Appendix C.2

Area Source Emissions

Inventory Documentation

(This page intentionally left blank)

TABLE OF CONTENTS

LIST OF TABLES

List of Acronyms

Acronym	Definition
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
NOx	Nitrogen Oxides
RDU	Raleigh/Durham International Airport
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 usually 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 source inventories detailed in this section have been developed for the Raleigh-Durham-Chapel Hill 8-hour ozone nonattainment area, referred to as the Triangle nonattainment area, as part of the process of redesignating them from nonattainment to attainment/maintenance for the 8-hour ozone standard. The Triangle area nonattainment counties include Durham, Franklin, Granville, Johnston, Orange, Person, and Wake Counties and Baldwin, Center, New Hope and Williams Townships in Chatham 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, from this point on this document will be referred to as the Procedures document, and the Emissions Inventory Improvement Program (EIIP) Technical Reports, Vol. 3, Area Sources[1] as of December 2002 (the most current version at the time of the inventory development), from this point on this document will be referred to as 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 Reports, the Procedures document or the USEPA's AP-42 Compilation of Air Pollutant Emission Factors, Fifth Edition, referred to as AP-42.

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, using population or employment data. All of these methods were used to estimate area source emissions. Since a complete area source inventory was readily available for the year 2002, often this inventory was grown to the base year 2005 being used in the redesignation demonstration and maintenance plan. This was due to the 2005 activity data not being readily available. For some source categories, 2004 activity data was available so it was used to estimate the emissions inventory, then it was grown to 2005.

The estimated 2002 population data, from the 2000 census, was used in conjunction with per capita emission factors, and 2004 employment data for most source categories, from on-line County Business Patterns[2], was used with per employee emission factors.

Table 2.2-1 contains the estimated population for the Triangle nonattainment area counties for this redesignation demonstration and maintenance plan (2005, 2008, 2011, 2014, 2017) as well as the 2002 estimate used to calculate the emissions. Since only a portion of Chatham County is nonattainment, Table 2.2-1 represent the estimated population in the nonattainment area only for Chatham County. Based on the 2000 census, approximately 43% of Chatham County's population is in the nonattainment area. This percentage was used to estimate the projected population of the nonattainment area for all of the years listed.

Table 2.2-1 Population Data

COUNTY	2002	2005	2008	2011	2014	2017
Chatham*	22,685	24,242	25,714	27,252	28,737	30,285
Durham	232,988	242,207	252,089	262,909	273,417	284,020
Franklin	50,422	54,099	57,756	61,462	65,212	69,197
Granville	51,554	53,360	55,861	58,675	61,384	64,352
Johnston	132,448	146,319	160,637	174,692	188,763	203,820
Orange	119,353	121,992	127,191	132,140	136,629	141,597
Person	36,744	37,131	38,248	39,436	40,560	41,774
Wake	679,785	755,053	832,613	905,667	978,823	1,056,139

* Nonattainment portion's population

For creating future year emission estimates for many source categories, the base year emission inventory was projected with a source category specific growth factor generated with the USEPA's Economic Growth Analysis System[4] version 5.0 beta (E-GAS 5.0) program. Source categories estimated by per-capita emission factors were grown using predicted future year populations provided by the North Carolina Office of State Budget and Management[3] and were based originally on 2000 census data. Population growth factors were calculated to adjust 2002 values to future years by multiplication. These growth factors are listed in Table 2.2-2.

Table 2.2-2 Population Growth Factors

COUNTY	2005	2008	2011	2014	2017
Chatham	1.0687	1.1336	1.2014	1.2668	1.3351
Durham	1.0396	1.0820	1.1284	1.1735	1.2190
Franklin	1.0729	1.1455	1.2190	1.2933	1.3724
Granville	1.0350	1.0835	1.1381	1.1907	1.2482
Johnston	1.1047	1.2128	1.3189	1.4252	1.5389
Orange	1.0221	1.0657	1.1071	1.1447	1.1864
Person	1.0105	1.0409	1.0733	1.1039	1.1369
Wake	1.1107	1.2248	1.3323	1.4399	1.5536

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 2002 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 reports were organized by Standard Industrial Classification (SIC) code. 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. The tables from the US Census showing the NAICS-SIC crosswalk are reproduced in Section 5 – Additional Data. It should be noted that the crosswalk is based on national totals and is not specific to any particular state. In Section 5.2, the employment fraction of the NAICS codes used to create the SIC code employment data is tabulated.

The employment numbers were obtained from the on-line 2004 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 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 x 3) + (1 x 35) = 41 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 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 x 35) + (2 x 75) = 185 employees
250 – 185 = 65 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 issue in quality assurance is that of developing a complete list of area sources. The Procedures document and the EIIP Tech Report were the primary reference used in preparing the list for the inventory. Next, measures to ensure valid emission estimates were adopted using guidance provided by document EPA-450/4-88-023, the EPA Quality Assurance Document for Post-1987 SIP Emission Inventories. Since many are based on AP-42 factors, factors given in the Procedures document or the EIIP Tech Report, sources of error would primarily be associated with the multiplier values and the accuracy of 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 calculations.

4.0 DISCUSSION OF AREA SOURCE CATEGORIES

There are five major area source categories comprising of a number of individual area source types. Sections 4.1 through 4.5 address each of these categories and include a number of subsections that corresponds to the contributory area sources. The objective of each subsection is to describe each source 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, 3) spillage and 4) truck transit losses. The emissions from vehicle refueling are captured in the mobile source inventory in the emission factors produced by the USEPA's MOBILE6.2 model and therefore are not estimated as part of the area source 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 not found to 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 accessed. From this information the rule effectiveness and rule penetration can be estimated. The rule effectiveness is the percentage of facilities complying with the rule, where as 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 factors for Stage I controls for the Triangle area 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
0.97	0.99	0.95

The volatile organic compound (VOC) emission factor for underground storage tank filling was calculated by using an equation from AP-42, page 5.2-4 (equation)

$$EF = 12.46 \quad \frac{[S \times P \times M]}{[\quad T \quad]} \times [1-(RE \times CE \times RP)]$$

where
EF = emission factor in (lbs VOC/1,000 gallons)
S = Saturation factor
P = True vapor pressure (psi)
M = Molecular weight of vapors (lb/lb-mole)
T = Temperature of bulk liquid (degree Rankin)
RE = Rule Effectiveness
CE = Control Efficiency
RP = Rule Penetration

The saturation factor was obtained from AP-42, Table 5.2-1 and the true vapor pressure (based on the Reid Vapor Pressure (RVP)) and molecular weight of vapors were obtained from AP-42, Table 7.1-2. An average of the June, July and August monthly temperatures for 2002 were used. These temperatures were obtained from the North Carolina Climatological Data[5], a publication of the National Oceanic and Atmospheric Administration. All of the factors used to calculate the emission factors for Stage I, i.e., balanced submerged filling, are listed in Table 4.1.1-2

Table 4.1.1-2 Factors Used For Calculating Emission Factor for Underground Storage Tank Filing

RVP	S	P	M	T
7.8 psi	1	5.53 psi	68.0 lbs/lb-mole	537.6^{o}R (77.6^{o}F)
9.0 psi	1	6.45 psi	67.2 lbs/lb-mole	537.6^{o}R (77.6^{o}F)

Wake and Durham Counties and the Dutchville Township in Granville County are subject to a 7.8 psi RVP requirement during the summer months. The remaining counties in the Triangle area are subject to a 9.0 RVP in the summer. Since such a small portion of Granville County is subject to the 7.8 psi RVP requirement, for simplicity, the emissions for the entire county will be calculated using a 9.0 psi RVP emission factor.

North Carolina plans to petition the USEPA to remove the 7.8 psi RVP requirement in early 2013. Therefore, the emission estimates for 2014 and 2017 for all counties in the Triangle area will be calculated based on the emission factors for a 9.0 psi.

$$EF_{9.0\ psi} = 12.46 \left[\frac{1 \times 6.45 \times 67.2}{537.6} \right] \times [1 - (0.97 \times 0.95 \times 0.99)]$$

$$= 0.880 \text{ lb VOC/1,000 gallon gasoline}$$

The emission factors for tank truck transit, breathing losses and spillage were obtained from the EIIP Tech Report, Table 11.3-1 and are listed below in Table 4.1.1-3. The tank truck transit emission factor includes the emission rate for an empty tank plus a full tank and was adjusted by a factor of 1.25 as recommended by the EIIP Tech Report, pg. 11.5-3.

Table 4.1.1-3 Emission Factors For Gasoline Dispensing

Reid Vapor Pressure	Underground Storage Tank Filling	Tank Truck Transit	Breathing	Spillage
7.8 psi	0.000765 lb/gal	0.000075 lb/gal	0.001 lb/gal	0.00068 lb/gal
9.0 psi	0.000880 lb/gal	0.000075 lb/gal	0.001 lb/gal	0.00068 lb/gal

The activity data needed to calculate the emissions is number of gallons of fuel sold in each county per year. This was obtained from a report from the North Carolina Petroleum Marketers Association. A weighting factor was devised by producing the sum of county population (1,000's), county registered vehicles (1,000's), and county motor fuel outlets. The factors were summed for the 100 counties and a fractional part of the whole found for each county. This fraction was multiplied by the state total gallons of gasoline and diesel in 2002 to get an estimate of gallons of fuel per county.

Table 4.1.1-4 Fuel Use Data 2002

County	Population in 1000's	Vehicles in 1000's	Motor Fuel Outlets	Add Columns 2, 3, & 4	County Fraction of State	Gasoline Use 1000's gals	Diesel Use 1000's gals
Chatham	52.5	49.1	53	156	0.00697	29,598.87	8,233.56
Durham	233.0	161.2	139	534.4	0.02386	101,395.11	28,205.23
Franklin	50.4	43.1	55	148.5	0.00663	28,175.85	7,837.72
Granville	51.6	41.6	67	159.5	0.00712	30,262.95	8,418.29
Johnston	132.4	113.1	133	379.3	0.01694	71,967.00	20,019.17
Orange	119.3	84.0	62	266.5	0.01190	50,564.74	14,065.67
Person	36.7	35.9	60	132.5	0.00592	25,140.07	6,993.25
Wake	679.8	564.6	382	1622.1	0.07244	307,771.4	85,613.23
State Totals	8,320.0	6,802.0	7,271	22392.7	1	4,248,710	1,181,870

According to the EIIP Tech Report, the activity days per week for truck transit and underground storage tank filling are 6 days per week and for spillage and breathing losses 7 days per week. For the future year inventories the base year emissions were grown using the appropriate E-GAS 5.0 factors listed in Table 4.1.1-5.

Table 4.1.1-5 Growth Factors for Gasoline Dispensing

2005	2008	2011	2014	2017
1.0011	1.0246	1.0375	1.0327	1.0333

Note that diesel fuel used is combined with gasoline for sake of simplification. This will result in some overestimation of VOC emissions because of different volatility.

The following examples show calculations for Wake County for 2005. The other years and other county emissions in the Triangle nonattainment area were done in like manner.

Tank Truck Transit

VOC_{2005} = ((308,000,000 + 85,613,230)gal/yr)*(.000075 lbvoc/gal)*(1 ton/2000 lb)*
(1.0011 $EGAS_{05/02}$)*(1/365 yr/day)*(7/6 dayswk/dayswk) = 0.047 tons/day

Underground Storage Tank Filling

VOC_{2005} = ((308,000,000 + 85,613,230)gal/yr)*(0.000765 lbvoc/gal)*(1 ton/2000 lb)*
(1.0011 $EGAS_{05/02}$)*(1/365 yr/day)*(7/6 dayswk/dayswk) = 0.482 tons/day

Breathing Loss

VOC_{2005} = ((308,000,000 + 85,613,230)gal/yr)*(0.001 lbvoc/gal)*(1 ton/2000 lb)*
(1.0011 $EGAS_{05/02}$)*(1/365 yr/day) = 0.545 tons/day

Spillage Loss

VOC_{2005} = ((308,000,000 + 85,613,230)gal/yr)*(0.00068 lbvoc/gal)*(1 ton/2000 lb)*
(1.0011 $EGAS_{05/02}$)*(1/365 yr/day) = 0.367 tons/day

The VOC emission estimates, in tons/day, from gasoline service stations for the Triangle nonattainment area are listed in Tables 4.1.1-6 through 4.1.1-9, and are totaled for this source category in Table 4.1.1-10. For Chatham County, the total county emissions were adjusted to the nonattainment portion of the County by multiplying by the fraction of the population in the nonattainment area by 43.22%.

Table 4.1.1-6 VOC Emissions From Tank Truck Transit

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.05	0.05	0.05	0.05	0.05
TOTAL	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**

Table 4.1.1-7 VOC Emissions From Underground Storage Tank Filling

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.02
Durham	0.16	0.16	0.16	0.19	0.19
Franklin	0.05	0.05	0.05	0.05	0.05
Granville	0.05	0.06	0.06	0.06	0.06
Johnston	0.13	0.13	0.13	0.13	0.13
Orange	0.09	0.09	0.09	0.09	0.09
Person	0.05	0.05	0.05	0.05	0.05
Wake	0.48	0.49	0.50	0.57	0.57
TOTAL	**1.03**	**1.05**	**1.06**	**1.16**	**1.16**

Table 4.1.1-8 VOC Emissions From Breathing Loss

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.02
Durham	0.18	0.18	0.18	0.18	0.18
Franklin	0.05	0.05	0.05	0.05	0.05
Granville	0.05	0.05	0.05	0.05	0.05
Johnston	0.13	0.13	0.13	0.13	0.13
Orange	0.09	0.09	0.09	0.09	0.09
Person	0.04	0.05	0.05	0.05	0.05
Wake	0.54	0.55	0.56	0.56	0.56
TOTAL	**1.10**	**1.12**	**1.13**	**1.13**	**1.13**

Table 4.1.1-9 VOC Emissions From Spillage

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.02
Durham	0.12	0.12	0.13	0.12	0.12
Franklin	0.03	0.03	0.03	0.03	0.03
Granville	0.04	0.04	0.04	0.04	0.04
Johnston	0.09	0.09	0.09	0.09	0.09
Orange	0.06	0.06	0.06	0.06	0.06
Person	0.03	0.03	0.03	0.03	0.03
Wake	0.37	0.38	0.38	0.38	0.38
TOTAL	**0.76**	**0.77**	**0.78**	**0.77**	**0.77**

Table 4.1.1-10 Total VOC Emissions From Gasoline Dispensing Facilities

County	2005	2008	2011	2014	2017
Chatham	0.06	0.06	0.06	0.06	0.06
Durham	0.48	0.48	0.49	0.51	0.51
Franklin	0.13	0.13	0.13	0.13	0.13
Granville	0.14	0.15	0.15	0.15	0.15
Johnston	0.36	0.36	0.36	0.36	0.36
Orange	0.25	0.25	0.25	0.25	0.25
Person	0.12	0.13	0.13	0.13	0.13
Wake	1.44	1.47	1.49	1.56	1.56
TOTAL	**2.98**	**3.03**	**3.06**	**3.15**	**3.15**

4.1.2 Aircraft Refueling

Like vehicle refueling, aircraft refueling results in VOC emissions from displacement of the vapor laden air in the aircraft's fuel tank. This source category is generally estimated only for large commercial airports. In the Triangle area, the one major airport is the Raleigh/Durham International Airport (RDU) located in Wake County. There are a few small commuter airports in the Triangle area, however, the amount of the emissions from these are be negligible.

The emissions from aircraft refueling were determined by using the number of gallons of fuel supplied to the airports and multiplying it by the appropriate emission factor. The businesses that supply the fuel to the airports were contacted to determine the amount and type of fuel supplied to each airport during 2002. The information obtained was for the two fuel types supplied, Jet A Kerosene and Aviation Gasoline. Table 4.1.2-1 tabulates the amount of each fuel supplied to each airport.

Table 4.1.2-1 Gallons of Fuel Consumed at Airports

County	Aviation Gasoline	Jet A Kerosene
Wake County (RDU)	536,163	87,104,173

The emission factors used are 11.38 lb VOC/1000 gallons of aviation gasoline and 0.065 lb VOC/1000 gallons of Jet A kerosene. Airport refueling occurs on a daily basis, therefore the activity days per week are 7. For the future year inventories, the base year emissions were grown using growth factors from the EGAS 5.0 projection model. The growth factors for the Triangle area are listed in Table 4.1.2-2.

Table 4.1.2-2 Growth Factors For Aircraft Refueling

County	2005	2008	2011	2014	2017
Wake County (RDU)	1.1083	1.256	1.3874	1.5092	1.6295

The emissions for the base year and future years were calculated using equations 4.1.2-1 and 4.1.2-2, respectively.

$$EM_i = \frac{\text{Gallons} \times EF_i}{(2000 \text{ lbs/ton}) \times (7 \text{ days/week}) \times (52 \text{ weeks/year})} \qquad 4.1.2\text{-}1$$

$$PJ_bEM_i = EM_i \times GF_a \qquad 4.1.2\text{-}2$$

where EM_i = emissions for source category (i)
EF_i = emission factor for source category (i)
PJ_bEM_i = projected future year (b) emissions for source category (i)
GF_a = growth factor for redesignation area (a)

Examples of the emission calculation for Wake County are listed below:

Aviation Gasoline consumed at RDU = 536,163 gallons
Jet A Kerosene consumed at RDU = 87,104,173 gallons
Emission Factor for Aviation Gasoline = 11.38 lb VOC/10^3 gallon
Emission Factor for Jet A Kerosene = 0.065 lb VOC/10^3 gallon
Growth Factor for 2005 = 1.1083

From equation 4.1.2-1:

$$VOC_{2002} = \frac{(536.1\ 10^3 \text{ gallons A.G./year}) \times (11.38 \text{ lb VOC/1000 gallons})}{(2000 \text{ lb/ton}) \times (7 \text{ days/week}) \times (52 \text{ weeks/year})}$$
$$= 0.0084 \text{ tons VOC/day from aviation gasoline}$$

$$VOC_{2002} = \frac{(87{,}104.2\ 10^3 \text{ gallons Jet A kerosene/year}) \times (0.065 \text{ lb VOC/1000 gallons})}{(2000 \text{ lb/ton}) \times (7 \text{ days/week}) \times (52 \text{ weeks/year})}$$
$$= 0.0078 \text{ tons VOC/day from aviation gasoline}$$

$$\text{Total } VOC_{2002} = 0.01 + 0.01$$
$$= 0.02 \text{ tons VOC/day}$$

For the emission estimates from aircraft refueling for all counties in the Triangle nonattainment area, refer to Table 4.1.2-3.

Table 4.1.2-3 Total VOC Emissions From Aircraft Refueling

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.02	0.02	0.02	0.03
TOTAL	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**

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 cleaners (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 cleaners are estimated by multiplying the number of employees at dry cleaners by a national per-employee emission factor, 1800 lbs. of VOC/employee/year, found in the EIIP Tech. Report. The number of employees was obtained from the County Business Patterns for NAICS codes 812310 (coin operated) and 812320 (commercial). As previously described, the NAICS employment numbers were previously processed to exclude any facilities with 100 or more employees which were deemed to be point sources. For the Triangle nonattainment area there were no facilities large enough to be considered point sources. Table 4.2.1-1 below shows employment numbers used. The fractional employees for commercial dry cleaners are due to a fractional part of the 812320 NAICS being used to estimate SIC 7216 employment.

Table 4.2.1-1 Employment Data for Dry Cleaners

County	Estimated Number of Coin Operated Employees	Estimated Number of Commercial Employees
Chatham	6	5.71
Durham	29	145.18
Franklin	17	2.45
Granville	44	0.00
Johnston	19	35.07
Orange	3	114.19
Person	3	14.68

Wake	333	622.33

According to the EIIP Tech. Report, the activity days per week is 6 days. For the base year and future years inventories, the 2004 year emissions were grown using E-GAS 5.0 growth factors (Table 4.2.1-2). Coin operated dry cleaning was projected by factors for SCC 2420020000 while commercial dry cleaning was projected by factors for SCC 2420010000. The factors for both are the same.

Table 4.2.1-2 Growth Factors for Dry Cleaning

2005	2008	2011	2014	2017
1.007491	1.024969	1.044944	1.117353	1.189763

The emissions for 2004 were calculated using equation 4.2.1-1 and the emissions for the base year and future years were calculated using equation 4.2.1-2. Note that for Chatham County, the county total was multiplied by 0.4322 to adjust for only part of Chatham being classified nonattainment. This number is the fraction of the population in the nonattainment area based on the 2000 Census.

$$EM = \frac{\text{Employees} \times \text{EF}}{(2000\ \text{lb/tons}) \times ((6\ \text{days/week})/(7\ \text{days/week})) \times (365\ \text{days/year})} \qquad 4.2.1\text{-}1$$

$$PJ_aEM = EM \times GF_a \qquad 4.2.1\text{-}2$$

where EM = emissions for source category tons/day
EF = emission factor for source category, 1800 lbs VOC/employee/yr
PJ_aEM = projected base year (a) or projected future year (a) emissions
GF_a = growth factor for base year or projected future year (a)

Examples of the emission calculation for commercial dry cleaners in Wake County are listed below:

Number of employees = 622.33
Emission factor = 1800 lbs VOC/employee/year
Projection factor for 2005 = 1.007491

From equation 4.2.1-1 and 4.2.1-2

$$VOC_{2004} = \frac{(622.33\ \text{employees}) \times (1800\ \text{lb VOC/employee/yr})}{(2000\ \text{lb/ton})\ (6\ \text{days/wk}/7\ \text{days/wk})\ (365\ \text{days/yr})}$$

$$= 1.7903\ \text{tons VOC/day}$$

VOC_{2005} = 1.7903 x 1.007491
= 1.80 tons VOC/day

The VOC emission estimates, in tons/day, from dry cleaning for the Triangle nonattainment area are listed in Table 4.2.1-4.

Table 4.2.1-3 VOC Emissions From Dry Cleaning Operations

County	2005	2008	2011	2014	2017
Coin Operated					
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.08	0.09	0.09	0.09	0.10
Franklin	0.05	0.05	0.05	0.05	0.06
Granville	0.13	0.13	0.13	0.14	0.15
Johnston	0.06	0.06	0.06	0.06	0.07
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.97	0.98	1.00	1.07	1.14
Sub Total	1.32	1.34	1.36	1.44	1.55
Commercial					
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.42	0.43	0.44	0.47	0.50
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.10	0.10	0.11	0.11	0.12
Orange	0.33	0.34	0.34	0.37	0.39
Person	0.04	0.04	0.04	0.05	0.05
Wake	1.80	1.83	1.87	2.00	2.13
Sub Total	2.71	2.76	2.82	3.02	3.21
Total	**4.03**	**4.10**	**4.18**	**4.46**	**4.76**

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. Therefore, an employee per SIC code emission factor is not very reliable. The per-capita emission factor of 1.3 lbs VOC/person/year provided by the EIIP Tech. Report was used to calculate the VOC emissions. This emission factor estimates the emissions from facilities less than 100 tons VOC/year. It assumes that facilities greater than 100 tons VOC/year will be in the point source inventory. The population used to calculate the base year emissions is found in Table 2.2-1, 2002 column.

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, source classification code 4-05-xxx-xxx, that emit less than 100 tons/year, in the Triangle nonattainment area.

Since the emissions are calculated based on population, the future years inventories were grown using the population growth factors from Table 2.2-2. The emissions for the base year and future years were calculated using equations 4.2.2-1 and 4.2.2-2, respectively.

$$EM_a = ((EF)*(Population_{2002})*(1 \text{ ton}/2000 \text{ lb})) \qquad 4.2.2\text{-}1$$

$$PJ_bEM_a = EM_a \times GF_a \times (1 \text{ yr}/365 \text{ days}) \times (7 \text{ days}/5 \text{ days}) \qquad 4.2.2\text{-}2$$

where EM = emissions for source category for county (a) ton/yr
EF = emission factor for source category, 1.3 lbs VOC/person/yr
PJ_bEM_a = projected future year (b) emissions for county (a) ton/day
GF_a = growth factor for county (a)

Examples of the emission calculation for Wake County are listed below:

Wake County Population = 679,785 people
Emission factor = 1.3 lbs VOC/person/yr
Point Source Emissions = 0 tons/day
Projection factor for 2005 = 1.1107
From equation 4.2.2-1 and 4.2.2-2

VOC_{2002} = (1.3)*(679,785)*(1/2000)-92.03 = 349.83 Tons/Year

VOC_{2005} = (349.83)*(1.1107)*(1/365)*(7/5) = 1.49 Tons/Day

The VOC emission estimates, in tons/day, from graphic arts operations for the Triangle nonattainment area are listed in Table 4.2.2-1.

Table 4.2.2-1 VOC Emissions From Graphic Arts Operations

County	2005	2008	2011	2014	2017
Chatham	0.06	0.06	0.07	0.07	0.08
Durham	0.61	0.63	0.66	0.68	0.71
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.13	0.14	0.15	0.15	0.16
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.31	0.32	0.33	0.34	0.36
Person	0.09	0.10	0.10	0.10	0.10
Wake	1.49	1.65	1.79	1.93	2.09
TOTAL	**2.69**	**2.90**	**3.10**	**3.27**	**3.50**

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 and are therefore 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. These machines are batch loaded, and 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 the per employee factors (from the EIIP Area Source Document, Chapter 6, Table 6.5-2) listed in Table 4.2.3-1 below:

Table 4.2.3-1 Emission Factors Cleaning & Degreasing

Source Category	lb VOC/employee/yr
Electronic and Other Elec: 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 2004 County Business Patterns. For each of these categories, employment in a number of SIC groups is needed. These employment numbers were generated from the NAICS employment numbers for each county and summed as needed. See SIC Codes from NAICS Codes for Employment Based Categories in section 5.0 for the full listing of NAICS and SIC for each source category. The following table shows the employment for each source category and county. Fractional employee numbers are a result of the NAICS to SIC conversion process.

Table 4.2.3-2 Cleaning and Degreasing Employment

	Open Top Degreasing		Cold Cleaning	
County	Electronic & Other Electrical	Miscellaneous Manufacturing:	Miscellaneous Manufacturing	Auto Repair Services
Chatham	15	682.00	307.22	374.79
Durham	248.51	2619.79	945.15	1674.64
Franklin	11.40	769.83	451.94	317.89
Granville	0	565.34	175.36	389.98
Johnston	163.02	1759.60	775.24	984.36
Orange	121.55	865.37	405.47	459.90
Person	3	432.21	77.01	355.20
Wake	674.16	8371.91	3540.07	4831.85

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 starting with the 2005 estimated emissions. The work week is 6 days for these categories. The following SCC's were used to assign EGAS derived growth growth factors: electronic open top, 2415130000; miscellaneous open top, 2415100000; auto repair cold cleaning, 2415360000; and miscellaneous manufacturing cold cleaning, 2415300000. The growth factors are shown in Table 4.2.3-3 below.

Table 4.2.3-3 Growth Factors for Solvent Cleaning

SCC	2005	2008	2011	2014	2017
2415100000	1.037797	1.125113	1.176012	1.321639	1.460889
2415130000	1.065846	1.288013	1.490898	1.718909	1.943728
2415300000	1.037797	1.125113	1.176012	1.321639	1.460889
2415360000	1.056942	1.24337	1.401521	1.49961	1.594384

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

$$EM = \frac{(\text{Employment}_{2004}) \times EF}{(2000 \text{ lb/tons})} \qquad 4.2.3\text{-}1$$

$$PJ_bEM_a = EM \times GF_a \times [1 - RF] \times (1/365) \times (7/6) \qquad 4.2.3\text{-}2$$

where EM = emissions for source category t/y
EF = emission factor for source category
PJ_bEM_a = projected future year (b) daily emissions for county in maintenance area (a)
GF_a = growth factor for maintenance area (a)
RF = Reduction factor, 31% or 43%

Examples of the emission calculation for Person County for the "Auto Repair Services: Cold Cleaning" subcategory are listed below:

2004 Category Employment for Person County = 355.20
2005 Growth Factor for SCC 2415360000 = 1.056942
Emission Factor = 270 lb VOC/employee/year
Reduction Factor = 0.43

From Equations 4.2.11-1

$$VOC_{2004} = \frac{(355.20 \text{ employees}) \times (270 \text{ lb VOC/employee year})}{(2000 \text{ lb/ton})}$$

$$= 47.95 \text{ tons VOC/year}$$

$$VOC_{2005} = \frac{(47.95 \text{ t/y}) \times (1.056942 GF_{2005/2002}) \times (7/6) \times [1 - 0.43]}{(365 \text{ days/year})}$$

$$= 0.09 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from the four subcategories and the total for this source category are summarized in the tables below. All emission estimates are in tons/day. Note that Chatham County was reduced to the fraction of the population in the nonattainment area (0.4322).

Table 4.2.3-4 VOC Emissions From Electronic and Other Elec.: Open Top Degreasing

County	**2005**	**2008**	**2011**	**2014**	**2017**
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.00	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.03	0.03	0.04	0.04
TOTAL	**0.04**	**0.06**	**0.06**	**0.07**	**0.08**

Table 4.2.3-5 VOC Emissions From Miscellaneous Manufacturing: Open Top Degreasing

County	**2005**	**2008**	**2011**	**2014**	**2017**
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.03	0.03	0.03	0.04	0.04
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.02	0.02	0.02	0.03	0.03
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.01	0.01	0.01	0.01
Wake	0.09	0.10	0.11	0.12	0.13
TOTAL	**0.17**	**0.19**	**0.20**	**0.23**	**0.24**

Table 4.2.3-6 VOC Emissions From Miscellaneous Manufacturing: Cold Cleaning

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.03	0.03
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.00	0.00	0.00	0.01	0.01
Johnston	0.02	0.02	0.02	0.02	0.02
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.08	0.09	0.09	0.10	0.11
TOTAL	**0.14**	**0.15**	**0.15**	**0.18**	**0.19**

Table 4.2.3-7 VOC Emissions From Auto Repair Services: Cold Cleaning

County	2005	2008	2011	2014	2017
Chatham	0.04	0.05	0.06	0.06	0.06
Durham	0.44	0.51	0.58	0.62	0.66
Franklin	0.08	0.10	0.11	0.12	0.12
Granville	0.10	0.12	0.13	0.14	0.15
Johnston	0.26	0.30	0.34	0.36	0.39
Orange	0.12	0.14	0.16	0.17	0.18
Person	0.09	0.11	0.12	0.13	0.14
Wake	1.26	1.48	1.67	1.78	1.89
TOTAL	**2.39**	**2.81**	**3.17**	**3.38**	**3.59**

Table 4.2.3-8 Total VOC Emissions From Surface Cleaning and Degreasing

County	2005	2008	2011	2014	2017
Chatham	0.04	0.05	0.06	0.06	0.06
Durham	0.50	0.57	0.64	0.70	0.75
Franklin	0.10	0.12	0.13	0.14	0.14
Granville	0.11	0.13	0.14	0.16	0.17
Johnston	0.31	0.35	0.39	0.42	0.45
Orange	0.14	0.17	0.19	0.20	0.21
Person	0.09	0.12	0.13	0.14	0.15

Wake	1.45	1.70	1.90	2.04	2.17
TOTAL	**2.74**	**3.21**	**3.58**	**3.86**	**4.10**

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 solvent are typically 100% volatile and can constitute up to 6.5 pounds of VOC per gallon of cleaner or paint.

The EIIP methodology for estimating emissions from this source category recommends apportioning a national VOC emission estimate to the county level by the number of employees reported for NAISC code 811121. The national estimate of 79,429.59 tons of VOC per year was based on 1997 data. In order to estimate the emissions for 2004, the national VOC estimate provided by the EIIP Tech. Report was divided by the 1997 national employment data to create a per employee emission factor. See the calculation below:

National Emissions = 79,429.59 tons/year
National Employment = 205,172 employees

EF = (79,429.59)/(205,172) = 0.387 tons/employee/year

This emission factor was used with the 2004 employment data to estimate emissions from auto body refinishing. The employment data was obtained from the 2004 County Business Patterns[2] and is list in Table 4.2.4-1.

Table 4.2.4-1 Employment Values used for Auto Body Refinishing

County	# of Employees
Chatham	35
Durham	109
Franklin	15
Granville	39
Johnston	91
Orange	36
Person	31
Wake	574

According to the EIIP Tech. Report the activity days per week is 5 days. For the base year and future year inventories, the 2004 year emissions were grown using E-GAS 5.0 growth factors for SCC 2401005000 (Table 4.2.4-2).

Table 4.2.4-2 Growth Factors for Auto Body Refinishing

2005	2008	2011	2014	2017
1.026316	1.108746	1.185758	1.273607	1.348684

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 starting with the 2005 estimated emissions. The emissions for 2004 were calculated using equation 4.2.4-1 and the emissions for the base year and future years were calculated using equation 4.2.4-2.

$$EM = \frac{\text{Employees} \times EF}{(365 \text{ days/year}) \times (5 \text{ days/week}/\ 7 \text{ days/week})} \qquad 4.2.4\text{-}1$$

$$PJ_aEM = EM \times GF_a \times [1-RF] \qquad 4.2.4\text{-}2$$

where EM = emissions for source category
EF = emission factor for source category, 0.387 tons VOC/employee/yr
PJ_aEM = projected base year (a) or projected future year (a) emissions
GF_a = growth factor for base year or projected future year (a)
RF = USEPA's estimated reduction factor

Note that only part of Chatham County is nonattainment so the total county emissions were multiplied by 0.4322, which is the 2000 population fraction in the nonattainment area.

Examples of the emission calculation for Durham County are listed below:

Number of employees = 109
Emission factor = 0.387 tons VOC/employee/year
Projection factor for 2005 = 1.026316
Reduction factor = 0.37

From equation 4.2.3-1 and 4.2.3-2

$$VOC_{2004} = \frac{(109 \text{ employees}) \times (0.387 \text{ ton VOC/employee/yr})}{(365 \text{ days/year}) \times (5 \text{ days/week/ } 7 \text{ days/week})}$$

$$= 0.1618 \text{ tons VOC/day}$$

$$VOC_{2005} = 0.1618 \times 1.026316 \times [1-0.37]$$

$$= 0.10 \text{ tons VOC/day}$$

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

Table 4.2.4-3 VOC Emissions From Auto Body Refinishing

County	2005	2008	2011	2014	2017
Chatham	0.01	0.02	0.02	0.02	0.02
Durham	0.10	0.11	0.12	0.13	0.14
Franklin	0.01	0.02	0.02	0.02	0.02
Granville	0.04	0.04	0.04	0.05	0.05
Johnston	0.09	0.09	0.10	0.11	0.11
Orange	0.03	0.04	0.04	0.04	0.05
Person	0.03	0.03	0.03	0.04	0.04
Wake	0.55	0.60	0.64	0.68	0.72
TOTAL	**0.86**	**0.95**	**1.01**	**1.09**	**1.15**

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 data by a usage factor for either water or solvent based coatings, an emissions factor for either water or solvent based coatings, and a seasonal adjustment factor (SAF); then dividing by 365 days/year to get a daily number. This method entails gathering national architectural paint usage from the County Business industrial report MA325F and generating per capita usage factors. It is important to be able to differentiate between the water based usage from the solvent based usage since the emission factor for solvent based paints is over 5 times higher than water based paints.

SAF = ((3rd Quarter usage)*12 months)/((total usage)*3 months)

(For 2002) = (189,790,000 gal*12 months)/(718,664,000 gal*3 months) = 1.06

Emissions Factor: Water based = 0.74 lb VOC/gallon;
Solvent Based= 3.87 lb VOC/gallon

$VOC_{ai} = (POP_{ai}*UF_b*EF_b*SAF)/((365\ days/yr)*(2000lbs/ton))$ -- ton/day

Where:

	VOC_{ai}	=	VOC emissions for county (a) in year (i)
	POP_{ai}	=	Population for county (a) in year (i)
	EF_b	=	emission factor for paint type (b)
	SAF	=	Seasonal adjustment factor
	UF_b	=	Usage factor for paint type (b)

The usage factor is found by dividing the national total architectural surface coating quantities for either solvent or water-based coatings by the U.S. population for that year. For 2002, the usage factor for each paint type is estimated below:

UF solvent: (127,703,000 gallons of solvent based) / (287,973,924) = 0.443 gal./person
UF water : (589,527,000 gallons of water based) / (287,973,924) = 2.047 gal./person

The SAF and usage factor calculated for 2002 was assumed to remain constant in future years. Additionally, 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 starting with the 2005 estimated emissions. Examples of the emission calculations for Wake County are listed below:

Solvent Based Emission Factor = 3.87 lb VOC/gallon
Water Based Emission Factor = 0.74 lb VOC/gallon
Seasonal Adjustment Factor = 1.06
Future Control Factor = (1 - 0.25) or 0.75

For 2005:

$$VOC_{solvent} = \frac{(755{,}053\ \text{people}) \times (0.443\ \text{gal/person}) \times (3.87\ \text{lb VOC/gallon/yr}) \times (1.06) \times (0.75)}{(365\ \text{days/yr}) \times (2000\ \text{lb/ton})} = 1.41\ \text{tons VOC/day}$$

$$VOC_{water} = \frac{(755{,}053\ \text{people}) \times (2.047\ \text{gal/person}) \times (0.74\ \text{lb VOC/gallon/yr}) \times (1.06) \times (0.75)}{(365\ \text{days/yr}) \times (2000\ \text{lb/ton})} = 1.25\ \text{tons VOC/day}$$

$$VOC_{2005} = (1.41 + 1.25)\ \text{tons VOC/day} = 2.65\ \text{tons VOC/day}$$

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

Table 4.2.5-1 VOC Emissions From Architectural Coatings

County	2005	2008	2011	2014	2017
Chatham	0.09	0.09	0.10	0.10	0.11
Durham	0.85	0.89	0.93	0.96	1.00
Franklin	0.19	0.20	0.22	0.23	0.24
Granville	0.19	0.20	0.21	0.22	0.23
Johnston	0.51	0.56	0.61	0.66	0.72
Orange	0.43	0.45	0.47	0.48	0.50
Person	0.13	0.13	0.14	0.14	0.15
Wake	2.65	2.92	3.18	3.44	3.71
TOTAL	**5.04**	**5.44**	**5.86**	**6.23**	**6.66**

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 extent of emissions is largely a function of the paint being solvent or water based. The North Carolina Department of Transportation (NCDOT) utilizes three general types of paint, which can be classified as water based paint, epoxy paint containing organic solvents, and thermoplastic paint. The use of thermoplastic paint results in negligible VOC emissions and therefore is not included in the emissions inventory.

Although the NCDOT utilizes both water and solvent based paints, there is uncertainty with respect to what percentage of the paint used is organic solvent based. To avoid under estimating the emissions from this source category, it is assumed that all paint, excluding thermoplastic, is organic solvent based.

The NCDOT reported that 854,215 gallons of paint were used statewide in 2002. The gallons of paint by county were apportioned by number of lane miles in the county divided by the state total (Equation 4.2.6-1) and the estimated gallons used are listed in Table 4.2.6-1. The emission factors were obtained from the EIIP Tech. Report, Table-14.4-1 and Table-14.5-2, which gave emission factors as a function of gallons of paint (3.64 lb VOC/gal.). Additionally the EIIP Tech. Report stated that the activity days per week is 5 and the SAF is 1.3.

$$\text{Gallons Paint}_{County} = (\text{Gallons Paint}_{State}) \times \frac{(\text{\# Lane Miles})_{County}}{(\text{\# Lane Miles})_{State}} \qquad 4.2.6\text{-}1$$

Table 4.2.6-1 Traffic Marking Paint Usage

County	Lane Miles	Paint (gallons)
Chatham	949.09	11306.30
Durham	678.39	8081.51
Franklin	745.67	8883.00
Granville	756.42	9011.06
Johnston	1,62.50	18,613.72
Orange	762.64	9,085.16
Person	589.49	7,022.46
Wake	2,29.09	24,172.10
State Total	71,705.77	854,215.00

For the future years inventories, the base year emissions were grown using growth factors from the E-GAS 5.0 model and are listed in Table 4.2.6-2.

Table 4.2.6-2 Growth Factors for Traffic Marking Emissions

2005	2008	2011	2014	2017
1.0011	1.0246	1.0375	1.0327	1.0333

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 starting with the 2005 estimated emissions. The emissions for the base year and future years were calculated using equations 4.2.6-2 and 4.2.6-3, respectively.

$$EM_P = \frac{(\text{Paint used}) \times EF_P \times SAF}{(5\ \text{days/week}) \times (52\ \text{weeks/year}) \times (2000\ \text{lb/ton})} \qquad 4.2.6\text{-}2$$

$$PJ_bEM_a = EM_P \times GF_a \times [1\text{-}RF] \qquad 4.2.6\text{-}3$$

where EM_P = emissions for reported paint usage
EF_P = emission factor for reported paint usage
SAF = Seasonal adjustment factor, 1.3

PJ_bEM_a	=	projected future year (b) emissions for county in maintenance area (a)
GF_a	=	growth factor for maintenance area (a)
RF	=	Reduction Factor, 0.25

Examples of the emission calculation for Chatham County are listed below:

Gallons of paint used = 11,306.30 gallons/year
Emission factor for gallons = 3.64 lb VOC/gallon

Projection factor for 2005 = 1.0011
Reduction factor = [1 – 0.25] = 0.75
Chatham Partial County Adjustment Factor = 0.4322

From equation 4.2.6-1 and 4.2.6-2

$$VOC_{2002} = \frac{(11{,}306.30 \text{ gallons}) \times (3.64 \text{ lb VOC/gallon/year}) \times 1.3 \times 0.4322}{(5 \text{ days/wk}) \times (52 \text{ wks/yr}) \times (2000 \text{ lb/ton})}$$

$$= 0.044 \text{ tons VOC/day}$$

$$VOC_{2005} = 0.044 \times 1.0011 \times 0.75$$

$$= 0.033 \text{ tons VOC/day}$$

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

Table 4.2.6-3 VOC Emissions From Traffic Markings

County	2005	2008	2011	2014	2017
Chatham	0.03	0.33	0.34	0.35	0.35
Durham	0.06	0.06	0.06	0.06	0.06
Franklin	0.06	0.06	0.06	0.06	0.06
Granville	0.06	0.06	0.06	0.06	0.06
Johnston	0.13	0.13	0.13	0.13	0.13
Orange	0.06	0.06	0.06	0.06	0.06
Person	0.05	0.05	0.05	0.05	0.05
Wake	0.17	0.17	0.17	0.17	0.17
TOTAL	**0.62**	**0.92**	**0.93**	**0.94**	**0.94**

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, three of the industrial surface coating subcategories, namely other product coatings, high-performance maintenance, and other special purpose coatings, only utilized per capita emission factors and have no NAICS associated with them. The emission factors, obtained from the EIIP Tech. Report, Table 8.5-2, for these surface coating subcategories are listed in the Table 4.2.7-1 below.

Table 4.2.7-1 Per Capita Emission Factors For Industrial Surface Coating

Subcategory	Per Capita Factor (lb/yr/person)
Other product coatings	0.6
High-performance maintenance.	0.8
Other special purpose coatings	0.8

The emissions for the remaining industrial surface coating subcategories were estimated using per employee emission factors. These emission factors were obtained from the EIIP Tech. Report, Table 8.5-1 and are listed below in Table 4.2.7-2.

Table 4.2.7-2 Per Employee Emission Factors for Industrial Surface Coating

Subcategory	Per Employee Factor (lb VOC/employee/yr)
Furniture & Fixtures	944
Metal Containers	6,029
Automobile (new)	794
Machinery & Equipment	77
Appliances	463
Other Transportation Equipment	35
Sheet, strip & Coil	2,877
Factory Finished Wood	131
Electrical Insulation	290
Marine Coatings	308

The EIIP Tech. Report also listed SIC codes for these industrial surface coating subcategories. As stated earlier, the SIC codes were replaced in 1997 with NAICS. The employment data was estimated using the method outlined in Section 2.2. See Table 4.2.7-3 for the employment numbers used. Note that as a result of the NAICS to SIC employment conversion a fractional employment value may be generated. In these instances, the employment data was rounded to the nearest whole number.

Table 4.2.7-3 Employment Data for Surface Coating Subcategories

Subcategory	Chatham	Durham	Franklin	Granville	Johnston	Orange	Person	Wake
Furniture & Fixtures	16	24	4	14	69	101	13	273
Metal Containers	0	0	0	0	1	0	0	3
Automobile (new)	0	1	0	0	1	0	0	15
Machinery & Equipment	97	281	164	48	276	14	10	818
Appliances	0	0	0	0	1	0	0	6
Other Transportation Equipment	0	15	0	0	10	0	0	56
Sheet, strip & Coil	0	15	0	7	15	1	0	43
Factory Finished Wood	246	40	314	78	137	28	9	727
Electrical Insulation	75	3	0	0	0	0	0	3
Marine Coatings	0	6	0	0	35	3	0	20

According to the EIIP Tech. Report the activity days per week is 5 days. To estimate the future year emissions from the subcategories that used a per capita emission factor, the population growth factors were used (Table 2.2-2). For the subcategories that used an employment based emission factor, the future year inventories were grown using the E-GAS 5.0 growth factors from Table 4.2.7-4. The SCC's shown are the ones that appeared most appropriate for the particular category.

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

Subcategory & SCC	2005	2008	2011	2014	2017
Furniture and fixtures 2401020000	1.03025	1.06032	1.04503	1.21424	1.37188
Metal Containers 2401040000	1.03597	1.17266	1.30456	1.39808	1.49161
Automobiles (new) 2401070000	1.05065	1.21939	1.36443	1.50180	1.64146
Machinery and Equipment 2401055000	1.11728	1.53911	1.91696	2.10334	2.25274
Appliances 2401060000	1.02500	1.04375	1.02917	1.19687	1.35521
Other Transportation Equipment 2401085000	1.05442	1.19048	1.29252	1.44898	1.61224
Sheet, Strip, and Coil 2401045000	1.04390	1.18110	1.29268	1.42927	1.56829
Factory Finished Wood 2401015000	1.03371	1.13287	1.20575	1.29400	1.38671
Electrical Insulation 2401065000	1.02890	1.10737	1.15573	1.15762	1.14303
Marine Coatings 2401080000	1.00000	0.98723	0.98298	1.05957	1.13617

Federal rules are expected to reduce VOC emission from industrial surface coating operations in the future years with respect to the emission factors used. 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 2005 estimated 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%
High-Performance Maintenance	36%
Other Special Purpose Coatings	25%

The following equations demonstrate the calculation of the 2005 emissions for Wake County for the various categories:

Furniture and Fixtures

VOC_{2005} = (944 lb VOC/empl. yr)*(273 empl.)*(1/2000 ton/lb)*(1.03025 $EGAS_{05/04}$)*
(1/365 yr/day)*(7/5 day/wrk day)*(1-(30/100) ton/ton)
= 0.36 ton VOC/day

Metal Containers

VOC_{2005} = (6,029 lb VOC/empl. yr)*(3 empl.)*(1/2000 ton/lb)*
(1.03597 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.02 ton VOC/day

Automobiles (New)

VOC_{2005} = (794 lb VOC/empl. yr)*(15 empl.)*(1/2000 ton/lb)*
(1.05065 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.02 ton VOC/day

Machinery & Equipment

VOC_{2005} = (77 lb VOC/empl. yr)*(818 empl.)*(1/2000 ton/lb)*
(1.11728 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.09 ton VOC/day

Appliances

$$VOC_{2005} = (463 \text{ lb VOC/empl. yr})*(6 \text{ empl.})*(1/2000 \text{ ton/lb})*(1.02500 \text{ } EGAS_{05/04})*(1/365 \text{ yr/day})*(7/5 \text{ day/wrk day})*(1-(36/100) \text{ ton/ton}) = 0.00 \text{ ton VOC/day}$$

Other Transportation Equipment (Railroad)

$$VOC_{2005} = (35 \text{ lb VOC/empl. yr})*(6 \text{ empl.})*(1/2000 \text{ ton/lb})*(1.05442 \text{ } EGAS_{05/04})*(1/365 \text{ yr/day})*(7/5 \text{ day/wrk day})*(1-(36/100) \text{ ton/ton}) = 0.00 \text{ ton VOC/day}$$

Sheet, Strip, & Coil

$$VOC_{2005} = (2{,}877 \text{ lb VOC/empl. yr})*(43 \text{ empl.})*(1/2000 \text{ ton/lb})*(1.04390 \text{ } EGAS_{05/04})*(1/365 \text{ yr/day})*(7/5 \text{ day/wrk day})*(1-(36/100) \text{ ton/ton}) = 0.16 \text{ ton VOC/day}$$

Factory Finished Wood

$$VOC_{2005} = (131 \text{ lb VOC/empl. yr})*(727 \text{ empl.})*(1/2000 \text{ ton/lb})*(1.03371 \text{ } EGAS_{05/04})*(1/365 \text{ yr/day})*(7/5 \text{ day/wrk day})*(1-(36/100) \text{ ton/ton}) = 0.12 \text{ ton VOC/day}$$

Electrical Insulation

$$VOC_{2005} = (290 \text{ lb VOC/empl. yr})*(3 \text{ empl.})*(1/2000 \text{ ton/lb})*(1.02890 \text{ } EGAS_{05/04})*(1/365 \text{ yr/day})*(7/5 \text{ day/wrk day})*(1-(36/100) \text{ ton/ton}) = 0.00 \text{ ton VOC/day}$$

Marine Coatings

$$VOC_{2005} = (308 \text{ lb VOC/empl. yr})*(20 \text{ empl.})*(1/2000 \text{ ton/lb})*(1.00000 \text{ } EGAS_{05/04})*(1/365 \text{ yr/day})*(7/5 \text{ day/wrk day})*(1-(24/100) \text{ ton/ton}) = 0.01 \text{ ton VOC/day}$$

Other Product Coatings

$$VOC_{2005} = (0.6 \text{ lb VOC/person yr})*(679{,}785 \text{ person})*(1/2000 \text{ ton/lb})*(1.1107 \text{ } pop_{05/04})*(1/365 \text{ yr/day})*(7/5 \text{ day/wrk day})*(1-(25/100) \text{ ton/ton}) = 0.65 \text{ ton VOC/day}$$

High-Performance Maintenance Coatings

$$VOC_{2005} = (0.8 \text{ lb VOC/person yr})*(679{,}785 \text{ person})*(1/2000 \text{ ton/lb})*(1.1107 \text{ } pop_{05/04})*(1/365 \text{ yr/day})*(7/5 \text{ day/wrk day})*(1-(36/100) \text{ ton/ton}) = 0.74 \text{ ton VOC/day}$$

Other Special Purpose Coatings

$$VOC_{2005} = (0.8 \text{ lb VOC/person yr})*(679{,}785 \text{ person})*(1/2000 \text{ ton/lb})*(1.1107 \text{ } pop_{05/04})*(1/365 \text{ yr/day})*(7/5 \text{ day/wrk day})*(1-(25/100) \text{ ton/ton}) = 0.87 \text{ ton VOC/day}$$

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. All Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.2.7-6 VOC Emissions From Furniture and Fixtures

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.03	0.03	0.03	0.04	0.04
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.02	0.02	0.02	0.02	0.02
Johnston	0.09	0.09	0.09	0.11	0.12
Orange	0.13	0.14	0.13	0.16	0.18
Person	0.02	0.02	0.02	0.02	0.02
Wake	0.36	0.37	0.36	0.42	0.47
TOTAL	0.67	0.69	0.67	0.79	0.87

Table 4.2.7-7 VOC Emissions From Metal Containers

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.03	0.03	0.03	0.03
TOTAL	0.03	0.04	0.04	0.04	0.04

Table 4.2.7-8 VOC Emissions From Automobiles (New)

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.02	0.02	0.02	0.02
TOTAL	0.02	0.02	0.02	0.02	0.02

Table 4.2.7-9 VOC Emissions From Machinery and Equipment

County	2005	2008	2011	2014	2017
Chatham	0.00	0.01	0.01	0.01	0.01
Durham	0.03	0.04	0.05	0.06	0.06
Franklin	0.02	0.02	0.03	0.03	0.03
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.03	0.04	0.05	0.05	0.06
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.09	0.12	0.15	0.16	0.17
TOTAL	0.18	0.24	0.30	0.32	0.34

Table 4.2.7-10 VOC Emissions From Appliances

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	0.00	0.00	0.00	0.00	0.00

Table 4.2.7-11 VOC Emissions From Other Transportation Equipment (Railroad)

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	0.00	0.00	0.00	0.00	0.00

Table 4.2.7-12 VOC Emissions From Sheet, Strip, and Coil

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.06	0.06	0.07	0.08	0.08
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.03	0.03	0.03	0.04	0.04
Johnston	0.06	0.06	0.07	0.08	0.08
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.16	0.18	0.20	0.22	0.24
TOTAL	0.31	0.33	0.37	0.42	0.44

Table 4.2.7-13 VOC Emissions From Factory Finished Wood

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.02
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.05	0.06	0.06	0.07	0.07
Granville	0.01	0.01	0.02	0.02	0.02
Johnston	0.02	0.02	0.03	0.03	0.03
Orange	0.00	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00

Wake	0.12	0.13	0.14	0.15	0.16
TOTAL	0.23	0.26	0.29	0.31	0.32

Table 4.2.7-14 VOC Emissions From Electrical Insulation

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	0.01	0.01	0.01	0.01	0.01

Table 4.2.7-15 VOC Emissions From Marine Coatings

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.02	0.02	0.02	0.02	0.02
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	0.03	0.03	0.03	0.03	0.03

Table 4.2.7-16 VOC Emissions From Other Product Coatings

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.03
Durham	0.21	0.22	0.23	0.24	0.25
Franklin	0.05	0.05	0.05	0.06	0.06
Granville	0.05	0.05	0.05	0.05	0.06
Johnston	0.13	0.14	0.15	0.16	0.18

Orange	0.11	0.11	0.11	0.12	0.12
Person	0.03	0.03	0.03	0.04	0.04
Wake	0.65	0.72	0.78	0.84	0.91
TOTAL	**1.25**	**1.34**	**1.42**	**1.53**	**1.65**

Table 4.2.7-17 VOC Emissions From High-performance Maintenance Coatings

County	2005	2008	2011	2014	2017
Chatham	0.02	0.03	0.03	0.03	0.03
Durham	0.24	0.25	0.26	0.27	0.28
Franklin	0.05	0.06	0.06	0.06	0.07
Granville	0.05	0.05	0.06	0.06	0.06
Johnston	0.14	0.16	0.17	0.19	0.20
Orange	0.12	0.12	0.13	0.13	0.14
Person	0.04	0.04	0.04	0.04	0.04
Wake	0.74	0.82	0.89	0.96	1.04
TOTAL	**1.40**	**1.53**	**1.64**	**1.74**	**1.86**

Table 4.2.7-18 VOC Emissions From Other Special Purpose Coatings

County	2005	2008	2011	2014	2017
Chatham	0.03	0.03	0.03	0.03	0.03
Durham	0.28	0.29	0.30	0.31	0.33
Franklin	0.06	0.07	0.07	0.08	0.08
Granville	0.06	0.06	0.07	0.07	0.07
Johnston	0.17	0.18	0.20	0.22	0.23
Orange	0.14	0.15	0.15	0.16	0.16
Person	0.04	0.04	0.05	0.05	0.05
Wake	0.87	0.96	1.04	1.13	1.22
TOTAL	**1.65**	**1.78**	**1.91**	**2.05**	**2.17**

Table 4.2.7-19 Total VOC Emissions From Industrial Surface Coatings

County	2005	2008	2011	2014	2017
Chatham	0.11	0.13	0.13	0.13	0.14
Durham	0.86	0.90	0.95	1.01	1.05
Franklin	0.24	0.27	0.28	0.31	0.32

Granville	0.23	0.23	0.26	0.27	0.28
Johnston	0.67	0.72	0.79	0.87	0.93
Orange	0.50	0.53	0.53	0.58	0.61
Person	0.13	0.13	0.14	0.15	0.15
Wake	3.04	3.36	3.62	3.94	4.27
TOTAL	5.78	6.27	6.70	7.26	7.75

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 districts and not on a county basis. District tonnage was allocated on a county basis by apportioning county paved mileage as reported in the NCDOT 2000 Highway Summary Report. However, the amount of emulsified asphalt used is not tracked by the NCDOT in any useable way. As a consequence, the NCDOT provided the following methodology to predict emulsified usage:

$$\text{Square Yd. of hot-mix} = \frac{(\text{Tons of Hot-mix}) \times (2000\ \text{lbs./Ton})}{(220\ \text{lbs/ Square Yd. of Hot-mix})} \qquad 4.2.8\text{-}1$$

$$\text{Gallons of Emulsified asphalt} = (\text{Sq. Yd. of hot-mix}) \times (0.08\ \text{gal./Sq. Yd. of hot-mix}) \qquad 4.2.8\text{-}2$$

The estimated tonnage of hot-mix asphalt used by a county and the resulting calculated gallons of emulsified asphalt used in 2002 are listed in Table 4.2.8-1.

Table 4.2.8-1 Tons and Gallons of Asphalt used for Paving

County	Tons of Hot-Mix Asphalt	Gallons of Emulsified Asphalt
Chatham	15,546	11,306
Durham	11,112	8,082
Franklin	12,214	8,883
Granville	12,390	9,011
Johnston	25,594	18,614
Orange	12,492	9,085
Person	9,656	7,022
Wake	33,237	24,172

The VOC emissions were calculated using the emissions factor for emulsified asphalt (9.2 lb VOC/barrel) and the number of gallons of emulsified asphalt per barrel (42 gal./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.

For future year inventories, the base year emissions were grown using factors from the E-GAS 5.0 model and are listed in Table 4.2.8-2.

Table 4.2.8-2 Growth Factors for Asphalt Paving Emissions

2005	2008	2011	2014	2017
1.0876	1.2018	1.3001	1.3936	1.4841

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.

$$EM = \frac{\text{(gallons Emulsified Asphalt)} \times EF \times SAF}{\text{(42 gal/barrel)} \times \text{(2000 lb/tons)} \times \text{(365 days/year)}} \qquad 4.2.8\text{-}3$$

$$PJ_bEM_a = EM \times GF_a \qquad 4.2.8\text{-}4$$

where EM = emissions for source category
EF = emission factor for source category
SAF = Seasonal adjustment factor, 1.33
PJ_bEM_a = projected future year (b) emissions for county in redesignation area (a)

GF_a = growth factor for redesignation area (a)

Examples of the emission calculation for Wake County are listed below:

Number of gallons of emulsified asphalt used = 24,172
Emission Factor = 9.2 lb VOC/barrel of asphalt
Seasonal adjustment factor = 1.33
Projection factor for 2005 = 1.0876

From Equation 4.2.8-3 and 4.2.8-4:

$$VOC_{2002} = \frac{(24{,}172\text{gallons}) \times (9.2 \text{ lb VOC/barrel of asphalt}) \times (1.33)}{(42 \text{ gal/barrel}) \times (2000 \text{ lb/ton}) \times (365 \text{ days/year})}$$
$$= 0.0096 \text{ tons VOC/day}$$

$$VOC_{2005} = 0.0160 \times 1.0876$$
$$= 0.0104 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from asphalt paving for the Triangle nonattainment area are listed in Table 4.2.8-3. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.2.8-3 VOC Emissions From Asphalt Paving

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.01
Granville	0.00	0.00	0.00	0.00	0.01
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.00	0.00	0.00	0.00	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.02**	**0.02**	**0.02**	**0.02**	**0.05**

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 amount of asphalt roofing activity is estimated by summing the number of felt, cap, and flashing squares used in North Carolina during the year 2000. This information was ascertained from the Asphalt Roofing Manufacturing Association. The amount of asphalt used is given by the Equation 4.2.9-1, which uses the default value of 20 lbs. of asphalt / square found in the EIIP Tech. Report. The emissions by county were apportioned by roofing establishments in the county divided by the state total (Equation 4.2.9-2), using the number of establishments from NAISC code 23561 from the 2000 County Business Patterns[2]. See Table 4.2.9-1 for the number of commercial establishments and the estimated tons of asphalt used for each county.

$$\text{Asphalt (Ton/yr)} = \frac{\text{(\# squares) x (20 lbs. of asphalt/square)}}{\text{(2000 lbs./ton)}} \qquad 4.2.9\text{-}1$$

$$\text{Asphalt}_{\text{County}} = \frac{(\text{Tons Asphalt}_{\text{State}}) \text{ x } (\text{\# Roofing Establishments})_{\text{County}}}{(\text{\# Roofing Establishments})_{\text{State}}} \qquad 4.2.9\text{-}2$$

Table 4.2.9-1 Number of Commercial Establishments & Tons of Asphalt Used

County	# Establishments	Tons of Asphalt
Chatham	3	16.65
Durham	19	105.46
Franklin	3	16.65
Granville	3	16.65
Johnston	28	155.42
Orange	11	61.06
Person	3	16.65
Wake	92	510.66
State Totals	973	5400.80

Asphalt roofing activities are assumed to have uniform operations throughout the year with a 5-day work week per the EIIP Tech. Report. Additionally, the EIIP Tech. Report reported the emissions factor as 6.2 lbs. VOC/ton asphalt for roofing operations. For future year inventories, 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 4.2.9-2 Growth Factors for Asphalt Roofing Emissions

2005	2008	2011	2014	2017

1.0876	1.2018	1.3001	1.3936	1.4841

The emissions for the base year and future year inventories were calculated using Equations 4.2.9-3 and 4.2.9-4, respectively.

$$EM = \frac{(\text{tons Asphalt}) \times EF}{(2000\ \text{lb/tons}) \times (5\ \text{days/week}) \times (52\ \text{weeks/year})} \qquad 4.2.9\text{-}3$$

$$PJ_bEM_a = EM \times GF_a \qquad 4.2.9\text{-}4$$

where EM = emissions for source category
EF = emission factor for source category
PJ_bEM_a = projected future year (b) emissions for county in redesignation area (a)
GF_a = growth factor for redesignation area (a)

Examples of the emission calculation for Wake County are listed below:

Number of Roofing Establishments in Wake County = 92
Number of Roofing Establishments in State = 973
Tons of Asphalt in State = 5400.8 tons/year
Emission Factor = 6.2 lb VOC/tons of asphalt
Growth Factor = 1.0876

From Equations 4.2.9-2

$$\text{Tons Asphalt}_{Wake} = \frac{(5400.8\ \text{tons/year}) \times (92\ \text{establishments})_{Wake}}{(973\ \text{establishments})_{State}} = 510.66\ \text{tons/year}$$

From Equation 4.2.9-3 and 4.2.9-4:

$$VOC_{2000} = \frac{(510.66\ \text{tons/year}) \times (6.2\ \text{lb VOC/ton of asphalt})}{(2000\ \text{lb/ton}) \times (5\ \text{days/week}) \times (52\ \text{weeks/year})} = 0.0061\ \text{tons VOC/day}$$

$$VOC_{2005} = 0.0061 \times 1.0876 = 0.0066\ \text{tons VOC/day}$$

The VOC emission estimates, in tons/day, from asphalt roofing for the Triangle nonattainment area are listed in Table 4.2.9-3.

Table 4.2.9-3 VOC Emissions From Asphalt Roofing

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

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.

<u>Agricultural Pesticides</u>

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 occur 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 including the Triangle area counties.

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 reports 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.

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

where AI = active ingredient.

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

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

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

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
Soybeans			***Corn Silage***		
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
Cotton			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	***Corn Grain***		
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
Tobacco			Thiocarb	90	0.6
Acephate	70	1.5	Methomyl	50	0.45
Spinosad	13	0.05	***Oats***		
Methomyl	11	0.45	M Parathion	5	0.5
Endosulfan	7	1	***Wheat***		
Imidacolopri d	62	0.03	M Parathion	5	0.5
Chloropicrin	41	79.8	***Sweet Potatoes***		
Dichloropropene	35	89.5	Napropamide	50	1.5
Clomazone	75	1	Clomazone	25	0.87
Metalaxyl	49	0.76	Fluazifop	20	0.17
Barley			Carbaryl	25	0.67
M Parathion	0.8	0.5	***Peanuts***		
Irish Potatoes			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
Sorghum			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, p 9.5-4, which relates active ingredients to VOC emissions. According to the EIIP Tech. Report, for every pound of active ingredient there are 2.45 pounds of VOC, of this 90% is evaporated. The emission factors for each crop were calculated using Equation 4.2.10-2, with an example calculation for soybean following.

$$EF_{CROP} = (\text{lb } AI_{CROP}/\text{acre}) \times (2.45 \text{ lb. VOC/lb. of AI}) \times (0.90) \qquad 4.2.10\text{-}2$$

Where EF_{CROP} = Emission factor in lbs. VOC/active ingredient for each crop
AI_{CROP} = Active ingredient for each crop

For soybeans the emission factor is:
Lbs. AI/acre for soybean = 0.844 lbs. AI/acre

$$EF_{SOYBEAN} = (0.844 \text{ lb active ingredient/acre}) \times (2.45 \text{ lb VOC/active ingredient}) \times (0.90)$$
$$= 1.861 \text{ lbs. VOC/acre}$$

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 pounds/acre for chloropicrin and 89.5 pounds/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 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		
- *Non-fumigant*	2.317	5.109
- *Fumigant*	64.043	64.043
Total Tobacco		69.152
Peanuts		
- *Non-fumigant*	2.9175	6.433
- *Fumigant*	0.128	0.282
Total Peanuts		6.715
Irish Potatoes	1.9350	4.267
Sorghum	0.0375	0.083

Table 4.2.10-3 Acres of Crops Planted

County	Cotton	Tobacco	Soybean	Wheat	Sweet Potato	Oats
Chatham	40	595	1,400	1,000	6	58
Durham	0	850	300	500	1	110
Franklin	300	3,490	13,900	4,900	1	960
Granville	0	4,595	2,600	2,700	1	110
Johnston	17,500	7,950	56,000	7,100	6,090	1,900
Orange	0	1,035	2,000	1,400	1	110
Person	0	3,260	6,000	5,300	1	110
Wake	250	5,910	9,400	3,200	900	1,260

Table 4.2.10-3 Acres of Crops Planted (continued)

County	Barley	Corn -Grain	Corn - Silage	Peanuts	Irish Potatoes	Sorghum
Chatham	50	1,100	1,300	0	7	25
Durham	66	125	150	0	18	69
Franklin	66	950	150	0	4,150	69
Granville	66	800	900	0	7	69
Johnston	36	7,800	58	9	7	73
Orange	300	700	2,200	0	13	69
Person	66	1,800	400	0	7	69
Wake	50	800	0	0	7	25

An SAF of 2.4 is applied to correct for the almost exclusive use of agricultural pesticides from April to August. For base year and future year inventories, the 2002 year emissions were projected using growth factors that were generated by the E-GAS 5.0 model. These growth factors are listed below.

Table 4.2.10-4 Growth Factors for Pesticide Application

2005	2008	2011	2014	2017
1.0980	1.2042	1.3042	1.3847	1.4622

The emissions for 2002 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.

$$EM_a = \frac{(\sum (CROP)_a \ x \ EF_{CROP}) \ x \ SAF}{(2000 \text{ lb/tons}) \ x \ (365 \text{ days/year})} \qquad 4.2.10\text{-}3$$

$$PJ_bEM_a = EM \ x \ GF_b \qquad 4.2.10\text{-}4$$

where EM_a = emissions for source category in county (a)
$CROP$ = acres of specific crop in county (a)
EF_{CROP} = emission factor for specific crop
SAF = Seasonal adjustment factor, 2.4
PJ_bEM_a = projected future year (b) emissions for county (a)
GF_b = growth factor for projected future year (b)

Examples of the emission calculation for Wake County are listed below:

Table 4.2.10-5 Wake County Data and Emission Factors for Sprayed Crops

Crop	Acres	Emission Factor (lbs. VOC/acre)
Cotton	250	4.999
Tobacco	5,910	146.32
Soybean	9,400	1.861
Wheat	3,200	0.055
Sweet Potato	900	2.578
Oats	1,260	0.055
Barley	50	0.009
Corn, Grain	800	3.947
Corn, Silage	0	3.947
Peanuts	0	6.164
Irish Potatoes	7	2.679
Sorghum	25	0.083

SAF = 2.4
Projection factor for 2005 = 1.0980

From Equation 4.2.10-3 and 4.2.10-4:

$$(\sum (CROP)_a \times EF_{CROP}) = [(250 \times 4.999) + (5{,}910 \times 146.32) + (9{,}400 \times 1.861) + (3{,}200 \times 0.055) + (900 \times 2.578) + (1{,}260 \times 0.055) + (50 \times 0.009) + (800 \times 3.947) + (0 \times 3.947) + (0 \times 6.164) + (7 \times 2.679) + (25 \times 0.083)]$$

$$= 889{,}238.7 \text{ lbs VOC/year}$$

$$VOC_{2002} = \frac{(889{,}238.7\text{lbs. VOC/year}) \times 2.4}{(2000 \text{ lb/ton}) \times (365 \text{ days/year})} = 2.92 \text{ ton VOC/day}$$

$$VOC_{2005} = 2.92 \times 1.0980 = 3.21 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from agricultural pesticides for the Triangle nonattainment area are listed in Table 4.2.10-6. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.2.10-6 VOC Emissions From Agricultural Pesticides

County	2005	2008	2011	2014	2017
Chatham	0.16	0.17	0.18	0.20	0.21
Durham	0.46	0.50	0.54	0.57	0.61
Franklin	2.02	2.22	2.40	2.55	2.69
Granville	2.47	2.71	2.93	3.11	3.29
Johnston	5.06	5.55	6.01	6.38	6.74
Orange	0.60	0.66	0.72	0.76	0.80
Person	1.79	1.97	2.13	2.26	2.39
Wake	3.21	3.52	3.81	4.05	4.28
TOTAL	**15.77**	**17.30**	**18.72**	**19.88**	**21.01**

Nonagricultural Pesticide

Nonagricultural pesticide applications are considered as part of the commercial/consumer solvent use emission factor and no longer a separate subcategory. Please refer to the next section.

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.

There are seven categories. They are named and their emission factors listed in Table 4.2.11-1 below.

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

Subcategory	lb VOC/yr/person.
All Coatings and Related Products	0.95
All FIFRA Related Products	1.78
Miscellaneous Products (Not Otherwise Covered)	0.07
Personal Care Products	2.32
Household Products	0.079
Automotive Aftermarket Products	1.36
Adhesives and Sealants	0.57

VOC emissions for this category is estimated by using nationally based per capita emissions factors. The county population values listed in Table 2.2-1 and the population growth factors listed in Table 2.2-2 were used to estimate the emissions from this source category.

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 2005 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.

$$EM = \frac{(Population_{2002}) \text{ x } EF}{(2000 \text{ lb/tons})} \qquad 4.2.11\text{-}1$$

$$PJ_bEM_a = EM \text{ x } GF_a \text{ x } [1 - RF] \text{ x } (1/365) \qquad 4.2.11\text{-}2$$

where
- EM = emissions for source category t/y
- EF = emission factor for source category
- PJ_bEM_a = projected future year (b) emissions for county in redesignation area (a)
- GF_a = growth factor for redesignation area (a)
- RF = Reduction factor, 25%

Examples of the emission calculation for Wake County for the “all coatings and related products” subcategory are listed below:

2002 Population in Wake County = 679,785
2005 Growth Factor for Wake County 1.1107
Emission Factor = 0.95 lb VOC/person/year
Reduction Factor = 0.25

From Equations 4.2.11-1

$$VOC_{2002} = \frac{(679{,}785 \text{ people}) \text{ x } (0.95 \text{ lb VOC/person year})}{(2000 \text{ lb/ton})}$$
$$= 322.8979 \text{ tons VOC/year}$$

$$VOC_{2005} = \frac{(322.8979 \text{t/y}) \text{ x } (1.1107\ GF_{2005/2002}) \text{ x } [1 - 0.25]}{(365 \text{ days/year})}$$
$$= 0.7369 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from commercial/consumer solvents subcategories for the Triangle nonattainment area are listed in Tables 4.2.11-2 through 4.2.11-8, and are totaled for this source category in Table 4.2.11-9.

Table 4.2.11-2 VOC Emissions From All Coatings and Related Products

County	2005	2008	2011	2014	2017
Chatham	0.02	0.03	0.03	0.03	0.03
Durham	0.24	0.25	0.26	0.27	0.28
Franklin	0.05	0.06	0.06	0.06	0.07
Granville	0.05	0.05	0.06	0.06	0.06
Johnston	0.14	0.16	0.17	0.18	0.2
Orange	0.12	0.12	0.13	0.13	0.14
Person	0.04	0.04	0.04	0.04	0.04
Wake	0.74	0.81	0.88	0.96	1.03
TOTAL	**1.40**	**1.52**	**1.63**	**1.73**	**1.85**

Table 4.2.11-3 VOC Emissions From All FIFRA Related Products

County	2005	2008	2011	2014	2017
Chatham	0.04	0.05	0.05	0.05	0.06
Durham	0.44	0.46	0.48	0.50	0.52
Franklin	0.10	0.11	0.11	0.12	0.13
Granville	0.10	0.10	0.11	0.11	0.12
Johnston	0.27	0.29	0.32	0.35	0.37
Orange	0.22	0.23	0.24	0.25	0.26
Person	0.07	0.07	0.07	0.07	0.08
Wake	1.38	1.52	1.66	1.79	1.93
TOTAL	**2.62**	**2.83**	**3.04**	**3.24**	**3.47**

Table 4.2.11-4 VOC Emissions From Miscellaneous Products (Not Otherwise Covered)

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.05	0.06	0.07	0.07	0.08
TOTAL	**0.09**	**0.10**	**0.11**	**0.11**	**0.12**

Table 4.2.11-5 VOC Emissions From Personal Care Products

County	2005	2008	2011	2014	2017
Chatham	0.06	0.06	0.06	0.07	0.07
Durham	0.58	0.60	0.63	0.65	0.68
Franklin	0.13	0.14	0.15	0.16	0.16
Granville	0.13	0.13	0.14	0.15	0.15
Johnston	0.35	0.38	0.42	0.45	0.49
Orange	0.29	0.30	0.31	0.33	0.34
Person	0.09	0.09	0.09	0.10	0.10
Wake	1.80	1.98	2.16	2.33	2.52
TOTAL	**3.43**	**3.68**	**3.96**	**4.24**	**4.51**

Table 4.2.11-6 VOC Emissions From Household Products

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.01	0.01
Granville	0.00	0.00	0.00	0.00	0.01
Johnston	0.01	0.01	0.01	0.02	0.02
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.06	0.07	0.07	0.08	0.09
TOTAL	**0.10**	**0.11**	**0.11**	**0.14**	**0.16**

Table 4.2.11-7 VOC Emissions From Automotive Aftermarket Products

County	2005	2008	2011	2014	2017
Chatham	0.03	0.04	0.04	0.04	0.04
Durham	0.34	0.35	0.37	0.38	0.40
Franklin	0.08	0.08	0.09	0.09	0.10
Granville	0.07	0.08	0.08	0.09	0.09
Johnston	0.20	0.22	0.24	0.26	0.28
Orange	0.17	0.18	0.18	0.19	0.20
Person	0.05	0.05	0.06	0.06	0.06
Wake	1.05	1.16	1.27	1.37	1.48
TOTAL	**1.99**	**2.16**	**2.33**	**2.48**	**2.65**

Table 4.2.11-8 VOC Emissions From Adhesives and Sealants

County	2005	2008	2011	2014	2017
Chatham	0.01	0.02	0.02	0.02	0.02
Durham	0.14	0.15	0.15	0.16	0.17
Franklin	0.03	0.03	0.04	0.04	0.04
Granville	0.03	0.03	0.03	0.04	0.04
Johnston	0.09	0.09	0.10	0.11	0.12
Orange	0.07	0.07	0.08	0.08	0.08
Person	0.02	0.02	0.02	0.02	0.02
Wake	0.44	0.49	0.53	0.57	0.62
TOTAL	**0.83**	**0.90**	**0.97**	**1.04**	**1.11**

Table 4.2.11-9 Total VOC Emissions From Commercial/Consumer Solvent

County	2005	2008	2011	2014	2017
Chatham	0.16	0.20	0.20	0.21	0.22
Durham	1.78	1.85	1.93	2.00	2.09
Franklin	0.39	0.42	0.45	0.48	0.51
Granville	0.38	0.39	0.42	0.45	0.47
Johnston	1.07	1.16	1.27	1.38	1.49
Orange	0.89	0.92	0.96	1.00	1.04
Person	0.27	0.27	0.28	0.29	0.30
Wake	5.52	6.09	6.64	7.17	7.75
TOTAL	**10.46**	**11.30**	**12.15**	**12.98**	**13.87**

4.3 BIOPROCESS EMISSION SOURCES

Bioprocess emission sources include those sources whose emissions result from biological processes (e.g., fermentations). Source categories include bakeries, breweries, wineries and distilleries. The methodology used to calculate the projected emissions from these sources are described in detail in each subsection.

4.3.1 Bakeries

Ethanol, a VOC, is a by-product of fermentation of bread dough. The ethanol emissions from large commercial bakeries are accounted for as point sources; however, ethanol emissions occur from grocery store bakery departments and small business bakeries not accounted for under the point source inventory.

The EIIP Tech. Report prescribes accounting for these emissions by the use of a per capita consumption factor of 70 pounds of bread per person per year and an emission factor of 0.5 pounds of VOC per 1000 pounds of baked bread. The county populations obtained from the 2002 Census (see Table 2.2-1) and growth factors from Table 2.2-2 were used to estimate the emissions from this source category.

According to the EIIP Tech. Report, emissions from this source category occur 365 days per year and therefore no seasonal adjustment required. For future year inventories, the projected future year population was multiplied by the emission factor. The emissions for the base year and future year inventories were calculated using Equation 4.3.1-1.

$$EM_f = \frac{(\text{Population})_b \times CF \times EF \times GF_{f/b}}{(2000 \text{ lb/tons}) \times (365 \text{ days/year})} \qquad 4.3.1\text{-}1$$

where EM_f = emissions for source category in future year
Population_b = Population in base year
$GF_{f/b}$ = Growth factor base to future
CF = Consumption factor, 70 lb bread/person/year
EF = emission factor for source category, 0.5 lb VOC/1000 lb bread baked

Examples of the emission calculation for Wake County are listed below:

2002 Population in Wake County = 679,785
Consumption factor = 70 lb bread/person/year

Emission Factor = 0.5 lb VOC/1000 lb bread baked = 0.0005 lb VOC/lb bread baked

From Equations 4.3.1-1

$$VOC_{2005} = \frac{(679{,}785 \text{ per})\text{x}(70 \text{ lb br/per year})\text{x}(0.0005 \text{ lb VOC/lb br})\text{x}(1.1107_{\ 2005/2002})}{(2000 \text{ lb/ton})\text{x}(365 \text{ days/year})}$$

$$= 0.0361 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from bakeries for the Triangle nonattainment area are listed in Table 4.3.1-1.

Table 4.3.1-1 VOC Emissions From Bakeries

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.04	0.04	0.04	0.05	0.05
TOTAL	**0.07**	**0.07**	**0.07**	**0.08**	**0.08**

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 orchard heaters. 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 2002 for each of these categories was ascertained from the North Carolina Division of Forest Resources (NCDFR) and are listed in Table 4.4.1-1.

Table 4.4.1-1 Acres of Land Burned by Fires

	Wild Fires	Prescribed	Total
Chatham	220.2	1067	1287.2
Durham	92.0	36	128.0
Franklin	138.8	198	336.8
Granville	121.7	267	388.7
Johnston	257.5	117	374.5
Orange	55.5	30	85.5
Person	155.7	167	322.7
Wake	107.3	53	160.3

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 AP42, Table 13.1-2, were used to estimate the emissions from forest burns. These factors are 0.108 tons VOC per acre burned and 0.018 tons nitrogen oxides (NOx) 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. The number of acres burned in 2002 provided by the NCDFR was used as an estimate of the number of acres burned in 2005. For the base year 2005 and future year inventories, it is assumed that the number of acres burned remains relatively constant and therefore the emissions do not change from year to year. The emissions for the 2005 year inventory were based on 2002 data and were calculated using Equation 4.4.1-1.

$$EM_P = \frac{(\text{\# acres burned}) \times EF_P}{(365 \text{ days/year})} \qquad 4.4.1\text{-}1$$

where EM_P = emissions for source category for pollutant (P)
EF_P = emission factor for pollutant (P)

Examples of the emission calculation for Wake County are listed below:

Number of acres burned in Wake County = 160.3
VOC Emission Factor = 0.108 tons VOC/acre burned
NOx emission factor = 0.018 tons NOx/acre burned

From Equations 4.4.1-1

$$VOC_{2005} = \frac{(160.3 \text{ acres burned}) \times (0.108 \text{ tons VOC/acre burned})}{(365 \text{ days/year})}$$

$$= 0.0474 \text{ tons VOC/day}$$

$$NOx_{2005} = \frac{(160.3 \text{ acres burned}) \times (0.018 \text{ tons NOx/acre burned})}{(365 \text{ days/year})}$$

$$= 0.0079 \text{ tons NOx/day}$$

The VOC and NOx emission estimates, in tons/day, from forest fires for the Triangle nonattainment area are listed in Table 4.4.1-2. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.1-2 Emissions from Forest Fires

County	VOC	NOx
Chatham	0.16	0.03
Durham	0.04	0.01
Franklin	0.10	0.02
Granville	0.12	0.02
Johnston	0.11	0.02
Orange	0.03	0.00
Person	0.10	0.02
Wake	0.05	0.01
TOTAL	**0.71**	**0.13**

4.4.2 Structure Fires

The U.S. Fire Administration (USFA) of the Department of Homeland Security maintains statistics on the number of fires per county. The number of fires per county for 2002 was derived from 2001 and 2002 population statistics and 2001 USFA fire statistics. The USFA fire statistics were obtained from the USFA website at http://www.usfa.fema.gov/safety/. As 2002 fire statistics were not available, a fires per person factor for 2001 was calculated and found to be equal to 0.00184 fires/person. The 2001 county population values were obtained from the North Carolina State Demographics website at http://demog.state.nc.us/. The 0.00184 fires per person was applied to the 2002 population for each county to determine the number of fires in each county for 2002. The population values are listed in Table 2.2-1 in Section 2.

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 pounds of VOC per ton burned and 1.4 pounds of NOx per ton burned. The loading factor is 1.15 tons of material burned per structural fire.

According to the EIIP Tech. Report, emissions from this source category occur 365 days per year and there is no seasonal adjustment required. Base year 2005 emissions and future year inventories were obtained by applying growth factors to 2002 emissions data. Growth factors were provided by the North Carolina Office of State Budget and Management and were based originally on 2000 census data. These growth factors are listed in Table 2.2-2, Population Growth Factors, of Section 2.2 above.

For future year inventories, the base year emissions were grown using the percent growth in population for each county (see Table 2.2-2). The emissions for the 2002 were calculated using Equation 4.4.2-1. Base year 2005 and future year inventories were calculated using Equation 4.4.2-2.

$$EM_P = \frac{(\text{2002 County population}) \times (FPP) \times (CF) \times (EF_P)}{(\text{2000 lb/tons}) \times (\text{365 days/year})} \qquad 4.4.2\text{-}1$$

$$PJ_aEM = EM_P \times GF_a \qquad 4.4.2\text{-}2$$

where EM_P = emissions for structure fires for pollutant (P)
FPP = fires per person in 2001, 0.00184 fires/person
CF = Conversion factor, 1.15 tons burned/structure fire
EF_P = emission factor for pollutant (P)
PJ_aEM = projected future year (a) emissions for county
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

2002 Wake Population = 679,785 persons
Fires per person in 2001 = 0.00184 fires/person
Conversion factor = 1.15 tons burned/structure fire
VOC Emission Factor = 11 lb VOC/tons burned
NOx Emission Factor = 1.4 lb NOx/ton burned
Growth Factor = 1.1107

From Equations 4.4.2-1 and 4.4.2-2

$$VOC_{2002} = \frac{(679{,}785) \times (\text{0.00184 fires/person}) \times (\text{1.15 tons burned/fire}) \times (\text{11 lb VOC/ton burned})}{(\text{2000 lb/ton}) \times (\text{365 days/year})}$$
$$= \text{0.0217 tons VOC/day}$$

$$VOC_{2005} = (\text{0.0017 tons VOC/day}) \times 0.9765$$

$= 0.0212$ tons VOC/day

$$NOx_{2002} = \frac{(679{,}785) \times (0.00184 \text{ fires/person}) \times (1.15 \text{ tons burned/fire}) \times (1.4 \text{ lb NOx/ton burned})}{(2000 \text{ lb/ton}) \times (365 \text{ days/year})}$$
$$= 0.0028 \text{ tons NOx/day}$$

$$NOx_{2005} = (0.002 \text{ tons NOx/day}) \times 0.9765$$
$$= 0.0027 \text{ tons NOx/day}$$

The VOC and NOx emission estimates, in tons/day, from structure fires for the Triangle nonattainment area are listed in Table 4.4.2-2 and Table 4.4.2-3.

Table 4.4.2-2 VOC Emissions From Structure Fire

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.01	0.01	0.01	0.01
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.03	0.03	0.03	0.03
TOTAL	**0.03**	**0.05**	**0.05**	**0.05**	**0.05**

Table 4.4.2-3 NOx Emissions From Structure Fire

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

4.4.3 Charbroiling

The commercial charbroiling of ground beef emits 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 ascertain the number of restaurants in each county in 2002 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 to calculate the number of charbroiling restaurants for Triangle nonattainment area counties. See Table 4.4.3-1 for the number of restaurants in each county surveyed and the percentage of charbroiling restaurants. The number of restaurants in the Triangle nonattainment area counties was as follows: 42 in Chatham County, 489 in Durham County, 33 in Franklin County, 74 in Granville County, 143 in Johnston County, 214 in Orange County, 34 in Person County, and 1242 in Wake County.

Table 4.4.3-1 Restaurants in Each County Surveyed

County	# Restaurants	% Charbroiling (as reported)
Davidson	215	--
Davie	62	--
Durham	489	8%
Forsyth	595	--
Granville	74	--
Guilford	937	13%
Wake	1310	19%
Average		**13%**

According to the EIIP Tech. Report, the average throughput of meat per restaurant with a charbroiler is 1160 pounds per week and the emissions factor is 3.94 pounds of VOC per 1000 pounds of meat. Emissions from this source category occur 365 days per year and therefore no seasonal adjustment required. For future year inventories, the base year emissions were projected using E-GAS 5.0 growth factors and are listed in Table 4.4.3-2.

Table 4.4.3-2 Growth Factors for Charbroiling

2005	2008	2011	2014	2017
1.0291	1.0688	1.1061	1.1352	1.1702

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

$$EM_a = \frac{\text{(\# Restaurants) x (\% Charbroiling) x (CF) x (EF)}}{\text{(2000 lb/tons) x (1 yr/52 wks)}} \quad 4.4.3\text{-}1$$

$$PJ_bEM_a = EM_a \text{ x } GF_{ab}\text{x (1 yr/365 days)} \quad 4.4.3\text{-}2$$

where EM_a = emissions for source category in county (a) ton/yr
CF = conversion factor, 1160 lb meat charbroiled/week
EF = emission factor, 3.94 lb VOC/1000 lb meat charbroiled
PJ_bEM = projected future year (b) emissions for county in redesignation area ton/year
GF_{ab} = growth factor for base year (a) to future year (b)

Examples of the emission calculation for Franklin County are listed below:

\# Restaurants in County = 33
% of restaurants charbroiling = 13%
Conversion factory = 1160 lb meat/week charbroiled
Emission factor = 3.94 lb VOC/1000 lb meat charbroiled = 0.00394lb VOC/lb meat
Projection factor for 2005 = 1.0291

From Equation 4.4.3-1 and 4.4.3-2:

$$VOC_{2002} = \frac{\text{(33 restaurants) x (0.13) x (1160 lb/week) x (0.00394 lb VOC/lb meat)}}{\text{(2000 lb/ton) x (1 yr/52weeks)}}$$
$$= 0.5098 \text{ ton VOC/year}$$

$$VOC_{2005} = 0.5098 \text{ x } 1.0291 \text{ x } (1/365)$$
$$= 0.0014 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from charbroiling for the Triangle nonattainment area are listed in Table 4.4.3-3. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.3-3 VOC Emissions From Charbroiling

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.05	0.06	0.06	0.06	0.06
TOTAL	**0.09**	**0.10**	**0.10**	**0.10**	**0.10**

4.4.4 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 pounds of MSW is generated per person per day and 0.64 pounds of yard trimmings are generated per person per day. Since it is illegal to burn within the corporate limits, the rural population was estimated by using the same percentage of rural population in each county as what was reported in the 2000 census. The 2000 total and rural population for each county are listed in Table 4.4.4-1. The year 2000 total and rural populations for each county was obtained from the North Carolina Office of State Budget and Management, State Data Center.

Table 4.4.4-1 2000 Total and Rural Populations

County	2000 Population Data		Estimated 2002 Rural Population
	Total	Rural	
Chatham	49,329	39,825	42,374
Durham	223,314	16,763	17,489
Franklin	47,260	43,137	46,023
Granville	48,498	31,802	33,806
Johnston	121,965	83,377	90,543
Orange	118,227	37,782	38,142
Person	35,623	26,131	26,953
Wake	627,846	74,679	80,857

The emission factors for open burning of MSW were obtained from AP42, Table 2.5-1, and are 30 pounds VOC per ton MSW burned and 6 pounds NOx per ton MSW burned. The emission factors for open burning of yard trimmings were obtained from AP42, Table 2.5-1 and EIIP Section 4.1.3, Table 16.4-7, and are 28 pounds VOC per ton yard trimmings burned and 6 pounds NOx per ton yard trimmings burned. Emissions from these source categories occur 365 days per year and therefore no seasonal adjustment required. For the base year and future year inventories, the 2002 year emissions were projected using the percent growth in the total county population. These growth factors are found in Table 2.2-2 in Section 2.2, above. The emissions for the year 2002 were calculated using Equation 4.4.4-1 and the base year and future year inventories were calculated using Equation 4.4.4-2.

$$EM_P = \frac{(\text{Rural Population in 2002}) \times (CF) \times (EF_P)}{(2000\ \text{lb/tons})} \qquad 4.4.4\text{-}1$$

$$PJ_aEM = EM_P \times GF_a \qquad 4.4.4\text{-}2$$

where EM_P = emissions for pollutant (P)
CF = conversion factor, 3.77 lb MSW/person/day
= 0.001885 ton MSW/person/day
EF_P = emission factor for pollutant (P)
PJ_aEM = projected future year (a) emissions for county
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

Rural Population in County in 2002 = 80,857
Conversion factor = 0.001885 ton MSW/person/day
VOC Emission factor = 30 lb VOC/ton MSW burned
NOx Emission factor = 6 lb NOx/ton MSW burned
Growth factor for 2005 = 1.1107

From Equation 4.4.4-1 and 4.4.4-2:

$$VOC_{2002} = \frac{(80{,}857\text{people}) \times (0.001885\ \text{ton MSW/person/day}) \times (30\ \text{lb VOC/ton MSW})}{(2000\ \text{lb/ton})}$$
$$= 2.29\ \text{ton VOC/day}$$

$$VOC_{2005} = 2.29\ \text{ton VOC/day} \times 1.1107$$
$$= 2.54\ \text{ton VOC/day}$$

$$NOx_{2002} = \frac{(80{,}857\text{people})\ \times\ (0.001885\text{ ton MSW/person/day})\ \times\ (6\text{ lb NOx/ton MSW})}{(2000\text{ lb/ton})}$$

$$= 0.46\text{ ton NOx/day}$$

$$NOx_{2005} = 0.46\text{ ton NOx/day} \times 1.1107$$

$$= 0.51\text{ tons NOx/day}$$

The VOC and NOx emission estimates, in tons/day, from the open burning of MSW and yard trimmings for the Triangle nonattainment area are listed in Table 4.4.4-2 through Table 4.4.4-5. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.4-2 VOC Emissions From MSW Burning

County	2005	2008	2011	2014	2017
Chatham	1.28	1.36	1.44	1.52	1.60
Durham	0.51	0.54	0.56	0.58	0.60
Franklin	1.40	1.49	1.59	1.68	1.79
Granville	0.99	1.04	1.09	1.14	1.19
Johnston	2.83	3.10	3.38	3.65	3.94
Orange	1.10	1.15	1.19	1.23	1.28
Person	0.77	0.79	0.82	0.84	0.87
Wake	2.54	2.80	3.05	3.29	3.55
TOTAL	**11.42**	**12.27**	**13.12**	**13.93**	**14.82**

Table 4.4.4-3 VOC Emissions From Burning of Yard Trimmings

County	2005	2008	2011	2014	2017
Chatham	0.20	0.22	0.23	0.24	0.25
Durham	0.08	0.08	0.09	0.09	0.10
Franklin	0.22	0.24	0.25	0.27	0.28
Granville	0.16	0.16	0.17	0.18	0.19
Johnston	0.45	0.49	0.54	0.58	0.62
Orange	0.17	0.18	0.19	0.20	0.20
Person	0.12	0.13	0.13	0.13	0.14
Wake	0.40	0.44	0.48	0.52	0.56
TOTAL	**1.80**	**1.94**	**2.08**	**2.21**	**2.34**

Table 4.4.4-4 NOx Emissions From MSW Burning

County	2005	2008	2011	2014	2017
Chatham	0.26	0.27	0.29	0.30	0.32
Durham	0.10	0.11	0.11	0.12	0.12
Franklin	0.28	0.30	0.32	0.34	0.36
Granville	0.20	0.21	0.22	0.23	0.24
Johnston	0.57	0.62	0.68	0.73	0.79
Orange	0.22	0.23	0.24	0.25	0.26
Person	0.15	0.16	0.16	0.17	0.17
Wake	0.51	0.56	0.61	0.66	0.71
TOTAL	**2.29**	**2.46**	**2.63**	**2.80**	**2.97**

Table 4.4.4-5 NOx Emissions From Burning of Yard Trimmings

County	2005	2008	2011	2014	2017
Chatham	0.04	0.05	0.05	0.05	0.05
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.05	0.05	0.05	0.06	0.06
Granville	0.03	0.04	0.04	0.04	0.04
Johnston	0.10	0.11	0.11	0.12	0.13
Orange	0.04	0.04	0.04	0.04	0.04
Person	0.03	0.03	0.03	0.03	0.03
Wake	0.09	0.10	0.10	0.11	0.12
TOTAL	**0.40**	**0.44**	**0.44**	**0.47**	**0.49**

4.4.5 Natural Gas, Liquid Petroleum Gas, Oil, Coal, and Wood Combustion

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

Fuel usage data for North Carolina for 2002 was taken from NC Energy Outlook 2003 by Global Insight, Inc. The following table shows the data used.

Table 4.4.5-1 Fuel Use in North Carolina 2002

Fuel	Units	Residential	Commercial	Industrial
NG	10^6 ft^3	64,014	40,580	95,718
LPG	gallons	282,775,596	47,960,199	198,606,965
Oil	gallons	215,804,019	113,088,933	343,414,390
Coal	tons	46,872	85,735	0
Wood	tons	1,625,111	164,327	8,583,778

Emission factors used are shown in Table 4.4.5-2 below.

Table 4.4.5-2 Combustion Emission Factors

Fuel	Units	Res VOC	Res NOx	Com VOC	Com NOx	Ind VOC	Ind NOx
NG	lb/10^6 ft^3	5.5	94	5.5	167.5	4.96	163.33
LPG	lb/gal	0.0003	0.014	0.00035	0.0145	0.00035	0.02
Oil	lb/gal	0.000713	0.018	0.000735	0.037	0.00024	0.039
Coal	lb/ton	0.07	9.1	0.07	15.8	0.07	14.9
Wood	lb/ton	107.6	2.6	0.255326	3.304224	0.255326	3.304224

Residential NG and LPG fuel usage for The Triangle nonattainment area counties 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 NG or LPG in a county to the total households in the State heated with NG or LPG. The number of households heated with NG or LPG was obtained from the 2000 Census and is shown in Table 4.4.5-3.

Table 4.4.5-3 Households Heated with NG or LPG

County	Natural Gas	LPG
Chatham	3,066	5,828
Durham	35,446	4,569
Franklin	497	6,071
Granville	2,756	4,249
Johnston	3,641	14,032
Orange	15,295	5,860
Person	2,716	3,648
Wake	100,902	17,686
North Carolina	757,777	394,275

Commercial and industrial fuel usage was apportioned according to the number of business establishments in the State and counties. The numbers were taken from 1997 (last year of SIC based statistics) County Business Patterns. Establishments with SICs from 50*xx* through 99*xx* were summed. The apportionment numbers are in Table 4.4.5-4 below.

Table 4.4.5-4 Commercial and Industrial Fuel Apportionment

County	Business Establishments
Chatham	645
Durham	4,448
Franklin	448
Granville	555
Johnston	1,626
Orange	2,193
Person	509
Wake	14,564
State	148,762

All emission were calculated and apportioned for 2002 annual basis, grown with E-GAS 5.0 factors (Table 4.4.5-5) and then adjusted for season (Residential and Commercial NG and LPG only) and day. Where point source emissions are indicated in Table 4.4.5-6, these were deducted from the 2002 annual number.

Table 4.4.5-5 Growth Factors for Fuel Combustion

Source Category	2005	2008	2011	2014	2017
Residential Fuel Combustion					
Natural Gas	1.0814	1.1627	1.2341	1.2837	1.3364
Liquid Petroleum Gas	0.9867	1.0435	1.0811	1.1222	1.1608
Commercial Fuel Combustion					
Natural Gas	1.0390	1.1237	1.2415	1.2943	1.3705
Liquid Petroleum Gas	1.0635	1.0455	1.0671	1.0771	1.0982
Oil	1.1711	1.2584	1.3240	1.3846	1.4441
Coal	1.0645	1.0426	1.0503	1.0458	1.0467
Wood	1.0000	1.0000	1.0000	1.0000	1.0000
Industrial Fuel Combustion					
Natural Gas	1.0776	1.1290	1.1746	1.1971	1.2438
Liquid Petroleum Gas	0.9900	1.0395	1.0699	1.1132	1.1620

Oil	0.9970	1.0148	1.0358	1.0937	1.1317

Table 4.4.5-6 Point Source Emissions for Fuel Combustion

County	Commercial Natural Gas		Industrial Fuel Oil		Industrial Natural Gas	
	NOx (tons/yr)	VOC (tons/yr)	NOx (tons/yr)	VOC (tons/yr)	NOx (tons/yr)	VOC (tons/yr)
Chatham	2.28	0.12	58.057	1.755	71.612	2.507
Durham	36.013	2.072	113.501	0.510	14.563	0.744
Franklin	0	0	0.4	0	0.14	0.007
Granville	0	0	0	0	12.123	0.661
Johnston	17.329	0.399	13.3	0.6	13.3	0.6
Orange	296.316	1.579	500.51	2.941	510.094	3.291
Person	0	0	0	0	26.682	1.746
Wake	51.86	2.594	13.361	0.673	71.931	2.771

Residential NG and LPG usage is influenced strongly by seasonal temperatures. During the summer months usage will be confined to cooking, heating water, and possibly heating clothes dryers. Commercial NG and LPG usage is also seasonal but less so. The North Carolina Utilities Commission provided data from the U.S. Department of Energy, Energy Information Administration giving monthly usage of natural gas by residential and commercial customers in North Carolina for 2002. It is assumed that LPG is used seasonally like NG. From this information July adjustment factors were calculated that adjust an average day to a summer day. For residential customers the factor is 0.2027 and for commercial it is 0.4425. Other fuel users were considered to have even fuel usage throughout the year.

It was assumed that during the summer months no residential oil, coal, or wood were used since these are normally used only for heating.

The following equation demonstrates the calculation of residential VOC emissions for Wake County from natural gas in 2005. All residential VOC and NOx emissions for NG and LPG were done in an analogous manner.

$$\begin{aligned} EM_{2005} &= (64{,}014 \cdot 10^6\ ft^3/yr)*(5.5\ lbVOC/10^6\ ft^3)*(1ton/2000\ lb)* \\ &\quad (100{,}902\ housholds/757{,}777\ households)*(1\ yr/365days)* \\ &\quad (0.2027\ July\ day/day)*(1.0814\ \ EGAS_{2005/2002}) \\ &= 0.0141\ tons\ VOC/day \end{aligned}$$

The VOC and NOx emission estimates, in tons/day, from residential fuel combustion for the Triangle nonattainment area are listed in Tables 4.4.5-7 and 4.4.5-8. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-7 VOC Emissions From NG and LPG Residential Fuel Combustion

County	2005	2008	2011	2014	2017
Natural Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.02	0.02	0.02	0.02
TOTAL	**0.01**	**0.03**	**0.03**	**0.03**	**0.03**
Liquid Petroleum Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Table 4.4.5-8 NOx Emissions From NG and LPG Residential Fuel Combustion

County	2005	2008	2011	2014	2017
Natural Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.08	0.09	0.10	0.10	0.10
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.04	0.04	0.04	0.04	0.05
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.24	0.26	0.27	0.29	0.30
TOTAL	**0.39**	**0.42**	**0.44**	**0.46**	**0.48**
Liquid Petroleum Gas					
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.02	0.02	0.02	0.02	0.02
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.04	0.04	0.04	0.04	0.05
Orange	0.02	0.02	0.02	0.02	0.02
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.05	0.05	0.05	0.06	0.06
TOTAL	**0.17**	**0.17**	**0.17**	**0.18**	**0.19**

The following equation demonstrates the calculation of commercial VOC emissions for Wake County from NG in 2005. All commercial VOC and NOx emissions for NG and LPG were done in an analogous manner.

$$EM_{2005} = ((40{,}580 * 10^6\ ft^3/yr) * (5.5\ lbVOC/10^6\ ft^3) * (1ton/2000\ lb) * (14{,}564\ bus./148{,}762\ bus.) - 2.594\ ton/year\ point\ adj.) * (1\ yr/365days) * (0.4425\ July\ day/day) * (1.0390\ EGAS_{2005/2002})$$

$$= 0.0106\ tons\ VOC/day\ \ 0.0049$$

The VOC and NOx emission estimates, in tons/day, from commercial fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-9 VOC Emissions From NG and LPG Commercial Fuel Combustion

County	2005	2008	2011	2014	2017
Natural Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
Liquid Petroleum Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Table 4.4.5-10 NOx Emissions From NG and LPG Commercial Fuel Combustion

County	2005	2008	2011	2014	2017
Natural Gas					
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.09	0.10	0.11	0.11	0.12
Franklin	0.01	0.01	0.02	0.02	0.02
Granville	0.02	0.02	0.02	0.02	0.02
Johnston	0.03	0.03	0.03	0.03	0.04
Orange	0.06	0.07	0.07	0.08	0.08
Person	0.01	0.02	0.02	0.02	0.02
Wake	0.36	0.39	0.43	0.45	0.47
TOTAL	**0.59**	**0.65**	**0.71**	**0.74**	**0.78**

Table 4.4.5-10 NOx Emissions From NG and LPG Commercial Fuel Combustion (cont.)

County	2005	2008	2011	2014	2017
Liquid Petroleum Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.04	0.04	0.04	0.04	0.05
TOTAL	**0.06**	**0.06**	**0.06**	**0.06**	**0.08**

The following equation demonstrates the calculation of commercial VOC emissions for Wake County from oil in 2005. All commercial VOC and NOx emissions for oil were done in an analogous manner.

$$
\begin{aligned}
EM_{2005} &= ((113088933 \text{ gal/yr})*(0.000735 \text{ lb VOC/gal})*(1\text{ton}/2000 \text{ lb})* \\
&\quad (14{,}564 \text{ bus.}/148{,}762 \text{ bus.}) - 0 \text{ ton/year point adj})*(1 \text{ yr}/365\text{days})* \\
&\quad (1.1711\ EGAS_{2005/2002}) \\
&= 0.0131 \text{ tons VOC/day}
\end{aligned}
$$

The VOC and NOx emission estimates, in tons/day, from commercial oil fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-11 VOC Emissions From Commercial Oil Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.02
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.03**

Table 4.4.5-12 NOx Emissions From Commercial Oil Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.02
Durham	0.20	0.22	0.23	0.24	0.25
Franklin	0.02	0.02	0.02	0.02	0.02
Granville	0.03	0.03	0.03	0.03	0.03
Johnston	0.06	0.07	0.07	0.07	0.08
Orange	0.10	0.11	0.11	0.12	0.12
Person	0.02	0.02	0.03	0.03	0.03
Wake	0.64	0.69	0.73	0.76	0.79
TOTAL	**1.08**	**1.17**	**1.23**	**1.28**	**1.34**

The following equation demonstrates the calculation of commercial NOx emissions for Wake County from coal in 2005. All commercial VOC and NOx emissions for coal were done in an analogous manner.

$$
\begin{aligned}
EM_{2005} &= ((85{,}735 \text{ ton/year})*(15.8 \text{ lb NOx/ton})*(1\text{ton}/2000 \text{ lb})* \\
&\quad (14{,}564 \text{ bus.}/148{,}762 \text{ bus.}) - 0 \text{ ton/year point adj})*(1 \text{ yr}/365\text{days})* \\
&\quad (1.0645\ \ EGAS_{2005/2002}) \\
&= 0.1934 \text{ tons NOx/day}
\end{aligned}
$$

The VOC and NOx emission estimates, in tons/day, from commercial coal fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-13 VOC Emissions From Commercial Coal Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00

TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Table 4.4.5-14 NOx Emissions From Commercial Coal Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.06	0.06	0.06	0.06	0.06
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.02	0.02	0.02	0.02	0.02
Orange	0.03	0.03	0.03	0.03	0.03
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.19	0.19	0.19	0.19	0.19
TOTAL	**0.33**	**0.33**	**0.33**	**0.33**	**0.33**

The following equation demonstrates the calculation of commercial NOx emissions for Wake County from wood in 2005. All commercial VOC and NOx emissions for wood were done in an analogous manner.

$$
\begin{aligned}
EM_{2005} &= ((164{,}327 \text{ ton/year})*(3.3042 \text{ lb NOx/ton})*(1\text{ton}/2000 \text{ lb})* \\
&\quad (14{,}564 \text{ bus.}/148{,}762 \text{ bus.}) - 0 \text{ ton/year point adj})*(1 \text{ yr}/365\text{days})* \\
&\quad (1.0000 \;\; EGAS_{2005/2002}) \\
&= 0.0728 \text{ tons NOx/day}
\end{aligned}
$$

The VOC and NOx emission estimates, in tons/day, from commercial wood fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-15 VOC Emissions From Commercial Wood Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00

Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

Table 4.4.5-16 NOx Emissions From Commercial Wood Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.07	0.07	0.07	0.07	0.07
TOTAL	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**

Industrial sources were calculated in a manner similar to commercial sources burning oil or coal. There were no industrial coal burning sources. It was decided to not report any industrial wood burning as it was thought that any such sources must be captured in the point source inventory.

The VOC and NOx emission estimates, in tons/day, from industrial fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-17 VOC Emissions From Industrial NG Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.06	0.06	0.07	0.07	0.07
TOTAL	**0.10**	**0.10**	**0.11**	**0.11**	**0.11**

Table 4.4.5-18 NOx Emissions From Industrial NG Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.67	0.70	0.73	0.75	0.78
Franklin	0.07	0.07	0.08	0.08	0.08
Granville	0.05	0.05	0.05	0.05	0.05
Johnston	0.21	0.22	0.23	0.23	0.24
Orange	0.28	0.30	0.31	0.31	0.33
Person	0.00	0.00	0.00	0.00	0.00
Wake	2.11	2.21	2.30	2.35	2.44
TOTAL	**3.39**	**3.55**	**3.70**	**3.77**	**3.92**

Table 4.4.5-19 VOC Emissions From Industrial LPG Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

Table 4.4.5-20 NOx Emissions From Industrial LPG Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.17	0.17	0.18	0.19	0.20
Franklin	0.02	0.02	0.02	0.02	0.02
Granville	0.02	0.02	0.02	0.02	0.02
Johnston	0.06	0.06	0.06	0.07	0.07
Orange	0.08	0.08	0.09	0.09	0.09
Person	0.02	0.02	0.02	0.02	0.02
Wake	0.53	0.55	0.57	0.59	0.62
TOTAL	**0.91**	**0.93**	**0.97**	**1.01**	**1.05**

Table 4.4.5-21 VOC Emissions From Industrial Oil Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

Table 4.4.5-22 NOx Emissions From Industrial Oil Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.56	0.57	0.59	0.62	0.64
Franklin	0.05	0.05	0.06	0.06	0.06
Granville	0.07	0.07	0.07	0.07	0.08
Johnston	0.20	0.20	0.20	0.22	0.22
Orange	0.24	0.25	0.25	0.27	0.28
Person	0.06	0.06	0.07	0.07	0.07
Wake	1.79	1.81	1.86	1.96	2.03
TOTAL	**2.97**	**3.01**	**3.10**	**3.27**	**3.38**

4.4.6 Vehicle Fires

Vehicle fire emissions within the nonattainment area are estimated by considering the estimated number vehicles burned in the Triangle 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, 1996.

The estimated number of vehicle fires was determined by apportioning a national fire statistic to a county level. The USFA of the Department of Homeland Security maintains national-level fire statistics. The number of fires nationwide in 2002 was 1,734,500 and was available from the USFA website at http://www.usfa.fema.gov/statistics/national/. The percentage of vehicle fires was applied to the national-level total number of fires. The number of national-level vehicle fires was then apportioned to a state-level. The ratio of North Carolina vehicle miles traveled (VMT) to U.S. VMT (92,894,000,000 VMT / 2,855,756,000,000 VMT) was applied to the number of national-level vehicle fires to obtain the number of North Carolina vehicle fires. The VMT statistics were obtained from the U.S. Department of Transportation, Federal Highway Administration website at http://www.fhwa.dot.gov/policy/ohim/hs02/vm2.htm. The number of state-level vehicle fires was then apportioned to a county level based on paved mile per county in 2002. Paved mile per county data was obtained from the NCDOT.

Using the above method, 2002 vehicle fire emissions were calculated. Base year 2005 emissions were calculated by applying growth factors to 2002 vehicle fire emissions data. For 2002, the estimated number of vehicle fires in the Triangle nonattainment area counties are listed in Table 4.4.6-1 below.

Table 4.4.6-1 Vehicle Fires in the Triangle Area Counties

County	Estimated Number of Vehicle Fires
Chatham	154
Durham	106
Franklin	114
Granville	123
Johnston	237
Orange	118
Person	96
Wake	310

The amount of vehicle material burned (the fuel loading) in a vehicle fire was estimated by assuming that an average vehicle has 500 pounds of components (.25 tons) that can burn in a fire, based on a 3,700 pounds average vehicle weight (CARB, 1995).

The emission factors were obtained from Table 2.5-1, Emission Factors for Open Burning of Municipal Refuse, of the USEPA's AP-42, Section 2.5 Open Burning, 1996. The emission factors are 32 pounds of VOC per ton burned and 4 pounds of NOx per ton burned.

The 2005 base year and the future year inventories were grown from the 2002 estimated emissions using growth factors generated by the E-GAS 5.0 model. These growth factors are listed in Table 4.4.6-2 below.

Table 4.4.6-2 Growth Factors for Vehicle Fires

2005	2008	2011	2014	2017
1.0541	1.1047	1.1538	1.2035	1.2538

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

$$EM_P = \frac{(\text{\# of Vehicle Fires per year}) \times (CF) \times (EF_P)}{(2000 \text{ lb/tons}) \times (365 \text{ days/year})} \qquad 4.4.6\text{-}1$$

$$PJ_aEM = EM_P \times GF_a \qquad 4.4.6\text{-}2$$

where EM_P = emissions for structure fires for pollutant (P)
CF = Conversion factor, 0.25 tons burned/vehicle fire
EF_P = emission factor for pollutant (P)
PJ_aEM = projected future year (a) emissions for county in nonattainment area
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

\# of Vehicle fires in Wake County = 310
Conversion factor = 0.25 tons burned/vehicle fire
VOC Emission Factor = 32 lb VOC/tons burned
NOx Emission Factor = 4 lb NOx/ton burned
Growth Factor $_{(2002\text{-}2005)}$) = 1.0541

From Equations 4.4.6-1 and 4.4.6-2

$$VOC_{2002} = \frac{(310 \text{ fires}) \times (0.25 \text{ tons burned/fire}) \times (32 \text{ lb VOC/ton burned})}{(2000 \text{ lb/ton}) \times (365 \text{ days/year})}$$
$$= 0.0034 \text{ tons VOC/day}$$

$$VOC_{2005} = (0.0034 \text{ tons VOC/day}) \times 1.0541$$
$$= 0.0036 \text{ tons VOC/day}$$

$$NOx_{2002} = \frac{(310 \text{ fires}) \times (0.25 \text{ tons burned/fire}) \times (4 \text{ lb VOC/ton burned})}{(2000 \text{ lb/ton}) \times (365 \text{ days/year})}$$

$$= 0.0004 \text{ tons NOx/day}$$

$$NOx_{2005} = (0.0004 \text{ tons NOx/day}) \times 1.0541$$

$$= 0.0004 \text{ tons NOx/day}$$

The VOC and NOx emission estimates, in tons/day, from vehicle fires for the Triangle nonattainment area are listed in Table 4.4.6-3 and Table 4.4.6-4.

Table 4.4.6-3 VOC Emissions From Vehicle Fires

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Table 4.4.6-4 NOx Emissions From Vehicle Fires

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

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 or 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, one forth 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 percent of the time. The yield of pollutant used, 11 pounds of VOC per ton of fuel consumed, is and 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.

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

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	Acres
Chatham	1000
Durham	500
Franklin	4900
Granville	2700
Johnston	7100
Orange	1400
Person	5300
Wake	3200

For the base year and future years inventories, the 2002 year emissions were grown using E-GAS 5.0 growth factors and are listed in Table 4.4.7-2 below. The emissions for 2002 were calculated using equation 4.4.7-1 and the emissions for the base year and future years were calculated using equation 4.4.7-2.

Table 4.4.7-2 Growth Factors for Agricultural Burning

2005	2008	2011	2014	2017
1.0980	1.2042	1.3042	1.3847	1.4622

$$EM = \frac{(\frac{1}{4} \times (\text{wheat acreage})) \times EF}{(2000 \text{ lb/ton}) \times (61 \text{ days/year})} \qquad 4.4.7\text{-}1$$

where EM = emissions for source category for VOC
EF = emission factor for VOC

$$PJ_aEM = EM \times GF_a \qquad 4.4.7\text{-}2$$

where EM = emissions for agricultural burning for VOC
PJ_aEM = projected future year (a) emissions for county in nonattainment area
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

Number of wheat acres in Wake County = 3200
VOC Emission Factor = 20.9 lbs. VOC/acre burned

From Equations 4.4.7-1

$$VOC_{2002} = \frac{(\frac{1}{4} \times (3200 \text{ acres burned})) \times (20.9 \text{ lbs. VOC/acre burned})}{(2000 \text{ lb/ton}) \times (61 \text{ days/year})}$$
$$= 0.137 \text{ tons VOC/day}$$

$$VOC_{2005} = (0.137 \text{ tons VOC/day}) \times 1.0980$$
$$= 0.150 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from agricultural burning for the Triangle nonattainment area are listed in Table 4.4.7-3. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.7-3 VOC Emissions From Agricultural Burning

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.03	0.03
Durham	0.02	0.03	0.03	0.03	0.03
Franklin	0.23	0.25	0.27	0.29	0.31
Granville	0.13	0.14	0.15	0.16	0.17
Johnston	0.33	0.37	0.40	0.42	0.44
Orange	0.07	0.07	0.08	0.08	0.09
Person	0.25	0.27	0.30	0.31	0.33
Wake	0.15	0.17	0.18	0.19	0.20
TOTAL	**1.20**	**1.32**	**1.43**	**1.51**	**1.60**

4.4.8 On Site Incineration

On site incineration occurs at industrial and commercial facilities. Normally these facilities would be captured in the point source inventory. Emissions from this source category have been included to account for any smaller facilities that may not be captured in the point source inventory.

Emissions are calculated and projected based on population of the county (Table 2.2-1 and Table 2.2-2). The emission factors are 8.556 lb VOC/ton waste and 2.5 lb NOx/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 2002 were calculated using equation 4.4.8-1 and the emissions for the base year and future years were calculated using equation 4.4.8-2.

$$EM_P = \frac{(2002\ \text{population}) \times (LF) \times (EF_P)}{(2000\ \text{lb/tons}) \times (365\ \text{days/year})} \qquad 4.4.8\text{-}1$$

$$PJ_aEM = EM_P \times GF_a \qquad 4.4.8\text{-}2$$

where EM_P = emissions for on site incineration for pollutant (P)
LF = Fuel loading Factory, 0.023 tons refuse burned/person/year
EF_P = emission factor for pollutant (P)
PJ_aEM = projected future year (a) emissions for county in nonattainment area
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

Population of Wake County = 679,785 people
Fuel loading factor = 0.023 tons refuse burned/person/year
VOC Emission Factor = 8.556 lb VOC/tons burned
NOx Emission Factor = 2.5 lb NOx/ton burned
Growth Factor $_{(2002\text{-}2005})$ = 1.1107

From Equations 4.4.8-1 and 4.4.8-2

$$VOC_{2002} = \frac{(679{,}785\ \text{people}) \times (0.023\ \text{tons refuse burned/person/yr}) \times (8.556\ \text{lb VOC/ton burned})}{(2000\ \text{lb/ton}) \times (365\ \text{days/year})}$$
$$= 0.183\ \text{tons VOC/day}$$

$$VOC_{2005} = (0.183\ \text{tons VOC/day}) \times 1.1107$$
$$= 0.203\ \text{tons VOC/day}$$

$$NOx_{2002} = \frac{(679{,}785\ \text{people}) \times (0.023\ \text{tons refuse burned/person/yr}) \times (2.5\ \text{lb NOx/ton burned})}{(2000\ \text{lb/ton}) \times (365\ \text{days/year})}$$

$$= 0.054\ \text{tons NOx/day}$$

$$NOx_{2005} = (0.054\ \text{tons NOx/day}) \times 1.1107$$
$$= 0.060\ \text{tons NOx/day}$$

The VOC and NOx emission estimates, in tons/day, from on-site incineration for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.8-1 VOC Emissions From Commercial On Site Incineration

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.07	0.07	0.07	0.07	0.08
Franklin	0.01	0.02	0.02	0.02	0.02
Granville	0.01	0.02	0.02	0.02	0.02
Johnston	0.04	0.04	0.05	0.05	0.05
Orange	0.03	0.03	0.04	0.04	0.04
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.20	0.22	0.24	0.26	0.28
TOTAL	**0.38**	**0.42**	**0.46**	**0.48**	**0.51**

Table 4.4.8-2 NOx Emissions From Commercial On Site Incineration

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.01	0.01
Granville	0.00	0.00	0.00	0.00	0.01
Johnston	0.01	0.01	0.01	0.01	0.02
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.06	0.07	0.07	0.08	0.08
TOTAL	**0.10**	**0.11**	**0.11**	**0.13**	**0.15**

Table 4.4.8-3 VOC Emissions From Industrial On Site Incineration

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.07	0.07	0.07	0.07	0.08
Franklin	0.01	0.02	0.02	0.02	0.02
Granville	0.01	0.02	0.02	0.02	0.02
Johnston	0.04	0.04	0.05	0.05	0.05
Orange	0.03	0.03	0.04	0.04	0.04
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.20	0.22	0.24	0.26	0.28
TOTAL	**0.38**	**0.42**	**0.46**	**0.48**	**0.51**

Table 4.4.8-4 NOx Emissions From Industrial On Site Incineration

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.01	0.01
Granville	0.00	0.00	0.00	0.00	0.01
Johnston	0.01	0.01	0.01	0.01	0.02
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.06	0.07	0.07	0.08	0.08
TOTAL	**0.10**	**0.11**	**0.11**	**0.13**	**0.15**

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 Triangle nonattainment area are summarized in the tables below. These emissions are in tons per day.

Table 4.6-1 Total Area Source VOC Emissions

County	2005	2008	2011	2014	2017
Chatham	2.47	2.96	3.10	3.24	3.38
Durham	7.46	7.82	8.20	8.57	8.96
Franklin	5.29	5.73	6.11	6.47	6.82
Granville	5.43	5.81	6.19	6.53	6.86
Johnston	12.52	13.60	14.72	15.70	16.69
Orange	5.23	5.49	5.71	5.95	6.21
Person	4.12	4.41	4.67	4.88	5.10
Wake	27.34	29.74	31.91	34.24	36.53
TOTAL	**69.86**	**75.56**	**80.61**	**85.58**	**90.55**

Table 4.6-2 Total Area Source NOx Emissions

County	2005	2008	2011	2014	2017
Chatham	0.37	0.39	0.41	0.42	0.45
Durham	2.04	2.13	2.22	2.30	2.38
Franklin	0.55	0.57	0.62	0.67	0.69
Granville	0.47	0.49	0.50	0.51	0.55
Johnston	1.35	1.43	1.50	1.59	1.73
Orange	1.15	1.21	1.24	1.29	1.34
Person	0.34	0.36	0.38	0.39	0.39
Wake	6.75	7.07	7.37	7.70	8.02
TOTAL	**13.02**	**13.65**	**14.24**	**14.87**	**15.55**

5.0 ADDITIONAL DATA

5.1 SIC TO NAICS CROSSWALK

U.S. Census Bureau

ECONOMIC CENSUS 1997

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 24: Lumber and wood products - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	24	Lumber and wood products	36,735	111,930,684	757,267	18,668,558
	241	Logging	13,533	13,625,734	83,212	2,014,254
	242	Sawmills and planing mills	6,270	32,750,181	178,575	4,477,618
	243	Millwork, plywood, and structural members	9,373	33,200,977	260,726	6,599,370
	244	Wood containers	2,922	4,332,491	49,580	936,731
	245	Wood buildings and mobile homes	1,028	13,179,370	91,234	2,362,873
	249	Miscellaneous wood products	3,609	14,841,931	93,940	2,277,712

N=Comparable data not available D=Withheld to avoid disclosure

SIC 24: Lumber and wood products - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
241	97/92		**Logging**	**13,533**	**13,625,734**	**83,212**	**2,014,254**
2411			Logging	13,533	13,625,734	83,212	2,014,254
0% of	113310	10	Logging	13,533	13,625,734	83,212	2,014,254
SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
242	97/92		**Sawmills and planing mills**	**6,270**	**32,750,181**	**178,575**	**4,477,618**
2421							

			Sawmills & planing mills, general	5,176	29,414,116	143,292	3,741,583
	100% of 321113	10	Sawmills (pt)	4,334	24,743,160	119,456	3,191,780
	74% of 321912	10	Cut stock, resawing lumber, & planing (pt)	761	4,447,045	22,105	515,145
	0% of 321918	10	Other millwork (including flooring) (pt)	5	19,285	91	2,695
	5% of 321999	10	All other miscellaneous wood product mfg (pt)	76	204,626	1,640	31,963
2426			Hardwood dimension & flooring mills	992	3,206,954	33,940	708,100
	24% of 321912	20	Cut stock, resawing lumber, & planing (pt)	619	1,455,914	17,109	357,168
	30% of 321918	20	Other millwork (including flooring) (pt)	127	1,368,123	10,521	235,924
	5% of 337215	10	Showcase, partition, shelving, & locker mfg (pt)	246	382,917	6,310	115,008
2429			Special product sawmills, n.e.c.	102	129,111	1,343	27,935
	0% of 321113	20	Sawmills (pt)	70	26,457	304	5,750
	2% of 321920	10	Wood container & pallet mfg (pt)	24	68,695	684	14,493
	1% of 321999	20	All other miscellaneous wood product mfg (pt)	8	33,959	355	7,692

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
243	9/32		**Millwork, plywood, and structural members**	**9,373**	**33,200,977**	**260,726**	**6,599,370**
2431			Millwork	2,745	12,013,383	92,259	2,344,586
	321911		Wood window & door mfg	1,409	8,896,734	64,771	1,714,686
	69% of 321918	30	Other millwork (including flooring) (pt)	1,336	3,116,649	27,488	629,900
2434			Wood kitchen cabinets	5,096	7,483,209	79,579	1,866,940
	82% of 337110	10	Wood kitchen cabinet & counter top mfg (pt)	5,096	7,483,209	79,579	1,866,940
2435			Hardwood veneer & plywood	332	2,856,487	22,151	525,887
	321211		Hardwood veneer & plywood mfg	332	2,856,487	22,151	525,887
2436			Softwood veneer & plywood	155	5,762,664	28,843	912,613
	321212		Softwood veneer & plywood mfg	155	5,762,664	28,843	912,613
2439			Structural wood members, n.e.c.	1,045	5,085,234	37,894	949,344
	0% of 321113	30	Sawmills (pt)	0	0	0	0
	321213		Engineered wood member (except truss) mfg	53	1,431,123	5,372	154,564
	321214		Truss mfg	992	3,654,111	32,522	794,780
	0% of 321912	30	Cut stock, resawing lumber, & planing (pt)	0	0	0	0

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)

244	97/92		**Wood containers**	**2,922**	**4,332,491**	**49,580**	**936,731**
2441			Nailed wood boxes & shook	318	405,966	4,885	108,629
	9% of 321920	20	Wood container & pallet mfg (pt)	318	405,966	4,885	108,629
2448			Wood pallets & skids	2,347	3,449,491	38,994	717,863
	77% of 321920	30	Wood container & pallet mfg (pt)	2,347	3,449,491	38,994	717,863
2449			Wood containers, n.e.c.	257	477,034	5,701	110,239
	11% of 321920	40	Wood container & pallet mfg (pt)	257	477,034	5,701	110,239

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
245	97/92		**Wood buildings and mobile homes**	**1,028**	**13,179,370**	**91,234**	**2,362,873**
2451			Mobile homes	319	10,167,746	68,269	1,788,646
	321991		Manufactured home (mobile home) mfg	319	10,167,746	68,269	1,788,646
2452			Prefabricated wood buildings	709	3,011,624	22,965	574,227
	321992		Prefabricated wood building mfg	709	3,011,624	22,965	574,227

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
249	97/92		**Miscellaneous wood products**	**3,609**	**14,841,931**	**93,940**	**2,277,712**
2491			Wood preserving	451	4,461,521	11,668	298,123
	321114		Wood preservation	451	4,461,521	11,668	298,123
2493			Reconstituted wood products	316	5,273,794	25,269	797,838
	321219		Reconstituted wood product mfg	316	5,273,794	25,269	797,838
2499			Wood products, n.e.c.	2,842	5,106,616	57,003	1,181,751
	1% of 321912	40	Cut stock, resawing lumber, & planing (pt)	20	73,251	549	12,847
	2% of 321920	50	Wood container & pallet mfg (pt)	49	65,184	870	18,727
	94% of 321999	30	All other miscellaneous wood product mfg (pt)	2,324	3,740,920	41,844	879,178
	0% of 332321	10	Metal window & door mfg (pt)	0	0	0	0
	15% of 339999	10	All other miscellaneous mfg (pt)	449	1,227,261	13,740	270,999

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
(Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu   Menu of all 2-digit SICs   Data in formats for downloading   PDF report

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 25: Furniture and fixtures - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	25	Furniture and fixtures	12,095	61,527,902	523,872	13,344,344
	251	Household furniture	5,609	26,334,791	265,115	5,861,109
	252	Office furniture	1,036	11,340,955	74,863	2,402,387
	253	Public building and related furniture	468	7,869,175	36,979	1,022,978
	254	Partitions and fixtures	3,751	10,637,959	101,925	2,899,667
	259	Miscellaneous furniture and fixtures	1,231	5,345,022	44,990	1,158,203

N=Comparable data not available D=Withheld to avoid disclosure

SIC 25: Furniture and fixtures - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
251	97/92		**Household furniture**	**5,609**	**26,334,791**	**265,115**	**5,861,109**
2511			Wood household furniture	3,035	10,940,684	123,368	2,587,446
	97% of 337122	10	Nonupholstered wood household furniture mfg (pt)	3,035	10,940,684	123,368	2,587,446
2512			Upholstered household furniture	1,095	8,034,017	85,258	1,930,167
	96% of 337121	10	Upholstered household furniture mfg (pt)	1,095	8,034,017	85,258	1,930,167
2514			Metal household furniture	420	2,422,853	22,835	503,957
	337124		Metal household furniture mfg	420	2,422,853	22,835	503,957

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
2515			Mattresses & bedsprings	742	4,067,225	24,673	643,390
	2% of 337121	20	Upholstered household furniture mfg (pt)	35	159,199	1,601	31,760
	337910		Mattress mfg	707	3,908,026	23,072	611,630
2517			Wood TV & radio cabinets	100	320,714	4,273	84,391
	337129		Wood television, radio, & sewing machine cabinet mfg	100	320,714	4,273	84,391
2519			Household furniture, n.e.c.	217	549,298	4,708	111,758
	337125		Household furniture (except wood & metal) mfg	217	549,298	4,708	111,758
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
252	97/92		**Office furniture**	**1,036**	**11,340,955**	**74,863**	**2,402,387**
2521			Wood office furniture	677	3,110,020	30,641	781,220
	337211		Wood office furniture mfg	677	3,110,020	30,641	781,220
2522			Office furniture, except wood	359	8,230,935	44,222	1,621,167
	337214		Office furniture (except wood) mfg	359	8,230,935	44,222	1,621,167
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
253	97/92		**Public building and related furniture**	**468**	**7,869,175**	**36,979**	**1,022,978**
2531			Public building & related furniture	468	7,869,175	36,979	1,022,978
	57% of 336360	30	Motor vehicle seating & interior trim mfg (pt)	184	6,060,320	20,784	610,043
	42% of 337127	10	Institutional furniture mfg (pt)	267	1,697,870	15,254	385,680
	9% of 339942	10	Lead pencil & art good mfg (pt)	17	110,985	941	27,255
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
254	97/92		**Partitions and fixtures**	**3,751**	**10,637,959**	**101,925**	**2,899,667**
2541			Wood partitions & fixtures	2,825	5,388,485	57,453	1,624,792
	10% of 337110	20	Wood kitchen cabinet & counter top mfg (pt)	812	938,353	9,785	254,585
	337212		Custom architectural woodwork & millwork mfg	1,105	2,197,493	24,363	715,011
	28% of 337215	20	Showcase, partition, shelving, & locker mfg (pt)	908	2,252,639	23,305	655,196
2542			Partitions & fixtures, except wood	926	5,249,474	44,472	1,274,875
	66% of 337215	30	Showcase, partition, shelving, & locker mfg (pt)	926	5,249,474	44,472	1,274,875
SIC	**NAICS**	**Pt**	**Description**	**Establish-**	**Value of Shipments**	**Paid**	**Annual payroll**

			ments	($1,000)	employees	($1,000)
259	97/92	**Miscellaneous furniture and fixtures**	**1,231**	**5,345,022**	**44,990**	**1,158,203**
2591		Drapery hardware, blinds, & shades	488	2,393,564	19,617	436,757
337920		Blind & shade mfg	488	2,393,564	19,617	436,757
2599		Furniture & fixtures, n.e.c.	743	2,951,458	25,373	721,446
57% of 337127 20		Institutional furniture mfg (pt)	727	2,305,770	22,448	605,971
4% of 339113 10		Surgical appliance & supplies mfg (pt)	16	645,688	2,925	115,475

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

(Drawbridge open.) Not comparable SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu Menu of all 2-digit SICs Data in formats for downloading PDF report

Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

Census 2000 | Subjects A to Z | Search | Product Catalog | Data Tools | FOIA | Quality | Privacy Policy | Policies | Contact Us | Home

USCENSUSBUREAU

Helping You Make Informed Decisions

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 33: Primary metal industries - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	33	Primary metal industries	6,275	188,774,795	692,175	26,829,622
	331	Blast furnace and basic steel products	954	77,532,783	217,679	10,059,589
	332	Iron and steel foundries	1,144	17,533,215	132,853	4,666,674
	333	Primary nonferrous metals	179	16,320,560	33,255	1,404,870
	334	Secondary nonferrous metals	256	6,977,168	13,479	468,021
	335	Nonferrous rolling and drawing	1,011	52,863,733	166,344	6,093,518
	336	Nonferrous foundries (castings)	1,676	11,598,177	94,496	2,897,629
	339	Miscellaneous primary metal products	1,055	5,949,159	34,069	1,239,321

N=Comparable data not available D=Withheld to avoid disclosure

SIC 33: Primary metal industries - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
331	97/92		**Blast furnace and basic steel products**	**954**	**77,532,783**	**217,679**	**10,059,589**
3312			Blast furnaces & steel mills	201	56,796,871	145,805	7,446,304
	25% of 324199	20	All other petroleum & coal products mfg (pt)	8	438,107	1,731	74,553
	99% of 331111	10	Iron & steel mills (pt)	193	56,358,764	144,074	7,371,751
3313			Electrometallurgical products	28	1,535,779	4,035	168,728

	331112		Electrometallurgical ferroalloy product mfg	24	1,409,834	3,724	156,946
	3% of 331492	10	Other nonferrous metal secondary smelting, refining, & alloying (	4	125,945	311	11,782
3315			Steel wire & related products	304	5,291,290	25,754	799,508
	331222		Steel wire drawing	273	4,920,798	23,489	733,281
	7% of 332618	10	Other fabricated wire product mfg (pt)	31	370,492	2,265	66,227
3316			Cold finishing of steel shapes	186	6,343,466	14,362	639,349
	331221		Cold-rolled steel shape mfg	186	6,343,466	14,362	639,349
3317			Steel pipe & tubes	235	7,565,377	27,723	1,005,700
	331210		Iron & steel pipes & tubes mfg from purchased steel	235	7,565,377	27,723	1,005,700
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
332	9/92		**Iron and steel foundries**	**1,144**	**17,533,215**	**132,853**	**4,666,674**
3321			Gray iron foundries	669	11,911,623	83,570	3,120,450
	97% of 331511	10	Iron foundries (pt)	669	11,911,623	83,570	3,120,450
3322			Malleable iron foundries	28	352,615	2,628	113,937
	3% of 331511	20	Iron foundries (pt)	28	352,615	2,628	113,937
3324			Steel investment foundries	159	2,341,737	22,673	669,452
	331512		Steel investment foundries	159	2,341,737	22,673	669,452
3325			Steel foundries, n.e.c.	288	2,927,240	23,982	762,835
	331513		Steel foundries (except investment)	288	2,927,240	23,982	762,835
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
333	9/92		**Primary nonferrous metals**	**179**	**16,320,560**	**33,255**	**1,404,870**
3331			Primary copper	16	6,540,441	7,360	287,382
	331411		Primary smelting & refining of copper	16	6,540,441	7,360	287,382
3334			Primary aluminum	21	6,224,610	15,763	707,402
	331312		Primary aluminum production	21	6,224,610	15,763	707,402
3339			Primary nonferrous metals, n.e.c.	142	3,555,509	10,132	410,086
	331419		Other nonferrous metal primary smelting & refining	142	3,555,509	10,132	410,086
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
334	9/92		**Secondary nonferrous metals**	**256**	**6,977,168**	**13,479**	**468,021**
3341			Secondary nonferrous metals	256	6,977,168	13,479	468,021

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	95% of 331314	10	Secondary smelting & alloying of aluminum (pt)	101	3,478,625	6,226	210,318
	85% of 331423	10	Secondary smelting, refining, & alloying of copper (pt)	24	1,082,052	1,768	69,988
	64% of 331492	20	Other nonferrous metal secondary smelting, refining, & alloying (	131	2,416,491	5,485	187,715
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
335	97/92		**Nonferrous rolling and drawing**	**1,011**	**52,863,733**	**166,344**	**6,093,518**
3351			Copper rolling & drawing	129	7,679,080	21,150	786,621
	331421		Copper rolling, drawing, & extruding	129	7,679,080	21,150	786,621
3353			Aluminum sheet, plate, & foil	70	13,755,566	25,111	1,199,382
	331315		Aluminum sheet, plate, & foil mfg	70	13,755,566	25,111	1,199,382
	0% of 332996	10	Fabricated pipe & pipe fitting mfg (pt)	0	0	0	0
3354			Aluminum extruded products	160	6,177,701	30,357	944,829
	331316		Aluminum extruded product mfg	160	6,177,701	30,357	944,829
3355			Aluminum rolling & drawing, n.e.c.	20	1,295,284	2,657	97,537
	78% of 331319	10	Other aluminum rolling & drawing (pt)	20	1,295,284	2,657	97,537
3356			Nonferrous rolling & drawing, n.e.c.	184	4,839,547	17,237	709,102
	66% of 331491	10	Other nonferrous metal rolling, drawing, & extruding (pt)	184	4,839,547	17,237	709,102
3357			Nonferrous wire drawing & insulating	448	19,116,555	69,832	2,356,047
	22% of 331319	20	Other aluminum rolling & drawing (pt)	16	361,323	1,649	46,377
	331422		Copper wire (except mechanical) drawing	36	1,029,653	4,692	131,549
	34% of 331491	20	Other nonferrous metal rolling, drawing, & extruding (pt)	83	2,475,702	8,635	280,606
	335921		Fiber optic cable mfg	38	2,767,017	8,589	364,654
	335929		Other communication & energy wire mfg	275	12,482,860	46,267	1,532,861
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
336	97/92		**Nonferrous foundries (castings)**	**1,676**	**11,598,177**	**94,496**	**2,897,629**
3363			Aluminum die-castings	318	3,791,717	27,717	906,108
	331521		Aluminum die-casting foundries	318	3,791,717	27,717	906,108
3364			Nonferrous die-casting, except aluminum	279	2,055,264	17,243	502,552
	331522		Nonferrous (except aluminum) die-casting foundries	279	2,055,264	17,243	502,552
3365			Aluminum foundries	626	3,937,406	34,098	1,013,843
	331524		Aluminum foundries (except die-casting)	626	3,937,406	34,098	1,013,843

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
3366			Copper foundries	312	854,704	8,909	260,340
	331525		Copper foundries (except die-casting)	312	854,704	8,909	260,340
3369			Nonferrous foundries, n.e.c.	141	959,086	6,529	214,786
	331528		Other nonferrous foundries (except die-casting)	141	959,086	6,529	214,786
339	97/92		**Miscellaneous primary metal products**	**1,055**	**5,949,159**	**34,069**	**1,239,321**
3398			Metal heat treating	808	3,485,459	22,674	802,930
	332811		Metal heat treating	808	3,485,459	22,674	802,930
3399			Primary metal products, n.e.c.	247	2,463,700	11,395	436,391
1% of	331111	20	Iron & steel mills (pt)	82	596,791	2,440	95,739
5% of	331314	20	Secondary smelting & alloying of aluminum (pt)	10	172,555	488	18,975
15% of	331423	20	Secondary smelting, refining, & alloying of copper (pt)	11	187,036	565	21,117
32% of	331492	30	Other nonferrous metal secondary smelting, refining, & alloying (	117	1,207,951	5,814	225,722
6% of	332618	20	Other fabricated wire product mfg (pt)	27	299,367	2,088	74,838

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
(Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu | Menu of all 2-digit SICs | Data in formats for downloading | PDF report

Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

Census 2000 | Subjects A to Z | Search | Product Catalog | Data Tools | FOIA | Quality | Privacy Policy | Policies | Contact Us | Home

USCENSUSBUREAU

Helping You Make Informed Decisions

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 34: Fabricated metal products - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	34	Fabricated metal products	37,985	231,704,012	1,549,494	50,904,372
	341	Metal cans and shipping containers	425	13,352,606	33,634	1,377,932
	342	Cutlery, handtools, and hardware	2,494	D	(100,000+)	D
	343	Plumbing and heating, except electric	662	8,671,083	49,165	1,501,147
	344	Fabricated structural metal products	13,959	65,206,295	459,789	14,111,998
	345	Screw machine products, bolts, etc.	3,785	16,460,738	133,399	4,573,452
	346	Metal forgings and stampings	3,625	44,832,778	267,958	10,486,353
	347	Metal services, n.e.c.	5,610	14,454,652	130,755	3,722,220
	348	Ordnance and accessories, n.e.c.	434	5,438,140	38,482	1,489,257
	349	Miscellaneous fabricated metal products	6,991	D	(100,000+)	D

N=Comparable data not available D=Withheld to avoid disclosure

SIC 34: Fabricated metal products - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
341	97/92		**Metal cans and shipping containers**	**425**	**13,352,606**	**33,634**	**1,377,932**
3411			Metal cans	274	12,042,011	27,316	1,185,705

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	332431		Metal can mfg	274	12,042,011	27,316	1,185,705
3412			Metal barrels, drums, & pails	151	1,310,595	6,318	192,227
	58% of 332439	10	Other metal container mfg (pt)	151	1,310,595	6,318	192,227
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
342	97/32		**Cutlery, handtools, and hardware**	**2,494**	**D**	**(100,000+)**	**D**
3421			Cutlery	164	2,198,365	11,129	357,283
	100% of 332211	10	Cutlery & flatware (except precious) mfg (pt)	164	2,198,365	11,129	357,283
3423			Hand & edge tools, n.e.c.	1,069	5,677,903	42,947	1,329,593
	86% of 332212	10	Hand & edge tool mfg (pt)	1,069	5,677,903	42,947	1,329,593
3425			Hand saws & saw blades	176	1,452,540	9,149	300,538
	332213		Saw blade & handsaw mfg	176	1,452,540	9,149	300,538
3429			Hardware, n.e.c.	1,085	D	(50k-99999)	D
	18% of 332439	20	Other metal container mfg (pt)	117	402,378	4,135	116,588
	96% of 332510	10	Hardware mfg (pt)	952	10,359,952	70,884	2,186,800
	D 332919	10	Other metal valve & pipe fitting mfg (pt)	16	D	(500-999)	D
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
343	97/32		**Plumbing and heating, except electric**	**662**	**8,671,083**	**49,165**	**1,501,147**
3431			Metal sanitary ware	88	1,575,505	9,994	280,462
	332998		Enameled iron & metal sanitary ware mfg	88	1,575,505	9,994	280,462
3432			Plumbing fittings & brass goods	121	3,708,187	16,676	510,498
	332913		Plumbing fixture fitting & trim mfg	116	3,590,128	16,202	499,675
	1% of 332999	20	All other miscellaneous fabricated metal product mfg (pt)	5	118,059	474	10,823
3433			Heating equipment, except electric	453	3,387,391	22,495	710,187
	91% of 333414	10	Heating equipment (except warm air furnaces) mfg (pt)	453	3,387,391	22,495	710,187
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
344	97/32		**Fabricated structural metal products**	**13,959**	**65,206,295**	**459,789**	**14,111,998**
3441			Fabricated structural metal	2,900	14,200,270	84,704	2,672,087
	87% of 332312	10	Fabricated structural metal mfg (pt)	2,900	14,200,270	84,704	2,672,087
3442			Metal doors, sash, & trim	1,384	9,876,049	72,970	1,896,135

	SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
96% of		332321	20	Metal window & door mfg (pt)	1,384	9,876,049	72,970	1,896,135
	3443			Fabricated plate work, boiler shops	2,130	11,463,395	87,038	2,886,191
		332313		Plate work mfg	1,035	2,806,913	25,453	797,131
		332410		Power boiler & heat exchanger mfg	472	3,849,100	27,542	946,401
		332420		Metal tank (heavy gauge) mfg	614	4,764,118	33,704	1,134,441
0% of		333415	10	AC & warm air heating & commercial/industrial refrig equip mfg (p	9	43,264	339	8,218
	3444			Sheet metal work	4,605	16,233,432	131,900	4,128,514
		332322		Sheet metal work mfg	4,479	15,957,992	129,826	4,068,484
12% of		332439	30	Other metal container mfg (pt)	126	275,440	2,074	60,030
	3446			Architectural metal work	1,744	3,536,413	30,960	875,174
88% of		332323	10	Ornamental & architectural metal work mfg (pt)	1,744	3,536,413	30,960	875,174
	3448			Prefabricated metal buildings	604	4,199,550	25,946	776,575
		332311		Prefabricated metal building & component mfg	604	4,199,550	25,946	776,575
	3449			Miscellaneous metal work	592	5,697,186	26,271	877,322
		332114		Custom roll forming	401	3,074,662	15,219	500,899
13% of		332312	20	Fabricated structural metal mfg (pt)	152	2,166,021	8,729	302,853
4% of		332321	30	Metal window & door mfg (pt)	33	364,564	1,974	64,115
2% of		332323	20	Ornamental & architectural metal work mfg (pt)	6	91,939	349	9,455
	SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
	345			**Screw machine products, bolts, etc.**	**3,785**	**16,460,738**	**133,399**	**4,573,452**
	3451			Screw machine products	2,745	8,326,077	80,404	2,634,075
		332721		Precision turned product mfg	2,745	8,326,077	80,404	2,634,075
	3452			Bolts, nuts, rivets, & washers	1,040	8,134,661	52,995	1,939,377
		332722		Bolt, nut, screw, rivet, & washer mfg	1,040	8,134,661	52,995	1,939,377
	SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
	346			**Metal forgings and stampings**	**3,625**	**44,832,778**	**267,958**	**10,486,353**
	3462			Iron & steel forgings	421	4,924,426	26,432	1,035,345
		332111		Iron & steel forging	421	4,924,426	26,432	1,035,345
	3463			Nonferrous forgings	84	1,858,708	9,129	366,879
		332112		Nonferrous forging	84	1,858,708	9,129	366,879
	3465			Automotive stampings	810	23,668,110	126,905	5,647,964

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	336370		Motor vehicle metal stamping	810	23,668,110	126,905	5,647,964
3466			Crowns & closures	67	969,982	4,682	167,443
	332115		Crown & closure mfg	67	969,982	4,682	167,443
3469			Metal stampings, n.e.c.	2,243	13,411,552	100,810	3,268,722
	332116		Metal stamping	2,166	12,041,638	93,086	3,039,459
	332214		Kitchen utensil, pot, & pan mfg	77	1,369,914	7,724	229,263
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
347	97/92		**Metal services, n.e.c.**	**5,610**	**14,454,652**	**130,755**	**3,722,220**
3471			Plating & polishing	3,404	5,979,405	74,640	2,089,261
	332813		Electroplating, plating, polishing, anodizing, & coloring	3,404	5,979,405	74,640	2,089,261
3479			Metal coating & allied services	2,206	8,475,247	56,115	1,632,959
	332812		Metal coating/engraving (exc jewelry/silverware)/allied services	2,156	8,460,896	55,904	1,628,585
0% of	339911	10	Jewelry (except costume) mfg (pt)	22	5,798	79	1,620
1% of	339912	10	Silverware & plated ware mfg (pt)	12	6,296	103	2,091
0% of	339914	10	Costume jewelry & novelty mfg (pt)	16	2,257	29	663
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
348	97/92		**Ordnance and accessories, n.e.c.**	**434**	**5,438,140**	**38,482**	**1,489,257**
3482			Small arms ammunition	113	938,818	6,863	242,068
	332992		Small arms ammunition mfg	113	938,818	6,863	242,068
3483			Ammunition, except small arms, n.e.c.	53	1,497,045	9,427	379,450
	332993		Ammunition (except small arms) mfg	53	1,497,045	9,427	379,450
3484			Small arms	198	1,251,792	9,907	320,614
	332994		Small arms mfg	198	1,251,792	9,907	320,614
3489			Ordnance & accessories, n.e.c.	70	1,750,485	12,285	547,125
	332995		Other ordnance & accessories mfg	70	1,750,485	12,285	547,125
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
349	97/92		**Miscellaneous fabricated metal products**	**6,991**	**D**	**(100,000+)**	**D**
3491			Industrial valves	538	8,699,300	53,459	1,904,134
	332911		Industrial valve mfg	538	8,699,300	53,459	1,904,134

3492		Fluid power valves & hose fittings	424	6,602,909	37,132	1,324,392
100% of	332912 10	Fluid power valve & hose fitting mfg (pt)	424	6,602,909	37,132	1,324,392
3493		Steel springs, except wire	129	761,711	5,381	174,467
	332611	Spring (heavy gauge) mfg	129	761,711	5,381	174,467
3494		Valves & pipe fittings, n.e.c.	245	2,827,380	18,216	576,136
94% of	332919 20	Other metal valve & pipe fitting mfg (pt)	222	2,753,397	17,652	558,712
1% of	332999 30	All other miscellaneous fabricated metal product mfg (pt)	23	73,983	564	17,424
3495		Wire springs	396	D	(10k-24999)	D
	332612	Spring (light gauge) mfg	394	2,481,151	18,798	564,372
D	334518 10	Watch, clock, & part mfg (pt)	2	D	(100-249)	D
3496		Miscellaneous fabricated wire products	1,253	4,587,656	41,821	1,025,279
87% of	332618 30	Other fabricated wire product mfg (pt)	1,253	4,587,656	41,821	1,025,279
3497		Metal foil & leaf	107	3,257,743	10,615	418,574
	322225	Laminated aluminum foil mfg for flexible packaging uses	43	1,546,143	4,967	211,497
16% of	332999 40	All other miscellaneous fabricated metal product mfg (pt)	64	1,711,600	5,648	207,077
3498		Fabricated pipe & fittings	856	4,024,999	29,364	870,291
100% of	332996 20	Fabricated pipe & pipe fitting mfg (pt)	856	4,024,999	29,364	870,291
3499		Fabricated metal products, n.e.c.	3,043	D	(50k-99999)	D
	332117	Powder metallurgy part mfg	128	1,317,301	10,760	367,623
12% of	332439 40	Other metal container mfg (pt)	98	273,541	2,331	70,293
4% of	332510 20	Hardware mfg (pt)	58	435,815	3,401	93,516
D	332919 30	Other metal valve & pipe fitting mfg (pt)	7	D	(250-499)	D
72% of	332999 50	All other miscellaneous fabricated metal product mfg (pt)	2,592	7,558,137	63,736	1,870,813
2% of	337215 40	Showcase, partition, shelving, & locker mfg (pt)	78	123,057	1,295	35,369
4% of	339914 20	Costume jewelry & novelty mfg (pt)	82	49,953	568	10,912

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

(Drawbridge open.) Not comparable SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu Menu of all 2-digit SICs Data in formats for downloading PDF report

Source: 1997 Economic Census, Comparative Statistics

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 35: Industrial machinery and equipment - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	35	Industrial machinery and equipment	56,383	407,393,276	1,978,226	74,550,422
	351	Engines and turbines	390	D	(50k-99999)	D
	352	Farm and garden machinery	1,656	D	(50k-99999)	D
	353	Construction and related machinery	3,523	47,935,156	213,334	8,081,030
	354	Metalworking machinery	11,706	39,692,950	296,489	11,812,262
	355	Special industry machinery	4,781	D	(100,000+)	D
	356	General industrial machinery	4,479	44,080,890	265,359	9,752,818
	357	Computer and office equipment	2,181	D	(100,000+)	D
	358	Refrigeration and service machinery	2,277	39,317,539	204,675	6,800,658
	359	Industrial machinery, n.e.c.	25,390	38,647,841	368,481	12,360,014

N=Comparable data not available D=Withheld to avoid disclosure

SIC 35: Industrial machinery and equipment - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
351	97/92		**Engines and turbines**	**390**	**D**	**(50k-99999)**	**D**
3511			Turbines & turbine generator sets	86	5,783,057	19,529	910,316

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	333611		Turbine & turbine generator set unit mfg	86	5,783,057	19,529	910,316
3519			Internal combustion engines, n.e.c.	304	D	(50k-99999)	D
	D 333618	10	Other engine equipment mfg (pt)	297	D	(50k-99999)	D
	0% of 336399	10	All other motor vehicle parts mfg (pt)	7	123,954	896	24,247
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
352	9/32		**Farm and garden machinery**	**1,656**	**D**	**(50k-99999)**	**D**
3523			Farm machinery & equipment	1,508	D	(50k-99999)	D
	D 332212	20	Hand & edge tool mfg (pt)	1	D	(20-99)	D
	10% of 332323	30	Ornamental & architectural metal work mfg (pt)	140	380,152	3,082	86,294
	333111		Farm machinery & equipment mfg	1,339	15,921,455	66,370	2,370,599
	1% of 333922	10	Conveyor & conveying equipment mfg (pt)	28	33,377	320	6,663
3524			Lawn & garden equipment	148	D	(25k-49999)	D
	D 332212	30	Hand & edge tool mfg (pt)	3	D	(20-99)	D
	333112		Lawn & garden tractor & home lawn & garden equipment mfg	145	7,454,511	28,617	739,727
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
353	9/32		**Construction and related machinery**	**3,523**	**47,935,156**	**213,334**	**8,081,030**
3531			Construction machinery	897	24,117,413	87,607	3,374,527
	333120		Construction machinery mfg	785	21,965,455	74,965	2,998,967
	57% of 333923	10	Overhead traveling crane, hoist, & monorail system mfg (pt)	87	1,805,198	10,263	290,989
	4% of 336510	10	Railroad rolling stock mfg (pt)	25	346,760	2,379	84,571
3532			Mining machinery	292	2,710,923	13,547	486,496
	333131		Mining machinery & equipment mfg	292	2,710,923	13,547	486,496
3533			Oil field machinery	563	6,240,079	29,451	1,166,759
	333132		Oil & gas field machinery & equipment mfg	563	6,240,079	29,451	1,166,759
3534			Elevators & moving stairways	196	1,607,066	9,442	340,525
	333921		Elevator & moving stairway mfg	196	1,607,066	9,442	340,525
3535			Conveyors & conveying equipment	871	6,346,525	39,279	1,531,625
	100% of 333922	20	Conveyor & conveying equipment mfg (pt)	871	6,346,525	39,279	1,531,625
3536			Hoists, cranes, & monorails	220	1,340,561	7,751	278,899

	43% of 333923	20	Overhead traveling crane, hoist, & monorail system mfg (pt)	220	1,340,561	7,751	278,899
3537			Industrial trucks & tractors	484	5,572,589	26,257	902,199
	0% of 332439	50	Other metal container mfg (pt)	4	6,775	64	1,492
	0% of 332999	60	All other miscellaneous fabricated metal product mfg (pt)	19	27,488	240	6,939
	333924		Industrial truck, tractor, trailer, & stacker machinery mfg	461	5,538,326	25,953	893,768

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
354	9/92		**Metalworking machinery**	**11,706**	**39,692,950**	**296,489**	**11,812,262**
3541			Machine tools, metal cutting types	393	5,183,521	28,849	1,241,372
	97% of 333512	10	Machine tool (metal cutting types) mfg (pt)	393	5,183,521	28,849	1,241,372
3542			Machine tools, metal forming types	225	2,255,011	14,185	598,606
	333513		Machine tool (metal forming types) mfg	225	2,255,011	14,185	598,606
3543			Industrial patterns	673	623,927	7,959	285,038
	332997		Industrial pattern mfg	673	623,927	7,959	285,038
3544			Special dies, tools, jigs, & fixtures	7,275	13,361,490	128,770	5,318,715
	333511		Industrial mold mfg	2,529	5,116,635	48,657	2,088,950
	333514		Special die & tool, die set, jig, & fixture mfg	4,746	8,244,855	80,113	3,229,765
3545			Machine tool accessories	2,105	6,061,450	54,304	1,897,399
	11% of 332212	40	Hand & edge tool mfg (pt)	185	714,277	6,379	254,257
	333515		Cutting tool & machine tool accessory mfg	1,920	5,347,173	47,925	1,643,142
3546			Power-driven handtools	217	3,609,779	16,816	531,378
	333991		Power-driven handtool mfg	217	3,609,779	16,816	531,378
3547			Rolling mill machinery	100	700,084	4,149	167,312
	333516		Rolling mill machinery & equipment mfg	100	700,084	4,149	167,312
3548			Welding apparatus	244	4,433,877	22,434	915,152
	100% of 333992	10	Welding & soldering equipment mfg (pt)	244	4,433,877	22,434	915,152
	0% of 335311	10	Power, distribution, & specialty transformer mfg (pt)	0	0	0	0
3549			Metalworking machinery, n.e.c.	474	3,463,811	19,023	857,290
	333518		Other metalworking machinery mfg	474	3,463,811	19,023	857,290

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments	Paid employees	Annual payroll

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
					($1,000)		($1,000)
355			**Special industry machinery**	**4,781**	**D**	**(100,000+)**	**D**
3552			Textile machinery	478	1,779,034	13,600	449,014
	100% of 333292	10	Textile machinery mfg (pt)	478	1,779,034	13,600	449,014
3553			Woodworking machinery	327	1,321,752	9,117	302,233
	333210		Sawmill & woodworking machinery mfg	327	1,321,752	9,117	302,233
3554			Paper industries machinery	366	3,438,235	18,594	772,659
	333291		Paper industry machinery mfg	366	3,438,235	18,594	772,659
3555			Printing trades machinery	546	D	(10k-24999)	D
	D 333293	10	Printing machinery & equipment mfg (pt)	546	D	(10k-24999)	D
3556			Food products machinery	597	2,877,841	19,026	715,068
	333294		Food product machinery mfg	597	2,877,841	19,026	715,068
3559			Special industry machinery, n.e.c.	2,467	D	(100,000+)	D
	333220		Plastics & rubber industry machinery mfg	455	3,584,992	18,574	743,901
	333295		Semiconductor machinery mfg	257	11,158,627	40,087	1,701,669
	D 333298	10	All other industrial machinery mfg (pt)	1,677	D	(50k-99999)	D
	7% of 333319	10	Other commercial & service industry machinery mfg (pt)	78	644,019	2,890	96,069
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
356			**General industrial machinery**	**4,479**	**44,080,890**	**265,359**	**9,752,818**
3561			Pumps & pumping equipment	489	6,826,043	36,552	1,422,919
	100% of 333911	10	Pump & pumping equipment mfg (pt)	489	6,826,043	36,552	1,422,919
3562			Ball & roller bearings	185	6,120,940	36,991	1,386,126
	332991		Ball & roller bearing mfg	185	6,120,940	36,991	1,386,126
3563			Air & gas compressors	314	5,633,008	24,821	940,349
	333912		Air & gas compressor mfg	314	5,633,008	24,821	940,349
3564			Blowers & fans	574	4,075,925	29,906	902,298
	333411		Air purification equipment mfg	370	2,174,729	16,183	470,103
	333412		Industrial & commercial fan & blower mfg	204	1,901,196	13,723	432,195
3565			Packaging machinery	689	4,858,270	31,581	1,255,960
	333993		Packaging machinery mfg	689	4,858,270	31,581	1,255,960
3566			Speed changers, drives, & gears	268	2,402,392	16,231	597,248

	333612		Speed changer, industrial high-speed drive, & gear mfg	268	2,402,392	16,231	597,248
3567			Industrial furnaces & ovens	404	2,871,475	17,585	657,191
	333994		Industrial process furnace & oven mfg	404	2,871,475	17,585	657,191
3568			Power transmission equipment, n.e.c.	299	3,301,091	21,604	770,962
	333613		Mechanical power transmission equipment mfg	299	3,301,091	21,604	770,962
3569			General industrial machinery, n.e.c.	1,257	7,991,746	50,088	1,819,765
88% of	333999	10	All other miscellaneous general-purpose machinery mfg (pt)	1,257	7,991,746	50,088	1,819,765
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
357			**Computer and office equipment**	**2,181**	**D**	**(100,000+)**	**D**
3571			Electronic computers	563	66,331,909	100,115	4,282,451
	334111		Electronic computer mfg	563	66,331,909	100,115	4,282,451
3572			Computer storage devices	211	13,907,367	42,364	1,950,230
	334112		Computer storage device mfg	211	13,907,367	42,364	1,950,230
3575			Computer terminals	142	1,483,460	5,764	253,087
	334113		Computer terminal mfg	142	1,483,460	5,764	253,087
3577			Computer peripheral equipment, n.e.c.	1,006	25,130,308	87,253	4,337,970
93% of	334119	10	Other computer peripheral equipment mfg (pt)	1,006	25,130,308	87,253	4,337,970
3578			Calculating & accounting equipment	96	2,014,806	7,683	275,962
5% of	333313	10	Office machinery mfg (pt)	35	144,380	966	30,889
7% of	334119	20	Other computer peripheral equipment mfg (pt)	61	1,870,426	6,717	245,073
3579			Office machines, n.e.c.	163	D	(10k-24999)	D
96% of	333313	20	Office machinery mfg (pt)	134	3,047,549	13,865	427,315
D	334518	20	Watch, clock, & part mfg (pt)	16	D	(500-999)	D
21% of	339942	20	Lead pencil & art good mfg (pt)	13	257,020	1,234	30,572
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
358			**Refrigeration and service machinery**	**2,277**	**39,317,539**	**204,675**	**6,800,658**
3581			Automatic merchandising machines	121	1,325,960	8,178	215,627
	333311		Automatic vending machine mfg	121	1,325,960	8,178	215,627
3582							

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
			Commercial laundry equipment	68	604,966	4,523	136,783
	333312		Commercial laundry, drycleaning, & pressing machine mfg	68	604,966	4,523	136,783
3585			Refrigeration & heating equipment	852	28,473,461	140,978	4,736,239
	100% of 333415	20	AC & warm air heating & commercial/industrial refrig equip mfg (p	792	22,846,865	119,456	3,682,296
	336391		Motor vehicle air-conditioning mfg	60	5,626,596	21,522	1,053,943
3586			Measuring & dispensing pumps	71	1,316,899	6,824	251,438
	333913		Measuring & dispensing pump mfg	71	1,316,899	6,824	251,438
3589			Service industry machinery, n.e.c.	1,165	7,596,253	44,172	1,460,571
	81% of 333319	20	Other commercial & service industry machinery mfg (pt)	1,165	7,596,253	44,172	1,460,571
359	97/92		**Industrial machinery, n.e.c.**	**25,390**	**38,647,841**	**368,481**	**12,360,014**
3592			Carburetors, pistons, rings, & valves	141	2,755,311	17,518	672,786
	336311		Carburetor, piston, piston ring, & valve mfg	141	2,755,311	17,518	672,786
3593			Fluid power cylinders & actuators	320	3,528,906	23,062	900,438
	100% of 333995	10	Fluid power cylinder & actuator mfg (pt)	320	3,528,906	23,062	900,438
3594			Fluid power pumps & motors	170	2,712,058	15,482	605,485
	100% of 333996	10	Fluid power pump & motor mfg (pt)	170	2,712,058	15,482	605,485
3596			Scales & balances, except laboratory	122	682,940	4,871	148,755
	333997		Scale & balance (except laboratory) mfg	122	682,940	4,871	148,755
3599			Industrial machinery, n.e.c.	24,637	28,968,626	307,548	10,032,550
	332710		Machine shops	23,619	27,143,131	290,951	9,497,047
	5% of 332999	70	All other miscellaneous fabricated metal product mfg (pt)	132	506,611	4,199	136,429
	2% of 333319	30	Other commercial & service industry machinery mfg (pt)	50	172,536	1,335	35,719
	13% of 333999	20	All other miscellaneous general-purpose machinery mfg (pt)	836	1,146,348	11,063	363,355

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

(Drawbridge open.) Not comparable SIC sales or receipts cannot be estimated within 3% from NAICS data.

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 36: Electronic and other electric equipment - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	36	Electronic and other electric equipment	17,104	348,559,508	1,582,348	58,256,420
	361	Electric distribution equipment	901	12,325,326	67,929	2,276,264
	362	Electrical industrial apparatus	2,388	28,643,846	169,046	5,474,383
	363	Household appliances	356	D	(100,000+)	D
	364	Electric lighting and wiring equipment	2,106	26,197,139	158,615	4,888,856
	365	Household audio and video equipment	834	10,699,568	48,325	1,438,451
	366	Communications equipment	2,213	80,949,148	283,751	13,272,409
	367	Electronic components and accessories	6,605	141,997,578	611,693	22,958,642
	369	Miscellaneous electrical equipment and supplies	1,701	D	(100,000+)	D

N=Comparable data not available D=Withheld to avoid disclosure

SIC 36: Electronic and other electric equipment - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)

361		97/92	**Electric distribution equipment**	**901**	**12,325,326**	**67,929**	**2,276,264**
3612			Transformers	318	4,716,162	26,638	822,096
	100% of 335311	20	Power, distribution, & specialty transformer mfg (pt)	318	4,716,162	26,638	822,096
3613			Switchgear & switchboard apparatus	583	7,609,164	41,291	1,454,168
	335313		Switchgear & switchboard apparatus mfg	583	7,609,164	41,291	1,454,168
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
362		97/92	**Electrical industrial apparatus**	**2,388**	**28,643,846**	**169,046**	**5,474,383**
3621			Motors & generators	528	11,788,281	71,112	2,072,046
	96% of 335312	10	Motor & generator mfg (pt)	528	11,788,281	71,112	2,072,046
3624			Carbon & graphite products	126	2,254,410	10,887	407,987
	335991		Carbon & graphite product mfg	126	2,254,410	10,887	407,987
3625			Relays & industrial controls	1,321	11,762,789	68,365	2,429,039
	335314		Relay & industrial control mfg	1,321	11,762,789	68,365	2,429,039
3629			Electrical industrial apparatus, n.e.c.	413	2,838,366	18,682	565,311
	41% of 335999	10	All other miscellaneous electrical equipment & component mfg (pt)	413	2,838,366	18,682	565,311
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
363		97/92	**Household appliances**	**356**	**D**	**(100,000+)**	**D**
3631			Household cooking equipment	84	3,543,231	17,543	480,836
	335221		Household cooking appliance mfg	84	3,543,231	17,543	480,836
3632			Household refrigerators & freezers	27	4,887,364	24,597	801,717
	335222		Household refrigerator & home freezer mfg	27	4,887,364	24,597	801,717
3633			Household laundry equipment	17	3,723,375	14,801	480,076
	335224		Household laundry equipment mfg	17	3,723,375	14,801	480,076
3634			Electric housewares & fans	154	3,817,521	19,229	458,176
	9% of 333414	20	Heating equipment (except warm air furnaces) mfg (pt)	16	329,270	2,171	46,787
	335211		Electric housewares & household fan mfg	138	3,488,251	17,058	411,389
3635			Household vacuum cleaners	34	2,399,206	10,537	340,498
	100% of 335212	10	Household vacuum cleaner mfg (pt)	34	2,399,206	10,537	340,498
3639			Household appliances, n.e.c.	40	D	(10k-	D

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
						24999)	
	D 333298	20	All other industrial machinery mfg (pt)	4	D	(20-99)	D
	0% of 335212	20	Household vacuum cleaner mfg (pt)	0	0	0	0
	335228		Other major household appliance mfg	36	3,300,662	13,309	425,991
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
364		97/92	**Electric lighting and wiring equipment**	**2,106**	**26,197,139**	**158,615**	**4,888,856**
3641			Electric lamps	82	3,306,009	15,903	574,696
	335110		Electric lamp bulb & part mfg	82	3,306,009	15,903	574,696
3643			Current-carrying wiring devices	519	5,877,522	44,907	1,293,583
	335931		Current-carrying wiring device mfg	519	5,877,522	44,907	1,293,583
3644			Noncurrent-carrying wiring devices	219	4,451,186	23,540	787,075
	335932		Noncurrent-carrying wiring device mfg	219	4,451,186	23,540	787,075
3645			Residential lighting fixtures	497	2,177,355	16,395	406,444
	97% of 335121	20	Residential electric lighting fixture mfg (pt)	497	2,177,355	16,395	406,444
3646			Commercial lighting fixtures	356	4,047,437	23,090	657,341
	335122		Commercial/industrial/institutional electric lighting fixture mfg	356	4,047,437	23,090	657,341
3647			Vehicular lighting equipment	106	3,282,824	16,506	628,534
	336321		Vehicular lighting equipment mfg	106	3,282,824	16,506	628,534
3648			Lighting equipment, n.e.c.	327	3,054,806	18,274	541,183
	100% of 335129	10	Other lighting equipment mfg (pt)	327	3,054,806	18,274	541,183
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
365		97/92	**Household audio and video equipment**	**834**	**10,699,568**	**48,325**	**1,438,451**
3651			Household audio & video equipment	554	8,454,194	31,727	944,647
	334310		Audio & video equipment mfg	554	8,454,194	31,727	944,647
3652			Prerecorded records & tapes	280	2,245,374	16,598	493,804
	58% of 334612	10	Prerecorded CD (except software), tape, & record reproducing (pt)	280	2,245,374	16,598	493,804
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
366		97/92	**Communications equipment**	**2,213**	**80,949,148**	**283,751**	**13,272,409**
3661			Telephone & telegraph apparatus	625	39,673,619	110,408	5,591,933

	334210		Telephone apparatus mfg	598	38,300,044	104,262	5,329,203
	1% of 334416	10	Electronic coil, transformer, & other inductor mfg (pt)	7	8,904	63	1,836
	5% of 334418	10	Printed circuit assembly (electronic assembly) mfg (pt)	20	1,364,671	6,083	260,894
3663			Radio & TV communications equipment	1,091	37,042,241	148,156	6,765,352
	94% of 334220	10	Radio & TV broadcasting & wireless communications equipment mfg (	1,091	37,042,241	148,156	6,765,352
3669			Communications equipment, n.e.c.	497	4,233,288	25,187	915,124
	334290		Other communications equipment mfg	497	4,233,288	25,187	915,124
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
367	9/92		**Electronic components and accessories**	**6,605**	**141,997,578**	**611,693**	**22,958,642**
3671			Electron tubes	159	3,858,499	21,976	742,074
	334411		Electron tube mfg	159	3,858,499	21,976	742,074
3672			Printed circuit boards	1,401	9,787,576	76,702	2,313,578
	334412		Bare printed circuit board mfg	1,401	9,787,576	76,702	2,313,578
3674			Semiconductors & related devices	1,099	78,539,562	199,497	10,112,757
	334413		Semiconductor & related device mfg	1,099	78,539,562	199,497	10,112,757
3675			Electronic capacitors	129	2,482,163	18,882	531,259
	334414		Electronic capacitor mfg	129	2,482,163	18,882	531,259
3676			Electronic resistors	119	1,280,527	11,964	314,045
	334415		Electronic resistor mfg	119	1,280,527	11,964	314,045
3677			Electronic coils & transformers	426	1,512,232	19,178	450,160
	98% of 334416	20	Electronic coil, transformer, & other inductor mfg (pt)	426	1,512,232	19,178	450,160
3678			Electronic connectors	347	5,598,906	37,232	1,172,969
	334417		Electronic connector mfg	347	5,598,906	37,232	1,172,969
3679			Electronic components, n.e.c.	2,925	38,938,113	226,262	7,321,800
	6% of 334220	20	Radio & TV broadcasting & wireless communications equipment mfg (	126	2,265,873	16,305	606,528
	95% of 334418	20	Printed circuit assembly (electronic assembly) mfg (pt)	695	24,704,154	104,971	3,582,172
	334419		Other electronic component mfg	1,851	10,547,090	92,200	2,769,216
	8% of 336322	10	Other motor vehicle electrical & electronic equipment mfg (pt)	253	1,420,996	12,786	363,884
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**

369	97/92	**Miscellaneous electrical equipment and supplies**	1,701	D	(100,000+)	D
3691		Storage batteries	137	4,432,112	23,288	789,579
	335911	Storage battery mfg	137	4,432,112	23,288	789,579
3692		Primary batteries, dry & wet	45	2,322,896	8,917	281,467
	335912	Primary battery mfg	45	2,322,896	8,917	281,467
3694		Engine electrical equipment	569	9,074,335	52,216	1,642,014
	54% of 336322 20	Other motor vehicle electrical & electronic equipment mfg (pt)	569	9,074,335	52,216	1,642,014
3695		Magnetic & optical recording media	259	4,726,363	21,345	815,970
	334613	Magnetic & optical recording media mfg	259	4,726,363	21,345	815,970
3699		Electrical equipment & supplies, n.e.c.	691	D	(25k-49999)	D
	2% of 332212 50	Hand & edge tool mfg (pt)	4	140,811	424	32,361
	0% of 333292 20	Textile machinery mfg (pt)	0	0	0	0
	D 333293 20	Printing machinery & equipment mfg (pt)	5	D	(100-249)	D
	0% of 333314 10	Optical instrument & lens mfg (pt)	5	7,320	56	1,871
	0% of 333315 10	Photographic & photocopying equipment mfg (pt)	0	0	0	0
	10% of 333319 40	Other commercial & service industry machinery mfg (pt)	57	934,728	8,513	382,013
	3% of 333512 20	Machine tool (metal cutting types) mfg (pt)	8	151,363	522	27,050
	D 333618 20	Other engine equipment mfg (pt)	2	D	(1-19)	D
	0% of 333992 20	Welding & soldering equipment mfg (pt)	6	11,101	71	3,028
	0% of 334119 30	Other computer peripheral equipment mfg (pt)	0	0	0	0
	1% of 334510 10	Electromedical & electrotherapeutic apparatus mfg (pt)	11	52,855	542	20,770
	0% of 334511 10	Search, detection, navigation, & guidance instrument mfg (pt)	7	77,832	604	24,725
	1% of 334516 10	Analytical laboratory instrument mfg (pt)	10	36,473	159	7,518
	0% of 334519 10	Other measuring & controlling device mfg (pt)	5	6,174	29	1,621
	0% of 335129 20	Other lighting equipment mfg (pt)	4	859	8	180
	59% of 335999 20	All other miscellaneous electrical equipment & component mfg (pt)	567	4,051,267	26,072	923,183
	0% of 339114 10	Dental equipment & supplies mfg (pt)	0	0	0	0

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

(Drawbridge open.) Not comparable SIC sales or receipts cannot be estimated within 3% from NAICS data.

Data in formats for

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 37: Transportation equipment - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	37	Transportation equipment	12,387	515,881,602	1,561,662	68,298,623
	371	Motor vehicles and equipment	5,274	D	(100,000+)	D
	372	Aircraft and parts	1,711	98,963,996	411,247	20,703,396
	373	Ship and boat building and repairing	3,482	17,015,123	148,261	4,641,293
	374	Railroad equipment	207	7,916,635	31,633	1,234,564
	375	Motorcycles, bicycles, and parts	385	D	(10k-24999)	D
	376	Guided missiles, space vehicles, parts	99	18,929,257	76,808	4,500,660
	379	Miscellaneous transportation equipment	1,229	D	(50k-99999)	D

N=Comparable data not available D=Withheld to avoid disclosure

SIC 37: Transportation equipment - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
371		97/92	**Motor vehicles and equipment**	**5,274**	**D**	**(100,000+)**	**D**
3711			Motor vehicles & car bodies	472	D	(100,000+)	D
	336111		Automobile mfg	194	95,385,563	114,060	6,411,952
	336112		Light truck & utility vehicle mfg	112	110,400,169	94,033	5,361,980
	336120		Heavy duty truck mfg	84	14,490,344	28,214	1,212,651

	1% of 336211	10	Motor vehicle body mfg (pt)	76	82,633	404	10,503
	D 336992	10	Military armored vehicle, tank, & tank component mfg (pt)	6	D	(250-499)	D
3713			Truck & bus bodies	715	8,719,326	41,779	1,189,519
	96% of 336211	20	Motor vehicle body mfg (pt)	715	8,719,326	41,779	1,189,519
3714			Motor vehicle parts & accessories	3,609	120,951,593	490,657	19,565,925
	3% of 336211	30	Motor vehicle body mfg (pt)	23	265,552	1,201	40,558
	336312		Gasoline engine & engine parts mfg	881	25,974,369	81,368	3,555,964
	38% of 336322	30	Other motor vehicle electrical & electronic equipment mfg (pt)	193	6,446,681	30,489	1,054,750
	336330		Motor vehicle steering & suspension component (except spring) mfg	212	10,750,312	48,944	2,336,212
	100% of 336340	20	Motor vehicle brake system mfg (pt)	269	10,033,288	43,132	1,486,119
	336350		Motor vehicle transmission & power train parts mfg	523	33,288,093	111,954	5,564,722
	100% of 336399	20	All other motor vehicle parts mfg (pt)	1,508	34,193,298	173,569	5,527,600
3715			Truck trailers	390	5,507,768	30,678	836,590
	336212		Truck trailer mfg	390	5,507,768	30,678	836,590
3716			Motor homes	88	3,943,709	18,086	507,700
	336213		Motor home mfg	88	3,943,709	18,086	507,700

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
372	97/92		**Aircraft and parts**	**1,711**	**98,963,996**	**411,247**	**20,703,396**
3721			Aircraft	204	56,273,651	200,961	10,733,030
	336411		Aircraft mfg	204	56,273,651	200,961	10,733,030
3724			Aircraft engines & engine parts	369	22,617,284	82,557	4,223,020
	336412		Aircraft engine & engine parts mfg	369	22,617,284	82,557	4,223,020
3728			Aircraft parts & equipment, n.e.c.	1,138	20,073,061	127,729	5,747,346
	0% of 332912	20	Fluid power valve & hose fitting mfg (pt)	0	0	0	0
	0% of 333995	20	Fluid power cylinder & actuator mfg (pt)	0	0	0	0
	0% of 333996	20	Fluid power pump & motor mfg (pt)	0	0	0	0
	336413		Other aircraft part & auxiliary equipment mfg	1,138	20,073,061	127,729	5,747,346

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
373	97/92		**Ship and boat building and repairing**	**3,482**	**17,015,123**	**148,261**	**4,641,293**
3731			Ship building & repairing	700	10,571,810	97,385	3,366,404
	336611		Ship building & repairing	700	10,571,810	97,385	3,366,404

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
3732			Boat building & repairing	2,782	6,443,313	50,876	1,274,889
	336612		Boat building	1,043	5,622,040	41,422	1,033,974
	18% of 811490	20	Boat repair	1,739	821,273	9,454	240,915
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
374	97/92		**Railroad equipment**	**207**	**7,916,635**	**31,633**	**1,234,564**
3743			Railroad equipment	207	7,916,635	31,633	1,234,564
	0% of 333911	20	Pump & pumping equipment mfg (pt)	0	0	0	0
	96% of 336510	20	Railroad rolling stock mfg (pt)	207	7,916,635	31,633	1,234,564
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
375	97/92		**Motorcycles, bicycles, and parts**	**385**	**D**	**(10k-24999)**	**D**
3751			Motorcycles, bicycles, & parts	385	D	(10k-24999)	D
	D 336991	10	Motorcycle, bicycle, & parts mfg (pt)	385	D	(10k-24999)	D
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
376	97/92		**Guided missiles, space vehicles, parts**	**99**	**18,929,257**	**76,808**	**4,500,660**
3761			Guided missiles & space vehicles	22	14,791,466	52,158	3,156,221
	336414		Guided missile & space vehicle mfg	22	14,791,466	52,158	3,156,221
3764			Space propulsion units & parts	28	3,239,033	18,540	1,066,084
	336415		Guided missile & space vehicle propulsion unit & parts mfg	28	3,239,033	18,540	1,066,084
3769			Space vehicle equipment, n.e.c.	49	898,758	6,110	278,355
	336419		Other guided missile & space vehicle parts & auxiliary equip mfg	49	898,758	6,110	278,355
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
379	97/92		**Miscellaneous transportation equipment**	**1,229**	**D**	**(50k-99999)**	**D**
3792			Travel trailer & campers	315	3,076,049	20,112	506,058
	67% of 336214	10	Travel trailer & camper mfg (pt)	315	3,076,049	20,112	506,058
3795			Tanks & tank components	37	D	(5000-9999)	D
	D 336992	20	Military armored vehicle, tank, & tank component mfg (pt)	37	D	(5000-9999)	D
3799			Transportation equipment, n.e.c.	877	D	(25k-49999)	D

D	332212 60	Hand & edge tool mfg (pt)	1	D	(20-99)	D
33% of	336214 20	Travel trailer & camper mfg (pt)	498	1,485,367	13,240	299,845
	336999	All other transportation equipment mfg	378	4,557,989	19,466	512,362

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
(Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu | Menu of all 2-digit SICs | Data in formats for downloading | PDF report

Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

Census 2000 | Subjects A to Z | Search | Product Catalog | Data Tools | FOIA | Quality | Privacy Policy | Policies | Contact Us | Home

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 38: Instruments and related products - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	38	Instruments and related products	11,727	D	(100,000+)	D
	381	Search and navigation equipment	680	32,497,776	187,557	9,958,084
	382	Measuring and controlling devices	4,787	46,449,122	263,237	11,037,829
	384	Medical instruments and supplies	4,818	D	(100,000+)	D
	385	Ophthalmic goods	575	3,607,813	26,366	814,242
	386	Photographic equipment and supplies	739	21,305,761	63,642	2,928,089
	387	Watches, clocks, watchcases, and parts	128	718,191	5,646	155,180

N=Comparable data not available D=Withheld to avoid disclosure

SIC 38: Instruments and related products - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
381	97/92		**Search and navigation equipment**	**680**	**32,497,776**	**187,557**	**9,958,084**
3812			Search & navigation equipment	680	32,497,776	187,557	9,958,084
	100% of 334511	20	Search, detection, navigation, & guidance instrument mfg (pt)	680	32,497,776	187,557	9,958,084

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
382	97/92		**Measuring and controlling devices**	**4,787**	**46,449,122**	**263,237**	**11,037,829**
3821							

			Laboratory apparatus & furniture	385	2,471,153	18,253	686,742
	339111		Laboratory apparatus & furniture mfg	385	2,471,153	18,253	686,742
3822			Environmental controls	317	2,935,692	21,450	664,820
	334512		Automatic environmental control mfg	317	2,935,692	21,450	664,820
3823			Process control instruments	1,002	7,890,923	49,196	2,004,259
	334513		Industrial process control instrument mfg	1,002	7,890,923	49,196	2,004,259
3824			Fluid meters & counting devices	222	3,765,769	17,390	683,294
	334514		Totalizing fluid meter & counting device mfg	222	3,765,769	17,390	683,294
3825			Instruments to measure electricity	843	13,877,200	63,522	3,008,675
	2% of 334416	30	Electronic coil, transformer, & other inductor mfg (pt)	17	24,303	190	6,985
	334515		Electricity measuring & testing instrument mfg	826	13,852,897	63,332	3,001,690
3826			Analytical instruments	664	7,157,038	38,200	1,782,600
	100% of 334516	20	Analytical laboratory instrument mfg (pt)	664	7,157,038	38,200	1,782,600
3827			Optical instruments & lenses	495	3,174,652	20,801	833,784
	100% of 333314	20	Optical instrument & lens mfg (pt)	495	3,174,652	20,801	833,784
3829			Measuring & controlling devices, n.e.c.	859	5,176,695	34,425	1,373,655
	100% of 334519	20	Other measuring & controlling device mfg (pt)	853	5,114,547	33,904	1,356,368
	0% of 339112	10	Surgical & medical instrument mfg (pt)	6	62,148	521	17,287

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
384	97/92		**Medical instruments and supplies**	**4,818**	**D**	**(100,000+)**	**D**
3841			Surgical & medical instruments	1,598	18,450,024	107,298	4,139,100
	100% of 339112	20	Surgical & medical instrument mfg (pt)	1,598	18,450,024	107,298	4,139,100
3842			Surgical appliances & supplies	1,728	D	(50k-99999)	D
	D 322121	30	Paper (except newsprint) mills (pt)	2	D	(250-499)	D
	7% of 322291	20	Sanitary paper product mfg (pt)	16	651,398	2,236	68,411
	7% of 334510	20	Electromedical & electrotherapeutic apparatus mfg (pt)	74	807,427	6,722	224,883
	96% of 339113	20	Surgical appliance & supplies mfg (pt)	1,636	14,743,779	82,390	2,865,055
3843			Dental equipment & supplies	877	2,699,867	18,072	613,286
	100% of 339114	20	Dental equipment & supplies mfg (pt)	877	2,699,867	18,072	613,286
3844			X-ray apparatus & tubes	155	3,942,256	14,276	664,233
	334517		Irradiation apparatus mfg	155	3,942,256	14,276	664,233

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
3845			Electromedical equipment	460	10,567,566	47,121	2,372,703
92% of	334510	30	Electromedical & electrotherapeutic apparatus mfg (pt)	460	10,567,566	47,121	2,372,703

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
385	97/92		**Ophthalmic goods**	**575**	**3,607,813**	**26,366**	**814,242**
3851			Ophthalmic goods	575	3,607,813	26,366	814,242
	339115		Ophthalmic goods mfg	575	3,607,813	26,366	814,242

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
386	97/92		**Photographic equipment and supplies**	**739**	**21,305,761**	**63,642**	**2,928,089**
3861			Photographic equipment & supplies	739	21,305,761	63,642	2,928,089
	325992		Photographic film, paper, plate, & chemical mfg	311	12,895,637	38,935	1,828,139
100% of	333315	20	Photographic & photocopying equipment mfg (pt)	428	8,410,124	24,707	1,099,950

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
387	97/92		**Watches, clocks, watchcases, and parts**	**128**	**718,191**	**5,646**	**155,180**
3873			Watches, clocks, & watchcases	128	718,191	5,646	155,180
78% of	334518	30	Watch, clock, & part mfg (pt)	128	718,191	5,646	155,180

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
(Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu | Menu of all 2-digit SICs | Data in formats for downloading | PDF report

Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

Census 2000 | Subjects A to Z | Search | Product Catalog | Data Tools | FOIA | Quality | Privacy Policy | Policies | Contact Us | Home

USCENSUSBUREAU
Helping You Make Informed Decisions

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 39: Miscellaneous manufacturing industries - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	39	Miscellaneous manufacturing industries	18,043	50,997,838	393,972	10,563,481
	391	Jewelry, silverware, and plated ware	2,828	7,243,618	46,547	1,208,070
	393	Musical instruments	576	1,356,651	13,411	363,022
	394	Toys and sporting goods	3,600	D	(100,000+)	D
	395	Pens, pencils, office, and art supplies	1,017	3,987,200	28,150	738,265
	396	Costume jewelry and notions	1,075	D	(10k-24999)	D
	399	Miscellaneous manufactures	8,947	D	(100,000+)	D

N=Comparable data not available D=Withheld to avoid disclosure

SIC 39: Miscellaneous manufacturing industries - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
391	97/92		**Jewelry, silverware, and plated ware**	**2,828**	**7,243,618**	**46,547**	**1,208,070**
3911			Jewelry, precious metal	2,272	5,416,836	34,694	884,942
	100% of 339911	20	Jewelry (except costume) mfg (pt)	2,272	5,416,836	34,694	884,942
3914			Silverware & plated ware	162	907,716	6,457	187,774
	0% of 332211	20	Cutlery & flatware (except precious) mfg (pt)	11	8,032	101	2,699
	99% of 339912	20	Silverware & plated ware mfg (pt)	151	899,684	6,356	185,075

SIC	NAICS	Pt	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
3915			Jewelers' materials & lapidary work	394	919,066	5,396	135,354
	339913		Jewelers' material & lapidary work mfg	394	919,066	5,396	135,354
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
393	97/92		**Musical instruments**	**576**	**1,356,651**	**13,411**	**363,022**
3931			Musical instruments	576	1,356,651	13,411	363,022
	339992		Musical instrument mfg	576	1,356,651	13,411	363,022
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
394	97/92		**Toys and sporting goods**	**3,600**	**D**	**(100,000+)**	**D**
3942			Dolls	240	299,821	3,393	63,722
	339931		Doll & stuffed toy mfg	240	299,821	3,393	63,722
3944			Games, toys, & children's vehicles	789	D	(25k-49999)	D
	D 336991	20	Motorcycle, bicycle, & parts mfg (pt)	4	D	(20-99)	D
	339932		Game, toy, & children's vehicle mfg	785	4,534,497	29,622	773,459
3949			Sporting & athletic goods, n.e.c.	2,571	10,591,160	69,664	1,831,218
	339920		Sporting & athletic goods mfg	2,571	10,591,160	69,664	1,831,218
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
395	97/92		**Pens, pencils, office, and art supplies**	**1,017**	**3,987,200**	**28,150**	**738,265**
3951			Pens & mechanical pencils	112	1,590,770	8,394	261,580
	339941		Pen & mechanical pencil mfg	112	1,590,770	8,394	261,580
3952			Lead pencils & art goods	152	883,200	6,002	143,660
	0% of 325998	30	All other miscellaneous chemical product & preparation mfg (pt)	0	0	0	0
	0% of 337127	30	Institutional furniture mfg (pt)	9	16,749	187	5,901
	70% of 339942	30	Lead pencil & art good mfg (pt)	143	866,451	5,815	137,759
3953			Marking devices	634	643,007	7,831	185,316
	339943		Marking device mfg	634	643,007	7,831	185,316
3955			Carbon paper & inked ribbons	119	870,223	5,923	147,709
	339944		Carbon paper & inked ribbon mfg	119	870,223	5,923	147,709
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
396	97/92		**Costume jewelry and notions**	**1,075**	**D**	**(10k-24999)**	**D**
3961			Costume jewelry	826	1,223,475	13,976	314,581

96% of	339914 30	Costume jewelry & novelty mfg (pt)	826	1,223,475	13,976	314,581
3965		Fasteners, buttons, needles, & pins	249	D	(5000-9999)	D
D	339993 20	Fastener, button, needle, & pin mfg (pt)	249	D	(5000-9999)	D

SIC	NAICS Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
399	97/92	**Miscellaneous manufactures**	**8,947**	**D**	**(100,000+)**	**D**
3991		Brooms & brushes	274	1,703,139	13,882	372,010
84% of	339994 20	Broom, brush, & mop mfg (pt)	274	1,703,139	13,882	372,010
3993		Signs & advertising displays	5,709	7,910,809	82,956	2,382,461
	339950	Sign mfg	5,709	7,910,809	82,956	2,382,461
3995		Burial caskets	177	1,271,184	6,962	212,491
	339995	Burial casket mfg	177	1,271,184	6,962	212,491
3996		Hard surface floor coverings	26	1,819,931	5,614	255,635
97% of	326192 20	Resilient floor covering mfg (pt)	26	1,819,931	5,614	255,635
3999		Mfg industries, n.e.c.	2,761	D	(50k-99999)	D
3% of	314999 50	All other miscellaneous textile product mills (pt)	52	173,353	2,167	42,673
1% of	316110 20	Leather & hide tanning & finishing (pt)	26	24,625	329	7,616
0% of	321999 50	All other miscellaneous wood product mfg (pt)	0	0	0	0
0% of	322299 30	All other converted paper product mfg (pt)	0	0	0	0
0% of	323110 30	Commercial lithographic printing (pt)	0	0	0	0
0% of	323111 30	Commercial gravure printing (pt)	0	0	0	0
0% of	323112 30	Commercial flexographic printing (pt)	0	0	0	0
0% of	323113 40	Commercial screen printing (pt)	0	0	0	0
0% of	323119 30	Other commercial printing (pt)	0	0	0	0
1% of	325998 40	All other miscellaneous chemical product & preparation mfg (pt)	9	80,624	572	18,596
1% of	326199 20	All other plastics product mfg (pt)	140	319,241	3,141	77,397
D	332212 70	Hand & edge tool mfg (pt)	7	D	(500-999)	D
3% of	332999 80	All other miscellaneous fabricated metal product mfg (pt)	185	285,362	3,231	85,799
3% of	335121 30	Residential electric lighting fixture mfg (pt)	53	69,864	1,216	22,121
1% of	337127 40	Institutional furniture mfg (pt)	5	28,296	329	8,183
85% of	339999 20	All other miscellaneous mfg (pt)	2,284	7,183,815	60,397	1,563,790

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS SIC: Transportation, communications, and utilities %% **

SIC 41: Local and interurban passenger transportation - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
	41	Local and interurban passenger transportation	19,621	D	(100,000+)	D
	411	Local and suburban passenger transportation	10,147	D	(100,000+)	D
	412	Taxi service	3,184	1,280,597	27,850	392,759
	413	Interurban and rural bus transportation	407	1,147,432	19,900	549,727
	414	Charter bus service	1,531	1,768,199	31,483	548,026
	415	School bus service	4,326	4,233,836	147,441	1,810,695
	417	Bus terminal and service facilities	26	15,253	220	5,190

N=Comparable data not available D=Withheld to avoid disclosure

%% Data do not include large certificated passenger carriers that report to the Office of Airline Statistics, U.S. Department of Transportation

** Railroad transportation and U.S. Postal Service industries are out of scope for the 1997 Economic Ce

SIC 41: Local and interurban passenger transportation - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
411	97/92		**Local and suburban passenger transportation**	**10,147**	**D**	**(100,000+)**	**D**
4111			Local & suburban transit	1,152	D	(25k-49999)	D
	485111		Mixed mode transit systems	28	51,567	759	24,112
	485112		Commuter rail systems	16	D	(2500-	D

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
						4999)	
	485113		Bus & motor vehicle transit systems	542	1,152,525	27,448	744,397
	485119		Other urban transit systems	32	D	(500-999)	D
	90% of 485999	10	Scheduled airport shuttle service	534	601,988	13,435	217,633
4119			Other local passenger transportation	8,995	8,147,039	179,736	3,183,251
	485320		Limousine service	3,234	1,873,924	29,432	487,867
	4% of 485410	20	Employee bus service	158	158,947	4,223	67,261
	485991		Special needs transportation	1,789	1,141,413	31,791	486,676
	10% of 485999	20	All other passenger transportation	232	67,395	1,078	15,557
	83% of 487110	10	Sightseeing buses	307	462,186	6,858	145,734
	88% of 621910	90	Ambulance or rescue service (except by air)	3,275	4,443,174	106,354	1,980,156
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Revenue ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
412	97/92		**Taxi service**	**3,184**	**1,280,597**	**27,850**	**392,759**
4121			Taxi service	3,184	1,280,597	27,850	392,759
	485310		Taxi service	3,184	1,280,597	27,850	392,759
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Revenue ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
413	97/92		**Interurban and rural bus transportation**	**407**	**1,147,432**	**19,900**	**549,727**
4131			Interurban & rural bus transportation	407	1,147,432	19,900	549,727
	485210		Interurban & rural bus transportation	407	1,147,432	19,900	549,727
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Revenue ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
414	97/92		**Charter bus service**	**1,531**	**1,768,199**	**31,483**	**548,026**
4141			Charter bus service, local	482	459,953	8,694	143,572
	26% of 485510	10	Charter bus service, local	482	459,953	8,694	143,572
4142			Charter bus service, interstate/interurban	1,049	1,308,246	22,789	404,454
	74% of 485510	20	Charter bus service, interstate/interurban	1,049	1,308,246	22,789	404,454
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Revenue ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
415	97/92		**School bus service**	**4,326**	**4,233,836**	**147,441**	**1,810,695**
4151			School bus service	4,326	4,233,836	147,441	1,810,695
	96% of 485410	10	School bus service	4,326	4,233,836	147,441	1,810,695
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Revenue ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
417	97/92		**Bus terminal and service facilities**	**26**	**15,253**	**220**	**5,190**
4173			Bus terminal & service facilities	26	15,253	220	5,190

4% of 488490 10	Terminal or maintenance facilities for motor vehicle pass trans	26	15,253	220	5,190

N=Comparable data not available D=Withheld to avoid disclosure
%% Data do not include large certificated passenger carriers that report to the Office of Airline Statistics, U.S. Department of Transportation
** Railroad transportation and U.S. Postal Service industries are out of scope for the 1997 Economic Ce

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
(Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu | Menu of all 2-digit SICs | Data in formats for downloading | PDF report

Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

Census 2000 | Subjects A to Z | Search | Product Catalog | Data Tools | FOIA | Quality | Privacy Policy | Policies | Contact Us | Home

USCENSUSBUREAU
Helping You Make Informed Decisions

1997 Economic Census: Bridge Between SIC and NAICS SIC: Transportation, communications, and utilities %% **

SIC 42: Motor freight transportation and warehousing - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
	42	Motor freight transportation and warehousing	133,373	197,375,341	1,960,130	55,739,452
	421	Trucking and courier services, except air	119,868	184,178,773	1,831,577	52,513,343
	422	Public warehousing and storage	13,491	13,183,579	128,433	3,222,154
	423	Trucking terminal facilities	14	12,989	120	3,955

N=Comparable data not available D=Withheld to avoid disclosure
%% Data do not include large certificated passenger carriers that report to the Office of Airline Statistics, U.S. Department of Transportation
** Railroad transportation and U.S. Postal Service industries are out of scope for the 1997 Economic Ce

SIC 42: Motor freight transportation and warehousing - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
421	97/92		**Trucking and courier services, except air**	**119,868**	**184,178,773**	**1,831,577**	**52,513,343**
4212			Local trucking without storage	61,063	51,384,852	473,694	12,642,812
	90% of 484110	Σ	General freight trucking, local	14,545	11,108,345	73,967	3,166,529
	484110	10	General freight trucking without storage, local, truckload	10,296	7,783,545	73,967	1,934,702
	484110	20	General freight trucking w/o storage, local, less than truckload	4,249	3,324,800	47,246	1,231,827
	10% of 484210	10	Used household & office goods moving, local, without storage	3,259	1,198,983	20,858	395,383
	96% of 484220	Σ	Specialized freight (except used goods) trucking, local	34,935	18,932,851	10,951	4,514,945

SIC		NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
		484220	10	Hazardous materials trucking (except waste), local	1,434	1,267,441	10,951	366,278
		484220	20	Agricultural products trucking without storage, local	8,065	2,785,495	29,925	629,234
		484220	30	Dump trucking	17,440	9,748,351	81,553	2,083,930
		484220	40	Specialized trucking without storage, local	7,996	5,131,564	56,450	1,435,503
		562111		Solid waste collection	7,083	18,211,495	137,049	4,048,032
		562112		Hazardous waste collection	414	1,095,553	8,468	317,464
		562119		Other waste collection	827	837,625	7,227	200,459
4213				Trucking, except local	47,315	105,764,108	915,091	28,992,807
		484121		General freight trucking, long-distance, truckload	23,111	51,142,148	425,758	12,690,093
		484122		General freight trucking, long-distance, less than truckload	6,210	25,010,091	258,972	9,509,916
	72% of	484210	20	Used household & office goods moving, long-distance	3,555	9,111,477	65,734	1,741,891
	100% of	484230	Σ	Specialized freight (except used goods) trucking, long-distance	14,439	20,500,392	28,396	5,050,907
		484230	10	Hazardous materials trucking (except waste), long-distance	2,043	3,840,724	28,396	918,360
		484230	20	Agricultural products trucking, long-distance	5,389	3,693,332	32,371	789,921
		484230	30	Other specialized trucking, long-distance	7,007	12,966,336	103,860	3,342,626
4214				Local trucking with storage	3,744	4,221,111	57,749	1,401,608
	10% of	484110	Σ	General freight trucking, local	915	1,164,931	7,468	355,591
		484110	30	General freight trucking with storage, local, truckload	542	678,272	7,468	199,953
		484110	40	General freight trucking with storage, local, less than truckload	373	486,659	6,096	155,638
	18% of	484210	30	Used household & office goods moving, local, with storage	2,286	2,273,241	34,958	806,674
	4% of	484220	50	Specialized trucking with storage, local	543	782,939	9,227	239,343
4215				Courier services, except by air	7,746	22,808,702	385,043	9,476,116
	53% of	492110	10	Courier services (except by air)	2,362	19,289,602	317,630	8,234,379
		492210		Local messengers & local delivery	5,384	3,519,100	67,413	1,241,737
SIC		**NAICS**	**Pt**	**Description**	**Establish-ments**	**Revenue ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
422		97/92		**Public warehousing and storage**	**13,491**	**13,183,579**	**128,433**	**3,222,154**
4221				Farm product warehousing & storage facilities	486	673,198	5,280	118,542
		493130		Farm product warehousing & storage	486	673,198	5,280	118,542
4222				Refrigerated products warehousing	872	2,268,823	22,109	609,335
	100% of	493120	10	Refrigerated products warehousing	872	2,268,823	22,109	609,335

4225			General warehousing & storage	10,912	7,846,325	81,450	1,918,952
	100% of 493110	10	General warehousing & storage (except in foreign trade zones)	3,918	5,320,671	62,777	1,622,917
	531130		Lessors of miniwarehouses & self storage units	6,994	2,525,654	18,673	296,035
4226			Other special warehousing & storage	1,221	2,395,233	19,594	575,325
	0% of 493110	20	General warehousing & storage in foreign trade zones	3	718	7	111
	0% of 493120	20	Fur storage	5	1,504	12	249
	100% of 493190	Σ	Other warehousing & storage	1,213	2,393,011	6,158	574,965
	493190	10	Household goods warehousing & storage	317	451,574	6,158	141,630
	493190	20	Specialized goods warehousing & storage	896	1,941,437	13,417	433,335
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Revenue ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
423	97/92		**Trucking terminal facilities**	**14**	**12,989**	**120**	**3,955**
4231			Trucking terminal facilities	14	12,989	120	3,955
	3% of 488490	20	Motor freight terminal & joint terminal maint facility trans	14	12,989	120	3,955

N=Comparable data not available D=Withheld to avoid disclosure
%% Data do not include large certificated passenger carriers that report to the Office of Airline Statistics, U.S. Department of Transportation
** Railroad transportation and U.S. Postal Service industries are out of scope for the 1997 Economic Ce

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
(Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu   Menu of all 2-digit SICs   Data in formats for downloading   PDF report

Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

Census 2000 | Subjects A to Z | Search | Product Catalog | Data Tools | FOIA | Quality | Privacy Policy | Policies | Contact Us | Home

USCENSUSBUREAU
Helping You Make Informed Decisions

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Retail trade

SIC 55: Automotive dealers and gasoline service stations - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
	55	Automotive dealers and gasoline service stations	202,237	788,231,182	2,283,756	55,502,391
	551	Motor vehicle dealers (new and used)	25,897	518,971,824	1,046,243	35,202,751
	552	Motor vehicle dealers (used only)	23,340	34,680,468	92,752	2,197,396
	553	Auto and home supply stores	40,565	35,028,316	300,953	6,044,147
	554	Gasoline service stations	98,846	170,660,068	741,040	9,488,181
	555	Boat dealers	5,262	8,934,230	35,134	839,296
	556	Recreational vehicle dealers	3,014	10,069,749	29,463	813,962
	557	Motorcycle dealers	3,635	7,369,260	29,026	712,065
	559	Automotive dealers, not elsewhere classified	1,678	2,517,267	9,145	204,593

N=Comparable data not available D=Withheld to avoid disclosure

SIC 55: Automotive dealers and gasoline service stations - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
551	97/92		**Motor vehicle dealers (new and used)**	**25,897**	**518,971,824**	**1,046,243**	**35,202,751**
5511			Motor vehicle dealers (new & used)	25,897	518,971,824	1,046,243	35,202,751
	441110		New car dealers	25,897	518,971,824	1,046,243	35,202,751

SIC	NAICS	Pt	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
552	97/92		**Motor vehicle dealers (used only)**	**23,340**	**34,680,468**	**92,752**	**2,197,396**
5521			Motor vehicle dealers (used only)	23,340	34,680,468	92,752	2,197,396
	441120		Used car dealers	23,340	34,680,468	92,752	2,197,396
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Sales ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
553	97/92		**Auto and home supply stores**	**40,565**	**35,028,316**	**300,953**	**6,044,147**
5531			Auto & home supply stores	40,565	35,028,316	300,953	6,044,147
	47% of 441310	10	Auto supplies stores	24,508	20,143,722	175,587	3,096,231
	68% of 441320	10	New tire dealers	14,814	13,312,367	113,807	2,761,880
	6% of 452990	32	Other auto & home supplies stores	1,243	1,572,227	11,559	186,036
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Sales ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
554	97/92		**Gasoline service stations**	**98,846**	**170,660,068**	**741,040**	**9,488,181**
5541			Gasoline service stations	98,846	170,660,068	741,040	9,488,181
	78% of 447110	20	Gasoline stations with convenience stores	53,641	100,103,399	432,935	5,234,676
	100% of 447190	Σ	Other gasoline stations	45,205	70,556,669	238,465	4,253,505
	447190	10	Gasoline stations with no convenience stores	42,270	55,523,140	238,465	3,338,637
	447190	20	Truck stops	2,935	15,033,529	69,640	914,868
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Sales ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
555	97/92		**Boat dealers**	**5,262**	**8,934,230**	**35,134**	**839,296**
5551			Boat dealers	5,262	8,934,230	35,134	839,296
	441222		Boat dealers	5,262	8,934,230	35,134	839,296
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Sales ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
556	97/92		**Recreational vehicle dealers**	**3,014**	**10,069,749**	**29,463**	**813,962**
5561			Recreational vehicle dealers	3,014	10,069,749	29,463	813,962
	441210		Recreational vehicle dealers	3,014	10,069,749	29,463	813,962
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Sales ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
557	97/92		**Motorcycle dealers**	**3,635**	**7,369,260**	**29,026**	**712,065**
5571			Motorcycle dealers	3,635	7,369,260	29,026	712,065
	441221		Motorcycle dealers	3,635	7,369,260	29,026	712,065
SIC	**NAICS**	**Pt**	**Description**	**Establish-**	**Sales**	**Paid**	**Annual payroll**

			ments	($1,000)	employees	($1,000)
559	97/92	**Automotive dealers, not elsewhere classified**	**1,678**	**2,517,267**	**9,145**	**204,593**
5599		Automotive dealers, not elsewhere classified	1,678	2,517,267	9,145	204,593
441229		All other motor vehicle dealers	1,678	2,517,267	9,145	204,593

N=Comparable data not available D=Withheld to avoid disclosure

$$ 1992 sales data include sales from catalog order desks. 1997 sales data exclude sales from catalog order des
Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
(Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu | Menu of all 2-digit SICs | Data in formats for downloading | PDF report

Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

Census 2000 | Subjects A to Z | Search | Product Catalog | Data Tools | FOIA | Quality | Privacy Policy | Policies | Contact Us | Home

USCENSUSBUREAU
Helping You Make Informed Decisions

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Service industries

SIC 75: Truck rental services, without drivers - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description		Establish-ments	Receipts ($1,000)	Paid employees	Annual payroll ($1,000)
	75	Automotive repair, services, and parking	Taxable	191,907	99,574,966	1,094,161	22,643,253
	751	Automotive rental and leasing, without drivers	Taxable	10,542	28,921,850	158,062	3,870,601
	752	Automobile parking	Taxable	10,358	5,174,724	76,166	967,701
	753	Automotive repair shops	Taxable	142,372	55,685,916	630,614	14,808,177
	754	Automotive services, except repair	Taxable	28,635	9,792,476	229,319	2,996,774

N=Comparable data not available D=Withheld to avoid disclosure

SIC 75: Truck rental services, without drivers - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description		Establish-ments	Receipts ($1,000)	Paid employees	Annual payroll ($1,000)
751	97/92		**Automotive rental and leasing, without drivers**	Taxable	**10,542**	**28,921,850**	**158,062**	**3,870,601**
7513			Truck rental services, without drivers	Taxable	4,936	10,081,603	45,224	1,377,581
98% of	532120	Σ	Truck, utility trailer, & RV rental & leasing	Taxable	4,936	10,081,603	13,138	1,377,581
	532120	10	Truck rental	Taxable	2,498	2,420,548	13,138	296,754
	532120	20	Truck leasing	Taxable	2,438	7,661,055	32,086	1,080,827
7514			Passenger car rental	Taxable	4,367	14,783,704	102,623	2,129,602

SIC	NAICS	Pt	Description		Establishments	Receipts ($1,000)	Paid employees	Annual payroll ($1,000)
	532111		Passenger car rental	Taxable	4,367	14,783,704	102,623	2,129,602
7515			Passenger car leasing	Taxable	879	3,800,424	8,325	315,960
	532112		Passenger car leasing	Taxable	879	3,800,424	8,325	315,960
7519			Utility trailer & recreational vehicle rental	Taxable	360	256,119	1,890	47,458
	3% of 532120	90	Utility trailer & RV (recreational vehicle) rental & leasing	Taxable	360	256,119	1,890	47,458
SIC	**NAICS**	**Pt**	**Description**		**Establish-ments**	**Receipts ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
752	97/92		**Automobile parking**	Taxable	**10,358**	**5,174,724**	**76,166**	**967,701**
7521			Automobile parking	Taxable	10,358	5,174,724	76,166	967,701
	812930		Parking lots & garages	Taxable	10,358	5,174,724	76,166	967,701
SIC	**NAICS**	**Pt**	**Description**		**Establish-ments**	**Receipts ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
753	97/92		**Automotive repair shops**	Taxable	**142,372**	**55,685,916**	**630,614**	**14,808,177**
7532			Top, body, & upholstery repair shops & paint shops	Taxable	35,569	17,755,296	205,172	5,172,206
	100% of 811121	Σ	Automotive body, paint, & interior repair & maintenance	Taxable	35,569	17,755,296	192,853	5,172,206
	811121	10	Paint or body repair shops	Taxable	33,144	16,645,229	192,853	4,899,276
	811121	20	Van conversion services	Taxable	639	723,189	6,507	156,778
	811121	30	Upholstery & interior repair shops	Taxable	1,786	386,878	5,812	116,152
7533			Automotive exhaust system repair shops	Taxable	5,251	1,985,377	23,015	524,940
	811112		Automotive exhaust system repair	Taxable	5,251	1,985,377	23,015	524,940
7534			Tire retreading & repair shops	Taxable	1,760	1,270,577	10,930	248,727
	326212		Tire retreading	Taxable	754	982,607	7,939	192,387
	27% of 811198	10	Tire repair shops	Taxable	1,006	287,970	2,991	56,340
7536			Automotive glass replacement shops	Taxable	5,599	3,149,984	29,187	753,574
	811122		Automotive glass replacement shops	Taxable	5,599	3,149,984	29,187	753,574
7537			Automotive transmission repair shops	Taxable	6,768	2,431,584	29,442	709,254
	811113		Automotive transmission repair	Taxable	6,768	2,431,584	29,442	709,254
7538			General automotive repair shops	Taxable	77,751	25,598,455	290,634	6,438,842
	811111		General automotive repair	Taxable	77,751	25,598,455	290,634	6,438,842
7539			Automotive repair shops, n.e.c.	Taxable	9,674	3,494,643	42,234	960,634
	100% of 811118	Σ	Other automotive mechanical & electrical repair & maintenance	Taxable	9,674	3,494,643	4,802	960,634
	811118	10	Carburetor repair shops	Taxable	1,091	363,763	4,802	106,409

5.2 FRACTION OF NAICS CODE EMPLOYMENT USED TO CREATE SIC EMPLOYMENT

SIC	NAICS	SIC Employees 1997	NAICS Employees ‘1997	Employee Fraction	NAICS description
Factory Finished Wood Surface Coating					
2426	321918	10521	38100	0.276	Other millwork (including flooring)
2426	337215	6310	75382	0.084	Showcase, partition, shelving, & locker mfg
2426	321912	17109	39763	0.430	Cut stock, resawing lumber, & planing
2429	321113	304	119760	0.003	Sawmills
2429	321920	684	51134	0.013	Wood container & pallet mfg
2429	321999	355	43839	0.008	All other miscellaneous wood product mfg
2431	321911	64771	64771	1.000	Wood window & door mfg
2431	321918	27488	38100	0.721	Other millwork (including flooring)
2434	337110	79579	99257	0.802	Wood kitchen cabinet & counter top mfg
2435	321211	22151	22151	1.000	Hardwood veneer & plywood mfg
2436	321212	28843	28843	1.000	Softwood veneer & plywood mfg
2439	321912	0	39763	0.000	Cut stock, resawing lumber, & planing
2439	321214	32522	32522	1.000	Truss mfg
2439	321113	0	119760	0.000	Sawmills
2439	321213	5372	5372	1.000	Engineered wood member (except truss) mfg
2441	321920	4885	51134	0.096	Wood container & pallet mfg
2448	321920	38994	51134	0.763	Wood container & pallet mfg
2449	321920	5701	51134	0.111	Wood container & pallet mfg
2451	321991	68269	68269	1.000	Manufactured home (mobile home) mfg
2452	321992	22965	22965	1.000	Prefabricated wood building mfg
2493	321219	25269	25269	1.000	Reconstituted wood product mfg
2499	339999	13740	74137	0.185	All other miscellaneous mfg
2499	332321	0	74944	0.000	Metal window & door mfg
2499	321920	870	51134	0.017	Wood container & pallet mfg
2499	321912	549	39763	0.014	Cut stock, resawing lumber, & planing
2499	321999	41844	43839	0.954	All other miscellaneous wood product mfg
Furniture & Fixtures Surface Coating and Part of Miscellaneous Degreasing					
2511	337122	123368	128248	0.962	Nonupholstered wood household furniture mfg
2512	337121	85258	90009	0.947	Upholstered household furniture mfg
2514	337124	22835	22835	1.000	Metal household furniture mfg
2515	337121	1601	90009	0.018	Upholstered household furniture mfg
2515	337910	23072	23072	1.000	Mattress mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees ‘1997	Employee Fraction	NAICS description
2517	337129	4273	4273	1.000	Wood television, radio, & sewing machine cabinet mfg
2519	337125	4708	4708	1.000	Household furniture (except wood & metal) mfg
2521	337211	30641	30641	1.000	Wood office furniture mfg
2522	337214	44222	44222	1.000	Office furniture (except wood) mfg
2531	336360	20784	45600	0.456	Motor vehicle seating & interior trim mfg
2531	337127	15254	38218	0.399	Institutional furniture mfg
2531	339942	941	7990	0.118	Lead pencil & art good mfg
2541	337110	9785	99257	0.099	Wood kitchen cabinet & counter top mfg
2541	337212	24363	24363	1.000	Custom architectural woodwork & millwork mfg
2541	337215	23305	75382	0.309	Showcase, partition, shelving, & locker mfg
2542	337215	44472	75382	0.590	Showcase, partition, shelving, & locker mfg
2591	337920	19617	19617	1.000	Blind & shade mfg
2599	337127	22448	38218	0.587	Institutional furniture mfg
2599	339113	2925	85315	0.034	Surgical appliance & supplies mfg
Part of Misc. Degreasing					
3312	324199	1731	3671	0.472	All other petroleum & coal products mfg
3312	331111	144074	146514	0.983	Iron & steel mills
3313	331112	3724	3724	1.000	Electrometallurgical ferroalloy product mfg
3313	331492	311	11610	0.027	Other nonferrous metal secondary smelting, refining, & alloying
3315	331222	23489	23489	1.000	Steel wire drawing
3315	332618	2265	46174	0.049	Other fabricated wire product mfg
3316	331221	14362	14362	1.000	Cold-rolled steel shape mfg
3317	331210	27723	27723	1.000	Iron & steel pipes & tubes mfg from purchased steel
3321	331511	83570	86198	0.970	Iron foundries
3322	331511	2628	86198	0.030	Iron foundries
3324	331512	22673	22673	1.000	Steel investment foundries
3325	331513	23982	23982	1.000	Steel foundries (except investment)
3331	331411	7360	7360	1.000	Primary smelting & refining of copper
3334	331312	15763	15763	1.000	Primary aluminum production
3339	331419	10132	10132	1.000	Other nonferrous metal primary smelting & refining
3341	331423	1768	2333	0.758	Secondary smelting, refining, & alloying of copper

SIC	NAICS	SIC Employees 1997	NAICS Employees ‘1997	Employee Fraction	NAICS description
3341	331492	5485	11610	0.472	Other nonferrous metal secondary smelting, refining, & alloying
3341	331314	6226	6714	0.927	Secondary smelting & alloying of aluminum
3351	331421	21150	21150	1.000	Copper rolling, drawing, & extruding
3353	331315	25111	25111	1.000	Aluminum sheet, plate, & foil mfg
3353	332996	0	29364	0.000	Fabricated pipe & pipe fitting mfg
3354	331316	30357	30357	1.000	Aluminum extruded product mfg
3355	331319	2657	4306	0.617	Other aluminum rolling & drawing
3356	331491	17237	25872	0.666	Other nonferrous metal rolling, drawing, & extruding
Part of Misc. Degreasing and Part of Electrical Insulation Surface Coating					
3357	331319	1649	4306	0.383	Other aluminum rolling & drawing
3357	331422	4692	4692	1.000	Copper wire (except mechanical) drawing
3357	331491	8635	25872	0.334	Other nonferrous metal rolling, drawing, & extruding
3357	335921	8589	8589	1.000	Fiber optic cable mfg
3357	335929	46267	46267	1.000	Other communication & energy wire mfg
Part of Misc. Degreasing					
3363	331521	27717	27717	1.000	Aluminum die-casting foundries
3364	331522	17243	17243	1.000	Nonferrous (except aluminum) die-casting foundries
3365	331524	34098	34098	1.000	Aluminum foundries (except die-casting)
3366	331525	8909	8909	1.000	Copper foundries (except die-casting)
3369	331528	6529	6529	1.000	Other nonferrous foundries (except die-casting)
3398	332811	22674	22674	1.000	Metal heat treating
3399	331111	2440	146514	0.017	Iron & steel mills
3399	331314	488	6714	0.073	Secondary smelting & alloying of aluminum
3399	331423	565	2333	0.242	Secondary smelting, refining, & alloying of copper
3399	331492	5814	11610	0.501	Other nonferrous metal secondary smelting, refining, & alloying
3399	332618	2088	46174	0.045	Other fabricated wire product mfg
Part of Misc. Degreasing and Metal Containers Surface Coating					
3411	332431	27316	27316	1.000	Metal can mfg
3412	332439	6318	14922	0.423	Other metal container mfg
Part of Misc. Degreasing					

SIC	NAICS	SIC Employees 1997	NAICS Employees ‘1997	Employee Fraction	NAICS description
3421	332211	11129	11230	0.991	Cutlery & flatware (except precious) mfg
3423	332212	42947	50388	0.852	Hand & edge tool mfg
3425	332213	9149	9149	1.000	Saw blade & handsaw mfg
3429	332439	4135	14922	0.277	Other metal container mfg
3429	332510	70884	74285	0.954	Hardware mfg
3429	332919	750	18739	0.040	Other metal valve & pipe fitting mfg
3431	332998	9994	9994	1.000	Enameled iron & metal sanitary ware mfg
3432	332913	16202	16202	1.000	Plumbing fixture fitting & trim mfg
3432	332999	474	79070	0.006	All other miscellaneous fabricated metal product mfg
3433	333414	22495	24666	0.912	Heating equipment (except warm air furnaces) mfg
3441	332312	84704	93433	0.907	Fabricated structural metal mfg
3442	332321	72970	74944	0.974	Metal window & door mfg
3443	333415	339	119795	0.003	AC & warm air heating & commercial/industrial refrig equip mfg
3443	332420	33704	33704	1.000	Metal tank (heavy gauge) mfg
3443	332313	25453	25453	1.000	Plate work mfg
3443	332410	27542	27542	1.000	Power boiler & heat exchanger mfg
3444	332322	129826	129826	1.000	Sheet metal work mfg
3444	332439	2074	14922	0.139	Other metal container mfg
3446	332323	30960	34391	0.900	Ornamental & architectural metal work mfg
3448	332311	25946	25946	1.000	Prefabricated metal building & component mfg
3449	332114	15219	15219	1.000	Custom roll forming
3449	332312	8729	93433	0.093	Fabricated structural metal mfg
3449	332321	1974	74944	0.026	Metal window & door mfg
3449	332323	349	34391	0.010	Ornamental & architectural metal work mfg
3451	332721	80404	80404	1.000	Precision turned product mfg
3452	332722	52995	52995	1.000	Bolt, nut, screw, rivet, & washer mfg
3462	332111	26432	26432	1.000	Iron & steel forging
3463	332112	9129	9129	1.000	Nonferrous forging
3465	336370	126905	126905	1.000	Motor vehicle metal stamping
3466	332115	4682	4682	1.000	Crown & closure mfg
3469	332116	93086	93086	1.000	Metal stamping
3469	332214	7724	7724	1.000	Kitchen utensil, pot, & pan mfg
3471	332813	74640	74640	1.000	Electroplating, plating, polishing, anodizing, & coloring

SIC	NAICS	SIC Employees 1997	NAICS Employees ‘1997	Employee Fraction	NAICS description
Part of Misc. Degreasing and Sheet, Strip & Coil Surface Coating					
3479	332812	55904	55904	1.000	Metal coating/engraving (exc jewelry/silverware)/allied services
3479	339911	79	34773	0.002	Jewelry (except costume) mfg
3479	339912	103	6459	0.016	Silverware & plated ware mfg
3479	339914	29	14573	0.002	Costume jewelry & novelty mfg
Part of Misc. Degreasing					
3482	332992	6863	6863	1.000	Small arms ammunition mfg
3483	332993	9427	9427	1.000	Ammunition (except small arms) mfg
3484	332994	9907	9907	1.000	Small arms mfg
3489	332995	12285	12285	1.000	Other ordnance & accessories mfg
3491	332911	53459	53459	1.000	Industrial valve mfg
3492	332912	37132	37132	1.000	Fluid power valve & hose fitting mfg
3493	332611	5381	5381	1.000	Spring (heavy gauge) mfg
3494	332919	17652	18739	0.942	Other metal valve & pipe fitting mfg
3494	332999	564	79070	0.007	All other miscellaneous fabricated metal product mfg
3495	332612	18798	18798	1.000	Spring (light gauge) mfg
3495	334518	175	6333	0.028	Watch, clock, & part mfg
3496	332618	41821	46174	0.906	Other fabricated wire product mfg
3497	332999	5648	79070	0.071	All other miscellaneous fabricated metal product mfg
3497	322225	4967	4967	1.000	Laminated aluminum foil mfg for flexible packaging uses
3498	332996	29364	29364	1.000	Fabricated pipe & pipe fitting mfg
3499	332439	2331	14922	0.156	Other metal container mfg
3499	332510	3401	74285	0.046	Hardware mfg
3499	332919	375	18739	0.020	Other metal valve & pipe fitting mfg
3499	332999	63736	79070	0.806	All other miscellaneous fabricated metal product mfg
3499	337215	1295	75382	0.017	Showcase, partition, shelving, & locker mfg
3499	339914	568	14573	0.039	Costume jewelry & novelty mfg
3499	332117	10760	10760	1.000	Powder metallurgy part mfg
Part of Misc. Degreasing and Machinery & Equipment Surface Coating					
3511	333611	19529	19529	1.000	Turbine & turbine generator set unit mfg
3519	333618	56338	56348	1.000	Other engine equipment mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3519	336399	896	174465	0.005	All other motor vehicle parts mfg
3523	332212	60	50388	0.001	Hand & edge tool mfg
3523	333922	320	39599	0.008	Conveyor & conveying equipment mfg
3523	333111	66370	66370	1.000	Farm machinery & equipment mfg
3523	332323	3082	34391	0.090	Ornamental & architectural metal work mfg
3524	332212	60	50388	0.001	Hand & edge tool mfg
3524	333112	28617	28617	1.000	Lawn & garden tractor & home lawn & garden equipment mfg
3531	333120	74965	74965	1.000	Construction machinery mfg
3531	333923	10263	18014	0.570	Overhead traveling crane, hoist, & monorail system mfg
3531	336510	2379	34012	0.070	Railroad rolling stock mfg
3532	333131	13547	13547	1.000	Mining machinery & equipment mfg
3533	333132	29451	29451	1.000	Oil & gas field machinery & equipment mfg
3534	333921	9442	9442	1.000	Elevator & moving stairway mfg
3535	333922	39279	39599	0.992	Conveyor & conveying equipment mfg
3536	333923	7751	18014	0.430	Overhead traveling crane, hoist, & monorail system mfg
3537	333924	25953	25953	1.000	Industrial truck, tractor, trailer, & stacker machinery mfg
3537	332439	64	14922	0.004	Other metal container mfg
3537	332999	240	79070	0.003	All other miscellaneous fabricated metal product mfg
3541	333512	28849	29371	0.982	Machine tool (metal cutting types) mfg
3542	333513	14185	14185	1.000	Machine tool (metal forming types) mfg
3543	332997	7959	7959	1.000	Industrial pattern mfg
3544	333511	48657	48657	1.000	Industrial mold mfg
3544	333514	80113	80113	1.000	Special die & tool, die set, jig, & fixture mfg
3545	332212	6379	50388	0.127	Hand & edge tool mfg
3545	333515	47925	47925	1.000	Cutting tool & machine tool accessory mfg
3546	333991	16816	16816	1.000	Power-driven handtool mfg
3547	333516	4149	4149	1.000	Rolling mill machinery & equipment mfg
3548	335311	0	26638	0.000	Power, distribution, & specialty transformer mfg
3548	333992	22434	22505	0.997	Welding & soldering equipment mfg
3549	333518	19023	19023	1.000	Other metalworking machinery mfg
3552	333292	13600	13600	1.000	Textile machinery mfg
3553	333210	9117	9117	1.000	Sawmill & woodworking machinery mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3554	333291	18594	18594	1.000	Paper industry machinery mfg
3555	333293	17500	21000	0.833	Printing machinery & equipment mfg
3556	333294	19026	19026	1.000	Food product machinery mfg
3559	333319	2890	56910	0.051	Other commercial & service industry machinery mfg
3559	333220	18574	18574	1.000	Plastics & rubber industry machinery mfg
3559	333295	40087	40087	1.000	Semiconductor machinery mfg
3559	333298	53046	53106	0.999	All other industrial machinery mfg
3561	333911	36552	36552	1.000	Pump & pumping equipment mfg
3562	332991	36991	36991	1.000	Ball & roller bearing mfg
3563	333912	24821	24821	1.000	Air & gas compressor mfg
3564	333411	16183	16183	1.000	Air purification equipment mfg
3564	333412	13723	13723	1.000	Industrial & commercial fan & blower mfg
3565	333993	31581	31581	1.000	Packaging machinery mfg
3566	333612	16231	16231	1.000	Speed changer, industrial high-speed drive, & gear mfg
3567	333994	17585	17585	1.000	Industrial process furnace & oven mfg
3568	333613	21604	21604	1.000	Mechanical power transmission equipment mfg
3569	333999	50088	61151	0.819	All other miscellaneous general-purpose machinery mfg
3571	334111	100115	100115	1.000	Electronic computer mfg
3572	334112	42364	42364	1.000	Computer storage device mfg
3575	334113	5764	5764	1.000	Computer terminal mfg
3577	334119	87253	93970	0.929	Other computer peripheral equipment mfg
3578	333313	966	14831	0.065	Office machinery mfg
3578	334119	6717	93970	0.071	Other computer peripheral equipment mfg
3579	333313	13865	14831	0.935	Office machinery mfg
3579	334518	750	6333	0.118	Watch, clock, & part mfg
3579	339942	1234	7990	0.154	Lead pencil & art good mfg
3581	333311	8178	8178	1.000	Automatic vending machine mfg
3582	333312	4523	4523	1.000	Commercial laundry, drycleaning, & pressing machine mfg
3585	333415	119456	119795	0.997	AC & warm air heating & commercial/industrial refrig equip mfg
3585	336391	21522	21522	1.000	Motor vehicle air-conditioning mfg
3586	333913	6824	6824	1.000	Measuring & dispensing pump mfg
3589	333319	44172	56910	0.776	Other commercial & service industry

SIC	NAICS	SIC Employees 1997	NAICS Employees ‘1997	Employee Fraction	NAICS description
					machinery mfg
3592	336311	17518	17518	1.000	Carburetor, piston, piston ring, & valve mfg
3593	333995	23062	23062	1.000	Fluid power cylinder & actuator mfg
3594	333996	15482	15482	1.000	Fluid power pump & motor mfg
3596	333997	4871	4871	1.000	Scale & balance (except laboratory) mfg
3599	332710	290951	290951	1.000	Machine shops
3599	332999	4199	79070	0.053	All other miscellaneous fabricated metal product mfg
3599	333319	1335	56910	0.023	Other commercial & service industry machinery mfg
3599	333999	11063	61151	0.181	All other miscellaneous general-purpose machinery mfg
Part of Misc. & Electronic Degreasing and Part of Electrical Insulation Surface Coating					
3612	335311	26638	26638	1.000	Power, distribution, & specialty transformer mfg
Part of Misc. & Electronic Degreasing					
3613	335313	41291	41291	1.000	Switchgear & switchboard apparatus mfg
3621	335312	71112	74666	0.952	Motor & generator mfg
3624	335991	10887	10887	1.000	Carbon & graphite product mfg
3625	335314	68365	68365	1.000	Relay & industrial control mfg
3629	335999	18682	44754	0.417	All other miscellaneous electrical equipment & component mfg
Part of Misc. & Electronic Degreasing and Appliance Surface Coating					
3631	335221	17543	17543	1.000	Household cooking appliance mfg
3632	335222	24597	24597	1.000	Household refrigerator & home freezer mfg
3633	335224	14801	14801	1.000	Household laundry equipment mfg
3634	333414	2171	24666	0.088	Heating equipment (except warm air furnaces) mfg
3634	335211	17058	17058	1.000	Electric housewares & household fan mfg
3635	335212	10537	10537	1.000	Household vacuum cleaner mfg
3639	333298	60	53106	0.001	All other industrial machinery mfg
3639	335212	0	10537	0.000	Household vacuum cleaner mfg
3639	335228	13309	13309	1.000	Other major household appliance mfg
Part of Misc. & Electronic Degreasing					
3641	335110	15903	15903	1.000	Electric lamp bulb & part mfg
3643	335931	44907	44907	1.000	Current-carrying wiring device mfg
3644	335932	23540	23540	1.000	Noncurrent-carrying wiring device mfg
3645	335121	16395	17685	0.927	Residential electric lighting fixture mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3646	335122	23090	23090	1.000	Commercial/industrial/institutional electric lighting fixture mfg
3647	336321	16506	16506	1.000	Vehicular lighting equipment mfg
3648	335129	18274	18282	1.000	Other lighting equipment mfg
3651	334310	31727	31727	1.000	Audio & video equipment mfg
3652	334612	16598	25554	0.650	Prerecorded CD (except software), tape, & record reproducing
3661	334210	104262	104262	1.000	Telephone apparatus mfg
3661	334416	63	19431	0.003	Electronic coil, transformer, & other inductor mfg
3661	334418	6083	111054	0.055	Printed circuit assembly (electronic assembly) mfg
3663	334220	148156	164461	0.901	Radio & TV broadcasting & wireless communications equipment mfg
3669	334290	25187	25187	1.000	Other communications equipment mfg
3671	334411	21976	21976	1.000	Electron tube mfg
3672	334412	76702	76702	1.000	Bare printed circuit board mfg
3674	334413	199497	199497	1.000	Semiconductor & related device mfg
3675	334414	18882	18882	1.000	Electronic capacitor mfg
3676	334415	11964	11964	1.000	Electronic resistor mfg
3677	334416	19178	19431	0.987	Electronic coil, transformer, & other inductor mfg
3678	334417	37232	37232	1.000	Electronic connector mfg
3679	336322	12786	95491	0.134	Other motor vehicle electrical & electronic equipment mfg
3679	334220	16305	164461	0.099	Radio & TV broadcasting & wireless communications equipment mfg
3679	334418	104971	111054	0.945	Printed circuit assembly (electronic assembly) mfg
3679	334419	92200	92200	1.000	Other electronic component mfg
3691	335911	23288	23288	1.000	Storage battery mfg
3692	335912	8917	8917	1.000	Primary battery mfg
3694	336322	52216	95491	0.547	Other motor vehicle electrical & electronic equipment mfg
3695	334613	21345	21345	1.000	Magnetic & optical recording media mfg
3699	333992	71	22505	0.003	Welding & soldering equipment mfg
3699	335999	26072	44754	0.583	All other miscellaneous electrical equipment & component mfg
3699	335129	8	18282	0.000	Other lighting equipment mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees ‘1997	Employee Fraction	NAICS description
3699	334519	29	33933	0.001	Other measuring & controlling device mfg
3699	334516	159	38359	0.004	Analytical laboratory instrument mfg
3699	334119	0	93970	0.000	Other computer peripheral equipment mfg
3699	334510	542	54385	0.010	Electromedical & electrotherapeutic apparatus mfg
3699	339114	0	18072	0.000	Dental equipment & supplies mfg
3699	333512	522	29371	0.018	Machine tool (metal cutting types) mfg
3699	333319	8513	56910	0.150	Other commercial & service industry machinery mfg
3699	333315	0	24707	0.000	Photographic & photocopying equipment mfg
3699	333314	56	20857	0.003	Optical instrument & lens mfg
3699	333293	175	21000	0.008	Printing machinery & equipment mfg
3699	333292	0	13600	0.000	Textile machinery mfg
3699	332212	424	50388	0.008	Hand & edge tool mfg
3699	334511	604	188161	0.003	Search, detection, navigation, & guidance instrument mfg
3699	333618	10	56348	0.000	Other engine equipment mfg
Part of Misc. Degreasing and New Automobile Surface Coating					
3711	336992	375	5788	0.065	Military armored vehicle, tank, & tank component mfg
3711	336111	114060	114060	1.000	Automobile mfg
3711	336112	94033	94033	1.000	Light truck & utility vehicle mfg
3711	336120	28214	28214	1.000	Heavy duty truck mfg
3711	336211	404	43384	0.009	Motor vehicle body mfg
Part of Misc. Degreasing and Part of Other Transportation Equipment Surface Coating					
3713	336211	41779	43384	0.963	Motor vehicle body mfg
3714	336312	81368	81368	1.000	Gasoline engine & engine parts mfg
3714	336322	30489	95491	0.319	Other motor vehicle electrical & electronic equipment mfg
3714	336330	48944	48944	1.000	Motor vehicle steering & suspension component (except spring) mfg
3714	336340	43132	43132	1.000	Motor vehicle brake system mfg
3714	336350	111954	111954	1.000	Motor vehicle transmission & power train parts mfg
3714	336399	173569	174465	0.995	All other motor vehicle parts mfg
3714	336211	1201	43384	0.028	Motor vehicle body mfg
3715	336212	30678	30678	1.000	Truck trailer mfg
3716	336213	18086	18086	1.000	Motor home mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3721	336411	200961	200961	1.000	Aircraft mfg
3724	336412	82557	82557	1.000	Aircraft engine & engine parts mfg
3728	332912	0	37132	0.000	Fluid power valve & hose fitting mfg
3728	336413	127729	127729	1.000	Other aircraft part & auxiliary equipment mfg
3728	333995	0	23062	0.000	Fluid power cylinder & actuator mfg
3728	333996	0	15482	0.000	Fluid power pump & motor mfg
Part of Misc. Degreasing and Marine Surface Coating					
3731	336611	97385	97385	1.000	Ship building & repairing
3732	336612	41422	41422	1.000	Boat building
3732	811490	9454	65213	0.145	Other personal & household goods repair & maintenance
Part of Misc. Degreasing and Part of Other Transportation Equipment Surface Coating					
3743	333911	0	36552	0.000	Pump & pumping equipment mfg
3743	336510	31633	34012	0.930	Railroad rolling stock mfg
3751	336991	17158	17218	0.997	Motorcycle, bicycle, & parts mfg
3761	336414	52158	52158	1.000	Guided missile & space vehicle mfg
3764	336415	18540	18540	1.000	Guided missile & space vehicle propulsion unit & parts mfg
3769	336419	6110	6110	1.000	Other guided missile & space vehicle parts & auxiliary equip mfg
3792	336214	20112	33352	0.603	Travel trailer & camper mfg
3795	336992	5415	5788	0.936	Military armored vehicle, tank, & tank component mfg
3799	336214	13240	33352	0.397	Travel trailer & camper mfg
3799	336999	19466	19466	1.000	All other transportation equipment mfg
3799	332212	60	50388	0.001	Hand & edge tool mfg
Part of Misc. Degreasing					
3812	334511	187557	188161	0.997	Search, detection, navigation, & guidance instrument mfg
3821	339111	18253	18253	1.000	Laboratory apparatus & furniture mfg
3822	334512	21450	21450	1.000	Automatic environmental control mfg
3823	334513	49196	49196	1.000	Industrial process control instrument mfg
3824	334514	17390	17390	1.000	Totalizing fluid meter & counting device mfg
3825	334416	190	19431	0.010	Electronic coil, transformer, & other inductor mfg
3825	334515	63332	63332	1.000	Electricity measuring & testing instrument mfg
3826	334516	38200	38359	0.996	Analytical laboratory instrument mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees ‘1997	Employee Fraction	NAICS description
3827	333314	20801	20857	0.997	Optical instrument & lens mfg
3829	339112	521	107819	0.005	Surgical & medical instrument mfg
3829	334519	33904	33933	0.999	Other measuring & controlling device mfg
3841	339112	107298	107819	0.995	Surgical & medical instrument mfg
3842	322121	375	120176	0.003	Paper (except newsprint) mills
3842	322291	2236	21791	0.103	Sanitary paper product mfg
3842	334510	6722	54385	0.124	Electromedical & electrotherapeutic apparatus mfg
3842	339113	82390	85315	0.966	Surgical appliance & supplies mfg
3843	339114	18072	18072	1.000	Dental equipment & supplies mfg
3844	334517	14276	14276	1.000	Irradiation apparatus mfg
3845	334510	47121	54385	0.866	Electromedical & electrotherapeutic apparatus mfg
3851	339115	26366	26366	1.000	Ophthalmic goods mfg
3861	325992	38935	38935	1.000	Photographic film, paper, plate, & chemical mfg
3861	333315	24707	24707	1.000	Photographic & photocopying equipment mfg
3873	334518	5646	6333	0.892	Watch, clock, & part mfg
3911	339911	34694	34773	0.998	Jewelry (except costume) mfg
3914	332211	101	11230	0.009	Cutlery & flatware (except precious) mfg
3914	339912	6356	6459	0.984	Silverware & plated ware mfg
3915	339913	5396	5396	1.000	Jewelers' material & lapidary work mfg
3931	339992	13411	13411	1.000	Musical instrument mfg
3942	339931	3393	3393	1.000	Doll & stuffed toy mfg
3944	336991	60	17218	0.003	Motorcycle, bicycle, & parts mfg
3944	339932	29622	29622	1.000	Game, toy, & children's vehicle mfg
3949	339920	69664	69664	1.000	Sporting & athletic goods mfg
3951	339941	8394	8394	1.000	Pen & mechanical pencil mfg
3952	339942	5815	7990	0.728	Lead pencil & art good mfg
3952	337127	187	38218	0.005	Institutional furniture mfg
3952	325998	0	35915	0.000	All other miscellaneous chemical product & preparation mfg
3953	339943	7831	7831	1.000	Marking device mfg
3955	339944	5923	5923	1.000	Carbon paper & inked ribbon mfg
3961	339914	13976	14573	0.959	Costume jewelry & novelty mfg
3965	339993	7500	7842	0.956	Fastener, button, needle, & pin mfg
3991	339994	13882	16826	0.825	Broom, brush, & mop mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees ‘1997	Employee Fraction	NAICS description
3993	339950	82956	82956	1.000	Sign mfg
3995	339995	6962	6962	1.000	Burial casket mfg
3996	326192	5614	6070	0.925	Resilient floor covering mfg
3999	323119	0	33016	0.000	Other commercial printing
3999	337127	329	38218	0.009	Institutional furniture mfg
3999	335121	1216	17685	0.069	Residential electric lighting fixture mfg
3999	332999	3231	79070	0.041	All other miscellaneous fabricated metal product mfg
3999	332212	750	50388	0.015	Hand & edge tool mfg
3999	326199	3141	526382	0.006	All other plastics product mfg
3999	325998	572	35915	0.016	All other miscellaneous chemical product & preparation mfg
3999	314999	2167	64480	0.034	All other miscellaneous textile product mills
3999	323113	0	72221	0.000	Commercial screen printing
3999	339999	60397	74137	0.815	All other miscellaneous mfg
3999	316110	329	15317	0.021	Leather & hide tanning & finishing
3999	321999	0	43839	0.000	All other miscellaneous wood product mfg
3999	322299	0	24302	0.000	All other converted paper product mfg
3999	323110	0	415117	0.000	Commercial lithographic printing
3999	323111	0	23260	0.000	Commercial gravure printing
3999	323112	0	30588	0.000	Commercial flexographic printing
Part of Misc. Open Top Degreasing & Auto Repair Cold Cleaning					
4173	488490	220	7480	0.029	Other support activities for road transportation
4231	488490	120	7480	0.016	Other support activities for road transportation
5511	441110	1046243	1046243	1.000	New car dealers
5521	441120	92752	92752	1.000	Used car dealers
5541	447190	69640	308105	0.226	Other gasoline stations
5541	447110	432935	613957	0.705	Gasoline stations with convenience stores
5541	447190	238465	308105	0.774	Other gasoline stations
5551	441222	35134	35134	1.000	Boat dealers
5561	441210	29463	29463	1.000	Recreational vehicle dealers
7532	811121	192853	205172	0.940	Automotive body, paint, & interior repair & maintenance
7532	811121	6507	205172	0.032	Automotive body, paint, & interior repair & maintenance
7532	811121	5812	205172	0.028	Automotive body, paint, & interior repair & maintenance

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
7533	811112	23015	23015	1.000	Automotive exhaust system repair
7534	811198	2991	14780	0.202	All other automotive repair & maintenance
7534	326212	7939	7939	1.000	Tire retreading
7536	811122	29187	29187	1.000	Automotive glass replacement shops
7537	811113	29442	29442	1.000	Automotive transmission repair
7538	811111	290634	290634	1.000	General automotive repair
7539	811118	3954	42234	0.094	Other automotive mechanical & electrical repair & maintenance
7539	811118	4802	42234	0.114	Other automotive mechanical & electrical repair & maintenance
7539	811118	18216	42234	0.431	Other automotive mechanical & electrical repair & maintenance
7539	811118	6890	42234	0.163	Other automotive mechanical & electrical repair & maintenance
7539	811118	8372	42234	0.198	Other automotive mechanical & electrical repair & maintenance
Dry Cleaning					
7215	812310	53023	53023	1.000	Dry cleaning, coin operated
7216	812320	166208	203777	0.816	Dry cleaning, commercial

6.0 REFERENCES

1. Emissions Inventory Improvement Program (EIIP) Technical Reports, Vol. 3, Area Sources as of December 2002, (http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html).

2. 2000 County Business Patterns, http://www.census.gov/econ/www/index.html

3. North Carolina Office of State Budget and Management, http://demog.state.nc.us/

4. Economic Growth Analysis System (E-GAS) version 5.0 Beta, http://www.epa.gov/ttn/ecas/egas5.htm

5. Climatological Data, North Carolina, June 2000 Volume 105 Number 06, July 2000 Volume 105 Number 07, August Volume 105 Number 08.

Appendix C.3

On-road Mobile Source Emissions

Inventory Documentation

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION AND SCOPE

This appendix documents the development of on-road mobile source emissions inventories for the Raleigh-Durham-Chapel Hill, North Carolina 8-Hour Ozone Maintenance Area. These emissions inventories are used to generate revised motor vehicle emissions budgets (MVEBs) for the area based on the latest approved emissions model. On June 7, 2007, the North Carolina Division of Air Quality (NCDAQ) submitted the "Redesignation Demonstration and Maintenance Plan for the Raleigh-Durham-Chapel Hill, North Carolina 8-Hour Ozone Nonattainment Area" to the U. S. Environmental Protection Agency (USEPA). The plan provided documentation that the Raleigh-Durham-Chapel Hill, North Carolina 8-Hour Ozone Nonattainment Area (hereinafter referred to as the “Triangle area”) had attained compliance with the 1997 8-hour ozone standard. The Triangle area includes Durham, Franklin, Granville, Johnston, Orange, Person, and Wake Counties and Baldwin, Center, New Hope and Williams Townships in Chatham County. The plan also established MVEBs for nitrogen oxides (NO_x) emissions from on-road mobile sources for each county in the Triangle area. The MVEBs were based on the results of emissions modeling using MOBILE6.2, the USEPA’s approved on-road mobile source emissions model at that time. The Triangle area was redesignated as a maintenance area on December 27, 2007.

In 2010, the MOBILE6.2 model was superseded by the MOVES (MOtor Vehicle Emissions Simulator) model. To ease the transition from MOBILE6.2 to MOVES, the USEPA also established a grace period, ending March 2, 2013, which allows state and local jurisdictions the option to continue using MOBILE6.2 for transportation conformity emissions analyses. After the grace period ends, MOVES must be used for all transportation conformity emissions analysis modeling; therefore, MOVES-based or MOVES-compatible MVEBs must be developed and approved for all nonattainment and maintenance areas prior to any transportation conformity analyses which use MOVES. Mobile source emissions comprise significant portions of the overall nitrogen oxides (NOx) and volatile organic compounds (VOCs) emissions in the Triangle area. Mobile sources can be subdivided into two subcategories, on-road mobile and off-highway mobile sources. Off-road mobile sources are further divided into nonroad mobile, railroad locomotives and aircraft engines. The larger contributor to the mobile source emissions is from on-road mobile sources.

This appendix covers only the procedures for developing MOVES-based NOx and VOC emissions inventories for the Triangle area on-road mobile sources. These emission inventories will replace the MOBILE6.2-based inventories used in the original Triangle area maintenance plan.

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. MOVES2010b (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.

MOVES-based emission inventories were developed for the maintenance plan base year (2005), the plan interim year (2011), and the plan future year (2017). Emission inventories for 2008 and 2014 were also generated for use in developing MVEBs for conformity analysis purposes. Each inventory represents the estimated emissions for a typical summer day, specifically a July weekday.

3.0 QUALITY ASSURANCE MEASURES

The quality assurance (QA) for the on-road 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 MOBILE SOURCE EMISSIONS MODELING

On-road mobile sources produce NOx, 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 mobile sources are defined as those vehicles that travel on public roadways. 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.

An important component of the on-road mobile emission estimation process is interagency consultation. The primary transportation partners involved in the Triangle redesignation interagency consultation process included: NCDOT, USEPA, Federal Highway Administration (FHWA), Triangle J Council of Governments, Capital Area Metropolitan Planning Organization (CAMPO), Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO), the Burlington-Graham Metropolitan Planning Organization (BGMPO), and the Kerr-Tar Regional Council of Governments. CAMPO performed travel demand modeling using the Triangle Regional Model (TRM) and provided the speed and VMT data for the areas within the municipal planning organization boundaries. The NCDOT provided speed and VMT data for the portions of four counties (Franklin, Granville, Johnston, and Person Counties) not covered by the TRM, which are referred to as non-modeled analysis areas (NMAA). The NCDOT also provided vehicle registration data and vehicle mix data for all Triangle area counties

4.2 MOVES Model Input

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

4.2.1 On-road Vehicle Speed Data

Emissions modeling using MOVES requires vehicle speed input data formatted as fractions of driving time in each of sixteen speed ranges, called “speed bins”, for each combination of clock hour/day type (week day or weekend day), vehicle type, and road type. Speed Bin 1 represents speeds from 0 to 2.5 mph, and Speed Bin 16 represents speeds of 72.5 mph and greater. Speed Bins 2 through 15 each represent 5 mph speed ranges between 2.5 mph and 72.5 mph. The fractions for each combination of vehicle type, road type, and hour/day type sum to one. To generate these average speed distribution input tables, the NCDAQ used spreadsheet-based data converters developed by the USEPA to process the speed and VMT data provided by CAMPO and NCDOT.

Raw Speed Data

The CAMPO provided the speed and VMT data for the areas within their jurisdiction (all of Durham, Orange, and Wake counties, the portion of the Triangle non-attainment area within Chatham, and portions of Franklin, Granville, Johnston, and Person counties). The data was categorized by roadway functional class and by the three travel periods described in Table 4.2.1-1.

Table 4.2.1-1 Triangle Regional Model Travel Periods

Travel Period	Start Time	Duration
AM Peak	6:00 AM – 10:00AM	4 hours
PM Peak	3:00 PM - 7:00 PM	4 hours
Off-peak	10:00 AM - 3:00 PM, 7:00 PM - 6:00 AM	16 hours

The NCDOT provided speed and VMT data for the NMAA portions of Franklin, Granville, Johnston, and Person Counties. These data were generated from Highway Performance Monitoring System (HPMS) VMT data. The NMAA speed data, unlike the TRM speed data, was provided as daily average speeds categorized by roadway functional class.

Tables 4.2.1-2 and 4.2.1-9 provide a summary of the TRM speed data. Table 4.2.1-10 lists all NMAA speed data. The column headings in these tables represent the road types used in the modeling and are listed below.

Heading	Functional Class	Heading	Functional Class
RI	Rural Interstate	UI	Urban Interstate
RPA	Rural Other Principle Arterial	UF	Urban Freeway & Expressway
RMA	Rural Minor Arterial	UPA	Urban Other Principal Arterial
RMjC	Rural Major Collector	UMiA	Urban Minor Arterial
RMiC	Rural Minor Collector	UC	Urban Collector
RL	Rural Local	UL	Urban Local

Table 4.2.1-2 Chatham County Speeds from Triangle Regional Model

County	Year	Period	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMiA	UC	UL
Chatham	2005	AM	-	54.6	47.0	45.6	41.7	20.6	-	-	43.7	36.7	49.0	43.0
		OP	-	53.9	46.8	45.0	41.4	21.0	-	-	43.2	32.7	48.0	43.0
		PM	-	56.4	47.5	45.4	42.0	20.3	-	-	49.7	41.3	51.2	43.0
	2008	AM	-	55.9	46.9	45.5	41.4	21.2	-	-	50.5	35.4	49.0	42.9
		OP	-	55.4	46.8	45.0	41.1	21.5	-	-	50.2	31.5	47.4	42.8
		PM	-	56.8	47.6	45.3	41.8	20.9	-	-	53.7	41.4	51.1	43.0
	2011	AM	-	56.6	46.8	45.5	41.0	21.6	-	-	54.9	33.7	48.6	42.9
		OP	-	56.3	46.8	44.8	40.7	21.9	-	-	54.8	29.9	46.8	42.8
		PM	-	57.1	47.6	45.2	41.5	21.3	-	-	56.2	40.8	51.0	43.0
	2014	AM	-	56.5	46.7	45.3	40.6	21.6	-	-	54.8	31.3	47.7	42.9
		OP	-	56.1	46.5	44.4	40.2	21.8	-	-	54.4	27.6	46.1	42.8
		PM	-	57.0	47.6	45.1	41.1	21.2	-	-	56.0	38.6	50.8	43.0
	2017	AM	-	56.3	46.5	45.1	40.2	21.6	-	-	54.6	28.9	46.8	42.9
		OP	-	55.8	46.3	43.9	39.7	21.8	-	-	54.1	25.3	45.4	42.9
		PM	-	56.9	47.5	45.1	40.6	21.1	-	-	55.8	36.4	50.7	43.0

Table 4.2.1-3 Durham County Speeds from Triangle Regional Model

County	Year	Period	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMiA	UC	UL
Durham	2005	AM	70.5	47.9	53.0	46.0	41.5	26.9	62.1	54.0	40.3	38.0	40.2	22.4
		OP	68.4	42.2	52.1	43.5	41.4	27.2	55.0	50.1	37.1	35.9	39.0	22.5
		PM	70.9	50.0	56.6	47.4	41.8	26.5	64.6	57.2	42.7	40.4	41.9	22.1
	2008	AM	70.5	45.6	52.9	45.3	41.4	27.4	63.5	53.7	39.6	38.2	40.4	22.3
		OP	68.6	42.0	51.6	42.8	41.3	27.7	58.1	50.5	36.2	36.2	38.8	22.4
		PM	70.9	47.6	56.5	47.1	41.7	27.2	65.7	57.0	41.9	40.6	42.0	22.1
	2011	AM	70.4	44.2	52.8	44.6	41.3	27.7	64.2	53.4	39.1	38.2	40.4	22.3
		OP	68.5	42.0	51.1	42.1	41.1	27.9	59.9	50.4	35.6	36.3	38.6	22.4
		PM	70.9	46.1	56.5	46.8	41.6	27.5	66.4	56.8	41.4	40.7	42.0	22.1
	2014	AM	70.1	44.2	52.8	44.3	41.2	27.3	63.4	52.8	39.2	37.9	40.1	22.3
		OP	67.9	42.5	50.5	41.7	41.0	27.6	58.9	49.5	35.3	35.9	38.2	22.3
		PM	70.7	46.2	56.4	46.6	41.6	27.2	66.1	56.6	41.6	40.4	41.8	22.1
	2017	AM	69.7	44.3	52.8	43.9	41.1	27.0	62.7	52.3	39.3	37.6	39.9	22.3
		OP	67.2	43.1	49.8	41.2	40.9	27.3	57.9	48.6	35.1	35.5	37.9	22.3
		PM	70.4	46.2	56.4	46.4	41.6	26.8	65.7	56.5	41.8	40.2	41.6	22.1

Table 4.2.1-4 Franklin County Speeds from Triangle Regional Model

County	Yr	Period	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMiA	UC	UL
Franklin	2005	AM	-	59.8	54.7	50.7	45.3	16.5	-	-	52.2	41.9	44.4	20.9
		OP	-	59.4	54.4	50.2	45.2	16.6	-	-	51.4	41.0	44.1	21.3
		PM	-	60.1	55.1	51.3	45.7	16.4	-	-	52.9	44.7	44.8	20.4
	2008	AM	-	59.9	54.6	51.1	45.5	20.5	-	-	52.1	42.4	42.8	20.9
		OP	-	59.6	54.2	50.7	45.4	20.6	-	-	51.1	41.1	42.6	21.1
		PM	-	60.2	55.0	51.7	45.8	20.4	-	-	52.8	44.6	43.0	20.5
	2011	AM	-	59.9	54.5	51.4	45.5	23.1	-	-	51.9	42.6	41.9	21.0
		OP	-	59.6	54.1	51.0	45.4	23.3	-	-	50.9	41.1	41.7	21.1
		PM	-	60.2	54.9	52.0	45.8	23.1	-	-	52.7	44.6	42.1	20.5
	2014	AM	-	59.7	54.4	51.3	45.5	22.9	-	-	51.7	42.6	42.4	21.0
		OP	-	59.3	54.0	50.8	45.4	23.1	-	-	50.7	40.8	42.2	21.1
		PM	-	60.0	54.8	51.9	45.8	22.9	-	-	52.6	44.5	42.7	20.5
	2017	AM	-	59.4	54.2	51.2	45.4	22.7	-	-	51.6	42.6	43.0	21.0
		OP	-	59.0	53.8	50.7	45.3	22.9	-	-	50.4	40.5	42.6	21.1
		PM	-	59.7	54.8	51.8	45.7	22.8	-	-	52.4	44.5	43.4	20.4

Table 4.2.1-5 Granville County Speeds from Triangle Regional Model

County	Yr	Period	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMiA	UC	UL
Granville		AM	-	49.5	57.9	45.1	41.4	18.4	-	-	-	33.8	43.0	-
	2005	OP	-	49.5	57.8	44.6	41.1	18.7	-	-	-	32.6	42.5	-
		PM	70.9	49.8	57.9	45.9	42.3	19.3	-	-	-	36.3	44.6	-
		AM	70.8	49.7	44.5	45.3	41.8	21.8	-	-	-	32.6	44.7	-
	2008	OP	69.7	49.6	44.0	44.9	41.5	22.1	-	-	-	31.7	44.3	-
		PM	71.0	49.9	47.5	46.2	42.6	22.5	-	-	-	36.1	46.1	-
		AM	70.8	49.8	35.6	45.4	42.1	24.0	-	-	-	31.5	45.8	-
	2011	OP	69.6	49.7	34.7	45.0	41.8	24.4	-	-	-	31.0	45.3	-
		PM	71.1	50.0	40.4	46.4	42.9	24.6	-	-	-	36.0	47.0	-
		AM	70.7	49.8	35.6	45.3	42.0	23.9	-	-	-	30.7	45.5	-
	2014	OP	69.4	49.8	34.5	44.8	41.8	24.3	-	-	-	30.4	45.0	-
		PM	71.0	50.1	40.0	46.2	42.9	24.4	-	-	-	35.7	46.8	-
		AM	70.6	49.9	35.6	45.2	42.0	23.8	-	-	-	29.8	45.3	-
	2017	OP	69.3	49.9	34.3	44.6	41.7	24.2	-	-	-	29.8	44.6	-
		PM	70.9	50.2	39.7	46.1	43.0	24.2	-	-	-	35.5	46.7	-

Table 4.2.1-6 Johnston County Speeds from Triangle Regional Model

County	Yr	Period	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMiA	UC	UL
Johnston		AM	71.5	50.3	54.0	52.2	45.1	21.3	68.3	-	38.1	44.4	41.9	24.3
	2005	OP	69.9	48.2	53.3	51.2	44.9	21.4	65.5	-	33.8	43.5	40.6	24.3
		PM	71.2	50.3	54.2	53.0	45.4	21.3	69.3	-	39.6	46.5	42.9	23.5
		AM	71.5	55.6	53.6	51.6	44.8	23.0	68.5	-	39.5	44.3	42.5	24.2
	2008	OP	70.1	53.9	53.1	50.8	44.5	23.2	66.2	-	36.6	43.2	41.0	24.1
		PM	71.2	56.0	53.9	52.8	45.2	23.0	69.2	-	41.0	46.6	43.8	23.6
		AM	71.5	59.1	53.3	51.2	44.5	24.2	68.6	-	40.4	44.1	42.7	24.2
	2011	OP	70.0	57.6	53.0	50.5	44.3	24.3	66.5	-	38.2	42.8	40.9	24.0
		PM	71.0	59.8	53.7	52.6	45.1	24.1	69.1	-	41.9	46.6	44.3	23.8
		AM	71.4	58.9	53.3	51.1	44.5	24.2	68.3	-	40.0	43.6	42.3	24.1
	2014	OP	69.6	57.3	52.9	50.2	44.1	24.4	66.0	-	37.4	42.0	40.1	23.7
		PM	70.4	59.6	53.7	52.5	45.1	24.1	68.8	-	41.8	46.4	44.0	24.0
		AM	71.4	58.8	53.3	51.0	44.4	24.2	68.1	-	39.6	43.2	41.9	24.1
	2017	OP	69.1	57.0	52.9	50.0	44.0	24.4	65.6	-	36.7	41.2	39.3	23.5
		PM	69.8	59.4	53.7	52.4	45.1	24.1	68.5	-	41.8	46.2	43.8	24.1

Table 4.2.1-7 Orange County Speeds from Triangle Regional Model

County	Yr	Period	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMiA	UC	UL
Orange	2005	AM	70.1	-	51.5	48.0	41.8	21.0	68.2	44.5	37.4	36.3	38.2	21.4
		OP	68.2	-	51.2	47.7	41.7	21.1	64.0	42.4	35.5	34.7	37.7	21.3
		PM	69.7	-	52.2	48.4	42.3	21.2	69.1	46.8	39.9	38.1	38.6	21.0
	2008	AM	69.5	-	51.7	47.6	41.4	22.8	67.8	42.6	35.6	34.9	37.8	21.5
		OP	66.9	-	51.4	47.3	41.3	23.0	62.5	40.1	33.3	33.3	37.1	21.6
		PM	69.0	-	52.5	48.0	42.0	23.1	68.5	45.8	39.0	37.2	38.5	21.2
	2011	AM	69.0	-	51.8	47.3	41.1	24.0	67.0	41.1	34.3	34.0	37.7	21.7
		OP	5.9	-	51.5	46.9	41.1	24.2	60.8	38.1	31.6	32.3	36.7	21.8
		PM	68.5	-	52.6	47.7	41.8	24.4	67.9	45.1	38.4	36.7	38.5	21.4
	2014	AM	69.0	-	51.7	47.1	41.0	23.9	65.6	40.3	34.1	34.1	37.9	21.9
		OP	65.5	-	51.4	46.6	40.9	24.0	58.6	36.9	31.1	31.9	37.0	21.9
		PM	68.4	-	52.5	47.6	41.8	24.2	67.5	44.5	38.3	36.7	38.7	21.6
	2017	AM	68.9	-	51.5	46.9	40.9	23.8	64.1	39.5	33.9	34.1	38.1	22.1
		OP	65.2	-	51.2	46.4	40.8	23.9	56.4	35.8	30.6	31.5	37.2	22.0
		PM	68.2	-	52.4	47.6	41.7	24.1	67.0	44.0	38.2	36.8	39.0	21.8

Table 4.2.1-8 Person County Speeds from Triangle Regional Model

County	Yr	Period	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMiA	UC	UL
Person	2005	AM	-	46.4	44.4	48.1	44.6	25.2	-	-	-	-	-	-
		OP	-	46.6	44.0	47.9	44.5	25.2	-	-	-	-	-	-
		PM	-	47.5	44.6	48.6	44.7	25.3	-	-	-	-	-	-
	2008	AM	-	46.5	45.1	48.3	45.5	26.4	-	-	-	-	-	-
		OP	-	46.8	44.7	48.2	45.2	26.3	-	-	-	-	-	-
		PM	-	47.7	45.3	48.9	45.7	26.5	-	-	-	-	-	-
	2011	AM	-	46.5	45.6	48.5	46.0	27.2	-	-	-	-	-	-
		OP	-	46.9	45.1	48.4	45.6	27.1	-	-	-	-	-	-
		PM	-	47.7	45.7	49.2	46.3	27.3	-	-	-	-	-	-
	2014	AM	-	46.4	45.4	48.6	46.0	27.1	-	-	-	-	-	-
		OP	-	46.7	44.9	48.4	45.6	27.0	-	-	-	-	-	-
		PM	-	47.6	45.5	49.1	46.3	27.3	-	-	-	-	-	-
	2017	AM	-	46.3	45.2	48.6	46.0	27.1	-	-	-	-	-	-
		OP	-	46.6	44.7	48.4	45.6	26.9	-	-	-	-	-	-
		PM	-	47.5	45.4	49.1	46.3	27.2	-	-	-	-	-	-

Table 4.2.1-9 Wake County Speeds from Triangle Regional Model

County	Yr	Period	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMiA	UC	UL
Wake	2005	AM	-	68.5	52.1	48.8	39.2	24.1	63.5	58.8	45.0	41.1	39.2	24.5
		OP	-	68.0	51.0	47.8	38.9	24.2	60.6	56.3	43.2	39.4	38.1	24.4
		PM	-	68.6	53.2	49.3	39.7	23.8	66.5	61.1	49.1	43.7	41.2	24.1
	2008	AM	39.5	65.7	49.7	47.8	38.6	25.6	61.9	58.1	43.7	40.2	38.8	24.3
		OP	41.2	65.2	48.5	46.8	38.1	25.8	58.7	55.6	41.8	38.5	37.5	24.2
		PM	41.3	66.0	50.7	48.7	39.2	24.9	65.7	60.7	48.7	43.6	41.3	24.0
	2011	AM	65.2	63.9	47.9	47.1	38.0	26.6	60.7	57.4	42.8	39.5	38.4	24.3
		OP	67.6	63.4	46.7	46.1	37.4	26.8	57.1	54.8	40.8	37.8	36.9	24.1
		PM	68.3	64.4	48.8	48.3	38.8	25.8	65.0	60.4	48.4	43.5	41.3	23.9
	2014	AM	63.2	64.2	47.5	47.1	37.5	26.5	60.3	56.6	42.7	39.2	38.2	24.5
		OP	64.1	63.5	46.3	46.1	36.9	26.6	56.3	53.9	40.4	37.3	36.5	24.2
		PM	66.5	64.5	48.6	48.2	38.6	25.9	64.6	60.2	48.4	43.3	41.3	24.2
	2017	AM	61.3	64.5	47.1	47.2	37.1	26.5	59.9	55.9	42.6	38.8	37.9	24.7
		OP	60.7	63.6	45.9	46.2	36.3	26.4	55.5	53.1	40.1	36.7	36.1	24.4
		PM	64.7	64.7	48.3	48.0	38.3	26.0	64.1	60.0	48.3	43.2	41.2	24.4

Table 4.2.1-10 NMAA Speeds for the Triangle Area

County	Year	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMiA	UC	UL
Franklin	2005	-	47.4	44.2	43.3	42.4	42.4	-	-	28.7	32.0	-	31.1
	2008	-	47.4	44.2	43.3	42.4	42.4	-	-	28.7	32.0	-	31.1
	2011	-	47.4	44.2	43.3	42.4	42.4	-	-	28.7	32.0	-	31.1
	2014	-	47.4	44.2	43.3	42.4	42.4	-	-	28.7	32.0	-	31.1
	2017	-	47.4	44.2	43.3	42.4	42.4	-	-	28.7	32.0	-	31.1
Granville	2005	65.6	46.0	44.0	43.1	42.3	42.4	62.6	-	29.0	32.0	31.0	31.1
	2008	65.6	46.0	44.0	43.1	42.3	42.4	62.6	-	29.0	32.0	31.0	31.1
	2011	65.6	46.0	44.0	43.1	42.3	42.4	62.6	-	29.0	32.0	31.0	31.1
	2014	65.6	46.0	44.1	43.1	42.3	42.4	62.6	-	29.0	32.0	31.0	31.1
	2017	65.6	46.0	44.0	43.1	42.3	42.4	62.6	-	29.0	32.0	31.0	31.1
Johnston	2005	65.8	47.3	44.2	43.3	42.4	42.4	62.7	-	29.0	30.9	31.1	31.1
	2008	65.8	47.3	44.2	43.3	42.4	42.4	62.7	-	29.0	30.9	31.1	31.1
	2011	65.8	47.3	44.2	43.3	42.4	42.4	62.7	-	29.0	30.9	31.1	31.1
	2014	65.8	47.3	44.2	43.3	42.4	42.4	62.7	-	29.0	31.0	31.1	31.1
	2017	65.8	47.3	44.2	43.3	42.4	42.4	62.7	-	29.0	30.9	31.1	31.1
Person	2005	-	46.1	44.1	43.3	42.4	42.4	-	-	29.1	32.0	31.1	31.1
	2008	-	46.1	44.1	43.3	42.4	42.4	-	-	29.1	32.0	31.1	31.1
	2011	-	46.1	44.1	43.3	42.4	42.4	-	-	29.1	32.0	31.1	31.1
	2014	-	46.1	44.1	43.3	42.4	42.4	-	-	29.1	32.0	31.1	31.1
	2017	-	46.1	44.1	43.3	42.4	42.4	-	-	29.1	32.0	31.1	31.1

Average Speed Distribution Calculations

To generate the MOVES average speed distribution tables from the speed and VMT data provided, NCDAQ used spreadsheet-based tools (developed by NCDAQ and EPA) to perform the calculation procedures described below.

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 that observed average speed = 1

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

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

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

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

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

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

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

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

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

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

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

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

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.

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

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

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

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

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

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

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

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

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 2010 data. The NCDOT provided the data based on the number of vehicle types per year from 1974 through 2010. Vehicles greater than 25 years old were combined and included as the 25th 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, the USEPA 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 Data

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 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 2006 for the 2005 modeling year, 2008 data counts for the 2008 modeling year, and 2010 counts for the 2011, 2014, and 2017 modeling years. Tables 4.2.3-1 through 4.2.3-3 shows the percent of VMT per vehicle type for each of the 12 road classes.

Table 4.2.3-1 North Carolina Vehicle Activity Summary by Functional Classification - 2006

FC Code	Functional Classification	Samples	MC	Cars	2A4T	Bus	2ASU	3ASU	4ASU	4AST	5AST	6AST	5AMT	6AMT	7AMT
1	Rural Principal Arterial – Interstate	24	0.0040	0.5924	0.1294	0.0107	0.0269	0.0078	0.0005	0.0193	0.1921	0.0074	0.0057	0.0025	0.0016
2	Rural Principal Arterial – Other	76	0.0077	0.6686	0.1844	0.0079	0.0342	0.0120	0.0011	0.0135	0.0652	0.0030	0.0017	0.0007	0.0004
6	Rural Minor Arterial	38	0.0062	0.6769	0.1964	0.0083	0.0385	0.0122	0.0010	0.0126	0.0463	0.0019	0.0001	0.0001	0.0003
7	Rural Major Collector	22	0.0062	0.7130	0.1985	0.0054	0.0332	0.0105	0.0009	0.0085	0.0235	0.0011	0.0000	0.0000	0.0002
8	Rural Minor Collector	28	0.0075	0.7057	0.2036	0.0068	0.0405	0.0107	0.0006	0.0093	0.0154	0.0011	0.0000	0.0000	0.0002
9	Rural Local System														
11	Urban Principal Arterial - Interstate	22	0.0051	0.6790	0.1400	0.0084	0.0274	0.0099	0.0005	0.0126	0.1098	0.0027	0.0030	0.0012	0.0005
12	Urban Principal Arterial - Other Freeways or Expressways	21	0.0041	0.7250	0.1570	0.0070	0.0275	0.0098	0.0009	0.0109	0.0539	0.0027	0.0008	0.0003	0.0004
14	Urban Principal Arterial - Other	31	0.0058	0.7458	0.1675	0.0055	0.0280	0.0085	0.0009	0.0087	0.0272	0.0016	0.0003	0.0001	0.0002
16	Urban Minor Arterial	30	0.0060	0.7740	0.1620	0.0057	0.0284	0.0072	0.0008	0.0065	0.0079	0.0016	0.0000	0.0000	0.0003
17	Urban Collector	22	0.0068	0.7731	0.1705	0.0053	0.0272	0.0080	0.0003	0.0047	0.0041	0.0004	0.0000	0.0000	0.0001
19	Urban Local System														

Table 4.2.3-2 North Carolina Vehicle Activity Summary by Functional Classification – 2008

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

Table 4.2.3-3 North Carolina Vehicle Activity Summary by Functional Classification – 2010

FC	**Functional Classification**	Stations	MC	Cars	2A4T	Bus	2ASU	3ASU	4ASU	4AST	5AST	6AST	5AMT	6AMT	7AMT
1	Rural Principal Arterial - Interstate	31	0.0036	0.6504	0.1341	0.0064	0.0240	0.0075	0.0003	0.0129	0.1532	0.0017	0.0037	0.0017	0.0004
2	Rural Principal Arterial - Other	117	0.0055	0.6713	0.1898	0.0083	0.0353	0.0091	0.0010	0.0153	0.0596	0.0026	0.0014	0.0005	0.0003
6	Rural Minor Arterial	89	0.0051	0.7075	0.1914	0.0060	0.0322	0.0080	0.0011	0.0105	0.0362	0.0017	0.0001	0.0000	0.0002
7	Rural Major Collector	219	0.0066	0.6987	0.2068	0.0065	0.0335	0.0080	0.0008	0.0098	0.0277	0.0014	0.0000	0.0000	0.0002
8	Rural Minor Collector	34	0.0086	0.6700	0.2041	0.0085	0.0392	0.0113	0.0009	0.0103	0.0444	0.0023	0.0000	0.0000	0.0003
9	Rural Local System	55	0.0088	0.6819	0.2154	0.0128	0.0466	0.0116	0.0011	0.0092	0.0112	0.0012	0.0000	0.0000	0.0002
11	Urban Principal Arterial - Interstate	72	0.0039	0.7128	0.1469	0.0063	0.0233	0.0073	0.0003	0.0074	0.0876	0.0010	0.0021	0.0010	0.0002
12	Principal Arterial - Frwy/Expwy	70	0.0050	0.7149	0.1687	0.0072	0.0276	0.0085	0.0008	0.0123	0.0508	0.0016	0.0017	0.0006	0.0002
14	Urban Principal Arterial - Other	177	0.0056	0.7576	0.1668	0.0055	0.0257	0.0078	0.0012	0.0077	0.0195	0.0017	0.0004	0.0002	0.0003
16	Urban Minor Arterial	143	0.0065	0.7668	0.1672	0.0050	0.0263	0.0073	0.0009	0.0070	0.0115	0.0011	0.0001	0.0000	0.0002
17	Urban Collector	36	0.0061	0.7657	0.1719	0.0069	0.0273	0.0083	0.0007	0.0057	0.0064	0.0007	0.0000	0.0000	0.0002
19	Urban Local System	23	0.0086	0.7396	0.1762	0.0176	0.0341	0.0080	0.0004	0.0053	0.0091	0.0010	0.0000	0.0001	0.0001

4.2.4 Disaggregating State Specific Vehicle Mix Information for MOVES

The procedures in Section 4.1.4 and 4.1.5 of the Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation were used to create vehicle mix tables used as inputs for VMT converter applications provided by the USEPA. The procedures map the vehicle mixes shown in Section 4.2.3 (12 roadway functional classes, 13 vehicle types) to the mix matrix required for the VMT converter applications (12 roadway functional classes, 16 vehicle types). The process also provides calculation of projected mixes for future years.

The resulting vehicle mix tables are presented in Section 5.1.

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. The MOVES model allows the user to select from among 13 source use types and 4 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 that reflect the full range of vehicles that will operate in each county. In general, all valid diesel, gasoline, and CNG (only transit buses) vehicle and fuel combinations should be selected, unless data is available showing that some vehicles or fuels are not used in the area of analysis.

4.2.6 Road Type

The determination of rural or urban road types should be based on the HPMS classification of the roads in the county being analyzed. The Road Type Panel is used to specify the types of roads that are included in the run. The MOVES model defines five different road types to categorize the roadways used in a particular MOVES run. The five road types are as follows:

- Off-Network (road type 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).

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., road types 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.

The MOVES model 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

For this inventory, county-level emissions for a typical summer day, specifically a July weekday, were modeled for each year of interest. Emissions from all processes that generate NOx or VOC, such as running exhaust, start exhaust, and evaporative processes, were included to ensure that all emissions of these pollutants from on-road sources were accounted for as required for SIPs or regional conformity analyses.

4.2.8 Temperature, Relative Humidity and Barometric Pressure Data

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 NOx emissions from motor vehicles. The MOVES model requires a temperature (in degrees Fahrenheit) and relative humidity (in percent – 0 to 100 scale) for each clock hour. For example, MOVES requires a 24-hour temperature and humidity profile to model a full day of emissions on an hourly basis. For the Triangle area on-road mobile source emission estimates, the NCDAQ used average July 2005 24-hour temperature profile from the Automated Surface Observing System at the Raleigh-Durham International Airport (KRDU). The temperature and relative humidity profiles used 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.

The MOVES model 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 the USEPA emissions regulations; thus making it easier for users to develop local data for MOVES. The MOVES model categorizes vehicles into 13 source types, which are subsets of the 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

The MOVES model 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 override 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 vehicle populations, 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.

The MOVES model categorizes 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 the NCDOT collects vehicle registration data. The latest vehicle registration data broken down by county and towns is available by January of each year. Since the vehicle type database available from NCDOT differs from what is required for MOVES2010b, 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.

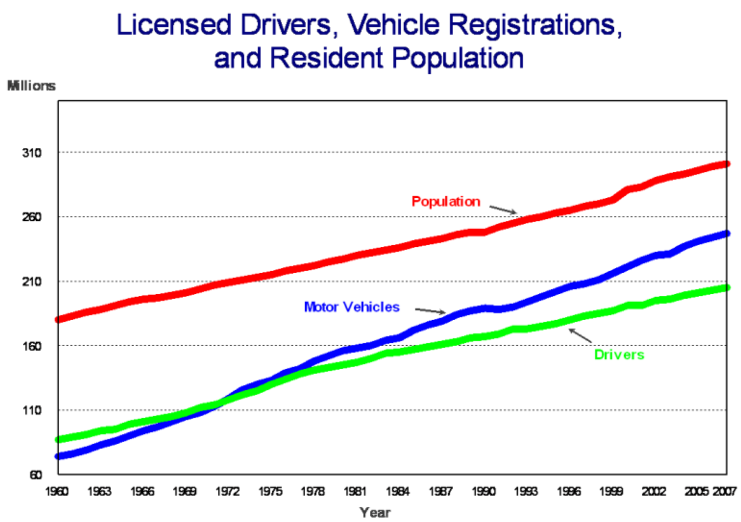


Figure 4.2.9-1 Federal Highway Association Statistics Graph

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 the OSBM website are certified annual 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

2011 vehicle population would be grown to 2017 based on this surrogate of projected county population follows:

$$\text{Vehicle Pop}_{2017} = \text{Vehicle Pop}_{2011} * (\text{Human Pop}_{2017} / \text{Human Pop}_{2011})$$

4.2.10 Vehicle Inspection and Maintenance Program Parameters

In 2002, North Carolina implemented a new vehicle emissions inspection and maintenance (I/M) program based on vehicle onboard diagnostics (OBDII). This program covers all light duty gasoline powered vehicles (designated in MOVES as source type IDs 21, 31, and 32) that are model year 1996 and newer. The program was initially implemented in 9 counties and was expanded to include a total of 48 counties between July 2002 and January 2006. Durham, Orange, and Wake Counties were phased-in July 1, 2002 followed by Johnston County in July 1, 2003; Chatham and Franklin Counties in January 1, 2004; and Granville County in July 1, 2004. Vehicles registered in Person County are not subject to emissions inspection requirements. In addition, the inspection stations are required to administer an anti-tampering check to ensure that emissions control equipment on any vehicle 1968 and newer has not been altered.

All MOVES modeling runs were executed with the appropriate I/M program parameters to properly account for the emissions reductions resulting from implementation of the program. The magnitude of the reductions is scaled by the I/M compliance factor parameters, which are calculated based on I/M compliance rates and waiver rates. For each year modeled, the appropriate endModelYearID value was specified to account for the exemption of the current model year vehicles from I/M requirements as specified in the I/M SIP. For example, if 2011 were modeled, endModelYearID value were set to 2010.

4.2.11 Reid Vapor Pressure Specifications

Reid Vapor Pressure (RVP) is a measurement of gasoline volatility. The use of lower RVP gasoline leads to lower VOC emissions from gasoline handling and evaporative VOC emissions from motor vehicles. Gasoline with an RVP of 9.0 pounds per square inch (psi) is required during May through September for the rural portion of Granville County and the entire area of Chatham, Franklin, Johnston and Orange Counties. Gasoline with an RVP of 7.8 psi is required in Durham and Wake Counties and Granville County (Dutchville Township only) during June through September.

The NCDAQ is requesting that the 7.8 psi RVP requirements be revised to 9.0 psi. To demonstrate the potential effects of these revisions, MOVES models for 2014 and 2017 were executed using both the current RVP requirements and using the revised 9.0 psi RVP. For 2014 and 2017, the MOVES model was run with the current I/M SIP compliance and waiver rates, 95% and 5%, respectively.

4.2.12 Diesel Sulfur Content

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 2010-2017.

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 Data

The TRM VMT data for the Triangle nonattainment area were generated by CAMPO using the TRM version 5 and were provided to NCDAQ on May 18, 2012. The TRM modeling incorporated the latest available socioeconomic, population and highway planning data.

The NCDOT provided VMT data for the NMAA portions of Franklin, Granville, Johnston, and Person Counties on June 21, 2012. These data were generated from Highway Performance Monitoring System (HPMS) VMT data. The NMAA VMT values were calculated by scaling the HPMS county-level VMT by the fraction of the county human population within the NMAA area:

$$VMT_{NMAA} = VMT_{county} * (Population_{NMAA} / Population_{county})$$

Tables 4.2.14-1 through 4.2.14-8 list the VMT data for all Triangle area counties. The values represent the average annual daily vehicle miles traveled (AADVMT) for the specified county/road type/travel period designation.

Table 4.2.14-1 Daily Vehicle Miles Traveled for Chatham County

Type	Period	Road Type	2005	2008	2011	2014	2017
TRM	AM	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	7,083	7,401	7,860	8,605	9,349
		Urban Minor Arterial	2,657	3,058	3,392	3,591	3,790
		Urban Collector	2,577	2,721	2,914	3,208	3,502
		Urban Local	14	25	31	32	33
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	107,314	115,977	125,780	137,863	149,945
		Rural Minor Arterial	6,817	6,868	7,166	7,961	8,755
		Rural Major Collector	54,536	53,688	54,487	58,579	62,670
		Rural Minor Collector	12,567	13,619	14,847	16,428	18,008
		Rural Local	42,930	50,037	58,188	68,427	78,665
	OP	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	10,737	10,848	11,337	12,583	13,829
		Urban Minor Arterial	3,463	3,825	4,167	4,471	4,774
		Urban Collector	3,468	3,636	3,840	4,116	4,391
		Urban Local	17	25	32	37	42
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	193,295	208,830	225,910	246,081	266,253
		Rural Minor Arterial	11,019	10,995	11,362	12,510	13,658
		Rural Major Collector	86,706	83,836	84,001	90,239	96,476
		Rural Minor Collector	17,885	19,438	21,110	23,020	24,931
		Rural Local	58,677	68,516	79,522	92,864	106,205
	PM	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	8,192	8,616	9,170	9,984	10,799
		Urban Minor Arterial	3,545	4,185	4,689	4,918	5,148
		Urban Collector	3,534	3,762	4,019	4,337	4,654
		Urban Local	17	50	68	61	53
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	140,030	151,490	164,054	178,824	193,595
		Rural Minor Arterial	8,265	8,358	8,748	9,735	10,723
		Rural Major Collector	78,650	78,112	79,064	83,000	86,935
		Rural Minor Collector	16,472	17,702	19,182	21,163	23,143
		Rural Local	57,374	66,536	76,968	89,940	102,912
Chatham County Total VMT			**937,841**	**1,002,154**	**1,081,908**	**1,192,577**	**1,303,238**

Table 4.2.14-2 Daily Vehicle Miles Traveled for Durham County

Type	Period	Road Type	2005	2008	2011	2014	2017
TRM	AM	Urban Interstate	515,062	572,365	618,030	640,417	662,805
		Freeway & Expressway	368,062	379,247	400,855	443,311	485,766
		Urban Other Principle Arterial	234,398	245,610	257,842	272,114	286,386
		Urban Minor Arterial	360,933	370,888	382,084	395,762	409,441
		Urban Collector	141,460	145,999	151,260	157,963	164,667
		Urban Local	287,746	298,844	311,601	327,679	343,757
		Rural Interstate	34,444	33,511	33,579	35,648	37,717
		Rural Other Principle Arterial	5,421	7,062	8,116	7,998	7,881
		Rural Minor Arterial	43,263	45,699	47,917	49,701	51,484
		Rural Major Collector	35,899	38,436	41,249	44,610	47,971
		Rural Minor Collector	10,367	9,969	9,856	10,315	10,774
		Rural Local	28,560	31,199	33,714	35,979	38,244
	OP	Urban Interstate	947,212	1,047,532	1,127,992	1,168,731	1,209,470
		Freeway & Expressway	564,521	585,274	622,825	693,973	765,120
		Urban Other Principle Arterial	347,408	371,954	396,103	419,458	442,814
		Urban Minor Arterial	529,238	545,514	560,790	574,068	587,347
		Urban Collector	198,022	208,858	218,487	225,702	232,918
		Urban Local	414,359	433,027	452,279	472,697	493,115
		Rural Interstate	63,937	62,872	63,214	66,370	69,525
		Rural Other Principle Arterial	9,313	11,071	12,109	11,708	11,306
		Rural Minor Arterial	53,887	56,978	59,696	61,668	63,639
		Rural Major Collector	52,724	54,363	56,869	61,108	65,346
		Rural Minor Collector	15,822	14,746	14,230	14,833	15,437
		Rural Local	35,238	39,291	43,071	46,303	49,535
	PM	Urban Interstate	642,101	721,098	782,183	807,441	832,699
		Freeway & Expressway	441,499	449,927	472,230	522,281	572,332
		Urban Other Principle Arterial	284,141	301,432	317,836	332,468	347,099
		Urban Minor Arterial	461,844	471,817	484,209	501,439	518,670
		Urban Collector	181,913	187,724	194,789	204,362	213,934
		Urban Local	381,675	392,734	407,451	429,485	451,520
		Rural Interstate	45,590	44,358	44,215	46,249	48,284
		Rural Other Principle Arterial	6,301	8,212	9,439	9,299	9,158
		Rural Minor Arterial	51,011	53,280	55,368	57,097	58,827
		Rural Major Collector	46,257	49,490	52,855	56,484	60,114
		Rural Minor Collector	13,769	12,917	12,578	13,265	13,952
		Rural Local	37,109	41,017	44,736	48,076	51,417
Durham County Total VMT			**7,890,506**	**8,344,315**	**8,801,657**	**9,266,062**	**9,730,471**

Table 4.2.14-3 Daily Vehicle Miles Traveled for Franklin County

Type	Period	Road Type	2005	2008	2011	2014	2017
TRM	AM	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	43,077	41,641	41,263	42,997	44,731
		Urban Minor Arterial	15,058	15,110	15,489	16,522	17,556
		Urban Collector	6,648	5,493	4,911	5,478	6,045
		Urban Local	9,050	10,470	11,479	11,665	11,852
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	47,940	47,848	48,587	50,985	53,384
		Rural Minor Arterial	82,763	83,568	84,924	87,382	89,840
		Rural Major Collector	56,277	56,171	57,591	62,062	66,532
		Rural Minor Collector	33,075	31,706	31,409	33,253	35,097
		Rural Local	41,413	51,530	59,479	63,094	66,708
	OP	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	69,581	67,343	66,656	69,072	71,488
		Urban Minor Arterial	24,584	23,552	23,444	25,188	26,931
		Urban Collector	9,661	8,021	7,227	8,125	9,023
		Urban Local	12,900	15,241	16,862	17,041	17,220
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	83,229	82,750	83,632	87,233	90,834
		Rural Minor Arterial	133,407	133,939	135,380	138,639	141,897
		Rural Major Collector	87,025	87,665	90,464	97,581	104,699
		Rural Minor Collector	45,994	44,100	43,720	46,368	49,016
		Rural Local	56,664	71,024	82,389	87,765	93,141
	PM	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	53,155	51,248	50,581	52,395	54,208
		Urban Minor Arterial	19,464	19,581	20,089	21,380	22,671
		Urban Collector	8,262	6,947	6,296	6,971	7,646
		Urban Local	11,154	13,120	14,524	14,805	15,086
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	61,465	61,129	61,814	64,537	67,261
		Rural Minor Arterial	105,134	106,051	107,685	110,754	113,823
		Rural Major Collector	71,115	71,273	73,343	79,241	85,139
		Rural Minor Collector	40,198	38,457	37,993	40,085	42,177
		Rural Local	52,249	65,438	75,704	80,126	84,549
Non-Modeled Analysis Area		Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	12,804	12,784	12,642	12,255	11,869
		Urban Minor Arterial	8,180	8,168	8,077	7,830	7,583
		Urban Collector	0	0	0	0	0
		Urban Local	3,563	3,557	3,518	3,410	3,303
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	27,454	27,412	27,107	26,278	25,450
		Rural Minor Arterial	42,141	42,076	41,609	40,337	39,065
		Rural Major Collector	43,104	43,037	42,559	41,258	39,957
		Rural Minor Collector	32,044	31,994	31,639	30,672	29,705
		Rural Local	24,328	24,291	24,021	23,287	22,552
Franklin County Total VMT			**1,474,160**	**1,503,735**	**1,544,107**	**1,606,071**	**1,668,038**

Table 4.2.14-4 Daily Vehicle Miles Traveled for Granville County

Type	Period	Road Type	2005	2008	2011	2014	2017
TRM	AM	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	0	0	0	0	0
		Urban Minor Arterial	5,025	3,768	2,992	3,179	3,366
		Urban Collector	11,390	9,655	8,670	9,185	9,700
		Urban Local	0	0	0	0	0
		Rural Interstate	100,593	98,643	98,254	100,986	103,718
		Rural Other Principle Arterial	2,035	1,773	1,625	1,703	1,782
		Rural Minor Arterial	382	895	1,249	1,285	1,321
		Rural Major Collector	103,736	97,198	94,280	98,602	102,924
		Rural Minor Collector	30,571	29,328	28,883	30,035	31,188
		Rural Local	38,967	47,737	55,424	60,942	66,461
	OP	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	0	0	0	0	0
		Urban Minor Arterial	7,211	5,402	4,250	4,416	4,581
		Urban Collector	15,821	13,328	11,856	12,424	12,992
		Urban Local	0	0	0	0	0
		Rural Interstate	226,130	222,891	222,004	225,820	229,635
		Rural Other Principle Arterial	3,081	2,747	2,553	2,638	2,723
		Rural Minor Arterial	617	1,353	1,863	1,923	1,983
		Rural Major Collector	179,835	165,844	159,297	167,640	175,982
		Rural Minor Collector	44,924	41,173	39,141	40,543	41,946
		Rural Local	57,951	70,633	81,382	88,265	95,147
	PM	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	0	0	0	0	0
		Urban Minor Arterial	5,907	4,472	3,606	3,875	4,144
		Urban Collector	13,598	11,583	10,456	11,106	11,755
		Urban Local	0	0	0	0	0
		Rural Interstate	144,558	141,043	139,601	142,305	145,009
		Rural Other Principle Arterial	2,694	2,336	2,129	2,227	2,324
		Rural Minor Arterial	478	1,066	1,471	1,509	1,546
		Rural Major Collector	131,484	123,624	120,191	125,613	131,034
		Rural Minor Collector	39,406	37,235	36,297	37,826	39,355
		Rural Local	48,427	59,953	69,984	77,025	84,066
Non-Modeled Analysis Area		Urban Interstate	57,410	57,606	57,288	55,939	54,590
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	28,200	28,298	28,143	27,480	26,817
		Urban Minor Arterial	40,850	40,989	40,761	39,802	38,842
		Urban Collector	24,180	24,265	24,133	23,564	22,996
		Urban Local	12,610	12,656	12,588	12,291	11,995
		Rural Interstate	235,143	235,959	234,661	229,136	223,610
		Rural Other Principle Arterial	12,471	12,515	12,446	12,153	11,860
		Rural Minor Arterial	23,223	23,303	23,175	22,630	22,084
		Rural Major Collector	160,981	161,540	160,651	156,868	153,085
		Rural Minor Collector	63,925	64,147	63,794	62,292	60,789
		Rural Local	69,298	69,539	69,156	67,528	65,899
Granville County Total VMT			**1,943,112**	**1,924,497**	**1,924,254**	**1,960,755**	**1,997,249**

Table 4.2.14-5 Daily Vehicle Miles Traveled for Johnston County

Type	Period	Road Type	2005	2008	2011	2014	2017
Triangle Regional Model	AM	Urban Interstate	51,765	51,939	52,549	54,031	55,514
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	90,934	76,976	68,785	72,130	75,476
		Urban Minor Arterial	49,641	54,945	59,784	63,693	67,602
		Urban Collector	23,811	24,694	26,220	29,032	31,845
		Urban Local	54,362	57,819	62,560	69,869	77,178
		Rural Interstate	386,185	376,544	379,798	408,840	437,882
		Rural Other Principle Arterial	91,432	151,834	193,433	197,424	201,415
		Rural Minor Arterial	71,400	64,213	60,920	65,417	69,913
		Rural Major Collector	227,136	221,058	224,210	245,820	267,431
		Rural Minor Collector	41,361	45,436	50,235	56,484	62,732
		Rural Local	130,146	152,154	172,016	187,586	203,156
	OP	Urban Interstate	99,910	102,474	105,670	110,133	114,597
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	169,463	128,977	103,988	109,989	115,991
		Urban Minor Arterial	69,663	77,872	85,489	91,920	98,352
		Urban Collector	34,738	35,561	37,402	41,279	45,156
		Urban Local	78,841	82,883	88,974	99,161	109,348
		Rural Interstate	1,103,454	1,071,743	1,103,921	1,263,880	1,423,839
		Rural Other Principle Arterial	173,824	286,708	365,669	376,787	387,905
		Rural Minor Arterial	107,635	94,665	88,450	95,745	103,040
		Rural Major Collector	328,874	320,658	326,293	359,629	392,965
		Rural Minor Collector	55,787	60,846	67,104	75,760	84,416
		Rural Local	175,852	204,117	229,622	249,605	269,588
	PM	Urban Interstate	67,959	67,425	67,719	69,667	71,615
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	109,745	94,674	86,028	90,229	94,430
		Urban Minor Arterial	59,294	66,126	72,308	77,194	82,079
		Urban Collector	31,439	32,245	34,083	37,986	41,889
		Urban Local	72,752	77,417	83,596	92,805	102,013
		Rural Interstate	617,576	595,896	604,177	672,378	740,578
		Rural Other Principle Arterial	111,671	184,176	234,854	241,878	248,903
		Rural Minor Arterial	89,059	79,866	75,823	82,077	88,332
		Rural Major Collector	289,057	281,459	285,558	313,052	340,546
		Rural Minor Collector	51,893	57,274	63,710	72,254	80,798
		Rural Local	164,177	191,503	216,695	237,621	258,548
Non-Modeled Analysis Area		Urban Interstate	87,140	91,662	93,817	91,238	88,658
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	50,290	52,899	54,142	52,654	51,165
		Urban Minor Arterial	67,610	71,120	72,793	70,792	68,791
		Urban Collector	14,060	14,787	15,133	14,717	14,301
		Urban Local	15,520	16,329	16,715	16,255	15,795
		Rural Interstate	220,472	231,920	237,377	230,850	224,323
		Rural Other Principle Arterial	89,564	94,215	96,432	93,780	91,129
		Rural Minor Arterial	33,819	35,576	36,413	35,411	34,410
		Rural Major Collector	123,063	129,453	132,499	128,856	125,213
		Rural Minor Collector	35,804	37,663	38,549	37,489	36,429
		Rural Local	134,814	141,814	145,151	141,160	137,169
Johnston County Total VMT			**6,152,992**	**6,389,615**	**6,716,664**	**7,224,557**	**7,732,455**

Table 4.2.14-6 Daily Vehicle Miles Traveled for Orange County

Type	Period	Road Type	2005	2008	2011	2014	2017
TRM	AM	Urban Interstate	222,682	229,862	237,580	246,374	255,168
		Freeway & Expressway	82,198	86,877	91,316	95,273	99,229
		Urban Other Principle Arterial	83,382	94,781	103,878	108,370	112,861
		Urban Minor Arterial	107,342	116,157	125,668	136,569	147,470
		Urban Collector	18,446	19,425	21,017	23,834	26,652
		Urban Local	73,680	86,060	98,036	109,204	120,372
		Rural Interstate	248,497	275,037	293,546	295,992	298,439
		Rural Other Principle Arterial	0	0	0	0	0
		Rural Minor Arterial	45,837	40,439	37,437	39,226	41,015
		Rural Major Collector	73,319	74,785	77,864	84,168	90,473
		Rural Minor Collector	38,603	43,330	47,709	51,392	55,075
		Rural Local	55,558	60,902	67,351	76,010	84,668
	OP	Urban Interstate	444,101	467,185	487,236	501,224	515,211
		Freeway & Expressway	130,504	135,540	141,216	148,172	155,129
		Urban Other Principle Arterial	127,542	144,161	158,142	166,844	175,547
		Urban Minor Arterial	163,129	169,700	179,506	195,786	212,065
		Urban Collector	24,569	25,335	27,009	30,503	33,997
		Urban Local	104,300	116,563	129,796	144,966	160,137
		Rural Interstate	556,575	610,755	649,582	657,703	665,824
		Rural Other Principle Arterial	0	0	0	0	0
		Rural Minor Arterial	83,883	74,123	68,636	71,697	74,758
		Rural Major Collector	113,558	112,147	113,855	121,801	129,747
		Rural Minor Collector	60,915	67,017	72,639	77,300	81,960
		Rural Local	77,271	86,073	95,568	106,449	117,329
	PM	Urban Interstate	299,914	313,242	324,981	333,540	342,100
		Freeway & Expressway	98,302	102,662	107,128	111,808	116,487
		Urban Other Principle Arterial	103,222	116,503	126,727	130,839	134,951
		Urban Minor Arterial	142,362	153,814	165,639	178,208	190,778
		Urban Collector	25,325	26,939	29,405	33,573	37,741
		Urban Local	96,378	114,574	131,650	146,488	161,327
		Rural Interstate	347,593	379,525	402,352	406,972	411,592
		Rural Other Principle Arterial	0	0	0	0	0
		Rural Minor Arterial	59,915	54,071	50,861	52,917	54,974
		Rural Major Collector	98,184	99,386	102,982	111,363	119,744
		Rural Minor Collector	50,915	57,152	62,939	67,825	72,712
		Rural Local	71,880	78,445	86,441	97,299	108,156
Orange County Total VMT			**4,329,881**	**4,632,567**	**4,915,692**	**5,159,689**	**5,403,688**

Table 4.2.14-7 Daily Vehicle Miles Traveled for Person County

Type		Road Type	2005	2008	2011	2014	2017
TRM	AM	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	0	0	0	0	0
		Urban Minor Arterial	0	0	0	0	0
		Urban Collector	0	0	0	0	0
		Urban Local	0	0	0	0	0
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	15,317	13,684	12,740	13,172	13,604
		Rural Minor Arterial	62,324	56,450	53,404	56,016	58,628
		Rural Major Collector	29,492	27,665	26,949	28,456	29,963
		Rural Minor Collector	178	1,873	3,044	3,166	3,288
		Rural Local	76,795	75,767	76,002	78,765	81,528
	OP	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	0	0	0	0	0
		Urban Minor Arterial	0	0	0	0	0
		Urban Collector	0	0	0	0	0
		Urban Local	0	0	0	0	0
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	21,688	19,540	18,291	18,843	19,395
		Rural Minor Arterial	90,645	81,530	76,574	79,934	83,294
		Rural Major Collector	48,450	45,041	43,348	45,086	46,825
		Rural Minor Collector	291	2,725	4,387	4,507	4,626
		Rural Local	110,632	109,185	109,343	112,710	116,076
	PM	Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	0	0	0	0	0
		Urban Minor Arterial	0	0	0	0	0
		Urban Collector	0	0	0	0	0
		Urban Local	0	0	0	0	0
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	18,591	16,472	15,236	15,763	16,291
		Rural Minor Arterial	73,236	65,124	60,737	63,804	66,871
		Rural Major Collector	37,205	34,376	33,009	34,567	36,125
		Rural Minor Collector	229	2,270	3,684	3,846	4,008
		Rural Local	96,521	94,947	95,009	98,345	101,681
Non-Modeled Analysis Area		Urban Interstate	0	0	0	0	0
		Freeway & Expressway	0	0	0	0	0
		Urban Other Principle Arterial	28,363	27,255	26,515	26,512	26,509
		Urban Minor Arterial	6,847	6,579	6,401	6,400	6,399
		Urban Collector	8,405	8,077	7,857	7,856	7,856
		Urban Local	3,731	3,586	3,488	3,488	3,487
		Rural Interstate	0	0	0	0	0
		Rural Other Principle Arterial	11,093	10,660	10,370	10,369	10,368
		Rural Minor Arterial	29,127	27,989	27,229	27,226	27,223
		Rural Major Collector	30,399	29,211	28,418	28,415	28,412
		Rural Minor Collector	22,096	21,232	20,656	20,654	20,651
		Rural Local	32,682	31,404	30,552	30,548	30,545
Person County Total VMT			**854,337**	**812,642**	**793,243**	**818,448**	**843,653**

Table 4.2.14-8 Daily Vehicle Miles Traveled for Wake County

Type	Period	Road Type	2005	2008	2011	2014	2017
TRM	AM	Urban Interstate	1,441,406	1,619,171	1,759,129	1,823,471	1,887,812
		Freeway & Expressway	417,954	446,452	473,284	496,784	520,285
		Urban Other Principle Arterial	1,145,247	1,242,944	1,324,729	1,374,694	1,424,658
		Urban Minor Arterial	1,273,783	1,390,606	1,494,679	1,573,250	1,651,821
		Urban Collector	504,429	566,217	619,285	654,914	690,542
		Urban Local	998,515	1,118,686	1,232,589	1,333,956	1,435,324
		Rural Interstate	0	2,440	5,549	9,993	14,437
		Rural Other Principle Arterial	23,688	28,292	32,263	34,968	37,672
		Rural Minor Arterial	6,135	12,436	18,899	25,684	32,469
		Rural Major Collector	37,649	41,624	44,273	44,269	44,265
		Rural Minor Collector	16,669	15,937	15,930	17,374	18,818
		Rural Local	37,115	49,609	60,671	68,872	77,072
	OP	Urban Interstate	2,322,789	2,634,307	2,879,003	2,990,054	3,101,105
		Freeway & Expressway	691,720	720,127	748,274	775,902	803,530
		Urban Other Principle Arterial	1,822,608	1,994,809	2,138,616	2,225,635	2,312,654
		Urban Minor Arterial	1,835,379	2,008,527	2,164,620	2,286,606	2,408,592
		Urban Collector	707,777	783,060	850,097	900,642	951,188
		Urban Local	1,382,770	1,531,861	1,679,471	1,824,121	1,968,771
		Rural Interstate	0	3,595	6,851	9,428	12,005
		Rural Other Principle Arterial	44,889	53,321	60,906	66,797	72,689
		Rural Minor Arterial	9,272	19,577	28,290	33,815	39,341
		Rural Major Collector	64,412	68,048	70,767	71,652	72,536
		Rural Minor Collector	23,602	21,418	20,732	23,042	25,353
		Rural Local	48,622	60,698	72,672	84,440	96,208
	PM	Urban Interstate	1,735,621	1,955,580	2,129,307	2,210,569	2,291,832
		Freeway & Expressway	514,222	545,787	578,761	614,552	650,343
		Urban Other Principle Arterial	1,405,827	1,525,578	1,623,808	1,678,995	1,734,182
		Urban Minor Arterial	1,590,743	1,734,970	1,862,618	1,957,105	2,051,593
		Urban Collector	636,985	717,335	784,733	826,226	867,719
		Urban Local	1,282,137	1,440,364	1,589,142	1,719,024	1,848,906
		Rural Interstate	0	1,984	5,693	12,850	20,007
		Rural Other Principle Arterial	31,145	37,374	42,764	46,473	50,182
		Rural Minor Arterial	7,696	15,720	24,223	33,682	43,141
		Rural Major Collector	46,125	51,229	54,801	55,308	55,814
		Rural Minor Collector	22,212	21,448	21,497	23,169	24,842
		Rural Local	48,983	67,021	82,317	92,128	101,940
Wake County Total VMT			**22,178,126**	**24,548,152**	**26,601,243**	**28,020,444**	**29,439,648**

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 weekday, by county. Table 4.3-1 summarizes the NOx and VOC emissions.

Table 4.3-1 On-road Mobile Source VOC and NOx Emissions by County

County	Current 7.8 psi RVP[1]					9.0 psi RVP	
	2005	2008	2011	2014	2017	2014	2017
VOC Emissions(tons/day)							
Chatham*	2.49	2.14	1.73	1.44	1.19	1.44	1.19
Durham	13.00	10.62	8.28	6.66	5.29	6.89	5.46
Franklin	4.18	3.47	2.73	2.23	1.83	2.23	1.83
Granville	4.48	3.65	2.83	2.26	1.80	2.26	1.80
Johnston	13.17	11.09	8.87	7.37	6.10	7.37	6.10
Orange	6.96	5.79	4.54	3.63	2.86	3.63	2.86
Person	3.17	2.60	2.05	1.65	1.35	1.65	1.35
Wake	40.21	34.74	28.10	22.98	18.55	23.79	19.18
Total	87.66	74.10	59.13	48.22	38.97	49.26	39.77
Change in Total 2017 Future Year Emissions Due to RVP Change.							0.80
% Change in Total 2017 Future Year Emissions Due to RVP Change.							2.05%
NOx Emissions (tons/day)							
Chatham*	3.84	3.34	2.76	2.25	1.86	2.25	1.86
Durham	28.50	24.73	18.77	14.59	11.51	14.69	11.58
Franklin	6.08	5.00	3.89	3.05	2.43	3.05	2.43
Granville	8.55	6.73	4.96	3.74	2.89	3.74	2.89
Johnston	27.37	22.40	16.99	13.46	10.87	13.46	10.87
Orange	17.90	15.23	11.35	8.67	6.76	8.67	6.76
Person	3.88	3.16	2.38	1.85	1.48	1.85	1.48
Wake	79.06	71.46	56.36	44.23	35.08	44.56	35.31
Total	175.18	152.05	117.46	91.84	72.89	92.27	73.18
Net Change in Total 2017 Future Year Emissions Due to RVP Change							0.30
% Change in Total 2017 Future Year Emissions Due to RVP Change							0.41%

*Chatham County emissions are for the portion of the county in the nonattainment area.

[1] 7.8 psi for Wake, Durham and Granville Counties and 9.0 psi for the remaining counties.

4.4 Motor Vehicle Emissions Budgets for Conformity

Transportation Conformity

The purpose of transportation conformity is to ensure that Federal transportation actions occurring in a nonattainment areas does not hinder the area from maintaining the 8-hour ozone standard. This means that the level of emissions estimated by the NCDOT or the MPOs for the Transportation Implementation Plan and Long Range Transportation Plan must not exceed the MVEBs as defined in this maintenance plan.

Highway Mobile Source VOC Insignificance

Section 93.109(k) in the Transportation Conformity Rule Amendments for the new 8-hour ozone and fine particulate matter NAAQS addresses areas with insignificant motor vehicle emissions. It reads:

> *Notwithstanding the other paragraphs in this section, an area is not required to satisfy a regional emissions analysis for §93.118 and/or §93.119 for a given pollutant/precursor and NAAQS, if EPA finds through the adequacy or approval process that a SIP demonstrates that regional motor vehicle emissions are an insignificant contributor to the air quality problem for that pollutant/precursor and NAAQS. The SIP would have to demonstrate that it would be unreasonable to expect that such an area would experience enough motor vehicle emissions growth in that pollutant/precursor for a NAAQS violation to occur.*

The rule suggests that such a finding would be based on a number of factors, including the percentage of motor vehicle emissions in the context of the total State Implementation Plan (SIP) inventory, the current state of air quality as determined by monitoring data for that NAAQS, the absence of SIP motor vehicle control measures, and historical trends and future projections of the growth of motor vehicle emissions.

The NCDAQ has examined the sources of VOC emissions and their contribution to ozone formation in North Carolina. Because of the generally warm and moist climate of North Carolina, vegetation abounds in many forms, and forested lands naturally cover much of the state. The biogenic sector is the most abundant source of VOCs in North Carolina and accounts for approximately 90% of the total VOCs statewide. The overwhelming abundance of biogenic VOCs makes the majority of North Carolina a NOx limited environment for the formation of ozone. This holds true for all of the Triangle area counties. Since biogenic emissions were not generated specifically for this maintenance plan, we used emission summaries from the

NCDAQ's 2002 and 2009 modeling effort underway for the attainment demonstrations in other portions of North Carolina. Figures 4.4-1 and 4.4-2 provide the percent contributions from point, highway mobile, area, off-road mobile and biogenic sources to the total VOC emissions in the Triangle nonattainment area in 2002 and 2009, respectively.

Figure 4.4-1 Triangle Area 2002 Daily Summertime VOC Emissions

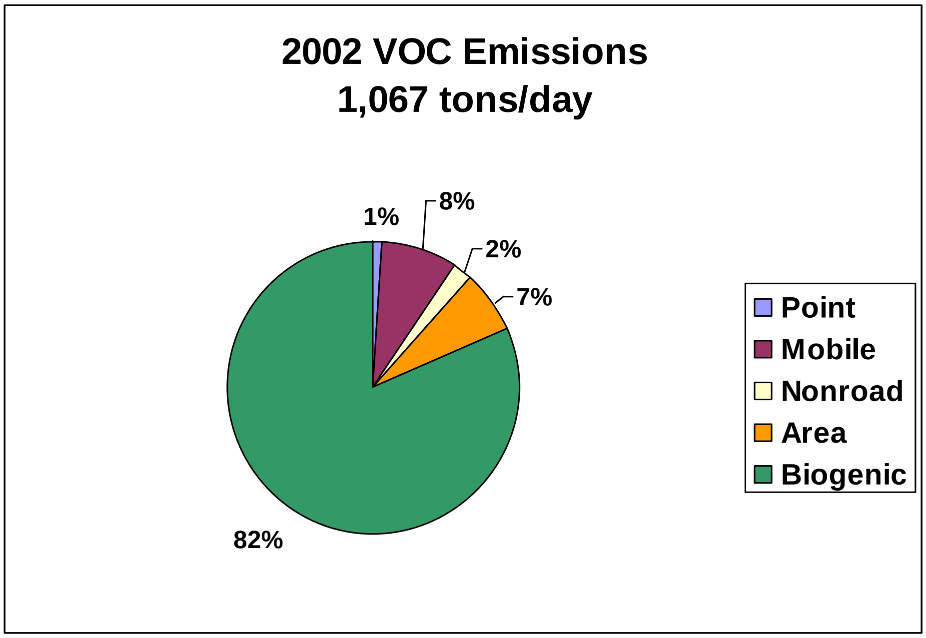
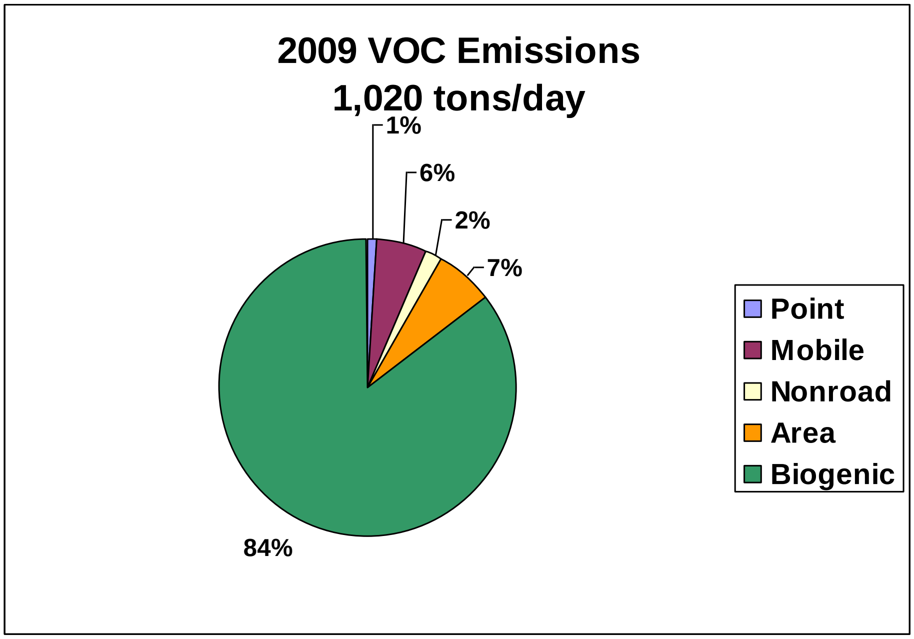


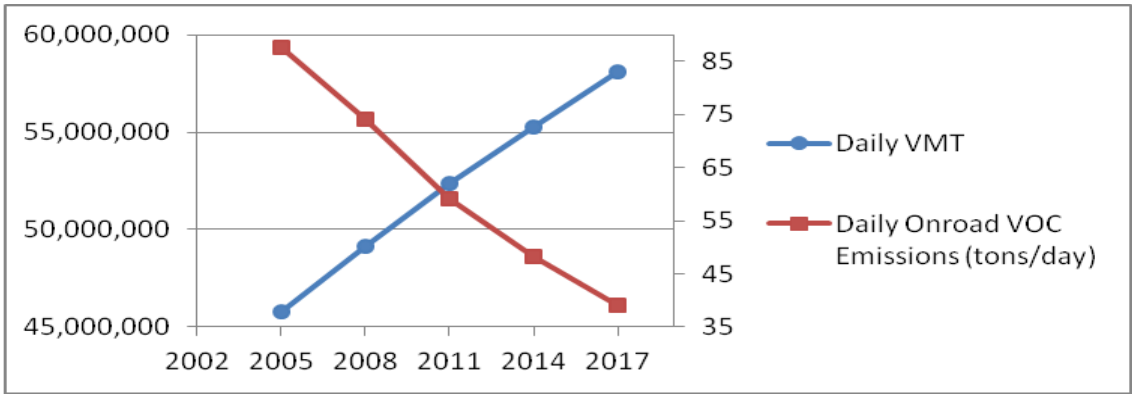
Figure 4.4-2 Triangle Area 2009 Daily Summertime VOC Emissions



In the Triangle area, highway mobile sources contribute only 8 and 6 percent of the 2002 and 2009 total VOC inventories, respectively.

Also noteworthy are the projected decreases in highway mobile VOC emissions through the year 2017 despite projected VMT increases. These reductions are due mainly to the retirement of older vehicles and the growing fleet of Tier 2 vehicles on the roads in future years. Some additional reductions are attributable to North Carolina's I/M program in the Triangle area. The VMT and VOC projections are summarized in Figures 4.4-3 below.

Figure 4.4-3 Triangle Area VMT and VOC emissions growth

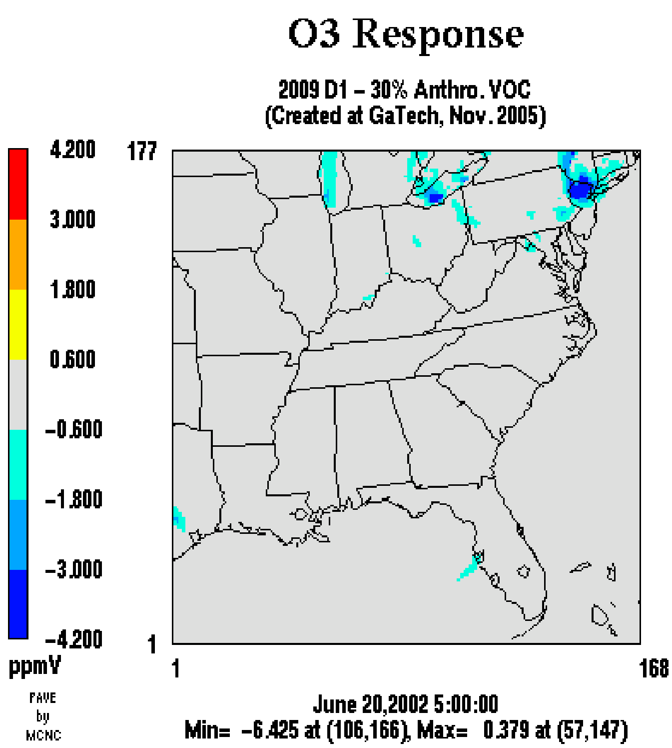


The current state of air quality in the Triangle nonattainment area is steadily improving. The current ozone design value in the Triangle nonattainment area is 0.080 parts per million (ppm) based on data from 2004-2006.

A recent modeling sensitivity test was performed by the Association for Southeastern Integrated Planning (ASIP) that allows an analysis of VOC contributions to ozone concentrations in the Southeastern United States. ASIP is a regional collaborative, set up by the Southeastern States Air Resource Managers, Inc. (SESARM), focused on the coordination of planning activities associated with the analysis of fine particulate matter and 8-hour ozone nonattainment areas and development of options for attaining and maintaining the NAAQS. One of the analyses conducted by ASIP is a series of emissions sensitivity modeling runs to quantify the contributions of various emission sources to ozone and fine particles. The modeling system used in this analysis consisted of 3 components: 1) the Penn State University/National Center for Atmospheric Research Mesoscale Model (MM5 version 3.6.1+), 2) the Sparse Matrix Operator Kernel Emissions Modeling System (SMOKE version 2.1), and 3) the Community Multiscale Air Quality (CMAQ version 4.4) model. Model configurations, input data, and modeling methods are consistent with those suggested by USEPA in "Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS".

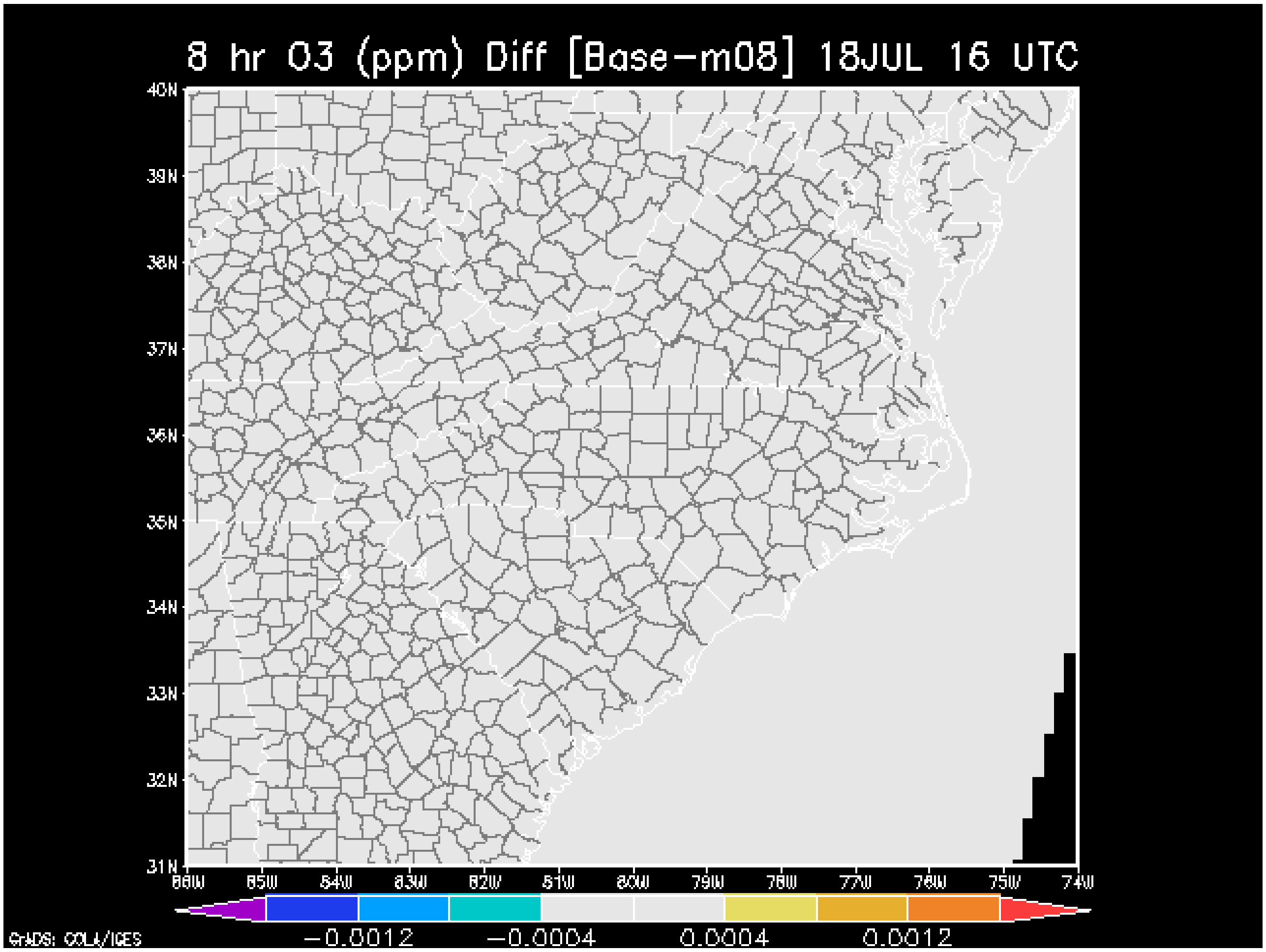
The emissions sensitivities are calculated by taking the difference between two air quality model simulations: one with base case emissions and another with reduced emissions inputs. The emissions sensitivity discussed here reduces *all* anthropogenic VOCs in the modeling domain by 30% from 2009 emission levels. Translating this to the Triangle nonattainment area emissions, this 30% anthropogenic VOC reduction is equivalent to nearly eliminating all highway mobile VOC emissions in all Triangle nonattainment area in 2009. This emissions sensitivity was run for a 39 day period (June 1-July 9). In all 39 days of the modeling simulation, the 8-hour ozone maximum concentrations were unchanged in the Triangle nonattainment area – a clear indicator that highway mobile VOC is an insignificant contributor to ozone formation in that area. In fact, there was not an 8-hour ozone response as high as 1 ppb anywhere in North Carolina during the sensitivity simulation. Figure 4.4-4 provides an example from the 30% anthropogenic VOC reduction modeling illustrating the lack of ozone response North Carolina.

Figure 4.4-4 8-hour Ozone response to 30% anthropogenic VOC reductions in 2009



Additional mobile source sensitivity simulations have been conducted by the NCDAQ. These modeling runs focused specifically on the impact of mobile source VOC emissions on ozone. The first sensitivity reduced mobile source VOC by 50% in the counties in the Triangle ozone nonattainment area (Chatham, Durham, Franklin, Granville, Orange, Person and Wake Counties) in the year 2008. This emissions sensitivity was run for a 7 day period (July 13-19). In all 7 days of the modeling simulation, the 8-hour ozone maximum concentrations were unchanged in the Triangle area (and all of North Carolina), a clear indicator that highway mobile VOC is an insignificant contributor to ozone formation in that area. Figure 4.4-5 provides an example of the lack of an 8-hour ozone response from the 50% mobile VOC reduction sensitivity modeling.

Figure 4.4-5 8-hour Ozone Response to 50% mobile VOC decrease in 2008



The second sensitivity conducted by the NCDAQ focused on a 50% increase of mobile source VOC in the same counties and over the same 7-day period mentioned above. The results were identical, no change in 8-hour ozone concentrations indicating highway mobile VOC is an insignificant contributor to ozone formation in the Triangle area.

Based on the information discussed above, the NCDAQ steadfastly believes highway mobile VOCs are insignificant contributors to ozone formation in the Triangle nonattainment area. Emission estimates indicate highway mobile VOC is a small percentage of the total VOC emissions inventory. Highway mobile VOC emissions are projected to decrease into the future notwithstanding VMT increases. The area is currently below the NAAQS and emission sensitivity modeling performed by ASIP and the NCDAQ indicates no change in future ozone concentrations when VOC emissions are significantly changed. Further, the NCDAQ considers it unreasonable to expect that the Triangle nonattainment area will experience enough motor vehicle VOC emissions growth for a future ozone violation to occur. For these reasons, the NCDAQ will not be setting MVEB for VOC for the Triangle nonattainment area.

Safety Margin

A safety margin is the difference between the attainment level of emissions from all source categories (i.e., point, area, and mobile) and the projected level of emissions from all source categories. The State may choose to allocate some of the safety margin to the MVEBs, for transportation conformity purposes, so long as the total level of emissions from all source categories remains below the attainment level of emissions.

The NCDAQ has decided to allocate a portion of the safety margin to the MVEBs to allow for unanticipated growth in VMT, changes to vehicle mix assumptions, etc. that will influence the emission estimations. The NCDAQ has developed and implemented a four-step approach for determining the amount of safety margin to apply to the MVEBs.

Step 1 Percentage below the standard

All counties get 5% safety margin in 2008

This component of the methodology takes into account the current (2004-2006) monitored ozone design value in the nonattainment area relative to the level of the standard. In the Triangle area, the highest current ozone design value is 0.080 ppm. Therefore, based on the latest monitored ozone data, the area is 5% below the standard. This percentage is used to adjust the mobile source emissions in 2008 and 2017 for purposes of establishing MVEBs.

Step 2 Account for continued rapid growth and provide flexibility for counties that are small contributors to on-road mobile NOx emissions inventory

Chatham, Granville and Person get 10% additional safety margin in 2008

Durham, Franklin, Johnston, Orange and Wake get 5% additional safety margin in 2008

Additional safety margin increases of 5-10% are applied to all counties. This is simply to account for continued rapid growth in the Triangle area.

Chatham, Granville and Person Counties are allocated 5% more than the other counties in this step because they make very small contributions to the overall on-road mobile NOx emissisons inventory in the Triangle area and are on the edge of the rapidly growing metropolitan region. This additional allocation is in response to concerns raised in the January 31, 2006 letter from Ed Johnson, Director of the North Carolina Capital Area Metropolitan Planning Organization, to Laura Boothe, NCDAQ (Appendix B).

Step 3 Account for input uncertainty in final year of the maintenance plan

All counties get 10% additional safety margin in 2017.

An additional increase of 10% is applied to the 2017 MVEBs to account for potential changes in VMT, vehicle mix and vehicle age distribution. This additional percentage is added to the current percentages outlined in the steps above. The NCDAQ believes this additional 10% is appropriate for the 2017 because ozone values will continue to drop as NOx levels in 2017 are projected to be less than half of what they are currently in the nonattainment area.

Step 4 Ensure the sum of the safety margins applied to the MVEB does not exceed 50% of the total safety margin available

The NCDAQ will implement a cap to the safety margin applied to the MVEBs. The sum of the safety margins applied to the MVEBs in the entire nonattainment area cannot exceed 50% of the total safety margin available. In this analysis, the sum of the 2008 Triangle nonattainment area safety margins applied to the MVEBs is 14,396 kg (15.87 tons/day). The sum of the 2017 Triangle nonattainment area safety margins applied to the MVEB is 13,563 kg (14.95 tons/day).

Table 4.4-1 summarizes the percent increase to the MVEB for purposes of transportation conformity for each county in the Triangle nonattainment area.

Table 4.4-1 Percent Increase to MVEB

County	2008	2017
Chatham	15%	25%
Durham	10%	20%
Franklin	10%	20%
Granville	15%	25%
Johnston	10%	20%
Orange	10%	20%
Person	15%	25%
Wake	10%	20%

<u>Motor Vehicle Emission Budgets</u>

As part of the consultation process on setting MVEBs, NCDAQ sent out a request for comment on setting the geographic extent of the MVEBs to all of the transportation partners. A copy of the letter can be found in Appendix B. In the letter, NCDAQ expressed its preference for setting county level budgets and some of the reasons why NCDAQ believed county level budgets were appropriate.

The NCDAQ received comments from several of the transportation partners regarding the geographic extent of the MVEBs. Some of the partners wanted county-by-county budgets; others wanted regional budgets. Copies of the letters received can be found in Appendix B. Upon careful consideration of all arguments, NCDAQ decided to move forward with setting county-by-county MVEB. The NCDAQ believes that the concerns raised in the requests for regional budgets can be addressed by adding to the safety margins for the areas of concern.

Additionally, there was discussion through the interagency consultation process on the years to set MVEBs for the Triangle maintenance plan. According to Section 93.118 of the transportation conformity rule, a maintenance plan must establish MVEBs for the last year of the maintenance plan (in this case, 2017). Through the interagency consultation process, it was decided that another MVEBs would be set for the year 2008 in the Triangle maintenance plan.

Although the emissions up to this point have been expressed in terms of tons per day, the MVEBs will be set in terms of kilograms (kg) per day. The reason for the change is how the emission factors used to calculate mobile emissions are created. The MOBILE model generates the emission factors in grams per mile. In past conformity exercises, there have been some issues with conversion to tons per day, as well as concerns with how the MVEBs were rounded to the hundredth place. Setting MVEBs in kilograms per day will avoid these issues in future conformity determinations.

The table below shows the counties with their highway mobile NOx emissions expressed in tons per day and the corresponding kilograms per day values for 2008 and 2017.

Table 4.4-2 Highway Mobile Source NOx Emissions Triangle Nonattainment Area

County	Current 7.8 psi RVP		Revised 9.0 psi RVP	
	2008		2017	
	Tons/day	Kg/day	Tons/day	Kg/day
Chatham*	3.34	3,033	1.86	1,690
Durham	24.73	22,438	11.58	10,509
Franklin	5.00	4,537	2.43	2,204
Granville	6.73	6,105	2.89	2,622
Johnston	22.40	20,320	10.87	9,865
Orange	15.23	13,820	6.76	6,137
Person	3.16	2,871	1.48	1,340
Wake	71.46	64,825	35.31	32,034
Total	152.05	137,951	73.18	66,401

*Chatham County emissions for nonattainment area only.

The NCDAQ will set MVEBs, for transportation conformity purposes, as county budgets within the Triangle maintenance area for 2008 and 2017. Tables 4.4-3 through 4.4-10 below list out the NOx MVEBs, for transportation conformity purposes, by county for the years 2008 and 2017. Upon the USEPA's affirmative adequacy finding for these county level sub-area MVEBs, these MVEBs will become the applicable MVEBs for each county.

Table 4.4-3 Chatham County MVEB in kilograms per day

	2008	2017
NOx Emissions (kg/day)		
Base Emissions	3,033	1,690
Safety Margin Allocated to MVEB	455	422
NOx Conformity MVEB	3,488	2,112

Table 4.4-4 Durham County MVEB in kilograms per day

	2008	2017
NOx Emissions (kg/day)		
Base Emissions	22,438	10,509
Safety Margin Allocated to MVEB	2,244	2,101
NOx Conformity MVEB	24,682	12,610

Table 4.4-5 Franklin County MVEB in kilograms per day

	2008	2017
NOx Emissions (kg/day)		
Base Emissions	4,537	2,204
Safety Margin Allocated to MVEB	454	441
NOx Conformity MVEB	4,991	2,645

Table 4.4-6 Granville County MVEB in kilograms per day

	2008	2017
NOx Emissions (kg/day)		
Base Emissions	6,105	2,622
Safety Margin Allocated to MVEB	916	656
NOx Conformity MVEB	7,021	3,278

Table 4.4-7 Johnston County MVEB in kilograms per day

	2008	2017
NOx Emissions (kg/day)		
Base Emissions	20,320	9,865
Safety Margin Allocated to MVEB	2,032	1,972
NOx Conformity MVEB	22,352	11,837

Table 4.4-8 Orange County MVEB in kilograms per day

	2008	2017
NOx Emissions (kg/day)		
Base Emissions	13,820	6,137
Safety Margin Allocated to MVEB	1,382	1,227
NOx Conformity MVEB	15,202	7,364

Table 4.4-9 Person County MVEB in kilograms per day

	2008	2017
NOx Emissions (kg/day)		
Base Emissions	2,871	1,340
Safety Margin Allocated to MVEB	431	335
NOx Conformity MVEB	3,302	1,675

Table 4.4-10 Wake County MVEB in kilograms per day

	2008	2017
NOx Emissions (kg/day)		
Base Emissions	64,825	32,034
Safety Margin Allocated to MVEB	6,483	6,407
NOx Conformity MVEB	71,308	38,441

5.0 MOVES Input Data

5.1 VEHICLE MIX DATA

Tables 5.1-1 through 5.1-2 show definitions of the vehicle types and facility (roadway) types referred to in the vehicle mix tables. Tables 5.1-3 through 5.1-7 list the vehicle mix data for each inventory year modeled.

Table 5.1-1 Vehicle Type Descriptions

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

Table 5.1-1 Facility (Roadway) Type Descriptions

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

Table 5.1-1 3 2005 North Carolina Vehicle Mix Data

Vehicle Type	Fraction of VMT on Facility Type by Vehicle Type (each column should sum to 1)											
	11	13	15	17	19	21	23	25	27	29	31	33
1	0.3489	0.4137	0.4225	0.4408	0.4401	0.4382	0.3964	0.4260	0.4420	0.4528	0.4567	0.4459
2	0.0638	0.0757	0.0773	0.0806	0.0805	0.0802	0.0725	0.0779	0.0808	0.0828	0.0835	0.0816
3	0.2125	0.2520	0.2574	0.2685	0.2681	0.2670	0.2414	0.2595	0.2692	0.2758	0.2782	0.2716
4	0.0655	0.0776	0.0793	0.0827	0.0826	0.0823	0.0744	0.0800	0.0829	0.0850	0.0857	0.0837
5	0.0301	0.0357	0.0365	0.0380	0.0380	0.0378	0.0342	0.0368	0.0381	0.0391	0.0394	0.0385
6	0.0883	0.0450	0.0391	0.0269	0.0273	0.0285	0.0566	0.0367	0.0261	0.0188	0.0162	0.0234
7	0.0087	0.0044	0.0038	0.0026	0.0027	0.0028	0.0056	0.0036	0.0026	0.0018	0.0016	0.0023
8	0.0071	0.0036	0.0031	0.0022	0.0022	0.0023	0.0045	0.0029	0.0021	0.0015	0.0013	0.0019
9	0.0053	0.0027	0.0023	0.0016	0.0016	0.0017	0.0034	0.0022	0.0015	0.0011	0.0010	0.0014
10	0.0196	0.0100	0.0087	0.0060	0.0061	0.0063	0.0126	0.0082	0.0058	0.0042	0.0036	0.0052
11	0.0233	0.0119	0.0103	0.0071	0.0072	0.0075	0.0149	0.0097	0.0069	0.0050	0.0043	0.0062
12	0.0253	0.0129	0.0112	0.0077	0.0078	0.0082	0.0162	0.0105	0.0075	0.0054	0.0046	0.0067
13	0.0902	0.0459	0.0399	0.0274	0.0279	0.0291	0.0578	0.0375	0.0266	0.0192	0.0165	0.0239
14	0.0046	0.0023	0.0020	0.0014	0.0014	0.0015	0.0029	0.0019	0.0013	0.0010	0.0008	0.0012
15	0.0021	0.0010	0.0009	0.0006	0.0006	0.0007	0.0013	0.0009	0.0006	0.0004	0.0004	0.0005
16	0.0047	0.0056	0.0057	0.0059	0.0059	0.0059	0.0053	0.0057	0.0060	0.0061	0.0062	0.0060
Sum	1	1	1	1	1	1	1	1	1	1	1	1

Table 5.1-2 2008 North Carolina Vehicle Mix Data

	Fraction of VMT on Facility Type by Vehicle Type (each column should sum to 1)											
Vehicle Type	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**	**33**
1	0.3219	0.3731	0.3796	0.4002	0.3969	0.3829	0.3510	0.3805	0.3987	0.4095	0.4117	0.3957
2	0.0715	0.0829	0.0843	0.0889	0.0882	0.0851	0.0780	0.0845	0.0886	0.0910	0.0915	0.0880
3	0.2381	0.2761	0.2808	0.2960	0.2937	0.2832	0.2596	0.2815	0.2950	0.3029	0.3047	0.2929
4	0.0734	0.0851	0.0865	0.0912	0.0905	0.0873	0.0800	0.0867	0.0909	0.0933	0.0939	0.0902
5	0.0337	0.0391	0.0398	0.0419	0.0416	0.0401	0.0368	0.0399	0.0418	0.0429	0.0432	0.0415
6	0.0814	0.0423	0.0376	0.0232	0.0247	0.0300	0.0594	0.0384	0.0244	0.0161	0.0140	0.0192
7	0.0080	0.0041	0.0037	0.0023	0.0024	0.0029	0.0058	0.0038	0.0024	0.0016	0.0014	0.0019
8	0.0065	0.0034	0.0030	0.0019	0.0020	0.0024	0.0047	0.0031	0.0020	0.0013	0.0011	0.0015
9	0.0050	0.0026	0.0023	0.0014	0.0015	0.0019	0.0037	0.0024	0.0015	0.0010	0.0009	0.0012
10	0.0183	0.0095	0.0084	0.0052	0.0055	0.0067	0.0133	0.0086	0.0055	0.0036	0.0031	0.0043
11	0.0214	0.0111	0.0099	0.0061	0.0065	0.0079	0.0156	0.0101	0.0064	0.0042	0.0037	0.0050
12	0.0233	0.0121	0.0108	0.0066	0.0071	0.0086	0.0170	0.0110	0.0070	0.0046	0.0040	0.0055
13	0.0833	0.0433	0.0385	0.0237	0.0253	0.0307	0.0608	0.0393	0.0250	0.0165	0.0143	0.0196
14	0.0072	0.0054	0.0062	0.0037	0.0048	0.0131	0.0061	0.0047	0.0036	0.0037	0.0033	0.0159
15	0.0032	0.0024	0.0028	0.0017	0.0021	0.0059	0.0028	0.0021	0.0016	0.0017	0.0015	0.0072
16	0.0038	0.0075	0.0058	0.0060	0.0072	0.0113	0.0054	0.0034	0.0056	0.0061	0.0077	0.0104
Sum	1	1	1	1	1	1	1	1	1	1	1	1

Table 5.1-3 2011 North Carolina Vehicle Mix Data

	Fraction of VMT on Facility Type by Vehicle Type (each column should sum to 1)											
Vehicle Type	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**	**33**
1	0.3184	0.3493	0.3648	0.3674	0.3548	0.3641	0.3488	0.3586	0.3752	0.3791	0.3805	0.3715
2	0.0800	0.0879	0.0917	0.0924	0.0892	0.0915	0.0877	0.0901	0.0943	0.0953	0.0956	0.0934
3	0.2663	0.2924	0.3052	0.3074	0.2967	0.3046	0.2919	0.3000	0.3138	0.3171	0.3183	0.3109
4	0.0821	0.0901	0.0941	0.0948	0.0915	0.0939	0.0900	0.0925	0.0967	0.0977	0.0981	0.0958
5	0.0377	0.0414	0.0432	0.0435	0.0420	0.0432	0.0413	0.0425	0.0445	0.0449	0.0451	0.0440
6	0.0676	0.0412	0.0296	0.0268	0.0358	0.0267	0.0428	0.0343	0.0212	0.0179	0.0163	0.0191
7	0.0066	0.0040	0.0029	0.0026	0.0035	0.0026	0.0042	0.0033	0.0021	0.0017	0.0016	0.0019
8	0.0055	0.0034	0.0024	0.0022	0.0029	0.0022	0.0035	0.0028	0.0017	0.0015	0.0013	0.0016
9	0.0042	0.0025	0.0018	0.0016	0.0022	0.0016	0.0026	0.0021	0.0013	0.0011	0.0010	0.0012
10	0.0151	0.0092	0.0066	0.0060	0.0080	0.0059	0.0096	0.0076	0.0047	0.0040	0.0036	0.0043
11	0.0179	0.0109	0.0078	0.0071	0.0095	0.0070	0.0113	0.0091	0.0056	0.0047	0.0043	0.0050
12	0.0194	0.0118	0.0085	0.0077	0.0103	0.0077	0.0123	0.0098	0.0061	0.0051	0.0047	0.0055
13	0.0692	0.0421	0.0303	0.0274	0.0366	0.0273	0.0438	0.0351	0.0217	0.0183	0.0166	0.0195
14	0.0043	0.0055	0.0040	0.0043	0.0056	0.0086	0.0042	0.0048	0.0037	0.0034	0.0046	0.0118
15	0.0021	0.0028	0.0020	0.0022	0.0028	0.0043	0.0021	0.0024	0.0018	0.0017	0.0023	0.0059
16	0.0036	0.0055	0.0051	0.0066	0.0086	0.0088	0.0039	0.0050	0.0056	0.0065	0.0061	0.0086
Sum	1	1	1	1	1	1	1	1	1	1	1	1

Table 5.1-4 2014 North Carolina Vehicle Mix Data

	Fraction of VMT on Facility Type by Vehicle Type (each column should sum to 1)											
Vehicle Type	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**	**33**
1	0.2821	0.3104	0.3238	0.3268	0.3161	0.3247	0.3093	0.3184	0.3330	0.3366	0.3377	0.3310
2	0.0861	0.0946	0.0987	0.0996	0.0964	0.0989	0.0943	0.0970	0.1016	0.1027	0.1031	0.1009
3	0.2864	0.3149	0.3285	0.3314	0.3208	0.3292	0.3138	0.3229	0.3380	0.3418	0.3429	0.3358
4	0.0882	0.0970	0.1012	0.1021	0.0988	0.1014	0.0967	0.0995	0.1041	0.1053	0.1056	0.1034
5	0.0406	0.0446	0.0465	0.0469	0.0454	0.0466	0.0444	0.0457	0.0479	0.0484	0.0486	0.0476
6	0.0680	0.0428	0.0308	0.0282	0.0376	0.0301	0.0438	0.0357	0.0224	0.0191	0.0181	0.0243
7	0.0066	0.0042	0.0030	0.0027	0.0037	0.0029	0.0043	0.0035	0.0022	0.0019	0.0018	0.0024
8	0.0056	0.0035	0.0025	0.0023	0.0031	0.0025	0.0036	0.0029	0.0018	0.0016	0.0015	0.0020
9	0.0042	0.0026	0.0019	0.0017	0.0023	0.0019	0.0027	0.0022	0.0014	0.0012	0.0011	0.0015
10	0.0153	0.0096	0.0069	0.0064	0.0085	0.0068	0.0099	0.0080	0.0051	0.0043	0.0041	0.0055
11	0.0179	0.0113	0.0081	0.0074	0.0099	0.0079	0.0115	0.0094	0.0059	0.0050	0.0048	0.0064
12	0.0195	0.0123	0.0088	0.0081	0.0108	0.0086	0.0125	0.0102	0.0064	0.0055	0.0052	0.0070
13	0.0696	0.0438	0.0315	0.0289	0.0385	0.0308	0.0448	0.0366	0.0230	0.0195	0.0185	0.0249
14	0.0035	0.0022	0.0016	0.0014	0.0019	0.0015	0.0022	0.0018	0.0011	0.0010	0.0009	0.0012
15	0.0017	0.0011	0.0008	0.0007	0.0010	0.0008	0.0011	0.0009	0.0006	0.0005	0.0005	0.0006
16	0.0047	0.0051	0.0054	0.0054	0.0052	0.0054	0.0051	0.0053	0.0055	0.0056	0.0056	0.0055
Sum	1	1	1	1	1	1	1	1	1	1	1	1

Table 5.1-5 2017 North Carolina Vehicle Mix Data

	Fraction of VMT on Facility Type by Vehicle Type (each column should sum to 1)											
Vehicle Type	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**	**33**
1	0.2642	0.2908	0.3031	0.3060	0.2961	0.3038	0.2897	0.2981	0.3120	0.3153	0.3166	0.3101
2	0.0891	0.0979	0.1022	0.1031	0.0998	0.1024	0.0976	0.1004	0.1051	0.1063	0.1067	0.1045
3	0.2967	0.3262	0.3403	0.3433	0.3323	0.3411	0.3251	0.3345	0.3501	0.3541	0.3552	0.3479
4	0.0914	0.1005	0.1049	0.1058	0.1024	0.1051	0.1002	0.1031	0.1079	0.1091	0.1095	0.1072
5	0.0420	0.0462	0.0482	0.0486	0.0471	0.0483	0.0460	0.0474	0.0496	0.0502	0.0503	0.0493
6	0.0679	0.0427	0.0307	0.0282	0.0375	0.0301	0.0437	0.0356	0.0224	0.0190	0.0180	0.0243
7	0.0068	0.0043	0.0031	0.0028	0.0037	0.0030	0.0043	0.0035	0.0022	0.0019	0.0018	0.0024
8	0.0057	0.0036	0.0026	0.0024	0.0032	0.0025	0.0037	0.0030	0.0019	0.0016	0.0015	0.0020
9	0.0042	0.0026	0.0019	0.0017	0.0023	0.0018	0.0027	0.0022	0.0014	0.0012	0.0011	0.0015
10	0.0152	0.0096	0.0069	0.0063	0.0084	0.0068	0.0098	0.0080	0.0050	0.0043	0.0040	0.0054
11	0.0180	0.0113	0.0081	0.0075	0.0100	0.0080	0.0116	0.0095	0.0059	0.0050	0.0048	0.0064
12	0.0196	0.0123	0.0089	0.0081	0.0108	0.0087	0.0126	0.0103	0.0065	0.0055	0.0052	0.0070
13	0.0694	0.0437	0.0314	0.0288	0.0384	0.0308	0.0447	0.0365	0.0229	0.0195	0.0184	0.0248
14	0.0035	0.0022	0.0016	0.0014	0.0019	0.0015	0.0022	0.0018	0.0011	0.0010	0.0009	0.0012
15	0.0017	0.0011	0.0008	0.0007	0.0010	0.0008	0.0011	0.0009	0.0006	0.0005	0.0005	0.0006
16	0.0046	0.0050	0.0053	0.0053	0.0051	0.0053	0.0050	0.0052	0.0054	0.0055	0.0055	0.0054
Sum	1	1	1	1	1	1	1	1	1	1	1	1

5.2 METEOROLOGICAL DATA

The table below lists the meteorological data used for all counties. This data was based on July 2005 24-hour temperature and relative humidity observations from Raleigh-Durham International Airport (KRDU). Each record represents the temperature and relative humidity reading for a specific clock hour, averaged over all days of the month. For example, the first record shows the average temperature and relative humidity observed between midnight and 1:00AM during July 2005.

monthID	zoneID	hourID	temperature	relHumidity
7	371830	1	75	90
7	371830	2	74	93
7	371830	3	73	94
7	371830	4	73	95
7	371830	5	73	96
7	371830	6	73	96
7	371830	7	73	96
7	371830	8	74	88
7	371830	9	77	80
7	371830	10	78	77
7	371830	11	81	68
7	371830	12	82	64
7	371830	13	85	54
7	371830	14	86	53
7	371830	15	89	50
7	371830	16	89	49
7	371830	17	88	51
7	371830	18	86	57
7	371830	19	86	60
7	371830	20	84	67
7	371830	21	81	70
7	371830	22	80	75
7	371830	23	77	82
7	371830	24	76	86

Appendix C.4

Off-road Mobile Source

Emissions Inventory Documentation

(*this page intentionally left blank)*

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION AND SCOPE

Mobile sources comprise about 74% of the nitrogen oxides (NOx) emissions in the Raleigh-Durham-Chapel Hill, NC nonattainment area, often referred to as the Triangle area. The Triangle area nonattainment counties include Durham, Franklin, Granville, Johnston, Orange, Person, and Wake Counties and Baldwin, Center, New Hope and Williams Townships in Chatham County. Mobile sources can be subdivided into two subcategories, highway mobile sources (~55% of the Triangle nonattainment area NOx) and off-road mobile sources (~19% of the Triangle nonattainment area NOx). Highway mobile sources are discussed in Appendix C.3. Off-road mobile sources are further divided into nonroad mobile sources (emissions of these are calculated by the NONROAD2008a model), railroad locomotives, aircraft engines, and commercial marine vessels. Commercial marine vessels do not operate in the Triangle area. The term “nonroad” is commonly used to name all of these off-road emission source groups.

In the original 2007 redesignation demonstration and maintenance plan, the model used to generate off-road emissions was the NONROAD2005c mobile model. Since 2007, USEPA has updated the nonroad mobile model to NONROAD2008a. NONROAD2008a is the latest USEPA approved nonroad mobile model. In this supplement, the NONROAD2008a mobile model is used to generate nonroad mobile emissions for all inventory years – 2005, 2008, 2011, 2014, and 2017. Reported emissions for aircraft and railroads are unchanged from the original redesignation demonstration and maintenance plan. Additionally, the off-road mobile emissions documentation includes the general conformity analysis for two new nuclear generating units at Duke-Progress Energy Company in Wake County.

2.0 OVERALL METHODOLOGY

2.1 SOURCE CATEGORY IDENTIFICATION

Off-road mobile sources were identified from 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); 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); and from the USEPA's off-road mobile model NONROAD2008a released July 6, 2009.

2.2 EMISSION ESTIMATION APPROACH

Mobile source emissions are estimated by the methodologies suggested in the USEPA document Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations. The estimation of emissions from mobile sources, like area sources, involves multiplying an activity level by an emission factor.

The majority of the off-road mobile emissions were estimated by using the USEPA off-road mobile model NONROAD2008a. Direct emissions are generated with this model. For aircraft engine emissions, the Federal Aviation Administration (FAA) Emissions and Dispersion Modeling System (EDMS) model was used. Aircraft operations were input into the model and the model predicts the engine emissions based on average landing and take-off practices for the aircraft type. For railroad locomotive emissions, emission factors were obtained from the Mobile Source Procedures document and the activity level was obtained from the various railroad companies.

The USEPA designated only a part of Chatham County as nonattainment for the 1997 8-hour ozone NAAQS. The off-road emissions for Chatham County were apportioned to the nonattainment area by using the percent population in the four townships designated nonattainment to the whole County. Based on the 2000 census, approximately 43.2% of Chatham County's population is in the nonattainment area. This percentage was used to estimate the off-road emissions of the nonattainment area for all of the years in the maintenance plan.

3.0 QUALITY ASSURANCE MEASURES

The quality assurance (QA) procedures for the off-road mobile source categories were conducted in the same manner as the area source categories. That is, for each category, the completed emission estimate (including a discussion of the methodology) was given to an individual who was not involved with the compilation of emissions for that category. This individual reviewed the information and commented to the emissions inventory developer on any needed modifications.

4.0 OFF-ROAD MOBILE SOURCES

Off-road mobile sources are those sources that can move but do not use the highway system. Examples include lawn mowers, agricultural equipment, construction equipment, aircraft engines and railroad locomotives. All but the aircraft engine and railroad locomotive emissions are estimated using the USEPA off-road mobile model NONROAD2008a. The emissions from aircraft engines are estimated using FAA reported activity values multiplied by the USEPA determined emission factors. Emissions from railroad locomotives are also estimated using activity levels and emission factors. The methodology used to calculate the emissions from these off-road mobile sources are described in detail in the subsections that follow.

4.1 NONROAD Model Mobile Sources

The nonroad mobile source category includes a diverse collection of equipment such as lawn mowers, chain saws, tractors, all terrain vehicles, fork lifts and construction equipment. The USEPA included more than 80 different types of equipment in the NONROAD2008a model. To facilitate analysis and reporting, the USEPA grouped the equipment types into eleven equipment categories. These include:

- Agricultural equipment
- Airport ground support equipment
- Commercial equipment
- Construction and mining equipment
- Industrial equipment
- Lawn and garden equipment-commercial
- Lawn and garden equipment -residential
- Logging equipment
- Railroad maintenance equipment
- Recreational marine equipment
- Recreational equipment

Within these groups the emissions are calculated for five different engine types. These include: 2-stroke and 4-stroke spark engines, diesel engines, liquid propane gas and compressed natural gas fueled engines. This level of detail is not reported in this document.

The NONROAD2005c model version was used to estimate emissions for the original 1997 8-hour ozone redesignation demonstration and maintenance plan dated June 7, 2007. This version of the model was released to the public on March 21, 2006. It was discovered that some of the original inputs to the options files were not well chosen. This revision to the Raleigh-Durham-Chapel Hill NC 8-Hour Redesignation Demonstration and Maintenance Plan gave the opportunity to use the improved model version with improvements in choice of fuel properties and temperatures. It was discovered the the Reid Vapor Pressure (RVP), a measure of gasoline volatility, was set at 7.8 psi for Chatham, Franklin, Johnston, Orange, and Person Counties when it should have been set at 9.0 psi. for all years. The temperatures originally used to run

NONROAD2005c were for an average summer weekday in 2005. The temperatures for the runs of NONROAD2008a were chosen for an average July weekday in 2005, a more appropriate choice for this demonstration. The gasoline oxygen content was set at 0 in the original demonstration. In this revision it was set at appropriate historic values up through 2011 and at expected values for 2014 and 2017. Ethanol content of gasoline was set at historic or anticipated values depending on the year. Ethanol content could not be set in the older model. Diesel fuel sulfur content was adjusted based on current USEPA recommendations.

NONROAD2008a is the latest final release of the USEPA NONROAD model that was first released in June 2000, and incorporates many revisions to improve the model's predictive ability. The main change from NONROAD2005c to NONROAD2008a is inclusion of emission reductions from the diesel (CI) recreational marine standards in the Locomotive/Marine final rule (Federal Register Vol 73, No.88, page25098, May 6, 2008) and the Small Spark Ignition (SI) and SI Recreational Marine final rule (Federal Register Vol 73, No.196, page 59034, October 8, 2008. The improved model is also able to model effects of ethanol blends on fuel tank and hose permeation.

After an examination of temperature data in North Carolina and comparing it to surrounding states, it was decided that North Corolina should be in the Southeast group rather than the Mid-Atlantic group of states in the SEASON.DAT file of the NONROAD2008a model as issued. The file was changed accordingly. The consequence is a change of monthly temporal profiles of operation of various types of equipment. The other data files that are part of the model were unchanged.

The option files used in the NONROAD2008a model were tailored to reflect North Carolina specific information. As mentioned above, emissions were calculated for a typical July weekday. Average temperatures for July 2005, measured at the Raleigh-Durham Airport, were used. Diesel fuel properties were from the USEPA suggested nationwide average fuel properties. Additional information about ethanol and (methyl tert-butyl ether) MTBE was provided by Mr. Timothy Laughlin of the NC Petroleum & Convenience Marketers and Mr. Clarence A. Rupard of the Motor Fuels Section of the NC Department of Agriculture & Consumer Services. Copies of the option files are in Section 6 and may be reviewed to see the particular input values chosen.

Gasoline volatility is specified by measurement of Reid Vapor Pressure (RVP). During May through August, RVP for gasoline sold in Durham, Granville, and Wake counties has been limited to no higher than 7.8 pounds per square inch (psi). The RVP limit for Chatham, Franklin, Johnston, Orange, and Person counties is 9.0 psi. NONROAD2008a model option files for 2005, 2008, and 2011 were set to these RVP values. Because North Carolina is requesting that the required RVP for Durham, Granville, and Wake Counties be adjusted up from 7.8 psi to 9.0 psi, the RVP in the 2014 and 2017 option files for those counties were set to 9.0 psi. Additionally, option files for 2014 and 2017 were also run with the RVP set at 7.8 psi for these three counties for comparison purposes as shown in Table 4.1-12.

For reporting purposes, the resulting emissions from the NONROAD2008a model were totaled for each equipment category by county. The model generates VOC and NOx emissions directly. 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 emission factors due to emission standards, changes in fuel specifications, and activity levels. These future emission factors and activity levels are accounted for in the NONROAD model. The fuel specifications are provided in the options files.

The summary of these results are tabulated in Tables 4.1-1 through 4.1-11. Table 4.1-12 summarizes of the NONROAD model categories emissions for each county within the Triangle nonattainment area. To estimate the emissions for just the nonattainment area in Chatham County, the County emissions estimated by the NONROAD model were multiplied by the percent of population (43.2%) located in the nonattainment townships compared to the county as a whole.

Table 4.1-1 Agricultural Equipment Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.01	0.01	0.01	0.01	0.01
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.03	0.03	0.02	0.02	0.02
Granville	0.02	0.02	0.01	0.01	0.01
Johnston	0.10	0.09	0.07	0.06	0.05
Orange	0.02	0.02	0.01	0.01	0.01
Person	0.02	0.02	0.02	0.01	0.01
Wake	0.03	0.02	0.02	0.02	0.01
Total	**0.23**	**0.21**	**0.16**	**0.14**	**0.12**
NOx Emissions					
Chatham*	0.08	0.07	0.06	0.06	0.05
Durham	0.03	0.03	0.03	0.02	0.02
Franklin	0.24	0.22	0.20	0.18	0.15
Granville	0.15	0.14	0.13	0.11	0.09
Johnston	0.78	0.73	0.67	0.58	0.49
Orange	0.14	0.13	0.12	0.10	0.09
Person	0.17	0.16	0.15	0.13	0.11
Wake	0.19	0.18	0.17	0.14	0.12
Total	**1.78**	**1.66**	**1.53**	**1.32**	**1.12**

*Chatham County emissions for nonattainment area only.

Table 4.1-2 Airport Ground Support Equipment Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.03	0.02	0.02	0.02	0.01
Total	**0.03**	**0.02**	**0.02**	**0.02**	**0.01**
NOx Emissions					
Chatham*	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.26	0.24	0.22	0.18	0.14
Total	**0.26**	**0.24**	**0.22**	**0.18**	**0.14**

*Chatham County emissions for nonattainment area only.

Table 4.1-3 Commercial Equipment Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.04	0.03	0.03	0.02	0.02
Durham	0.31	0.27	0.23	0.18	0.17
Franklin	0.06	0.05	0.04	0.03	0.03
Granville	0.04	0.04	0.03	0.03	0.02
Johnston	0.18	0.16	0.13	0.10	0.09
Orange	0.13	0.12	0.10	0.08	0.07
Person	0.05	0.04	0.04	0.03	0.03
Wake	1.91	1.67	1.42	1.13	1.05
Total	**2.72**	**2.38**	**2.02**	**1.60**	**1.48**
NOx Emissions					
Chatham*	0.02	0.02	0.02	0.02	0.02
Durham	0.19	0.19	0.18	0.16	0.14
Franklin	0.03	0.03	0.03	0.03	0.03
Granville	0.03	0.03	0.03	0.02	0.02
Johnston	0.10	0.11	0.10	0.09	0.08
Orange	0.08	0.08	0.08	0.07	0.06
Person	0.03	0.03	0.03	0.02	0.02
Wake	1.16	1.16	1.12	0.98	0.87
Total	**1.64**	**1.65**	**1.59**	**1.39**	**1.24**

*Chatham County emissions for nonattainment area only.

Table 4.1-4 Construction and Mining Equipment Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.06	0.05	0.04	0.04	0.03
Durham	0.71	0.58	0.49	0.43	0.38
Franklin	0.05	0.04	0.03	0.03	0.02
Granville	0.14	0.12	0.10	0.09	0.08
Johnston	0.22	0.18	0.16	0.13	0.12
Orange	0.31	0.25	0.22	0.18	0.16
Person	0.04	0.03	0.03	0.03	0.02
Wake	1.97	1.59	1.37	1.18	1.04
Total	**3.50**	**2.84**	**2.44**	**2.11**	**1.85**
NOx Emissions					
Chatham*	0.38	0.35	0.31	0.25	0.19
Durham	4.30	3.92	3.47	2.82	2.15
Franklin	0.28	0.26	0.23	0.18	0.14
Granville	0.87	0.79	0.70	0.57	0.44
Johnston	1.34	1.22	1.09	0.88	0.67
Orange	0.86	1.70	1.51	1.22	0.93
Person	0.25	0.23	0.20	0.17	0.13
Wake	11.87	10.83	9.60	7.79	5.95
Total	**21.15**	**19.30**	**17.11**	**13.88**	**10.60**

*Chatham County emissions for nonattainment area only.

Table 4.1-5 Industrial Equipment Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.04	0.03	0.02	0.01	0.01
Durham	0.47	0.33	0.20	0.10	0.07
Franklin	0.05	0.03	0.02	0.01	0.01
Granville	0.11	0.08	0.05	0.02	0.02
Johnston	0.12	0.08	0.05	0.03	0.02
Orange	0.02	0.02	0.01	0.01	0.00
Person	0.06	0.04	0.02	0.01	0.01
Wake	0.40	0.28	0.17	0.10	0.06
Total	**1.27**	**0.89**	**0.54**	**0.29**	**0.20**
NOx Emissions					
Chatham*	0.16	0.12	0.08	0.05	0.04
Durham	1.88	1.44	0.97	0.63	0.45
Franklin	0.19	0.15	0.10	0.07	0.05
Granville	0.43	0.33	0.22	0.14	0.10
Johnston	0.49	0.38	0.27	0.18	0.13
Orange	0.12	0.10	0.08	0.06	0.05
Person	0.22	0.17	0.12	0.08	0.06
Wake	1.70	1.34	0.95	0.66	0.51
Total	**5.19**	**4.03**	**2.79**	**1.87**	**1.39**

*Chatham County emissions for nonattainment area only.

Table 4.1-6 Lawn and Garden Equipment Emissions (Commercial)

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.14	0.10	0.09	0.08	0.07
Durham	1.46	1.08	0.93	0.80	0.80
Franklin	0.33	0.24	0.21	0.18	0.18
Granville	0.37	0.28	0.24	0.20	0.20
Johnston	0.85	0.63	0.54	0.46	0.46
Orange	0.66	0.49	0.42	0.36	0.36
Person	0.26	0.19	0.17	0.14	0.14
Wake	8.52	6.30	5.43	4.68	4.65
Total	**12.59**	**9.31**	**8.03**	**6.90**	**6.86**
NOx Emissions					
Chatham*	0.03	0.03	0.03	0.02	0.02
Durham	0.27	0.28	0.27	0.22	0.21
Franklin	0.06	0.06	0.06	0.05	0.05
Granville	0.07	0.07	0.07	0.06	0.05
Johnston	0.16	0.16	0.16	0.13	0.12
Orange	0.12	0.13	0.12	0.10	0.09
Person	0.05	0.05	0.05	0.04	0.04
Wake	1.58	1.64	1.58	1.29	1.21
Total	**2.34**	**2.42**	**2.34**	**1.91**	**1.79**

*Chatham County emissions for nonattainment area only.

Table 4.1-7 Lawn and Garden Equipment Emissions (Residential)

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.07	0.07	0.06	0.04	0.04
Durham	0.74	0.67	0.56	0.46	0.39
Franklin	0.16	0.15	0.13	0.10	0.08
Granville	0.14	0.12	0.10	0.09	0.07
Johnston	0.41	0.37	0.32	0.24	0.20
Orange	0.38	0.35	0.30	0.23	0.19
Person	0.12	0.11	0.09	0.07	0.06
Wake	2.06	1.85	1.57	1.29	1.07
Total	**4.08**	**3.69**	**3.13**	**2.52**	**2.10**
NOx Emissions					
Chatham*	0.01	0.01	0.01	0.00	0.00
Durham	0.06	0.06	0.06	0.05	0.04
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.03	0.03	0.03	0.03	0.02
Orange	0.03	0.03	0.03	0.02	0.02
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.15	0.17	0.18	0.14	0.11
Total	**0.31**	**0.33**	**0.34**	**0.27**	**0.22**

*Chatham County emissions for nonattainment area only.

Table 4.1-8 Logging Equipment Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.02	0.01	0.01	0.01	0.01
Durham	0.01	0.00	0.00	0.00	0.00
Franklin	0.02	0.02	0.02	0.02	0.02
Granville	0.03	0.02	0.02	0.02	0.02
Johnston	0.04	0.02	0.02	0.02	0.03
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.02	0.01	0.01	0.01	0.01
Wake	0.04	0.03	0.03	0.03	0.03
Total	**0.19**	**0.12**	**0.12**	**0.12**	**0.13**
NOx Emissions					
Chatham*	0.03	0.02	0.02	0.01	0.01
Durham	0.01	0.01	0.01	0.00	0.00
Franklin	0.04	0.03	0.02	0.02	0.01
Granville	0.04	0.03	0.02	0.02	0.01
Johnston	0.06	0.04	0.03	0.02	0.01
Orange	0.02	0.02	0.01	0.01	0.00
Person	0.03	0.02	0.02	0.01	0.01
Wake	0.06	0.05	0.04	0.03	0.01
Total	**0.29**	**0.22**	**0.17**	**0.12**	**0.06**

*Chatham County emissions for nonattainment area only.

Table 4.1-9 Railroad Maintenance Equipment Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
NOx Emissions					
Chatham*	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
Total	**0.01**	**0.01**	**0.01**	**0.01**	**0.00**

*Chatham County emissions for nonattainment area only.

Table 4.1-10 Recreational Equipment Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.00	0.00	0.00	0.00	0.00
Durham	0.47	0.50	0.47	0.43	0.36
Franklin	0.01	0.01	0.00	0.00	0.00
Granville	0.01	0.01	0.00	0.00	0.00
Johnston	0.47	0.50	0.47	0.42	0.35
Orange	1.37	1.47	1.40	1.26	1.04
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.30	0.31	0.28	0.25	0.22
Total	**2.63**	**2.80**	**2.62**	**2.36**	**1.97**
NOx Emissions					
Chatham*	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.02	0.02	0.02
Orange	0.03	0.04	0.04	0.04	0.04
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.03	0.02	0.02	0.02
Total	**0.07**	**0.10**	**0.10**	**0.10**	**0.10**

*Chatham County emissions for nonattainment area only.

Table 4.1-11 Recreational Marine Equipment Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.18	0.17	0.14	0.11	0.09
Durham	0.12	0.10	0.09	0.07	0.06
Franklin	0.04	0.04	0.03	0.03	0.02
Granville	0.08	0.08	0.06	0.05	0.04
Johnston	0.06	0.06	0.05	0.04	0.03
Orange	0.03	0.02	0.02	0.02	0.01
Person	0.19	0.17	0.14	0.11	0.09
Wake	0.37	0.33	0.28	0.23	0.18
Total	**1.07**	**0.97**	**0.81**	**0.66**	**0.52**
NOx Emissions					
Chatham*	0.01	0.02	0.02	0.02	0.02
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.00	0.01	0.01	0.01	0.01
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.01	0.02	0.02	0.02	0.02
Wake	0.03	0.03	0.04	0.04	0.04
Total	**0.07**	**0.10**	**0.11**	**0.11**	**0.11**

*Chatham County emissions for nonattainment area only.

Table 4.1-12 Total NONROAD2008a Model Engine Emissions

	Current 7.8 psi RVP[1]					9.0 psi RVP	
County	2005	2008	2011	2014	2017	2014	2017
VOC Emissions							
Chatham*	0.56	0.47	0.40	0.32	0.28	0.32	0.28
Durham	4.29	3.53	2.97	2.42	2.15	2.47	2.23
Franklin	0.75	0.61	0.50	0.42	0.38	0.42	0.38
Granville	0.94	0.77	0.61	0.50	0.45	0.51	0.46
Johnston	2.45	2.09	1.81	1.50	1.35	1.50	1.35
Orange	2.93	2.75	2.49	2.16	1.85	2.16	1.85
Person	0.76	0.61	0.52	0.41	0.37	0.41	0.37
Wake	15.63	12.40	10.59	8.66	8.08	8.93	8.32
Total	**28.31**	**23.23**	**19.89**	**16.39**	**14.91**	**16.72**	**15.24**
NOx Emissions							
Chatham*	0.72	0.64	0.55	0.43	0.35	0.43	0.35
Durham	6.76	5.96	5.02	3.94	3.04	3.93	3.04
Franklin	0.85	0.76	0.65	0.54	0.44	0.54	0.44
Granville	1.61	1.41	1.19	0.94	0.73	0.94	0.73
Johnston	2.98	2.7	2.39	1.95	1.55	1.95	1.55
Orange	2.40	2.23	1.99	1.62	1.28	1.62	1.28
Person	0.77	0.69	0.6	0.48	0.4	0.48	0.4
Wake	17.02	15.67	13.92	11.27	8.98	11.27	8.98
Total	**33.11**	**30.06**	**26.31**	**21.17**	**16.77**	**21.16**	**16.77**

*Chatham County emissions for nonattainment area only.
[1] 7.8 psi for Wake, Durham and Granville Counties and 9.0 psi for remaining counties.
Note: Table does not include aircraft and railroad emissions.

4.2 Aircraft Engines

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 has little or no effect on ground level ozone.

The aircraft operations of interest are termed the landing and take-off (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 take-off and climbout as it heads back to cruising altitudes, above the mixing layer.

Aircrafts 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, or 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. General aviation include 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. The military aircraft are treated as a separate classification since the LTO operations reported at the airports group all military aircraft together.

Base year 2005 emissions for aircraft engines were projected from the 2002 emissions inventory prepared for the Southeast Regional Haze Planning Organization Visibility Improvement State and Tribal Association of the Southeast (VISTAS). The projection from 2002 to 2005 was made using growth factors generated from the Economic Growth Analysis System Version 5.0 Beta (E-GAS 5.0).

For 2002 aircraft emissions, VISTAS used 1999 emission estimates developed for the USEPA's 1999 National Emission Inventory (NEI) Version 2 as base year estimates for the VISTAS region. VISTAS then projected the revised 1999 inventory to 2002 using surrogate growth indicators. For the aircraft category, 1999 and 2002 approach operations by airport and aircraft type were compiled by VISTAS from the Federal Aviation Administration's Air Traffic Activity Data System (ATADS).The airport-level LTOs were assigned to counties and summed for the county. For counties with aircraft emissions without a county match in ATADS, state-average growth factors were calculated and applied.

Table 4.2-1 summarizes the VOC and NOx emissions for aircraft engines.

Table 4.2-1 Aircraft Engine Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.25	0.29	0.32	0.34	0.37
Total	**0.25**	**0.29**	**0.32**	**0.34**	**0.37**
NOx Emissions					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	1.52	1.71	1.90	2.06	2.23
Total	**1.52**	**1.71**	**1.90**	**2.06**	**2.23**

4.3 Railroad Locomotives

Railroads are categorized by size (Class I, Class 2) and passenger service (Amtrak and NCDOT Rail Division). Class I railroads are long haul operations, consisting of Norfolk Southern Corporation and CSX Corporation. Class II and Class III railroads are short lines, serving localized markets. Passenger service is provided by Amtrak and the NCDOT Rail Division. These entities lease trackage from Class I railroads. Base year 2005 emissions for railroad locomotive engines were projected from the 2002 VISTAS emissions inventory. The projection from 2002 to 2005 was made using growth factors generated from the E-GAS 5.0.

For 2002 railroad locomotive engine emissions, VISTAS used 1999 emission estimates developed for the USEPA's 1999 NEI Version 2 as base year estimates for the VISTAS region. Projected emissions for 2002 were developed in two steps as described below. For 1999 to 2001, State-level rail fuel consumption was obtained from the Department of Energy, Energy Information Administration's (EIA's) *Fuel Oil and Kerosene Sales.* For 2001 to 2002, VISTAS applied national growth factors developed from fuel consumption projections in EIA's *Annual Energy Outlook.* A growth factor of 1.4 was used for locomotives and applied to 1999 emissions to first develop 2001 emissions. Table 4.3.1 lists the growth factors used to generate 2002 emissions.

Table 4.3-1 2002 National Rail Transportation Energy Use by Fuel Type (Trillion BTU)

	2001	**2002**	**Growth Factor (GF)**
Intercity Rail (Electric)	10.17	10.40	1.0226
Intercity Rail (Diesel)	16.60	16.88	1.0169
Transit Rail (Electric)	46.36	47.40	1.0224
Intercity/Transit Rail Average (SCC 2285002008)			**1.0206**
Commuter Rail (Electric)	16.13	16.49	1.0223
Commuter Rail (Diesel)	26.31	26.76	1.0171
Commuter Rail Average (SCC 2285002009)			**1.0197**
Freight Rail (Distillate) (SCCs 2285002000, 2285002005, 2285002006, 2285002007, 2285002010)	512.81	492.32	0.9600

Source: Department of Energy, Energy Information Administration, Annual Energy Outlook 2003: Table 34. Transportation Sector Energy Use by Fuel Type Within a Mode

The summary of emissions from all railroad locomotives in each county are in Table 4.3-2.

Table 4.3-2 Railroad Locomotive Engine Emissions

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.08	0.07	0.07	0.06	0.06
Orange	0.02	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.03	0.03	0.03	0.02	0.02
Total	**0.14**	**0.12**	**0.12**	**0.10**	**0.10**
NOx Emissions					
Chatham*	0.06	0.05	0.05	0.04	0.04
Durham	0.32	0.29	0.27	0.26	0.24
Franklin	0.04	0.04	0.03	0.03	0.03
Granville	0.03	0.03	0.03	0.03	0.03
Johnston	1.90	1.74	1.60	1.51	1.43
Orange	0.37	0.34	0.31	0.29	0.28
Person	0.06	0.05	0.05	0.04	0.04
Wake	0.72	0.65	0.60	0.57	0.54
Total	**3.50**	**3.19**	**2.94**	**2.77**	**2.63**

*Chatham County emissions for nonattainment area only.

5.0 GENERAL CONFORMITY BUDGET

Duke Progress Energy (previously Progress Energy) plans to construct two new nuclear generating plants (units 2 and 3) in Wake County. The company determined that emissions of NOx will exceed 100 tons per year during the several years of construction. As a result of the construction being in the Triangle Ozone Maintenance Area compliance with general conformity regulations is necessary. Duke Progress Energy requested that a State Implementation Plan (SIP) revision be made granting them a sufficient emissions budget during the construction to allow them to proceed without additional measures such as emission offsets. Examination of available safety margins in the Triangle Redesignation and Maintenance Plan showed that ample margins are available to allow the granting of the requested budget.

In Appendix C.5 is a letter dated July 29, 2011 from Sheila C. Holman, Director of the North Carolina Division of Air Quality, to John Elnitsky, Vice President, Nuclear Plant Development, Progress Energy Carolinas, Inc. advising him that the North Carolina Division of Air Quality has sent a letter to the USEPA stating our commitment to revise our SIP to grant a construction emissions budget for the Shearon Harris expansion. There is also a letter to Gwendolyn Keyes Fleming, Regional Administrator, USEPA Region 4 stating our commitment to revise the redesignation and maintenance plan for the Raleigh-Durham-Chapel Hill 1997 8-hour ozone nonattainment area to incorporate the construction emissions for the Progress Energy Shearon Harris nuclear power plant, units 2 and 3.

Duke Progress Energy furnished estimates of construction emissions for each year of construction on assumptions of an early start year and a later start year. The later start year emissions were lower due primarily to cleaner diesel engines in the heavy equipment that will be used. The highest daily emissions for NOx were estimated to be 2.01 tpd in year 2013 and the highest daily emissions of VOC were estimated to be 0.16 tpd in year 2013. Since these values are worst case and since ample margins appear to be available these are the values budgeted each year for the several years that construction will take place. Emissions are primarily from construction equipment. Smaller amounts of emissions come from railroad operations. The emission rates shown in the following tables for the two equipment categories as well as the totals are from the July 14, 2010 document from Duke Progress Energy to the U.S. Nuclear Regulatory Commission titled SHEARON HARRIS NUCLEAR POWERPLANT, UNITS 2 AND 3; DOCKET NOS. 52-022 AND 52-023; RESPONSE TO SUPPLEMENTAL REQUEST FOR ADDITIONAL INFORMATION CONCERNING ANALYSIS OF EMISSIONS TO SUPPORT GENERAL CONFORMITY.

The construction emissions budget is granted for the time necessary to complete the project provided that the requirements of 40§93.157 are met. The lead Federal agency (the U.S. Nuclear Regulatory Commission) or Duke Progress Energy shall inform NCDAQ of the date construction begins and the date it is complete. Once construction is complete the construction emissions budget shall be considered revoked.

Table 5.1 Construction and Mining Equipment Emissions (tpd)

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.06	0.05	0.04	0.04	0.03
Durham	0.71	0.58	0.49	0.43	0.38
Franklin	0.05	0.04	0.03	0.03	0.02
Granville	0.14	0.12	0.10	0.09	0.08
Johnston	0.22	0.18	0.16	0.13	0.12
Orange	0.31	0.25	0.22	0.18	0.16
Person	0.04	0.03	0.03	0.03	0.02
Wake	1.97	1.59	1.37	1.18	1.04
Total	**3.50**	**2.84**	**2.44**	**2.11**	**1.85**
Shearon Harris Budget	0.00	0.00	0.15	0.15	0.15
Adjusted Total	**3.50**	**2.84**	**2.59**	**2.26**	**2.00**
NOx Emissions					
Chatham*	0.38	0.35	0.31	0.25	0.19
Durham	4.30	3.92	3.47	2.82	2.15
Franklin	0.28	0.26	0.23	0.18	0.14
Granville	0.87	0.79	0.70	0.57	0.44
Johnston	1.34	1.22	1.09	0.88	0.67
Orange	1.86	1.70	1.51	1.22	0.93
Person	0.25	0.23	0.20	0.17	0.13
Wake	11.87	10.83	9.60	7.79	5.95
Total	**21.15**	**19.30**	**17.11**	**13.88**	**10.60**
Shearon Harris Budget	0.00	0.00	1.92	1.92	1.92
Adjusted Total	**21.15**	**19.30**	**19.03**	**15.80**	**12.52**

*Chatham County emissions for nonattainment area only.

Table 5.2 Railroad Locomotive Engine Emissions (tpd)

County	2005	2008	2011	2014	2017
VOC Emissions					
Chatham*	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.08	0.07	0.07	0.06	0.06
Orange	0.02	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.03	0.03	0.03	0.02	0.02
Total	**0.14**	**0.12**	**0.12**	**0.10**	**0.10**
Shearon Harris Budget	0.00	0.00	0.01	0.01	0.01
Adjusted Total	**0.14**	**0.12**	**0.13**	**0.11**	**0.11**
NOx Emissions					
Chatham*	0.06	0.05	0.05	0.04	0.04
Durham	0.32	0.29	0.27	0.26	0.24
Franklin	0.04	0.04	0.03	0.03	0.03
Granville	0.03	0.03	0.03	0.03	0.03
Johnston	1.90	1.74	1.60	1.51	1.43
Orange	0.37	0.34	0.31	0.29	0.28
Person	0.06	0.05	0.05	0.04	0.04
Wake	0.72	0.65	0.60	0.57	0.54
Total	**3.50**	**3.19**	**2.94**	**2.77**	**2.63**
Shearon Harris Budget	0.00	0.00	0.09	0.09	0.09
Adjusted Total	**3.50**	**3.19**	**3.03**	**2.86**	**2.72**

*Chatham County emissions for nonattainment area only.

Off-road mobile source emissions were reported as non-zero values if emissions were 0.01 tons per day or greater. Table 5.3 summarizes the total VOC and NOx emissions from all off-road mobile source categories. The units are tons per day (tpd).

Table 5.3 Total Off-Road Mobile Source Emissions (tpd)

	Current 7.8 psi RVP[1]					9.0 psi RVP	
County	2005	2008	2011	2014	2017	2014	2017
VOC Emissions							
Chatham*	0.56	0.47	0.40	0.32	0.28	0.32	0.28
Durham	4.30	3.54	2.98	2.43	2.16	2.48	2.24
Franklin	0.75	0.61	0.50	0.42	0.38	0.42	0.38
Granville	0.94	0.77	0.61	0.50	0.45	0.51	0.46
Johnston	2.53	2.16	1.88	1.56	1.41	1.56	1.41
Orange	2.95	2.76	2.50	2.17	1.86	2.17	1.86
Person	0.76	0.61	0.52	0.41	0.37	0.41	0.37
Wake	15.91	12.72	10.94	9.02	8.47	9.29	8.71
Total	**28.70**	**23.64**	**20.33**	**16.83**	**15.38**	**17.16**	**15.71**
Shearon Harris Total Budget	0.00	0.00	0.16	0.16	0.16	0.16	0.16
Adjusted Total	**28.70**	**23.64**	**20.49**	**16.99**	**15.54**	**17.32**	**15.87**
NOx Emissions							
Chatham*	0.78	0.69	0.60	0.47	0.39	0.47	0.39
Durham	7.08	6.25	5.29	4.20	3.28	4.19	3.28
Franklin	0.89	0.80	0.68	0.57	0.47	0.57	0.47
Granville	1.64	1.44	1.22	0.97	0.76	0.97	0.76
Johnston	4.88	4.44	3.99	3.46	2.98	3.46	2.98
Orange	2.77	2.57	2.30	1.91	1.56	1.91	1.56
Person	0.83	0.74	0.65	0.52	0.44	0.52	0.44
Wake	19.26	18.03	16.42	13.90	11.75	13.90	11.75
Total	**38.13**	**34.96**	**31.15**	**26.00**	**21.63**	**25.99**	**21.63**
Shearon Harris Total Budget	0.00	0.00	2.01	2.01	2.01	2.01	2.01
Adjusted Total	**38.13**	**34.96**	**33.16**	**28.01**	**23.64**	**28.00**	**23.64**

*Chatham County emissions for nonattainment area only.
[1] 7.8 psi for Wake, Durham and Granville Counties and 9.0 psi for the remaining counties.

The lines labeled "Total" in table 5.3 above give emissions for the NONROAD2008a modeling plus aircraft and railroad emissions. The "Adjusted Total" includes the the Shearon Harris budget emissions. The units are tons per day.

6.0 NONROAD2008a MODEL – OPTION FILES

```
Written by Nonroad interface at 8/15/2012 5:09:30 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    : 2005
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            : Triangle O3 Redesignation & Maintance RVP change
Title 2            : Durham Granville Wake, July 2005
Fuel RVP for gas   : 7.8
Oxygen Weight %    : 0.25
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.2284
Marine Dsl sulfur %: 0.2637
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 5.0
EtOH Vol %         : 5.0
/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
Durham County NC   : 37063
Granville County NC: 37077
Wake County NC     : 37183
/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.
-------------------------------------------------------


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\trnga05.msg
OUTPUT DATA         : c:\nonroad\outputs\trnga05.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/
```

```
Written by Nonroad interface at 8/15/2012 5:45:40 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    : 2005
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            : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2            : C F J O P, JULY 2005
Fuel RVP for gas   : 9.0
Oxygen Weight %    : 0.25
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.2284
```

```
Marine Dsl sulfur %: 0.2637
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 5.0
EtOH Vol %         : 5.0
/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
Chatham County NC  : 37037
Franklin County NC : 37069
Johnston County NC : 37101
Orange County NC   : 37135
Person County NC   : 37145
/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.
-------------------------------------------------------


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\trngb05.msg
OUTPUT DATA        : c:\nonroad\outputs\trngb05.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/



Written by Nonroad interface at 8/15/2012 6:01:15 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    : 2008
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            : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2            : DURHAM GRANVILLE WAKE, JULY 2008
Fuel RVP for gas   : 7.8
Oxygen Weight %    : 2.07
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.0351
Marine Dsl sulfur %: 0.0435
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 60
EtOH Vol %         : 10
/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
Durham County NC   : 37063
Granville County NC: 37077
Wake County NC     : 37183
/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.
```

```
-------------------------------------------------------


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\trnga08.msg
OUTPUT DATA        : c:\nonroad\outputs\trnga08.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/



Written by Nonroad interface at 8/15/2012 6:09:20 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    : 2008
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            : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2            : C F J O P, JULY 2008
Fuel RVP for gas   : 9.0
Oxygen Weight %    : 2.07
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.0351
Marine Dsl sulfur %: 0.0435
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 60
EtOH Vol %         : 10
/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
Chatham County NC  : 37037
Franklin County NC : 37069
Johnston County NC : 37101
Orange County NC   : 37135
Person County NC   : 37145
/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.
------------------------------------------------------


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\trngb08.msg
OUTPUT DATA        : c:\nonroad\outputs\trngb08.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/



Written by Nonroad interface at 8/15/2012 6:25:13 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            : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2            : DURHAM GRANVILLE WAKE, JULY 2011
Fuel RVP for gas   : 7.8
Oxygen Weight %    : 3.28
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.0032
Marine Dsl sulfur %: 0.0236
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
```

```
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 95
EtOH Vol %         : 10
/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
Durham County NC   : 37063
Granville County NC: 37077
```

```
Wake County NC     : 37183
/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.
------------------------------------------------------


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\trnga11.msg
OUTPUT DATA        : c:\nonroad\outputs\trnga11.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/



Written by Nonroad interface at 8/16/2012 11:47:06 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    : 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            : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2            : C F J O P, JULY 2011
Fuel RVP for gas   : 9.0
Oxygen Weight %    : 3.28
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.0032
Marine Dsl sulfur %: 0.0236
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 95
EtOH Vol %         : 10
/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
Chatham County NC  : 37037
Franklin County NC : 37069
Johnston County NC : 37101
Orange County NC   : 37135
Person County NC   : 37145
/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.
-------------------------------------------------------


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\trngb11.msg
OUTPUT DATA        : c:\nonroad\outputs\trngb11.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/




Written by Nonroad interface at 8/16/2012 12:04:55 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    : 2014
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             : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2             : DURHAM GRANVILLE WAKE, JULY 2014
Fuel RVP for gas    : 9.0
Oxygen Weight %     : 3.31
Gas sulfur %        : 0.003
Diesel sulfur %     : 0.0020
Marine Dsl sulfur %: 0.0052
CNG/LPG sulfur %    : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt    : 96
EtOH Vol %          : 10
/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
Durham County NC   : 37063
Granville County NC: 37077
Wake County NC     : 37183
/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.
-------------------------------------------------------


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\trnga14.msg
OUTPUT DATA         : c:\nonroad\outputs\trnga14.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/




Written by Nonroad interface at 8/16/2012 1:57:56 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    : 2014
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            : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2            : C F J O P, JULY 2014
Fuel RVP for gas   : 9.0
Oxygen Weight %    : 3.31
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.0020
Marine Dsl sulfur %: 0.0052
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 96
```

```
EtOH Vol %         : 10
/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
Chatham County NC  : 37037
Franklin County NC : 37069
Johnston County NC : 37101
Orange County NC   : 37135
Person County NC   : 37145
```

```
/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.
------------------------------------------------------


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\trngb14.msg
OUTPUT DATA        : c:\nonroad\outputs\trngb14.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/



Written by Nonroad interface at 12/17/2012 6:50:23 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    : 2014
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            : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2            : DURHAM GRANVILLE WAKE, JULY 2014
Fuel RVP for gas   : 7.8
Oxygen Weight %    : 3.31
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.0020
Marine Dsl sulfur %: 0.0052
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 96
EtOH Vol %         : 10
/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
Durham County NC   : 37063
Granville County NC: 37077
Wake County NC     : 37183
/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.
------------------------------------------------------


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\trngc14.msg
OUTPUT DATA          : c:\nonroad\outputs\trngc14.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/




Written by Nonroad interface at 8/16/2012 2:35:13 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     : 2017
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             : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2             : DURHAM GRANVILLE WAKE, JULY 2017
Fuel RVP for gas    : 9.0
Oxygen Weight %     : 3.34
Gas sulfur %        : 0.003
Diesel sulfur %     : 0.0011
Marine Dsl sulfur %: 0.0056
CNG/LPG sulfur %    : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt    : 97
EtOH Vol %          : 10
```

```
/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
Durham County NC   : 37063
Granville County NC: 37077
Wake County NC     : 37183
/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.
------------------------------------------------------


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\trnga17.msg
OUTPUT DATA        : c:\nonroad\outputs\trnga17.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/
```

```
Written by Nonroad interface at 8/16/2012 2:50:09 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    : 2017
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            : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
Title 2            : C F J O P, JULY 2017
Fuel RVP for gas   : 9.0
Oxygen Weight %    : 3.34
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.0011
Marine Dsl sulfur %: 0.0056
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 97
EtOH Vol %         : 10
/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
Chatham County NC  : 37037
Franklin County NC : 37069
Johnston County NC : 37101
Orange County NC   : 37135
Person County NC   : 37145
/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.
------------------------------------------------------


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\trngb17.msg
OUTPUT DATA        : c:\nonroad\outputs\trngb17.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/



Written by Nonroad interface at 12/17/2012 6:54:14 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    : 2017
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            : TRIANGLE O3 REDESIGNATION & MAINTANCE RVP CHANGE
```

```
Title 2            : DURHAM GRANVILLE WAKE, JULY 2017 rvp78
Fuel RVP for gas   : 7.8
Oxygen Weight %    : 3.34
Gas sulfur %       : 0.003
Diesel sulfur %    : 0.0011
Marine Dsl sulfur %: 0.0056
CNG/LPG sulfur %   : 0.003
Minimum temper. (F): 71.6
Maximum temper. (F): 92.9
Average temper. (F): 81.1
Altitude of region : LOW
EtOH Blend % Mkt   : 97
EtOH Vol %         : 10
/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
Durham County NC   : 37063
Granville County NC: 37077
Wake County NC     : 37183
/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.
------------------------------------------------------


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\trngc17.msg
OUTPUT DATA        : c:\nonroad\outputs\trngc17.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/
```