable Fuel Containers**

	<b>2011</b>	<b>2018</b>
Davidson	0.7106	0.4992
Davie	0.7103	0.4989
Forsyth	0.7106	0.4991
Guilford	0.7105	0.4991

The VOC emissions for the Traid maintenance area for portable fuel containers are shown below in Table 4.1.3-2.

**Table 4.1.3-2 Total VOC Emissions from Portable Fuel Containers (tons/day)**

County	2007	2011	2018
Davidson	0.2841	0.2019	0.1418
Davie	0.1332	0.0946	1.0665
Forsyth	0.7796	0.554	0.3891
Guilford	1.6268	1.1558	0.8119
<b>Total</b>	<b>2.8237</b>	<b>2.0063</b>	<b>2.4093</b>

## **4.2 STATIONARY SOURCE SOLVENT EVAPORATION**

There are eleven subcategories that involve stationary source solvent evaporative emissions. They include: dry cleaning, graphic arts, solvent cleaning, automotive refinishing, architectural coatings, traffic markings, industrial surface coating, asphalt paving, roofing operations, pesticide application and consumer/commercial solvent use. The methodology used to calculate the emissions from these sources are described in detail in each subsection.

### **4.2.1 Dry Cleaning**

The VOC emissions from dry cleaning vary with the type of process and the solvent used. For the most part, dry cleaning (coin-operated and conventional) are small business entities. As a result of their size, dry cleaning emissions are not captured as point sources. However, dry cleaning operations can be a significant emission source for VOC emissions, when taken collectively.

The emissions from dry cleaning are estimated by multiplying the number of employees at dry cleaning by a national per-employee emission factor, 467 lbs of VOC/employee/year. The emissions estimation and emission factor used for dry cleaning were obtained from ERTAC.

The number of employees was obtained from the US Census Bureau, County Business Patterns. Any facilities with 100 or more employees were deemed to be point sources and not included in the area source emissions inventory. Table 4.2.1-1 below shows employment numbers used in the emissions estimation.

**Table 4.2.1-1 Employment for Dry cleaning**

County	2007 Employment for Dry Cleaning
Davidson	63
Davie	18
Forsyth	331
Guilford	423

According to the EIIP Tech. Report, the activity is 6 days per week. The FORECAST function in Microsoft EXCEL was used to determine the future year dry cleaning employment data for 2011 and 2018 based on the past employment data for 2003 - 2008. The FORECAST tool uses linear interpolation to project future values based on historic data. The dry cleaning growth factors are shown in Table 4.2.1-2.

**Table 4.2.1-2 Growth Factors for Dry cleaning**

County	2011	2018
Davidson	0.9048	0.79370
Davie	0.5513	-0.1376
Forsyth	0.8126	1.0888
Guilford	0.5973	0.0362

The emissions for 2007 were calculated using equation 4.2.1-1 and the emissions for the interim year and future year emissions were calculated using equation 4.2.1-2.

$$EM = \frac{\text{no. of employees} * EF}{2,000 \text{ lbs/ton}} * (1 \text{ year}/52 \text{ weeks}) * (1 \text{ week}/6 \text{ days}) \quad 4.2.1-1$$

$$PJEM = EM * GF_a \quad 4.2.1-2$$

where:

EM = total daily emissions in tons/day



EF = emission factor, 467 lbs VOC/employee/year  
 PJEM = projected emissions in tons/day  
 GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, from dry cleaning for the Triad maintenance area are listed in Table 4.2.1-3.

**Table 4.2.1-3 VOC Emissions from Dry Cleaning (tons/day)**

County	2007	2011	2018
Davidson	0.047	0.043	0.037
Davie	0.013	0.007	-0.002
Forsyth	0.248	0.202	0.270
Guilford	0.317	0.189	0.011
<b>Total</b>	<b>0.625</b>	<b>0.441</b>	<b>0.316</b>

#### 4.2.2 Graphic Arts/Printing

Graphic arts include operations that are involved in printing of newspapers, magazines, books, and other printed materials, which can be divided into several subsets based upon printing technology. Over the last decade ink-jet and offset lithography have emerged as the dominant technologies. The use of oils as ink solvents and the reduction of alcohols in the fountain solution and in the cleanup solutions have resulted in notable reductions in emissions for offset lithography. Ink-jet printing results in essentially no VOC emissions.

A number of establishments that generate emissions in this source category are in-house graphic arts operations at plants that are in non-printing industries. The per-capita emission factor of 1,482 lbs VOC/employee/year provided by ERTAC was used to calculate the VOC emissions. The emissions are from facilities that emit less than 100 tons VOC/year. It assumes that facilities greater than 100 tons VOC/year will be included in the point source emissions inventory. The employment, obtained from the US Census Bureau, County Business Patterns, is based on the methodology outlined by E.H. Pechan & Associates, Inc. The base year employment for 2007 is in Table 4.2.2-1.

**Table 4.2.2-1 Employment for Graphic Arts**

County	2007 Graphic Arts Printing Employment
Davidson	65
Davie	9
Forsyth	2,436
Guilford	3,133

According to the Procedures document, Table 5.8-1, the activity days per week is 5 and there is no seasonal adjustment needed. There were no graphic arts point sources in the Triad maintenance area.

The interim year and future year emissions were also calculated using the FORECAST function in Microsoft EXCEL to linear interpolate the graphic arts printing operations employment. The growth factors were determined by using historical employment data from 2003-2008. The growth factor in Davie County remains constant because the fluctuations in employment between 2003 and 2008 caused the linear interpolation to be skewed. The growth factors are shown in Table 4.2.2-2.

**Table 4.2.2-2 Growth Factors for Graphic Arts**

County	2011	2018
Davidson	1.1905	1.1363
Davie	6.6165	6.6165
Forsyth	1.2615	1.6939
Guilford	1.1896	1.6705

The emissions for the base year and future years were calculated using equations 4.2.2-1 and 4.2.2-2, respectively.

$$EM = \frac{\text{county employment} * EF}{2,000 \text{ lbs/ton}} * (1 \text{ year}/52 \text{ weeks}) * (1 \text{ week}/5 \text{ days}) \quad 4.2.2-1$$

$$PJEM = EM * GF_a \quad 4.2.2-2$$

where:

EM = total daily emissions in tons/day

EF = emission factor, 1,482 lbs VOC/employee/year

PJEM = projected future year emissions in ton/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates from graphic arts operations for the Triad maintenance area are listed in Table 4.2.2-2.

**Table 4.2.2-3 VOC Emissions from Graphic Arts (tons/day)**

County	2007	2011	2018
Davidson	1.86	2.21	2.11
Davie	0.03	0.20	0.20
Forsyth	6.94	8.75	11.76
Guilford	8.93	10.62	14.92
<b>Total</b>	<b>17.76</b>	<b>21.78</b>	<b>28.99</b>

### 4.2.3 Solvent Cleaning and Degreasing

Solvent cleaning operations are integral to many businesses and industries, and are conducted for the purpose of removing grease, oils, waxes, carbon deposits, etc. from metals, plastic, or glass surfaces. Solvent cleaning is usually performed prior to painting, plating, inspection, repair, assembly, etc. The solvents used in the cleaning operations can be either in a liquid or vapor phase. Generally, these solvents have high vapor pressures that emit VOC emissions.

There are two basic types of solvent cleaning techniques, cold cleaning and vapor cleaning. Cold cleaning machines use solvents in the liquid phase to clean and remove foreign material such as oils and grease from the surface of materials. Cleaning operations include spraying/flushing solvent or parts agitation, wipe cleaning, brushing, and immersion.

The vapor cleaning technique can be further divided into open top degreasing and in-line cleaning. The open top degreasing machines are tanks designed to generate and contain solvent vapor. The tank is equipped with a heating system that boils the liquid solvent. As the solvent boils, dense solvent vapors rise and displace the air in the tank. Coolant is circulated in condensing coils on the top of the tank to create a controlled vapor zone within the tank. Condensing solvent vapors dissolve the contaminants on the surface of the workload and flush both the dissolved and undissolved contaminants from the workload.

In-line cleaning machines employ automated loading on a continuous basis. These machines are often custom made for large-scale operations. A continuous or multiple-batch loading system

greatly reduces or even eliminates the manual parts handling associated with batch cleaning. In-line cleaning machines are enclosed to prevent solvent losses; however, entry and exit openings cannot be sealed.

The VOC emissions for this category are estimated by using per employee factors obtained from the EIIP Tech. Report, Chapter 6, Table 6.5-2. The emission factors for these subcategories are listed in Table 4.2.3-1.

**Table 4.2.3-1 Solvent Cleaning and Degreasing Emission Factors**

Subcategory	Emission Factor (lbs/VOC/employee)
Electronic & Other Electrical: Open Top Degreasing	29
Miscellaneous Manufacturing: Open Top Degreasing	9.8
Miscellaneous Manufacturing: Cold Cleaning	24
Auto Repair Services: Cold Cleaning	270

Employment data was derived from the US Census Bureau, County Business Patterns. The following table shows the total employment for each subcategory per county.

**Table 4.2.3-2 Cleaning and Degreasing Employment**

	Open Top Degreasing		Cold Cleaning	
	Electronic & Other Electrical	Miscellaneous Manufacturing: Open Top Degreasing	Miscellaneous Manufacturing: Cold Cleaning	Auto Repair Services: Cold Cleaning
Davidson	3	3,344	2,363	973
Davie	2	573	329	209
Forsyth	254	3,818	1,167	2,573
Guilford	298	9,028	5,133	3,845

Federal rules are expected to reduce the VOC emission from solvent cleaning in the future years. The USEPA estimates (EPA420-R-00-020) that the federal rules will reduce the emissions from this source category by approximately 31% for open top processes and about 43% from cold cleaning processes. This reduction was applied to the base year emissions.

The work week is 6 days for this category. The growth factors were developed using linear interpolation of 2003-2008 employment data. The manufacturing employment was used for the electronic & other electrical: open top degreasing and miscellaneous manufacturing: cold cleaning subcategories. Employment for retail trade, transportation and warehousing and other services (except public administration) was used for the auto repair services: cold cleaning subcategory. Lastly, all of the employment categories were used for the miscellaneous manufacturing: open top degreasing subcategory. The employment categories used for the growth factors were determined based on the employment SIC codes used for each subcategory emissions calculation. The growth factors are shown in Tables 4.2.3-3-4.2.3-6.

**Table 4.2.3-3 Growth Factors for Electronic & Other Electrical: Open Top Degreasing**

	2011	2018
Davidson	0.6989	0.1781
Davie	1.1560	1.3668
Forsyth	0.9911	1.0467
Guilford	0.8949	0.7160

**Table 4.2.3-4 Growth Factors for Miscellaneous Manufacturing: Open Top Degreasing**

	2011	2018
Davidson	0.7706	0.3914
Davie	1.0927	1.3219
Forsyth	0.9701	0.9548
Guilford	0.9704	0.9236

**Table 4.2.3-5 Growth Factors for Miscellaneous Manufacturing: Cold Cleaning**

	2011	2018
Davidson	0.6989	0.1781
Davie	1.1560	1.3668
Forsyth	0.9911	1.0467
Guilford	0.8949	0.7160

**Table 4.2.3-6 Growth Factors for Auto Repair Services: Cold Cleaning**

	2011	2018
Davidson	0.8771	0.7088
Davie	1.0236	1.2729
Forsyth	0.9563	0.8944
Guilford	1.0248	1.0731

The emissions for the base year and future years were calculated using equations 4.2.3-1 and 4.2.3-2, respectively.

$$EM = \frac{\text{no. of employees} * EF * (1 \text{ year}/52 \text{ weeks}) * (1 \text{ week}/6 \text{ days}) * [1 - RF]}{2,000 \text{ lbs/tons}} \quad 4.2.3-1$$

$$PJEM = EM * GF_a \quad 4.2.3-2$$

where:

EM = total daily emissions in tons/day

EF = emission factor per subcategory

RF = reduction factors, 31% for degreasing processes and 43% for cold cleaning processes

PJEM = projected future year emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, are summarized in Tables 4.2.3-7 – 4.2.3-11.

**Table 4.2.3-7 VOC Emissions from Electronic & Other Electrical: Open Top Degreasing (tons/day)**

County	2007	2011	2018
Davidson	0.0001	0.0000	0.0000
Davie	0.0001	0.0001	0.0001
Forsyth	0.0081	0.0081	0.0085
Guilford	0.0095	0.0085	0.0068
<b>Total</b>	<b>0.0178</b>	<b>0.0167</b>	<b>0.0154</b>

**Table 4.2.3-8 VOC Emissions from Miscellaneous Manufacturing: Open Top Degreasing (tons/day)**

County	2007	2011	2018
Davidson	0.0366	0.0282	0.0143
Davie	0.0062	0.0068	0.0082
Forsyth	0.0414	0.0402	0.0395
Guilford	0.0980	0.0951	0.0905
<b>Total</b>	<b>0.1822</b>	<b>0.1703</b>	<b>0.1525</b>

**Table 4.2.3-9 VOC Emissions from Miscellaneous Manufacturing: Cold Cleaning (tons/day)**

County	2007	2011	2018
Davidson	0.0519	0.0363	0.0092
Davie	0.0074	0.0086	0.0101
Forsyth	0.0257	0.0254	0.0268
Guilford	0.1123	0.1005	0.0804
<b>Total</b>	<b>0.1972</b>	<b>0.1708</b>	<b>0.1265</b>

**Table 4.2.3-10 VOC Emissions from Auto Repair Services: Cold Cleaning (tons/day)**

County	2007	2011	2018
Davidson	0.2400	0.2105	0.1701
Davie	0.0513	0.0525	0.0653
Forsyth	0.6344	0.6067	0.5674
Guilford	0.9485	0.9720	1.0178
<b>Total</b>	<b>1.8742</b>	<b>1.8417</b>	<b>1.8206</b>

**Table 4.2.3-11 Total VOC Emissions from Surface Cleaning and Degreasing (tons/day)**

County	2007	2011	2018
Davidson	0.3286	0.2750	0.1936
Davie	0.0650	0.0680	0.0837
Forsyth	0.7096	0.6804	0.6422
Guilford	1.1683	1.1761	1.1955
<b>Total</b>	<b>2.2715</b>	<b>2.1995</b>	<b>2.1150</b>

#### 4.2.4 Auto Body Refinishing

Auto body refinishing operations consist of vehicle preparation, primer application, topcoat application and spray equipment cleaning. These operations result in significant VOC emissions. The solvents are typically 100% volatile and can constitute up to 6.5 lbs of VOC per gallon of cleaner or paint.

The methodology outlined in E.H. Pechan & Associates based on the emission factor development work from ERTAC was used for estimating emissions for this category. The emissions calculation is based on a per employee emission factor, 89 lbs/VOC/employee. The number of employees for 2007 was obtained from the US Census Bureau, County Business Patterns, and are listed in Table 4.2.4-1.

**Table 4.2.4-1 Employment for Auto Body Refinishing**

County	Number of Employees for 2007
Davidson	52
Davie	19
Forsyth	203
Guilford	310

According to the EIIP Tech. Report the activity days per week is 5 days. The growth factors were developed by using the FORECAST function in Microsoft EXCEL by linear interpolation of historic employment data from 2003-2008. The auto body refinishing growth factors are shown in Table 4.2.4-2.

**Table 4.2.4-2 Growth Factors for Auto Body Refinishing**

County	2011	2018
Davidson	1.2267	1.7152
Davie	0.6264	0.1991
Forsyth	0.9099	0.8705
Guilford	1.0073	1.0802

Federal rules are expected to reduce the VOC emission from auto body refinishing in the future years. The USEPA estimates that the federal rules will reduce the emissions from this source category by approximately 37%. This reduction was applied to the base year emissions. The



base year emissions were calculated using equation 4.2.4-1 and the emissions for the future years were calculated using equation 4.2.4-2.

$$EM = \frac{\text{no. of employees} * EF}{2,000 \text{ lbs/ton}} * (1 \text{ year}/52 \text{ weeks}) * (1 \text{ week}/5 \text{ days}) * [1-RF] \quad 4.2.4-1$$

$$PJEM = EM * GF_a \quad 4.2.4-2$$

where:

EM =total daily emissions in tons/day

EF = emission factor, 89 lbs. VOC/employee/year

RF = reduction factor, 37%

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, from auto body refinishing for the Triad maintenance area are listed in Table 4.2.4-3.

**Table 4.2.4-3 VOC Emissions from Auto Body Refinishing (tons/day)**

County	2007	2011	2018
Davidson	0.0057	0.0070	0.0097
Davie	0.0019	0.0012	0.0004
Forsyth	0.0221	0.0201	0.0192
Guilford	0.0334	0.0336	0.0361
<b>Total</b>	<b>0.0630</b>	<b>0.0619</b>	<b>0.0654</b>

#### 4.2.5 Architectural Coatings

This category includes the application of paint, primer, varnish or lacquer to architectural surfaces, and the use of solvents as thinners and for cleanup.

The VOC emissions for this source category were estimated by multiplying county population in Table 2.2-1 by a per capita emission factor as shown in equation 4.2.5-1. The future emissions were determined using equation 4.2.5-2. The population growth factors in Table 2.2-2 were used to calculate the interim and future years' emissions.

Federal rules are expected to reduce the VOC emission from architectural coatings in the future years. The USEPA estimates that the federal rules will reduce the emissions from this source category by approximately 25%. This reduction was applied to all of the emissions.

$$EM = \frac{\text{county population} * EF}{2,000 \text{ lbs/ton}} * (1 \text{ year}/52 \text{ weeks}) * (1 \text{ week}/7 \text{ days}) * [1-RF] \quad 4.2.5-1$$

$$PJEM = EM * GF_a \quad 4.2.5-2$$

where:

- EM = total daily emissions in tons/day
- EF = emission factor, 3.02 lbs. VOC/person/year
- RF = reduction factor, 25%
- PJEM = projected future emissions in tons/day
- GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, from architectural coatings for the Triad maintenance area are listed in Table 4.2.5-1.

**Table 4.2.5-1 VOC Emissions from Architectural Coatings (tons/day)**

County	2007	2011	2018
Davidson	0.4853	0.5090	0.5440
Davie	0.1253	0.1339	0.1483
Forsyth	1.0508	1.1422	1.2672
Guilford	1.4288	1.5273	1.6888
<b>Total</b>	<b>3.0900</b>	<b>3.3124</b>	<b>3.6483</b>

#### 4.2.6 Traffic Markings

The paint used in traffic markings operations (the painting of center lines, shoulders, etc.) emits VOC emissions during the drying process.

The emission estimation used to calculate the traffic marking emissions is based upon the number of lane miles for each county as specified in the methodology outlined by E.H. Pechan & Associates, Inc. The number of lane miles was obtained from the North Carolina Department of Transportation (NCDOT) for 2007 as shown in the table below.

**Table 4.2.6-1 Number of Lane Miles**

County	2007 Lane Miles
Davidson	3,068
Davie	1,075
Forsyth	2,410
Guilford	4,134

For the future years' emissions, the growth factors were developed using linear interpolation with Microsoft EXCEL FORECAST function. The statewide lane miles for 2003-2008 were used to determine the number of lane miles for 2011 and 2018. Statewide lane miles were used in lieu of county lane miles because the statewide information was readily available from the US Federal Highway Administration.

**Table 4.2.6-2 Growth Factors for Traffic Markings**

2011	2018
1.2871	1.4602

Additionally, federal rules are expected to reduce the VOC emission from traffic markings in the future years. The USEPA estimates that the federal rules will reduce the emissions from this source category by approximately 25%. This reduction was applied to the emissions for the base year and the interim and future years. According to the EIIP Tech. Report, the activity is 5 days per week and the SAF is 1.3.

The emissions for the base year and future years were calculated using equations 4.2.6-2 and 4.2.6-3, respectively.

$$EM = \frac{\text{no. of lane miles} * EF * SAF * (1 \text{ year}/52 \text{ weeks}) * (1 \text{ week}/5 \text{ days}) * [1-RF]}{2,000 \text{ lbs/ton}} \quad 4.2.6-2$$

$$PJEM = EM * GF_a \quad 4.2.6-3$$

where:

EM = total daily emissions in tons/year

EF = emission factor, 22.1 lbs. VOC/mile/year

SAF = seasonal adjustment factor, 1.3  
 RF = reduction factor, 25%  
 PJEM = projected future emissions in tons/day  
 GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, from traffic markings for the Triad maintenance area are listed in Table 4.2.6-3.

**Table 4.2.6-3 VOC Emissions from Traffic Markings (tons/day)**

County	2007	2011	2018
Davidson	0.1268	0.1631	0.1851
Davie	0.0443	0.0570	0.0646
Forsyth	0.0998	0.1284	0.1457
Guilford	0.1710	0.2201	0.2497
<b>Total</b>	<b>0.4418</b>	<b>0.5686</b>	<b>0.6451</b>

#### 4.2.7 Industrial Surface Coating

Surface coating operations involve applying a thin layer of coating (e.g. paint, lacquer, enamel, varnish, etc.) to the surface of an object for decorative or protective purposes. The coating products, which are solvent based, emit VOC emissions as the result of solvent evaporation during the drying or curing process.

Ideally, the VOC emissions from industrial surface coating activities should be captured as point sources. From a practical standpoint, this is not always accomplished. For example, two of the industrial surface coating subcategories, industrial maintenance coatings and other special purpose coatings, utilize per capita emission factors instead of per employment emission factors.

For industrial maintenance coatings and other special purpose coating emissions calculation, the population used is shown in Table 2.2-1. The employment used for the remaining subcategories is shown in Table 4.2.7-1.

**Table 4.2.7-1 Employment for Surface Coating Subcategories**

Subcategory	Davidson	Davie	Forsyth	Guilford
Furniture & Fixtures	595	3	129	1,126
Metal Containers	0	0	0	0
Automobile (new)	0	0	0	1
Machinery & Equipment	641	213	185	1,265
Appliances	82	0	0	45
Other Transportation Equipment	231	3	3	87
Sheet, strip & Coil	0	10	7	88
Factory Finished Wood	583	385	370	537
Electrical Insulation	0	0	0	0
Marine Coatings	2	0	12	8

The emission factors, obtained from ERTAC, for these surface coating subcategories are listed in the Table 4.2.7-2.

**Table 4.2.7-2 Per Capita Emission Factors for Industrial Surface Coating**

Subcategory	Per Capita Factor (lb/yr/person)
Industrial Maintenance Coatings	0.960
Other Special Purpose Coatings	0.007

The emissions for the remaining industrial surface coating subcategories were estimated using per employee emission factors. These emission factors were also obtained from ERTAC as shown in Table 4.2.7-3.

**Table 4.2.7-3 Per Employee Emission Factors for Industrial Surface Coating**

Subcategory	Per Employee Factor (lbs VOC/employee/yr)
Furniture & Fixtures	244
Metal Containers	2,326
Automobile (new)	164
Machinery & Equipment	109
Appliances	249
Other Transportation Equipment	222
Sheet, Strip & Coil	2,877
Factory Finished Wood	43
Electrical Insulation	24.7
Marine Coatings	198

According to the EIIP Tech. Report the activity days per week is 5 days. To estimate the interim year emissions and future year emissions from the subcategories that used a per capita emission factor, the population growth factors were used from Table 2.2-2. The remaining subcategories use a per employee emission factor. The growth factors for these categories are derived from the total manufacturing employment for each county.

**Table 4.2.7-4 Employment Growth Factors for Surface Coating Subcategories**

Subcategory	2011	2018
Davidson	0.6989	0.1781
Davie	1.1560	1.3668
Forsyth	0.9911	1.0467
Guilford	0.8949	0.7160

Federal rules are expected to reduce VOC emission from industrial surface coating operations. The USEPA estimates of percent reduction of emissions for the federal rules are listed in Table 4.2.7-5 below. These reductions were applied starting with the 2007 base year emissions.

**Table 4.2.7-5 Industrial Surface Coating Percent Reductions from Federal Rules**

Subcategory	Expected Reduction
Furniture & Fixtures	30%
Metal Containers	36%
Automobiles (New)	36%
Machinery & Equipment	36%
Appliances	36%
Other Transportation Equipment	36%
Sheet, Strip, & Coil	36%
Factory Finished Wood	36%
Electrical Insulation	36%
Marine Coatings	24%
Other Product	25%
Industrial Maintenance Coatings	36%
Other Special Purpose Coatings	25%

The emissions estimation for the industrial maintenance coatings and other special purpose coatings for the base year emissions are shown in equation 4.2.5-1 and the interim and future years emissions are shown in equation 4.2.5-2.

$$EM = \frac{\text{county population} * EF}{2,000 \text{ lbs/ton}} * (1 \text{ year}/52 \text{ weeks}) * (1 \text{ week}/5 \text{ days}) * [1-RF] \quad 4.2.5-1$$

$$PJEM = EM * GF_a \quad 4.2.5-2$$

where:

EM = total daily emissions in tons/day

EF = emission factor per subcategory

RF = reduction factor per subcategory

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The emissions estimation for the subcategories that are based upon a per employee emission factor for the base year emissions are shown in equation 4.2.5-3 and the future years emissions are shown in equation 4.2.5-4.

$$EM = \frac{\text{no. of employees} * EF}{2,000 \text{ lbs/ton}} * (1 \text{ year}/52 \text{ weeks}) * (1 \text{ week}/5 \text{ days}) * [1-RF] \quad 4.2.5-3$$

$$PJEM = EM * GF_a$$

4.2.5-4

where:

EM = total daily emissions in tons/day

EF = emission factor per subcategory

RF = reduction factor per subcategory

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, from all surface coating operations are listed in Tables 4.2.7-6 through 4.2.7-18 and are totaled for this source category in Table 4.2.7-19.

**Table 4.2.7-6 VOC Emissions from Furniture and Fixtures (tons/day)**

County	2007	2011	2018
Davidson	0.1367	0.0955	0.0243
Davie	0.0010	0.0011	0.0013
Forsyth	0.0294	0.0291	0.0308
Guilford	0.2587	0.2315	0.1852
<b>Total</b>	<b>0.4258</b>	<b>0.3572</b>	<b>0.2416</b>

**Table 4.2.7-7 VOC Emissions from Metal Containers (tons/day)**

County	2007	2011	2018
Davidson	0	0	0
Davie	0	0	0
Forsyth	0	0	0
Guilford	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Table 4.2.7-8 VOC Emissions from Automobiles (tons/day)**

County	2007	2011	2018
Davidson	0.0000	0.0000	0.0000
Davie	0.0000	0.0000	0.0000
Forsyth	0.0001	0.0001	0.0001
Guilford	0.2365	0.2117	0.1694
<b>Total</b>	<b>0.2367</b>	<b>0.2118</b>	<b>0.1695</b>



**Table 4.2.7-9 VOC Emissions from Machinery and Equipment (tons/day)**

County	2007	2011	2018
Davidson	0.134	0.0599	0.0153
Davie	0.045	0.0333	0.0394
Forsyth	0.039	0.0247	0.0261
Guilford	0.265	0.1518	0.1214
<b>Total</b>	<b>0.483</b>	<b>0.2697</b>	<b>0.2022</b>

**Table 4.2.7-10 VOC Emissions from Appliances (tons/day)**

County	2007	2011	2018
Davidson	0.0250	0.0174	0.0044
Davie	0.0000	0.0000	0.0000
Forsyth	0.0000	0.0000	0.0000
Guilford	0.0141	0.0126	0.0101
<b>Total</b>	<b>0.0390</b>	<b>0.0300</b>	<b>0.0145</b>

**Table 4.2.7-11 VOC Emissions from Other Transportation Equipment (tons/day)**

County	2007	2011	2018
Davidson	0.0634	0.0443	0.0113
Davie	0.0006	0.0007	0.0009
Forsyth	0.0006	0.0006	0.0007
Guilford	0.0237	0.0212	0.0170
<b>Total</b>	<b>0.0883</b>	<b>0.0668</b>	<b>0.0299</b>

**Table 4.2.7-12 VOC Emissions from Sheet, Strip & Coil (tons/day)**

County	2007	2011	2018
Davidson	0.0000	0.0000	0.0000
Davie	0.0352	0.0407	0.0481
Forsyth	0.0250	0.0247	0.0261
Guilford	0.3117	0.2789	0.2232
<b>Total</b>	<b>0.3718</b>	<b>0.3443</b>	<b>0.2974</b>

**Table 4.2.7-13 VOC Emissions from Factory Finished Wood (tons/day)**

County	2007	2011	2018
Davidson	0.0307	0.0215	0.0055
Davie	0.0205	0.0237	0.0280
Forsyth	0.0198	0.0197	0.0208
Guilford	0.0282	0.0252	0.0202
<b>Total</b>	<b>0.0992</b>	<b>0.0901</b>	<b>0.0745</b>

**Table 4.2.7-14 VOC Emissions from Electrical Insulation (tons/day)**

County	2007	2011	2018
Davidson	0	0	0
Davie	0	0	0
Forsyth	0	0	0
Guilford	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Table 4.2.7-15 VOC Emissions from Marine Coatings (tons/day)**

County	2007	2011	2018
Davidson	0.0005	0.0004	0.0001
Davie	0.0000	0.0000	0.0000
Forsyth	0.0038	0.0038	0.0040
Guilford	0.0024	0.0021	0.0017
<b>Total</b>	<b>0.0067</b>	<b>0.0063</b>	<b>0.0058</b>

**Table 4.2.7-16 VOC Emissions from Other Product Coatings (tons/day)**

County	2007	2011	2018
Davidson	0.0405	0.0283	0.0072
Davie	0.0008	0.0009	0.0010
Forsyth	0.0690	0.0684	0.0722
Guilford	0.0975	0.0873	0.0698
<b>Total</b>	<b>0.2078</b>	<b>0.1849</b>	<b>0.1502</b>

**Table 4.2.7-17 VOC Emissions from Industrial Maintenance Coatings (tons/day)**

County	2007	2011	2018
Davidson	0.1318	0.1383	0.1478
Davie	0.0339	0.0363	0.0402
Forsyth	0.2848	0.3096	0.3435
Guilford	0.3878	0.4146	0.4584
<b>Total</b>	<b>0.8384</b>	<b>0.8988</b>	<b>0.9899</b>

**Table 4.2.7-18 VOC Emissions from Other Special Purpose Coatings (tons/day)**

County	2007	2011	2018
Davidson	0.1283	0.1345	0.1438
Davie	0.0330	0.0353	0.0391
Forsyth	0.2783	0.3025	0.3356
Guilford	0.3788	0.4049	0.4477
<b>Total</b>	<b>0.8183</b>	<b>0.8772</b>	<b>0.9662</b>

**Table 4.2.7-19 Total VOC Emissions from Industrial Surface Coatings (tons/day)**

County	2007	2011	2018
Davidson	0.6909	0.5401	0.3597
Davie	0.1700	0.1720	0.1980
Forsyth	0.7498	0.7832	0.8599
Guilford	2.0044	1.8418	1.7241
<b>Total</b>	<b>3.6151</b>	<b>3.3371</b>	<b>3.1417</b>

#### 4.2.8 Asphalt Paving

Two types of asphalt paving are used for road paving and repair; emulsified asphalt and cutback asphalt. Emulsified asphalt is a type of liquefied road surfacing material made from a blend of water with an emulsifier. Cutback asphalt is a type of liquefied road surface that is prepared by blending or "cutting back" asphalt cement with various kinds of petroleum distillates. VOC emissions occur as the asphalt cures.

The NCDOT specification for asphalt in 2002 was hot mix and emulsified asphalt with hot mix but not cutback asphalt. Surrounding states have precluded the use of cut back by statutory

provisions; which has driven asphalt manufactures to discontinue cutback production throughout the region. The absence of the use of cutback has resulted in substantial reductions in emissions from asphalt paving operations in North Carolina.

Hot-mix is composed of high molecular weight organics with minimal vapor pressures; consequently, VOC emissions are negligible. The use of emulsified asphalt does result in VOC emissions; but the emissions are significantly less than cutback. New formulations of emulsified asphalt, such as cationic, continue to result in reduced emissions. The use of emulsified asphalt is primarily for tack coating, which is a surface preparation for the hot-mix layer. The tonnage of hot-mix asphalt is accounted for by the NCDOT based on districts and not on a county level basis. A usage factor was developed because the number of hot-mix asphalt could not be obtained for 2007 hot-mix asphalt amount. The amount of hot-mix asphalt for 2005 was used to generate the usage factor for 2007. The data from 2005 is from the 2005 Consolidated Emissions Reporting Rule emissions inventory. The 2005 statewide paved roads miles was obtained from the 2005 Highway and Road Mileage Report from NCDOT. The usage factor is shown in equation 4.2.8-1.

$$\begin{aligned}
 \text{Usage Factor} &= \frac{(2005 \text{ tons hot-mix asphalt}) * (2,000 \text{ lbs/ton}) * (0.08 \text{ gallons/sq yds})}{\frac{220 \text{ lbs/sq yds}}{2005 \text{ statewide paved miles}}} \\
 &= \frac{(62,500,000 \text{ tons hot-mix asphalt}) * (2,000 \text{ lbs/ton}) * (0.08 \text{ gallons/sq yds})}{73,598 \text{ statewide paved miles}} \\
 &= 617.6 \text{ gallons hot-mix asphalt/paved miles} \qquad \qquad \qquad 4.2.8-1
 \end{aligned}$$

The 2007 county paved miles is from the 2007 Highway and Road Mileage Report from NCDOT. The number of paved miles per county for 2007 is listed in Table 4.2.8-1.

**Table 4.2.8-1 Miles of Paved Roads**

County	2007 Miles of Paved Road
Davidson	2,916
Davie	990
Forsyth	2,024
Guilford	3,430

The VOC emissions were calculated using the emissions factor for emulsified asphalt is 9.2 lbs VOC/barrel and the number of gallons of emulsified asphalt per barrel 42 gallon/barrel from Table 17.5-2 of the EIIP Tech. Report. A SAF of 1.33 was applied to correct for the majority of paving operations occurring between March and November, as reported by the NCDOT.

The growth factors were developed using linear interpolation of historic data for 2003-2008 for the number of paved miles per county. The growth factors are shown in Table 2.2.8-2.

**Table 4.2.8-2 Growth Factors for Asphalt Paving**

County	2011	2018
Davidson	1.0072	1.0184
Davie	0.0168	1.0448
Forsyth	0.9958	0.9884
Guilford	1.0308	1.0774

The emissions for the base year and the future year inventories were calculated using equations 4.2.8-3 and 4.2.8-4, respectively.

$$EM = \frac{\text{gallons hot-mix asphalt} * EF * SAF * (1 \text{ year}/365 \text{ days})}{42 \text{ gal/barrel} * 2,000 \text{ lbs/tons}} \quad 4.2.8-3$$

$$PJEM_a = EM * GF_a \quad 4.2.8-4$$

where:

- EM = total daily emissions in tons/day
- EF = emission factor, 9.2 lbs. VOC/barrel/year
- SAF = seasonal adjustment factor, 1.33
- PJEM = projected future emissions in tons/day
- GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, from asphalt paving for the Triad maintenance area are listed in Table 4.2.8-3.

**Table 4.2.8-3 VOC Emissions from Asphalt Paving (tons/day)**

County	2007	2011	2018
Davidson	0.270	0.272	0.275
Davie	0.092	0.002	0.096
Forsyth	0.188	0.187	0.186
Guilford	0.318	0.328	0.343
<b>Total</b>	<b>0.868</b>	<b>0.789</b>	<b>0.900</b>

#### **4.2.9 Roofing Operations**

This category covers the installation and repair of asphalt roofs on commercial and industrial buildings. This category includes only hot-applied asphalt roofing, for which the only significant emissions source is the kettle used to heat the asphalt. The 2007 base year emissions were determined from E-GAS 5.0 because the number of felt, cap, and flashing squares used in North Carolina for 2007 was unavailable. The 2007 emissions were projected from the 2005 emissions submitted to the USEPA to meet the requirement of the Consolidated Emissions Requirement Rule. The interim and future years were also determined by using E-GAS 5.0. The growth factors for the Triad maintenance area are listed in Table 4.2.9-1.

For future year emissions, the base year emissions were grown using growth factors from the E-GAS 5.0 model and are listed in Table 4.2.9-2.

**Table 4.2.9-1 Growth Factors for Asphalt Roofing**

2011	2018
1.0952	1.2822

The VOC emission estimates, in tons/day, from asphalt roofing for the Triad maintenance area are listed in Table 4.2.9-2.

**Table 4.2.9-2 VOC Emissions from Roofing Operations (tons/day)**

County	2007	2011	2018
Davidson	0.0007	0.0008	0.0009
Davie	0.0000	0.0000	0.0000
Forsyth	0.0024	0.0026	0.0031
Guilford	0.0024	0.0026	0.0031
<b>Total</b>	<b>0.0055</b>	<b>0.0060</b>	<b>0.0071</b>

#### **4.2.10 Pesticide Application**

Pesticides broadly include any substance used to kill or retard the growth of insects, rodents, fungi, weeds or microorganisms. Formulations of organic pesticides are commonly made by combining synthetic materials with various petroleum products. The petroleum products, or inert ingredients, act as a carrier of the active component and usually evaporate into the atmosphere.

##### Agricultural Pesticides

Agricultural pesticides are applied in various manners, which directly affect the possible emissions associated with the application, regardless of the amount of solvent contained in the pesticide. There are basically three types of pesticide/herbicide application methods. One is the "incorporated" type, in which the product is applied and immediately incorporated into the soil. It is expected that little, if any, evaporation of solvent occurs in this type of application. The next type, "pre-emergence", is where the product is put on the ground immediately after the crop is planted. This provides a protective layer. Some evaporation of solvent would be expected with this type of application. The largest emissions would occur from "over the top" application of pesticides. These pesticides are sprayed directly on the foliage to kill weeds or insects. This application would provide an opportunity for a great deal of solvent to evaporate.

The overall pesticide usage associated with agricultural crop production continues to slowly decrease in North Carolina driven by conservative pest management practices and the cost of pesticides as reported by the North Carolina State University (NCSU) Extension Center. The large majority of pesticide usage is confined to the production of tobacco and cotton crops. Because of the small crop size and high cash value, significant tobacco acreage is found in North Carolina.

The planted crop acreage from the North Carolina Agricultural Statistic Division and crop profile reports prepared by the NCSU Extension Center, and other university extension services, for the

US Department of Agriculture Pest Management Center were used to estimate agricultural pesticide usage. Crop acreage from the North Carolina Agricultural Statistic Division was obtained from <http://www.ncagr.com/stats/>. Crop profile reports conducted by NCSU are based on surveys; where participation is reported to be as high as 90 percent for the more important cash crops. Crop profile reports for grains and soybeans do not exist for North Carolina, therefore, data for these crops were obtained from other state profiles and from discussions with representatives of the NCSU Extension Center.

The individual crop profiles outline the current agricultural pesticide practices, i.e., the pesticide agents (insecticides, herbicides, fungicides), the percentage of acres treated and the pounds of active ingredient pesticide applied per acre. The crop profiles often report the application of the active ingredient (pounds of active ingredient per acre) as a range of values. For the worst case scenario, the highest reported value was used. The number of applications of a single pesticide was usually one for all pesticides. The few exceptions to one application are more than accounted for by the conservative practice of using the highest value of application rate.

The pounds of active ingredients for each crop were calculated by using Equation 4.2.10-1 and an example calculation for soybeans follows. Table 4.2.10-1 presents the pesticides associated with a particular crop, the % of treated acres, and the lbs. of active pesticide ingredient per year.

$$(\text{lbs. AI/acre})_{\text{CROP}} = \sum (\% \text{ acres treated}) \times (\text{lb AI/acre})_{\text{pesticide}} \quad 4.2.10-1$$

where AI = active ingredient.

For soybeans, the pounds of active ingredients for the crop is:

Pesticide	% Acres Treated	lbs AI/acre
Paraquat	20	0.47
Glyphosate	10	4
Sulfusate	5	4
Carbaryl	10	1.5

$$(\text{lbs AI/acre})_{\text{soybean}} = (0.20 \times 0.47) + (0.10 \times 4) + (0.05 \times 4) + (0.10 \times 1.5) \\ = 0.844 \text{ lbs. AI/acre for soybeans}$$



**Table 4.2.10-1 Agriculture Pesticides Application Rates**

Crop/Agent	% Acres Treated	lbs. active ingredient/Acre	Crop/Agent	% Acres Treated	lbs. active ingredient/Acre
<b><i>Soybeans</i></b>			<b><i>Corn Silage</i></b>		
Paraquat	20	0.47	Terbufos	35	1
Glyphosate	10	4	Chloropyrifus	10	1
Sulfusate	5	4	Phorate	10	1
Carbaryl	10	1.5	Ethoprop	5	1
<b><i>Cotton</i></b>			Carbofuran	5	1
Tribufos	100	0.75	M Parathion	50	0.75
Aldicarb	91	0.75	Thiocarb	90	0.6
Prourgite	0.45	0.73	Methomyl	50	0.45
Dicofol	0.55	1.6	<b><i>Corn Grain</i></b>		
Dicrotophos	0.45	0.2	Terbufos	35	1
Acephate	2.1	0.5	Chloropyrifus	10	1
M-Parathion	1	0.5	Phorate	10	1
L-cyhalothrin	99	0.145	Ethoprop	5	1
Thiocarb	40	0.75	Carbofuran	5	1
Aldicarb	50	0.725	M Parathion	50	0.75
<b><i>Tobacco</i></b>			Thiocarb	90	0.6
Acephate	70	1.5	Methomyl	50	0.45
Spinosad	13	0.05	<b><i>Oats</i></b>		
Methomyl	11	0.45	M Parathion	5	0.5
Endosulfan	7	1	<b><i>Wheat</i></b>		
Imidacloprid	62	0.03	M Parathion	5	0.5
Chloropicrin	41	79.8	<b><i>Sweet Potatoes</i></b>		
Dichloropropene	35	89.5	Napropamide	50	1.5
Clomazone	75	1	Clomazone	25	0.87
Metalaxyl	49	0.76	Fluazifop	20	0.17
<b><i>Barley</i></b>			Carbaryl	25	0.67
M Parathion	0.8	0.5	<b><i>Peanuts</i></b>		
<b><i>Irish Potatoes</i></b>			Chlorpyrifus	60	1
Phorate 3	40	1.20	Disulfoton	90	0.75
Glyphosate	6	5	Esfenvalerate	25	0.03
Metolachor	8	2	Folicur 1	51	0.51
Metribuzin	55	0.5	Vernolate	45	2.5
<b><i>Sorghum</i></b>			Dichloropropene	0.16	80
MethyParathion	1	0.75			
Chlorpyrifus	1	1			
Carbaryl	1	2			

The emission factors for each crop were calculated utilizing information from the EIIP Tech. Report, which relates active ingredients to VOC emissions. According to the EIIP Tech. Report, for every pound of active ingredient there are 2.45 lbs of VOC emitted and 90% of the emissions are evaporated. The emission factors for each crop were calculated using equation 4.2.10-2, with an example calculation for soybean following.

$$EF_{\text{crop}} = (\text{lb AI}_{\text{crop}}/\text{acre}) * (2.45 \text{ lb. VOC/lbs of AI}) * (0.90) \quad 4.2.10-2$$

where:

$EF_{\text{crop}}$  = emission factor in lbs VOC/active ingredient for each crop

$AI_{\text{crop}}$  = active ingredient for each crop.

The emission factor for soybeans is

$$\text{lbs AI/acre for soybean} = 0.844 \text{ lbs. AI/acre}$$

$$\begin{aligned} EF_{\text{soybean}} &= (0.844 \text{ lbs active ingredient/acre}) * (2.45 \text{ lbs VOC/active ingredient}) * (0.90) \\ &= 1.861 \text{ lbs VOC/acre.} \end{aligned}$$

An exception to the above calculation was for the usage of the following pesticides: chloropicrin and 1,3 dichloropropene. These fumigants are widely used for treating tobacco beds for nematodes and constitute a major portion of the pesticide inventory. They have a moderate vapor pressure of 18.3 and 34 millimeters of mercury (at 77° F), respectively, and their formulation is approximately 96% to 98% of the active ingredient. In light of these properties, the VOC emissions are assumed to be equal to the application per acre, which are 79 lbs/acre for chloropicrin and 89.5 lbs/acre for 1,3 dichloropropene. Table 4.2.10-2 list the pounds of active ingredients per acre and the calculated emission factor for each crop. The number of crops planted for 2007 in each county was obtained from the National Agricultural Statistics Service website. The number of acres of each crop planted in each county is listed in Table 4.2.10-3.

**Table 4.2.10-2 Emission Factors by Crop Type**

Crop	lbs active ingredients/acre	lbs VOC/acre
Soybeans	0.844	1.861
Cotton	2.267	4.999
Barley	0.004	0.009
Corn – Silage	1.79	3.947
Corn – Grain	1.79	3.947
Wheat	0.025	0.055
Oats	0.025	0.055
Sweet Potato	1.169	2.578
Tobacco		
- <i>Non-fumigant</i>	2.317	5.109
- <i>Fumigant</i>	64.043	64.043
Total Tobacco		69.152
Peanuts		
- <i>Non-fumigant</i>	2.9175	6.433
- <i>Fumigant</i>	0.128	0.282
Total Peanuts		6.715
Irish Potatoes	1.9350	4.267
Sorghum	0.0375	0.083

**Table 4.2.10-3 2007 Acres of Crops Planted**

County	Cotton	Tobacco	Soybean	Wheat	Sweet Potato	Oats
Davidson	0	635	14,500	3,000	0	1,000
Davie	0	205	7,800	4,000	0	0
Forsyth	0	770	33,900	1,400	0	0
Guilford	0	1,840	24,800	5,400	0	900

**Table 4.2.10-3 2007 Acres of Crops Planted (continued)**

County	Barley	Corn - Grain	Corn - Silage	Peanuts	Irish Potatoes	Sorghum
Davidson	500	6,800	1,250	0	0	0
Davie	0	6,100	950	0	0	0
Forsyth	0	3,700	140	0	0	0
Guilford	800	5,000	1,600	0	0	0

An SAF of 2.4 is applied to correct for the almost exclusive use of agricultural pesticides from April to August. For interim year and future year emissions, the growth factors were developed using Microsoft EXCEL FORECAST to linear interpolate the crops acreage for 2011 and 2018 from 2003-2008 historic data. Statewide acreage was used because the 2003-2008 acreage data was readily available via the NC Department of Agriculture. The acreage used in the calculation for 2011 and 2018 does not include oaks, barley and sorghum because the acreage for 2003-2008 was not available. The growth factors are listed in Table 4.2.10-4.

**Table 4.2.10-4 Growth Factors for Pesticide**

2011	2018
1.0602	1.1336

The emissions for 2007 were calculated using equation 4.2.10-3 and the emissions for the base year and future years were calculated using equation 4.2.10-4.

$$EM = \frac{(\sum (CROP) * EF_{crop}) * SAF * (1 \text{ year}/365 \text{ days})}{2,000 \text{ lbs/tons}} \quad 4.2.10-3$$

$$PJEM = EM * GF_a \quad 4.2.10-4$$

where:

EM = total daily emissions in tons/day

CROP = acres of each crop per county

EF<sub>crop</sub> = emission factor per crop

SAF = seasonal adjustment factor, 2.4

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, from agricultural pesticides for the Triad maintenance area are listed in Table 4.2.10-6.

**Table 4.2.10-6 VOC Emissions from Agricultural Pesticides (tons/day)**

County	2007	2011	2018
Davidson	0.293	0.311	0.332
Davie	3.166	3.357	3.589
Forsyth	2.013	2.134	2.282
Guilford	1.109	1.176	1.257
<b>Total</b>	<b>6.581</b>	<b>6.978</b>	<b>7.460</b>

#### 4.2.11 Commercial/Consumer Solvent Use

This category includes only non-industrial solvents that are used in commercial or consumer applications. The solvent containing products consist of a diverse grouping, e.g. personal care products, household products, automotive aftermarket products, adhesives and sealants, pesticides, some coatings and other commercial and consumer products that may emit VOC emissions.

The VOC emissions are estimated based on per capita emissions factors. The county population values listed in Table 2.2-1. The population growth factors listed in Table 2.2-2 were used to estimate the projected future year emissions. There are seven subcategories within the commercial/consumer solvent use category. They are listed in Table 4.2.11-1 with their respective emission factor.

**Table 4.2.11-1 Misc. Non-Industrial Consumer/Commercial Emission Factors**

Subcategory	lbs VOC/year/person
All Coatings and Related Products	0.95
All FIFRA Related Products	1.78
Miscellaneous Products	0.07
Personal Care Products	1.9
Household Products	1.8
Automotive Aftermarket Products	1.36
Adhesives and Sealants	0.57

According to the EIIP Tech. Report, emissions from this source category occur 365 days per year and there is no seasonal adjustment required. Federal rules are expected to reduce the VOC emissions from consumer solvents in the future years. The USEPA estimates that the federal rules will reduce the emissions from this source category by approximately 25%. This reduction was applied starting with 2007 estimated emissions. The emissions for the base year and future year inventories were calculated using Equations 4.2.11-1 and 4.2.11-2, respectively.

$$EM = \frac{\text{county population} * EF * (1 \text{ year}/365 \text{ days}) * [1 - RF]}{2,000 \text{ lbs/tons}} \quad 4.2.11-1$$

$$PJEM = EM * GF_a \quad 4.2.11-2$$

where:

EM = total daily emissions in tons/day

EF = emission factor per subcategory

RF = reduction factor, 25%

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emissions estimate, in tons/day, from the commercial/consumer solvents subcategories for the Triad maintenance area are listed in Tables 4.2.11-2 through 4.2.11-8. The total emissions for this source category are in Table 4.2.11-9.

**Table 4.2.11-2 VOC Emissions from All Coatings and Related Products (tons/day)**

County	2007	2011	2018
Davidson	0.1523	0.1597	0.1707
Davie	0.0390	0.0417	0.0462
Forsyth	0.3293	0.3579	0.3971
Guilford	0.4485	0.4794	0.5301
<b>Total</b>	<b>0.9690</b>	<b>1.0387</b>	<b>1.1441</b>

**Table 4.2.11-3 VOC Emissions from All FIFRA Related Products (tons/day)**

County	2007	2011	2018
Davidson	0.2850	0.2990	0.3195
Davie	0.0735	0.0786	0.0870
Forsyth	0.6173	0.6710	0.7444
Guilford	0.8400	0.8980	0.9929
<b>Total</b>	<b>1.8158</b>	<b>1.9466</b>	<b>2.1438</b>

**Table 4.2.11-4 VOC Emissions from Miscellaneous Products (tons/day)**

County	2007	2011	2018
Davidson	0.0113	0.0118	0.0126
Davie	0.0030	0.0032	0.0036
Forsyth	0.0240	0.0261	0.0289
Guilford	0.0330	0.0353	0.0390
<b>Total</b>	<b>0.0713</b>	<b>0.0764</b>	<b>0.0841</b>

**Table 4.2.11-5 VOC Emissions from Personal Care Products (tons/day)**

County	2007	2011	2018
Davidson	0.3045	0.3194	0.3413
Davie	0.0788	0.0842	0.0932
Forsyth	0.6593	0.7166	0.7951
Guilford	0.8963	0.9581	1.0594
<b>Total</b>	<b>1.9388</b>	<b>2.0783</b>	<b>2.2890</b>

**Table 4.2.11-6 VOC Emissions from Household Products (tons/day)**

County	2007	2011	2018
Davidson	0.2880	0.3021	0.3228
Davie	0.0743	0.0794	0.0879
Forsyth	0.6240	0.6783	0.7525
Guilford	0.8490	0.9076	1.0035
<b>Total</b>	<b>1.8353</b>	<b>1.9674</b>	<b>2.1667</b>

**Table 4.2.11-7 VOC Emissions from Automotive Aftermarket Products (tons/day)**

County	2007	2011	2018
Davidson	0.2175	0.2282	0.2438
Davie	0.0563	0.0601	0.0666
Forsyth	0.4718	0.5128	0.5689
Guilford	0.6413	0.6855	0.7580
<b>Total</b>	<b>1.3868</b>	<b>1.4866</b>	<b>1.6373</b>

**Table 4.2.11-8 VOC Emissions from Adhesives and Sealants (tons/day)**

County	2007	2011	2018
Davidson	0.0915	0.0960	0.1026
Davie	0.0233	0.0249	0.0275
Forsyth	0.1980	0.2152	0.2388
Guilford	0.2693	0.2878	0.3183
<b>Total</b>	<b>0.5820</b>	<b>0.6239</b>	<b>0.6872</b>

**Table 4.2.11-9 Total VOC Emissions from Commercial/Consumer Solvent (tons/day)**

County	2007	2011	2018
Davidson	1.3501	1.4162	1.5133
Davie	0.3482	0.3721	0.4120
Forsyth	2.9237	3.1779	3.5257
Guilford	3.9774	4.2517	4.7012
<b>Total</b>	<b>8.5994</b>	<b>9.2179</b>	<b>10.1522</b>

#### 4.4 OTHER MAN MADE AREA SOURCES

Other man made area sources include forest fires, slash burning and prescribed burning, agricultural burning, structure fires and vehicle fires. Some of these sources, such as orchard heaters and certain kinds of agricultural burning, are not active during the ozone season. The methodology used to calculate the emissions from these sources are described in detail in each subsection.



#### 4.4.1 Forest Fires

There are two types of forest fires; wild fires, which are accidental or felonious fires and prescribed burns, which are intentionally set for the purpose of forest and/or grassland management practice. The number of acres burned in 2007 for each of these categories was obtained from the North Carolina Division of Forest Resources (NCDFR) and are listed in Table 4.4.1-1. As shown in Table 4.4.1-1, there are no prescribed fires in the Triad maintenance area.

**Table 4.4.1-1 2007 Acres of Land Burned by Fires**

	Wild Fires	Prescribed	Total
Davidson	85	0	85
Davie	24	0	24
Forsyth	28	0	28
Guilford	112	0	112

The makeup of the plant life burned in each fire can vary from woodland to brush to grassland. The emission factors for the southern region of the United States from AP-42, Table 13.1-2, were used to estimate the emissions from forest burns. The emission factors are 0.108 tons VOC per acre burned and 0.018 tons of NO<sub>x</sub> per acre burned.

The NCDFR was not able to provide seasonal numbers, so the daily emissions are estimated by dividing by 365 days per year. For the base year 2007 and future year inventories, it is assumed that the number of acres burned remains relatively constant; therefore, the emissions between the base year and future years remain constant. The emissions were calculated using equation 4.4.1-1.

$$EM = \text{no. acres burned} * EF * (1 \text{ year}/365 \text{ days}) \quad 4.4.1-1$$

where:

EM = total daily emissions in tons/day

EF = emission factors, VOC = 0.108 tons/acre and NO<sub>x</sub> = 0.018 tons/acre

The VOC and NO<sub>x</sub> emission estimates, in tons/day, from forest fires for the Triad maintenance area are listed in Table 4.4.1-2.

**Table 4.4.1-2 Emissions from Forest Fires (tons/day)**

County	VOC Emissions	NOx Emissions
Davidson	0.0252	0.0042
Davie	0.0071	0.0012
Forsyth	0.0083	0.0014
Guilford	0.0331	0.0055
<b>Total</b>	<b>0.0737</b>	<b>0.0123</b>

#### 4.4.2 Structure Fires

The U.S. Fire Administration (USFA) maintains statistics on the number of fires per county. The number of fires per county for 2007 was derived from the USFA fire statistics. The 2007 USFA fire statistics were obtained from the USFA website. The structure fires category is based on both residential and non-residential structures. A fires per person factor was calculated for the residential structures based on the national number of residential fires divided by the national population for 2007. The fires per person factor for residential structures 0.0014 fires/person. A fires per person factor was also calculated for the non-residential structures based on the national number of non-residential fires divided by the national employment for 2007. The fires per employee factor for non-residential structures 0.00086 fires/employee. The 2007 county population was obtained from the North Carolina State Demographics and the 2007 county employment was obtained from the US Census Bureau, County Business Patterns. The fires per person factor was applied to the 2007 population for each county to determine the number of residential structure fires in each county. The fires per employee factor was applied to the 2007 county employment to determine the non-residential structure fires emissions for each county. To determine the total emissions from structure fires, the sum of the residential and non-residential structure fires emissions were totaled for each county. The population values are listed in Table 2.2-1 and the county employment is shown in Table 4.4.2-1.

**Table 4.4.2-1 2007 Employment**

	2007 Employment
Davidson	39,991
Davie	10,723
Forsyth	176,570
Guilford	263,686

The emission factors and fuel loading factors were obtained from the EIIP Tech. Report, Table 18.4-1 and Table 18.4-2, respectively. The emission factors are 11 lbs of VOC per ton

burned and 1.4 lbs of NO<sub>x</sub> per ton burned. The loading factor, which is 1.15 tons of material burned per structural fire, was also obtained from the EIIP Tech. Report.

According to the EIIP Tech. Report, emissions from this source category occur 365 days per year and there is no seasonal adjustment required.

For future year inventories, the base year emissions were grown using the percent growth in population for each county. The population growth factors were used because they are more conservative than the employment growth factors. The population growth factors are in Table 2.2-2. The structure fires emissions for the 2007 base year were calculated using equation 4.4.2-1. The projected future year inventories were calculated using equation 4.4.2-2.

$$EM = \frac{[(cnty\ pop * FPP) + (cnty\ empl * FPE)]}{2,000\ lbs/tons} * CF * EF * (1\ year/365\ days) \quad 4.4.2-1$$

$$PJEM = EM * GF_a \quad 4.4.2-2$$

where:

EM = total daily emissions in tons/day

FPP = fires per person, 0.0014 fires/person

FPE = fires per employee, 0.00086 fires/employee

CF = conversion factor, 1.15 tons burned/structure fire

EF = emission factors, VOC = 11 lbs/ton burned/year and NO<sub>x</sub> = 1.4 lbs/ton burned/year

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC and NO<sub>x</sub> emission estimates, in tons/day, from structure fires for the Triad maintenance area are listed in Table 4.4.2-2.

**Table 4.4.2-2 Emissions from Structure Fires (tons/day)**

County	2007		2011		2018	
	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC
Davidson	0.0005	0.0043	0.0005	0.0045	0.0006	0.0048
Davie	0.0001	0.0011	0.0001	0.0012	0.0001	0.0013
Forsyth	0.0014	0.0106	0.0015	0.0115	0.0017	0.0128
Guilford	0.0019	0.0148	0.0020	0.0158	0.0022	0.0175
<b>Total</b>	<b>0.0039</b>	<b>0.0308</b>	<b>0.0041</b>	<b>0.0330</b>	<b>0.0046</b>	<b>0.0364</b>

### 4.4.3 Vehicle Fires

Vehicle fire emissions within the maintenance area are estimated by considering the estimated number vehicles burned in the Triad area counties, the amount of material burned (the fuel loading) in a vehicle fire, and the emission factors for the open burning of automobile components. The assumptions for amount of material burned and the emission factors were based on the USEPA's AP-42, Section 2.5 - Open Burning.

The estimated number of vehicle fires was determined by apportioning a national fire statistic to a county level. The USFA maintains national-level fire statistics. The number of vehicle fires nationwide in 2007 was 258,000. The number of national vehicle fires was apportioned to a state-level using ratio of North Carolina vehicle miles traveled (VMT) to U.S. VMT (249,698,650 miles/3,029,822 x 10<sup>6</sup> miles). The number of statewide vehicle fires was then apportioned to a county level based on VMT in each county. The nationwide VMT statistics were obtained from the U.S. Department of Transportation, Federal Highway Administration website. The statewide and county VMT is Highway Performance Monitoring System data that was received from the NCDOT.

The above methodology was employed to calculate the vehicle fire emissions per county. For 2007, the VMT for the Triad maintenance area counties is listed in Table 4.4.6-1.

**Table 4.4.6-1 Vehicle Miles Traveled**

County	2007 VMT
Davidson	4,245,100
Davie	1,397,540
Forsyth	8,900,870
Guilford	11,814,280

The amount of vehicle material burned (the fuel loading) in a vehicle fire was estimated by assuming that an average vehicle has 500 lbs. of components (0.25 tons) that can burn in a fire, based on a 3,700 lbs. average vehicle weight (CARB, 1995).

The emission factors were obtained from AP-42, Table 2.5-1. The emission factors are 32 lbs. of VOC per ton burned and 4 lbs. of NO<sub>x</sub> per ton burned.

The projected future year emissions were developed by linear interpolation of the number of vehicle miles traveled for each county. The vehicle miles traveled was obtained from the NC DOT Highway Performance Management System. As with previous categories, the historic data used if for the linear interpolation is for 2003-2008. These growth factors are listed in Table 4.4.6-2 below.

**Table 4.4.6-2 Growth Factors for Vehicle Fires**

County	2011	2018
Davidson	0.9866	0.9710
Davie	0.9680	0.9785
Forsyth	1.0266	1.2795
Guilford	1.0480	1.1412

The emissions for the base year and future year inventories were calculated using equations 4.4.6-1 and 4.4.6-2, respectively.

$$EM = \frac{\text{US veh fires} * CF * EF * (\text{NC VMT/US VMT}) * (\text{cnty VMT/NC VMT}) * (1 \text{ yr}/365 \text{ dys})}{2,000 \text{ lbs/tons}} \quad 4.4.6-1$$

$$PJEM = EM * GF_a \quad 4.4.6-2$$

where:

EM = total daily emissions in tons/day

CF = conversion factor, 0.25 tons burned/vehicle fire

EF = emission factors, VOC = 32 lbs/ton burned year and NO<sub>x</sub> = 4 lbs/ton burned/year

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC and NO<sub>x</sub> emission estimates, in tons/day, from vehicle fires for the Triad maintenance area are listed in Table 4.4.6-3.

**Table 4.4.6-3 Emissions from Vehicle Fires (tons/day)**

County	2007		2011		2018	
	NOx	VOC	NOx	VOC	NOx	VOC
Davidson	0.0	0.0	0.0	0.0	0.0	0.0
Davie	0.0	0.0	0.0	0.0	0.0	0.0
Forsyth	0.0	0.0	0.0	0.0	0.0	0.0
Guilford	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>0.0</b>	<b>0.00</b>	<b>0.0</b>	<b>0.00</b>	<b>0.0</b>	<b>0.00</b>

#### 4.4.4 Charbroiling

Commercial charbroiling produces VOC emissions. According to the methodology in the EIIP Tech. Report, county Health Departments should be able to provide the number of restaurants in a county as well as the percentage of those restaurants that charbroil meat. The NCDAQ was able to obtain the number of restaurants in each county for 2007 from the North Carolina Division of Environmental Services, Inspection, Statistics and Fee Branch. To determine the percentage of charbroiling restaurants, the county Health Departments of several counties were surveyed. Three of the seven counties responded. The average percentage of the three responding counties was used as a surrogate for the number of charbroiling restaurants for all counties statewide. The three counties that supplied data were Durham County – 8%, Guilford County – 13% and Wake County 19%. The average between the three equates to 13%. Table 4.4.4-1 is the number of restaurants in 2007 in each county.

**Table 4.4.4-1 Total Number of Restaurants**

County	2007 Number of Restaurants
Davidson	259
Davie	86
Forsyth	737
Guilford	1,210

According to the EIIP Tech. Report, the average throughput of meat per restaurant with a charbroiler is 1,160 lbs. per week and the emission factor is 3.94 lbs. of VOC per 1,000 lbs. of meat. Emissions from this source category occur 365 days per year that results in no seasonal adjustment requirement. For projected future year emissions, growth factors were calculated

using linear interpolation of the restaurant employment from 2003-2008. Microsoft EXCEL FORECAST was used to calculate the growth factors that are listed in Table 4.4.4-2.

**Table 4.4.4-2 Growth Factors for Charbroiling**

County	2011	2018
Davidson	0.9849	1.0444
Davie	1.0726	1.3643
Forsyth	1.2085	1.4773
Guilford	1.1233	1.3116

The emissions for the base year and projected future year emissions were calculated using equations 4.4.3-1 and 4.4.3-2, respectively.

$$EM = \frac{\text{no. of restaurants} * \% \text{ charbroiling} * CF * EF * (1 \text{ week}/5 \text{ days})}{2,000 \text{ lbs/tons}} \quad 4.4.3-1$$

$$PJEM = EM * GF_a \quad 4.4.3-2$$

where:

EM = total daily emissions in tons/day

CF = conversion factor, 1,160 lbs meat charbroiled/week

EF = emission factor, 3.94 lbs VOC/1,000 lbs meat charbroiled

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, from charbroiling for the Triad maintenance area are listed in Table 4.4.3-3.

**Table 4.4.4-3 VOC Emissions (tpd) from Charbroiling**

County	2007	2011	2018
Davidson	0.015	0.015	0.016
Davie	0.005	0.005	0.007
Forsyth	0.044	0.053	0.065
Guilford	0.072	0.081	0.094
<b>Total</b>	<b>0.136</b>	<b>0.154</b>	<b>0.182</b>

#### 4.4.5 Open Burning – Municipal Solid Waste and Yard Trimmings

It was assumed that all municipal solid waste (MSW) and yard trimmings were burned in the open for solid waste generated outside the municipal corporate limits. According to the EIIP Tech. Report, Table 16.5-1, it is estimated that 3.77 lbs. of MSW is generated per person per day and 0.64 lbs. of yard trimmings are generated per person per day. Since it is illegal to burn within the corporate limits, the rural population for 2007 for each county was determined. The rural population was calculated by applying the 2000 census rural population percentage to the total 2007 county population. The 2007 total population for each county was obtained from the North Carolina Office of State Budget and Management, State Data Center. Table 4.4.5-1 shows the rural population percentage and the total rural population for each county.

**Table 4.4.5-1 Rural Population**

County	2000 Rural Population Percentage	2007 Rural Population
Davidson	56.6	88,256
Davie	77.1	31,076
Forsyth	9.1	30,723
Guilford	1.6	7,347

The emission factors for open burning of MSW were obtained from EIIP Tech. Report, Table 16.4-1. The emission factor for VOC is 6.676 lbs. per ton MSW burned and 6 lbs. NOx per ton MSW burned. The emission factor for VOC is the total VOC – Acetone = 8.556 - 1.88 = 6.676 pounds VOC/ton burned/year.

The emission factors for open burning of yard trimmings, from the EIIP Tech. Report, Section 4.1.3, Table 16.4-7, are 28 lbs. VOC per ton yard trimmings burned per year and 6 lbs. NOx per ton yard trimmings burned per year. Emissions from these source categories occur 365 days per year, therefore, no seasonal adjustment is required. The projected future year growth factors are in Table 2.2-2.

The base year emissions were calculated using equation 4.4.4-1 and the projected future year emissions were calculated using equation 4.4.4-2.

$$EM = \frac{\text{county rural population} * CF * EF}{2,000 \text{ lb/tons}} * (1 \text{ year}/365 \text{ days}) \quad 4.4.4-1$$



$$PJEM = EM * GF_a$$

4.4.4-2

where:

EM = total daily emissions in tons/day

CF = conversion factors, 3.77 lbs MSW/person/day and 0.64 lbs yard trimmings/person/day

EF = emission factors are:

VOC<sub>MSW</sub> = 6.7 lbs/ton burned/year

NO<sub>x</sub><sub>MSW</sub> = 6 lbs/ton burned/year

VOC<sub>yard</sub> = 28 lbs/ton burned/year

NO<sub>x</sub><sub>yard</sub> = 6 lbs/ton burned/year

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

Since the NCDAQ has an open burning regulation that prohibits the burning of man-made materials, the emissions estimated for MSW were reduced to account for this rule. The control efficiency is 100% since no burning yields no emissions. The rule penetration is also 100% since the regulation prohibits the burning of man-made materials statewide. Finally the rule effectiveness was set to a conservative 50% for the base year since the NCDAQ knows that burning of man-made materials does occur. The NCDAQ has started an aggressive campaign to make the public aware that it is illegal to burn man-made materials. The NCDAQ has sponsored radio ads as well as billboard signs in an effort to educate the public. Additionally, the NCDAQ has developed an educational video discussing open burning and the State's regulation. This video has been distributed to the fire departments across the State. Finally, at the 2009 North Carolina State Fair, the NCDAQ had a booth that allowed staff to talk with the general public about the open burning regulations and provide hand outs that discussed what was legal to burn. The NCDAQ expects that as the public becomes more aware of the open burning regulations, the rule effective will increase to 67% by 2018. A gradual increase in the rule effectiveness for the interim years was applied. The table below displays the rule effective numbers used in calculating the emissions.

**Table 4.4.5-2 Rule Effectiveness for MSW Open Burning**

2007	2011	2018
0.50	0.56	0.67

The formula used to apply these factors to the emissions estimates is shown below in equations 4.3-4 and 4.3-5.

$$EM_{P,MSW,Controlled} = EM_{P,MSW} \times (1 - (CE \times RP \times RE))$$

4.3-4

$$PJ_aEM_{Controlled} = PJ_aEM \times (1 - (CE \times RP \times RE)) \quad 4.3-5$$

- where  $EM_{P,MSW,Controlled}$  = controlled emissions from burning MSW for pollutant (P)  
 $EM_{P,MSW}$  = emissions from burning MSW for pollutant (P)  
 CE = control efficiency  
 RP = rule penetration  
 RE = rule effectiveness  
 $PJ_aEM_{Controlled}$  = controlled projected future year (a) emissions for county  
 $PJ_aEM$  = projected future year (a) emissions for county

The VOC and NO<sub>x</sub> emission estimates, in tons/day, from the open burning of MSW and yard trimmings for the Triad maintenance area are listed in Table 4.4.5-3 and Table 4.4.5-4.

**Table 4.4.5-3 Emissions from Municipal Solid Waste Burning (tons/day)**

County	2007		2011		2018	
	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC
Davidson	0.250	0.278	0.230	0.256	0.184	0.205
Davie	0.088	0.098	0.083	0.092	0.069	0.077
Forsyth	0.087	0.097	0.083	0.092	0.069	0.077
Guilford	0.208	0.231	0.195	0.217	0.162	0.180
<b>Total</b>	<b>0.633</b>	<b>0.704</b>	<b>0.591</b>	<b>0.657</b>	<b>0.484</b>	<b>0.539</b>

**Table 4.4.5-4 Emissions from Burning of Yard Trimmings (tons/day)**

County	2007		2011		2018	
	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC
Davidson	0.088	0.395	0.092	0.414	0.099	0.443
Davie	0.031	0.139	0.033	0.149	0.037	0.165
Forsyth	0.030	0.138	0.033	0.150	0.036	0.166
Guilford	0.073	0.329	0.078	0.352	0.086	0.389
<b>Total</b>	<b>0.222</b>	<b>1.001</b>	<b>0.236</b>	<b>1.065</b>	<b>0.258</b>	<b>1.163</b>

#### 4.4.6 Small Stationary Combustion Sources

This source category covers emissions from natural gas (NG), liquid petroleum gas (LPG), fuel oil, coal and wood combustion in the residential, commercial/institutional (referred to as commercial) and industrial sectors.

The “demand for energy” for these fuel types is known as fuel usage. The 2007 fuel usage data for North Carolina was obtained from the U.S. Department of Energy, Energy Information Administration (EIA) website for fuel consumption.

The following tables show the 2007 fuel usage for the residential, commercial and industrial source sectors in North Carolina.

**Table 4.4.6-1 2007 Residential Fuel Use in North Carolina**

Fuel	Units	Residential
Natural Gas (NG)	10 <sup>6</sup> ft <sup>3</sup>	58,365
Liquefied Petroleum Gas (LPG)	barrels	4,795,252
Oil	barrels	1,972,120
Coal	tons	4,496

**Table 4.4.6-2 2007 Commercial and Industrial Fuel Use in North Carolina**

Fuel	Units	Commercial	Industrial
Natural Gas (NG)	10 <sup>6</sup> ft <sup>3</sup>	45,434	88,401
Liquefied Petroleum Gas (LPG)	barrels	1,939,653	4,439,814
Oil	gallons	63,063,286	58,358,000
Coal	tons	40,464	0

The emission factors used to estimate the emissions, except residential wood, were obtained from E.H. Pechan & Associates, Inc. based on the ongoing emission factor development work conducted by the Eastern Regional Technical Advisory Group (ERTAC) in conjunction with the USEPA. The residential wood emission factors were obtained from a tool developed by the USEPA to calculate the emissions generated from residential wood combustion.

The emission factors used are shown in Table 4.6-3 below.

**Table 4.4.6-3 Fuel Combustion Emission Factors**

Fuel	Units	NOx	VOC
<i>Residential</i>			
NG	lb/10 <sup>6</sup> ft <sup>3</sup>	94	5.5
LPG	lb/ barrel	0.562	0.0219
Fuel Oil	lb/gal	0.018	0.0007
Wood	lb/ton	2.6	18.9
Coal	lb/ton	9.1	10
<i>Commercial</i>			
NG	lb/10 <sup>6</sup> ft <sup>3</sup>	100	5.5
LPG	lb/barrel	0.398	0.0219
Fuel Oil	lb/gal	0.02	0.00034
Coal	lb/ton	11	0.05
<i>Industrial</i>			
NG	lb/10 <sup>6</sup> ft <sup>3</sup>	100	5.5
LPG	lb/barrel	0.398	0.0219
Fuel Oil	lb/gal	0.02	0.0002

Residential Combustion Sources

The residential category for the fuel oil, coal, NG and LPG sources fuel usage for the Triad nonattainment area was calculated by apportioning the State total fuel usage to a county level. Fuel usage was apportioned by applying the ratio of the number of households heated with the appropriate fuel type in a county to the total households in the State heated with the appropriate fuel type, see equation 4.4.6-1 below.

$$\text{no. gal. fuel per cnty} = (\text{no. gal. fuel for state}) * \frac{(\text{no. housing units heated by fuel per cnty})}{(\text{no. housing units heated by fuel in state})} \quad 4.4.6-1$$

The number of households heated with fuel oil, coal, NG and LPG was obtained from the U.S. Census Bureau based on the latest census data which is 2000. The number of households heated per fuel type is shown in Table 4.4.6-4.

**Table 4.4.6-4 Residential Fuel Type**

County	Number of Households per Fuel Type			
	Fuel Oil	Coal	NG	LPG
Davidson	11,849	8	8,473	4,134
Davie	3,012	0	1,096	4,134
Forsyth	22,223	39	32,464	3,763
Guilford	10,715	12	76,608	7,941
North Carolina	271,482	406	890,790	383,823

For the residential wood combustion emissions, the USEPA developed a tool to generate the emissions for this subcategory. The emissions for this subcategory are for housing units with fireplaces as their main source of heating. The activity data used in the calculation was also obtained from the tool the USEPA developed to calculate residential wood combustion emissions. The emissions calculation is shown in equation 4.4.6-2 below.

$$EM = \frac{\text{activity data} * EF * (1 \text{ year}/365 \text{ days})}{2,000 \text{ lbs/ton}} \quad 4.4.6-2$$

where:

EM = total daily emissions in tons/day

EF = emission factors for VOC = 18.9 lbs/ton burned/year and

NO<sub>x</sub> = 2.6 lbs/ton burned/year

activity data = tons wood burned per year per county as shown below

Davidson	29.89
Davie	8.18
Forsyth	57.24
Guilford	81.84

#### Commercial and Industrial Combustion Sources

Commercial and industrial fuel usage was apportioned according to the number of employees in the commercial/industrial business establishments in the State and the Triad nonattainment counties. The commercial employment data was obtained from the County Business Patterns for NAICS codes 42(wholesale trade) through 81(other services - except public administration). For industrial combustion, the employment data was also obtained from the County Business Patterns for NAICS codes 31-33(manufacturing). Fuel usage was apportioned to the county level by applying the ratio of county employment to the total State employment, see equation 4.4.6-3.

$$\text{no. gal. fuel per county} = (\text{no. gal. fuel for State}) * \frac{(\text{commercial/industrial employment per county})}{(\text{commercial/industrial employment in State})}$$

4.4.6-3

The total number of employees for these establishments was used to allocate emissions to the county level. The 2007 commercial and industrial employment for each county are shown in Table 4.4.6-5.

**Table 4.4.6-5 Commercial and Industrial Combustion Employment**

	2007 Commercial Employment	2007 Industrial Employment
Davidson	18,429	12,136
Davie	5,002	2,999
Forsyth	81,819	23,378
Guilford	127,180	39,049

For the residential source sectors, the growth factors are based on the population for each county. The population growth factors are in Table 2.2-2.

The manufacturing (NAICS 31), wholesale trade (NAICS 42) and retail trade (NAICS 44) establishments were used to represent the employment data for the commercial and industrial source sectors. The FORECAST function in Microsoft EXCEL was used to determine the future year employment data for 2011 and 2018 based on the past employment data for 2003 - 2008. The FORECAST tool uses linear interpolation to project future values based on historic data. The table below shows the base year and future year manufacturing employment data.

**Table 4.4.6-6 Manufacturing Employment per County**

Year	Davidson	Davie	Forsyth	Guilford
2003	22,519	4,139	50,546	93,653
2004	22,313	4,134	49,515	94,958
2005	20,839	4,365	46,705	91,400
2006	19,689	4,831	53,603	89,121
2007	19,221	4,948	52,580	88,712
2008	18,150	5,191	50,544	86,853
2011	15,384	5,885	53,109	82,137
2018	8,930	7,518	56,326	71,134

The growth factors were developed based on the ratio of the base year (2007) employment to the future years (2011 and 2018) employment, see equation 4.4.6-4 below.

$$\text{Commercial/Industrial Growth Factors} = \frac{\text{FY}_{\text{emp}}}{\text{BY}_{\text{emp}}} \quad 4.4.6-4$$

where:

$\text{BY}_{\text{emp}}$  = 2007 employment per county

$\text{FY}_{\text{emp}}$  = future year employment per county

Based on the manufacturing employment data in Table 4.4.6-5 above, the commercial and industrial growth factors for each county are shown in Table 4.4.6-7 below.

**Table 4.4.6-7 Commercial/Industrial Growth Factors for Fuel Combustion**

County	2011	2018
Davidson	0.800	0.465
Davie	1.189	1.519
Forsyth	1.010	1.071
Guilford	0.926	0.802

The emissions for the 2007 base year emissions for each small stationary combustion source were calculated using equations 4.4.6-5 – 4.4.6-8.

$$\text{EM}_{\text{coal}} = \frac{\text{no. tons/year coal} * \text{EF}_{\text{coal}} * (1 \text{ year}/365 \text{ days})}{2,000 \text{ lb/ton}} \quad 4.4.6-5$$

$$\text{EM}_{\text{NG}} = \frac{\text{no. ft}^3/\text{year NG} * \text{EF}_{\text{NG}} * (1 \text{ year}/365 \text{ days})}{2,000 \text{ lbs /ton}} \quad 4.4.6-6$$

$$\text{EM}_{\text{LPG}} = \frac{\text{no. gal/year LPG} * \text{EF}_{\text{LPG}} * (1 \text{ year}/365 \text{ days})}{2,000 \text{ lbs /ton}} \quad 4.4.6-7$$

$$\text{EM}_{\text{fuel oil}} = \frac{\text{no. gal/year fuel oil} * \text{EF}_{\text{oil}} * (1 \text{ year}/365 \text{ days})}{2,000 \text{ lbs /ton}} \quad 4.4.6-8$$

$$EM_{\text{wood}} = \frac{\text{no. ton/year wood} * EF_{\text{wood}}}{2,000 \text{ lbs /ton}} * (1 \text{ year}/365 \text{ days})$$

4.4.6-9

where:

- EM<sub>coal</sub> = daily total coal emissions in tons/day
- EM<sub>NG</sub> = daily total Ng emissions in tons/day
- EM<sub>LPG</sub> = daily total LPG emissions in tons/day
- EM<sub>fuel oil</sub> = daily total fuel oil emissions in tons/day
- EM<sub>wood</sub> = daily total wood emissions in tons/day
- EF<sub>coal</sub> = emission factor for coal combustion per pollutant
- EF<sub>NG</sub> = emission factor for NG combustion per pollutant
- EF<sub>LPG</sub> = emission factor for LPG combustion per pollutant
- EF<sub>oil</sub> = emission factor for fuel oil combustion per pollutant
- EF<sub>wood</sub> = emission factor for wood combustion per pollutant

The emissions for the projected future years for all of the small stationary combustion sources were calculated using equation 4.4.6-10

$$PJEM = EM * GF_a \tag{4.4.6-10}$$

where:

- PJEM = projected future year emissions in tons/day
- GF<sub>a</sub> = growth factor (a) for projected future years.

The NO<sub>x</sub> and VOC emissions estimates for each fuel combustion source, in tons/day, for the residential source sector are listed in Tables 4.4.6-8 through 4.4.6-12. Based on U.S. Census Bureau data, Davie County does not use coal as a means of residential heating, therefore, there are no emissions estimates for coal combustion in Davie County.

**Table 4.4.6-8 Fuel Oil Emissions (tpd) for Residential Combustion**

County	2007		2011		2018	
	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC
Davidson	0.066	0.003	0.069	0.003	0.074	0.003
Davie	0.017	0.001	0.018	0.001	0.020	0.001
Forsyth	0.123	0.005	0.134	0.005	0.148	0.006
Guilford	0.059	0.002	0.063	0.002	0.070	0.002
<b>Total</b>	<b>0.265</b>	<b>0.011</b>	<b>0.284</b>	<b>0.011</b>	<b>0.312</b>	<b>0.012</b>



**Table 4.4.6-9 LPG Emissions (tpd) for Residential Combustion**

County	2007		2011		2018	
	NOx	VOC	NOx	VOC	NOx	VOC
Davidson	0.039	0.0015	0.0409	0.0016	0.0437	0.0017
Davie	0.0089	0.0004	0.0095	0.0004	0.0105	0.0005
Forsyth	0.0353	0.0014	0.0384	0.0015	0.0426	0.0017
Guilford	0.0745	0.0029	0.0796	0.0031	0.0881	0.0034
<b>Total</b>	<b>0.1577</b>	<b>0.0062</b>	<b>0.1684</b>	<b>0.0066</b>	<b>0.1849</b>	<b>0.0073</b>

**Table 4.4.6-10 NG Emissions (tpd) for Residential Combustion**

County	2007		2011		2018	
	NOx	VOC	NOx	VOC	NOx	VOC
Davidson	0.084	0.005	0.0881	0.0052	0.0942	0.0056
Davie	0.011	0.001	0.0118	0.0011	0.0130	0.0012
Forsyth	0.324	0.019	0.3522	0.0207	0.3907	0.0229
Guilford	0.760	0.044	0.8124	0.0470	0.8983	0.0520
<b>Total</b>	<b>1.179</b>	<b>0.069</b>	<b>1.2645</b>	<b>0.0740</b>	<b>1.3962</b>	<b>0.0817</b>

**Table 4.4.6-11 Coal Emissions (tpd) for Residential Combustion**

County	2007		2011		2018	
	NOx	VOC	NOx	VOC	NOx	VOC
Davidson	0.0010	0.0011	0.0010	0.0012	0.0011	0.0012
Davie	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Forsyth	0.0047	0.0052	0.0051	0.0057	0.0057	0.0063
Guilford	0.0014	0.0016	0.0015	0.0017	0.0017	0.0019
<b>Total</b>	<b>0.0071</b>	<b>0.0079</b>	<b>0.0076</b>	<b>0.0086</b>	<b>0.0085</b>	<b>0.0094</b>

**Table 4.4.6-12 Wood Emissions (tpd) for Residential Combustion**

County	2007		2011		2018	
	NOx	VOC	NOx	VOC	NOx	VOC
Davidson	0.007	0.047	0.0073	0.0493	0.0078	0.0527
Davie	0.002	0.013	0.0021	0.0139	0.0024	0.0154
Forsyth	0.013	0.092	0.0141	0.1000	0.0157	0.1110
Guilford	0.018	0.131	0.0192	0.1400	0.0213	0.1548
<b>Total</b>	<b>0.040</b>	<b>0.283</b>	<b>0.0427</b>	<b>0.3032</b>	<b>0.0472</b>	<b>0.3339</b>

The NO<sub>x</sub> and VOC emissions estimates for each fuel combustion source, in tons/day, for the commercial and industrial source sectors are listed in Tables 4.4.6-13 through 4.4.6-19. There are no wood combustion emissions estimates for the commercial and industrial source sectors because the only emission factors for wood combustion is residential furnaces which are captured in the residential source sector. Additionally, there are no coal combustion emissions for the industrial source sector because the emissions generated from coal are accounted for in the point sources inventory.

**Table 4.4.6-13 Coal Emissions (tpd) for Commercial Combustion**

County	2007		2011		2018	
	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC
Davidson	0.0057	0.0000	0.0046	0.0000	0.0027	0.0000
Davie	0.0016	0.0000	0.0019	0.0000	0.0024	0.0000
Forsyth	0.0254	0.0001	0.0257	0.0001	0.0272	0.0001
Guilford	0.0396	0.0002	0.0367	0.0002	0.0318	0.0002
<b>Total</b>	<b>0.0723</b>	<b>0.0003</b>	<b>0.0689</b>	<b>0.0003</b>	<b>0.0641</b>	<b>0.0003</b>

**Table 4.4.6-14 Fuel Oil Emissions (tpd) for Commercial Combustion**

County	2007		2011		2018	
	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC
Davidson	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Davie	0.0044	0.0001	0.0052	0.0001	0.0067	0.0002
Forsyth	0.0673	0.0011	0.0680	0.0011	0.0721	0.0012
Guilford	0.0699	0.0007	0.0647	0.0006	0.0561	0.0006
<b>Total</b>	<b>0.1416</b>	<b>0.0019</b>	<b>0.1379</b>	<b>0.0018</b>	<b>0.1349</b>	<b>0.0020</b>

**Table 4.4.6-15 LPG Emissions (tpd) for Commercial Combustion**

County	2007		2011		2018	
	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC
Davidson	0.0099	0.0005	0.0079	0.0004	0.0046	0.0002
Davie	0.0027	0.0001	0.0032	0.0001	0.0041	0.0002
Forsyth	0.0440	0.0024	0.0444	0.0024	0.0471	0.0026
Guilford	0.0687	0.0038	0.0636	0.0035	0.0551	0.0030
<b>Total</b>	<b>0.1253</b>	<b>0.0068</b>	<b>0.1191</b>	<b>0.0064</b>	<b>0.1109</b>	<b>0.0060</b>

**Table 4.4.6-16 NG Emissions (tpd) for Commercial Combustion**

County	2007		2011		2018	
	NOx	VOC	NOx	VOC	NOx	VOC
Davidson	0.0332	0.0001	0.0266	0.0001	0.0154	0.0000
Davie	0.0158	0.0009	0.0188	0.0011	0.0240	0.0014
Forsyth	0.1168	0.0000	0.1180	0.0000	0.1251	0.0000
Guilford	0.1866	0.0053	0.1728	0.0049	0.1497	0.0042
<b>Total</b>	<b>0.3524</b>	<b>0.0063</b>	<b>0.3362</b>	<b>0.0061</b>	<b>0.3142</b>	<b>0.0056</b>

**Table 4.4.6-17 Fuel Oil Emissions (tpd) for Industrial Combustion**

County	2007		2011		2018	
	NOx	VOC	NOx	VOC	NOx	VOC
Davidson	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Davie	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Forsyth	0.0159	0.0000	0.0161	0.0000	0.0170	0.0000
Guilford	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Total</b>	<b>0.0159</b>	<b>0.0000</b>	<b>0.0161</b>	<b>0.0000</b>	<b>0.0170</b>	<b>0.0000</b>

**Table 4.4.6-18 LPG Emissions (tpd) for Industrial Combustion**

County	2007		2011		2018	
	NOx	VOC	NOx	VOC	NOx	VOC
Davidson	0.0226	0.0012	0.0181	0.0010	0.0105	0.0006
Davie	0.0062	0.0003	0.0074	0.0004	0.0094	0.0005
Forsyth	0.1007	0.0055	0.1017	0.0056	0.1078	0.0059
Guilford	0.1573	0.0087	0.1457	0.0081	0.1262	0.0070
<b>Total</b>	<b>0.2868</b>	<b>0.0157</b>	<b>0.2729</b>	<b>0.0151</b>	<b>0.2539</b>	<b>0.0140</b>

**Table 4.4.6-19 NG Emissions (tpd) for Industrial Combustion**

County	2007		2011		2018	
	NOx	VOC	NOx	VOC	NOx	VOC
Davidson	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Davie	0.0156	0.0009	0.0185	0.0011	0.0237	0.0014
Forsyth	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Guilford	0.2796	0.0012	0.2589	0.0011	0.2242	0.0010
<b>Total</b>	<b>0.2952</b>	<b>0.0021</b>	<b>0.2774</b>	<b>0.0022</b>	<b>0.2479</b>	<b>0.0024</b>

Point sources are those stationary sources that require an air permit to operate. In general, these sources have a potential to emit more than 5 tons per year of CO, NO<sub>x</sub>, PM, SO<sub>2</sub> and/or VOC from a single facility. Point sources that meet this criterion are accounted for in the point source emissions inventory. They are subtracted from the area source emissions inventory to prevent double counting of emissions. The 2007 point source emissions data was subtracted from the overall area source emissions calculation.

Tables 4.4.6-20 – 4.4.6-23 illustrates the point source emissions that were subtracted from the commercial fuel oil and commercial NG sources as well as the industrial fuel oil and industrial NG sources. The remaining commercial and industrial combustion sources do not have point source emissions for the Triad nonattainment counties.

**Table 4.4.6-20 Point Source Commercial Fuel Oil Combustion Emissions (tpd)**

County	NO <sub>x</sub>	VOC
Davidson	0.0069	0.0000
Davie	0.0000	0.0000
Forsyth	0.0023	0.0001
Guilford	0.0047	0.0000
<b>Total</b>	<b>0.0139</b>	<b>0.0001</b>

**Table 4.4.6-21 Point Source Commercial Natural Gas Combustion Emissions (tpd)**

County	NO <sub>x</sub>	VOC
Davidson	0.0183	0.0028
Davie	0.0000	0.0000
Forsyth	0.0700	0.0098
Guilford	0.1174	0.0113
<b>Total</b>	<b>0.2057</b>	<b>0.0239</b>

**Table 4.4.6-22 Point Source Industrial Fuel Oil Combustion Emissions (tpd)**

County	NOx	VOC
Davidson	0.0085	0.0001
Davie	0.5183	0.0029
Forsyth	0.0253	0.0012
Guilford	0.1874	0.0023
<b>Total</b>	<b>0.7395</b>	<b>0.0065</b>

**Table 4.4.6-23 Point Source Industrial Natural Gas Combustion Emissions (tpd)**

County	NOx	VOC
Davidson	0.0508	0.0029
Davie	0.0076	0.0004
Forsyth	0.2871	0.0292
Guilford	0.2335	0.0172
<b>Total</b>	<b>0.5790</b>	<b>0.0497</b>

#### 4.4.7 Agricultural Burning

This source subcategory covers burning practices used to clear and/or prepare land for planting. These operations include stubble burning, burning of agricultural crop residues, and the burning of stand field crops as part of harvesting (e.g., sugar cane). According to the North Carolina Department of Agriculture, when soybeans are double cropped with wheat, the wheat stubble is usually burned back after harvest about one fourth of the time. According to Dr. J. Dunphy, a soybean specialist at North Carolina State University, the acres of soybean double cropped with wheat in North Carolina is approximately equal to the acres of wheat planted. Therefore, ¼ of the acreage of wheat planted in 2002 was used to calculate the emissions from agricultural burning practices in North Carolina.

The fuel loading factor and the yield of pollutant for burning wheat stubble was obtained from AP-42, Table 2.4.2. The fuel loading factor is 1.9 tons of fuel consumed per acre burned. The yield of pollutant was dependent upon whether the field was head-fire burned or back-fire burned. The percentage of each burning type used was not available, therefore, the assumption was made that each type was used 50% of the time. The yield of pollutant used, 11 lbs. of VOC per ton of fuel consumed, is an average of the two types of burning. To calculate the emission factor for VOC emissions, the fuel loading factor is multiplied by the yield of pollutant.

$$\begin{aligned}
 EF_{\text{VOC}} &= (1.9 \text{ tons/acre}) (11 \text{ lbs VOC/ton burned}) \\
 &= 20.9 \text{ lbs VOC/acre burned}
 \end{aligned}$$

The annual emissions were calculated using the number of acres burned and the per acre emission factor. According to the North Carolina Department of Agriculture, field burning occurs only during June and July, therefore, the daily emissions for agricultural burning were calculated by dividing the annual emissions by 61 days. No seasonal adjustment is needed since all of the burning occurs during the ozone season.

The number of acres of wheat planted was obtained from the North Carolina Agriculture Statistic Division and is tabulated in Table 4.4.7-1 below.

**Table 4.4.7-1 Acres of Land Burned by Agricultural Burning**

County	Number of Wheat Acres in 2007
Davidson	3,000
Davie	4,000
Forsyth	1,400
Guilford	5,400

The projected future year emissions were grown using growth factors that were linear interpolated using Microsoft EXCEL FORECAST. The historic data for the total number of wheat acres planted for 2003-2008 were used for the linear interpolation. Statewide wheat acreage was used because it was available for 2003-2008. The growth factors are shown in Table 4.4.7-2.

**Table 4.4.7-2 Growth Factors for Agricultural Burning**

2011	2018
1.3630	1.8519

The emissions for 2007 were calculated using equation 4.4.7-1 and the emissions for the interim year and future year were calculated using equation 4.4.7-2.

$$EM = \frac{(1/4 \times \text{wheat acreage}) * EF * (1 \text{ year}/61 \text{ days})}{2,000 \text{ lbs/ton}} \tag{4.4.7-1}$$

$$PJEM = EM * GF_a$$

4.4.7-2

where:

EM = total daily emissions in tons/day

EF = emission factor, VOC = 20.9 lbs/acre burned/year

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC emission estimates, in tons/day, from agricultural burning for the Triad maintenance area are listed in Table 4.4.7-3.

**Table 4.4.7-3 VOC Emissions from Agricultural Burning (tons/day)**

County	2007	2011	2018
Davidson	0.128	0.174	0.237
Davie	0.171	0.233	0.317
Forsyth	0.060	0.082	0.111
Guilford	0.231	0.315	0.428
<b>Total</b>	<b>0.590</b>	<b>0.804</b>	<b>1.093</b>

#### 4.4.8 On-Site Incineration

On-site incineration occurs at industrial and commercial facilities. Typically, these facilities are captured in the point source inventory. Emissions from this source category have been included to account for any smaller facilities that are not included in the point source emissions inventory.

Emissions are calculated and projected based on county population (Table 2.2-1 and Table 2.2-2). The emission factors are 8.556 lbs VOC/ton waste and 2.5 lbs NO<sub>x</sub>/ton waste. Waste fuel loading factor is 0.023 tons refuse per person per year. Industrial and commercial facilities have the same emission factors. The emissions for 2007 were calculated using equation 4.4.8-1 and the emissions for the base year and the projected future years were calculated using equation 4.4.8-2.

$$EM = \frac{\text{county population} * LF * EF}{2,000 \text{ lbs/tons}} * (1 \text{ year}/365 \text{ days}) \quad 4.4.8-1$$

$$PJEM = EM * GF_a \quad 4.4.8-2$$

where:

EM = total daily emissions in tons/day

LF = fuel loading factor, 0.023 tons refuse burned/person/year

EF = emission factors, VOC = 8.6 lbs/ton waste/year and NO<sub>x</sub> = 2.5 lbs/ton waste/year

PJEM = projected future emissions in tons/day

GF<sub>a</sub> = growth factor (a) for projected future years

The VOC and NO<sub>x</sub> emission estimates, in tons/day, from on-site incineration emissions for the Triad maintenance area are listed in the Table 4.4.8-1 below.

**Table 4.4.8-1 Emissions from Commercial On-Site Incineration (tons/day)**

County	2007		2011		2018	
	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC	NO <sub>x</sub>	VOC
Davidson	0.007	0.024	0.007	0.025	0.008	0.027
Davie	0.002	0.008	0.002	0.009	0.002	0.009
Forsyth	0.002	0.008	0.002	0.009	0.002	0.010
Guilford	0.006	0.020	0.006	0.021	0.007	0.024
<b>Total</b>	<b>0.017</b>	<b>0.060</b>	<b>0.017</b>	<b>0.064</b>	<b>0.019</b>	<b>0.070</b>

#### 4.5 BIOGENIC EMISSIONS

Biogenic emissions are primarily VOC emissions from vegetation and are kept constant through all years when modeling ozone. Since the redesignation plan is a comparison of future year to base year emissions and the biogenic emissions are kept constant, the biogenic emissions do not play a part in the redesignation demonstration. Upon discussions with the USEPA Region 4, it was agreed that the biogenic emissions did not need to be estimated for the redesignation demonstration and maintenance plan.

#### 4.6 SUMMARY OF AREA SOURCE EMISSIONS

The total area source emissions for the Triad maintenance area are summarized in the tables below. All of the emissions are in tons per day.



**Table 4.6-1 Total Area Source VOC Emissions (tpd)**

County	2007	2011	2018
Davidson	6.91	7.20	7.03
Davie	4.68	5.03	6.51
Forsyth	16.75	18.92	22.62
Guilford	22.89	24.56	29.19
<b>Total</b>	<b>51.23</b>	<b>55.71</b>	<b>65.35</b>

**Table 4.6-2 Total Area Source NOx Emissions (tons/day)**

County	2007	2011	2018
Davidson	0.62	0.60	0.55
Davie	0.21	0.22	0.23
Forsyth	0.99	1.04	1.11
Guilford	2.01	2.01	1.99
<b>Total</b>	<b>3.83</b>	<b>3.87</b>	<b>3.88</b>

## **Appendix B.3**

# **On-Road Mobile Sources Emission Inventory Documentation**

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## 1.0 INTRODUCTION AND SCOPE

As a requirement of the 1997 8-hour ozone standard implementation rule, areas that were maintenance for the 1-hour ozone standard and designated as attainment for the 1997 8-hour ozone standard have to submit a 110(a)(1) maintenance plan within 3 years of being designated as attainment. The Greensboro/Winston-Salem/High Point (referred to as the Triad area) 1-hour ozone maintenance area falls into this category and is required to have a 110(a)(1) maintenance plan. The 1-hour ozone maintenance area includes Davidson, Forsyth and Guilford Counties and a small portion of Davie County. For the purpose of this maintenance plan, emissions will be estimated for all of Davie County.

The scope of this appendix covers only the procedures associated with on-road mobile sources. On-road mobile sources produce nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOCs), along with a host of other pollutants. An emissions inventory comparison is necessary to determine maintenance. The years used for the comparison must include a base year (2007), at least one interim year (2011), and a future year (2018). The emissions comparison will be done for a typical ozone season day.

## 2.0 OVERALL METHODOLOGY

### 2.1 EMISSION ESTIMATION APPROACH

Mobile source emissions are estimated by the methodologies suggested in the United States Environmental Protection Agency (USEPA) documents Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations, Policy Guidance on the Use of MOVES2010 for State Implementation Plan Development, Transportation Conformity, and Other Purposes (EPA-420-B-09-046, December 2009), 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).

In December 2009, the USEPA released a new model for mobile sources. MOVES (MOtor Vehicle Emissions Simulator) is a computer program designed by the USEPA to estimate air pollution emissions from mobile sources. MOVES2010a (hereafter referred to as MOVES) replaces the USEPA's previous emissions model for on-road mobile sources, MOBILE6.2. MOVES can be used to estimate exhaust and evaporative emissions as well as brake and tire wear emissions from all types of on-road vehicles.

Compared to MOBILE6.2, MOVES incorporates substantially newer emissions test data and accounts for changes in vehicle technology and regulations as well as improved understanding of in-use emission levels and the factors that influence them. Also, MOVES has a completely new database-centered software framework.

The estimation of emissions from mobile sources involves multiplying an activity level by an emission factor. Previously this was done using MOBILE6.2 to calculate an emissions factor and multiplying it by the vehicle miles travelled (VMT). One important new feature of MOVES is the option to calculate emissions either as inventory estimates (total emissions in units of mass) or, emission rates (emissions per unit of distance for running emissions or per vehicle for starts, extended idle and resting evaporative emissions) in a look-up table format.

Use of the inventory option simplifies the post-processing of MOVES output, but it requires VMT and vehicle population data as an input to MOVES. When using the emission rates option, VMT and vehicle population are applied during post-processing external to MOVES. Either approach can be used to develop emissions estimates for state implementation plans (SIPs) and regional conformity analyses. If inventory option is selected, MOVES provides emissions estimates as mass, using VMT and vehicle population entered by the user. If emission rate option is selected, MOVES provides emission rates as mass per unit of activity. The emission rates option produces a look-up table of emission rates that must be post-processed to produce an inventory. The NCDAQ is electing to run the model in the inventory mode due to faster model run times and fewer post-processing requirements.

### **3.0 QUALITY ASSURANCE MEASURES**

The quality assurance (QA) for the highway mobile source category can be broken into two components: 1) input files and 2) MOVES outputs/summaries. Each of these components is detailed in the paragraphs below.

After the speed and VMT information is acquired from the North Carolina Department of Transportation (NCDOT), the speed information is checked for reasonableness against previous sets of speeds for the areas. Once the speeds are deemed reasonable, the NCDAQ enters the speed information into MOVES input files. In addition to the speed information, the user enters data to characterize local meteorology, fleet and activity information. All input files are checked against a “key” with the original source of the information. This QA step is always performed by a person other than the one who generated the files. If any discrepancies are found, they are noted back to the person who generated the input files for correction. Additionally, a report is kept that identifies the person who produced the input file, the person that QA’d the file, and

where the data originated. Once the input files have passed through the QA procedure, MOVES is run to generate emissions.

## **4.0 DISCUSSION OF ON-ROAD MOBILE SOURCES**

On-road mobile sources produce NO<sub>x</sub>, and VOC, along with a host of other pollutants. Emissions of these two pollutants are estimated in the on-road mobile source inventory for the maintenance plan. The objective of the following section is to describe the source category, the input files, and the emissions estimation procedures. This section also includes tables summarizing the estimated emissions for the projection years by county.

### **4.1 INTRODUCTION AND SCOPE**

On-road highway mobile sources are considered as those vehicles that travel on the roadways. On-road mobile sources are a major contributor to NO<sub>x</sub> emissions in North Carolina and a less significant contributor to VOC. Emissions from motor vehicles occur throughout the day while the vehicle is in motion, at idle, parked, and during refueling. All of these emissions processes need to be estimated in order to properly reflect the total emissions from this source category.

A very important component of the highway mobile emission estimation process is interagency consultation. The primary transportation partners involved in the Triad interagency consultation process included: NCDOT, USEPA, Federal Highway Administration (FHWA), Greensboro municipal planning organization (MPO), High Point MPO, Piedmont Triad regional planning organization (RPO), Winston-Salem Forsyth MPO, the Northwest Piedmont RPO, and the Piedmont Authority for Regional Transportation (PART). Specifically, PART runs the travel demand model (TDM) for the urban areas and provides speeds and VMT; the NCDOT was consulted for speeds and VMT for the rural counties where the Triad urban TDM did not extend. The NCDAQ had recently consulted with the transportation partners and developed MOVES input data for all counties in North Carolina for the year 2007 in conjunction with modeling being undertaken for the Southeastern Modeling, Analysis, and Planning (SEMAP) Project. Since this was the base year of analysis for the Triad 110(a)(1) Maintenance Plan, this data was suitable for use for the base year 2007.

For the year 2011, MOVES inputs were available from the recent update to the fine particulate matter redesignation demonstration and maintenance plan. The transportation partners agreed that the activity data we used for Davidson and Guilford Counties in the fine particulate matter plan update was the latest and should be used as inputs to the MOVES model. For Forsyth County, the transportation partners reviewed the most recent data the NCDAQ possessed from



the latest conformity determination and also agreed that the files were the most up to date and accurate representation for the emissions comparison. For the year 2018, no year-specific data had been collected for recent modeling or conformity exercises for Davidson, Guilford, or Forsyth Counties. However, it was possible to interpolate to the year 2018 from the latest data provided and the transportation partners agreed on that approach.

Since only a small portion of Davie County is covered by the TDM, the NCDAQ determined that the speeds and VMT provided by PART were not adequate for the analyzing the county as a whole. Therefore, for Davie County the off-peak Wake County speeds, along with Highway Performance Maintenance System (HPMS) VMT were used for all three years.

## **4.2 MOVES INPUT ASSUMPTIONS**

Due to the size and the complexity of the MOVES input and output files, the MOVES input files and output files will be provided electronically.

### **4.2.1 Speed Assumptions**

Vehicle power, speed, and acceleration have a significant effect on vehicle emissions. MOVES models those emission effects by assigning activity to specific drive cycles or operating mode distributions. The distribution of vehicle hours traveled (VHT) by average speed was used to determine an appropriate operating mode distribution. The Average Speed Distribution importer in MOVES calls for a speed distribution in VHT in 16 speed bins, by each road type, source type, and hour of the day included in the analysis. The methodology used to develop the average speed distribution inputs is documented below.

The speeds for the urban areas covered by the MPOs were generated from the region's TDM. The speeds for the urban, modeled areas of Forsyth, Guilford, and Davidson counties were provided by PART. Speeds for rural, non-modeled areas in Davidson Counties were generated by NCDOT. Since only a small area of Davie County is covered by a TDM, off-peak Wake County speeds were used for Davie County. The NCDAQ believes that the off-peak speed assumptions are a better representation of average speeds in North Carolina than the default speed assumptions in the MOVES model or the modeled speed for the small portion of Davie County covered by the TDM. Tables 4.2.1-1 through 4.2.1-5 provide a summary of the speeds in miles per hour (mph).

**Table 4.2.1-1 Modeled Area Speeds for Davidson County (miles/hour)**

Functional Class	2007	2011	2018
Urban Interstate	68	68	67
Urban Freeway or Expressway	57	57	56
Urban Other Principal Arterial	39	39	38
Urban Minor Arterial	40	40	40
Urban Collector	42	41	41
Urban Local	46	45	45
Rural Interstate	69	68	68
Rural Other Principal Arterial	---	---	---
Rural Minor Arterial	51	51	51
Rural Major Collector	43	43	42
Rural Minor Collector	49	48	48
Rural Local	49	49	48

**Table 4.2.1-2 Rural Area Speeds for Davidson County (miles/hour)**

Functional Class	2007	2011	2018
Urban Interstate	62	63	62
Urban Freeway or Expressway	56	56	56
Urban Other Principal Arterial	29	29	28
Urban Minor Arterial	32	32	32
Urban Collector	31	31	31
Urban Local	31	31	31
Rural Interstate	65	66	65
Rural Other Principal Arterial	45	46	45
Rural Minor Arterial	44	44	44
Rural Major Collector	43	43	43
Rural Minor Collector	42	42	42
Rural Local	42	42	42

**Table 4.2.1-3 Speeds Used for Davie County (miles/hour)**

Functional Class	2007	2011	2018
Urban Interstate	65	64	63
Urban Freeway or Expressway	---	---	---
Urban Other Principal Arterial	---	---	---
Urban Minor Arterial	42	41	40
Urban Collector	40	40	39
Urban Local	24	24	24
Rural Interstate	65	63	62
Rural Other Principal Arterial	---	---	---
Rural Minor Arterial	52	47	46
Rural Major Collector	49	46	46
Rural Minor Collector	39	38	38
Rural Local	22	23	23

**Table 4.2.1-4 Modeled Area Speeds for Forsyth County (miles/hour)**

Functional Class	2007	2011	2018
Urban Interstate	60	60	58
Urban Freeway or Expressway	50	50	50
Urban Other Principal Arterial	41	42	42
Urban Minor Arterial	42	42	42
Urban Collector	38	38	38
Urban Local	37	37	37
Rural Interstate	---	---	---
Rural Other Principal Arterial	54	54	54
Rural Minor Arterial	49	49	49
Rural Major Collector	45	45	45
Rural Minor Collector	45	45	45
Rural Local	44	44	44

**Table 4.2.1-5 Modeled Area Speeds for Guilford County (miles/hour)**

Functional Class	2007	2011	2018
Urban Interstate	55	55	55
Urban Freeway or Expressway	51	51	51
Urban Other Principal Arterial	39	39	39
Urban Minor Arterial	37	37	38
Urban Collector	37	37	37
Urban Local	34	34	35
Rural Interstate	60	59	57
Rural Other Principal Arterial	47	48	50
Rural Minor Arterial	43	42	45
Rural Major Collector	46	46	46
Rural Minor Collector	47	47	47
Rural Local	43	42	45

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 4.2.6). In MOVES, local roadways are included with arterials and collectors in the urban and rural unrestricted access roads category. In MOVES, the USEPA 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 than observed average speed = 1

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

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

Or more simply:  $\text{VHT Fraction } B = 1 - \text{VHT fraction } A$

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:

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

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

$$\begin{array}{rcccc} \text{VHT Fraction } A_{(\text{low bin})} & + & \text{VHT Fraction } B_{(\text{high bin})} & = & 1 \\ 0.4 & + & 0.6 & = & 1 \end{array}$$

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 road way 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.

$$VHT_{(Speed\ Bin\ X)} = \frac{[(VHT\ Fraction_{(UI)} * hourly\ VMT_{(UI)}) + (VHT\ Fraction_{(UF)} * hourly\ VMT_{(UF)})]}{(hourly\ VMT_{(UI)} + hourly\ VMT_{(UF)})}$$

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

$$VHT_{(Speed\ Bin\ 55)} = 0.2286$$

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

$$\begin{aligned} & \frac{\quad}{(250,000 + 100,000)} \\ \text{VHT}_{(\text{Speed Bin } 60)} &= 0.3428 \\ \text{VHT}_{(\text{Speed Bin } 65)} &= \frac{[(0.6 * 250,000) + (0.0 * 100,000)]}{(250,000 + 100,000)} \\ \text{VHT}_{(\text{Speed Bin } 65)} &= 0.4286 \end{aligned}$$

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.

#### 4.2.2 Vehicle Age Distribution

The age distribution of vehicle fleets can vary significantly from area to area. Fleets with a higher percentage of older vehicles will have higher emissions for two reasons. Older vehicles have typically been driven more miles and have experienced more deterioration in emission control systems. Additionally, a higher percentage of older vehicles also implies that there are more vehicles in the fleet that do not meet newer, more stringent emissions standards. Surveys of registration data indicate considerable local variability in vehicle age distributions.

For SIP and conformity purposes, the USEPA recommends and encourages states to develop local age distributions. The MOVES model categorizes the vehicle fleet into different vehicle classes and more model years than MOBILE6.2. A typical vehicle fleet includes a mix of vehicles of different ages. MOVES covers a 31 year range of vehicle ages, with vehicles 30 years and older grouped together. MOVES allows the user to specify the fraction of vehicles in each of 30 vehicle ages for each of the 13 source types in the model.

Local age distributions can be estimated from local vehicle registration data. The vehicle age distribution comes from annual registration data for North Carolina from the NCDOT. For this analysis, the age distribution was generated based on 2007 data for the year 2007 and the 2008 data for 2011 and 2018. The NCDOT provided the data based on the number of vehicle types per year from 1974 through 2007(8). Vehicles greater than 25 years old were combined and included as the 25<sup>th</sup> model year. 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). Since MOVES categorizes the vehicle fleet into different vehicle classes and more

model years, EPA has created data converters that take registration distribution input files created for MOBILE6.2 and converts them to the appropriate age distribution input tables for MOVES.

### 4.2.3 Vehicle Mix Assumptions

Vehicle mix or VMT mix is used by MOVES to convert annual VMT to VMT by HPMS class, VMT fractions by hour, and VMT by road type distribution. The vehicle mix is developed by the same method used in MOBILE6.2, as outlined below. The resulting file is then used in a MOVES supplied converter to develop the VMT by HPMS class, VMT fractions by hour, and VMT by road type distribution.

The vehicle mix refers to the percentage of different vehicle types on each of the 12 FHWA road types. These road types are listed above in the speed assumptions section. It is critical for estimating on-road mobile emissions in an area to use data that accurately reflects the vehicles types traveling on each of these different road types.

In August 2004, the USEPA released the guidance document EPA420-R-04-013, Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation, which outlines how to convert the Highway Performance Monitoring System (HPMS) traffic count data to MOBILE6.2 vehicle mix data. Outlined below is the methodology used to convert the 13 HPMS vehicle types count data reported to FHWA and generate a state specific vehicle mix.

The North Carolina HPMS data used to generate the statewide vehicle mix was based on 2007 for the 2007 base year and the 2008 data counts for the 2011 interim year and the 2018 future year. The use of the 2008 data for the year 2011 and 2018 is described below. Table 4.2.3-1 shows the percent of vehicles per vehicle type for each of the 12 road classes.

**Table 4.2.3-1 2008 North Carolina HPMS Data**

FC	Functional Classification	Samples	MC	Cars	2A4T	Bus	2ASU	3ASU	4ASU	4AST	5AST	6AST	5AMT	6AMT	7AMT
1	Rural Principal Arterial - Interstate	17	0.0038	0.6013	0.1372	0.0104	0.0286	0.0075	0.0005	0.0186	0.1765	0.0066	0.0051	0.0023	0.0015
2	Rural Principal Arterial - Other	69	0.0075	0.6682	0.1880	0.0078	0.0346	0.0118	0.0011	0.0134	0.0621	0.0029	0.0016	0.0006	0.0004
6	Rural Minor Arterial	32	0.0058	0.6678	0.2031	0.0090	0.0398	0.0122	0.0012	0.0132	0.0454	0.0020	0.0002	0.0001	0.0003
7	Rural Major Collector	20	0.0060	0.7232	0.1949	0.0054	0.0321	0.0105	0.0010	0.0076	0.0179	0.0010	0.0000	0.0000	0.0001
8	Rural Minor Collector	25	0.0072	0.7027	0.2082	0.0069	0.0421	0.0114	0.0007	0.0082	0.0114	0.0009	0.0000	0.0000	0.0002
9	Rural Local System	27	0.0113	0.6512	0.2273	0.0190	0.0568	0.0139	0.0012	0.0100	0.0077	0.0012	0.0000	0.0000	0.0003
11	Urban Principal Arterial - Interstate	21	0.0054	0.6678	0.1375	0.0089	0.0282	0.0105	0.0005	0.0147	0.1184	0.0033	0.0031	0.0012	0.0006
12	Urban Principal Arterial - Other Freeways or Expressways	13	0.0034	0.7132	0.1600	0.0068	0.0278	0.0090	0.0008	0.0130	0.0618	0.0022	0.0013	0.0004	0.0004
14	Urban Principal Arterial - Other	24	0.0056	0.7449	0.1701	0.0053	0.0292	0.0088	0.0012	0.0086	0.0242	0.0016	0.0002	0.0001	0.0003
16	Urban Minor Arterial	21	0.0061	0.7821	0.1575	0.0053	0.0280	0.0069	0.0006	0.0057	0.0064	0.0012	0.0000	0.0000	0.0002
17	Urban Collector	14	0.0077	0.7830	0.1620	0.0048	0.0262	0.0088	0.0002	0.0043	0.0025	0.0004	0.0000	0.0000	0.0001
19	Urban Local System	14	0.0104	0.7244	0.1839	0.0230	0.0364	0.0090	0.0003	0.0051	0.0065	0.0009	0.0000	0.0001	0.0000



#### 4.2.4 Disaggregating State Specific Information

Section 4.1.5 of Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation, illustrates how to map the HPMS statewide vehicle data to general MOBILE6.2 vehicle categories. This mapping is outlined below:

**Table 4.2.4-1 Mapping of HPMS data to MOBILE6.2 Categories**

HPMS Category	General Category
Motorcycle	Motorcycle (MC)
Passenger Car	Passenger Car (LDV)
Other 2-Axle, 4-Tire Vehicles	Light Truck (LDT)
Busses	Bus (HDB)
All Other Trucks: Single unit, 2-axle, 6-tire Single unit, 3-axle Single unit, 4 or more axle Single trailer, 4 or fewer axle Single trailer, 5-axle Single trailer, 6 or more axle Multi-trailer, 5 or fewer axle Multi-trailer, 6-axle Multi-trailer, 7 or more axle	Heavy Duty Truck (HDV)

The HPMS data in Table 4.2.3-1 was grouped into these five general categories for each road type. In order to expand the five general categories to the 16 vehicle types used in MOBILE6.2, the national average VMT fractions by each vehicle class were used. The 2008 fractions were used since the state specific data is from 2008. The national average data was obtained from Table 4.1.2 in Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation. An example for rural interstates is illustrated below:

From Table 4.2.3-1 above:

Passenger Cars	=	60.13%	5 axle Trailer	=	17.65%
Pickup Trucks	=	13.72%	6 axle Trailer	=	0.66%
Bus	=	1.04%	5 axle Multi Trailer	=	0.51%
2 axle Trucks	=	2.86%	6 axle Multi Trailer	=	0.23%
3 axle Trucks	=	0.75%	7 axle Multi Trailer	=	0.15%
4 axle Trucks	=	0.05%	Motorcycles	=	0.38%

4 axle Trailer = 1.86%

Therefore, the five general categories are:

Motorcycles	=	0.38%
Light Duty Vehicles	=	60.13%
Light Duty Trucks	=	13.72%
Heavy Duty Buses	=	1.04%
Heavy Duty Vehicles	=	24.73%

From Table 4.1.2 in Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation, the 2008 national average vehicle mix for light duty trucks, buses and heavy duty trucks are:

Light Duty Trucks			Heavy Duty Trucks		
LDT1	=	0.0846	HDV2B	=	0.0388
LDT2	=	0.2817	HDV3	=	0.0038
LDT3	=	0.0868	HDV4	=	0.0031
LDT4	=	0.0399	HDV5	=	0.0024
<b>Total</b>	=	<b>.4930</b>	HDV6	=	0.0087
			HDV7	=	0.0102
			HDV8A	=	0.0111
			HDV8B	=	0.0397
			<b>Total</b>	=	<b>.1178</b>

Buses		
HDBS	=	0.0020
HDBT	=	0.0009
<b>Total</b>	=	<b>0.0029</b>

Using the methodology described in Section 4.1.5 in Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation the new 2008 North Carolina statewide mix was developed. The basic formula for developing the mix is shown below,

$$\text{Vehicle Type} = (\text{2008 M6.2 fraction for vehicle}) \times \frac{(\text{2008 State total for group})}{(\text{2008 M6.2 total for subcategory})}$$

Table 4.2.4-2 displays the calculation for each vehicle type for the 2008 rural interstate vehicle mix.

**Table 4.2.4-2 Calculation of New 2008 Statewide Rural Interstate Vehicle Mix**

Vehicle Type		Calculation		New 2008 Mix
LDV	=	LDV	=	0.6013
MC	=	MC	=	0.0038
<b>Light Duty Trucks</b>				
LDT1	=	$0.0846 \times (0.1372/0.4930)$	=	0.0235
LDT2	=	$0.2817 \times (0.1372/0.4930)$	=	0.0784
LDT3	=	$0.0868 \times (0.1372/0.4930)$	=	0.0242
LDT4	=	$0.0399 \times (0.1372/0.4930)$	=	0.0111
<b>Heavy Duty Vehicles</b>				
HDV2B	=	$0.0388 \times (0.2473/0.1178)$	=	0.0815
HDV3	=	$0.0038 \times (0.2473/0.1178)$	=	0.0080
HDV4	=	$0.0031 \times (0.2473/0.1178)$	=	0.0065
HDV5	=	$0.0024 \times (0.2473/0.1178)$	=	0.0050
HDV6	=	$0.0087 \times (0.2473/0.1178)$	=	0.0183
HDV7	=	$0.0102 \times (0.2473/0.1178)$	=	0.0214
HDV8A	=	$0.0111 \times (0.2473/0.1178)$	=	0.0233
HDV8B	=	$0.0397 \times (0.2473/0.1178)$	=	0.0833
<b>Buses</b>				
HDBS	=	$0.0020 \times (0.0104/0.0029)$	=	0.0072
HDBT	=	$0.0009 \times (0.0104/0.0029)$	=	0.0032

2011 and 2018 Statewide Vehicle Mix

Once the 2008 new vehicle mix was generated, the other years were created using the methodology described in Section 4.1.4 in Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation. This method grouped light duty vehicles, light duty trucks and motorcycles together and heavy duty buses, heavy duty trucks and heavy duty vehicles together. The combined percentages for these groupings are listed below.

Light Duty Vehicles = 74.23%

Heavy Duty Vehicles = 25.77%

The MOBILE6.2 vehicle mix fractions for the year being developed were obtained from Table 4.1.2 in Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation. The MOBILE6.2 vehicle fractions for 2011 are listed below.

Light Duty Vehicles		Heavy Duty Vehicles	
LDV	= 0.3428	HDV2B	= 0.0390
LDT1	= 0.0911	HDV3	= 0.0038
LDT2	= 0.3031	HDV4	= 0.0032
LDT3	= 0.0934	HDV5	= 0.0024
LDT4	= 0.043	HDV6	= 0.0087
		HDV7	= 0.0103
		HDV8A	= 0.0112
		HDV8B	= 0.0398
		HDBS	= 0.0020
		HDBT	= 0.0010
<b>Total</b>	<b>= 0.8787</b>	<b>Total</b>	<b>= .1214</b>

The North Carolina 2011 vehicle mix was created using the MOBILE6.2 fractions using the following formula:

$$\text{Vehicle Type} = (\text{2011 M6 fraction for vehicle}) \times \frac{(\text{2008 State total for group})}{(\text{2011 M6 total for group})}$$

Table 4.2.4-3 below displays the calculations used to generate the 2011 North Carolina vehicle mix for rural interstate.

**Table 4.2.4-3 Calculation of 2011 Statewide Rural Interstate Vehicle Mix**

Vehicle Type		Calculation		2011 State Mix
<b>Light Duty Vehicles</b>				
LDV	=	$0.3428 \times (0.7423/0.8787)$	=	0.2896
LDT1	=	$0.0911 \times (0.7423/0.8787)$	=	0.0770
LDT2	=	$0.3031 \times (0.7423/0.8787)$	=	0.2561
LDT3	=	$0.0934 \times (0.7423/0.8787)$	=	0.0789
LDT4	=	$0.0430 \times (0.7423/0.8787)$	=	0.0363
MC	=	$0.0053 \times (0.7423/0.8787)$		0.0045
<b>Heavy Duty Vehicles</b>				
HDV2B	=	$0.0390 \times (0.2577/0.1214)$	=	0.0828
HDV3	=	$0.0038 \times (0.2577/0.1214)$	=	0.0081
HDV4	=	$0.0032 \times (0.2577/0.1214)$	=	0.0068
HDV5	=	$0.0024 \times (0.2577/0.1214)$	=	0.0051
HDV6	=	$0.0087 \times (0.2577/0.1214)$	=	0.0185
HDV7	=	$0.0103 \times (0.2577/0.1214)$	=	0.0219
HDV8A	=	$0.0112 \times (0.2577/0.1214)$	=	0.0238
HDV8B	=	$0.0398 \times (0.2577/0.1214)$	=	0.0845
HDBS	=	$0.0020 \times (0.0104/0.0029)$	=	0.0042
HDBT	=	$0.0010 \times (0.0104/0.0029)$	=	0.0021

This method was used to generate the future year, 2018, vehicle mix as well. The North Carolina transportation partners consider the statewide vehicle mix to be the best representation of the vehicle population in the Triad nonattainment area. The vehicle mixes for all years can be found in Section 5.1 of this appendix.

As stated earlier in this section, vehicle mix or VMT mix is used in MOVES converters to develop VMT by HPMS class, VMT fractions by hour, and VMT by road type distribution, which are inputs to the model.

#### **4.2.5 Vehicles/Equipment: On-Road Vehicle Equipment**

The Vehicles/Equipment menu item and panel is used to specify the vehicle types that are included in the MOVES run. MOVES allows the user to select from among 13 “source use

types” (the terminology that MOVES uses to describe vehicle types), and four different fuel types (gasoline, diesel, compressed natural gas (CNG), and electricity).

For SIP and regional conformity analyses, users must select the appropriate fuel and vehicle type combinations in the On Road Vehicle Equipment panel to reflect the full range of vehicles that will operate in the county. In general, users should simply select all valid diesel, gasoline, and CNG (only transit buses) vehicle and fuel combinations, unless data is available showing that some vehicles or fuels are not used in the area of analysis.

#### **4.2.6 Road Type**

The Road Type Panel is used to define the types of roads that are included in the run. MOVES defines five different Road Types:

- Off-Network (roadtype 1) – all locations where the predominant activity is 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)

Users should select the road types present in the area being analyzed. The determination of rural or urban road types should be based on the HPMS classification of the roads in the county being analyzed.

The NCDAQ followed the USEPA guidance that states that all SIP and regional conformity analyses must include the Off-Network road type in order to account for emissions from vehicle starts, extended idle activity, and evaporative emissions (for VOCs). The Off-Network road type is automatically selected when start or extended idle pollutant processes are chosen and must be selected for all evaporative emissions to be quantified. Off-Network activity in MOVES is primarily determined by the Source Type Population input, which is described in Section 4.2.9 of this document. Some evaporative emissions are estimated on roadways (i.e., roadtypes 2, 3, 4, and 5) to account for evaporative emissions that occur when vehicles are driving. All roads types are automatically selected when Refueling emission processes are selected.

MOVES uses Road Type to assign default drive cycles to activity on road types 2, 3, 4, and 5. For example, for unrestricted access road types, MOVES uses drive cycles that assume stop and go driving, including multiple accelerations, decelerations, and short periods of idling. For restricted access road types, MOVES uses drive cycles that include a higher fraction of cruise activity with less time spent accelerating or idling, although some ramp activity is also included.

#### **4.2.7 Pollutants and Processes**

In MOVES, pollutant refers to particular types of pollutants or precursors of the pollutant, such as NO<sub>x</sub> or VOCs, while process refers to the mechanism by which emissions are created, such as running exhaust or start exhaust. Users must select all processes associated with a particular pollutant in order to account for all emissions of that pollutant. For example, there are 11 separate pollutant processes in MOVES for VOC, or hydrocarbon, emissions; all 11 must be selected when estimating VOC emissions for SIPs or regional conformity analyses. For this maintenance plan the pollutants under consideration were NO<sub>x</sub> and VOC.

#### **4.2.8 Temperature, Relative Humidity and Barometric Pressure Assumptions**

Local temperature and humidity data are required inputs for SIP and regional conformity analyses with MOVES. Ambient temperature is a key factor in estimating emission rates for on-road vehicles with substantial effects on most pollutant processes. Relative humidity is also important for estimating NO<sub>x</sub> emissions from motor vehicles. MOVES requires a temperature (in degrees Fahrenheit) and relative humidity (in percent – 0 to 100 scale) for each hour selected in the Run Spec. For example, MOVES requires a 24-hour temperature and humidity profile to model a full day of emissions on an hourly basis. For mobile source emission estimates, the NCDAQ used 2007 July monthly averages for the 24-hour temperature and relative humidity profiles from the Triad Regional Airport (GSO) for Davidson, Davie, Forsyth, and Guilford Counties. Data were obtained North Carolina State Climate Retrieval and Observations Network of the Southeast Database (CRONOS). The temperature and relative humidity profiles as presented in the MOVES input files are listed in section 5.2.

#### **4.2.9 Source Type Population**

Source type (i.e., vehicle type) population is used by MOVES to calculate start and evaporative emissions. In MOVES, start and resting evaporative emissions are related to the population of vehicles in an area. Since vehicle type population directly determines start and evaporative emission, users must develop local data for this input.



MOVES uses a vehicle classification system based on the way vehicles are classified in the Federal Highway Administration’s HPMS rather than on the way they are classified in EPA emissions regulations; thus making it easier for users to develop local data for MOVES. MOVES categorizes vehicles into 13 source types, which are subsets of 6 HPMS vehicle types in MOVES, as shown in the crosswalk in Table 4.2.9-1. The USEPA believes that states should be able to develop population data for many of these source type categories from state motor vehicle registration data (e.g., motorcycles, passenger cars, passenger trucks, light commercial trucks) and from local transit agencies, school districts, bus companies, and refuse haulers (intercity, transit, and school buses, and refuse trucks). The NCDOT supplied the NCDAQ with source population data as described in the following section.

**Table 4.2.9-1 MOVES Source Types and HPMS Vehicle Types**

Source Type ID	Source Types	HPMS Vehicle Type ID	HPMS Vehicle Type
11	Motorcycle	10	Motorcycles
21	Passenger Car	20	Passenger Cars
31	Passenger Truck	30	Other 2 axle-4 tire vehicles
32	Light Commercial Truck	30	Other 2 axle-4 tire vehicles
41	Intercity Bus	40	Buses
42	Transit Bus	40	Buses
43	School Bus	40	Buses
51	Refuse Truck	50	Single Unit Trucks
52	Single Unit Short-haul Truck	50	Single Unit Trucks
53	Single Unit Long-haul Truck	50	Single Unit Trucks
54	Motor Home	50	Single Unit Trucks
61	Combination Short-haul Truck	60	Combination Trucks
62	Combination Long-haul Truck	60	Combination Trucks

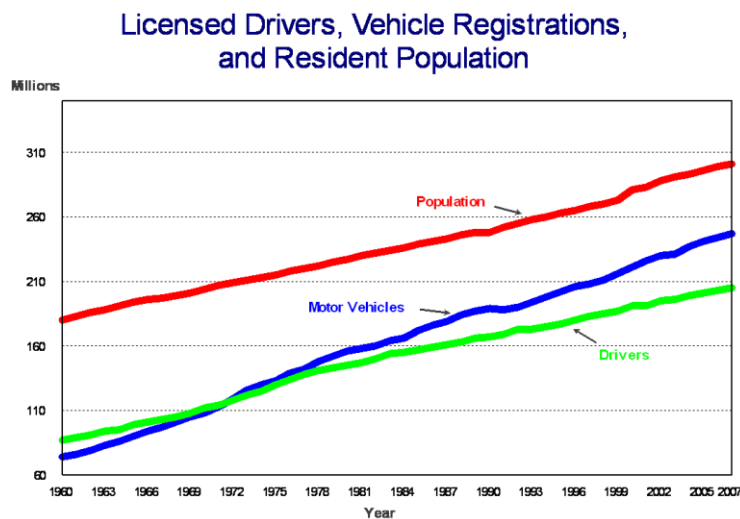
Source Type Population – Local Data

MOVES uses allocation factors to distribute emissions and activity (such as vehicle type populations) to individual counties. The NCDAQ is committed to using representative local data which will over ride MOVES default values through the County Data Manager. This decision was based on the fact that default allocation factors used in MOVES are derived from the VMT.

Since the allocations are based on VMT, the vehicle populations allocated to counties are proportional to the VMT being allocated to that county. The NCDAQ corresponded with the USEPA Office of Transportation and Air Quality (OTAQ) to arrive at an acceptable method to allocate current year as well as to project future year vehicle populations to source type populations. The NCDAQ believes that using MOVES default vehicle population to estimate a fraction is the best method of taking state specific vehicle registration data and allocating county total vehicles to specific vehicle source types.

MOVES categorize vehicles into 13 source types, which are subsets of 6 HPMS vehicle types. Presently NCDAQ is unable to develop county source type population data for many of these source type categories based on how NCDOT collect vehicle registration data. The latest vehicle registration data broken down by county and towns is available by January of each year. Since the vehicle types database available from NCDOT differs from what MOVES2010a expects, the NCDAQ relies on MOVES default fractions and applies these fractions to county total vehicle population, minus trailers. It is assumed that trailers do not have engines and do not generate VMT.

For future year MOVES runs, the NCDAQ needed to be able to grow the vehicle population reflective of the county of interest. From FHWA Highway Statistics graph of Licensed Drivers, Vehicle Registrations, and Resident Population, the NCDAQ has determined that growth in human population is a better indicator of growth in vehicle ownership as compared to VMT growth.



**Figure 4.2.9-1 Federal Highway Association Statistics Graph**

In order to forecast future year vehicle population and disaggregate to the appropriate source type, a reliable source of county population is needed. The North Carolina Office of State

Budget and Management (OSBM) coordinates with the Census in the Federal State Cooperative Program for population estimates for all state government data, with special emphasis on a consistent set of population projections. On OSBM website are annual certified county population estimates which account for births, deaths and natural growth representing a net migration populous at the county level.

Population data is updated annually in May and certified by September for the previous year's data. Projected annual county population estimates are available to adjust future year county vehicle populations as needed. The USEPA has indicated that using human population growth as a surrogate to project vehicle population growth is an acceptable option. An example of how a 2008 vehicle population would be grown to 2011 based on this surrogate of projected county population follows:

$$\text{Vehicle Pop}_{2011} = \text{Vehicle Pop}_{2008} * (\text{Human Pop}_{2011}/\text{Human Pop}_{2008})$$

#### **4.2.10 Vehicle Inspection and Maintenance Program Assumptions**

In 2002, North Carolina implemented a new vehicle emissions inspection program referred to as onboard diagnostics (OBDII). This program covers all light duty gasoline powered vehicles that are model year 1996 and newer. The program was initially implemented in 9 counties and was expanded to include a total of 48 counties between July 2002 and January 2006. Forsyth and Guilford Counties were phased in July 2002. Davidson was phased-in July 1, 2003.

Inspection and maintenance programs continue to be important local control programs in many nonattainment areas. MOVES includes the capability of modeling all the aspects of an I/M program that have a significant impact on vehicle emissions. The USEPA recommends that users modeling an existing I/M program in MOVES begin by examining the default I/M program description included in MOVES for the particular county in question.

#### **4.2.11 Reid Vapor Pressure Assumptions**

The Reid Vapor Pressure (RVP) is a measurement of gasoline volatility. During June through mid-September, the RVP for gasoline sold in Davidson, Guilford, and Forsyth Counties has been limited to no higher than 7.8 pounds per square inch (psi). Only a small part of Davie County is limited to a 7.8 psi RVP and it has been found that no gasoline stations are in the nonattainment portion. Therefore, Davie County emissions are calculated with a 9.0 psi RVP for all years. Accordingly, the 2007 and 2011 MOVES emissions modeling results are based on these RVP requirements. However, the NCDAQ is requesting to relax the 7.8 psi RVP requirement to

9.0 psi for Davidson, Forsyth, and Guilford Counties. Therefore, the 2018 MOVES emissions modeling runs for all four counties were conducted using 9.0 psi as the gasoline RVP requirement.

#### **4.2.12 Diesel Sulfur Content Assumptions**

The diesel fuel sulfur content is required in MOVES to generate fine particulate matter emission factors because the amount of sulfur in diesel fuel directly correlates to sulfate particulate emissions. The USEPA recommends a diesel fuel sulfur content of 43 parts per million (ppm) for the period June 2006-May 2010 and 11 ppm for June 2010 -2015.

#### **4.2.13 Fuel (Formulation and Supply)**

In general, users should first review the MOVES default fuel formulation and fuel supply data, and then make changes only where local volumetric fuel property information is available. The lone exception to this guidance is in the case of RVP where a user should change the value to reflect the regulatory requirements and differences between ethanol- and non-ethanol blended gasolines. The current version of MOVES does not allow the user to create new fuel identification numbers. Thus, per current the USEPA guidance, the NCDAQ edited the default fuel supply tables for the individual counties to reflect the county-specific RVP data.

#### **4.2.14 VMT Assumptions**

As input, MOVES requires *annual* VMT by HPMS vehicle class. The USEPA has created a tool that allows users to input average annual daily VMT as well as monthly and weekend day adjustment factors to create the annual VMT by HPMS class and appropriate monthly and daily adjustments needed by MOVES. The USEPA has also created a set of software tools that can import VMT tables by MOBILE6.2 vehicle types (either 8, 12, 16, or 28 MOBILE6.2 vehicle types) and facility types, as well as MOBILE6.2 hourly VMT fractions, VMT mix, and ramp fractions and convert these to the equivalent MOVES tables of VMT by HPMS class, VMT fractions by hour, and road type distribution. Mapping MOBILE6.2 vehicle types to their equivalent MOVES source types is a complex process. The USEPA strongly encourages states to use the converter tools to create the appropriate MOVES input tables from MOBILE6.2 data to avoid errors.

The VMT for Davidson, Forsyth, and Guilford Counties was provided by PART. The NCDAQ used HPMS VMT, provided by the NCDOT, for Davie County. Tables 4.3-1 through 4.3-5 list the daily VMT used in the emissions calculations.

**Table 4.2.14-1 Modeled Daily Vehicle Miles Traveled for Davidson County**

Functional Class	2007	2011	2018
Urban Interstate	384,796	427,523	492,152
Urban Freeway or Expressway	401,585	436,626	539,617
Urban Other Principal Arterial	395,721	417,566	458,938
Urban Minor Arterial	306,578	333,766	377,222
Urban Collector	169,691	188,452	216,234
Urban Local	257,457	282,255	317,562
Rural Interstate	200,251	221,276	256,977
Rural Other Principal Arterial	0	0	314
Rural Minor Arterial	205,871	224,000	278,436
Rural Major Collector	160,474	175,155	198,647
Rural Minor Collector	131,117	144,647	160,314
Rural Local	271,057	301,554	335,180

**Table 4.2.14-2 Daily Vehicle Miles Traveled for Davidson County Rural Donut Area**

Functional Class	2007	2011	2018
Urban Interstate	320,816	364,745	385,141
Urban Freeway or Expressway	180,851	205,614	217,111
Urban Other Principal Arterial	250,224	284,492	300,400
Urban Minor Arterial	224,257	254,965	269,222
Urban Collector	94,327	107,235	113,232
Urban Local	86,696	98,562	104,074
Rural Interstate	221,286	251,587	265,655
Rural Other Principal Arterial	131,109	149,062	157,397
Rural Minor Arterial	174,748	198,673	209,783
Rural Major Collector	209,824	238,551	251,890
Rural Minor Collector	145,704	165,660	174,924
Rural Local	86,863	98,757	104,280

**Table 4.2.14-3 Daily Vehicle Miles Traveled for Davie County**

Functional Class	2007	2011	2018
Urban Interstate	141,540	141,833	166,098
Urban Freeway or Expressway	0	0	0
Urban Other Principal Arterial	0	0	0
Urban Minor Arterial	73,080	84,207	98,614
Urban Collector	2,320	2,576	3,017
Urban Local	630	955	1,118
Rural Interstate	519,630	506,874	593,593
Rural Other Principal Arterial	0	0	0
Rural Minor Arterial	345,910	354,959	415,688
Rural Major Collector	132,470	142,377	166,736
Rural Minor Collector	106,170	107,535	125,933
Rural Local	75,790	82,319	96,403

**Table 4.2.14-4 Modeled Daily Vehicle Miles Traveled for Forsyth County**

Functional Class	2007	2011	2018
Urban Interstate	1,915,395	2,258,655	2,941,881
Urban Freeway or Expressway	3,231,072	3,439,788	3,737,958
Urban Other Principal Arterial	360,199	390,017	438,010
Urban Minor Arterial	1,597,133	1,672,282	1,799,321
Urban Collector	1,458,502	1,564,181	1,745,877
Urban Local	1,071,597	1,145,293	1,280,870
Rural Interstate	0	0	0
Rural Other Principal Arterial	114,464	126,364	147,666
Rural Minor Arterial	152,788	162,746	190,750
Rural Major Collector	50,068	54,047	60,224
Rural Minor Collector	116,027	127,370	146,375
Rural Local	122,324	137,254	158,936

**Table 4.2.14-5 Modeled Daily Vehicle Miles Traveled for Guilford County**

Functional Class	2007	2011	2018
Urban Interstate	3,820,915	4,419,157	5,348,011
Urban Freeway or Expressway	2,169,129	2,452,593	3,025,837
Urban Other Principal Arterial	2,347,233	2,477,254	2,696,718
Urban Minor Arterial	2,713,492	2,837,423	3,155,743
Urban Collector	1,347,771	1,452,017	1,651,614
Urban Local	769,943	815,646	886,721
Rural Interstate	950,514	1,090,492	1,387,115
Rural Other Principal Arterial	493,116	545,289	577,123
Rural Minor Arterial	227,023	273,514	282,092
Rural Major Collector	763,250	838,619	951,445
Rural Minor Collector	352,321	393,534	459,597
Rural Local	406,976	435,206	520,915

### 4.3 ESTIMATED EMISSIONS FROM ON-ROAD MOBILE SOURCES

Using the inventory approach in the MOVES model gives a summary of emissions in tons per typical summer day, by county. Table 4.3-1 summarizes the NO<sub>x</sub> and VOC emissions.

**Table 4.3-1 On-Road Mobile Source Emissions by County (tons/day)**

County	Current 7.8 psi RVP <sup>1</sup>						Revised 9.0 psi RVP	
	NO <sub>x</sub>			VOC			NO <sub>x</sub>	VOC
	2007	2011	2018	2007	2011	2018	2018	2018
Davidson	15.08	11.70	4.24	6.60	5.03	2.42	4.27	2.48
Davie	5.03	3.50	2.08	1.85	1.41	0.90	2.08	0.90
Forsyth	27.73	17.26	10.84	12.05	6.75	4.23	10.88	4.34
Guilford	42.78	32.10	18.84	17.41	12.97	7.82	18.93	8.04
<b>Total</b>	<b>90.62</b>	<b>64.56</b>	<b>36.00</b>	<b>37.91</b>	<b>26.16</b>	<b>15.37</b>	<b>36.16</b>	<b>15.76</b>
Net Change in Total Future Year Emissions Due to RVP Change							<b>0.16</b>	<b>0.39</b>
% Change in Total 2018 Future Year Emissions Due to RVP & I/M changes							<b>0.45%</b>	<b>2.54%</b>

<sup>1</sup> 7.8 psi for Davidson, Forsyth, and Guilford Counties and 9.0 psi for Davie County.

## 5.0 MOVES INPUT DATA

Due to the size and the complexity of the MOVES input and output files, the MOVES input files and output files will be provided electronically. The MOBILE6.2 vehicle mix, as well as the temperature and humidity profiles used in MOVES are presented below.

### 5.1 NORTH CAROLINA'S VEHICLE MIX

#### 5.1.1 2007 State Vehicle Mix

2007 State Vehicle Mix							
Rural	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4
LDV	HDV6	HDV7	HDV8a	HDV8b	HDBS	HDBT	MC
Interstate							
0.3273	0.0681	0.2265	0.0698	0.0321	0.0862	0.0085	0.0069
0.0051	0.0192	0.0227	0.0247	0.0882	0.0076	0.0034	0.0037
Princ. Art.							
0.3853	0.0801	0.2666	0.0822	0.0378	0.0434	0.0043	0.0035
0.0026	0.0097	0.0114	0.0125	0.0444	0.0055	0.0025	0.0082
Minor Art.							
0.3931	0.0818	0.2720	0.0838	0.0386	0.0381	0.0037	0.0030
0.0023	0.0085	0.0100	0.0109	0.0389	0.0061	0.0027	0.0065
Major Collector							
0.4149	0.0864	0.2873	0.0886	0.0408	0.0232	0.0023	0.0019
0.0014	0.0052	0.0061	0.0066	0.0237	0.0038	0.0017	0.0061
Minor Collector							
0.4123	0.0858	0.2854	0.0880	0.0405	0.0244	0.0024	0.0020
0.0014	0.0054	0.0064	0.0070	0.0250	0.0046	0.0021	0.0073
Local							
0.3972	0.0826	0.2749	0.0847	0.0390	0.0301	0.0030	0.0024
0.0018	0.0067	0.0079	0.0086	0.0308	0.0131	0.0059	0.0113
Urban							
LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4
HDV5	HDV6	HDV7	HDV8a	HDV8b	HDBS	HDBT	MC
Interstate							
0.3701	0.0770	0.2563	0.0790	0.0364	0.0553	0.0054	0.0044
0.0033	0.0123	0.0146	0.0159	0.0566	0.0058	0.0026	0.0050
Freeway							
0.3959	0.0823	0.2739	0.0844	0.0389	0.0373	0.0037	0.0030
0.0022	0.0083	0.0098	0.0107	0.0382	0.0045	0.0020	0.0049
Princ. Art.							
0.4128	0.0859	0.2857	0.0880	0.0405	0.0249	0.0024	0.0020
0.0015	0.0055	0.0066	0.0072	0.0255	0.0037	0.0017	0.0061
Minor Art							
0.4245	0.0883	0.2937	0.0905	0.0417	0.0164	0.0016	0.0013
0.0010	0.0036	0.0043	0.0047	0.0167	0.0038	0.0017	0.0062
Coll							
0.4273	0.0889	0.2957	0.0912	0.0420	0.0140	0.0014	0.0011
0.0008	0.0031	0.0037	0.0040	0.0143	0.0033	0.0015	0.0077
Local							
0.4108	0.0854	0.2842	0.0876	0.0403	0.0192	0.0019	0.0015



0.0011 0.0043 0.0051 0.0055 0.0196 0.0159 0.0072 0.0104

### 5.1.2 2011 State Vehicle Mix

2011 State Vehicle Mix							
Rural	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4
LDV	HDV6	HDV7	HDV8a	HDV8b	HDBS	HDBT	MC
Interstate							
0.2894	0.0770	0.2561	0.0789	0.0363	0.0828	0.0081	0.0068
0.0051	0.0185	0.0219	0.0238	0.0845	0.0042	0.0021	0.0045
Princ. Art.							
0.3367	0.0896	0.2980	0.0918	0.0423	0.0438	0.0043	0.0036
0.0027	0.0098	0.0116	0.0126	0.0447	0.0022	0.0011	0.0052
Minor Art.							
0.3421	0.0909	0.3024	0.0932	0.0429	0.0396	0.0039	0.0032
0.0024	0.0088	0.0105	0.0114	0.0404	0.0020	0.0010	0.0053
Major Collector							
0.3606	0.0958	0.3188	0.0982	0.0452	0.0244	0.0024	0.0020
0.0015	0.0054	0.0064	0.0070	0.0249	0.0012	0.0006	0.0056
Minor Collector							
0.3581	0.0952	0.3167	0.0976	0.0449	0.0263	0.0026	0.0022
0.0016	0.0059	0.0069	0.0076	0.0269	0.0013	0.0007	0.0055
Local							
0.3471	0.0923	0.3070	0.0946	0.0435	0.0354	0.0034	0.0029
0.0022	0.0079	0.0093	0.0102	0.0361	0.0018	0.0009	0.0054
Urban							
LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4
HDV5	HDV6	HDV7	HDV8a	HDV8b	HDBS	HDBT	MC
Interstate							
0.3161	0.0841	0.2797	0.0862	0.0397	0.0608	0.0059	0.0050
0.0037	0.0136	0.0161	0.0175	0.0620	0.0031	0.0016	0.0049
Freeway							
0.3418	0.0909	0.3023	0.0932	0.0429	0.0397	0.0039	0.0033
0.0024	0.0089	0.0105	0.0114	0.0405	0.0020	0.0010	0.0053
Princ. Art.							
0.3590	0.0954	0.3176	0.0979	0.0451	0.0255	0.0025	0.0021
0.0016	0.0057	0.0067	0.0073	0.0260	0.0013	0.0007	0.0056
Minor Art							
0.3691	0.0980	0.3262	0.1005	0.0463	0.0174	0.0017	0.0014
0.0011	0.0039	0.0046	0.0050	0.0178	0.0009	0.0004	0.0057
Coll							
0.3717	0.0988	0.3286	0.1013	0.0466	0.0152	0.0015	0.0012
0.0009	0.0034	0.0040	0.0044	0.0155	0.0008	0.0004	0.0057
Local							
0.3585	0.0952	0.3169	0.0977	0.0450	0.0261	0.0025	0.0021
0.0016	0.0058	0.0069	0.0075	0.0267	0.0013	0.0007	0.0055

### 5.1.3 2018 State Vehicle Mix

Rural		2018 State Vehicle Mix					
LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4
HDV5	HDV6	HDV7	HDV8a	HDV8b	HDBS	HDBT	MC
Interstate							
0.2447	0.0847	0.2819	0.0869	0.0399	0.0826	0.0082	0.0069
0.0050	0.0185	0.0219	0.0237	0.0845	0.0042	0.0021	0.0043
Princ. Art.							
0.2845	0.0985	0.3280	0.1011	0.0465	0.0437	0.0043	0.0037
0.0027	0.0098	0.0116	0.0126	0.0447	0.0022	0.0011	0.0050
Minor Art.							
0.2890	0.1000	0.3329	0.1026	0.0472	0.0395	0.0039	0.0033
0.0024	0.0088	0.0105	0.0114	0.0404	0.0020	0.0010	0.0051
Major Collector							
0.3047	0.1054	0.3509	0.1082	0.0497	0.0243	0.0024	0.0020
0.0015	0.0054	0.0064	0.0070	0.0249	0.0012	0.0006	0.0054
Minor Collector							
0.3026	0.1047	0.3486	0.1075	0.0494	0.0263	0.0026	0.0022
0.0016	0.0059	0.0069	0.0075	0.0269	0.0013	0.0007	0.0053
Local							
0.2932	0.1015	0.3379	0.1042	0.0479	0.0353	0.0035	0.0030
0.0022	0.0079	0.0093	0.0101	0.0361	0.0018	0.0009	0.0052
Urban							
LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4
HDV5	HDV6	HDV7	HDV8a	HDV8b	HDBS	HDBT	MC
Interstate							
0.2674	0.0925	0.3079	0.0949	0.0436	0.0606	0.0060	0.0051
0.0037	0.0136	0.0160	0.0174	0.0620	0.0031	0.0015	0.0047
Freeway							
0.2889	0.1000	0.3328	0.1026	0.0471	0.0396	0.0039	0.0033
0.0024	0.0089	0.0105	0.0114	0.0405	0.0020	0.0010	0.0051
Princ. Art.							
0.3035	0.1050	0.3496	0.1077	0.0495	0.0255	0.0025	0.0021
0.0016	0.0057	0.0067	0.0073	0.0260	0.0013	0.0006	0.0054
Minor Art							
0.3116	0.1079	0.3591	0.1107	0.0509	0.0174	0.0017	0.0015
0.0011	0.0039	0.0046	0.0050	0.0178	0.0009	0.0004	0.0055
Coll							
0.3139	0.1087	0.3618	0.1115	0.0512	0.0152	0.0015	0.0013
0.0009	0.0034	0.0040	0.0044	0.0155	0.0008	0.0004	0.0055
Local							
0.3028	0.1048	0.3488	0.1075	0.0494	0.0261	0.0026	0.0022
0.0016	0.0058	0.0069	0.0075	0.0267	0.0013	0.0007	0.0053

**5.2 METEOROLOGY: DAVIDSON, DAVIE, FORSYTH, AND GUILFORD COUNTY  
TEMPERATURE AND RELATIVE HUMIDITY**

STATE CLIMATE OFFICE OF NORTH CAROLINA  
 NC CRONOS Database  
 2007 data retrieval from Greensboro Airport (KGSO)  
 Greensboro, Guilford County  
 Latitude: 36.0977469    Longitude: -79.9372975  
 Elevation: 926 ft.

7	0	31	71	76
7	1	31	70.1	77
7	2	31	69.5	78
7	3	31	68.8	79
7	4	31	68.4	80
7	5	31	68.4	80
7	6	31	70.7	76
7	7	31	73.8	69
7	8	31	76.9	62
7	9	31	79.2	58
7	10	31	81	54
7	11	31	82.5	51
7	12	31	83.8	48
7	13	31	84.8	46
7	14	31	84.3	46
7	15	31	82.9	50
7	16	31	83.5	48
7	17	31	82.3	50
7	18	31	80.1	54
7	19	31	77.7	60
7	20	31	75.6	66
7	21	31	74.1	70
7	22	31	73.1	72
7	23	31	71.9	74

## **Appendix B.4**

# **Nonroad Mobile Sources Emission Inventory Documentation**

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## **1.0 INTRODUCTION AND SCOPE**

Nonroad mobile sources are equipment that can move but are not licensed to use the public roads and highways. The nonroad mobile source category includes a diverse collection of equipment such as lawn mowers, chain saws, tractors, all terrain vehicles, forklifts and construction equipment. Emissions from this equipment are calculated using the NONROAD model developed by the United States Environmental Protection Agency (USEPA). This category also includes aircraft, railroad locomotives, and commercial marine vessels. No commercial marine vessels operate in Davidson, Davie, Forsyth, or Guilford Counties so there are no emissions reported for this category.

For this maintenance demonstration, emissions of oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOC) were estimated for the base year of 2007 and future years of 2011 and 2018.

## **2.0 OVERALL METHODOLOGY**

### **2.1 SOURCE CATEGORY IDENTIFICATION**

Nonroad mobile sources were identified using the USEPA guidance document EPA-450/4-91-016, *Procedures for the Preparation of Emissions Inventories for Carbon Monoxide and Precursors of Ozone* (Procedures document). Nonroad mobile source emissions are estimated by the methodologies suggested in the USEPA document, EPA-454/R-05-001, *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations*; EPA-450/4-81-026d (Revised) *Procedures for Emission Inventory Preparation, Volume IV; Mobile Sources* (Mobile Source Procedures); from the USEPA's nonroad model NONROAD2008a released July 6, 2009; and from the EDMS5.0 model developed by the USEPA and the Federal Aviation Administration (FAA).

### **2.2 EMISSION ESTIMATION APPROACH**

For the majority of nonroad categories, emissions were estimated using the USEPA's NONROAD2008a model. Model runs were performed for each of the four counties for each of the three years. The model runs were developed for a typical July weekday.

Aircraft emissions for 2007 were obtained from E.H. Pechan & Associates, Inc. (Pechan) work to develop a modeling inventory for the Southeastern States Air Resource Managers, Inc. (SESARM). Pechan started with the 2008 aircraft emission inventory developed by the USEPA for the National Emissions Inventory (NEI) and backcast it with growth factors derived from

activity data in the Federal Aviation Administration's (FAA) Air Traffic Activity Data System (ATADS). Pechan also incorporated emissions for military aircraft developed by the North Carolina Division of Air Quality (NCDAQ) to replace the USEPA estimates for military aircraft at civilian airports.

Growth factors to estimate emissions for 2011 and 2018 were developed by the NCDAQ using operations counts from the FAA's Terminal Area Forecast (TAF).

Railroad emissions for 2007 (Class I, II, III, and railyards) were produced by Pechan by growing an inventory developed by the Eastern Regional Technical Advisory Committee (ERTAC) for the 2008 NEI. Passenger railroad emissions were developed by the NCDAQ for 2007. Growth factors were based on projected railroad fuel use. Future emission reductions due to emission control measures were calculated based on future emission factors published in the USEPA document *Emission Factors for Locomotives*, EPA-420-F-09-025.

### **3.0 QUALITY ASSURANCE MEASURES**

For the NONROAD model runs, the options files (files that display the variables used to setup a model run) 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 after taking into consideration the differences between the counties.

Information about the quality assurance measures taken by the USEPA in developing the 2008 aircraft inventory may be found in USEPA documentation. E.H. Pechan provides information about their quality assurance measures in their document for SESARM titled *Area and Nonroad 2007 Base Year Inventories Final Report*, contract No. S-2009-06-01 (Appendix C).

The 2008 emission estimates for aircraft were developed under quality assurance procedures required by the USEPA for the NEI. For military aircraft at civilian airports, the NCDAQ developed emission factors based on surveys of military aircraft operations at military airports in the State. These factors were derived from operations counts and emissions calculated using the Emission and Dispersion Modeling System version 5.1.2 (EDMS) was carefully reviewed. Growth factors were calculated using data provided by the Federal Aviation Administration.

## 4.0 EMISSIONS AND DETAILED METHODOLOGY

### 4.1 CATEGORIES FROM THE NONROAD MODEL

The USEPA included more than 80 different types of equipment in the NONROAD model. To facilitate analysis and reporting, the USEPA grouped the equipment types into eleven equipment categories. These include:

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

The eleventh category, aircraft ground support equipment, was not calculated with the NONROAD model because the method of calculation performed by the EDMS model was judged to be superior. Additionally, the emissions are estimated for five different engine types. These include: 2-stroke and 4-stroke spark ignition engines, diesel engines, liquid propane gas and compressed natural gas fueled engines.

The NONROAD2008a model version was used to estimate emissions for the maintenance plan. This latest version of the model was released to the public on July 6, 2009.

NONROAD2008a is the latest release of the USEPA NONROAD model that was first released in June 2000, and incorporates many revisions to improve the model's predictive ability. Compared to NONROAD2005c, this model revision accounts for emission reductions from the Diesel Recreational Marine standards in the Loco/Marine final rule published in the Federal Register (FR) (73FR 25098) and the Small Spark Ignition and Spark Ignition Recreational Marine final rule (FR 59034). There are a number of additional improvements including the ability to model the effects of ethanol blends on fuel tank and hose permeation losses.

The options files (wherein all the modeling variables are set) used in the NONROAD2008a model were tailored to reflect North Carolina specific information. Copies of the options input files are in Section 6.0 of this document. The model was run for a typical July weekday for the years 2007, 2011, and 2018. The seasonal file for the model was modified to place North Carolina in the Southeast states group rather than the Mid-Atlantic group. This change was made because the NCDAQ had reviewed temperature data of North Carolina compared to states in the Southeast and the Mid-Atlantic. The results of this comparison indicated that North

Carolina temperatures are more in-line with the Southeast States. Future year estimates of fuel oxygen (due to Federal ethanol mandates) and fuel sulfur (due to the USEPA requirements) were incorporated. Default data was used for the remaining input files used in the NONROAD model.

Gasoline volatility is specified by measurement of Reid Vapor Pressure (RVP). During June through mid-September, the RVP for gasoline sold in Davidson, Guilford, and Forsyth Counties has been limited to no higher than 7.8 pounds per square inch (psi). Only a small part of Davie County is limited to a 7.8 psi RVP and it has been found that no gasoline stations are in the nonattainment portion. Additionally, because of the Yadkin River, access to Davidson County and the gasoline from there is less convenient than it might otherwise be. Therefore, the Davie County nonroad model emissions are calculated with a 9.0 psi RVP for all years. The NONROAD model option files for 2007 and 2011 for Davidson, Guilford, and Forsyth Counties were set to 7.8 psi RVP. North Carolina is requesting that the required RVP for The Triad counties (Including the small part of Davie County) be adjusted from 7.8 psi to 9.0 psi; therefore, the option file for Davidson, Guilford, and Forsyth counties for 2018 was set to 9.0 psi.

For reporting purposes, the resulting emissions from the NONROAD2008a model were totaled for each equipment category by county. The results for most of the equipment categories by county indicate a reduction in emissions with time into the future years. These reduced emission projections are influenced by several factors, including expected future changes in engine standards, fuel specifications, scrappage of old equipment, and activity levels. These future engine standards and activity levels are accounted for in the model.

The summary of the model results expressed in tons emitted per typical July weekday are tabulated in Table 4-1 through Table 4-10.

**Table 4- 1 Agricultural Equipment Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.26	0.23	0.16	0.03	0.03	0.02
Davie	0.19	0.17	0.11	0.02	0.02	0.01
Forsyth	0.13	0.11	0.08	0.02	0.01	0.01
Guilford	0.23	0.21	0.14	0.03	0.02	0.02
<b>Total</b>	<b>0.81</b>	<b>0.72</b>	<b>0.49</b>	<b>0.10</b>	<b>0.08</b>	<b>0.06</b>

**Table 4- 2 Commercial Equipment Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.16	0.15	0.12	0.24	0.19	0.14
Davie	0.03	0.03	0.02	0.05	0.04	0.03
Forsyth	0.47	0.44	0.33	0.70	0.55	0.40
Guilford	1.21	1.15	0.86	1.81	1.43	1.04
<b>Total</b>	<b>1.87</b>	<b>1.77</b>	<b>1.33</b>	<b>2.80</b>	<b>2.21</b>	<b>1.61</b>

**Table 4- 3 Construction and Mining Equipment Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.61	0.52	0.29	0.09	0.07	0.05
Davie	0.27	0.23	0.13	0.04	0.03	0.02
Forsyth	2.35	2.02	1.14	0.35	0.29	0.21
Guilford	5.35	4.59	2.60	0.80	0.65	0.48
<b>Total</b>	<b>8.58</b>	<b>7.36</b>	<b>4.16</b>	<b>1.28</b>	<b>1.04</b>	<b>0.76</b>

**Table 4- 4 Industrial Equipment Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	1.09	0.66	0.28	0.26	0.13	0.04
Davie	0.19	0.11	0.05	0.04	0.02	0.01
Forsyth	1.34	0.82	0.37	0.31	0.16	0.05
Guilford	2.63	1.59	0.69	0.62	0.32	0.10
<b>Total</b>	<b>5.25</b>	<b>3.18</b>	<b>1.39</b>	<b>1.23</b>	<b>0.63</b>	<b>0.20</b>

**Table 4- 5 Lawn and Garden Equipment (Commercial) Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.09	0.08	0.06	0.37	0.29	0.25
Davie	0.06	0.06	0.04	0.26	0.21	0.18
Forsyth	0.33	0.31	0.23	1.35	1.08	0.94
Guilford	0.77	0.73	0.55	3.18	2.55	2.20
<b>Total</b>	<b>1.25</b>	<b>1.18</b>	<b>0.88</b>	<b>5.16</b>	<b>4.13</b>	<b>3.57</b>

**Table 4- 6 Lawn and Garden Equipment (Residential) Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.04	0.04	0.02	0.41	0.33	0.22
Davie	0.01	0.01	0.01	0.10	0.08	0.05
Forsyth	0.08	0.08	0.05	0.89	0.71	0.47
Guilford	0.12	0.11	0.07	1.21	0.96	0.64
<b>Total</b>	<b>0.25</b>	<b>0.24</b>	<b>0.15</b>	<b>2.61</b>	<b>2.08</b>	<b>1.38</b>

**Table 4- 7 Logging Equipment Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.02	0.02	0.00	0.01	0.01	0.01
Davie	0.01	0.00	0.00	0.00	0.00	0.00
Forsyth	0.01	0.01	0.00	0.01	0.01	0.01
Guilford	0.02	0.01	0.00	0.01	0.01	0.01
<b>Total</b>	<b>0.06</b>	<b>0.04</b>	<b>0.00</b>	<b>0.03</b>	<b>0.03</b>	<b>0.03</b>

**Table 4- 8 Pleasure Craft Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.02	0.02	0.02	0.21	0.16	0.09
Davie	0.00	0.00	0.00	0.02	0.02	0.01
Forsyth	0.00	0.01	0.01	0.04	0.03	0.02
Guilford	0.01	0.01	0.01	0.11	0.09	0.05
<b>Total</b>	<b>0.03</b>	<b>0.04</b>	<b>0.04</b>	<b>0.38</b>	<b>0.30</b>	<b>0.17</b>

**Table 4- 9 Railroad Equipment Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.01	0.00	0.00	0.00	0.00	0.00
Davie	0.00	0.00	0.00	0.00	0.00	0.00
Forsyth	0.00	0.00	0.00	0.00	0.00	0.00
Guilford	0.01	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>0.02</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

**Table 4- 10 Recreational Equipment Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.01	0.01	0.01	0.25	0.23	0.16
Davie	0.02	0.02	0.02	0.72	0.69	0.47
Forsyth	0.01	0.01	0.01	0.04	0.03	0.02
Guilford	0.02	0.02	0.02	0.29	0.26	0.19
<b>Total</b>	<b>0.06</b>	<b>0.06</b>	<b>0.06</b>	<b>1.30</b>	<b>1.21</b>	<b>0.84</b>

#### 4.2 AIRCRAFT ENGINES AND AIRPORT GROUND SUPPORT

Aircraft engines, like other engines, emit pollutants whenever the engines are in operation. However, the only emissions that are of concern for this inventory are the portion of the operation that occurs below the mixing layer. This is because the emissions tend to disperse whenever the aircraft is above the mixing layer and therefore have little or no effect on ground level air pollutant concentrations.

The aircraft emissions of interest are produced during the landing and takeoff (LTO) cycle. The cycle begins when the aircraft approaches the airport, descending below the mixing layer, lands and taxis to the gate. It continues as the aircraft idles at the gate and then taxis back out to the runway for the subsequent takeoff and climb out as it heads back to cruising altitudes, above the mixing layer. Associated with these emissions are emissions from ground support equipment (GSE) and auxiliary power units (APU).

Aircraft can be categorized by use into four classifications: commercial, air taxis, general aviation and military. Commercial aircraft include those used for scheduled service transporting passengers, freight or both. Air taxis and commuter aircraft also fly scheduled service carrying passengers and/or freight but usually are smaller aircraft and operate on a more limited basis than commercial carriers. Air taxis may also be used for unscheduled on-demand flights. General

aviation includes all other non-military aircraft used for recreational flying, personal transportation, and various other activities. Military aircraft cover a wide range of sizes, uses, and operating missions. Military operations at civilian airports (as in the Triad) are often associated with National Guard, Army Reserve, and Air Force Reserve training.

Emission estimates were developed by the USEPA for year 2008 for all airports in North Carolina as part of the National Emission Inventory. Emission calculations for commercial aircraft were made using the EDMS 5.1 model developed by the USEPA and the Federal Aviation Administration (FAA). Emissions for air taxi and general aviation (both subgrouped into piston engine and turbine engine categories) were made using emission factors developed by the USEPA working with the FAA. More detail about this process is found in *Documentation for Aircraft Component of the National Emissions Inventory Methodology*, ERG No.: 0245.02.302.001, Contract No.: EP-D-07-097 prepared by Eastern Research Group under contract to E.H. Pechan for the USEPA. For military operations at civilian airports, emissions were calculated using emission factors developed by NCDAQ from surveys of military airports in North Carolina.

Emissions for aircraft operations in Davidson, Davie, Guilford, and Forsyth counties were projected from 2008 to the maintenance plan year 2007 by Pechan using backcasting factors developed from the FAA’s ATADS data. Factors to project to 2011 and 2018 were developed by the NCDAQ using activity projections from the FAA’s Terminal Area Forecast (TAF) for North Carolina. The TAF estimates future activity at three airports in the four county area. Growth factors specific to these airports were developed. Composite factors were developed from these three airports’ estimates and applied to the other small airports in the four Triad counties. The EDMS model calculates emissions from ground support equipment and emissions from auxiliary power units (APU) both associated with certain aircraft. Ground support equipment consists of equipment such as tractors used to tow airplanes to the gate or catering trucks that bring food to large airliners. APUs are typically smaller engines on aircraft that provide power for electricity or air conditioning when the main engines are shut off.

**Table 4- 11 Aircraft and Auxiliary Power Units Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.00	0.00	0.00	0.03	0.02	0.02
Davie	0.00	0.00	0.00	0.07	0.05	0.05
Forsyth	0.01	0.01	0.01	0.07	0.05	0.05
Guilford	0.35	0.30	0.42	0.19	0.15	0.18
<b>TOTAL</b>	<b>0.36</b>	<b>0.31</b>	<b>0.43</b>	<b>0.36</b>	<b>0.27</b>	<b>0.30</b>



**Table 4- 12 Aircraft Ground Support Equipment Emissions, tons/day**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	0.00	0.00	0.00	0.00	0.00	0.00
Davie	0.00	0.00	0.00	0.00	0.00	0.00
Forsyth	0.00	0.00	0.00	0.00	0.00	0.00
Guilford	0.05	0.04	0.06	0.02	0.01	0.02
<b>TOTAL</b>	<b>0.05</b>	<b>0.04</b>	<b>0.06</b>	<b>0.02</b>	<b>0.01</b>	<b>0.02</b>

### 4.3 RAILROAD LOCOMOTIVES

Railroad companies are categorized by size (Class I, Class II, or Class III) and passenger service (Amtrak and NCDOT Rail Division). 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 NCDOT Rail Division provide passenger service.

Railroad locomotive emissions for classes I, II, and III plus rail yards were calculated for all of North Carolina for 2007 by E.H.Pechan as part of the 2007 base year inventory prepared for SESARM. The Pechan inventory was prepared based on the ERTAC inventory developed for the 2008 National Emission Inventory. Some of the details of the ERTAC work are based on proprietary information provided by the railroad companies. The calculation methodologies followed procedures acceptable to the USEPA. Additional detail can be found in the SESARM document *Area and Nonroad 2007 Base Year Inventories Final Report*, contract No. S-2009-06-01.

Passenger railroad emissions were developed by NCDAQ for 2007. This was done using information supplied by the North Carolina Department of Transportation and emission factors from *Emission Factors for Locomotives*, EPA-420-F-09-025. Railroad emissions are shown in Table 4- 13 below:

**Table 4- 13 Railroad Emissions (tons/day)**

County	NOx			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	1.25	1.02	0.93	0.07	0.06	0.05
Davie	0.00	0.00	0.00	0.00	0.00	0.00
Forsyth	0.21	0.17	0.17	0.01	0.01	0.01
Guilford	1.06	0.83	0.69	0.06	0.05	0.03
<b>TOTAL</b>	<b>2.52</b>	<b>2.02</b>	<b>1.79</b>	<b>0.14</b>	<b>0.12</b>	<b>0.09</b>

#### 4.4 COMBINED NONROAD EMISSIONS

**Table 4- 14 Combined Nonroad Emissions, tons/day**

County	NO <sub>x</sub>			VOC		
	2007	2011	2018	2007	2011	2018
Davidson	3.56	2.75	1.89	1.97	1.52	1.05
Davie	0.78	0.63	0.38	1.32	1.16	0.83
Forsyth	4.94	3.99	2.40	3.79	2.93	2.19
Guilford	11.83	9.59	6.11	8.33	6.50	4.96
<b>TOTAL</b>	<b>21.11</b>	<b>16.96</b>	<b>10.78</b>	<b>15.41</b>	<b>12.11</b>	<b>9.03</b>

#### 5.0 PROJECTION AND CONTROL FACTORS

##### 5.1 AIRCRAFT EMISSIONS GROWTH

Factors to grow aircraft emissions were produced by running the FAA’s Terminal Area Forecast model to produce estimates of aircraft operations for 2007, 2011, and 2018 as described above. For the three airports in the four counties that appear in the TAF, growth factors unique to each of these airports were produced. For the rest of the airports in the four counties composite growth factors were produced from the three. The projection factors are shown in Table 5- 1 below.

**Table 5- 1 Aircraft Growth Factors**

Airport	FIPS	Year	Growth Factors	SCC	SCC Description
EXX	37057	2007	1.000000	2275020000	AirCarrier
EXX	37057	2011	1.000000	2275020000	AirCarrier
EXX	37057	2018	1.000000	2275020000	AirCarrier
GSO	37081	2007	1.000000	2275020000	AirCarrier
GSO	37081	2011	0.869718	2275020000	AirCarrier
GSO	37081	2018	1.218433	2275020000	AirCarrier
INT	37067	2007	1.000000	2275020000	AirCarrier
INT	37067	2011	0.980907	2275020000	AirCarrier
INT	37067	2018	0.980907	2275020000	AirCarrier
composite	37aaa	2007	1.000000	2275020000	AirCarrier
composite	37aaa	2011	0.872524	2275020000	AirCarrier
composite	37aaa	2018	1.212441	2275020000	AirCarrier

**Table 5- 1 Aircraft Growth Factors**

Airport	FIPS	Year	Growth Factors	SCC	SCC Description
EXX	37057	2007	1.000000	2275070000	APU
EXX	37057	2011	1.000000	2275070000	APU
EXX	37057	2018	1.000000	2275070000	APU
GSO	37081	2007	1.000000	2275070000	APU
GSO	37081	2011	0.869718	2275070000	APU
GSO	37081	2018	1.218433	2275070000	APU
INT	37067	2007	1.000000	2275070000	APU
INT	37067	2011	0.980907	2275070000	APU
INT	37067	2018	0.980907	2275070000	APU
composite	37aaa	2007	1.000000	2275070000	APU
composite	37aaa	2011	0.872524	2275070000	APU
composite	37aaa	2018	1.212441	2275070000	APU
EXX	37057	2007	1.000000	2275060011	Air Taxi Piston
EXX	37057	2011	1.000000	2275060011	Air Taxi Piston
EXX	37057	2018	1.000000	2275060011	Air Taxi Piston
GSO	37081	2007	1.000000	2275060011	Air Taxi Piston
GSO	37081	2011	0.789363	2275060011	Air Taxi Piston
GSO	37081	2018	1.037863	2275060011	Air Taxi Piston
INT	37067	2007	1.000000	2275060011	Air Taxi Piston
INT	37067	2011	0.678422	2275060011	Air Taxi Piston
INT	37067	2018	0.678422	2275060011	Air Taxi Piston
composite	37aaa	2007	1.000000	2275060011	Air Taxi Piston
composite	37aaa	2011	0.785318	2275060011	Air Taxi Piston
composite	37aaa	2018	1.017900	2275060011	Air Taxi Piston
EXX	37057	2007	1.000000	2275060012	Air Taxi Turbine
EXX	37057	2011	1.000000	2275060012	Air Taxi Turbine
EXX	37057	2018	1.000000	2275060012	Air Taxi Turbine
GSO	37081	2007	1.000000	2275060012	Air Taxi Turbine
GSO	37081	2011	0.789363	2275060012	Air Taxi Turbine
GSO	37081	2018	1.037863	2275060012	Air Taxi Turbine
INT	37067	2007	1.000000	2275060012	Air Taxi Turbine
INT	37067	2011	0.678422	2275060012	Air Taxi Turbine
INT	37067	2018	0.678422	2275060012	Air Taxi Turbine
composite	37aaa	2007	1.000000	2275060012	Air Taxi Turbine
composite	37aaa	2011	0.785318	2275060012	Air Taxi Turbine
composite	37aaa	2018	1.017900	2275060012	Air Taxi Turbine
EXX	37057	2007	1.000000	2275050011	Gen Aviation Piston
EXX	37057	2011	1.000000	2275050011	Gen Aviation Piston
EXX	37057	2018	1.000000	2275050011	Gen Aviation Piston
GSO	37081	2007	1.000000	2275050011	Gen Aviation Piston
GSO	37081	2011	0.677367	2275050011	Gen Aviation Piston

**Table 5- 1 Aircraft Growth Factors**

Airport	FIPS	Year	Growth Factors	SCC	SCC Description
GSO	37081	2018	0.737698	2275050011	Gen Aviation Piston
INT	37067	2007	1.000000	2275050011	Gen Aviation Piston
INT	37067	2011	0.682758	2275050011	Gen Aviation Piston
INT	37067	2018	0.727821	2275050011	Gen Aviation Piston
composite	37aaa	2007	1.000000	2275050011	Gen Aviation Piston
composite	37aaa	2011	0.704263	2275050011	Gen Aviation Piston
composite	37aaa	2018	0.752108	2275050011	Gen Aviation Piston
EXX	37057	2007	1.000000	2275050012	Gen Aviation turbine
EXX	37057	2011	1.000000	2275050012	Gen Aviation turbine
EXX	37057	2018	1.000000	2275050012	Gen Aviation turbine
GSO	37081	2007	1.000000	2275050012	Gen Aviation turbine
GSO	37081	2011	0.677367	2275050012	Gen Aviation turbine
GSO	37081	2018	0.737698	2275050012	Gen Aviation turbine
INT	37067	2007	1.000000	2275050012	Gen Aviation turbine
INT	37067	2011	0.682758	2275050012	Gen Aviation turbine
INT	37067	2018	0.727821	2275050012	Gen Aviation turbine
composite	37aaa	2007	1.000000	2275050012	Gen Aviation turbine
composite	37aaa	2011	0.704263	2275050012	Gen Aviation turbine
composite	37aaa	2018	0.752108	2275050012	Gen Aviation turbine
EXX	37057	2007	1.000000	2275001000	Military
EXX	37057	2011	1.000000	2275001000	Military
EXX	37057	2018	1.000000	2275001000	Military
GSO	37081	2007	1.000000	2275001000	Military
GSO	37081	2011	0.762342	2275001000	Military
GSO	37081	2018	0.762342	2275001000	Military
INT	37067	2007	1.000000	2275001000	Military
INT	37067	2011	2.584416	2275001000	Military
INT	37067	2018	2.584416	2275001000	Military
composite	37aaa	2007	1.000000	2275001000	Military
composite	37aaa	2011	1.099251	2275001000	Military
composite	37aaa	2018	1.099251	2275001000	Military
EXX	37057	2007	1.000000	2265008005	GSE, Gasoline
EXX	37057	2011	1.000000	2265008005	GSE, Gasoline
EXX	37057	2018	1.000000	2265008005	GSE, Gasoline
GSO	37081	2007	1.000000	2265008005	GSE, Gasoline
GSO	37081	2011	0.869718	2265008005	GSE, Gasoline
GSO	37081	2018	1.218433	2265008005	GSE, Gasoline
INT	37067	2007	1.000000	2265008005	GSE, Gasoline
INT	37067	2011	0.980907	2265008005	GSE, Gasoline
INT	37067	2018	0.980907	2265008005	GSE, Gasoline
composite	37aaa	2007	1.000000	2265008005	GSE, Gasoline

**Table 5- 1 Aircraft Growth Factors**

Airport	FIPS	Year	Growth Factors	SCC	SCC Description
composite	37aaa	2011	0.872524	2265008005	GSE, Gasoline
composite	37aaa	2018	1.212441	2265008005	GSE, Gasoline
EXX	37057	2007	1.000000	2267008005	GSE, LPG
EXX	37057	2011	1.000000	2267008005	GSE, LPG
EXX	37057	2018	1.000000	2267008005	GSE, LPG
GSO	37081	2007	1.000000	2267008005	GSE, LPG
GSO	37081	2011	0.869718	2267008005	GSE, LPG
GSO	37081	2018	1.218433	2267008005	GSE, LPG
INT	37067	2007	1.000000	2267008005	GSE, LPG
INT	37067	2011	0.980907	2267008005	GSE, LPG
INT	37067	2018	0.980907	2267008005	GSE, LPG
composite	37aaa	2007	1.000000	2267008005	GSE, LPG
composite	37aaa	2011	0.872524	2267008005	GSE, LPG
composite	37aaa	2018	1.212441	2267008005	GSE, LPG
EXX	37057	2007	1.000000	2268008005	GSE, CNG
EXX	37057	2011	1.000000	2268008005	GSE, CNG
EXX	37057	2018	1.000000	2268008005	GSE, CNG
GSO	37081	2007	1.000000	2268008005	GSE, CNG
GSO	37081	2011	0.869718	2268008005	GSE, CNG
GSO	37081	2018	1.218433	2268008005	GSE, CNG
INT	37067	2007	1.000000	2268008005	GSE, CNG
INT	37067	2011	0.980907	2268008005	GSE, CNG
INT	37067	2018	0.980907	2268008005	GSE, CNG
composite	37aaa	2007	1.000000	2268008005	GSE, CNG
composite	37aaa	2011	0.872524	2268008005	GSE, CNG
composite	37aaa	2018	1.212441	2268008005	GSE, CNG
EXX	37057	2007	1.000000	2270008005	GSE, Diesel
EXX	37057	2011	1.000000	2270008005	GSE, Diesel
EXX	37057	2018	1.000000	2270008005	GSE, Diesel
GSO	37081	2007	1.000000	2270008005	GSE, Diesel
GSO	37081	2011	0.869718	2270008005	GSE, Diesel
GSO	37081	2018	1.218433	2270008005	GSE, Diesel
INT	37067	2007	1.000000	2270008005	GSE, Diesel
INT	37067	2011	0.980907	2270008005	GSE, Diesel
INT	37067	2018	0.980907	2270008005	GSE, Diesel
composite	37aaa	2007	1.000000	2270008005	GSE, Diesel
composite	37aaa	2011	0.872524	2270008005	GSE, Diesel
composite	37aaa	2018	1.212441	2270008005	GSE, Diesel

## 5.1 RAILROAD EMISSIONS GROWTH AND CONTROL

Railroad growth factors were calculated using national fuel use estimates for freight and for intercity passenger service found on table 46 of the Energy Information Administration's *Annual Energy Outlook, 2010*. The energy inputs and the calculated growth factors are provided in the following table:

**Table 5-2 Railroad Growth Factors**

SCC	Year	Pollutant	Fuel trillion btu	Growth factor	Description
2285002006	2007	NOx	605.03	1.0000	Locomotives: Class I Operations
2285002006	2011	NOx	554.08	0.9158	Locomotives: Class I Operations
2285002006	2018	NOx	623.85	1.0311	Locomotives: Class I Operations
2285002007	2007	NOx	605.03	1.0000	Locomotives: Class II / III Operations
2285002007	2011	NOx	554.08	0.9158	Locomotives: Class II / III Operations
2285002007	2018	NOx	623.85	1.0311	Locomotives: Class II / III Operations
2285002008	2007	NOx	14.58	1.0000	Locomotives: Passenger Trains
2285002008	2011	NOx	14.06	0.9643	Locomotives: Passenger Trains
2285002008	2018	NOx	16.04	1.1001	Locomotives: Passenger Trains
2285002010	2007	NOx	605.03	1.0000	Yard Locomotives
2285002010	2011	NOx	554.08	0.9158	Yard Locomotives
2285002010	2018	NOx	623.85	1.0311	Yard Locomotives
2285002006	2007	VOC	605.03	1.0000	Locomotives: Class I Operations
2285002006	2011	VOC	554.08	0.9158	Locomotives: Class I Operations
2285002006	2018	VOC	623.85	1.0311	Locomotives: Class I Operations
2285002007	2007	VOC	605.03	1.0000	Locomotives: Class II / III Operations
2285002007	2011	VOC	554.08	0.9158	Locomotives: Class II / III Operations
2285002007	2018	VOC	623.85	1.0311	Locomotives: Class II / III Operations
2285002008	2007	VOC	14.58	1.0000	Locomotives: Passenger Trains
2285002008	2011	VOC	14.06	0.9643	Locomotives: Passenger Trains
2285002008	2018	VOC	16.04	1.1001	Locomotives: Passenger Trains
2285002010	2007	VOC	605.03	1.0000	Yard Locomotives
2285002010	2011	VOC	554.08	0.9158	Yard Locomotives
2285002010	2018	VOC	623.85	1.0311	Yard Locomotives

Control factors shown in the following table were calculated by using recommended emission factors for NOX and hydrocarbons (virtually the same as VOC) from *Emission Factors for Locomotives*, EPA-420-F-09-025. The control factors were calculated by dividing base year emission factors by the future year emission factors. Improving control factors are due to requirements for reduced emissions from new and rebuilt locomotive diesel engines. Future

emissions were calculated by multiplying the base year emissions by the associated growth factor and by the associated control factor.

**Table 5- 2 Railroad Control Factors**

SCC	Year	Pollutant	Emission Factor	Control Factor	Description
2285002006	2007	NOx	175	1.0000	Locomotives: Class I Operations
2285002006	2011	NOx	149	0.8514	Locomotives: Class I Operations
2285002006	2018	NOx	108	0.6171	Locomotives: Class I Operations
2285002007	2007	NOx	242	1.0000	Locomotives: Class II / III Operations
2285002007	2011	NOx	242	1.0000	Locomotives: Class II / III Operations
2285002007	2018	NOx	236	0.9752	Locomotives: Class II / III Operations
2285002008	2007	NOx	229	1.0000	Locomotives: Passenger Trains
2285002008	2011	NOx	167	0.7293	Locomotives: Passenger Trains
2285002008	2018	NOx	105	0.4585	Locomotives: Passenger Trains
2285002010	2007	NOx	249	1.0000	Yard Locomotives
2285002010	2011	NOx	235	0.9438	Yard Locomotives
2285002010	2018	NOx	202	0.8112	Yard Locomotives
2285002006	2007	VOC	9.3	1.0000	Locomotives: Class I Operations
2285002006	2011	VOC	7.7	0.8280	Locomotives: Class I Operations
2285002006	2018	VOC	4.2	0.4516	Locomotives: Class I Operations
2285002007	2007	VOC	11.7	1.0000	Locomotives: Class II / III Operations
2285002007	2011	VOC	11.7	1.0000	Locomotives: Class II / III Operations
2285002007	2018	VOC	11.7	1.0000	Locomotives: Class II / III Operations
2285002008	2007	VOC	9.5	1.0000	Locomotives: Passenger Trains
2285002008	2011	VOC	8.1	0.8526	Locomotives: Passenger Trains
2285002008	2018	VOC	4.1	0.4316	Locomotives: Passenger Trains
2285002010	2007	VOC	15	1.0000	Yard Locomotives
2285002010	2011	VOC	14	0.9333	Yard Locomotives
2285002010	2018	VOC	11.5	0.7667	Yard Locomotives

## 6.0 NONROAD2008a OPTION FILES

### 6.1 DAVIDSON COUNTY 2007

Written by Nonroad interface at 9/14/2010 3:30:00 PM  
 This is the options file for the NONROAD program.  
 The data is separated into "packets" bases on common information. Each packet is specified by an identifier and a terminator. Any notes or descriptions can be placed between the data packets.

9/2005 epa: Add growth & tech years to PERIOD packet  
 and Counties & Retrofit files to RUNFILES packet.

---

PERIOD PACKET

This is the packet that defines the period for which emissions are to be estimated. The order of the records matter. The selection of certain parameters will cause some of the record that follow to be ignored. The order of the records is as follows:

- 1 - Char 10 - Period type for this simulation.  
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

---

/PERIOD/  
Period type : Monthly  
Summation type : Typical day  
Year of episode : 2007  
Season of year :  
Month of year : July  
Weekday or weekend : Weekday  
Year of growth calc:  
Year of tech sel :  
/END/

---

OPTIONS PACKET

This is the packet that defines some of the user options that drive the model. Most parameters are used to make episode specific emission factor adjustments. The order of the records is fixed. The order is as follows.

- 1 - Char 80 - First title on reports
- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)
- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made  
Valid responses are: YES and NO

---

/OPTIONS/



Title 1 : TRIAD (110)  
Title 2 : DAVIDSON 2007; JULY  
Fuel RVP for gas : 7.8  
Oxygen Weight % : 1.51  
Gas sulfur % : 0.0043  
Diesel sulfur % : 0.1140  
Marine Dsl sulfur %: 0.1328  
CNG/LPG sulfur % : 0.003  
Minimum temper. (F): 68.1  
Maximum temper. (F): 87.6  
Average temper. (F): 77.9  
Altitude of region : LOW  
EtOH Blend % Mkt : 46.3  
EtOH Vol % : 9.3  
/END/

---

REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

- US TOTAL - emissions are for entire USA without state breakout.
- 50STATE - emissions are for all 50 states and Washington D.C., by state.
- STATE - emissions are for a select group of states and are state-level estimates
- COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.
- SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

- US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- 50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- STATE - state FIPS codes
- COUNTY - state or county FIPS codes. State FIPS code means include all counties in the

state.

SUBCOUNTY - county FIPS code and subregion code.

-----  
/REGION/  
Region Level : COUNTY  
Davidson County NC : 37057  
/END/

or use -  
Region Level : STATE  
Michigan : 26000  
-----

SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

-----  
/SOURCE CATEGORY/  
:2260001000  
:2265001000  
:2267001000  
:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000  
:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000  
:2260004000  
:2265004000  
:2267004000  
:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000  
:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000  
:2260007000  
:2265007000  
:2267007000

:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000  
:2267010000  
:2268010000  
:2270010000  
:2285000000  
:2282000000

/END/

Diesel Only -

:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -

:2260000000  
:2265000000  
:2267000000  
:2268000000  
:2282005010  
:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files and some of the input data files read by the model. If a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTion file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.  
-----

/RUNFILES/

ALLOC XREF : data\allocate\allocate.xrf  
ACTIVITY : data\activity\activity.dat  
EXH TECHNOLOGY : data\tech\tech-exh.dat  
EVP TECHNOLOGY : data\tech\tech-evp.dat  
SEASONALITY : data\season\season.dat  
REGIONS : data\season\season.dat  
MESSAGE : c:\nonroad\outputs\davitd07.msg  
OUTPUT DATA : c:\nonroad\outputs\davitd07.out  
EPS2 AMS :  
US COUNTIES FIPS : data\allocate\fips.dat  
RETROFIT :  
/END/

-----  
This is the packet that defines the equipment population files read by the model.  
-----

-----  
/POP FILES/  
Population File :c:\nonroad\data\pop\nc.pop  
/END/

POPULATION FILE : c:\nonroad\data\POP\MI.POP

-----  
This is the packet that defines the growth files  
files read by the model.  
-----

/GROWTH FILES/  
National defaults : data\growth\nation.grw  
/END/

/ALLOC FILES/  
Air trans. empl. :c:\nonroad\data\allocate\nc\_airtr.alo  
Undergrnd coal prod:c:\nonroad\data\allocate\nc\_coal.alo  
Construction cost :c:\nonroad\data\allocate\nc\_const.alo  
Harvested acres :c:\nonroad\data\allocate\nc\_farms.alo  
Golf course estab. :c:\nonroad\data\allocate\nc\_golf.alo  
Wholesale estab. :c:\nonroad\data\allocate\nc\_holsl.alo  
Family housing :c:\nonroad\data\allocate\nc\_house.alo  
Logging employees :c:\nonroad\data\allocate\nc\_loggn.alo  
Landscaping empl. :c:\nonroad\data\allocate\nc\_lscap.alo  
Manufacturing empl.:c:\nonroad\data\allocate\nc\_mnfg.alo  
Oil & gas employees:c:\nonroad\data\allocate\nc\_oil.alo  
Census population :c:\nonroad\data\allocate\nc\_pop.alo  
Allocation File :c:\nonroad\data\allocate\nc\_rail.alo  
RV Park establish. :c:\nonroad\data\allocate\nc\_rvprk.alo  
Snowblowers comm. :c:\nonroad\data\allocate\nc\_sbc.alo  
Snowblowers res. :c:\nonroad\data\allocate\nc\_sbr.alo  
Snowmobiles :c:\nonroad\data\allocate\nc\_snowm.alo  
Rec marine inboard :c:\nonroad\data\allocate\nc\_wib.alo  
Rec marine outboard:c:\nonroad\data\allocate\nc\_wob.alo  
/END/

-----  
This is the packet that defines the emssions factors  
files read by the model.  
-----

/EMFAC FILES/  
THC exhaust : data\emsfac\exhthc.emf  
CO exhaust : data\emsfac\exhco.emf  
NOX exhaust : data\emsfac\exhnox.emf  
PM exhaust : data\emsfac\exhpm.emf  
BSFC : data\emsfac\bsfc.emf  
Crankcase : data\emsfac\crank.emf  
Spillage : data\emsfac\spillage.emf  
Diurnal : data\emsfac\evdiu.emf  
Tank Perm : data\emsfac\evtank.emf  
Non-RM Hose Perm : data\emsfac\evhose.emf  
RM Fill Neck Perm : data\emsfac\evneck.emf  
RM Supply/Return : data\emsfac\evsupret.emf  
RM Vent Perm : data\emsfac\evvent.emf  
Hot Soaks : data\emsfac\evhotsk.emf

RuningLoss : data\emsfac\evrunls.emf  
/END/

-----  
This is the packet that defines the deterioration factors  
files read by the model.  
-----

/DETERIORATE FILES/  
THC exhaust : data\detfac\exhthc.det  
CO exhaust : data\detfac\exhco.det  
NOX exhaust : data\detfac\exhnox.det  
PM exhaust : data\detfac\exhpm.det  
Diurnal : data\detfac\evdiu.det  
Tank Perm : data\detfac\evtank.det  
Non-RM Hose Perm : data\detfac\evhose.det  
RM Fill Neck Perm : data\detfac\evneck.det  
RM Supply/Return : data\detfac\evsupret.det  
RM Vent Perm : data\detfac\evvent.det  
Hot Soaks : data\detfac\evhotsk.det  
RuningLoss : data\detfac\evrunls.det  
/END/

Optional Packets - Add initial slash "/" to activate

/STAGE II/  
Control Factor : 0.0  
/END/  
Enter percent control: 95 = 95% control = 0.05 x uncontrolled  
Default should be zero control.

/MODELYEAR OUT/  
EXHAUST BMY OUT :  
EVAP BMY OUT :  
/END/

SI REPORT/  
SI report file-CSV :OUTPUTS\NR POLLUT.CSV  
/END/

/DAILY FILES/  
DAILY TEMPS/RVP :  
/END/

PM Base Sulfur  
cols 1-10: dsl tech type;  
11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)  
/PM BASE SULFUR/  
T2 0.0350 0.02247  
T3 0.2000 0.02247  
T3B 0.0500 0.02247  
T4A 0.0500 0.02247  
T4B 0.0015 0.02247  
T4 0.0015 0.30  
T4N 0.0015 0.30  
T2M 0.0350 0.02247  
T3M 1.0 0.02247  
T4M 1.0 0.02247

/END/

## 6.2 DAVIE COUNTY 2007

Written by Nonroad interface at 10/8/2010 5:10:01 PM  
This is the options file for the NONROAD program.  
The data is sperated into "packets" bases on common  
information. Each packet is specified by an  
identifier and a terminator. Any notes or descriptions  
can be placed between the data packets.

9/2005 epa: Add growth & tech years to PERIOD packet  
and Counties & Retrofit files to RUNFILES packet.

---

### PERIOD PACKET

This is the packet that defines the period for  
which emissions are to be estimated. The order of the  
records matter. The selection of certain parameters  
will cause some of the record that follow to be ignored.  
The order of the records is as follows:

- 1 - Char 10 - Period type for this simulation.  
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

---

/PERIOD/

Period type : Monthly  
Summation type : Typical day  
Year of episode : 2007  
Season of year :  
Month of year : July  
Weekday or weekend : Weekday  
Year of growth calc:  
Year of tech sel :  
/END/

---

### OPTIONS PACKET

This is the packet that defines some of the user  
options that drive the model. Most parameters are  
used to make episode specific emission factor  
adjustments. The order of the records is fixed.  
The order is as follows.

- 1 - Char 80 - First title on reports

- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)
- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made  
Valid responses are: YES and NO

-----  
/OPTIONS/

Title 1 : TRIAD (110)  
 Title 2 : DAVIE 2007; JULY  
 Fuel RVP for gas : 9.0  
 Oxygen Weight % : 1.51  
 Gas sulfur % : 0.0043  
 Diesel sulfur % : 0.1140  
 Marine Dsl sulfur %: 0.1328  
 CNG/LPG sulfur % : 0.003  
 Minimum temper. (F): 68.1  
 Maximum temper. (F): 87.6  
 Average temper. (F): 77.9  
 Altitude of region : LOW  
 EtOH Blend % Mkt : 46.3  
 EtOH Vol % : 9.3  
 /END/

-----  
REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

- US TOTAL - emissions are for entire USA without state breakout.
- 50STATE - emissions are for all 50 states and Washington D.C., by state.
- STATE - emissions are for a select group of states and are state-level estimates
- COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.
- SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.

50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.

STATE - state FIPS codes

COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.

SUBCOUNTY - county FIPS code and subregion code.

-----  
/REGION/  
Region Level : COUNTY  
Davie County NC : 37059  
/END/

or use -  
Region Level : STATE  
Michigan : 26000  
-----

#### SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

-----  
/SOURCE CATEGORY/  
:2260001000  
:2265001000  
:2267001000  
:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000  
:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000  
:2260004000  
:2265004000  
:2267004000



:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000  
:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000  
:2260007000  
:2265007000  
:2267007000  
:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000  
:2267010000  
:2268010000  
:2270010000  
:2285000000  
:2282000000

/END/

Diesel Only -

:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -

:2260000000  
:2265000000  
:2267000000  
:2268000000  
:2282005010  
:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files and some of the input data files read by the model. If a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTion file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.  
-----

/RUNFILES/

ALLOC XREF : data\allocate\allocate.xrf

```

ACTIVITY           : data\activity\activity.dat
EXH TECHNOLOGY     : data\tech\tech-exh.dat
EVP TECHNOLOGY     : data\tech\tech-evp.dat
SEASONALITY        : data\season\season.dat
REGIONS            : data\season\season.dat
MESSAGE            : c:\nonroad\outputs\davie07.msg
OUTPUT DATA       : c:\nonroad\outputs\davie07.out
EPS2 AMS           :
US COUNTIES FIPS   : data\allocate\fips.dat
RETROFIT           :
/END/

```

-----  
This is the packet that defines the equipment population files read by the model.  
-----

```

/POP FILES/
Population File    : c:\nonroad\data\pop\nc.pop
/END/

```

```

POPULATION FILE    : c:\nonroad\data\POP\MI.POP

```

-----  
This is the packet that defines the growth files files read by the model.  
-----

```

/GROWTH FILES/
National defaults  : data\growth\nation.grw
/END/

```

```

/ALLOC FILES/
Air trans. empl.   :c:\nonroad\data\allocate\nc_airtr.alo
Undergrnd coal prod:c:\nonroad\data\allocate\nc_coal.alo
Construction cost :c:\nonroad\data\allocate\nc_const.alo
Harvested acres   :c:\nonroad\data\allocate\nc_farms.alo
Golf course estab.:c:\nonroad\data\allocate\nc_golf.alo
Wholesale estab.  :c:\nonroad\data\allocate\nc_holsl.alo
Family housing     :c:\nonroad\data\allocate\nc_house.alo
Logging employees :c:\nonroad\data\allocate\nc_loggn.alo
Landscaping empl. :c:\nonroad\data\allocate\nc_lscap.alo
Manufacturing empl.:c:\nonroad\data\allocate\nc_mnfg.alo
Oil & gas employees:c:\nonroad\data\allocate\nc_oil.alo
Census population :c:\nonroad\data\allocate\nc_pop.alo
Allocation File    :c:\nonroad\data\allocate\nc_rail.alo
RV Park establish.:c:\nonroad\data\allocate\nc_rvprk.alo
Snowblowers comm. :c:\nonroad\data\allocate\nc_sbc.alo
Snowblowers res.  :c:\nonroad\data\allocate\nc_sbr.alo
Snowmobiles       :c:\nonroad\data\allocate\nc_snowm.alo
Rec marine inboard :c:\nonroad\data\allocate\nc_wib.alo
Rec marine outboard:c:\nonroad\data\allocate\nc_wob.alo
/END/

```

-----  
This is the packet that defines the emssions factors files read by the model.  
-----

```

/EMFAC FILES/
THC exhaust      : data\emsfac\exhthc.emf
CO exhaust       : data\emsfac\exhco.emf
NOX exhaust      : data\emsfac\exhnox.emf
PM exhaust       : data\emsfac\exhpm.emf
BSFC             : data\emsfac\bsfc.emf
Crankcase        : data\emsfac\crank.emf
Spillage         : data\emsfac\spillage.emf
Diurnal          : data\emsfac\evdiu.emf
Tank Perm        : data\emsfac\evtank.emf
Non-RM Hose Perm : data\emsfac\evhose.emf
RM Fill Neck Perm : data\emsfac\evneck.emf
RM Supply/Return : data\emsfac\evsupret.emf
RM Vent Perm     : data\emsfac\evvent.emf
Hot Soaks        : data\emsfac\evhotsk.emf
RuningLoss       : data\emsfac\evrunls.emf
/END/

```

-----  
This is the packet that defines the deterioration factors  
files read by the model.  
-----

```

/DETERIORATE FILES/
THC exhaust      : data\detfac\exhthc.det
CO exhaust       : data\detfac\exhco.det
NOX exhaust      : data\detfac\exhnox.det
PM exhaust       : data\detfac\exhpm.det
Diurnal          : data\detfac\evdiu.det
Tank Perm        : data\detfac\evtank.det
Non-RM Hose Perm : data\detfac\evhose.det
RM Fill Neck Perm : data\detfac\evneck.det
RM Supply/Return : data\detfac\evsupret.det
RM Vent Perm     : data\detfac\evvent.det
Hot Soaks        : data\detfac\evhotsk.det
RuningLoss       : data\detfac\evrunls.det
/END/

```

Optional Packets - Add initial slash "/" to activate

```

/STAGE II/
Control Factor   : 0.0
/END/
Enter percent control: 95 = 95% control = 0.05 x uncontrolled
Default should be zero control.

```

```

/MODELYEAR OUT/
EXHAUST BMY OUT :
EVAP BMY OUT    :
/END/

```

```

SI REPORT/
SI report file-CSV :OUTPUTS\NRPOLLUT.CSV
/END/

```

```

/DAILY FILES/
DAILY TEMPS/RVP :
/END/

```

```

PM Base Sulfur
  cols 1-10: dsl tech type;
  11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)
/PM BASE SULFUR/
T2          0.0350    0.02247
T3          0.2000    0.02247
T3B         0.0500    0.02247
T4A         0.0500    0.02247
T4B         0.0015    0.02247
T4          0.0015    0.30
T4N         0.0015    0.30
T2M         0.0350    0.02247
T3M         1.0       0.02247
T4M         1.0       0.02247
/END/

```

### 6.3 FORSYTH COUNTY 2007

Written by Nonroad interface at 9/10/2010 2:33:51 PM  
This is the options file for the NONROAD program.  
The data is sperated into "packets" bases on common  
information. Each packet is specified by an  
identifier and a terminator. Any notes or descriptions  
can be placed between the data packets.

9/2005 epa: Add growth & tech years to PERIOD packet  
and Counties & Retrofit files to RUNFILES packet.

-----

#### PERIOD PACKET

This is the packet that defines the period for  
which emissions are to be estimated. The order of the  
records matter. The selection of certain parameters  
will cause some of the record that follow to be ignored.  
The order of the records is as follows:

- 1 - Char 10 - Period type for this simulation.  
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

-----

```

/PERIOD/
Period type      : Monthly
Summation type  : Typical day
Year of episode  : 2007
Season of year   :
Month of year    : July
Weekday or weekend : Weekday

```

Year of growth calc:  
Year of tech sel :  
/END/

---

OPTIONS PACKET

This is the packet that defines some of the user options that drive the model. Most parameters are used to make episode specific emission factor adjustments. The order of the records is fixed. The order is as follows.

- 1 - Char 80 - First title on reports
- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)
- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made  
Valid responses are: YES and NO

---

/OPTIONS/

Title 1 : TRIAD (110)  
Title 2 : FORSYTH 2007; JULY  
Fuel RVP for gas : 7.8  
Oxygen Weight % : 1.51  
Gas sulfur % : 0.0043  
Diesel sulfur % : 0.1140  
Marine Dsl sulfur %: 0.1328  
CNG/LPG sulfur % : 0.003  
Minimum temper. (F): 68.1  
Maximum temper. (F): 87.6  
Average temper. (F): 77.9  
Altitude of region : LOW  
EtOH Blend % Mkt : 46.3  
EtOH Vol % : 9.3  
/END/

---

REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

US TOTAL - emissions are for entire USA without state

breakout.

- 50STATE - emissions are for all 50 states and Washington D.C., by state.
- STATE - emissions are for a select group of states and are state-level estimates
- COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.
- SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

- US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- 50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- STATE - state FIPS codes
- COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.
- SUBCOUNTY - county FIPS code and subregion code.

-----  
/REGION/  
Region Level : COUNTY  
Forsyth County NC : 37067  
/END/

or use -  
Region Level : STATE  
Michigan : 26000  
-----

#### SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

-----  
/SOURCE CATEGORY/  
:2260001000  
:2265001000  
:2267001000

:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000  
:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000  
:2260004000  
:2265004000  
:2267004000  
:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000  
:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000  
:2260007000  
:2265007000  
:2267007000  
:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000  
:2267010000  
:2268010000  
:2270010000  
:2285000000  
:2282000000

/END/

Diesel Only -

:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -

:2260000000  
:2265000000  
:2267000000  
:2268000000  
:2282005010

:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files and some of the input data files read by the model. If a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTION file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.  
-----

/RUNFILES/  
ALLOC XREF : data\allocate\allocate.xrf  
ACTIVITY : data\activity\activity.dat  
EXH TECHNOLOGY : data\tech\tech-exh.dat  
EVP TECHNOLOGY : data\tech\tech-evp.dat  
SEASONALITY : data\season\season.dat  
REGIONS : data\season\season.dat  
MESSAGE : c:\nonroad\outputs\forsyt07.msg  
OUTPUT DATA : c:\nonroad\outputs\forsyt07.out  
EPS2 AMS :  
US COUNTIES FIPS : data\allocate\fips.dat  
RETROFIT :  
/END/

-----  
This is the packet that defines the equipment population files read by the model.  
-----

/POP FILES/  
Population File : c:\nonroad\data\pop\nc.pop  
/END/  
  
POPULATION FILE : c:\nonroad\data\POP\MI.POP

-----  
This is the packet that defines the growth files files read by the model.  
-----

/GROWTH FILES/  
National defaults : data\growth\nation.grw  
/END/

/ALLOC FILES/  
Air trans. empl. :c:\nonroad\data\allocate\nc\_airtr.alo  
Undergrnd coal prod:c:\nonroad\data\allocate\nc\_coal.alo  
Construction cost :c:\nonroad\data\allocate\nc\_const.alo  
Harvested acres :c:\nonroad\data\allocate\nc\_farms.alo  
Golf course estab. :c:\nonroad\data\allocate\nc\_golf.alo  
Wholesale estab. :c:\nonroad\data\allocate\nc\_holsl.alo  
Family housing :c:\nonroad\data\allocate\nc\_house.alo  
Logging employees :c:\nonroad\data\allocate\nc\_loggn.alo  
Landscaping empl. :c:\nonroad\data\allocate\nc\_lscap.alo



```

Manufacturing empl.:c:\nonroad\data\allocate\nc_mnfg.alo
Oil & gas employees:c:\nonroad\data\allocate\nc_oil.alo
Census population :c:\nonroad\data\allocate\nc_pop.alo
Allocation File   :c:\nonroad\data\allocate\nc_rail.alo
RV Park establish.:c:\nonroad\data\allocate\nc_rvprk.alo
Snowblowers comm.:c:\nonroad\data\allocate\nc_sbc.alo
Snowblowers res. :c:\nonroad\data\allocate\nc_sbr.alo
Snowmobiles      :c:\nonroad\data\allocate\nc_snowm.alo
Rec marine inboard:c:\nonroad\data\allocate\nc_wib.alo
Rec marine outboard:c:\nonroad\data\allocate\nc_wob.alo
/END/

```

-----  
This is the packet that defines the emssions factors  
files read by the model.  
-----

```

/EMFAC FILES/
THC exhaust      : data\emsfac\exhthc.emf
CO exhaust       : data\emsfac\exhco.emf
NOX exhaust      : data\emsfac\exhnox.emf
PM exhaust       : data\emsfac\exhpm.emf
BSFC             : data\emsfac\bsfc.emf
Crankcase        : data\emsfac\crank.emf
Spillage         : data\emsfac\spillage.emf
Diurnal          : data\emsfac\evdiu.emf
Tank Perm        : data\emsfac\evtank.emf
Non-RM Hose Perm : data\emsfac\evhose.emf
RM Fill Neck Perm : data\emsfac\evneck.emf
RM Supply/Return : data\emsfac\evsupret.emf
RM Vent Perm     : data\emsfac\evvent.emf
Hot Soaks        : data\emsfac\evhotsk.emf
RuningLoss       : data\emsfac\evrunls.emf
/END/

```

-----  
This is the packet that defines the deterioration factors  
files read by the model.  
-----

```

/DETERIORATE FILES/
THC exhaust      : data\detfac\exhthc.det
CO exhaust       : data\detfac\exhco.det
NOX exhaust      : data\detfac\exhnox.det
PM exhaust       : data\detfac\exhpm.det
Diurnal          : data\detfac\evdiu.det
Tank Perm        : data\detfac\evtank.det
Non-RM Hose Perm : data\detfac\evhose.det
RM Fill Neck Perm : data\detfac\evneck.det
RM Supply/Return : data\detfac\evsupret.det
RM Vent Perm     : data\detfac\evvent.det
Hot Soaks        : data\detfac\evhotsk.det
RuningLoss       : data\detfac\evrunls.det
/END/

```

Optional Packets - Add initial slash "/" to activate

```

/STAGE II/
Control Factor   : 0.0
/END/

```

Enter percent control: 95 = 95% control = 0.05 x uncontrolled  
Default should be zero control.

/MODELYEAR OUT/

EXHAUST BMY OUT :

EVAP BMY OUT :

/END/

SI REPORT/

SI report file-CSV :OUTPUTS\NR POLLUT.CSV

/END/

/DAILY FILES/

DAILY TEMPS/RVP :

/END/

PM Base Sulfur

cols 1-10: dsl tech type;

11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)

/PM BASE SULFUR/

T2 0.0350 0.02247

T3 0.2000 0.02247

T3B 0.0500 0.02247

T4A 0.0500 0.02247

T4B 0.0015 0.02247

T4 0.0015 0.30

T4N 0.0015 0.30

T2M 0.0350 0.02247

T3M 1.0 0.02247

T4M 1.0 0.02247

/END/

## 6.4 GUILFORD COUNTY 2007

Written by Nonroad interface at 9/10/2010 2:47:58 PM

This is the options file for the NONROAD program.

The data is sperated into "packets" bases on common information. Each packet is specified by an identifier and a terminator. Any notes or descriptions can be placed between the data packets.

9/2005 epa: Add growth & tech years to PERIOD packet  
and Counties & Retrofit files to RUNFILES packet.

-----  
PERIOD PACKET

This is the packet that defines the period for which emissions are to be estimated. The order of the records matter. The selection of certain parameters will cause some of the record that follow to be ignored. The order of the records is as follows:

1 - Char 10 - Period type for this simulation.

- Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

-----

/PERIOD/  
 Period type : Monthly  
 Summation type : Typical day  
 Year of episode : 2007  
 Season of year :  
 Month of year : July  
 Weekday or weekend : Weekday  
 Year of growth calc:  
 Year of tech sel :  
 /END/

-----

OPTIONS PACKET

This is the packet that defines some of the user options that drive the model. Most parameters are used to make episode specific emission factor adjustments. The order of the records is fixed. The order is as follows.

- 1 - Char 80 - First title on reports
- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)
- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made  
Valid responses are: YES and NO

-----

/OPTIONS/  
 Title 1 : TRIAD (110)  
 Title 2 : GUILFORD, 2007; JULY  
 Fuel RVP for gas : 7.8  
 Oxygen Weight % : 1.51  
 Gas sulfur % : 0.0043  
 Diesel sulfur % : 0.1140  
 Marine Dsl sulfur %: 0.1328  
 CNG/LPG sulfur % : 0.003  
 Minimum temper. (F): 68.1  
 Maximum temper. (F): 87.6  
 Average temper. (F): 77.9  
 Altitude of region : LOW

EtOH Blend % Mkt : 46.3  
EtOH Vol % : 9.3  
/END/

-----  
REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

- US TOTAL - emissions are for entire USA without state breakout.
- 50STATE - emissions are for all 50 states and Washington D.C., by state.
- STATE - emissions are for a select group of states and are state-level estimates
- COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.
- SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

- US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- 50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- STATE - state FIPS codes
- COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.
- SUBCOUNTY - county FIPS code and subregion code.

-----  
/REGION/  
Region Level : COUNTY  
Guilford County NC : 37081  
/END/

or use -  
Region Level : STATE  
Michigan : 26000

---

SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

---

/SOURCE CATEGORY/  
:2260001000  
:2265001000  
:2267001000  
:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000  
:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000  
:2260004000  
:2265004000  
:2267004000  
:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000  
:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000  
:2260007000  
:2265007000  
:2267007000  
:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000  
:2267010000  
:2268010000  
:2270010000

:2285000000  
:2282000000  
/END/

Diesel Only -  
:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -  
:2260000000  
:2265000000  
:2267000000  
:2268000000  
:2282005010  
:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files and some of the input data files read by the model. If a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTION file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.  
-----

/RUNFILES/  
ALLOC XREF : data\allocate\allocate.xrf  
ACTIVITY : data\activity\activity.dat  
EXH TECHNOLOGY : data\tech\tech-exh.dat  
EVP TECHNOLOGY : data\tech\tech-evp.dat  
SEASONALITY : data\season\season.dat  
REGIONS : data\season\season.dat  
MESSAGE : c:\nonroad\outputs\guilfo07.msg  
OUTPUT DATA : c:\nonroad\outputs\guilfo07.out  
EPS2 AMS :  
US COUNTIES FIPS : data\allocate\fips.dat  
RETROFIT :  
/END/

-----  
This is the packet that defines the equipment population files read by the model.  
-----

/POP FILES/  
Population File : c:\nonroad\data\pop\nc.pop  
/END/

POPULATION FILE : c:\nonroad\data\POP\MI.POP

-----  
This is the packet that defines the growth files files read by the model.  
-----

```
/GROWTH FILES/  
National defaults : data\growth\nation.grw  
/END/
```

```
/ALLOC FILES/  
Air trans. empl. :c:\nonroad\data\allocate\nc_airtr.alo  
Undergrnd coal prod:c:\nonroad\data\allocate\nc_coal.alo  
Construction cost :c:\nonroad\data\allocate\nc_const.alo  
Harvested acres :c:\nonroad\data\allocate\nc_farms.alo  
Golf course estab. :c:\nonroad\data\allocate\nc_golf.alo  
Wholesale estab. :c:\nonroad\data\allocate\nc_holsl.alo  
Family housing :c:\nonroad\data\allocate\nc_house.alo  
Logging employees :c:\nonroad\data\allocate\nc_loggn.alo  
Landscaping empl. :c:\nonroad\data\allocate\nc_lscap.alo  
Manufacturing empl.:c:\nonroad\data\allocate\nc_mnfg.alo  
Oil & gas employees:c:\nonroad\data\allocate\nc_oil.alo  
Census population :c:\nonroad\data\allocate\nc_pop.alo  
Allocation File :c:\nonroad\data\allocate\nc_rail.alo  
RV Park establish. :c:\nonroad\data\allocate\nc_rvprk.alo  
Snowblowers comm. :c:\nonroad\data\allocate\nc_sbc.alo  
Snowblowers res. :c:\nonroad\data\allocate\nc_sbr.alo  
Snowmobiles :c:\nonroad\data\allocate\nc_snowm.alo  
Rec marine inboard :c:\nonroad\data\allocate\nc_wib.alo  
Rec marine outboard:c:\nonroad\data\allocate\nc_wob.alo  
/END/
```

-----  
This is the packet that defines the emssions factors  
files read by the model.  
-----

```
/EMFAC FILES/  
THC exhaust : data\emsfac\exhthc.emf  
CO exhaust : data\emsfac\exhco.emf  
NOX exhaust : data\emsfac\exhnox.emf  
PM exhaust : data\emsfac\exhpm.emf  
BSFC : data\emsfac\bsfc.emf  
Crankcase : data\emsfac\crank.emf  
Spillage : data\emsfac\spillage.emf  
Diurnal : data\emsfac\evdiu.emf  
Tank Perm : data\emsfac\evtank.emf  
Non-RM Hose Perm : data\emsfac\evhose.emf  
RM Fill Neck Perm : data\emsfac\evneck.emf  
RM Supply/Return : data\emsfac\evsupret.emf  
RM Vent Perm : data\emsfac\evvent.emf  
Hot Soaks : data\emsfac\evhotsk.emf  
RuningLoss : data\emsfac\evrunls.emf  
/END/
```

-----  
This is the packet that defines the deterioration factors  
files read by the model.  
-----

```
/DETERIORATE FILES/  
THC exhaust : data\detfac\exhthc.det  
CO exhaust : data\detfac\exhco.det  
NOX exhaust : data\detfac\exhnox.det  
PM exhaust : data\detfac\exhpm.det
```

```

Diurnal          : data\detfac\evdiu.det
Tank Perm       : data\detfac\evtank.det
Non-RM Hose Perm : data\detfac\evhose.det
RM Fill Neck Perm : data\detfac\evneck.det
RM Supply/Return : data\detfac\evsupret.det
RM Vent Perm    : data\detfac\evvent.det
Hot Soaks       : data\detfac\evhotsk.det
RuningLoss      : data\detfac\evrunls.det
/END/

```

Optional Packets - Add initial slash "/" to activate

```

/STAGE II/
Control Factor   : 0.0
/END/
Enter percent control: 95 = 95% control = 0.05 x uncontrolled
Default should be zero control.

```

```

/MODELYEAR OUT/
EXHAUST BMY OUT :
EVAP BMY OUT    :
/END/

```

```

SI REPORT/
SI report file-CSV :OUTPUTS\NRPOLLUT.CSV
/END/

```

```

/DAILY FILES/
DAILY TEMPS/RVP :
/END/

```

```

PM Base Sulfur
  cols 1-10: dsl tech type;
  11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)
/PM BASE SULFUR/
T2      0.0350    0.02247
T3      0.2000    0.02247
T3B     0.0500    0.02247
T4A     0.0500    0.02247
T4B     0.0015    0.02247
T4      0.0015    0.30
T4N     0.0015    0.30
T2M     0.0350    0.02247
T3M     1.0       0.02247
T4M     1.0       0.02247
/END/

```

## 6.5 DAVIDSON COUNTY 2011

Written by Nonroad interface at 9/10/2010 3:06:32 PM  
This is the options file for the NONROAD program.  
The data is sperated into "packets" bases on common  
information. Each packet is specified by an  
identifier and a terminator. Any notes or descriptions  
can be placed between the data packets.



9/2005 epa: Add growth & tech years to PERIOD packet  
and Counties & Retrofit files to RUNFILES packet.

---

PERIOD PACKET

This is the packet that defines the period for which emissions are to be estimated. The order of the records matter. The selection of certain parameters will cause some of the record that follow to be ignored. The order of the records is as follows:

- 1 - Char 10 - Period type for this simulation.  
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

---

/PERIOD/  
Period type : Monthly  
Summation type : Typical day  
Year of episode : 2011  
Season of year :  
Month of year : July  
Weekday or weekend : Weekday  
Year of growth calc:  
Year of tech sel :  
/END/

---

OPTIONS PACKET

This is the packet that defines some of the user options that drive the model. Most parameters are used to make episode specific emission factor adjustments. The order of the records is fixed. The order is as follows.

- 1 - Char 80 - First title on reports
- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)
- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made

Valid responses are: YES and NO

-----  
/OPTIONS/

Title 1 : TRIAD (110)  
Title 2 : DAVIDSON 2011; JULY  
Fuel RVP for gas : 7.8  
Oxygen Weight % : 2.62  
Gas sulfur % : 0.0011  
Diesel sulfur % : 0.0031  
Marine Dsl sulfur %: 0.0234  
CNG/LPG sulfur % : 0.003  
Minimum temper. (F): 68.1  
Maximum temper. (F): 87.6  
Average temper. (F): 77.9  
Altitude of region : LOW  
EtOH Blend % Mkt : 78.8  
EtOH Vol % : 9.5  
/END/

-----  
REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

- US TOTAL - emissions are for entire USA without state breakout.
- 50STATE - emissions are for all 50 states and Washington D.C., by state.
- STATE - emissions are for a select group of states and are state-level estimates
- COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.
- SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

- US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- 50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- STATE - state FIPS codes

COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.

SUBCOUNTY - county FIPS code and subregion code.

-----  
/REGION/  
Region Level : COUNTY  
Davidson County NC : 37057  
/END/

or use -  
Region Level : STATE  
Michigan : 26000  
-----

SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

-----  
/SOURCE CATEGORY/  
:2260001000  
:2265001000  
:2267001000  
:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000  
:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000  
:2260004000  
:2265004000  
:2267004000  
:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000  
:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000

:2260007000  
:2265007000  
:2267007000  
:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000  
:2267010000  
:2268010000  
:2270010000  
:2285000000  
:2282000000

/END/

Diesel Only -

:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -

:2260000000  
:2265000000  
:2267000000  
:2268000000  
:2282005010  
:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files and some of the input data files read by the model. If a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTion file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.  
-----

/RUNFILES/

ALLOC XREF : data\allocate\allocate.xrf  
ACTIVITY : data\activity\activity.dat  
EXH TECHNOLOGY : data\tech\tech-exh.dat  
EVP TECHNOLOGY : data\tech\tech-evp.dat  
SEASONALITY : data\season\season.dat  
REGIONS : data\season\season.dat  
MESSAGE : c:\nonroad\outputs\davitd11.msg  
OUTPUT DATA : c:\nonroad\outputs\davitd11.out  
EPS2 AMS :  
US COUNTIES FIPS : data\allocate\fips.dat  
RETROFIT :  
/END/

-----  
This is the packet that defines the equipment population files read by the model.  
-----

/POP FILES/  
Population File :c:\nonroad\data\pop\nc.pop  
/END/  
  
POPULATION FILE : c:\nonroad\data\POP\MI.POP

-----  
This is the packet that defines the growth files files read by the model.  
-----

/GROWTH FILES/  
National defaults : data\growth\nation.grw  
/END/

/ALLOC FILES/  
Air trans. empl. :c:\nonroad\data\allocate\nc\_airtr.alo  
Undergrnd coal prod:c:\nonroad\data\allocate\nc\_coal.alo  
Construction cost :c:\nonroad\data\allocate\nc\_const.alo  
Harvested acres :c:\nonroad\data\allocate\nc\_farms.alo  
Golf course estab. :c:\nonroad\data\allocate\nc\_golf.alo  
Wholesale estab. :c:\nonroad\data\allocate\nc\_holsl.alo  
Family housing :c:\nonroad\data\allocate\nc\_house.alo  
Logging employees :c:\nonroad\data\allocate\nc\_loggn.alo  
Landscaping empl. :c:\nonroad\data\allocate\nc\_lscap.alo  
Manufacturing empl.:c:\nonroad\data\allocate\nc\_mnfg.alo  
Oil & gas employees:c:\nonroad\data\allocate\nc\_oil.alo  
Census population :c:\nonroad\data\allocate\nc\_pop.alo  
Allocation File :c:\nonroad\data\allocate\nc\_rail.alo  
RV Park establish. :c:\nonroad\data\allocate\nc\_rvprk.alo  
Snowblowers comm. :c:\nonroad\data\allocate\nc\_sbc.alo  
Snowblowers res. :c:\nonroad\data\allocate\nc\_sbr.alo  
Snowmobiles :c:\nonroad\data\allocate\nc\_snowm.alo  
Rec marine inboard :c:\nonroad\data\allocate\nc\_wib.alo  
Rec marine outboard:c:\nonroad\data\allocate\nc\_wob.alo  
/END/

-----  
This is the packet that defines the emssions factors files read by the model.  
-----

/EMFAC FILES/  
THC exhaust : data\emsfac\exhthc.emf  
CO exhaust : data\emsfac\exhco.emf  
NOX exhaust : data\emsfac\exhnox.emf  
PM exhaust : data\emsfac\exhpm.emf  
BSFC : data\emsfac\bsfc.emf  
Crankcase : data\emsfac\crank.emf  
Spillage : data\emsfac\spillage.emf  
Diurnal : data\emsfac\evdiu.emf  
Tank Perm : data\emsfac\evtank.emf  
Non-RM Hose Perm : data\emsfac\evhose.emf  
RM Fill Neck Perm : data\emsfac\evneck.emf

```
RM Supply/Return      : data\emsfac\evsupret.emf
RM Vent Perm         : data\emsfac\evvent.emf
Hot Soaks           : data\emsfac\evhotsk.emf
RuningLoss          : data\emsfac\evrunls.emf
/END/
```

-----  
This is the packet that defines the deterioration factors files read by the model.  
-----

```
/DETERIORATE FILES/
THC exhaust         : data\detfac\exhthc.det
CO exhaust          : data\detfac\exhco.det
NOX exhaust         : data\detfac\exhnox.det
PM exhaust          : data\detfac\exhpm.det
Diurnal             : data\detfac\evdiu.det
Tank Perm           : data\detfac\evtank.det
Non-RM Hose Perm    : data\detfac\evhose.det
RM Fill Neck Perm   : data\detfac\evneck.det
RM Supply/Return    : data\detfac\evsupret.det
RM Vent Perm        : data\detfac\evvent.det
Hot Soaks           : data\detfac\evhotsk.det
RuningLoss          : data\detfac\evrunls.det
/END/
```

Optional Packets - Add initial slash "/" to activate

```
/STAGE II/
Control Factor      : 0.0
/END/
Enter percent control: 95 = 95% control = 0.05 x uncontrolled
Default should be zero control.
```

```
/MODELYEAR OUT/
EXHAUST BMY OUT    :
EVAP BMY OUT       :
/END/
```

```
SI REPORT/
SI report file-CSV :OUTPUTS\NRPOLLUT.CSV
/END/
```

```
/DAILY FILES/
DAILY TEMPS/RVP    :
/END/
```

```
PM Base Sulfur
  cols 1-10: dsl tech type;
  11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)
/PM BASE SULFUR/
T2          0.0350    0.02247
T3          0.2000    0.02247
T3B         0.0500    0.02247
T4A         0.0500    0.02247
T4B         0.0015    0.02247
T4          0.0015    0.30
T4N         0.0015    0.30
```

```
T2M      0.0350    0.02247
T3M      1.0      0.02247
T4M      1.0      0.02247
/END/
```

## 6.6 DAVIE COUNTY 2011

Written by Nonroad interface at 9/10/2010 3:22:01 PM  
This is the options file for the NONROAD program.  
The data is sperated into "packets" bases on common  
information. Each packet is specified by an  
identifier and a terminator. Any notes or descriptions  
can be placed between the data packets.

9/2005 epa: Add growth & tech years to PERIOD packet  
and Counties & Retrofit files to RUNFILES packet.

---

### PERIOD PACKET

This is the packet that defines the period for  
which emissions are to be estimated. The order of the  
records matter. The selection of certain parameters  
will cause some of the record that follow to be ignored.  
The order of the records is as follows:

- 1 - Char 10 - Period type for this simulation.  
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

---

```
/PERIOD/
Period type      : Monthly
Summation type  : Typical day
Year of episode  : 2011
Season of year   :
Month of year    : July
Weekday or weekend : Weekday
Year of growth calc:
Year of tech sel  :
/END/
```

---

### OPTIONS PACKET

This is the packet that defines some of the user  
options that drive the model. Most parameters are  
used to make episode specific emission factor  
adjustments. The order of the records is fixed.

The order is as follows.

- 1 - Char 80 - First title on reports
- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)
- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made  
Valid responses are: YES and NO

-----  
/OPTIONS/

Title 1 : TRIAD (110)  
Title 2 : DAVIE 2011; JULY  
Fuel RVP for gas : 9.0  
Oxygen Weight % : 2.62  
Gas sulfur % : 0.0011  
Diesel sulfur % : 0.0031  
Marine Dsl sulfur %: 0.0234  
CNG/LPG sulfur % : 0.003  
Minimum temper. (F): 68.1  
Maximum temper. (F): 87.6  
Average temper. (F): 77.9  
Altitude of region : LOW  
EtOH Blend % Mkt : 78.8  
EtOH Vol % : 9.5  
/END/

-----  
REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

- US TOTAL - emissions are for entire USA without state breakout.
- 50STATE - emissions are for all 50 states and Washington D.C., by state.
- STATE - emissions are for a select group of states and are state-level estimates
- COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.



SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.

50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.

STATE - state FIPS codes

COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.

SUBCOUNTY - county FIPS code and subregion code.

-----  
/REGION/  
Region Level : COUNTY  
Davie County NC : 37059  
/END/

or use -  
Region Level : STATE  
Michigan : 26000  
-----

#### SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

-----  
/SOURCE CATEGORY/  
:2260001000  
:2265001000  
:2267001000  
:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000  
:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000

:2260004000  
:2265004000  
:2267004000  
:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000  
:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000  
:2260007000  
:2265007000  
:2267007000  
:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000  
:2267010000  
:2268010000  
:2270010000  
:2285000000  
:2282000000

/END/

Diesel Only -

:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -

:2260000000  
:2265000000  
:2267000000  
:2268000000  
:2282005010  
:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files and some of the input data files read by the model. If a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTion file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.

```

-----
/RUNFILES/
ALLOC XREF      : data\allocate\allocate.xrf
ACTIVITY       : data\activity\activity.dat
EXH TECHNOLOGY : data\tech\tech-exh.dat
EVP TECHNOLOGY : data\tech\tech-evp.dat
SEASONALITY    : data\season\season.dat
REGIONS        : data\season\season.dat
MESSAGE        : c:\nonroad\outputs\daviell.msg
OUTPUT DATA   : c:\nonroad\outputs\daviell.out
EPS2 AMS       :
US COUNTIES FIPS : data\allocate\fips.dat
RETROFIT       :
/END/

```

-----  
This is the packet that defines the equipment population files read by the model.  
-----

```

/POP FILES/
Population File : c:\nonroad\data\pop\nc.pop
/END/

```

```

POPULATION FILE : c:\nonroad\data\POP\MI.POP

```

-----  
This is the packet that defines the growth files files read by the model.  
-----

```

/GROWTH FILES/
National defaults : data\growth\nation.grw
/END/

```

```

/ALLOC FILES/
Air trans. empl. :c:\nonroad\data\allocate\nc_airtr.alo
Undergrnd coal prod:c:\nonroad\data\allocate\nc_coal.alo
Construction cost :c:\nonroad\data\allocate\nc_const.alo
Harvested acres   :c:\nonroad\data\allocate\nc_farms.alo
Golf course estab. :c:\nonroad\data\allocate\nc_golf.alo
Wholesale estab.  :c:\nonroad\data\allocate\nc_holsl.alo
Family housing     :c:\nonroad\data\allocate\nc_house.alo
Logging employees :c:\nonroad\data\allocate\nc_loggn.alo
Landscaping empl. :c:\nonroad\data\allocate\nc_lscap.alo
Manufacturing empl.:c:\nonroad\data\allocate\nc_mnfg.alo
Oil & gas employees:c:\nonroad\data\allocate\nc_oil.alo
Census population :c:\nonroad\data\allocate\nc_pop.alo
Allocation File   :c:\nonroad\data\allocate\nc_rail.alo
RV Park establish. :c:\nonroad\data\allocate\nc_rvprk.alo
Snowblowers comm. :c:\nonroad\data\allocate\nc_sbc.alo
Snowblowers res.  :c:\nonroad\data\allocate\nc_sbr.alo
Snowmobiles       :c:\nonroad\data\allocate\nc_snowm.alo
Rec marine inboard :c:\nonroad\data\allocate\nc_wib.alo
Rec marine outboard:c:\nonroad\data\allocate\nc_wob.alo
/END/

```

This is the packet that defines the emissions factors files read by the model.

```
-----  
/EMFAC FILES/  
THC exhaust      : data\emsfac\exhthc.emf  
CO exhaust       : data\emsfac\exhco.emf  
NOX exhaust      : data\emsfac\exhnox.emf  
PM exhaust       : data\emsfac\exhpm.emf  
BSFC             : data\emsfac\bsfc.emf  
Crankcase        : data\emsfac\crank.emf  
Spillage         : data\emsfac\spillage.emf  
Diurnal          : data\emsfac\evdiu.emf  
Tank Perm        : data\emsfac\evtank.emf  
Non-RM Hose Perm : data\emsfac\evhose.emf  
RM Fill Neck Perm : data\emsfac\evneck.emf  
RM Supply/Return : data\emsfac\evsupret.emf  
RM Vent Perm     : data\emsfac\evvent.emf  
Hot Soaks        : data\emsfac\evhotsk.emf  
RuningLoss       : data\emsfac\evrunls.emf  
/END/
```

-----  
This is the packet that defines the deterioration factors files read by the model.

```
-----  
/DETERIORATE FILES/  
THC exhaust      : data\detfac\exhthc.det  
CO exhaust       : data\detfac\exhco.det  
NOX exhaust      : data\detfac\exhnox.det  
PM exhaust       : data\detfac\exhpm.det  
Diurnal          : data\detfac\evdiu.det  
Tank Perm        : data\detfac\evtank.det  
Non-RM Hose Perm : data\detfac\evhose.det  
RM Fill Neck Perm : data\detfac\evneck.det  
RM Supply/Return : data\detfac\evsupret.det  
RM Vent Perm     : data\detfac\evvent.det  
Hot Soaks        : data\detfac\evhotsk.det  
RuningLoss       : data\detfac\evrunls.det  
/END/
```

Optional Packets - Add initial slash "/" to activate

```
/STAGE II/  
Control Factor   : 0.0  
/END/  
Enter percent control: 95 = 95% control = 0.05 x uncontrolled  
Default should be zero control.
```

```
/MODELYEAR OUT/  
EXHAUST BMY OUT :  
EVAP BMY OUT    :  
/END/
```

```
SI REPORT/  
SI report file-CSV :OUTPUTS\NRPOLLUT.CSV  
/END/
```

```
/DAILY FILES/  
DAILY TEMPS/RVP      :  
/END/
```

```
PM Base Sulfur  
  cols 1-10: dsl tech type;  
  11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)  
/PM BASE SULFUR/  
T2      0.0350    0.02247  
T3      0.2000    0.02247  
T3B     0.0500    0.02247  
T4A     0.0500    0.02247  
T4B     0.0015    0.02247  
T4      0.0015    0.30  
T4N     0.0015    0.30  
T2M     0.0350    0.02247  
T3M     1.0       0.02247  
T4M     1.0       0.02247  
/END/
```

## 6.7 FORSYTH COUNTY 2011

Written by Nonroad interface at 9/10/2010 2:37:37 PM  
This is the options file for the NONROAD program.  
The data is sperated into "packets" bases on common  
information. Each packet is specified by an  
identifier and a terminator. Any notes or descriptions  
can be placed between the data packets.

9/2005 epa: Add growth & tech years to PERIOD packet  
and Counties & Retrofit files to RUNFILES packet.

---

### PERIOD PACKET

This is the packet that defines the period for  
which emissions are to be estimated. The order of the  
records matter. The selection of certain parameters  
will cause some of the record that follow to be ignored.  
The order of the records is as follows:

- 1 - Char 10 - Period type for this simulation.  
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

---

```
/PERIOD/  
Period type      : Monthly  
Summation type  : Typical day  
Year of episode  : 2011
```

Season of year :  
Month of year : July  
Weekday or weekend : Weekday  
Year of growth calc:  
Year of tech sel :  
/END/

---

OPTIONS PACKET

This is the packet that defines some of the user options that drive the model. Most parameters are used to make episode specific emission factor adjustments. The order of the records is fixed. The order is as follows.

- 1 - Char 80 - First title on reports
- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)
- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made  
Valid responses are: YES and NO

---

/OPTIONS/  
Title 1 : TRIAD (110)  
Title 2 : FORSYTH 2011; JULY  
Fuel RVP for gas : 7.8  
Oxygen Weight % : 2.62  
Gas sulfur % : 0.0011  
Diesel sulfur % : 0.0031  
Marine Dsl sulfur %: 0.0234  
CNG/LPG sulfur % : 0.003  
Minimum temper. (F): 68.1  
Maximum temper. (F): 87.6  
Average temper. (F): 77.9  
Altitude of region : LOW  
EtOH Blend % Mkt : 78.8  
EtOH Vol % : 9.5  
/END/

---

REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

- US TOTAL - emissions are for entire USA without state breakout.
  
- 50STATE - emissions are for all 50 states and Washington D.C., by state.
  
- STATE - emissions are for a select group of states and are state-level estimates
  
- COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.
  
- SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

- US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.
  
- 50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.
  
- STATE - state FIPS codes
  
- COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.
  
- SUBCOUNTY - county FIPS code and subregion code.

-----  
/REGION/  
Region Level : COUNTY  
Forsyth County NC : 37067  
/END/

or use -  
Region Level : STATE  
Michigan : 26000  
-----

#### SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

-----  
/SOURCE CATEGORY/

:2260001000  
:2265001000  
:2267001000  
:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000  
:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000  
:2260004000  
:2265004000  
:2267004000  
:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000  
:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000  
:2260007000  
:2265007000  
:2267007000  
:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000  
:2267010000  
:2268010000  
:2270010000  
:2285000000  
:2282000000

/END/

Diesel Only -

:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -

:2260000000  
:2265000000



:2267000000  
:2268000000  
:2282005010  
:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files and some of the input data files read by the model. If a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTion file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.  
-----

/RUNFILES/  
ALLOC XREF : data\allocate\allocate.xrf  
ACTIVITY : data\activity\activity.dat  
EXH TECHNOLOGY : data\tech\tech-exh.dat  
EVP TECHNOLOGY : data\tech\tech-evp.dat  
SEASONALITY : data\season\season.dat  
REGIONS : data\season\season.dat  
MESSAGE : c:\nonroad\outputs\forsyt11.msg  
OUTPUT DATA : c:\nonroad\outputs\forsyt11.out  
EPS2 AMS :  
US COUNTIES FIPS : data\allocate\fips.dat  
RETROFIT :  
/END/

-----  
This is the packet that defines the equipment population files read by the model.  
-----

/POP FILES/  
Population File : c:\nonroad\data\pop\nc.pop  
/END/  
  
POPULATION FILE : c:\nonroad\data\POP\MI.POP

-----  
This is the packet that defines the growth files files read by the model.  
-----

/GROWTH FILES/  
National defaults : data\growth\nation.grw  
/END/

/ALLOC FILES/  
Air trans. empl. :c:\nonroad\data\allocate\nc\_airtr.alo  
Undergrnd coal prod:c:\nonroad\data\allocate\nc\_coal.alo  
Construction cost :c:\nonroad\data\allocate\nc\_const.alo  
Harvested acres :c:\nonroad\data\allocate\nc\_farms.alo  
Golf course estab. :c:\nonroad\data\allocate\nc\_golf.alo  
Wholesale estab. :c:\nonroad\data\allocate\nc\_holsl.alo

```

Family housing      :c:\nonroad\data\allocate\nc_house.alo
Logging employees  :c:\nonroad\data\allocate\nc_loggn.alo
Landscaping empl.  :c:\nonroad\data\allocate\nc_lscap.alo
Manufacturing empl.:c:\nonroad\data\allocate\nc_mnfg.alo
Oil & gas employees:c:\nonroad\data\allocate\nc_oil.alo
Census population  :c:\nonroad\data\allocate\nc_pop.alo
Allocation File    :c:\nonroad\data\allocate\nc_rail.alo
RV Park establish. :c:\nonroad\data\allocate\nc_rvprk.alo
Snowblowers comm. :c:\nonroad\data\allocate\nc_sbc.alo
Snowblowers res.  :c:\nonroad\data\allocate\nc_sbr.alo
Snowmobiles       :c:\nonroad\data\allocate\nc_snowm.alo
Rec marine inboard :c:\nonroad\data\allocate\nc_wib.alo
Rec marine outboard:c:\nonroad\data\allocate\nc_wob.alo
/END/

```

-----  
This is the packet that defines the emssions factors  
files read by the model.  
-----

```

/EMFAC FILES/
THC exhaust      : data\emsfac\exhthc.emf
CO exhaust       : data\emsfac\exhco.emf
NOX exhaust      : data\emsfac\exhnox.emf
PM exhaust       : data\emsfac\exhpm.emf
BSFC             : data\emsfac\bsfc.emf
Crankcase        : data\emsfac\crank.emf
Spillage         : data\emsfac\spillage.emf
Diurnal          : data\emsfac\evdiu.emf
Tank Perm        : data\emsfac\evtank.emf
Non-RM Hose Perm : data\emsfac\evhose.emf
RM Fill Neck Perm : data\emsfac\evneck.emf
RM Supply/Return : data\emsfac\evsupret.emf
RM Vent Perm     : data\emsfac\evvent.emf
Hot Soaks        : data\emsfac\evhotsk.emf
RuningLoss       : data\emsfac\evrunls.emf
/END/

```

-----  
This is the packet that defines the deterioration factors  
files read by the model.  
-----

```

/DETERIORATE FILES/
THC exhaust      : data\detfac\exhthc.det
CO exhaust       : data\detfac\exhco.det
NOX exhaust      : data\detfac\exhnox.det
PM exhaust       : data\detfac\exhpm.det
Diurnal          : data\detfac\evdiu.det
Tank Perm        : data\detfac\evtank.det
Non-RM Hose Perm : data\detfac\evhose.det
RM Fill Neck Perm : data\detfac\evneck.det
RM Supply/Return : data\detfac\evsupret.det
RM Vent Perm     : data\detfac\evvent.det
Hot Soaks        : data\detfac\evhotsk.det
RuningLoss       : data\detfac\evrunls.det
/END/

```

Optional Packets - Add initial slash "/" to activate

```

/STAGE II/
Control Factor      : 0.0
/END/
Enter percent control: 95 = 95% control = 0.05 x uncontrolled
Default should be zero control.

/MODELYEAR OUT/
EXHAUST BMY OUT    :
EVAP BMY OUT       :
/END/

SI REPORT/
SI report file-CSV :OUTPUTS\NRPOLLUT.CSV
/END/

/DAILY FILES/
DAILY TEMPS/RVP    :
/END/

PM Base Sulfur
  cols 1-10: dsl tech type;
  11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)
/PM BASE SULFUR/
T2      0.0350    0.02247
T3      0.2000    0.02247
T3B     0.0500    0.02247
T4A     0.0500    0.02247
T4B     0.0015    0.02247
T4      0.0015    0.30
T4N     0.0015    0.30
T2M     0.0350    0.02247
T3M     1.0       0.02247
T4M     1.0       0.02247
/END/

```

## 6.8 GUILFORD COUNTY 2011

Written by Nonroad interface at 9/10/2010 2:51:09 PM  
This is the options file for the NONROAD program.  
The data is sperated into "packets" bases on common  
information. Each packet is specified by an  
identifier and a terminator. Any notes or descriptions  
can be placed between the data packets.

9/2005 epa: Add growth & tech years to PERIOD packet  
and Counties & Retrofit files to RUNFILES packet.

---

### PERIOD PACKET

This is the packet that defines the period for  
which emissions are to be estimated. The order of the  
records matter. The selection of certain parameters  
will cause some of the record that follow to be ignored.

The order of the records is as follows:

- 1 - Char 10 - Period type for this simulation.  
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

-----  
/PERIOD/  
Period type : Monthly  
Summation type : Typical day  
Year of episode : 2011  
Season of year :  
Month of year : July  
Weekday or weekend : Weekday  
Year of growth calc:  
Year of tech sel :  
/END/  
-----

OPTIONS PACKET

This is the packet that defines some of the user options that drive the model. Most parameters are used to make episode specific emission factor adjustments. The order of the records is fixed. The order is as follows.

- 1 - Char 80 - First title on reports
- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)
- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made  
Valid responses are: YES and NO

-----  
/OPTIONS/  
Title 1 : TRIAD (110)  
Title 2 : GUILFORD, 2011; JULY  
Fuel RVP for gas : 7.8  
Oxygen Weight % : 2.62  
Gas sulfur % : 0.0011  
Diesel sulfur % : 0.0031  
Marine Dsl sulfur %: 0.0234  
CNG/LPG sulfur % : 0.003  
Minimum temper. (F): 68.1

Maximum temper. (F): 87.6  
Average temper. (F): 77.9  
Altitude of region : LOW  
EtOH Blend % Mkt : 78.8  
EtOH Vol % : 9.5  
/END/

---

REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

- US TOTAL - emissions are for entire USA without state breakout.
- 50STATE - emissions are for all 50 states and Washington D.C., by state.
- STATE - emissions are for a select group of states and are state-level estimates
- COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.
- SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

- US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- 50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- STATE - state FIPS codes
- COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.
- SUBCOUNTY - county FIPS code and subregion code.

---

/REGION/  
Region Level : COUNTY  
Guilford County NC : 37081  
/END/

or use -  
Region Level : STATE  
Michigan : 26000

---

SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

---

/SOURCE CATEGORY/  
:2260001000  
:2265001000  
:2267001000  
:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000  
:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000  
:2260004000  
:2265004000  
:2267004000  
:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000  
:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000  
:2260007000  
:2265007000  
:2267007000  
:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000

:2267010000  
:2268010000  
:2270010000  
:2285000000  
:2282000000

/END/

Diesel Only -

:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -

:2260000000  
:2265000000  
:2267000000  
:2268000000  
:2282005010  
:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files and some of the input data files read by the model. If a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTION file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.  
-----

/RUNFILES/

ALLOC XREF : data\allocate\allocate.xrf  
ACTIVITY : data\activity\activity.dat  
EXH TECHNOLOGY : data\tech\tech-exh.dat  
EVP TECHNOLOGY : data\tech\tech-evp.dat  
SEASONALITY : data\season\season.dat  
REGIONS : data\season\season.dat  
MESSAGE : c:\nonroad\outputs\guilfo11.msg  
OUTPUT DATA : c:\nonroad\outputs\guilfo11.out  
EPS2 AMS :  
US COUNTIES FIPS : data\allocate\fips.dat  
RETROFIT :  
-----

/END/

-----  
This is the packet that defines the equipment population files read by the model.  
-----

/POP FILES/

Population File : c:\nonroad\data\pop\nc.pop

/END/

POPULATION FILE : c:\nonroad\data\POP\MI.POP  
-----

This is the packet that defines the growth files  
files read by the model.

-----  
/GROWTH FILES/

National defaults : data\growth\nation.grw  
/END/

/ALLOC FILES/

Air trans. empl. :c:\nonroad\data\allocate\nc\_airtr.alo  
Undergrnd coal prod:c:\nonroad\data\allocate\nc\_coal.alo  
Construction cost :c:\nonroad\data\allocate\nc\_const.alo  
Harvested acres :c:\nonroad\data\allocate\nc\_farms.alo  
Golf course estab. :c:\nonroad\data\allocate\nc\_golf.alo  
Wholesale estab. :c:\nonroad\data\allocate\nc\_holsl.alo  
Family housing :c:\nonroad\data\allocate\nc\_house.alo  
Logging employees :c:\nonroad\data\allocate\nc\_loggn.alo  
Landscaping empl. :c:\nonroad\data\allocate\nc\_lscap.alo  
Manufacturing empl.:c:\nonroad\data\allocate\nc\_mnfg.alo  
Oil & gas employees:c:\nonroad\data\allocate\nc\_oil.alo  
Census population :c:\nonroad\data\allocate\nc\_pop.alo  
Allocation File :c:\nonroad\data\allocate\nc\_rail.alo  
RV Park establish. :c:\nonroad\data\allocate\nc\_rvprk.alo  
Snowblowers comm. :c:\nonroad\data\allocate\nc\_sbc.alo  
Snowblowers res. :c:\nonroad\data\allocate\nc\_sbr.alo  
Snowmobiles :c:\nonroad\data\allocate\nc\_snowm.alo  
Rec marine inboard :c:\nonroad\data\allocate\nc\_wib.alo  
Rec marine outboard:c:\nonroad\data\allocate\nc\_wob.alo  
/END/

-----  
This is the packet that defines the emssions factors  
files read by the model.

-----  
/EMFAC FILES/

THC exhaust : data\emsfac\exhthc.emf  
CO exhaust : data\emsfac\exhco.emf  
NOX exhaust : data\emsfac\exhnox.emf  
PM exhaust : data\emsfac\exhpm.emf  
BSFC : data\emsfac\bsfc.emf  
Crankcase : data\emsfac\crank.emf  
Spillage : data\emsfac\spillage.emf  
Diurnal : data\emsfac\evdiu.emf  
Tank Perm : data\emsfac\evtank.emf  
Non-RM Hose Perm : data\emsfac\evhose.emf  
RM Fill Neck Perm : data\emsfac\evneck.emf  
RM Supply/Return : data\emsfac\evsupret.emf  
RM Vent Perm : data\emsfac\evvent.emf  
Hot Soaks : data\emsfac\evhotsk.emf  
RuningLoss : data\emsfac\evrunls.emf  
/END/

-----  
This is the packet that defines the deterioration factors  
files read by the model.

-----  
/DETERIORATE FILES/

THC exhaust : data\detfac\exhthc.det



```

CO exhaust      : data\detfac\exhco.det
NOX exhaust    : data\detfac\exhnox.det
PM exhaust     : data\detfac\exhpm.det
Diurnal       : data\detfac\evdiu.det
Tank Perm     : data\detfac\evtank.det
Non-RM Hose Perm : data\detfac\evhose.det
RM Fill Neck Perm : data\detfac\evneck.det
RM Supply/Return : data\detfac\evsupret.det
RM Vent Perm   : data\detfac\evvent.det
Hot Soaks     : data\detfac\evhotsk.det
RuningLoss    : data\detfac\evrunls.det
/END/

```

Optional Packets - Add initial slash "/" to activate

```

/STAGE II/
Control Factor      : 0.0
/END/
Enter percent control: 95 = 95% control = 0.05 x uncontrolled
Default should be zero control.

```

```

/MODELYEAR OUT/
EXHAUST BMY OUT    :
EVAP BMY OUT      :
/END/

```

```

SI REPORT/
SI report file-CSV :OUTPUTS\NRPOLLUT.CSV
/END/

```

```

/DAILY FILES/
DAILY TEMPS/RVP   :
/END/

```

```

PM Base Sulfur
  cols 1-10: dsl tech type;
  11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)
/PM BASE SULFUR/
T2      0.0350    0.02247
T3      0.2000    0.02247
T3B     0.0500    0.02247
T4A     0.0500    0.02247
T4B     0.0015    0.02247
T4      0.0015    0.30
T4N     0.0015    0.30
T2M     0.0350    0.02247
T3M     1.0       0.02247
T4M     1.0       0.02247
/END/

```

## 6.9 DAVIDSON, FORSYTH, and GUILFORD COUNTIES 2018

Written by Nonroad interface at 5/15/2012 10:32:04 AM  
This is the options file for the NONROAD program.  
The data is sperated into "packets" bases on common

information. Each packet is specified by an identifier and a terminator. Any notes or descriptions can be placed between the data packets.

9/2005 epa: Add growth & tech years to PERIOD packet and Counties & Retrofit files to RUNFILES packet.

---

PERIOD PACKET

This is the packet that defines the period for which emissions are to be estimated. The order of the records matter. The selection of certain parameters will cause some of the record that follow to be ignored. The order of the records is as follows:

- 1 - Char 10 - Period type for this simulation.  
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

---

/PERIOD/  
Period type : Monthly  
Summation type : Typical day  
Year of episode : 2018  
Season of year :  
Month of year : July  
Weekday or weekend : Weekday  
Year of growth calc:  
Year of tech sel :  
/END/

---

OPTIONS PACKET

This is the packet that defines some of the user options that drive the model. Most parameters are used to make episode specific emission factor adjustments. The order of the records is fixed. The order is as follows.

- 1 - Char 80 - First title on reports
- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)

- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made  
Valid responses are: YES and NO

```

-----
/OPTIONS/
Title 1          : Triad RVP to 9.0
Title 2          : 2018
Fuel RVP for gas : 9.0
Oxygen Weight % : 2.62
Gas sulfur %     : 0.0011
Diesel sulfur %  : 0.0011
Marine Dsl sulfur %: 0.0056
CNG/LPG sulfur % : 0.003
Minimum temper. (F): 68.1
Maximum temper. (F): 87.6
Average temper. (F): 77.9
Altitude of region : LOW
EtOH Blend % Mkt  : 78.8
EtOH Vol %       : 9.5
/END/

```

-----  
REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

- US TOTAL - emissions are for entire USA without state breakout.
- 50STATE - emissions are for all 50 states and Washington D.C., by state.
- STATE - emissions are for a select group of states and are state-level estimates
- COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.
- SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

- US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.
- 50STATE - Nothing needs to be specified. The FIPS

code 00000 is used automatically.

STATE - state FIPS codes

COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.

SUBCOUNTY - county FIPS code and subregion code.

-----

/REGION/  
Region Level : COUNTY  
Davidson County NC : 37057  
Forsyth County NC : 37067  
Guilford County NC : 37081  
/END/

or use -  
Region Level : STATE  
Michigan : 26000

-----

#### SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

-----

/SOURCE CATEGORY/  
:2260001000  
:2265001000  
:2267001000  
:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000  
:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000  
:2260004000  
:2265004000  
:2267004000  
:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000

:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000  
:2260007000  
:2265007000  
:2267007000  
:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000  
:2267010000  
:2268010000  
:2270010000  
:2285000000  
:2282000000

/END/

Diesel Only -

:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -

:2260000000  
:2265000000  
:2267000000  
:2268000000  
:2282005010  
:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files and some of the input data files read by the model. If a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTION file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.  
-----

/RUNFILES/

ALLOC XREF : data\allocate\allocate.xrf  
ACTIVITY : data\activity\activity.dat  
EXH TECHNOLOGY : data\tech\tech-exh.dat  
EVP TECHNOLOGY : data\tech\tech-evp.dat  
SEASONALITY : data\season\season.dat  
REGIONS : data\season\season.dat  
MESSAGE : c:\nonroad\outputs\triadrvp.msg  
OUTPUT DATA : c:\nonroad\outputs\triadrvp.out

EPS2 AMS :  
US COUNTIES FIPS : data\allocate\fips.dat  
RETROFIT :  
/END/

-----  
This is the packet that defines the equipment population files read by the model.  
-----

/POP FILES/  
Population File : c:\nonroad\data\pop\nc.pop  
/END/

POPULATION FILE : c:\nonroad\data\POP\MI.POP

-----  
This is the packet that defines the growth files files read by the model.  
-----

/GROWTH FILES/  
National defaults : data\growth\nation.grw  
/END/

/ALLOC FILES/  
Air trans. empl. :c:\nonroad\data\allocate\nc\_airtr.alo  
Undergrnd coal prod:c:\nonroad\data\allocate\nc\_coal.alo  
Construction cost :c:\nonroad\data\allocate\nc\_const.alo  
Harvested acres :c:\nonroad\data\allocate\nc\_farms.alo  
Golf course estab. :c:\nonroad\data\allocate\nc\_golf.alo  
Wholesale estab. :c:\nonroad\data\allocate\nc\_holsl.alo  
Family housing :c:\nonroad\data\allocate\nc\_house.alo  
Logging employees :c:\nonroad\data\allocate\nc\_loggn.alo  
Landscaping empl. :c:\nonroad\data\allocate\nc\_lscap.alo  
Manufacturing empl.:c:\nonroad\data\allocate\nc\_mnfg.alo  
Oil & gas employees:c:\nonroad\data\allocate\nc\_oil.alo  
Census population :c:\nonroad\data\allocate\nc\_pop.alo  
Allocation File :c:\nonroad\data\allocate\nc\_rail.alo  
RV Park establish. :c:\nonroad\data\allocate\nc\_rvprk.alo  
Snowblowers comm. :c:\nonroad\data\allocate\nc\_sbc.alo  
Snowblowers res. :c:\nonroad\data\allocate\nc\_sbr.alo  
Snowmobiles :c:\nonroad\data\allocate\nc\_snowm.alo  
Rec marine inboard :c:\nonroad\data\allocate\nc\_wib.alo  
Rec marine outboard:c:\nonroad\data\allocate\nc\_wob.alo  
/END/

-----  
This is the packet that defines the emssions factors files read by the model.  
-----

/EMFAC FILES/  
THC exhaust : data\emsfac\exhthc.emf  
CO exhaust : data\emsfac\exhco.emf  
NOX exhaust : data\emsfac\exhnox.emf  
PM exhaust : data\emsfac\exhpm.emf  
BSFC : data\emsfac\bsfc.emf  
Crankcase : data\emsfac\crank.emf

```

Spillage           : data\emsfac\spillage.emf
Diurnal           : data\emsfac\evdiu.emf
Tank Perm         : data\emsfac\evtank.emf
Non-RM Hose Perm  : data\emsfac\evhose.emf
RM Fill Neck Perm : data\emsfac\evneck.emf
RM Supply/Return  : data\emsfac\evsupret.emf
RM Vent Perm      : data\emsfac\evvent.emf
Hot Soaks         : data\emsfac\evhotsk.emf
RuningLoss        : data\emsfac\evrunls.emf
/END/

```

-----  
This is the packet that defines the deterioration factors files read by the model.  
-----

```

/DETERIORATE FILES/
THC exhaust       : data\detfac\exhthc.det
CO exhaust        : data\detfac\exhco.det
NOX exhaust       : data\detfac\exhnox.det
PM exhaust        : data\detfac\exhpm.det
Diurnal           : data\detfac\evdiu.det
Tank Perm         : data\detfac\evtank.det
Non-RM Hose Perm  : data\detfac\evhose.det
RM Fill Neck Perm : data\detfac\evneck.det
RM Supply/Return  : data\detfac\evsupret.det
RM Vent Perm      : data\detfac\evvent.det
Hot Soaks         : data\detfac\evhotsk.det
RuningLoss        : data\detfac\evrunls.det
/END/

```

Optional Packets - Add initial slash "/" to activate

```

/STAGE II/
Control Factor    : 0.0
/END/
Enter percent control: 95 = 95% control = 0.05 x uncontrolled
Default should be zero control.

```

```

/MODELYEAR OUT/
EXHAUST BMY OUT  :
EVAP BMY OUT     :
/END/

```

```

SI REPORT/
SI report file-CSV :OUTPUTS\NR POLLUT.CSV
/END/

```

```

/DAILY FILES/
DAILY TEMPS/RVP  :
/END/

```

```

PM Base Sulfur
  cols 1-10: dsl tech type;
  11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)
/PM BASE SULFUR/
T2      0.0350    0.02247
T3      0.2000    0.02247

```

```

T3B      0.0500    0.02247
T4A      0.0500    0.02247
T4B      0.0015    0.02247
T4       0.0015    0.30
T4N      0.0015    0.30
T2M      0.0350    0.02247
T3M      1.0       0.02247
T4M      1.0       0.02247
/END/

```

## 6.10 DAVIE COUNTY 2018

Written by Nonroad interface at 9/10/2010 3:25:25 PM  
This is the options file for the NONROAD program.  
The data is sperated into "packets" bases on common  
information. Each packet is specified by an  
identifier and a terminator. Any notes or descriptions  
can be placed between the data packets.

9/2005 epa: Add growth & tech years to PERIOD packet  
and Counties & Retrofit files to RUNFILES packet.

---

### PERIOD PACKET

This is the packet that defines the period for  
which emissions are to be estimated. The order of the  
records matter. The selection of certain parameters  
will cause some of the record that follow to be ignored.  
The order of the records is as follows:

- 1 - Char 10 - Period type for this simulation.  
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
- 2 - Char 10 - Type of inventory produced.  
Valid responses are: TYPICAL DAY and PERIOD TOTAL
- 3 - Integer - year of episode (4 digit year)
- 4 - Char 10 - Month of episode (use complete name of month)
- 5 - Char 10 - Type of day  
Valid responses are: WEEKDAY and WEEKEND

---

```

/PERIOD/
Period type      : Monthly
Summation type  : Typical day
Year of episode  : 2018
Season of year   :
Month of year    : July
Weekday or weekend : Weekday
Year of growth calc:
Year of tech sel  :
/END/

```

---

### OPTIONS PACKET



This is the packet that defines some of the user options that drive the model. Most parameters are used to make episode specific emission factor adjustments. The order of the records is fixed. The order is as follows.

- 1 - Char 80 - First title on reports
- 2 - Char 80 - Second title on reports
- 3 - Real 10 - Fuel RVP of gasoline for this simulation
- 4 - Real 10 - Oxygen weight percent of gasoline for simulation
- 5 - Real 10 - Percent sulfur for gasoline
- 6 - Real 10 - Percent sulfur for diesel
- 7 - Real 10 - Percent sulfur for LPG/CNG
- 8 - Real 10 - Minimum daily temperature (deg. F)
- 9 - Real 10 - maximum daily temperature (deg. F)
- 10 - Real 10 - Representative average daily temperature (deg. F)
- 11 - Char 10 - Flag to determine if region is high altitude  
Valid responses are: HIGH and LOW
- 12 - Char 10 - Flag to determine if RFG adjustments are made  
Valid responses are: YES and NO

-----  
/OPTIONS/

Title 1 : TRIAD (110)  
Title 2 : DAVIE 2018; JULY  
Fuel RVP for gas : 9.0  
Oxygen Weight % : 2.62  
Gas sulfur % : 0.0011  
Diesel sulfur % : 0.0011  
Marine Dsl sulfur %: 0.0056  
CNG/LPG sulfur % : 0.003  
Minimum temper. (F): 68.1  
Maximum temper. (F): 87.6  
Average temper. (F): 77.9  
Altitude of region : LOW  
EtOH Blend % Mkt : 78.8  
EtOH Vol % : 9.5  
/END/

-----  
REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:

US TOTAL - emissions are for entire USA without state breakout.

50STATE - emissions are for all 50 states and Washington D.C., by state.

STATE - emissions are for a select group of states and are state-level estimates

COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.

SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.

50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.

STATE - state FIPS codes

COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.

SUBCOUNTY - county FIPS code and subregion code.

-----  
/REGION/  
Region Level : COUNTY  
Davie County NC : 37059  
/END/

or use -  
Region Level : STATE  
Michigan : 26000  
-----

#### SOURCE CATEGORY PACKET

This packet is used to tell the model which source categories are to be processed. It is optional. If used, only those source categories list will appear in the output data file. If the packet is not found, the model will process all source categories in the population files.

-----  
/SOURCE CATEGORY/  
:2260001000  
:2265001000  
:2267001000  
:2268001000  
:2270001000  
:2260002000  
:2265002000  
:2267002000  
:2268002000  
:2270002000

:2260003000  
:2265003000  
:2267003000  
:2268003000  
:2270003000  
:2260004000  
:2265004000  
:2267004000  
:2268004000  
:2270004000  
:2260005000  
:2265005000  
:2267005000  
:2268005000  
:2270005000  
:2260006000  
:2265006000  
:2267006000  
:2268006000  
:2270006000  
:2260007000  
:2265007000  
:2267007000  
:2268007000  
:2270007000  
:2260009000  
:2265009000  
:2267009000  
:2268009000  
:2270009000  
:2260010000  
:2265010000  
:2267010000  
:2268010000  
:2270010000  
:2285000000  
:2282000000

/END/

Diesel Only -

:2270000000  
:2282020000  
:2285002015

Spark Ignition Only -

:2260000000  
:2265000000  
:2267000000  
:2268000000  
:2282005010  
:2282005015  
:2282010005  
:2285004015  
:2285006015

-----  
This is the packet that lists the names of output files  
and some of the input data files read by the model. If

a drive:\path\ is not given, the location of the NONROAD.EXE file itself is assumed. You will probably want to change the names of the Output and Message files to match that of the OPTion file, e.g., MICH-97.OPT, MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.

```
-----  
/RUNFILES/  
ALLOC XREF      : data\allocate\allocate.xrf  
ACTIVITY       : data\activity\activity.dat  
EXH TECHNOLOGY : data\tech\tech-exh.dat  
EVP TECHNOLOGY : data\tech\tech-evp.dat  
SEASONALITY    : data\season\season.dat  
REGIONS        : data\season\season.dat  
MESSAGE        : c:\nonroad\outputs\davie18.msg  
OUTPUT DATA   : c:\nonroad\outputs\davie18.out  
EPS2 AMS       :  
US COUNTIES FIPS : data\allocate\fips.dat  
RETROFIT       :  
/END/
```

```
-----  
This is the packet that defines the equipment population  
files read by the model.
```

```
-----  
/POP FILES/  
Population File : c:\nonroad\data\pop\nc.pop  
/END/
```

```
POPULATION FILE : c:\nonroad\data\POP\MI.POP
```

```
-----  
This is the packet that defines the growth files  
files read by the model.
```

```
-----  
/GROWTH FILES/  
National defaults : data\growth\nation.grw  
/END/
```

```
-----  
/ALLOC FILES/  
Air trans. empl. :c:\nonroad\data\allocate\nc_airtr.alo  
Undergrnd coal prod:c:\nonroad\data\allocate\nc_coal.alo  
Construction cost :c:\nonroad\data\allocate\nc_const.alo  
Harvested acres :c:\nonroad\data\allocate\nc_farms.alo  
Golf course estab. :c:\nonroad\data\allocate\nc_golf.alo  
Wholesale estab. :c:\nonroad\data\allocate\nc_holsl.alo  
Family housing :c:\nonroad\data\allocate\nc_house.alo  
Logging employees :c:\nonroad\data\allocate\nc_loggn.alo  
Landscaping empl. :c:\nonroad\data\allocate\nc_lscap.alo  
Manufacturing empl.:c:\nonroad\data\allocate\nc_mnfg.alo  
Oil & gas employees:c:\nonroad\data\allocate\nc_oil.alo  
Census population :c:\nonroad\data\allocate\nc_pop.alo  
Allocation File :c:\nonroad\data\allocate\nc_rail.alo  
RV Park establish. :c:\nonroad\data\allocate\nc_rvprk.alo  
Snowblowers comm. :c:\nonroad\data\allocate\nc_sbc.alo  
Snowblowers res. :c:\nonroad\data\allocate\nc_sbr.alo
```

```
Snowmobiles      :c:\nonroad\data\allocate\nc_snowm.alo
Rec marine inboard :c:\nonroad\data\allocate\nc_wib.alo
Rec marine outboard:c:\nonroad\data\allocate\nc_wob.alo
/END/
```

-----  
This is the packet that defines the emssions factors  
files read by the model.  
-----

```
/EMFAC FILES/
THC exhaust      : data\emsfac\exhthc.emf
CO exhaust       : data\emsfac\exhco.emf
NOX exhaust      : data\emsfac\exhnox.emf
PM exhaust       : data\emsfac\exhpm.emf
BSFC             : data\emsfac\bsfc.emf
Crankcase        : data\emsfac\crank.emf
Spillage         : data\emsfac\spillage.emf
Diurnal          : data\emsfac\evdiu.emf
Tank Perm        : data\emsfac\evtank.emf
Non-RM Hose Perm : data\emsfac\evhose.emf
RM Fill Neck Perm : data\emsfac\evneck.emf
RM Supply/Return : data\emsfac\evsupret.emf
RM Vent Perm     : data\emsfac\evvent.emf
Hot Soaks        : data\emsfac\evhotsk.emf
RuningLoss       : data\emsfac\evrunls.emf
/END/
```

-----  
This is the packet that defines the deterioration factors  
files read by the model.  
-----

```
/DETERIORATE FILES/
THC exhaust      : data\detfac\exhthc.det
CO exhaust       : data\detfac\exhco.det
NOX exhaust      : data\detfac\exhnox.det
PM exhaust       : data\detfac\exhpm.det
Diurnal          : data\detfac\evdiu.det
Tank Perm        : data\detfac\evtank.det
Non-RM Hose Perm : data\detfac\evhose.det
RM Fill Neck Perm : data\detfac\evneck.det
RM Supply/Return : data\detfac\evsupret.det
RM Vent Perm     : data\detfac\evvent.det
Hot Soaks        : data\detfac\evhotsk.det
RuningLoss       : data\detfac\evrunls.det
/END/
```

Optional Packets - Add initial slash "/" to activate

```
/STAGE II/
Control Factor   : 0.0
/END/
Enter percent control: 95 = 95% control = 0.05 x uncontrolled
Default should be zero control.
```

```
/MODELYEAR OUT/
EXHAUST BMY OUT :
EVAP BMY OUT    :
/END/
```

SI REPORT/  
SI report file-CSV :OUTPUTS\NRPOLLUT.CSV  
/END/

/DAILY FILES/  
DAILY TEMPS/RVP :  
/END/

PM Base Sulfur  
cols 1-10: dsl tech type;  
11-20: base sulfur wt%; or '1.0' means no-adjust (cert= in-use)  
/PM BASE SULFUR/  
T2           0.0350       0.02247  
T3           0.2000       0.02247  
T3B          0.0500       0.02247  
T4A          0.0500       0.02247  
T4B          0.0015       0.02247  
T4           0.0015       0.30  
T4N          0.0015       0.30  
T2M          0.0350       0.02247  
T3M          1.0           0.02247  
T4M          1.0           0.02247  
/END/