Appendix B

Appendix B.1

Point Source Emissions Inventory Documentation

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1.0 INTRODUCTION AND SCOPE

The point source inventory consists of emissions from individual facilities (point sources), airports, and rail yards. Industrial or commercial facilities having equipment that emits pollutants to the air have always been classified as point sources by air quality regulatory programs and are generally required to have permits issued by the North Carolina Division of Air Quality (DAQ) and the Mecklenburg County Air Quality (MCAQ). Airports or rail yards are not required to have air quality permits for construction and operation as airports or rail yards (although they could have equipment such as a boiler or generator that requires a permit). They do have fixed and known locations and their emissions quantities can be comparable to industrial sources so, for purposes of the United States Environmental Protection Agency's (EPA) National Emission Inventory (NEI), they are included in the point source inventory even though they are traditionally considered nonroad sources.

Although both the state and county agencies inventory all the criteria pollutants and a large number of toxic air pollutants, only the nitrogen oxides (NOx) and volatile organic compounds (VOC) are reported here since they are the precursor pollutants for ozone formation. All emissions are calculated on a ton per summer day basis. The emissions for each source classification are reported for the 2011 base year representing typical (average) summer day emissions for the month of July.

The point source inventories detailed in this document are for the North Carolina portion of the Charlotte–Gastonia–Salisbury 2008 8-hour ozone marginal nonattainment area, referred to as the Charlotte nonattainment area. The Charlotte nonattainment area includes a portion of Cabarrus, Gaston, Iredell, Lincoln, Rowan, Union Counties and all of Mecklenburg County. Only the facilities determined from their map coordinates to be inside the boundary of the nonattainment area were summarized and reported.

2.0 OVERALL METHODOLOGY

Permitted sources of emissions are required to periodically submit their emissions inventory to either the DAQ or MCAQ. All large permitted sources are required to report emissions annually. Smaller permitted sources are required to submit an emissions inventory every five years. Additionally, the EPA requires the DAQ and the MCAQ to submit emissions data for large stationary point sources to them on an annual basis. The latest year available for the point source inventory submitted to the EPA is 2011. For the smaller sources that report emissions every five years, the most recent emissions inventory available was used and was assumed to be equivalent to 2011 emissions since these smaller sources' emissions do not vary much from year to year.

The emissions data upon which this document is based were from files maintained by the DAQ and the MCAQ.

The EPA developed emission inventories for airports and rail yards as part of the 2011 NEI. Airport and rail yard emissions reported here were obtained from the 2011 NEI.

2.1 SOURCE IDENTIFICATION

All facilities required to have permits to operate sources of air pollution are known and are required to submit emission inventories.

The EPA used data from the Federal Aviation Administration to identify airport locations and develop airport inventories. Rail yard emissions data was developed by growing data from the 2008 NEI. Further information may be found in *2011 National Emissions Inventory, version 1 Technical Support Document* which can be downloaded from http://www.epa.gov/ttn/chief/net/2011nei/2011_neiv1_tsd_draft.pdf.

2.2 EMISSION ESTIMATION APPROACH

The documentation of emissions estimation methods used for emission inventories is a very important aspect of the inventory. The documentation is used as basis for quality assurance and verification of the validity of information submitted on the DAQ forms or via NCDAQ's internet based data system. The DAQ documentation titled "Uniform Policy and Documentation Standards for Emission Estimates" is provided to reporting facilities and the DAQ inventory reviewers as a guide to support quality inventory development efforts.

The emission inventory information reported to the DAQ and the local county air quality agencies was transferred to a state-developed emissions inventory program that helps ensure required data elements are not omitted. It also performs some calculations, thereby minimizing the occurrence of errors. Depending on the particular process and facility, emissions may be calculated by various means. In many cases, emissions are estimated using emission factors published in the EPA's *AP-42, Compilation of Air Pollutant Emission Factors*. In a few cases, site-specific emission factors may be used. Sometimes, a mass balance calculation can be employed. In some cases, there is direct continuous monitoring of emissions that are reported.

Emissions reported to and maintained by the DAQ or the MCAQ are annual emissions. A variety of detailed operating data, source configuration, and other process parameters are also reported according to DAQ reporting guidelines. This operational data is used to estimate the

average summer weekday emissions. The DAQ provides specific instructions and guidelines for submitting emissions data to the agency via its website.

Rail yard emissions were grown from the 2008 NEI by the EPA. These 2008 emissions were developed by ERTAC (Eastern Regional Technical Advisory Committee) with data provided by the railroad companies. Additional information may be found in *2011 National Emissions Inventory, version 1 Technical Support Document, Documentation for Locomotive Component of the National Emissions Inventory Methodology,* and a memorandum titled *Development of 2011 Railroad Component for National Emissions Inventory.* An emissions data report was downloaded from the EPA Emissions Information System (EIS) web site. The rail yards inside the nonattainment area were identified and the data summarized.

Airport emissions were developed by the EPA using procedures described in the document *Development of 2011 Aircraft Component for National Emissions Inventory*. In general, if detailed data for aircraft operations by aircraft type was available, emissions were calculated with the Emissions and Dispersion Modeling System (EDMS). Appropriate auxiliary power unit (APU) emissions and ground support equipment (GSE) emissions for these particular aircraft types were also calculated. Where only landing and takeoff counts were available for categories of aircraft (e.g. general aviation), assumptions were made for suitable emission factors to calculate emissions. A detailed report of aircraft emissions at all airports was obtained and the airports in the nonattainment area were identified. These data were summarized for presentation in this appendix.

3.0 QUALITY ASSURANCE

The emission inventory has undergone a number of quality assurance checks so that it meets the standards for submitting the annual inventory to the EPA. The state emissions inventory database program helps insure that important data elements are present. Where the program performs calculations, it helps avoid calculation errors. In addition, since the State began collecting annual fees for emissions from Title V sources, both the State and the sources are careful that the tons-per-year emissions reported are accurate.

The detail quality assurance and quality control procedures and measures, as outlined in the DAQ's Emissions Inventory Quality Assurance Project Plan (QAPP) and approved by the EPA, were applied to ensure the data meets specific data indicator goals and objectives.

Data downloaded from the EPA EIS from the 2011 NEI was subjected to quality assurance procedures described under quality assurance details under *2011 NEI Version 1 Documentation* found at http://www.epa.gov/ttn/chief/net/2011inventory.html#inventorydoc.

4.0 TOTAL POINT SOURCES EMISSIONS

In the following sections, the estimated facility emissions for each county in the Charlotte nonattainment area are identified and totaled for the base year of 2011. Only the facilities determined from their map coordinates to be inside the nonattainment areas of the nonattainment counties were summarized and reported.

4.1 CHARLOTTE NONATTAINMENT AREA POINT SOURCE SUMMARY

Table 4.1-1 2011 Total NOx Emissions (tons/day)

County	Point	Airport	Rail Yard	Total
Cabarrus*	1.09	0.01	0.00	1.1
Gaston*	26.43	0.01	0.00	26.44
Iredell*	4.63	0.00	0.00	4.63
Lincoln*	0.43	0.00	0.00	0.43
Mecklenburg	0.50	6.68	0.58	7.76
Rowan*	5.94	0.00	0.27	6.21
Union*	0.49	0.01	0.10	0.6
Total	**39.51**	**6.71**	**0.95**	**47.17**

Emissions for the counties with * are nonattainment area only

Table 4.1-2 2011 Total VOC Emissions (tons/day)

County	Point	Airport	Rail Yard	Total
Cabarrus*	0.87	0.02	0.00	0.89
Gaston*	1.73	0.01	0.00	1.74
Iredell*	0.97	0.00	0.00	0.97
Lincoln*	1.22	0.01	0.00	1.23
Mecklenburg	0.51	0.98	0.04	1.53
Rowan*	3.77	0.01	0.03	3.81
Union*	1.17	0.02	0.01	1.2
Total	**10.24**	**1.05**	**0.08**	**11.37**

Emissions for the counties with * are nonattainment area only

4.2 SUMMARY OF 2011 INDUSTRIAL POINT SOURCE EMISSIONS

In the following summary tables, any facilities whose daily NOx or VOC emissions that are smaller than 0.01 tons/day are not included in the summary.

Table 4.2-1a Cabarrus County 2011 NOx Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
WSACC - Rocky River Regional WWTP	1300002	22132	0.04
S & D Coffee, Inc.	1300051	31192	0.01
Piedmont Natural Gas - Concord Compressor Station	1300155	48621	0.02
CMC - Northeast, Inc.	1300005	62211	0.04
Martin Marietta Materials, Inc. - Bonds Quarry	1300136	212313	0.04
Concord City Generating Plant #1	1300103	221122	0.05
Concord City Generating Plant #2	1300104	221122	0.04
Perdue Farms Incorporated, Concord	1300107	311615	0.02
Philip Morris USA Inc., Cabarrus Manufacturing Facility	1300048	312221	0.01
Greif Packaging, LLC - Southeastern Packaging	1300083	322211	0.01
Blythe Construction, Inc., Plant No. 2	1300074	324121	0.01
Blythe Brothers Asphalt Co., LLC - Concord Plant	1300101	324121	0.02
Ferebee Asphalt Corporation	1300135	324121	0.01
Chemical Specialties, Inc.	1300040	325188	0.03
Corning Incorporated	1300117	327212	0.50
Galvan Industries, Inc.	1300029	332812	0.01
BFI Waste Systems of North America, CMS Landfill V	1300110	562213	0.10
Castle & Cooke	1300160	22133	0.01
CMS Charlotte Energy	1300163	221119	0.09
DNP IMS America	1300168	339944	0.03
Total			**1.09**

Table 4.2-1b Cabarrus County 2011 VOC Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
WSACC - Rocky River Regional WWTP	1300002	22132	0.01
S & D Coffee, Inc.	1300051	31192	0.19
Piedmont Natural Gas - Concord Compressor Station	1300155	48621	0.02
Whitley Handle, Inc.	1300079	321999	0.10
Blythe Construction, Inc., Plant No. 2	1300074	324121	0.01
Blythe Brothers Asphalt Co., LLC - Concord Plant	1300101	324121	0.02
Ferebee Asphalt Corporation	1300135	324121	0.01
Chemical Specialties, Inc.	1300040	325188	0.02
Carolina Counters Corporation	1300140	326191	0.01
Corning Incorporated	1300117	327212	0.05
Berenfield Containers SE Ltd	1300027	332439	0.26
BFI Waste Systems of North America, CMS Landfill V	1300110	562213	0.07

Plant	Facility ID	NAICS	Emissions
CMS Charlotte Energy	1300163	221119	0.01
Artistic Frame	1300165	337121	0.05
DNP IMS America	1300168	339944	0.04
Total			**0.87**

Table 4.2-2a Gaston County 2011 NOx Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
City of Gastonia - Long Creek WWTP	3600314	22132	0.02
New NGC, Inc. d/b/a National Gypsum Company	3600329	32742	0.03
Daimler Trucks North America, LLC - Mt. Holly Plant	3600153	33612	0.02
Caromont Health, Gaston Memorial Hospital	3600049	62211	0.03
Duke Power Company, LLC - Allen Steam Station	3600039	221112	18.52
Duke Energy Carolinas, LLC - Riverbend Steam Station	3600040	221112	7.22
NC Municipal Power Agency No.1 - Gastonia Prime Power Park	3600338	221119	0.01
NC Municipal Power Agency No. 1 - Gastonia Freightliner	3600325	221122	0.01
Valley Proteins, Inc. dba Carolina By-Products - Gastonia	3600026	311613	0.06
Pharr Yarns Complex 46	3600091	313111	0.02
Spartan Dyers, Inc., Sterling Division	3600093	313111	0.01
American & Efird Plants #5 & #15	3600224	313113	0.03
Pharr Yarns, Inc., Space Dye Plant	3600310	313312	0.01
Firestone Fibers & Textiles Company, LLC	3600044	314992	0.02
Firestone Fibers and Textiles Company, Kings Mountain Plant	3600251	314992	0.11
Buckeye Mt. Holly, LLC	3600233	322291	0.04
FMC Corporation - Lithium Division	3600078	325188	0.06
Chemtura Corporation	3600124	325211	0.01
Lubrizol Advanced Materials, Inc.	3600128	325211	0.01
Apex Tool Group (Gastonia Operations)	3600144	332212	0.01
Affinia Group, Inc., Wix Filtration Corp. - Allen Plant	3600137	336399	0.02
Gastonia Components & Logistics, LLC	3600152	336399	0.01
Modern Polymers	3600246	326199	0.01
Gaston Co. Green Energy	3600343	221119	0.06
Gaston Co. Landfill Hardin Site	3600339	562212	0.01
Powder Coating Services	3600340	332117	0.01
Owens Corning	3600347	31323	0.06
Total			**26.43**

Table 4.2-2b Gaston County 2011 VOC Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
Shorewood Packaging Corporation	3600199	32551	0.04
New NGC, Inc. d/b/a National Gypsum Company	3600329	32742	0.01
Daimler Trucks North America, LLC - Mt. Holly Plant	3600153	33612	0.46
Duke Power Company, LLC - Allen Steam Station	3600039	221112	0.22
Duke Energy Carolinas, LLC - Riverbend Steam Station	3600040	221112	0.09
Valley Proteins, Inc. dba Carolina By-Products - Gastonia	3600026	311613	0.03
Orograin - Gastonia	3600281	311812	0.01
Pharr Yarns Complex 46	3600091	313111	0.03
American & Efird Plants #5 & #15	3600224	313113	0.11
J. Charles Saunders Company	3600219	313312	0.03
Pharr Yarns, Inc., Space Dye Plant	3600310	313312	0.03
Firestone Fibers & Textiles Company, LLC	3600044	314992	0.01
Firestone Fibers and Textiles Company, Kings Mountain Plant	3600251	314992	0.01
Buckeye Mt. Holly, LLC	3600233	322291	0.03
FMC Corporation - Lithium Division	3600078	325188	0.02
Lubrizol Advanced Materials, Inc.	3600128	325211	0.01
Stabilus, Inc.	3600167	332999	0.14
LNS Turbo, Inc. - Kings Mountain	3600194	332999	0.03
Parker Hannifan Corporation	3600157	333996	0.02
Affinia Group, Inc., Wix Filtration Corp. - Allen Plant	3600137	336399	0.20
Gastonia Components & Logistics, LLC	3600152	336399	0.04
Modern Polymers	3600246	326199	0.11
Powder Coating Services	3600340	332117	0.01
Owens Corning	3600347	31323	0.04
Total			**1.73**

Table 4.2-3a Iredell County 2011 NOx Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
BestSweet, Inc.	4900292	31134	0.01
Transcontinental Gas Pipe Line Company, LLC - Station 150	4900225	48621	2.65
Lake Norman Regional Medical Center	4900264	62211	0.01
NGK Ceramics USA, Inc.	4900172	327999	0.04
Cardinal FG	4900261		1.92
Total			**4.63**

Table 4.2-3b Iredell County 2011 VOC Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
Transcontinental Gas Pipe Line Company, LLC - Station 150	4900225	48621	0.76
D&F Consolidated, Inc. dba Car-Mel Products, Inc.	4900275	313312	0.07
Custom Products, Inc.	4900180	336413	0.02
Cardinal FG	4900261		0.12
Total			**0.97**

Table 4.2-4a Lincoln County 2011 NOx Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
HOF Textiles, Inc.	5500091	31323	0.01
Duke Energy Corporation LCTS	5500082	221112	0.24
Textile Piece Dyeing Co., Inc.	5500013	313311	0.01
McMurray Fabrics, Inc. - Lincolnton	5500043	313311	0.01
Mohican Mills, Inc.	5500029	313312	0.05
South Fork Industries, Inc.	5500080	313312	0.02
Blythe Construction, Inc., Plant No. 8	5500093	324121	0.01
LANE (Denver)	5500111	324121	0.01
The Timken Company, Lincolnton Bearing Plant	5500046	332991	0.03
Cataler North America Corporation	5500106	336399	0.04
Total			**0.43**

Table 4.2-4b Lincoln County 2011 VOC Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
HOF Textiles, Inc.	5500091	31323	0.06
CPI Packaging, Inc.	5500089	32614	0.84
VT LeeBoy, Inc.	5500114	33312	0.03
Duke Energy Corporation LCTS	5500082	221112	0.01
Textile Piece Dyeing Co., Inc.	5500013	313311	0.02
McMurray Fabrics, Inc. - Lincolnton	5500043	313311	0.06
Mohican Mills, Inc.	5500029	313312	0.04
South Fork Industries, Inc.	5500080	313312	0.01
Blythe Construction, Inc., Plant No. 8	5500093	324121	0.01
LANE (Denver)	5500111	324121	0.01
The Timken Company, Lincolnton Bearing Plant	5500046	332991	0.00
Wireway/Husky Corporation	5500075	332999	0.13
Total			**1.22**

Table 4.2-5a Mecklenburg County 2011 NOx Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
Cargill, Inc.	69	311225	0.04
Frito-Lay, Incorporated	22	311919	0.17
Clariant Corporation	6000687	325132	0.03
Emerald Carolina Chemical, LLC	595	325991	0.01
Cognis Corporation	590	325998	0.01
Exopack Advanced Coatings	1	326112	0.02
Charlotte Pipe & Foundry Company, Inc.	626	331511	0.07
Gerdau Ameristeel US Inc. Charlotte Steel Mill Div	567	332312	0.15
Total			**0.50**

Table 4.2-5b Mecklenburg County 2011 VOC Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
Cargill, Inc.	69	311225	0.01
Frito-Lay, Incorporated	22	311919	0.03
Clariant Corporation	6000687	325132	0.03
Emerald Carolina Chemical, LLC	595	325991	0.03
Cognis Corporation	590	325998	0.06
Exopack Advanced Coatings	1	326112	0.02
Americh Corporation	192	326191	0.02
Charlotte Pipe & Foundry Company, Inc.	626	331511	0.09
Gerdau Ameristeel US Inc. Charlotte Steel Mill Div	567	332312	0.08
Motiva Enterprises LLC - Motiva Charlotte Complex	689	424710	0.06
Industrial Container Services -NC, LLC (Charlotte)	225	811310	0.08
Total			**0.51**

Table 4.2-6a Rowan County 2011 NOx Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
Rowan Regional Medical Center	8000060	62211	0.02
Duke Power Company, LLC - Buck Steam Station	8000004	221112	3.94
Plant Rowan County	8000163	221112	0.35
Cronland Lumber Co., Inc.	8000173	321912	0.02
Packaging Corporation of America	8000047	322211	0.01
Pinnacle Corrugated LLC	8000170	322211	0.01
LANE (Kannapolis)	8000012	324121	0.02
APAC-Atlantic, Inc., Salisbury Plant # 69	8000054	324121	0.01
Associated Asphalt Salisbury, Inc.	8000148	324122	0.01
Henkel Electronic Materials, LLC	8000055	325188	0.03
Akzo Nobel Surface Chemistry LLC.	8000182	325199	0.04
Performance Fibers Operations, Inc. - Salisbury Plant	8000034	325222	0.08

Plant	Facility ID	NAICS	Emissions
Innospec Active Chemicals, LLC - Spencer Plant	8000159	325613	0.01
Magna Composites LLC - Salisbury Operations	8000176	326199	0.01
HBD Industries Inc.	8000019	326299	0.01
Hitachi Metals North Carolina, Ltd.	8000117	327113	0.01
Boral Bricks Inc - Salisbury Plant	8000039	327121	0.04
Old Carolina Brick Company	8000046	327121	0.01
Taylor Clay Products, Inc.	8000084	327121	0.04
Carolina Stalite Company	8000003	327991	1.22
Norandal USA Inc	8000057	331315	0.05
Total			**5.94**

Table 4.2-6b Rowan County 2011 VOC Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
Johnson Concrete Company, Inc., Central Division	8000079	32732	0.01
B & E Custom Cabinets, Inc.	8000115	33711	0.01
Duke Power Company, LLC - Buck Steam Station	8000004	221112	0.07
Plant Rowan County	8000163	221112	0.05
Cronland Lumber Co., Inc.	8000173	321912	0.01
CMH Manufacturing Inc. d/b/a Schult Homes - Plant 957	8000168	321991	0.01
Packaging Corporation of America	8000047	322211	0.01
LANE (Kannapolis)	8000012	324121	0.01
Henkel Electronic Materials, LLC	8000055	325188	0.34
Akzo Nobel Surface Chemistry LLC.	8000182	325199	0.42
Performance Fibers Operations, Inc. - Salisbury Plant	8000034	325222	0.09
Athena Marble Inc.	8000126	326191	0.01
Magna Composites LLC - Salisbury Operations	8000176	326199	0.11
HBD Industries Inc.	8000019	326299	0.02
Norandal USA Inc	8000057	331315	2.48
WA Brown, Inc.	8000167	333415	0.01
McKenzie Sports Products, Inc.	8000104	339999	0.01
PGT Industries	8000181	332321	0.04
Infiltrator Systems	8000187	326112	0.06
Total			**3.77**

Table 4.2-7a Union County 2011 NOx Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
Archer Daniels Midland Company, Golden Grain & Feeds, Inc.	9000165	42451	0.01
Pilgrim's Pride Corporation - Wingate Feed Mill	9000074	311119	0.02

Plant	Facility ID	NAICS	Emissions
Bakery Feeds	9000169	311119	0.07
Tyson Foods, Inc., Monroe Processing Plant and Feed Mill	9000023	311615	0.05
Brooks Food Group - Monroe Plant	9000129	311999	0.03
Edwards Wood Products, Inc.	9000158	321912	0.02
OMNOVA Solutions, Inc.	9000117	323111	0.01
Hanson Brick East, LLC, dba Hanson Brick-Monroe	9000028	327124	0.02
ATI Allvac - Monroe Plant	9000055	331491	0.02
ATI Allvac - Bakers Plant	9000056	331491	0.17
Consolidated Metco, Inc.	9000036	331524	0.05
Yale Security Inc., Norton Door Controls	9000012	332321	0.01
NC Muni Monre Ashcraft	9000207	221122	0.01
Total			**0.49**

Table 4.2-7b Union County 2011 VOC Emissions (tons/day)

Plant	Facility ID	NAICS	Emissions
Darnel, Inc.	9000199	32614	0.29
Challenge Golf	9000202	33992	0.04
Mint Hill Cabinet Shop, Inc.	9000142	44211	0.02
Bakery Feeds	9000169	311119	0.35
Decore-ative Specialties, Inc.	9000170	321911	0.01
Edwards Wood Products, Inc.	9000158	321912	0.02
OMNOVA Solutions, Inc.	9000117	323111	0.17
AEP Industries, Inc.	9000136	326113	0.03
Charlotte Pipe and Foundry Company - Plastics Division	9000009	326122	0.02
ATI Allvac - Bakers Plant	9000056	331491	0.02
Yale Security Inc., Norton Door Controls	9000012	332321	0.02
McGee Corporation	9000143	332322	0.01
Colfax Pump Group, IMO Pump Division	9000130	333911	0.01
Hudson Bros. Trailer Mfg., Inc.	9000131	336212	0.01
Conn-Selmer Ludwig Facility Plant 2	9000041	339992	0.01
Conn-Selmer Ludwig Facility, Plant 3	9000124	339992	0.01
Bostic Packaging	9000215		0.09
Challenge Golf	9000202	33992	0.04
Total			**1.17**

4.3 SUMMARY OF 2011 NONROAD ORIGIN POINT SOURCE EMISSIONS

Table 4.3-1 Charlotte Nonattainment Area 2011 Rail Yard Emissions (tons/day)

County	Facility Site Name	NOx	VOC
Mecklenburg	CHARLOTTE	0.26	0.02
Mecklenburg	PINOKA	0.32	0.02
Rowan	OLDSPENCER	0.21	0.02
Rowan	SALISBURY	0.06	0.01
Union	MONROE	0.10	0.01
Total		**0.95**	**0.08**

Table 4.3-2 Charlotte Nonattainment Area 2011 Airport Emissions (tons/day)

County	Emission Group	NOx	VOC
Cabarrus	Aircraft	0.01	0.02
Gaston	Aircraft	0.01	0.01
Lincoln	Aircraft	0.00	0.01
Mecklenburg	Aircraft	6.06	0.81
Mecklenburg	APU	0.18	0.02
Mecklenburg	GSE	0.44	0.15
Rowan	Aircraft	0.00	0.01
Union	Aircraft	0.01	0.02
Total		**6.71**	**1.05**

5.0 DISCUSSION OF INDUSTRIAL POINT SOURCE CATEGORIES

Industrial processes in the inventory are identified with North American Industry Classification System (NAICS). NAICS is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. The following is the 2011 inventory reported by NAICS code. In general, the first two digits of the NAICS code describe the process and rest of the digits give more detail as to the fuel used, size of source, etc. The sections that follow are grouped by the first two digits of the NAICS code.

A listing of NAICS code with descriptions may be found in http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2012. Occasionally, new NAICS are defined so it may be useful to search the US Census Bureau website for the most up-to-date NAICS information.

5.1 MINING, QUARRYING, AND OIL AND GAS EXTRACTION

The Mining, Quarrying, and Oil and Gas Extraction sector comprises establishments that extract naturally occurring mineral solids, The Mining, Quarrying, and Oil and Gas Extraction sector distinguishes two basic activities: mine operation and mining support activities. Mine operation includes establishments operating mines, quarries, or oil and gas wells on their own account or for others on a contract or fee basis. Mining support activities include establishments that perform exploration (except geophysical surveying) and/or other mining services on a contract or fee basis (except mine site preparation and construction).

Table 5.1 tabulates the emissions for the NAICS codes 21-xxxx, mining, quarrying, and oil and gas extraction.

Table 5.1a Summary of NAICS 21-xxxx 2011 NOx Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Cabarrus	Martin Marietta Materials, Inc. - Bonds Quarry	212313	0.04
Total			**0.04**

5.2 UTILITIES

The Utilities sector comprises establishments engaged in the provision of the following utility services: electric power, natural gas, steam supply, water supply, and sewage removal. Within this sector, the specific activities associated with the utility services provided vary by utility: electric power includes generation, transmission, and distribution; natural gas includes distribution; steam supply includes provision and/or distribution; water supply includes treatment and distribution; and sewage removal includes collection, treatment, and disposal of waste through sewer systems and sewage treatment facilities.

Industries in the Utilities subsector provide electric power, natural gas, steam supply, water supply, and sewage removal through a permanent infrastructure of lines, mains, and pipes. Establishments are grouped together based on the utility service provided and the particular system or facilities required to perform the service.

Table 5.2 tabulates the emissions for the NAICS codes 22-xxxx, utilities.

Table 5.2a Summary of NAICS 22-xxxx 2011 NOx Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Gaston	Duke Power Company, LLC - Allen Steam Station	221112	18.52
Gaston	Duke Energy Carolinas, LLC - Riverbend Steam Station	221112	7.22
Lincoln	Duke Energy Corporation LCTS	221112	0.24
Rowan	Duke Power Company, LLC - Buck Steam Station	221112	3.94
Rowan	Plant Rowan County	221112	0.35
Gaston	NC Municipal Power Agency No. 1 - Gastonia Prime Power Park	221119	0.01
Gaston	Gaston Co. Green Energy	221119	0.06
Cabarrus	CMS Charlotte Energy	221119	0.09
Cabarrus	Concord City Generating Plant #1	221122	0.05
Cabarrus	Concord City Generating Plant #2	221122	0.04
Gaston	NC Municipal Power Agency No. 1 - Gastonia Freightliner	221122	0.01
Union	NC Muni Monre Ashcraft	221122	0.01
Cabarrus	WSACC - Rocky River Regional WWTP	22132	0.04
Gaston	City of Gastonia - Long Creek WWTP	22132	0.02
Cabarrus	Castle & Cooke	22133	0.01
Total			**30.61**

Table 5.2b Summary of NAICS 22-xxxx 2011 VOC Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Gaston	Duke Power Company, LLC - Allen Steam Station	221112	0.22
Gaston	Duke Energy Carolinas, LLC - Riverbend Steam Station	221112	0.09
Lincoln	Duke Energy Corporation LCTS	221112	0.01
Rowan	Duke Power Company, LLC - Buck Steam Station	221112	0.07
Rowan	Plant Rowan County	221112	0.05
Cabarrus	CMS Charlotte Energy	221119	0.01
Cabarrus	WSACC - Rocky River Regional WWTP	22132	0.01
Total			**0.46**

5.3 MANUFACTURING

The Manufacturing sector comprises establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products.

5.3.1 FOOD MANUFACTURING

Industries in the Food Manufacturing subsector transform livestock and agricultural products into products for intermediate or final consumption. The industry groups are distinguished by the

raw materials (generally of animal or vegetable origin) processed into food products.

The food products manufactured in these establishments are typically sold to wholesalers or retailers for distribution to consumers, but establishments primarily engaged in retailing bakery and candy products made on the premises not for immediate consumption are included.

Table 5.3.1 tabulates the emissions for the NAICS codes 31-xxxx, food manufacturing.

Table 5.3.1a Summary of NAICS 31-xxxx 2011 NOx Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Union	Pilgrim's Pride Corporation - Wingate Feed Mill	311119	0.02
Union	Bakery Feeds	311119	0.07
Iredell	BestSweet, Inc.	31134	0.01
Mecklenburg	Cargill, Inc.	311225	0.04
Gaston	Valley Proteins, Inc. dba Carolina By-Products - Gastonia	311613	0.06
Cabarrus	Perdue Farms Incorporated, Concord	311615	0.02
Union	Tyson Foods, Inc., Monroe Processing Plant and Feed Mill	311615	0.05
Mecklenburg	Frito-Lay, Incorporated	311919	0.17
Cabarrus	S & D Coffee, Inc.	31192	0.01
Union	Brooks Food Group - Monroe Plant	311999	0.03
Cabarrus	Philip Morris USA Inc., Cabarrus Manufacturing Facility	312221	0.01
Gaston	Pharr Yarns Complex 46	313111	0.02
Gaston	Spartan Dyers, Inc., Sterling Division	313111	0.01
Gaston	American & Efird Plants #5 & #15	313113	0.03
Lincoln	HOF Textiles, Inc.	31323	0.01
Gaston	Owens Corning	31323	0.06
Lincoln	Textile Piece Dyeing Co., Inc.	313311	0.01
Lincoln	McMurray Fabrics, Inc. - Lincolnton	313311	0.01
Gaston	Pharr Yarns, Inc., Space Dye Plant	313312	0.01
Lincoln	Mohican Mills, Inc.	313312	0.05
Lincoln	South Fork Industries, Inc.	313312	0.02
Gaston	Firestone Fibers & Textiles Company, LLC	314992	0.02
Gaston	Firestone Fibers and Textiles Company, Kings Mountain Plant	314992	0.11
Total			**0.85**

Table 5.3.1b Summary of NAICS 31-xxxx 2011 VOC Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Union	Bakery Feeds	311119	0.35
Mecklenburg	Cargill, Inc.	311225	0.01
Gaston	Valley Proteins, Inc. dba Carolina By-Products - Gastonia	311613	0.03
Gaston	Orograin - Gastonia	311812	0.01
Mecklenburg	Frito-Lay, Incorporated	311919	0.03
Cabarrus	S & D Coffee, Inc.	31192	0.19
Gaston	Pharr Yarns Complex 46	313111	0.03
Gaston	American & Efird Plants #5 & #15	313113	0.11
Lincoln	HOF Textiles, Inc.	31323	0.06
Gaston	Owens Corning	31323	0.04
Lincoln	Textile Piece Dyeing Co., Inc.	313311	0.02
Lincoln	McMurray Fabrics, Inc. - Lincolnton	313311	0.06
Gaston	J. Charles Saunders Company	313312	0.03
Gaston	Pharr Yarns, Inc., Space Dye Plant	313312	0.03
Iredell	D&F Consolidated, Inc. dba Car-Mel Products, Inc.	313312	0.01
Lincoln	Mohican Mills, Inc.	313312	0.04
Lincoln	South Fork Industries, Inc.	313312	0.01
Lincoln	D and F	313312	0.07
Gaston	Firestone Fibers & Textiles Company, LLC	314992	0.01
Gaston	Firestone Fibers and Textiles Company, Kings Mountain Plant	314992	0.01
Total			**1.15**

5.3.2 WOOD PRODUCT MANUFACTURING

Industries in the Wood Product Manufacturing subsector manufacture wood products, such as lumber, plywood, veneers, wood containers, wood flooring, wood trusses, manufactured homes (i.e., mobile homes), and prefabricated wood buildings. The production processes of the Wood Product Manufacturing subsector include sawing, planning, shaping, laminating, and assembling of wood products starting from logs that are cut into bolts, or lumber that then may be further cut, or shaped by lathes or other shaping tools. The lumber or other transformed wood shapes may also be subsequently planed or smoothed, and assembled into finished products, such as wood containers. The Wood Product Manufacturing subsector includes establishments that make

wood products from logs and bolts that are sawed and shaped, and establishments that purchase sawed lumber and make wood products. With the exception of sawmills and wood preservation establishments, the establishments are grouped into industries mainly based on the specific products manufactured.

Table 5.3.2 tabulates the emissions for the NAICS codes 32-xxxx, wood product manufacturing.

Table 5.3.2a Summary of NAICS 32-xxxx 2011 NOx Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Rowan	Cronland Lumber Co., Inc.	321912	0.02
Union	Edwards Wood Products, Inc.	321912	0.02
Cabarrus	Greif Packaging, LLC - Southeastern Packaging	322211	0.01
Rowan	Packaging Corporation of America	322211	0.01
Rowan	Pinnacle Corrugated LLC	322211	0.01
Gaston	Buckeye Mt. Holly, LLC	322291	0.04
Union	OMNOVA Solutions, Inc.	323111	0.01
Cabarrus	Blythe Construction, Inc., Plant No. 2	324121	0.01
Cabarrus	Blythe Brothers Asphalt Co., LLC - Concord Plant	324121	0.02
Cabarrus	Ferebee Asphalt Corporation	324121	0.01
Lincoln	Blythe Construction, Inc., Plant No. 8	324121	0.01
Lincoln	LANE (Denver)	324121	0.01
Rowan	LANE (Kannapolis)	324121	0.02
Rowan	APAC-Atlantic, Inc., Salisbury Plant # 69	324121	0.01
Rowan	Associated Asphalt Salisbury, Inc.	324122	0.01
Mecklenburg	Clariant Corporation	325132	0.03
Cabarrus	Chemical Specialties, Inc.	325188	0.03
Gaston	FMC Corporation - Lithium Division	325188	0.06
Rowan	Henkel Electronic Materials, LLC	325188	0.03
Rowan	Akzo Nobel Surface Chemistry LLC.	325199	0.04
Gaston	Chemtura Corporation	325211	0.01
Gaston	Lubrizol Advanced Materials, Inc.	325211	0.01
Gaston	RADICISPANDEX Corporation ** INACTIVE **	325222	0.12
Rowan	Performance Fibers Operations, Inc. - Salisbury Plant	325222	0.08
Rowan	Innospec Active Chemicals, LLC - Spencer Plant	325613	0.01
Mecklenburg	Emerald Carolina Chemical, LLC	325991	0.01

County	Facility Name	NAICS	Emissions
Mecklenburg	Cognis Corporation	325998	0.01
Mecklenburg	Exopack Advanced Coatings	326112	0.02
Rowan	Magna Composites LLC - Salisbury Operations	326199	0.01
Gaston	Modern Polymers	326199	0.01
Rowan	HBD Industries Inc.	326299	0.01
Rowan	Hitachi Metals North Carolina, Ltd.	327113	0.01
Rowan	Boral Bricks Inc - Salisbury Plant	327121	0.04
Rowan	Old Carolina Brick Company	327121	0.01
Rowan	Taylor Clay Products, Inc.	327121	0.04
Union	Hanson Brick East, LLC, dba Hanson Brick-Monroe	327124	0.02
Iredell	Cardinal FG	327211	1.92
Cabarrus	Corning Incorporated	327212	0.50
Gaston	New NGC, Inc. d/b/a National Gypsum Company	32742	0.03
Rowan	Carolina Stalite Company	327991	1.22
Iredell	NGK Ceramics USA, Inc.	327999	0.04
Total			**4.51**

Table 5.3.2b Summary of NAICS 32-xxxx 2011 VOC Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Union	Decore-ative Specialties, Inc.	321911	0.01
Rowan	Cronland Lumber Co., Inc.	321912	0.01
Union	Edwards Wood Products, Inc.	321912	0.02
Rowan	CMH Manufacturing Inc. d/b/a Schult Homes - Plant 957	321991	0.01
Cabarrus	Whitley Handle, Inc.	321999	0.10
Rowan	Packaging Corporation of America	322211	0.01
Gaston	Buckeye Mt. Holly, LLC	322291	0.03
Union	OMNOVA Solutions, Inc.	323111	0.17
Union	Bostic Packaging	323112	0.09
Cabarrus	Blythe Construction, Inc., Plant No. 2	324121	0.01
Cabarrus	Blythe Brothers Asphalt Co., LLC - Concord Plant	324121	0.02
Cabarrus	Ferebee Asphalt Corporation	324121	0.01
Lincoln	Blythe Construction, Inc., Plant No. 8	324121	0.01
Lincoln	LANE (Denver)	324121	0.01

County	Facility Name	NAICS	Emissions
Rowan	LANE (Kannapolis)	324121	0.01
Mecklenburg	Clariant Corporation	325132	0.03
Cabarrus	Chemical Specialties, Inc.	325188	0.02
Gaston	FMC Corporation - Lithium Division	325188	0.02
Rowan	Henkel Electronic Materials, LLC	325188	0.34
Rowan	Akzo Nobel Surface Chemistry LLC.	325199	0.42
Gaston	Lubrizol Advanced Materials, Inc.	325211	0.01
Gaston	RADICISPANDEX Corporation	325222	0.57
Rowan	Performance Fibers Operations, Inc. - Salisbury Plant	325222	0.09
Gaston	Shorewood Packaging Corporation	32551	0.04
Mecklenburg	Emerald Carolina Chemical, LLC	325991	0.03
Mecklenburg	Cognis Corporation	325998	0.06
Mecklenburg	Exopack Advanced Coatings	326112	0.02
Rowan	Infiltrator Systems	326112	0.06
Union	AEP Industries, Inc.	326113	0.03
Union	Charlotte Pipe and Foundry Company - Plastics Division	326122	0.02
Lincoln	CPI Packaging, Inc.	32614	0.84
Union	Darnel, Inc.	32614	0.29
Cabarrus	Carolina Counters Corporation	326191	0.01
Mecklenburg	Americh Corporation	326191	0.02
Rowan	Athena Marble Inc.	326191	0.01
Rowan	Magna Composites LLC - Salisbury Operations	326199	0.11
Gaston	Modern Polymers	326199	0.11
Rowan	HBD Industries Inc.	326299	0.02
Cabarrus	Corning Incorporated	327212	0.05
Iredell	Cardinal FG	327211	0.12
Rowan	Johnson Concrete Company, Inc., Central Division	32732	0.01
Gaston	New NGC, Inc. d/b/a National Gypsum Company	32742	0.01
Total			**3.88**

5.3.3 PRIMARY METAL MANUFACTURING

Industries in the Primary Metal Manufacturing subsector smelt and/or refine ferrous and nonferrous metals from ore, pig or scrap, using electrometallurgical and other process metallurgical techniques. Establishments in this subsector also manufacture metal alloys and super alloys by introducing other chemical elements to pure metals. The output of smelting and refining, usually in ingot form, is used in rolling, drawing, and extruding operations to make sheet, strip, bar, rod, or wire, and in molten form to make castings and other basic metal products.

Table 5.3.3 tabulates the emissions for the NAICS codes 33-xxxx, primary metal manufacturing.

Table 5.3.3a Summary of NAICS 33-xxxx 2011 NOx Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Rowan	Norandal USA Inc	331315	0.05
Union	ATI Allvac - Monroe Plant	331491	0.02
Union	ATI Allvac - Bakers Plant	331491	0.17
Mecklenburg	Charlotte Pipe & Foundry Company, Inc.	331511	0.07
Union	Consolidated Metco, Inc.	331524	0.05
Gaston	Powder Coating Services	332117	0.01
Gaston	Apex Tool Group (Gastonia Operations)	332212	0.01
Mecklenburg	Gerdau Ameristeel US Inc. Charlotte Steel Mill Div	332312	0.15
Union	Yale Security Inc., Norton Door Controls	332321	0.01
Cabarrus	Galvan Industries, Inc.	332812	0.01
Lincoln	The Timken Company, Lincolnton Bearing Plant	332991	0.03
Gaston	Daimler Trucks North America, LLC - Mt. Holly Plant	33612	0.02
Gaston	Affinia Group, Inc., Wix Filtration Corp. - Allen Plant	336399	0.02
Gaston	Gastonia Components & Logistics, LLC	336399	0.01
Lincoln	Cataler North America Corporation	336399	0.04
Cabarrus	DNP IMS America	339944	0.03
Total			**0.70**

Table 5.3.3b Summary of NAICS 33-xxxx 2011 VOC Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Rowan	Norandal USA Inc	331315	2.48
Union	ATI Allvac - Bakers Plant	331491	0.02

County	Facility Name	NAICS	Emissions
Mecklenburg	Charlotte Pipe & Foundry Company, Inc.	331511	0.09
Gaston	Powder Coating Services	332117	0.01
Mecklenburg	Gerdau Ameristeel US Inc. Charlotte Steel Mill Div	332312	0.08
Union	Yale Security Inc., Norton Door Controls	332321	0.02
Rowan	PGT Industries	332321	0.04
Union	McGee Corporation	332322	0.01
Cabarrus	Berenfield Containers SE Ltd	332439	0.26
Lincoln	The Timken Company, Lincolnton Bearing Plant	332991	0.00
Gaston	Stabilus, Inc.	332999	0.14
Gaston	LNS Turbo, Inc. - Kings Mountain	332999	0.03
Lincoln	Wireway/Husky Corporation	332999	0.13
Lincoln	VT LeeBoy, Inc.	33312	0.03
Rowan	WA Brown, Inc.	333415	0.01
Union	Colfax Pump Group, IMO Pump Division	333911	0.01
Gaston	Parker Hannifan Corporation	333996	0.02
Gaston	Daimler Trucks North America, LLC - Mt. Holly Plant	33612	0.46
Union	Hudson Bros. Trailer Mfg., Inc.	336212	0.01
Gaston	Affinia Group, Inc., Wix Filtration Corp. - Allen Plant	336399	0.20
Gaston	Gastonia Components & Logistics, LLC	336399	0.04
Iredell	Custom Products, Inc.	336413	0.02
Rowan	B & E Custom Cabinets, Inc.	33711	0.01
Cabarrus	Artistic Frame	337121	0.05
Union	Challenge Golf	33992	0.04
Cabarrus	DNP IMS America	339944	0.04
Union	Conn-Selmer Ludwig Facility Plant 2	339992	0.01
Union	Conn-Selmer Ludwig Facility, Plant 3	339992	0.01
Rowan	McKenzie Sports Products, Inc.	339999	0.01
Total			**4.28**

5.4 WHOLESALE TRADE

The Wholesale Trade sector comprises establishments engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The merchandise described in this sector includes the outputs of agriculture, mining, manufacturing, and certain information industries, such as publishing.

Table 5.4 tabulates the emissions for the NAICS codes 42-xxxx, wholesale trade.

Table 5.4a Summary of NAICS 42-xxxx 2011 NOx Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Union	Archer Daniels Midland Company, Golden Grain & Feeds, Inc.	42451	0.01
Total			**0.01**

Table 5.4b Summary of NAICS 42-xxxx 2011 VOC Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Mecklenburg	Motiva Enterprises LLC - Motiva Charlotte Complex	424710	0.06
Union	Mint Hill Cabinet Shop, Inc.	44211	0.02
Total			**0.08**

5.5 TRANSPORTATION AND WAREHOUSING

The Transportation and Warehousing sector includes industries providing transportation of passengers and cargo, warehousing and storage for goods, scenic and sightseeing transportation, and support activities related to modes of transportation. Establishments in these industries use transportation equipment or transportation related facilities as a productive asset. The type of equipment depends on the mode of transportation. The modes of transportation are air, rail, water, road, and pipeline.

Industries in the Pipeline Transportation subsector use transmission pipelines to transport products, such as crude oil, natural gas, refined petroleum products, and slurry. Industries are identified based on the products transported (i.e., pipeline transportation of crude oil, natural gas, refined petroleum products, and other products).

Table 5.5 tabulates the emissions for the NAICS codes 48-xxxx, transportation and warehousing.

Table 5.5a Summary of NAICS 48-xxxx 2011 NOx Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Cabarrus	Piedmont Natural Gas - Concord Compressor Station	48621	0.02
Iredell	Transcontinental Gas Pipe Line Company, LLC - Station 150	48621	2.65
Total			**2.67**

Table 5.5b Summary of NAICS 48-xxxx 2011 VOC Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Cabarrus	Piedmont Natural Gas - Concord Compressor Station	48621	0.02
Iredell	Transcontinental Gas Pipe Line Company, LLC - Station 150	48621	0.76
Total			**0.78**

5.6 ADMISTRATIVE, SUPPORT, WASTE MANAGEMENT, AND REMEDATION SERVICES

The Administrative, Support, Waste Management, and Remediation Services sector comprises establishments performing routine support activities for the day-to-day operations of other organizations. These essential activities are often undertaken in-house by establishments in many sectors of the economy. The establishments in this sector specialize in one or more of these support activities and provide these services to clients in a variety of industries and, in some cases, to households. Activities performed include: office administration, hiring and placing of personnel, document preparation and similar clerical services, solicitation, collection, security and surveillance services, cleaning, and waste disposal services.

Table 5.6 tabulates the emissions for the NAICS codes 56-xxxx, administrative and support and waste management and remediation services.

Table 5.6a Summary of NAICS 56-xxxx 2011 NOx Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Gaston	Gaston Co. Landfill Hardin Site	562212	0.01
Cabarrus	BFI Waste Systems of North America, CMS Landfill V	562213	0.10
Total			**0.11**

Table 5.6b Summary of NAICS 56-xxxx 2011 VOC Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Cabarrus	BFI Waste Systems of North America, CMS Landfill V	562213	0.07
Total			**0.07**

5.7 HEALTH CARE AND SOCIAL ASSISTANCE

The Health Care and Social Assistance sector comprises establishments providing health care and social assistance for individuals. The sector includes both health care and social assistance because it is sometimes difficult to distinguish between the boundaries of these two activities. The industries in this sector are arranged on a continuum starting with those establishments providing medical care exclusively, continuing with those providing health care and social assistance, and finally finishing with those providing only social assistance. The services provided by establishments in this sector are delivered by trained professionals. All industries in the sector share this commonality of process, namely, labor inputs of health practitioners or social workers with the requisite expertise. Many of the industries in the sector are defined based on the educational degree held by the practitioners included in the industry.

Table 5.7 tabulates the emissions for the NAICS codes 62-xxxx, health care and social assistance.

Table 5.7a Summary of NAICS 62-xxxx 2011 NOx Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Cabarrus	CMC - Northeast, Inc.	62211	0.04
Gaston	Caromont Health, Gaston Memorial Hospital	62211	0.03
Iredell	Lake Norman Regional Medical Center	62211	0.01
Rowan	Rowan Regional Medical Center	62211	0.02
Total			**0.10**

5.8 OTHER SERVICES

The Other Services (except Public Administration) sector comprises establishments engaged in providing services not specifically provided for elsewhere in the classification system. Establishments in this sector are primarily engaged in activities such as equipment and

machinery repairing, promoting or administering religious activities, grant making, advocacy, and providing dry cleaning and laundry services, personal care services, death care services, pet care services, photofinishing services, temporary parking services, and dating services.

Private households that engage in employing workers on or about the premises in activities primarily concerned with the operation of the household are included in this sector.

Table 5.8 tabulates the emissions for the NAICS codes 81-xxxx, other services (except public administration).

Table 5.8b Summary of NAICS 81-xxxx 2011 VOC Emissions (tons/day)

County	Facility Name	NAICS	Emissions
Mecklenburg	Industrial Container Services -NC, LLC (Charlotte)	811310	0.08
Total			**0.08**

Appendix B.2

Area Source Emissions

Inventory Documentation

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1.0 INTRODUCTION AND SCOPE

Area sources represent a collection of many small, stationary sources of air pollution emissions within a specified geographical area that individually emit less than the minimum emission levels prescribed for point sources. Because these sources are too small and/or too numerous to be surveyed and characterized individually, all area source activities are collectively estimated. The county is the geographic area for which emissions from area sources are compiled, primarily because counties are the smallest areas for which data used for estimating emissions is readily available.

The Charlotte-Gastonia-Salisbury, North Carolina marginal nonattainment area, referred to as the Charlotte nonattainment area, is comprised of the entire county of Mecklenburg and the nonattainment portions of Cabarrus, Gaston, Iredell, Lincoln, Rowan and Union Counties. County-level emissions for each of the six counties for which a portion of the county is included in the nonattainment area were estimated using the ratio of the population for the nonattainment area to the total county population. All emissions are calculated on a ton per summer day basis. The emissions for each source classification are reported for the 2011 base year representing typical (average) summer day emissions for the month of July.

2.0 OVERALL METHODOLOGY

2.1 SOURCE CATEGORY IDENTIFICATION

The area source categories were identified from two United States Environmental Protection Agency (EPA) guidance documents: *Procedures for the Preparation of Emission Inventories of Carbon Monoxide and Precursors of Ozone, Vol. 1*, EPA-450/4-91-016, (hereafter referred to as the *Procedures* document), and the *Emissions Inventory Improvement Program (EIIP) Technical Report, Vol. 3, Area Sources* (hereafter referred to as *EIIP Tech. Report*).

2.2 EMISSION ESTIMATION APPROACH

Area source emissions were 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 was 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 and emissions estimation methods used were obtained from the *EIIP Tech. Report*, the EPA's *Compilation of Air Pollutant Emission Factors, 5th Edition* (hereafter referred to as *AP-42*), or the emissions methods developed by the EPA for the 2011 National Emissions Inventory (NEI), Version 1. The 2011 NEI methods were based upon the emission factor development work conducted by the Eastern Regional Technical Advisory Group (ERTAC) in conjunction with the EPA.

The area source emissions were calculated based on the emissions methods developed for the 2011 NEI or the *EIIP Tech. Report* and *AP-42*. The majority of the area source categories were calculated with the methods outlined by Pechan because they incorporate the most recent emission factors and activity data available. The remaining area source categories were calculated using the *EIIP Tech. Report* and *AP-42* because these categories were not included as part of the area source categories updated for the 2011 NEI. The following outlines the area source categories calculated using the emissions methods developed for the 2011 NEI, Version 1:

- Residential Combustion
- Commercial Combustion
- Industrial Combustion

- Underground Storage Tanks – Stage I Balanced Submerged Filling
- Paved and Unpaved Roads
- Charbroiling
- Architectural Surface Coating
- Autobody Refinishing
- Traffic Markings
- Industrial Surface Coating
- Dry Cleaning
- Graphic Arts Printing
- Consumer and Commercial Solvents
- Asphalt Paving (emulsified)
- Aircraft Refueling
- Agricultural Burning
- Forest Fires
- Open Burning – Land Clearing and Yard Trimmings.

The emissions for the following remaining area source categories were calculated using the *EIIP Tech. Report* and *AP-42*:

- Asphalt Roofing
- Truck Transit
- Underground Storage Tank Breathing Loss
- Agricultural Pesticide
- Structure Fires
- Vehicle Fires
- Solvent Cleaning and Degreasing.

There are several methods for estimating the activity level for a specific area source category. Some of these methods include treating area sources as point sources, surveying local activity levels, apportioning national or statewide activity totals to local (county or sub-county) inventory areas, or using population and employment data. All of these methods were employed to determine the activity data needed for the various area source categories.

For some of the area source categories, the 2011 activity data were unavailable so the latest available data were utilized. For gasoline distribution, aircraft refueling and emulsified asphalt paving, the activity data used to calculate the emissions for these categories were purchased by the EPA for the development of the 2008 NEI. For the 2011 NEI, the EPA did not update the activity data for these categories, therefore, the 2008 NEI was pulled forward for the 2011 NEI. For agricultural pesticide, the 2007 harvested acres and 2008 pesticide application activity data were the latest available for the 2011 NEI emissions development. All of the stationary source solvent evaporation categories, charbroiling and structure fire emissions were calculated with the

2010 population or employment because 2010 was the latest available data. The combustion sources were projected from the 2007 Southeastern States Air Resources Managers, Inc. (SESARM) emissions inventory because their emissions were the best available at the time the Charlotte nonattainment area source emissions inventory was development.

For certain categories, there can be overlap between the point sources and the area sources, which can lead to double counting of emissions. To avoid double counting of emissions, point source emissions were identified so they could be subtracted from the applicable area source emissions.

There are a number of categories where emissions were calculated with emission factors based on employment. The latest available countywide employment was obtained from the 2010 US Census Bureau, County Business Patterns (USCBP) for the various North American Industry Classification System (NAICS) codes at the county level for North Carolina.

Additionally, many of the categories for the area source emissions use county population or the rural population portion of the county for the activity data. In order to calculate the emissions for these categories, the latest population data available, the 2010 population, was obtained from the US Census Bureau. The rural portion of the county population was also obtained from the 2010 US census data.

Table 2.2-1 contains the population for the Charlotte nonattainment area.

Table 2.2-1 Total County Population

County	2010 Total Population	2010 Rural Population
Cabarrus	178,011	34,273
Gaston	206,086	40,491
Iredell	159,437	60,446
Lincoln	78,265	42,696
Mecklenburg	919,628	9,798
Rowan	138,428	53,741
Union	201,292	54,931

Certain emission categories were adjusted for factors such as seasonal activity, rule effectiveness, and rule penetration. Where applicable, these are discussed in the description of the area source categories in this appendix.

3.0 QUALITY ASSURANCE MEASURES

The first step in the quality assurance process is to develop a list of area sources in the nonattainment area. The *Procedures* document and the *EIIP Tech. Report* were the primary references used in preparing this list for the emissions inventory. To ensure the accuracy of the emissions estimates, the area source emissions inventory team followed the quality assurance measures as outlined in the NC Division of Air Quality (DAQ) Emissions Inventory Quality Assurance Project Plan (QAPP).

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

4.0 DISCUSSION OF AREA SOURCE CATEGORIES

There are three major area source categories comprised of a number of individual types of area source categories. Sections 4.1 through 4.3 address each of these categories and include subsections that correspond to the category. The objective of each subsection is to describe each category and the emission estimation and/or projection procedures.

4.1 GASOLINE DISTRIBUTION

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

4.1.1 Gasoline Dispensing Facilities

Since service stations are so numerous, they are collectively considered as an area source. The area source emissions that are derived for this subsection involve determining the estimated emissions that occur at each of the following operations: 1) losses during storage tank filling, 2) storage tank breathing and working losses and 3) truck transit losses. The emissions from vehicle refueling are captured in the on-road mobile source emissions inventory (see Appendix B.3) and are not estimated as part of the area sources inventory.

Delivery to Outlets - Stage I Balanced Submerged Filling

Stage I controls capture the displacement of gasoline vapors from the storage tanks during the transfer of gasoline from tank trucks to storage tanks at the service station. 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 DAQ has an agreement with the Standards Division to also check for Stage I controls. A notice is sent to the DAQ 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, the DAQ 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, whereas the rule penetration is the percentage of facilities requiring Stage I controls. Control efficiency is the expected percent reduction from this control technology. The compliance and rule effectiveness rates for Stage I controls for the Charlotte nonattainment area were obtained from the Mooresville Region Stage I vapor recovery reports supplied by the DAQ's Mobile Sources Compliance Branch. The control efficiency rate, 0.95, is a conservative estimate used for the entire State. The Stage I compliance factors are listed in Table 4.1.1-1.

Table 4.1.1-1 Compliance Factors for Stage I Controls

Rule Effectiveness	Rule Penetration	Control Efficiency
1.00	0.99	0.95

The emissions calculation was obtained from *AP-42*, Chapter 5.2-Transportation and Marketing of Petroleum Liquids, Equation 1. The volatile organic compound (VOC) emission factor was calculated from Equation 4.1.1-1.

$$EF = \frac{12.46 * S * P * M}{T} \times [1-(RE * CE * RP)] \qquad 4.1.1\text{-}1$$

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 540 Rankin (80^o F = temperature of gasoline in July)
RE = Rule Effectiveness (decimal)
CE = Control Efficiency (decimal)
RP = Rule Penetration (decimal)

All of the variables used to calculate the emission factor 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 Stage I Balanced Submerged Filing

RVP	S	P	M	T
7.8 psi	1	5.79 psi	68.0 lbs/lb-mole	540 Rankin (80.0^oF)

$$EM = \frac{EF * TGD * (1 \text{ year}/365 \text{ days})}{2{,}000 \text{ lbs/ton}} \qquad 4.1.1\text{-}2$$

where EM = total daily emissions in tons/day
EF = emission factor, Equation 4.1.1-1
TGD = total gasoline consumed per county (gallons/year)

For the 2011 emissions estimates, the county gasoline consumption was grown from the 2008 county gasoline consumption because that is the latest data available. The growth factor was calculated by dividing the 2011 statewide fuel consumption, 4,376,652 gallons, by the 2008 statewide fuel consumption, 4,760,470 gallons. The resulting growth factor is 0.9194. This factor was applied to the 2008 county gasoline consumption to estimate the 2011 gasoline consumption.

Truck Transit

Truck transit emissions are the emissions that emanate from gasoline trucks in transit. The emissions equation is from the EIIP Tech. Report, Chapter 11-Gasoline Marketing, Equation 4.1.3-3.

$$EM = \frac{[TGD * EF * (1+0.09)] * (1 \text{ yr}/365 \text{ days})}{2{,}000 \text{ lbs/ton}} \qquad 4.1.1\text{-}3$$

where:
EM = total daily emissions in tons/day
TGD = total gasoline dispensed per county per 1,000 gallons
L_{EF} = loaded tank truck EF = 0.005 lbs/1,000 gallons
U_{EF} = unloaded tank truck EF = 0.055 lbs/1,000 gallons
$EF = L_{EF} + U_{EF}$ = 0.060 lbs/1,000 gallons
1+0.09 = 1+proportion of gasoline transported twice

The L_{EF} and the U_{EF} factors were obtained from the EIIP Tech. Report, Table 11.3-1.

Underground Storage Tank Breathing and Emptying

The emissions equation is from the EIIP Tech. Report, Chapter 11-Gasoline Marketing, Section 3. The emission factor was obtained from EIIP Tech. Report, Table 11.3-1. The base year emissions were calculated using equation 4.1.1-4.

$$EM = \frac{TGD * EF * (1 \text{ year}/365 \text{ days})}{2{,}000 \text{ lbs/ton}} \qquad 4.1.1\text{-}4$$

where:

EM = total daily emissions in tons/day
EF = emission factor, 1.0 lb/1,000 gallons/year
TGD = total gasoline dispensed per county per 1,000 gallons

The VOC emissions for gasoline distribution are in shown in Table 4.1.1-4.

Table 4.1.1-4 Total Gasoline Distribution VOC Emissions (tpd)

County	Stage I Emissions	Truck Transit Emissions	Underground Storage Tanks Emissions	Total 2011 Gasoline Distribution Emissions
Cabarrus*	0.06	0.01	0.10	0.17
Gaston*	0.06	0.01	0.12	0.19
Iredell*	0.01	0.00	0.02	0.03
Lincoln*	0.01	0.00	0.02	0.03
Mecklenburg	0.25	0.03	0.46	0.74
Rowan*	0.02	0.00	0.03	0.05
Union*	0.03	0.00	0.05	0.08
Total	**0.44**	**0.05**	**0.80**	**1.29**

Note: * indicates emissions for nonattainment portion only.

4.1.2 Aircraft Refueling

Like vehicle refueling, aircraft refueling results in VOC emissions. There are two processes that generate VOC emissions. Stage I is the displacement of vapors during the transfer of gasoline from tank trucks to storage tanks and vice versa. The other process is Stage II that involves the transfer of fuel from the tanker trucks into general aviation aircraft.

For Stage I and Stage II, the national-level emissions were calculated by multiplying the nationwide aviation gasoline (AvGas) consumption by the VOC emission factors and summing the emissions. Once the national-level emissions were calculated, they were allocated to the Petroleum Administration for Defense (PAD) Districts based on the amount of gasoline reported for each PAD. The PAD for North Carolina is PAD 1, which comprises 17 states along the Atlantic Coast. The emissions were then allocated to the county-level based on the number of landings and takeoffs (LTOs) for general aviation flights per county. The amount of aviation gasoline consumed for PAD 1 was obtained from the US Department of Energy, Energy Information Administration. The number of 2008 LTOs was obtained from the US Federal Aviation Administration by the EPA. The 2011 LTOs were not available for the PAD Districts or the counties. For the 2011 emissions estimates, the PAD District LTOs were grown from the 2008 PAD District LTOs because that is the latest data available. Since North Carolina is in

PAD District 1, a growth factor was applied to the 2008 PAD District 1 LTO. The growth factor was calculated by dividing the 2011 PAD District 1 AvGas consumption by the 2008 PAD District 1 AvGas consumption. This growth factor were applied to the 2008 PAD District 1 LTO to estimate the 2011 PAD District 1 LTO. The PAD District 1 growth factor is 1.3349.

The 2008 LTOs were also used for the Charlotte nonattainment counties because that is the only data that was available, therefore, it is assumed the LTOs remain constant between 2008 and 2011. The VOC emission factors are shown in Table 4.1.2-1 and the 2008 LTOs are shown in Table 4.1.2-2.

Table 4.1.2-1 Aircraft Refueling Emission Factors

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

Table 4.1.2-2 County-Level Landing-Takeoffs

County	2008 County-Level Landing-Takeoffs
Cabarrus	41,064
Gaston	18,102
Iredell	23,003
Lincoln	13,271
Mecklenburg	73,724
Rowan	35,923
Union	37,106

The following equation shows the emission estimate for the nationwide 2011 aviation gasoline consumption.

US AvGas Consumption = amount of nationwide AvGas consumed * 42 gal/barrel * VOC EF

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

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

where:

EM = total daily emissions in tons/day
US VOC Emissions = nationwide annual AvGas VOC emissions, lbs/year
PAD 1consumption = PAD 1 District I total AvGas consumption = 1,323,000 barrels/year
PAD 1 LTOs = PAD 1 District I landing-take offs for general aircraft = 17,588,837
County LTOs = county-level landing-take offs for general aircraft

The following table shows the emissions from Stage I, Stage II and the total emissions for aircraft refueling.

Table 4.1.2-3 Total Aircraft Refueling VOC Emissions (tpd)

County	Stage I Emissions	Stage II Emissions	Total Aircraft Refueling Emissions
Cabarrus*	0.04	0.002	0.04
Gaston*	0.02	0.001	0.02
Iredell*	0.01	0.000	0.01
Lincoln*	0.01	0.000	0.01
Mecklenburg	0.07	0.003	0.07
Rowan*	0.03	0.002	0.03
Union*	0.03	0.001	0.03
Total	**0.21**	**0.009**	**0.21**

Note: * indicates emissions for nonattainment portion only.

4.1.3 Portable Fuel Containers

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

The EPA has generated emissions for portable fuel containers for 2002, 2010, 2015, 2020 and 2030. The activity data used in the development of these emission inventories were obtained from the EPA's Nonroad Model, which uses a variety of variables like equipment size, equipment population, equipment age, Reid Vapor Pressure (RVP) and air temperature to estimate activity. The 2011 PFC emissions were calculated by linear interpolation using the Microsoft EXCEL FORECAST tool. The base year 2011 emissions were interpolated from the PFC emissions for 2002, 2010 and 2015.

Table 4.1.3-1 is the VOC emissions for the Charlotte nonattainment area for portable fuel containers.

Table 4.1.3-1 VOC Emissions (tpd) from Portable Fuel Containers

County	PFC Emissions
Cabarrus*	0.27
Gaston*	0.24
Iredell*	0.06
Lincoln*	0.07
Mecklenburg	2.40
Rowan*	0.14
Union*	0.40
Total	**3.58**

Note: * indicates emissions for nonattainment portion only.

4.2 STATIONARY SOURCE SOLVENT EVAPORATION

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

4.2.1 Dry Cleaning

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

The emissions from dry cleaning are estimated by multiplying the average number of employees at dry cleaning establishments by a national per-employee emission factor, 93 lbs of VOC/employee/year. The number of dry cleaning employees per county was obtained from the 2010 USCBP. Table 4.2.1-1 below shows the 2010 dry cleaning employment, latest data available, used in the emissions estimation.

Table 4.2.1-1 Employment for Dry cleaning

County	2010 Employment for Dry Cleaning
Cabarrus	114
Gaston	73
Iredell	42
Lincoln	42
Mecklenburg	803
Rowan	57
Union	113

The emissions were calculated using Equation 4.2.1-1.

$$EM = \frac{\text{no. of employees} * EF}{\text{2,000 lbs/ton}} * (\text{1 year/365 days}) \qquad \text{4.2.1-1}$$

The VOC emission estimates, in tons/day, from dry cleaning for the Charlotte nonattainment area are listed in Table 4.2.1-2.

Table 4.2.1-2 VOC Emissions (tpd) from Dry Cleaning

County	Dry Cleaning Emissions
Cabarrus*	0.014
Gaston*	0.009
Iredell*	0.002
Lincoln*	0.004
Mecklenburg	0.102
Rowan*	0.007
Union*	0.013
Total	**0.151**

Note: * indicates emissions for nonattainment portion only.

4.2.2 Graphic Arts/Printing

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

A number of establishments that generate emissions in this source category are in-house graphic arts operations at plants that are in non-printing industries. The emission factor of 201 lbs VOC/employee/year was used to calculate the VOC emissions. The employment was obtained from the 2010 USCBP. The graphic arts employment per county for 2010, latest employment available, is in Table 4.2.2-1.

Table 4.2.2-1 Employment for Graphic Arts

County	2010 Employment for Graphic Arts
Cabarrus	188
Gaston	199
Iredell	326
Lincoln	113
Mecklenburg	3,085
Rowan	465
Union	273

The emissions for the base year were calculated using equation 4.2.2-1.

$$EM = \frac{\text{county employment} * EF}{2{,}000 \text{ lbs/ton}} * (1 \text{ year}/365 \text{ days}) \qquad 4.2.2\text{-}1$$

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

Table 4.2.2-2 VOC Emissions (tpd) from Graphic Arts

County	Graphic Arts Emissions
Cabarrus*	0.05
Gaston*	0.05
Iredell*	0.04
Lincoln*	0.02
Mecklenburg	0.85
Rowan*	0.12
Union*	0.07
Total	**1.20**

Note: * indicates emissions for nonattainment portion only.

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 which emit VOC emissions.

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

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

In-line cleaning machines employ automated loading on a continuous basis. These machines are often custom made for large-scale operations. A continuous or multiple-batch loading system greatly reduces or even eliminates the manual parts handling associated with batch cleaning. In-line cleaning machines are enclosed to prevent solvent losses; however, entry and exit openings cannot be sealed.

The VOC emissions for this category are estimated by using per employee factors. The emission factor for degreasing is 36.965 VOC/employee/year.

Employment data was derived from the 2010 USCBP. The following table shows the 2010 employment per county for degreasing.

Table 4.2.3-1 Solvent Cleaning and Degreasing 2010 Employment

County	2010 Degreasing Employment
Cabarrus	5,024
Gaston	6,698
Iredell	7,282
Lincoln	2,855
Mecklenburg	33,867
Rowan	5,306
Union	5,987

The emissions for the base year were calculated using Equation 4.2.3-1.

$$EM = \frac{\text{no. of employees} * EF}{\text{2,000 lbs/tons}} * (\text{1 year/365 days}) \qquad 4.2.3\text{-}1$$

where:

EM = total daily emissions in tons/day
EF = emission factor

The VOC emission estimates, in tons/day, are summarized in Table 4.2.3-2.

Table 4.2.3-2 VOC Emissions (tpd) from Solvent Cleaning Degreasing

County	Degreasing Emissions
Cabarrus*	0.25
Gaston*	0.31
Iredell*	0.15
Lincoln*	0.12
Mecklenburg	1.71
Rowan*	0.25
Union*	0.26
Total	**3.05**

Note: * indicates emissions for nonattainment portion only.

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 emissions estimation is based on a per employee emission factor, 94.69 lbs/VOC/employee. The number of employees for 2010 was obtained from the USCBP, which are listed in Table 4.2.4-1.

Table 4.2.4-1 Employment for Auto Body Refinishing

County	2010 Auto Body Refinishing Employment
Cabarrus	1,056
Gaston	881
Iredell	812
Lincoln	211
Mecklenburg	5,388
Rowan	483
Union	502

The base year emissions were calculated using Equation 4.2.4-1.

$$EM = \frac{\text{no. of employees} * EF}{\text{2,000 lbs/ton}} * (\text{1 year/365 days}) \qquad 4.2.4\text{-}1$$

where:

EM =total daily emissions in tons/day
EF = emission factor

The VOC emission estimates, in tons/day, from auto body refinishing for the Charlotte nonattainment area are listed in Table 4.2.4-2.

Table 4.2.4-2 VOC Emissions (tpd) from Auto Body Refinishing

County	Auto Body Refinishing Emissions
Cabarrus*	0.14
Gaston*	0.11
Iredell*	0.04
Lincoln*	0.02
Mecklenburg	0.70
Rowan*	0.06
Union*	0.06
Total	**1.13**

Note: * indicates emissions for nonattainment portion only.

4.2.5 Architectural Coatings

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

The VOC emissions for this source category were estimated by multiplying county population in Table 2.2-1 by the per capita emission factor, 2.34 lbs/VOC/employee as shown in Equation 4.2.5-1.

$$EM = \frac{\text{county population} * EF}{2{,}000 \text{ lbs/ton}} * (1 \text{ year}/365 \text{ days}) \qquad 4.2.5\text{-}1$$

where:

EM = total daily emissions in tons/day
EF = emission factor

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

Table 4.2.5-1 VOC Emissions (tpd) from Architectural Coatings

County	Architectural Coatings Emissions
Cabarrus*	0.57
Gaston*	0.61
Iredell*	0.20
Lincoln*	0.20
Mecklenburg	2.95
Rowan*	0.41
Union*	0.56
Total	**5.50**

Note: * indicates emissions for nonattainment portion only.

4.2.6 Traffic Markings

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

The emission estimation used to calculate the traffic marking emissions is based upon the number of lane miles for each county. The number of lane miles was obtained from the North Carolina Department of Transportation (NCDOT) for 2010 as shown in Table 4.2.6-1.

Table 4.2.6-1 Number of Lane Miles

County	Number of Lane Miles in 2010
Cabarrus	1,396
Gaston	1,643
Iredell	1,828
Lincoln	827
Mecklenburg	4,007
Rowan	1,534
Union	1,856

The emissions for the base year were calculated using Equation 4.2.6-1.

$$EM = \frac{\text{no. of lane miles} * EF}{} * (1 \text{ year}/365 \text{ days})$$

2,000 lbs/ton 4.2.6-1

where:

EM = total daily emissions in tons/year
EF = emission factor, 0.29 lbs. VOC/mile/year

The VOC emission estimates, in tons/day, from traffic markings for the Charlotte nonattainment area are listed in Table 4.2.6-2.

Table 4.2.6-2 VOC Emissions (tpd) from Traffic Markings

County	Traffic Markings Emissions
Cabarrus*	0.001
Gaston*	0.001
Iredell*	0.000
Lincoln*	0.000
Mecklenburg	0.002
Rowan*	0.001
Union*	0.001
Total	**0.006**

Note: * indicates emissions for nonattainment portion only.

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.

Two of the industrial surface coating subcategories, industrial maintenance coatings and other special purpose coatings, utilize per capita emission factors instead of per employment emission factors. For industrial maintenance coatings and other special purpose coating emissions calculation, the population used is shown in Table 2.2-1.

The employment used for the remaining subcategories is shown in Table 4.2.7-1. For these subcategories, a per capita emission factor, shown in Table 4.2.7-1, is used to estimate the emissions. The emissions for the remaining industrial surface coating subcategories were estimated using per employee emission factors, also shown in Table 4.2.7-1. For these

subcategories, the 2010 employment per county were used to estimate the emissions. The 2010 county employment are in Table 4.2.7-2.

Table 4.2.7-1 Industrial Surface Coating Emission Factors

	VOC Emission Factors	
Subcategory	Per Capita Emission Factors (lbs VOC/person/year)	Per Employee Emission Factors (lbs VOC/employee/year)
Industrial Maintenance	0.603	
Other Special Purpose	0.006	
Metal Furniture		887.80
Metal Containers		3,035
New Automobiles		194
Machinery & Equipment		51.64
Aircraft		12.98
Sheet, Strip & Coil		609.39
Factory Finished Wood		48.07
Electrical Insulation		31.92
Misc. Manufacturing		92.42

Table 4.2.7-2 2010 Employment for Surface Coating Subcategories

Subcategory	Cabarrus	Gaston	Iredell	Lincoln	Mecklenburg	Rowan	Union
Factory Finished Wood	105	154	331	73	463	465	630
Metal Furniture	0	4	177	64	180	145	0
Metal Containers	46	0	0	0	133	0	0
Sheet, Strip & Coil	0	0	0	0	134	0	0
Machinery & Equipment	117	383	522	210	1,599	164	261
Electrical Insulation	0	0	132	0	10	8	1,381
New Automobiles	352	2,363	784	160	406	1,104	213
Aircraft	0	0	9	0	52	0	52
Misc. Manufacturing	509	343	325	35	1,310	135	612

The emissions estimation for the industrial maintenance coatings and other special purpose coatings for the base year emissions are shown in Equation 4.2.7-1.

$$EM = \frac{\text{county population} * EF}{2{,}000 \text{ lbs/ton}} * (1 \text{ year}/365 \text{ days}) \qquad 4.2.7\text{-}1$$

where:

EM = total daily emissions in tons/day
EF = emission factor per subcategory

The emissions estimation for the subcategories that are based upon a per employee emission factor for the base year emissions are shown in Equation 4.2.7-2.

$$EM = \frac{\text{no. of employees} * EF}{2{,}000 \text{ lbs/ton}} * (1 \text{ year}/365 \text{ days}) \qquad 4.2.7\text{-}2$$

where:

EM = total daily emissions in tons/day
EF = emission factor per subcategory

The VOC emission estimates, in tons/day, from all industrial surface coating operations are listed in Tables 4.2.7-3 through 4.2.7-13. The total emissions from the industrial surface coatings are summarized in Table 4.2.7-14.

Table 4.2.7-3 VOC Emissions (tpd) from Metal Furniture

County	Metal Furniture Emissions
Cabarrus*	0.000
Gaston*	0.004
Iredell*	0.086
Lincoln*	0.062
Mecklenburg	0.219
Rowan*	0.164
Union*	0.000
Total	**0.535**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-4 VOC Emissions (tpd) from Metal Containers

County	Metal Containers Emissions
Cabarrus*	0.190
Gaston*	0.000
Iredell*	0.000
Lincoln*	0.000
Mecklenburg	0.553
Rowan*	0.000
Union*	0.000
Total	**0.743**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-5 VOC Emissions (tpd) from New Automobiles

County	New Automobiles Emissions
Cabarrus*	0.093
Gaston*	0.579
Iredell*	0.083
Lincoln*	0.034
Mecklenburg	0.108
Rowan*	0.273
Union*	0.049
Total	**1.220**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-6 VOC Emissions (tpd) from Machinery and Equipment

County	Machinery and Equipment Emissions
Cabarrus*	0.008
Gaston*	0.025
Iredell*	0.015
Lincoln*	0.012
Mecklenburg	0.113
Rowan*	0.011
Union*	0.016
Total	**0.200**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-7 VOC Emissions (tpd) from Aircraft

County	Aircraft Emissions
Cabarrus*	0.00
Gaston*	0.00
Iredell*	0.00
Lincoln*	0.00
Mecklenburg	0.00
Rowan*	0.00
Union*	0.00
Total	**0.00**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-8 VOC Emissions (tpd) from Sheet, Strip & Coil

County	Sheet, Strip & Coil Emissions
Cabarrus*	0.000
Gaston*	0.000
Iredell*	0.000
Lincoln*	0.000
Mecklenburg	0.112
Rowan*	0.000
Union*	0.000
Total	**0.112**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-9 VOC Emissions (tpd) from Factory Finished Wood

County	Factory Finished Wood Emissions
Cabarrus*	0.007
Gaston*	0.009
Iredell*	0.009
Lincoln*	0.000
Mecklenburg	0.030
Rowan*	0.028
Union*	0.036
Total	**0.123**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-10 VOC Emissions (tpd) from Electrical Insulation

County	Electrical Insulation Emissions
Cabarrus*	0.000
Gaston*	0.000
Iredell*	0.002
Lincoln*	0.000
Mecklenburg	0.000
Rowan*	0.000
Union*	0.052
Total	**0.054**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-11 VOC Emissions (tpd) from Misc. Manufacturing

County	Misc. Manufacturing Emissions
Cabarrus*	0.064
Gaston*	0.040
Iredell*	0.016
Lincoln*	0.004
Mecklenburg	0.166
Rowan*	0.016
Union*	0.067
Total	**0.373**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-12 VOC Emissions (tpd) from Industrial Maintenance

County	Industrial Maintenance Emissions
Cabarrus*	0.146
Gaston*	0.157
Iredell*	0.053
Lincoln*	0.052
Mecklenburg	0.760
Rowan*	0.106
Union*	0.145
Total	**1.419**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-13 VOC Emissions (tpd) from Other Special Purpose

County	Other Special Purpose Emissions
Cabarrus*	0.002
Gaston*	0.002
Iredell*	0.001
Lincoln*	0.001
Mecklenburg	0.008
Rowan*	0.001
Union*	0.002
Total	**0.017**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.7-14 Total VOC Emissions (tpd) from Industrial Surface Coatings

County	Total Industrial Surface Coatings Emissions
Cabarrus*	0.51
Gaston*	0.82
Iredell*	0.27
Lincoln*	0.17
Mecklenburg	2.07
Rowan*	0.60
Union*	0.37
Total	**4.81**

Note: * indicates emissions for nonattainment portion only.

4.2.8 Emulsified Asphalt Paving

Asphalt paving is the process of applying asphalt concrete to seal or repair the surface of roads, parking lots, driveways, walkways or airport runways. Asphalt concrete is a composite material comprised of a binder and a mineral aggregate. The binder, referred to as asphalt cement, is a byproduct of petroleum refining and contains the semi-solid residual material left after the more volatile chemical fractions have been distilled off.

Asphalt cements are thinned with water and an emulsifying agent known as emulsified asphalts. The thinning reduces the viscosity of the asphalt making it easier to work with the mixture. The primary uses of emulsified asphalt include tack and seal operations, priming roadbeds and paving operations for pavements up to several inches thick.

Emulsified asphalt may contain up to 12% organic solvents by volume. Emissions from emulsified asphalt result from the evaporation of VOCs after the mixture is laid down.

The asphalt usage factor, used to convert tons of asphalt to barrels of asphalt, is shown in Equation 4.2.8-1.

Asphalt Usage Factor = (tons of asphalt * 2000 lbs / 8.34 lbs/gal) / 42 gal/barrel * (cnty paved roads/state paved roads) 4.2.8-1

The 2010 county paved miles is from the 2010 Highway and Road Mileage Report from NCDOT. The number of paved miles per county for 2010 is listed in Table 4.2.8-1.

Table 4.2.8-1 Miles of Paved Roads

County	2010 Miles of Paved Road
Cabarrus	792.60
Gaston	958.00
Iredell	1,435.61
Lincoln	764.71
Mecklenburg	980.07
Rowan	1,128.16
Union	1,548.97
State	74,832.65

The VOC emissions were calculated using the emissions factor for emulsified asphalt (9.2 lbs VOC/barrel) and the number of gallons of emulsified asphalt per barrel (42 gallon/barrel) from Table 17.5-2 of the *EIIP Tech. Report*.

The emissions for the base year were calculated using Equation 4.2.8-1.

$$EM = \frac{\text{asphalt usage factor} * EF}{2{,}000 \text{ lbs/tons}} * (1 \text{ year}/365 \text{ days}) \qquad 4.2.8\text{-}1$$

where:

EM = total daily emissions in tons/day
EF = emission factor

The VOC emission estimates, in tons/day, from asphalt paving for the Charlotte nonattainment area are listed in Table 4.2.8-2.

Table 4.2.8-2 VOC Emissions (tpd) from Asphalt Paving

County	Asphalt Emissions
Cabarrus*	0.0001
Gaston*	0.0001
Iredell*	0.0001
Lincoln*	0.0001
Mecklenburg	0.0001
Rowan*	0.0001
Union*	0.0002
Total	**0.0008**

Note: * indicates emissions for nonattainment portion only.

4.2.9 Agricultural Pesticide Applications

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

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

The individual crop profiles outline the current agricultural pesticide practices, i.e., the pesticide agents (insecticides, herbicides, fungicides), the percentage of acres treated and the pounds of active ingredient pesticide applied per acre. The crop profiles often report the application of the active ingredient (pounds of active ingredient per acre) as a range of values.

The pounds of active ingredients for each crop were calculated by using Equation 4.2.9-1.

$$(\text{lbs AI/acre})_{CROP} = \sum (\%\ \text{acres treated}) \times (\text{lb AI/acre})_{pesticide} \qquad 4.2.9\text{-}1$$

where AI = active ingredient.

The emission factors for each crop were calculated by multiplying the 90% evaporation rate, obtained from the EPA, Pesticides - Agricultural and Nonagricultural, Vol. 3, Ch. 9, Section 5.1, *Emissions Inventory Improvement Program*, June 2001, by the weighted average VOC content, 0.8349 lbs VOC/lbs AI, calculated using data from California's Department of Pesticide Regulation's Pesticide Product Emission Potential Database.

$$\text{VOC EF} = (0.8349\ \text{lbs VOC/lbs AI}) * (0.90) = 0.751\ \text{lbs VOC/lbs AI} \qquad 4.2.9\text{-}2$$

The latest available harvested crop data, 2007, was obtained from U.S. Department of Agriculture (USDA), *Census of Agriculture, 2007* and the application rate of active ingredient per treated acre was obtained from the 2008 Crop Life Foundation's Fungicides, Herbicides, and Insecticides database. The 2008 application data was latest available. The active ingredient applied was calculated from the Equation 4.2.9-3,

$$\text{active ingredient applied} = \Sigma_{crop,pesticide}\ \text{harvested acres} \times \text{percent of harvested acres treated with active ingredient} \times \text{application rate of active ingredient per treated acre} \qquad 4.2.9\text{-}3$$

Table 4.2.9-1 shows the 2007 total harvested acres per county and the calculated pesticide active ingredient applied in 2008 per county.

Table 4.2.9-1 Harvested Acres and Pesticide Active Ingredient

County	2007 Harvested Acres	Pesticide Active Ingredient Applied in 2008 (lbs)
Cabarrus	56,688	50,320
Gaston	27,471	17,580
Iredell	122,127	120,283
Lincoln	47,430	65,015
Mecklenburg	15,298	16,741
Rowan	110,233	182,777
Union	178,613	315,771

The emissions for 2011 were calculated using Equation 4.2.9-4.

$$EM = \frac{\Sigma (A_{pesticide,crop} \times VOC\ EF)}{2{,}000\ lbs/tons} * (1\ year/365\ days) \qquad 4.2.10\text{-}4$$

where:

EM = total daily emissions in tons/day

$A_{pesticide,crop}$ = pesticide active ingredient applied

The VOC emission estimates, in tons/day, from agricultural pesticides for the Charlotte nonattainment area are listed in Table 4.2.9-2.

Table 4.2.9-2 VOC Emissions (tpd) from Agricultural Pesticide Applications

County	Agricultural Pesticide Application Emissions
Cabarrus*	0.05
Gaston*	0.02
Iredell*	0.05
Lincoln*	0.05
Mecklenburg	0.02
Rowan*	0.17
Union*	0.28
Total	**0.64**

Note: * indicates emissions for nonattainment portion only.

4.2.10 Commercial/Consumer Solvent Use

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

The VOC emissions are estimated based on per capita emissions factors. The county population values are listed in Table 2.2-1. There are seven subcategories within the commercial/consumer solvent use category. They are listed in Table 4.2.10-1 with their respective emission factor.

Table 4.2.10-1 Misc. Non-Industrial Consumer/Commercial Emission Factors

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

The emissions for the base year were calculated using Equation 4.2.10-1.

$$EM = \frac{\text{county population} * EF}{\text{2,000 lbs/tons}} * (\text{1 year/365 days}) \qquad \text{4.2.10-1}$$

where:

EM = total daily emissions in tons/day
EF = emission factor per subcategory

The VOC emission estimates, in tons/day, from the commercial/consumer solvents subcategories for the Charlotte nonattainment area are listed in Tables 4.2.10-2 through 4.2.10-8. The total emissions for this source category are summarized in Table 4.2.10-9.

Table 4.2.10-2 VOC Emissions (tpd) from All Coatings and Related Products

County	Coatings and Related Products Emissions
Cabarrus*	0.23
Gaston*	0.25
Iredell*	0.08
Lincoln*	0.08
Mecklenburg	1.20
Rowan*	0.17
Union*	0.23
Total	**2.24**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.10-3 VOC Emissions (tpd) from All FIFRA Related Products

County	FIFRA and Related Products Emissions
Cabarrus*	0.43
Gaston*	0.46
Iredell*	0.16
Lincoln*	0.15
Mecklenburg	2.24
Rowan*	0.31
Union*	0.43
Total	**4.18**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.10-4 VOC Emissions (tpd) from Miscellaneous Products

County	Misc Products Emissions
Cabarrus*	0.02
Gaston*	0.02
Iredell*	0.01
Lincoln*	0.01
Mecklenburg	0.09
Rowan*	0.01
Union*	0.02
Total	**0.18**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.10-5 VOC Emissions (tpd) from Personal Care Products

County	Personal Care Products Emissions
Cabarrus*	0.46
Gaston*	0.49
Iredell*	0.17
Lincoln*	0.16
Mecklenburg	2.39
Rowan*	0.33
Union*	0.46
Total	**4.46**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.10-6 VOC Emissions (tpd) from Household Products

County	Household Products Emissions
Cabarrus*	0.44
Gaston*	0.47
Iredell*	0.16
Lincoln*	0.15
Mecklenburg	2.27
Rowan*	0.32
Union*	0.43
Total	**4.24**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.10-7 VOC Emissions (tpd) from Automotive Aftermarket Products

County	Automotive Aftermarket Products Emissions
Cabarrus*	0.33
Gaston*	0.35
Iredell*	0.12
Lincoln*	0.12
Mecklenburg	1.71
Rowan*	0.24
Union*	0.33
Total	**3.20**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.10-8 VOC Emissions (tpd) from Adhesives and Sealants

County	Adhesives and Sealants Emissions
Cabarrus*	0.14
Gaston*	0.15
Iredell*	0.05
Lincoln*	0.05
Mecklenburg	0.72
Rowan*	0.10
Union*	0.14
Total	**1.35**

Note: * indicates emissions for nonattainment portion only.

Table 4.2.10-9 Total VOC Emissions (tpd) from Commercial/Consumer Solvent

County	Total Consumer/Commercial Emissions
Cabarrus*	2.05
Gaston*	2.19
Iredell*	0.75
Lincoln*	0.72
Mecklenburg	10.62
Rowan*	1.48
Union*	2.04
Total	**19.85**

Note: * indicates emissions for nonattainment portion only.

4.3 OTHER MAN MADE AREA SOURCES

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

4.3.1 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 2011 for each of these categories was obtained from the North Carolina Forest Service (NCFS) and are listed in Table 4.3.1-1.

Table 4.3.1-1 2011 Acres of Land Burned by Fires

County	Wildfires	Prescribed	Total
Cabarrus	61	5	66
Gaston	55	0	55
Iredell	66	67	133
Lincoln	29	14	43
Mecklenburg	38	984	1,022
Rowan	96	258	354
Union	84	5	89

The makeup of the plant life burned in each fire can vary from woodland to brush to grassland. The emission factors and fuel loading were obtained from the *Development of the 2007 Base Year and Typical Year Fire Emission Inventory for the Southeastern States Air Resources Managers, Inc. – Final Report, May 22, 2012*. The emission factors and fuel loading are based on the type of vegetation that was burned per fire for both the prescribed fires and wildfires. The VOC and NOx emissions were generated for each fire per county.

The daily emissions are estimated by dividing by 365 days per year. The emissions were calculated using Equation 4.3.1-1.

$$EM_{pol} = \frac{(\text{no. acres burned} * \text{fuel loading} * EF_{pol})}{2{,}000 \text{ lbs/ton}} * (1 \text{ year}/365 \text{ days}) \qquad 4.3.1\text{-}1$$

where:

EM_{pol} = total daily emissions, in tons/day, per pollutant
Fuel loading = fuel consumption values, tons/acre
EF_{pol} = emission factors per pollutant, lbs/ton

The VOC and NOx emission estimates, in tons/day, from forest fires for the Charlotte nonattainment area are listed in Table 4.3.1-2.

Table 4.3.1-2 Emissions (tpd) from Forest Fires

	Forest Fires Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.001	0.001
Gaston*	0.002	0.004
Iredell*	0.002	0.003
Lincoln*	0.001	0.002
Mecklenburg	0.034	0.066
Rowan*	0.013	0.023
Union*	0.001	0.001
Total	**0.054**	**0.100**

Note: * indicates emissions for nonattainment portion only.

4.3.2 Structure Fires

The structure fires category is based on both residential and non-residential structures. The U.S. Fire Administration (USFA) maintains statistics on the number of national residential and non-residential fires. A fire per person factor was calculated for the residential structures based on the national number of residential fires divided by the national population for 2011. A fire per employee factor was also calculated for the non-residential structures based on the national number of non-residential fires divided by the national employment for 2011. Both the US population and employment were obtained from the US Census Bureau. The US residential fires totaled 364,500 and the non-residential fires totaled 85,400. The US population was 311,591,917 and the US employment was 113,425,965. Therefore, the fire per person factor for residential structures is 0.0012 and the fire per employee factor for non-residential structures is 0.0008. The structure fires emissions were allocated to the county level by the county population and employment. The 2010 county population and employment were obtained from the US Census Bureau. The fire per person factor for residential structures was applied to the 2010 county population to determine the number of residential structure fires per county. Additionally, a fire per employee factor for non-residential structures was applied to the 2010 total county employment to determine the non-residential structure fires per county. To determine the total emissions from structure fires, the sum of the residential and non-residential structure fires were totaled for each county. The county population, shown in Table 2.2-1, was used to estimate the emissions for the residential portion and the county employment, shown in Table 4.3.2-1, was used to estimate the emissions for the non-residential portion. The estimates of the residential and nonresidential portions were summed to obtain the total emissions for the structure fires.

Table 4.3.2-1 County Employment

County	2010 County Employment
Cabarrus	55,864
Gaston	57,599
Iredell	56,377
Lincoln	16,368
Mecklenburg	502,944
Rowan	38,896
Union	42,518

The emission factors and fuel loading factor were obtained from the EIIP Tech. Report, Table 18.4-1 and Table 18.4-2, respectively. The emission factors are 11 lbs of VOC per ton burned and 1.4 lbs of NOx per ton burned. The loading factor is 1.15 tons of material burned per structural fire was also obtained from the EIIP Tech. Report.

The structure fires emissions for the 2011 base year were calculated using equation 4.3.2-1.

$$EM_{pol} = \frac{[(\text{cnty pop} * FPP) + (\text{cnty empl} * FPE)]}{2{,}000 \text{ lbs/tons}} * CF * EF_{pol} * (1 \text{ year}/365 \text{ days}) \qquad 4.3.2\text{-}1$$

where:

EM_{pol} = total daily emissions in tons/day
FPP = fire per person factor
FPE = fire per employee factor
CF = conversion factor, 1.15 tons burned/structure fire
EF_{pol} = emission factors per pollutant

The VOC and NOx emission estimates, in tons/day, from structure fires for the Charlotte nonattainment area are listed in Tables 4.3.2-2.

Table 4.3.2-3 Emissions (tpd) from Structure Fires

	Structure Fires Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.0004	0.0001
Gaston*	0.0004	0.0001
Iredell*	0.0001	0.0000
Lincoln*	0.0001	0.0000
Mecklenburg	0.0024	0.0008
Rowan*	0.0003	0.0001
Union*	0.0004	0.0001
Total	**0.0041**	**0.0012**

Note: * indicates emissions for nonattainment portion only.

4.3.3 Charbroiling

Charbroiling is one of the categories the EPA revised for the 2008 NEI. The emission factors were developed and reviewed by an ERTAC advisory panel composed of state and EPA personnel. The emission factors were generated by taking the 2002 NEI emissions and dividing by the 2002 population to develop per capita emission factors. The charbroiling emission factors are shown in Table 4.3.3-1

Table 4.3.3-1 Charbroiling Emission Factors

Subcategory	VOC Emission Factors (lb VOC/person/year)
Conveyorized Charbroiling	0.0121
Under-fired Charbroiling	0.0415
Deep Fat Frying	0.0126
Flat Griddle Frying	0.0059
Clamshell Griddle Frying	0.0002

The emissions for the base year emissions are calculated using Equation 4.3.3-1.

$$EM = \frac{\text{county population} * EF}{2{,}000 \text{ lbs/tons}} * (1 \text{ year}/365 \text{ days}) \qquad 4.3.3\text{-}1$$

where:

EM = total daily emissions in tons/day
EF = emission factor per subcategory

The total VOC emissions from charbroiling are summarized in Table 4.3.3-2.

Table 4.3.3-2 Total VOC Emissions (tpd) from Charbroiling

County	Total Charbroiling Emissions
Cabarrus*	0.02
Gaston*	0.02
Iredell*	0.01
Lincoln*	0.01
Mecklenburg	0.09
Rowan*	0.01
Union*	0.02
Total	**0.18**

Note: * indicates emissions for nonattainment portion only.

4.3.4 Open Burning – Land Clearing and Yard Trimmings

Open burning of land clearing debris is the purposeful burning of debris, such as trees, shrubs, and brush, from the clearing of land for the construction of new buildings and highways. Open burning of yard waste is the purposeful burning of leaf and brush species in outdoor areas.

Land Clearing

The amount of material burned was estimated using the county-level total number of acres disturbed by residential, non-residential, and road construction. The acres disturbed reflect different years due to the latest availability of data from the various sources used to obtain the data. County-level weighted loading factors were applied to the total number of construction acres to convert acres to tons of available fuel. Counties that were more than 80% urban were assumed not to practice any open burning. Emission factors were developed by the EPA in consultation with the ERTAC and based primarily on the *AP-42* report. The NOx emission factor is 5 lbs/ton and the VOC emission factor is 11.6 lbs/ton.

The table below shows the total number of acres disturbed by residential, non-residential and road construction.

Table 4.3.4-1 Number of Acres Disturbed by Residential Construction, Non-Residential Construction and Road Construction

County	2010 Residential Construction Acres Disturbed	2011 Non-Residential Construction Acres Disturbed	2008 Road Construction Acres Disturbed	Total Acres Disturbed
Cabarrus	154	110	136	400
Gaston	117	134	84	335
Iredell	94	239	165	498
Lincoln	35	62	36	133
Mecklenburg	533	1,404	684	2,621
Rowan	55	88	56	199
Union	138	167	97	402
Total	**1,126**	**2,204**	**1,258**	**4,588**

The table below shows the county-level weighted fuel loading factors.

Table 4.3.4-2 Weighted Fuel Loading Factors

County	Weighted Fuel Loading Factors (tons/acre)
Cabarrus	47.33
Gaston	52.58
Iredell	42.68
Lincoln	45.08
Mecklenburg	47.73
Rowan	44.17
Union	42.79

The land clearing debris emissions were calculated using Equation 4.3.4-1.

$$EM_{pol} = \frac{EF_{pol} * \text{total acres disturbed} * \text{weighted fuel loading factor}}{2{,}000 \text{ lbs/ton}} * (1 \text{ year}/365 \text{ days}) \quad 4.3.4\text{-}1$$

where:

EM_{pol} = total daily emissions per pollutant in tons/day

EF_{pol} = emission factor per pollutant
total acres disturbed = total acres disturbed from residential, non-residential and road construction debris
weighted fuel loading factor = factor used to convert mass of construction debris from acres to tons

Table 4.3.4-3 shows the 2011 land clearing debris emissions in tons/day.

Table 4.3.4-3 Land Clearing Debris Emissions (tpd)

	Land Clearing Debris Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.00	0.00
Gaston*	0.00	0.00
Iredell*	0.06	0.13
Lincoln*	0.03	0.08
Mecklenburg	0.00	0.00
Rowan*	0.06	0.13
Union*	0.10	0.24
Total	**0.25**	**0.58**

Note: * indicates emissions for nonattainment portion only.

Yard Waste

According to the EPA report, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*, residential waste generation accounts for 55-65 percent of the total waste from the residential and commercial sectors. For the calculation of per capita yard waste subject to burning, the median value of 60 percent was assumed. This information was used to calculate a daily estimate of the per capita yard waste of 0.36 lbs/person/day. Of the total amount of yard waste generated, the yard waste composition was assumed to be 25 percent leaves, 25 percent brush, and 50 percent grass by weight.

Open burning of grass clippings is not typically practiced by homeowners, and as such only estimates for leaf burning and brush burning were developed. Approximately 25 to 32 percent of all waste that is subject to open burning is actually burned. A median value of 28 percent is assumed to be burned in all counties in the United States. Table 4.3.4-4 shows the 2010 leaf burned per county.

Table 4.3.4-4 Amount of Leaf Burned

County	2010 Leaf Burned
Cabarrus	0.00
Gaston	0.00
Iredell	274.64
Lincoln	193.99
Mecklenburg	0.00
Rowan	244.17
Union	249.58

Since it is illegal to burn within the corporate city limits, only the rural portion of the population was used in the emissions calculations. The rural population was calculated by applying the 2010 census rural population percentage to the total 2010 county population as shown in Table 2.2-2.

Controls for yard waste burning are generally in the form of a ban on open burning of waste in a given municipality or county. Counties that were more than 80% urban were assumed not to practice any open burning. Therefore, criteria pollutant emissions from residential yard waste burning are zero in these counties.

Emission factors for were developed by the EPA in consultation with the ERTAC. The VOC emission factor is 28 lbs/ton burned and the NOx emission factor is 6.2 lbs/ton burned.

The base year emissions were calculated using Equation 4.3.4-2.

$$EM_{pol} = \frac{\text{county rural pop} * \text{leaf waste burned} * EF_{pol}}{2{,}000 \text{ lb/tons}} * (1 \text{ yr}/365 \text{ dys}) \qquad 4.3.4\text{-}2$$

where:

EM_{pol} = total daily emissions in tons/day
EF_{pol} = emission factors per pollutant

The VOC and NOx emission estimates, in tons/day, from yard waste are listed in Table 4.3.4-5.

Table 4.3.4-5 Emissions from Burning of Yard Waste (tpd)

	Yard Waste Burning Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.000	0.000
Gaston*	0.000	0.000
Iredell*	0.001	0.004
Lincoln*	0.001	0.006
Mecklenburg	0.000	0.000
Rowan*	0.002	0.009
Union*	0.002	0.008
Total	**0.006**	**0.027**

Note: * indicates emissions for nonattainment portion only.

The total VOC and NOx emissions from open burning are shown in Table 4.3.4-6.

Table 4.3.4-6 Total Emissions from Open Burning (tpd)

	Open Burning Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.00	0.00
Gaston*	0.00	0.00
Iredell*	0.06	0.13
Lincoln*	0.03	0.09
Mecklenburg	0.00	0.00
Rowan*	0.06	0.14
Union*	0.10	0.25
Total	**0.25**	**0.61**

Note: * indicates emissions for nonattainment portion only.

4.3.5 Small Stationary Combustion Sources

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

The emission factors used to estimate the emissions, except residential wood, were obtained from the ongoing emission factor development work conducted by the ERTAC in conjunction with the EPA. The residential wood emission factors were obtained from a tool developed by the EPA to calculate the emissions generated from residential wood combustion.

The emission factors used are shown in Table 4.3.5-1 below.

Table 4.3.5-1 Fuel Combustion Emission Factors

Fuel	Units	NOx	VOC
Commercial			
NG	lb/10^6 ft^3	100	5.5
LPG	lb/10^3 gal	14.23	0.52
Fuel Oil	lb/10^3 gal	20	0.34
Coal	lb/ton	11	0.3
Wood	lb/10^6 BTU	0.22	0.017
Industrial			
NG	lb/10^6 ft^3	100	5.5
LPG	lb/10^3 gal	14.23	0.52
Fuel Oil	lb/10^3 gal	20	0.02
Wood	lb/10^6 BTU	0.22	0.017
Residential			
NG	lb/10^6 ft^3	94	5.5
LPG	lb/10^3 bbl	562.8	21.91
Fuel Oil	lb/10^3 gal	18	0.7
Coal	lb/ton	3	10
Wood-General Fireplace	lb/ton	2.6	18.9
Wood-non-EPA Certified Woodstove	lb/ton	2.8	53
Wood-EPA Certified Woodstove	lb/ton	2.28	12
Wood-Pellet-Fired Woodstove	lb/ton	3.8	0.041
Wood-Indoor Furnace	lb/ton	1.8	11.7
Wood-Outdoor Hydronic Heater	lb/ton	1.8	11.7
Wood-Outdoor Wood Burning Device-NEC	lb/ton	2.6	18.9
Wood-Residential Firelog	lb/ton	7.684	39.56

To avoid double counting, the point source emissions are subtracted from the total emissions. Point sources are those stationary sources that require an air permit to operate. In general, these sources have a potential to emit threshold of 5 tons per year or greater of CO, NO_x, PM, SO_2 and/or VOC from a single facility. Point sources that meet this criterion are accounted for in the point source emissions inventory. The 2011 point source emissions data was subtracted from the overall area source emissions. The point source emissions were obtained from the 2011 NEI, Version 1. Tables 4.3.5-2 and 4.3.5-3 illustrates the point source emissions that were subtracted from the total area source emissions. If the point source emission is greater than the total area source emissions, the area source emission is assumed to be zero.

Table 4.3.5-2 Commercial Combustion Point Source Emissions (tpd)

	2011 Point Source Commercial NG Combustion Emissions		2011 Point Source Commercial Fuel Oil Combustion Emissions	
County	NOx Emissions	VOC Emissions	NOx Emissions	VOC Emissions
Cabarrus	0.12	0.01	0.15	0.00
Gaston	8.54	1.85	0.01	0.00
Iredell	1.08	7.84	0.63	0.00
Lincoln	0.00	0.00	0.00	0.03
Mecklenburg	0.00	0.00	0.42	0.04
Rowan	0.51	0.00	0.00	0.00
Union	0.02	0.00	0.00	0.00
Total	**10.27**	**9.70**	**1.21**	**0.07**

Table 4.3.5-3 Industrial Combustion Point Source Emissions (tpd)

	2011 Point Source Industrial NG Combustion Emissions		2011 Point Source Industrial Distillate Oil Combustion Emissions		2011 Point Source Industrial Wood Combustion Emissions	
County	NOx Emissions	VOC Emissions	NOx Emissions	VOC Emissions	NOx Emissions	VOC Emissions
Cabarrus	14.73	8.19	247.05	221.28	0.00	0.00
Gaston	52.12	2.92	5,583.43	377.50	0.00	0.00
Iredell	1,732.05	277.50	1,897.48	577.71	3.68	0.11
Lincoln	11.41	0.63	100.14	360.16	0.00	0.00
Mecklenburg	40.77	2.42	2,819.14	548.62	0.00	0.00
Rowan	78.45	45.15	1,429.38	1,508.05	0.00	0.00
Union	1.55	0.08	75.83	303.92	0.00	0.00
Total	**1,931.08**	**336.89**	**12,152.45**	**3,897.24**	**3.68**	**0.11**

The 2011 industrial and commercial/institutional (ICI) combustion sources emissions were projected from the 2007 Southeastern States Air Resources Managers, Inc. (SESARM) area source emissions inventory because this is the latest available quality assured emissions inventory. The growth factors used to project the 2007 ICI combustion sources emissions are 0.8506 for the industrial combustion sources and 0.9662 for the commercial/institutional combustion sources. The growth factors were derived from employment data for each the industrial sector and the commercial/institutional sector. The 2011 residential combustion sources emissions inventory was obtained from the 2011 NEI, Version 1. The NOx and VOC emissions estimates, in tons/day, for the industrial, commercial and residential combustion sources are shown in Tables 4.3.5-4 through 4.3.5-17 and summarized in Tables 4.3.5-18 and 4.3.5-20.

Table 4.3.5-4 Industrial Natural Gas Combustion Emissions (tpd)

	Industrial NG Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.00	0.00
Gaston*	0.00	0.00
Iredell*	0.00	0.00
Lincoln*	0.00	0.00
Mecklenburg	1.33	0.07
Rowan*	0.00	0.00
Union*	0.04	0.00
Total	**1.37**	**0.07**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-5 Industrial Wood Combustion Emissions (tpd)

	Industrial Wood Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.01	0.00
Gaston*	0.01	0.00
Iredell*	0.00	0.00
Lincoln*	0.00	0.00
Mecklenburg	0.12	0.01
Rowan*	0.01	0.00
Union*	0.01	0.00
Total	**0.16**	**0.01**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-6 Industrial Liquefied Petroleum Gas Combustion Emissions (tpd)

	Industrial LPG Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.03	0.00
Gaston*	0.03	0.00
Iredell*	0.01	0.00
Lincoln*	0.01	0.00
Mecklenburg	0.29	0.02
Rowan*	0.02	0.00
Union*	0.02	0.00
Total	**0.41**	**0.02**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-7 Commercial Coal Combustion Emissions (tpd)

	Commercial Coal Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.01	0.00
Gaston*	0.01	0.00
Iredell*	0.00	0.00
Lincoln*	0.00	0.00
Mecklenburg	0.08	0.00
Rowan*	0.01	0.00
Union*	0.01	0.00
Total	**0.12**	**0.00**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-8 Commercial Natural Gas Combustion Emissions (tpd)

	Commercial NG Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.06	0.00
Gaston*	0.01	0.00
Iredell*	0.03	0.00
Lincoln*	0.00	0.00
Mecklenburg	0.63	0.03
Rowan*	0.04	0.00
Union*	0.04	0.00
Total	**0.81**	**0.03**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-9 Commercial Wood Combustion Emissions (tpd)

	Commercial Wood Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.01	0.00
Gaston*	0.01	0.00
Iredell*	0.00	0.00
Lincoln*	0.00	0.00
Mecklenburg	0.08	0.01
Rowan*	0.00	0.00
Union*	0.00	0.00
Total	**0.10**	**0.01**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-10 Commercial Liquefied Petroleum Gas Combustion Emissions (tpd)

	Commercial LPG Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.02	0.00
Gaston*	0.02	0.00
Iredell*	0.01	0.00
Lincoln*	0.00	0.00
Mecklenburg	0.14	0.01
Rowan*	0.01	0.00
Union*	0.01	0.00
Total	**0.21**	**0.01**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-11 Residential Coal Combustion Emissions (tpd)

	Residential Coal Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.000	0.000
Gaston*	0.004	0.004
Iredell*	0.003	0.004
Lincoln*	0.000	0.000
Mecklenburg	0.016	0.018
Rowan*	0.014	0.015
Union*	0.000	0.000
Total	**0.037**	**0.041**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-12 Residential Fuel Oil Combustion Emissions (tpd)

	Residential Fuel Oil Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.016	0.001
Gaston*	0.019	0.001
Iredell*	0.009	0.000
Lincoln*	0.010	0.000
Mecklenburg	0.024	0.001
Rowan*	0.024	0.001
Union*	0.010	0.000
Total	**0.112**	**0.004**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-13 Residential Natural Gas Combustion Emissions (tpd)

	Residential NG Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.22	0.01
Gaston*	0.37	0.02
Iredell*	0.06	0.00
Lincoln*	0.03	0.00
Mecklenburg	1.59	0.09
Rowan*	0.15	0.01
Union*	0.12	0.01
Total	**2.54**	**0.14**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-14 Residential Liquefied Petroleum Gas Combustion Emissions (tpd)

	Residential LPG Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.04	0.00
Gaston*	0.04	0.00
Iredell*	0.02	0.00
Lincoln*	0.02	0.00
Mecklenburg	0.05	0.00
Rowan*	0.03	0.00
Union*	0.08	0.00
Total	**0.28**	**0.00**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-15 Residential Wood Combustion Emissions (tpd)

	Residential Wood Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.02	0.23
Gaston*	0.02	0.24
Iredell*	0.01	0.09
Lincoln*	0.01	0.09
Mecklenburg	0.07	0.74
Rowan*	0.01	0.17
Union*	0.02	0.22
Total	**0.16**	**1.78**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-16 Residential Firelog Combustion Emissions (tpd)

	Residential Firelog Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.002	0.011
Gaston*	0.002	0.012
Iredell*	0.001	0.005
Lincoln*	0.001	0.005
Mecklenburg	0.016	0.081
Rowan*	0.002	0.010
Union*	0.002	0.010
Total	**0.026**	**0.134**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-17 Residential Kerosene Combustion Emissions (tpd)

	Residential Kerosene Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.005	0.000
Gaston*	0.005	0.000
Iredell*	0.003	0.000
Lincoln*	0.003	0.000
Mecklenburg	0.007	0.000
Rowan*	0.007	0.000
Union*	0.003	0.000
Total	**0.033**	**0.000**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-18 Total Industrial Combustion Emissions (tpd)

	Total Industrial Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.04	0.00
Gaston*	0.04	0.00
Iredell*	0.01	0.00
Lincoln*	0.01	0.00
Mecklenburg	1.74	0.10
Rowan*	0.03	0.00
Union*	0.07	0.00
Total	**1.94**	**0.10**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-19 Total Commercial Combustion Emissions (tpd)

	Total Commercial Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.11	0.00
Gaston*	0.07	0.00
Iredell*	0.05	0.00
Lincoln*	0.01	0.00
Mecklenburg	1.16	0.05
Rowan*	0.07	0.00
Union*	0.07	0.00
Total	**1.54**	**0.05**

Note: * indicates emissions for nonattainment portion only.

Table 4.3.5-20 Total Residential Combustion Emissions (tpd)

	Total Residential Combustion Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.30	0.25
Gaston*	0.46	0.28
Iredell*	0.11	0.10
Lincoln*	0.07	0.10
Mecklenburg	1.77	0.93
Rowan*	0.24	0.21
Union*	0.24	0.24
Total	**3.19**	**2.11**

Note: * indicates emissions for nonattainment portion only.

4.3.6 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., wheat). According to the North Carolina Department of Agriculture, when soybeans are double cropped with wheat, the wheat stubble is usually burned back after harvest about one fourth of the time. According to Dr. J. Dunphy, a soybean specialist at North Carolina State University, the acres of soybean double cropped with wheat in North Carolina is approximately equal to the acres of wheat planted. Therefore, ¼ of

the acreage of wheat planted is used to calculate the emissions from agricultural burning practices in North Carolina.

The fuel loading and emission factors were obtained from the SESARM Report, *Development of the 2007 Base Year and Typical Year Fire Emission Inventory for the Southeastern States Air Resources Managers Inc*. The fuel loading factor is 1.9 tons of fuel consumed per acre burned, the VOC emission factor is 9.22 lbs/ton and the NOx emission factor is 4.48 lbs/ton.

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 4.3.6-1 below.

Table 4.3.6-1 Acres of Wheat

County	2011 Wheat Acres
Cabarrus	4,000
Gaston	2,100
Iredell	7,500
Lincoln	4,300
Mecklenburg	undisclosed
Rowan	7,500
Union	46,800

The emissions for 2011 were calculated using Equation 4.3.6-1.

$$EM_{pol} = \frac{(¼ \text{ x wheat acreage}) * \text{fuel loading} * EF_{pol}}{2{,}000 \text{ lbs/ton}} * (1 \text{ year}/61 \text{ days}) \qquad 4.3.6\text{-}1$$

where:

EM_{pol} = total daily emissions in tons/day
EF_{pol} = emission factor per pollutant

The VOC emission estimates, in tons/day, from agricultural burning for the Charlotte nonattainment area are listed in Table 4.3.6-2.

Table 4.3.6-2 VOC Emissions (tpd) from Agricultural Burning

	Agricultural Burning Emissions	
County	NOx Emissions	VOC Emissions
Cabarrus*	0.0000	0.14
Gaston*	0.0000	0.07
Iredell*	0.0000	0.11
Lincoln*	0.0000	0.12
Mecklenburg	0.0000	0.00
Rowan*	0.0000	0.25
Union*	0.0001	1.46
Total	**0.0001**	**2.15**

Note: * indicates emissions for nonattainment portion only.

4.4 BIOGENIC EMISSIONS

Biogenic emissions are primarily VOC emissions from vegetation and are kept constant through all years when modeling ozone. Upon discussions with the EPA Region 4, it was agreed that the biogenic emissions did not need to be estimated for this 2011 base year emissions inventory SIP.

4.5 SUMMARY OF AREA SOURCE EMISSIONS

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

Table 4.5-1 Total Area Sources Emissions (tpd)

County	NOx Emissions	VOC Emissions
Cabarrus*	0.44	4.53
Gaston*	0.55	4.94
Iredell*	0.22	1.95
Lincoln*	0.12	1.72
Mecklenburg	4.48	23.47
Rowan*	0.40	3.95
Union*	0.47	6.13
Total	**6.68**	**46.69**

Note: * indicates emissions for nonattainment portion only.

Appendix B.3

On-Road Mobile Sources
Emission Inventory Documentation

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1.0 INTRODUCTION AND SCOPE

This appendix describes the procedures used to develop the inventories of NOx and VOC emissions from on-road mobile sources, which comprise nearly half of the total man-made NOx and VOC emissions for this area.

2.0 OVERALL METHODOLOGY

2.1 EMISSION ESTIMATION APPROACH

Inventories of NOx and VOC emissions from on-road mobile sources were developed using the MOtor Vehicle Emissions Simulator (MOVES) model, the United States Environmental Protection Agency's (EPA's) current official model for estimating air pollution emissions from on-road vehicles. MOVES2010b, the latest version of MOVES (released April 2012), was used for all modeling runs. All model input data development and modeling runs were conducted according to the methods and procedures outlined in the EPA documents: *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations* (EPA-454/R-05-001. August 2005, updated November 2005), *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).

Daily inventories were developed to represent the estimated on-road NOx and VOC emissions for a typical summer day, specifically a July 2011 weekday. First, MOVES modeling runs were executed to generate county-level emissions inventories for the seven Charlotte nonattainment area counties. These modeling runs used the MOVES input databases originally developed for the 2011 National Emissions Inventory (NEI), Version 1. Inventories for each of the six partial county areas were then calculated by scaling the county-wide inventory values by the fraction of the county human population within the nonattainment area portion of the county

3.0 QUALITY ASSURANCE MEASURES

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

Speed and vehicle miles traveled (VMT) datasets for the areas to be modeled (typically county-level data) are acquired from the transportation partners responsible for the travel demand model

(TDM) output. The speed information for each modeled area is checked for reasonableness against previous sets of speeds for that area. Once the speeds are deemed reasonable, the North Carolina Division of Air Quality (DAQ) 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 (e.g., VMT). 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 data which is then compiled and summarized as needed. The MOVES output data and corresponding summaries are checked for reasonableness by comparison to historical data. The accuracy and completeness of the summarized data are independently verified by a person other than the one who created the summaries.

4.0 DISCUSSION OF ON-ROAD MOBILE SOURCES

On-road mobile sources produce the ozone precursor pollutants NOx and VOC, along with a host of other pollutants. This emissions inventory specifically focuses on these two pollutants. The objective of the following section is to describe the source category, the input files, and the emissions estimation procedures.

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 vehicles are in motion, at idle, parked, and during refueling. All of these emissions processes are estimated in order to properly reflect the total emissions from this source category.

A very important component of the highway mobile emission estimation process is interagency consultation. The primary transportation partners involved in the Charlotte nonattainment area interagency consultation process included: NCDOT, EPA, Federal Highway Administration (FHWA), Cabarrus-Rowan Municipal Planning Organization (CRMPO), Charlotte Regional Transportation Planning Organization (CRTPO)[1], Charlotte DOT (CDOT), Lake Norman Rural

[1] Previously known as the Mecklenburg-Union MPO (MUMPO).

Planning Organization (RPO), Rocky River RPO and Mecklenburg County Air Quality (MCAQ). Specifically, MUMPO performed travel demand modeling (TDM) for the area and provided speeds and VMT. The DAQ consulted with the transportation partners for the appropriate speeds and VMT to use to develop these inventories. The NCDOT provided vehicle registration data and vehicle mix data for all Charlotte nonattainment area counties.

4.2 MOVES INPUT ASSUMPTIONS

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 are provided electronically.

4.2.1 Speed Assumptions

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

The speeds were generated from the region's TDM for years 2010 and 2013 with speed data provided for the following four time periods during the day: AM Peak, Midday, PM Peak and Night. The 2011 speeds were interpolated based on 2010 and 2013 data. Table 4.2.1 provides a summary of the speeds in miles per hour (mph) for the Charlotte nonattainment area. The column headings in these tables represent the road types used in the modeling and are listed below.

Abbreviations for FHWA Road Types

RI	Rural Interstate		UI	Urban Interstate
RPA	Rural Principle Arterial		UF	Urban Freeway & Expressway
RMA	Rural Minor Arterial		UPA	Urban Principal Arterial
RMjC	Rural Major Collector		UMA	Urban Minor Arterial
RMiC	Rural Minor Collector		UC	Urban Collector
RL	Rural Local		UL	Urban Local
			UH	Urban high-occupancy vehicle (HOV)

Table 4.2.1 Regional Model Speeds for the Charlotte Nonattainment Area (miles/hour)

Year	Time	RI	RPA	RMA	RMjC	RMiC	RL	UI	UF	UPA	UMA	UC	UL	UH
Cabarrus														
2011	AM	NA	48	52	41	40	28	42	NA	31	30	28	24	NA
	Midday	NA	53	58	46	43	28	66	NA	34	31	31	22	NA
	PM	NA	49	48	39	38	28	38	NA	28	28	26	22	NA
	Night	NA	57	60	52	47	28	68	NA	42	39	38	26	NA
Gaston														
2011	AM	61	57	42	42	40	28	43	52	30	30	29	24	NA
	Midday	63	58	54	49	40	28	63	55	34	35	29	24	NA
	PM	56	57	44	41	39	29	42	52	29	30	25	24	NA
	Night	63	58	57	51	41	28	63	56	39	40	33	24	NA
Iredell														
2011	AM	57	NA	16	29	26	30	51	NA	25	26	20	24	NA
	Midday	68	NA	15	34	28	30	64	NA	25	26	20	25	NA
	PM	59	NA	12	26	27	29	50	NA	21	23	18	24	NA
	Night	68	NA	33	43	40	31	68	NA	36	36	36	26	NA
Lincoln														
2011	AM	NA	57	43	56	43	28	NA	68	33	34	35	26	NA
	Midday	NA	62	46	57	46	28	NA	68	37	38	37	26	NA
	PM	NA	56	38	56	43	29	NA	68	32	33	34	25	NA
	Night	NA	66	52	58	47	28	NA	68	44	44	39	27	NA
Mecklenburg														
2011	AM	NA	35	31	30	36	30	45	49	24	24	22	22	63
	Midday	NA	44	43	40	41	29	58	55	28	28	27	21	65
	PM	NA	36	38	30	35	30	41	47	22	23	21	19	66
	Night	NA	49	45	46	45	29	62	58	37	37	36	24	0
Rowan														
2011	AM	NA	40	55	52	46	29	60	NA	39	35	33	24	NA
	Midday	NA	53	58	55	49	29	65	NA	39	35	31	23	NA
	PM	NA	46	54	51	46	29	59	NA	37	33	28	22	NA
	Night	NA	59	60	58	50	29	67	NA	45	41	38	25	NA
Union														
2011	AM	NA	50	48	45	45	31	NA	28	34	28	32	26	NA
	Midday	NA	52	51	48	47	30	NA	37	38	31	36	27	NA
	PM	NA	51	46	45	45	31	NA	28	32	26	29	26	NA
	Night	NA	53	56	52	48	31	NA	47	44	39	43	28	NA

MOVES uses four different road 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. The EPA recommends that the average speed distribution for

local roadway activity be included as part of a weighted distribution of average speed across all unrestricted roads along with the distribution of average speeds for arterials and connectors.

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

The general formula is:

$$VHT\ Fraction\ B = 1 - VHT\ Fraction$$

$Where$:

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

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

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

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 road way is used to weight the speed bin fraction. For example, below are speeds and VMT for urban restricted access road types:

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

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

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

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

Where:

RT = the HPMS road type

In this example, the Highway Performance Monitoring System (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 imply 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 EPA recommends and encourages states to develop local age distributions. 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. The MOVES model 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 from NCDOT. For this analysis, NCDOT provided county-level vehicle age data which included the number of registered vehicles by model year for the years 1974 through 2011, along with the total number of vehicles from model year 1973 and earlier. Since MOVES categorizes the vehicle fleet into different vehicle classes and more model years, EPA has created data converters that take registration distribution input files created for MOBILE6.2 and converts them to the appropriate age distribution input tables for MOVES. 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).

4.2.3 Vehicle Mix Assumptions

Vehicle mix or VMT mix is used by MOVES to convert annual VMT to VMT by HPMS class, VMT fractions by hour, and VMT by road type distribution. The vehicle mix is developed by the same method used in MOBILE6.2, as outlined below. The resulting file is 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 section 4.2.1. 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.

The EPA guidance document *Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation* (EPA420-R-04-013, August 2004) 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 to generate a state-specific vehicle mix.

The North Carolina HPMS data used to generate the statewide vehicle mix was based on 2011. The use of the 2011 data for all years is described below. Table 4.2.3-1 shows the percent of vehicles per vehicle type for each of the 12 road classes (there was no Urban HOV).

Table 4.2.3-1 2011 North Carolina HPMS Data

Functional Classification	MC	Cars	2A4T	Bus	2ASU	3ASU	4ASU	4AST	5AST	6AST	5AMT	6AMT	7AMT
Rural Interstate	0.0038	0.7025	0.1448	0.0057	0.0213	0.0067	0.0003	0.0086	0.1017	0.0011	0.0022	0.0010	0.0002
Rural Principal Arterial	0.0061	0.6954	0.1959	0.0063	0.0278	0.0068	0.0007	0.0117	0.0459	0.0018	0.0009	0.0003	0.0003
Rural Minor Arterial	0.0055	0.7172	0.1976	0.0053	0.0256	0.0061	0.0006	0.0088	0.0312	0.0017	0.0001	0.0000	0.0003
Rural Major Collector	0.0070	0.7057	0.2137	0.0055	0.0276	0.0062	0.0006	0.0086	0.0235	0.0013	0.0000	0.0000	0.0002
Rural Minor Collector	0.0120	0.6640	0.2178	0.0078	0.0311	0.0105	0.0009	0.0078	0.0455	0.0025	0.0000	0.0000	0.0002
Rural Local	0.0086	0.7178	0.2046	0.0090	0.0351	0.0103	0.0010	0.0055	0.0069	0.0011	0.0000	0.0000	0.0000
Urban Interstate	0.0041	0.7579	0.1563	0.0049	0.0182	0.0057	0.0003	0.0039	0.0466	0.0005	0.0011	0.0005	0.0001
Urban Freeways & Expressways	0.0062	0.7360	0.1748	0.0054	0.0217	0.0069	0.0007	0.0100	0.0354	0.0011	0.0012	0.0004	0.0001
Urban Principal Arterial	0.0053	0.7736	0.1686	0.0048	0.0206	0.0057	0.0010	0.0053	0.0130	0.0014	0.0003	0.0001	0.0003
Urban Minor Arterial	0.0057	0.7708	0.1772	0.0041	0.0220	0.0048	0.0006	0.0052	0.0085	0.0008	0.0001	0.0000	0.0001
Urban Collector	0.0046	0.7859	0.1688	0.0053	0.0199	0.0043	0.0004	0.0046	0.0055	0.0005	0.0000	0.0000	0.0001
Urban Local	0.0108	0.7175	0.1976	0.0099	0.0296	0.0130	0.0003	0.0055	0.0152	0.0006	0.0000	0.0002	0.0001

4.2.4 Disaggregating State-Specific Information

Section 4.1.5 of *Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation* (EPA420-R-04-013, August 2004) illustrates how to map the HPMS statewide vehicle data to general MOBILE6.2 vehicle categories. This mapping is outlined below:

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

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

The HPMS data in Table 4.2.3-1 was grouped into these five general categories for each road type. In order to expand the five general categories to the 16 vehicle types used in MOBILE6.2, the national average VMT fractions by each vehicle class were used. The 2011 fractions were used since the state-specific data is from 2011. The national average data was obtained from Table 4.1.2 in *Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation* (EPA420-R-04-013, August 2004). An example for rural interstates is illustrated below:

From Table 4.2.3-1 above:

Passenger Cars	=	70.25%	5 axle Trailer	=	10.17%
Pickup Trucks	=	14.48%	6 axle Trailer	=	0.11%
Bus	=	0.57%	5 axle Multi Trailer	=	0.22%
2 axle Trucks	=	2.13%	6 axle Multi Trailer	=	0.10%
3 axle Trucks	=	0.67%	7 axle Multi Trailer	=	0.02%
4 axle Trucks	=	0.03%	Motorcycles	=	0.38%
4 axle Trailer	=	0.86%			

Therefore, the five general categories are:

Motorcycles	=	0.38%	Heavy Duty Buses	=	0.57%
Light Duty Vehicles	=	70.25%	Heavy Duty Vehicles	=	14.32%
Light Duty Trucks	=	14.48%			

From Table 4.1.2 in *Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation* (EPA420-R-04-013, August 2004), the 2011 national average vehicle mix for light duty vehicles is 0.3428, and the light duty trucks, buses and heavy duty trucks are listed below:

Light Duty Trucks		
LDT1	=	0.0911
LDT2	=	0.3031
LDT3	=	0.0934
LDT4	=	0.0430
Total	**=**	**0.5306**

Busses		
HDBS	=	0.002
HDBT	=	0.001
Total	**=**	**0.003**

Heavy Duty Trucks		
HDV2B	=	0.0390
HDV3	=	0.0038
HDV4	=	0.0032
HDV5	=	0.0024
HDV6	=	0.0087
HDV7	=	0.0103
HDV8A	=	0.0112
HDV8B	=	0.0398
Total	=	**0.1184**

Using the methodology described in Section 4.1.5 in *Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation* (EPA420-R-04-013, August 2004) the new 2011 North Carolina statewide mix was developed. The one deviation from the guidance was that the DAQ grouped the light duty vehicles with the light duty trucks to normalize the vehicle mix. This was done because it is difficult to distinguish between light duty vehicles from light duty trucks in the count data. The basic formula for developing the mix is shown below,

$$\text{Vehicle Type} = \frac{\text{(2011 M6.2 fraction for vehicle)} * \text{(2011 State total for group)}}{\text{(2011 M6.2 total for subcategory)}}$$

Table 4.2.4-2 displays the calculation for each vehicle type for the 2011 rural interstate vehicle mix.

Table 4.2.4-2 Calculation of New 2011 Statewide Rural Interstate Vehicle Mix

Vehicle Type		Calculation		New 2011 Mix
MC	=	MC	=	0.0038
Light Duty Vehicles and Trucks				
LDV	=	0.3428 x (0.8473/0.8734)	=	0.3326
LDT1	=	0.0911 x (0.8473/0.8734)	=	0.0884
LDT2	=	0.3031 x (0.8473/0.8734)	=	0.2940
LDT3	=	0.0934 x (0.8473/0.8734)	=	0.0906
LDT4	=	0.0430 x (0.8473/0.8734)	=	0.0417
Heavy Duty Vehicles				
HDV2B	=	0.0390 x (0.1432/0.1184)	=	0.0472
HDV3	=	0.0038 x (0.1432/0.1184)	=	0.0046
HDV4	=	0.0032 x (0.1432/0.1184)	=	0.0039
HDV5	=	0.0024 x (0.1432/0.1184)	=	0.0029
HDV6	=	0.0087 x (0.1432/0.1184)	=	0.0105
HDV7	=	0.0103 x (0.1432/0.1184)	=	0.0125
HDV8A	=	0.0112 x (0.1432/0.1184)	=	0.0135
HDV8B	=	0.0398 x (0.1432/0.1184)	=	0.0481
Buses				
HDBS	=	0.0020 x (0.0057/0.0030)	=	0.0038
HDBT	=	0.0010 x (0.0057/0.0030)	=	0.0019

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

which are inputs to the model. The 2011 vehicle mix can be found in Section 5.1 of this appendix.

4.2.5 Vehicles/Equipment: On-Road Vehicle Equipment

The Vehicles/Equipment menu item and panel is used to specify the vehicle types that are included in the MOVES run. MOVES allows the user to select from among 13 "source use types" (the terminology that MOVES uses to describe vehicle types), and four different fuel types (gasoline, diesel, compressed natural gas (CNG), and electricity).

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

4.2.6 Road Type

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

- 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)

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

The DAQ followed the EPA guidance in *Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity* (EPA-420-B-12-028, April 2012), which 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.

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

4.2.7 Pollutants and Processes

In MOVES, pollutant refers to particular types of pollutants or precursors of the pollutant, such as NOx or VOCs, while process refers to the mechanism by which emissions are created, such as running exhaust or start exhaust. Users must select all processes associated with a particular pollutant in order to account for all emissions of that pollutant. For example, there are 11 separate pollutant processes in MOVES for VOC, i.e. hydrocarbon emissions; all 11 must be selected when estimating VOC emissions. For this inventory the pollutants under consideration were NOx and VOC.

4.2.8 Temperature and Relative Humidity Assumptions

Local temperature and humidity data are required inputs for 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 hour selected in the Run Spec. For example, MOVES requires a 24-hour temperature and humidity profile to model a full day of emissions on an hourly basis. For mobile source emission estimates, the DAQ used 2011 monthly averages for the 24-hour temperature and relative humidity profiles from the Charlotte-Douglas International Airport (KCLT). Data were obtained from the North Carolina State Climate Retrieval and Observations Network of the Southeast Database (CRONOS). The temperature and relative humidity profiles as presented in the MOVES input files are listed in Section 5.2.

4.2.9 Source-Type Population

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

MOVES uses a vehicle classification system based on the way vehicles are classified in the Federal Highway Administration's HPMS rather than on the way they are classified in the EPA 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 6 HPMS vehicle types in MOVES, as shown in the crosswalk in Table 4.2.9-1. The EPA 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 DAQ 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 DAQ used local source-type population data in lieu of MOVES default values. The use of local data is the preferred method since MOVES

default allocation factors are derived from VMT and vehicle populations allocated to counties are proportional to the VMT being allocated to that county. The DAQ corresponded with the EPA Office of Transportation and Air Quality (OTAQ) to arrive at an acceptable method to develop current and future year source-type populations based on the local vehicle registration data available from NCDOT. The DAQ believes that using MOVES default vehicle population fractions is the best method of allocating state-specific county level vehicle registration data to the specific vehicle source types.

MOVES uses 13 source-type categories which are subsets of 6 HPMS vehicle types. Presently DAQ is unable to develop county source-type population data for many of these source-type categories based on how 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 MOVES2010a expects, the DAQ 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.

4.2.10 Vehicle Inspection and Maintenance Program Assumptions

In 2002, North Carolina implemented a new vehicle emissions inspection program referred to as onboard diagnostics (OBDII). This program covers all light duty gasoline powered vehicles that are model year 1996 and newer. The program was initially implemented in 9 counties and was expanded to include a total of 48 counties between July 2002 and January 2006. Cabarrus, Gaston, Mecklenburg and Union Counties were phased in July 2002, Iredell and Rowan were phased-in July 1, 2003 and Lincoln was phased in January 2004.

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

4.2.11 Reid Vapor Pressure and Fuel Assumptions

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 only exception to this guidance is in the case of Reid Vapor Pressure (RVP) where a user should

change the value to reflect the regulatory requirements and differences between ethanol- and non-ethanol blended gasoline fuels. The current version of MOVES does not allow the user to create new fuel identification numbers. Thus, per current EPA guidance, the DAQ edited the default fuel supply tables for the individual counties to reflect the county-specific monthly RVP data.

The RVP reflects a gasoline's volatility. Lower RVP leads to lower VOC emissions from gasoline handling and lowers vapor losses from motor vehicles. Gasoline with an RVP of 7.8 pounds per square inch (psi) is required to be used during May through September for Gaston and Mecklenburg Counties. Gasoline with an RVP of 9.0 psi is sold in Cabarrus, Iredell, Lincoln, Rowan and Union Counties year round.

4.2.12 Diesel Sulfur Content Assumptions

The diesel fuel sulfur content for conventional diesel fuel 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 EPA recommends a diesel fuel sulfur content of 43 parts per million (ppm) for the period June 2006-May 2010 and 11 ppm for June 2010 -2015. The default fuel sulfur content (11 ppm) for conventional diesel fuel in MOVES was used for this analysis.

4.2.13 VMT Assumptions

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

The VMT data were provided for each year and each time period (i.e., AM Peak, Midday, PM Peak, and Night). Table 4.2.13-1 through Table 4.2.13-7 list the VMT used in the emissions calculations.

Table 4.2.13-1 Modeled Daily Vehicle Miles Traveled for Cabarrus County

Roadtype	2011 VMT				
	AM Peak	Midday	PM Peak	Night	Daily
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	36,956	46,907	41,255	28,247	153,366
Rural Minor Arterial	55,962	62,744	61,432	38,114	218,251
Rural Major Collector	91,147	113,923	100,854	64,331	370,255
Rural Minor Collector	57,256	69,777	71,780	36,517	235,331
Rural Local	105,276	149,216	126,262	79,922	460,676
Urban Interstate	290,679	376,791	311,273	214,469	1,193,212
Urban Freeway/Xprway	0	0	0	0	0
Urban Principal Arterial	187,942	275,849	218,325	162,247	844,364
Urban Minor Arterial	190,418	284,398	216,035	158,740	849,591
Urban Collector	143,411	215,742	172,832	100,819	632,804
Urban Local	196,842	313,151	232,337	154,371	896,701
Rural	346,597	442,567	401,583	247,131	1,437,878
Urban	1,009,292	1,465,931	1,150,802	790,646	4,416,671
Daily	1,355,888	1,908,498	1,552,386	1,037,777	5,854,549

Table 4.2.13-2 Modeled Daily Vehicle Miles Traveled for Gaston County

	2011 VMT				
Roadtype	AM Peak	Midday	PM Peak	Night	Daily
Rural Interstate	38,673	44,939	41,488	25,876	150,975
Rural Principal Arterial	56,638	59,304	59,569	37,180	212,690
Rural Minor Arterial	66,970	80,386	73,111	44,137	264,605
Rural Major Collector	81,353	102,392	96,113	61,149	341,007
Rural Minor Collector	41,511	47,171	50,755	25,322	164,759
Rural Local	72,762	101,998	89,013	55,221	318,995
Urban Interstate	465,166	561,619	498,573	343,102	1,868,460
Urban Freeway/Xprway	24,290	29,098	25,140	17,786	96,315
Urban Principal Arterial	277,992	384,776	316,638	220,900	1,200,306
Urban Minor Arterial	213,730	307,933	251,753	174,806	948,222
Urban Collector	58,719	80,290	71,372	41,660	252,041
Urban Local	207,924	330,353	243,802	172,108	954,186
Rural	357,906	436,191	410,048	248,885	1,453,030
Urban	1,247,821	1,694,069	1,407,279	970,363	5,319,532
Daily	1,605,727	2,130,260	1,817,327	1,219,249	6,772,562

Table 4.2.13-3 Modeled Daily Vehicle Miles Traveled for Iredell County

Roadtype	2011 VMT				
	AM Peak	Midday	PM Peak	Night	Daily
Rural Interstate	58,373	75,701	60,348	39,389	233,812
Rural Principal Arterial	0	0	0	0	0
Rural Minor Arterial	17,747	28,041	19,664	17,981	83,432
Rural Major Collector	39,132	57,145	44,671	32,631	173,580
Rural Minor Collector	49,979	69,257	57,892	33,633	210,760
Rural Local	105,857	160,129	123,975	81,589	471,550
Urban Interstate	219,882	307,594	235,216	173,873	936,566
Urban Freeway/Xprway	0	0	0	0	0
Urban Principal Arterial	31,774	52,334	37,039	29,782	150,930
Urban Minor Arterial	41,529	65,438	46,956	37,100	191,023
Urban Collector	49,006	80,811	56,676	41,359	227,852
Urban Local	87,941	151,046	105,505	69,281	413,774
Rural	271,088	390,273	306,551	205,223	1,173,134
Urban	430,132	657,224	481,393	351,395	1,920,144
Daily	701,220	1,047,497	787,944	556,618	3,093,279

Table 4.2.13-4 Modeled Daily Vehicle Miles Traveled for Lincoln County

Roadtype	2011 VMT				
	AM Peak	Midday	PM Peak	Night	Daily
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	22,195	28,329	23,672	15,657	89,853
Rural Minor Arterial	84,959	114,322	89,953	67,859	357,093
Rural Major Collector	52,043	65,943	59,167	37,294	214,447
Rural Minor Collector	55,838	63,517	63,777	33,901	217,034
Rural Local	145,583	206,170	170,591	107,757	630,101
Urban Interstate	0	0	0	0	0
Urban Freeway/Xprway	53,876	61,719	58,072	33,901	207,567
Urban Principal Arterial	20,691	29,879	22,812	17,632	91,014
Urban Minor Arterial	70,719	101,355	77,321	62,636	312,032
Urban Collector	18,136	25,547	21,717	13,427	78,826
Urban Local	42,572	67,734	50,028	35,836	196,170
Rural	360,618	478,282	407,160	262,467	1,508,527
Urban	205,994	286,234	229,950	163,431	885,609
Daily	566,611	764,515	637,111	425,899	2,394,136

Table 4.2.13-5 Modeled Daily Vehicle Miles Traveled for Mecklenburg County

	2011 VMT				
Roadtype	**AM Peak**	**Midday**	**PM Peak**	**Night**	**Daily**
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	39,019	48,052	44,112	28,447	159,630
Rural Minor Arterial	17,385	21,158	20,191	14,002	72,736
Rural Major Collector	17,147	23,317	20,245	10,995	71,703
Rural Minor Collector	33,436	42,220	42,542	21,682	139,880
Rural Local	71,121	97,766	87,184	46,077	302,148
Urban Interstate	1,754,520	2,298,621	1,935,825	1,331,899	7,320,865
Urban Freeway/Xprway	1,126,743	1,416,043	1,301,936	737,037	4,581,758
Urban Principal Arterial	1,127,995	1,707,353	1,307,134	957,919	5,100,400
Urban Minor Arterial	1,041,530	1,578,574	1,221,981	853,518	4,695,603
Urban Collector	818,291	1,227,358	955,651	653,724	3,655,023
Urban Local	1,485,353	2,383,980	1,767,379	1,146,904	6,783,616
Urban HOV	17,709	350	7,719	0	25,779
Rural	1,932,628	2,531,133	2,150,100	1,453,101	8,066,962
Urban	5,617,620	8,313,658	6,561,800	4,349,102	24,842,179
Daily	7,550,248	10,844,790	8,711,900	5,802,203	32,909,141

Table 4.2.13-6 Modeled Daily Vehicle Miles Traveled for Rowan County

	2011 VMT				
Roadtype	**AM Peak**	**Midday**	**PM Peak**	**Night**	**Daily**
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	37,007	46,468	40,573	24,993	149,042
Rural Minor Arterial	22,966	30,614	25,436	18,950	97,966
Rural Major Collector	125,371	146,919	137,718	89,918	499,926
Rural Minor Collector	86,060	95,529	97,392	49,814	328,795
Rural Local	123,743	165,909	142,608	93,259	525,519
Urban Interstate	347,865	426,480	376,690	245,957	1,396,991
Urban Freeway/Xprway	0	0	0	0	0
Urban Principal Arterial	112,663	162,910	127,017	91,044	493,633
Urban Minor Arterial	124,861	188,257	143,574	105,559	562,251
Urban Collector	123,280	171,225	144,491	90,955	529,951
Urban Local	167,456	264,446	196,422	133,382	761,707
Rural	395,147	485,439	443,727	276,934	1,601,248
Urban	876,125	1,213,318	988,194	666,897	3,744,533
Daily	1,271,272	1,698,757	1,431,921	943,831	5,345,781

Table 4.2.13-7 Modeled Daily Vehicle Miles Traveled for Union County

	2011 VMT				
Roadtype	**AM Peak**	**Midday**	**PM Peak**	**Night**	**Daily**
Rural Interstate	0	0	0	0	0
Rural Principal Arterial	67,429	92,044	72,298	51,298	283,068
Rural Minor Arterial	24,128	30,691	27,627	17,621	100,067
Rural Major Collector	240,288	331,491	269,697	187,341	1,028,816
Rural Minor Collector	73,774	94,809	84,943	50,079	303,604
Rural Local	271,260	368,271	317,608	186,236	1,143,375
Urban Interstate	0	0	0	0	0
Urban Freeway/Xprway	22,210	29,263	21,929	15,887	89,288
Urban Principal Arterial	143,552	206,399	158,630	116,266	624,847
Urban Minor Arterial	98,098	148,769	112,990	89,788	449,645
Urban Collector	116,385	167,448	133,737	84,904	502,474
Urban Local	211,159	325,465	248,711	168,798	954,132
Rural	676,878	917,306	772,173	492,574	2,858,931
Urban	591,404	877,343	675,997	475,642	2,620,387
Daily	1,268,282	1,794,649	1,448,171	968,216	5,479,318

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

Table 4.3-1 2011 On-Road Mobile Source NOx & VOC Emissions by County (tons per day)

County	Nonattainment Area Population Fraction	NOx Emissions (tons per day, July weekday)		VOC Emissions (tons per day, July weekday)	
		County-wide	Nonattainment Area	County-wide	Nonattainment Area
Cabarrus	99.2%	11.9475	11.85	6.3709	6.32
Gaston	92.2%	14.5237	13.39	7.5201	6.93
Iredell	39.9%	13.6570	5.45	6.5719	2.62
Lincoln	80.2%	5.3992	4.33	3.1001	2.49
Mecklenburg	100.0%	57.0053	57.01	26.0596	26.06
Rowan	92.9%	11.6091	10.78	6.1813	5.74
Union	86.9%	10.7256	9.32	5.9755	5.19
		Total:	**112.13**	**Total:**	**55.35**

5.0 MOVES INPUT DATA

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

5.1 NORTH CAROLINA'S VEHICLE MIX

5.1.1 2011 State Vehicle Mix

Rural:							
LDV	**LDT1**	**LDT2**	**LDT3**	**LDT4**	**HDV2B**	**HDV3**	**HDV4**
HDV5	**HDV6**	**HDV7**	**HDV8a**	**HDV8b**	**HDBS**	**HDBT**	**MC**
Interstate							
0.3326	0.0884	0.2940	0.0906	0.0417	0.0472	0.0046	0.0039
0.0029	0.0105	0.0125	0.0135	0.0481	0.0038	0.0019	0.0038
Princ. Art.							
0.3497	0.0930	0.3093	0.0953	0.0439	0.0317	0.0031	0.0026
0.0020	0.0071	0.0084	0.0091	0.0324	0.0042	0.0021	0.0061
Minor Art.							
0.3590	0.0954	0.3175	0.0978	0.0450	0.0245	0.0024	0.0020
0.0015	0.0055	0.0065	0.0070	0.0251	0.0035	0.0018	0.0055
Major Collector							
0.3609	0.0959	0.3191	0.0983	0.0453	0.0224	0.0022	0.0018
0.0014	0.0050	0.0059	0.0064	0.0229	0.0037	0.0018	0.0070
Minor Collector							
0.3460	0.0920	0.3060	0.0943	0.0434	0.0324	0.0032	0.0027
0.0020	0.0072	0.0086	0.0093	0.0331	0.0052	0.0026	0.0120
Local							
0.3621	0.0962	0.3201	0.0986	0.0454	0.0198	0.0019	0.0016
0.0012	0.0044	0.0052	0.0057	0.0202	0.0060	0.0030	0.0086
Urban:							
LDV	**LDT1**	**LDT2**	**LDT3**	**LDT4**	**HDV2B**	**HDV3**	**HDV4**
HDV5	**HDV6**	**HDV7**	**HDV8a**	**HDV8b**	**HDBS**	**HDBT**	**MC**
Interstate							
0.3588	0.0954	0.3172	0.0978	0.0450	0.0253	0.0025	0.0021
0.0016	0.0056	0.0067	0.0073	0.0258	0.0032	0.0016	0.0041
Freeway							
0.3575	0.0950	0.3161	0.0974	0.0448	0.0256	0.0025	0.0021
0.0016	0.0057	0.0067	0.0073	0.0261	0.0036	0.0018	0.0062

Princ. Art.							
0.3698	0.0983	0.3270	0.1008	0.0464	0.0157	0.0015	0.0013
0.0010	0.0035	0.0041	0.0045	0.0160	0.0032	0.0016	0.0053
Minor Art							
0.3719	0.0989	0.3290	0.1014	0.0467	0.0139	0.0014	0.0011
0.0009	0.0031	0.0037	0.0040	0.0142	0.0027	0.0014	0.0057
Coll							
0.3747	0.0996	0.3313	0.1021	0.0470	0.0116	0.0011	0.0010
0.0007	0.0026	0.0031	0.0033	0.0119	0.0036	0.0018	0.0046
Local							
0.3590	0.0954	0.3176	0.0979	0.0451	0.0212	0.0021	0.0017
0.0013	0.0047	0.0056	0.0061	0.0216	0.0066	0.0033	0.0108

5.2 METEOROLOGY: 2011 TEMPERATURE AND RELATIVE HUMIDITY

STATE CLIMATE OFFICE OF NORTH CAROLINA
NC CRONOS Database
Data retrieval from Douglas International Airport (KCLT)
Charlotte, Mecklenburg County
Latitude: 35.2140111 Longitude: -80.9431258
Elevation: 748 ft.

Month	Hour	Number of Records Compiled	Average Temp. (F)	Average Relative Humidity (%)
1	0	31	33.9	70
1	1	31	33	72
1	2	31	32.4	73
1	3	31	31.6	75
1	4	31	31	77
1	5	31	31	77
1	6	31	30.8	78
1	7	31	31.6	75
1	8	31	34.8	71
1	9	31	37.9	64
1	10	31	40.8	58
1	11	31	42.9	53
1	12	31	44.2	51
1	13	31	45.6	48
1	14	31	46.5	47

1	15	31	46.4	47
1	16	31	45.1	48
1	17	31	42.1	53
1	18	31	40.4	56
1	19	31	38.8	60
1	20	31	37.9	62
1	21	31	36.7	65
1	22	31	36	65
1	23	31	35.3	67
2	0	27	43.9	62
2	1	27	43.1	64
2	2	27	42.8	66
2	3	27	42.1	67
2	4	27	40.9	69
2	5	27	40.8	69
2	6	27	40.3	71
2	7	27	41.5	69
2	8	27	45.4	62
2	9	27	48.5	55
2	10	27	51.8	49
2	11	27	54.6	45
2	12	27	57.1	41
2	13	27	58.1	39
2	14	27	59.1	37
2	15	27	58.9	37
2	16	28	57.4	38
2	17	28	54.4	42
2	18	28	51.2	48
2	19	28	49.4	52
2	20	28	48.3	54
2	21	27	46.9	58
2	22	27	46.5	60
2	23	27	45.4	62
3	0	31	49.1	66
3	1	31	48.8	67
3	2	31	47.9	68
3	3	31	47.1	71
3	4	31	46.5	72
3	5	31	45.6	73
3	6	31	45.3	74
3	7	31	48.1	70
3	8	31	50.7	65
3	9	31	53.4	60
3	10	31	55.6	56
3	11	31	57.6	52

3	12	31	58.7	51
3	13	31	59.9	49
3	14	31	60.7	48
3	15	31	61.1	48
3	16	31	59.9	49
3	17	31	58.4	51
3	18	31	56.4	54
3	19	30	54	57
3	20	31	53.6	58
3	21	31	52.6	60
3	22	31	52.1	60
3	23	31	50.4	63
4	0	29	58.2	75
4	1	29	57.2	78
4	2	29	56.3	80
4	3	28	55.2	82
4	4	28	54.6	83
4	5	29	54.8	82
4	6	29	56.4	80
4	7	29	59.5	73
4	8	29	62.9	66
4	9	28	66.5	60
4	10	29	68.8	54
4	11	29	70.7	49
4	12	28	72.2	46
4	13	29	73.5	43
4	14	28	74.4	40
4	15	28	74.4	40
4	16	28	73.6	41
4	17	28	71.6	43
4	18	29	68	49
4	19	29	65.6	55
4	20	29	63.2	59
4	21	29	62	62
4	22	29	61.1	65
4	23	29	60	68
5	0	31	64.5	82
5	1	31	63.5	84
5	2	31	62.3	86
5	3	31	61.5	87
5	4	31	60.8	89
5	5	31	61	89
5	6	31	63.8	85
5	7	31	66.5	79
5	8	31	69.5	72

5	9	31	72.4	65
5	10	31	73.9	62
5	11	31	76	58
5	12	32	77.9	55
5	13	32	78.9	52
5	14	32	79.7	50
5	15	31	79.2	51
5	16	31	78.4	53
5	17	31	77	55
5	18	31	74	62
5	19	31	71.5	67
5	20	31	69.9	70
5	21	31	68.4	73
5	22	31	67.1	76
5	23	30	65.8	80
6	0	30	71.4	81
6	1	30	70.6	83
6	2	30	69.7	85
6	3	30	69.2	85
6	4	30	68.3	87
6	5	30	69.4	85
6	6	30	72.8	78
6	7	30	75.8	71
6	8	30	78.4	66
6	9	30	81.6	61
6	10	30	84.1	55
6	11	30	85.5	52
6	12	30	87.3	48
6	13	30	88.5	47
6	14	30	89.1	45
6	15	29	87.4	47
6	16	30	86.8	49
6	17	30	84.4	53
6	18	30	81.6	59
6	19	30	78.6	66
6	20	30	75.8	72
6	21	30	74.7	73
6	22	30	73.5	76
6	23	30	71.8	81
7	0	31	75.5	82
7	1	31	74.9	83
7	2	31	74.2	84
7	3	31	73.1	88
7	4	31	72.9	87
7	5	31	73.1	88

7	6	31	76	83
7	7	31	79.3	75
7	8	31	81.8	70
7	9	31	84.3	65
7	10	31	86.9	59
7	11	31	88.6	55
7	12	31	89.5	53
7	13	31	90	51
7	14	31	90.7	50
7	15	31	90	51
7	16	31	88.1	54
7	17	31	86.6	57
7	18	31	83.7	63
7	19	31	81.3	68
7	20	31	79.6	72
7	21	31	78.9	74
7	22	31	77.2	79
7	23	30	75.8	82
8	0	31	73	81
8	1	31	72	84
8	2	31	71.6	85
8	3	31	71.4	85
8	4	31	70.5	87
8	5	31	70.2	87
8	6	31	72.8	84
8	7	31	76.5	75
8	8	31	79.8	68
8	9	31	82.3	63
8	10	31	84.5	58
8	11	31	86.4	54
8	12	31	87.2	51
8	13	31	88.5	49
8	14	31	88.9	48
8	15	31	87.9	49
8	16	31	86.8	51
8	17	31	84.9	54
8	18	31	81.5	62
8	19	31	79.3	65
8	20	31	77.5	69
8	21	31	76.4	72
8	22	31	75.1	74
8	23	31	74	78
9	0	30	66.5	86
9	1	30	65.9	88
9	2	30	65.7	89

9	3	30	65	90
9	4	30	64.9	90
9	5	30	64.5	90
9	6	30	65.6	89
9	7	29	68.6	84
9	8	30	71.6	76
9	9	30	74.1	70
9	10	30	76.4	65
9	11	30	77.7	62
9	12	30	78.9	60
9	13	30	79.7	56
9	14	30	80	55
9	15	30	79.8	55
9	16	30	79	56
9	17	30	76.8	60
9	18	30	72.4	71
9	19	30	71.6	71
9	20	30	69.6	76
9	21	30	68.6	78
9	22	30	66.7	84
9	23	30	66.5	85
10	0	31	53.3	79
10	1	31	52.9	80
10	2	31	51.8	82
10	3	31	51	83
10	4	31	50.7	84
10	5	31	50.2	84
10	6	31	50.2	85
10	7	31	54.6	79
10	8	31	59.1	67
10	9	31	63	58
10	10	30	65.3	53
10	11	31	67.4	49
10	12	31	68.7	47
10	13	31	69.7	45
10	14	31	69.8	44
10	15	31	69	46
10	16	31	67.3	48
10	17	31	63.3	56
10	18	31	59.4	65
10	19	31	58.6	66
10	20	31	57.2	69
10	21	31	56.2	72
10	22	31	54.6	75
10	23	31	53.5	78

11	0	30	47.4	81
11	1	30	47	81
11	2	30	46.1	84
11	3	30	45.5	85
11	4	30	45.1	85
11	5	30	45.2	85
11	6	30	44.3	86
11	7	30	47.4	83
11	8	30	51.9	75
11	9	30	55.8	66
11	10	30	58.8	59
11	11	30	60.8	55
11	12	30	62.3	52
11	13	30	63.4	50
11	14	30	63.3	50
11	15	30	62.5	52
11	16	30	60.4	54
11	17	29	57.6	61
11	18	30	55.6	64
11	19	30	54.2	67
11	20	30	53	69
11	21	30	51.4	73
11	22	30	50	75
11	23	30	48	80
12	0	31	44.4	78
12	1	31	43.9	79
12	2	31	43.3	80
12	3	31	42.7	81
12	4	31	42.5	82
12	5	31	41.9	82
12	6	31	41.7	82
12	7	31	42.1	83
12	8	31	46	76
12	9	31	49.8	68
12	10	31	52.6	62
12	11	31	54.6	59
12	12	31	56	56
12	13	31	57.2	55
12	14	31	57.7	54
12	15	31	56.8	55
12	16	31	55.2	58
12	17	31	52.1	64
12	18	31	51.2	65
12	19	31	49.3	69
12	20	31	48.9	68

12	21	31	47.3	71
12	22	31	47	72
12	23	31	46.1	74

Appendix B.4

Nonroad Mobile Sources
Emission Inventory Documentation

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List of Tables

1. INTRODUCTION AND SCOPE

Nonroad mobile sources are equipment that can move but are not licensed to use public roads and highways. The nonroad mobile source category includes a diverse collection of equipment such as lawn mowers, chain saws, tractors, all terrain vehicles, forklifts, and construction equipment. The majority of the emissions from this equipment are calculated using the NONROAD2008a model developed by the United States Environmental Protection Agency (EPA). This category also includes aircraft, railroad locomotives, and commercial marine vessels. No commercial marine vessels operate in Cabarrus, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, or Union counties so none are reported. Aircraft emissions, traditionally a nonroad category, are reported as point sources (see Appendix B.1) in keeping with the EPA practice for the National Emissions Inventory (NEI) where they are reported to occur at the locations of the airports where they are generated. Emissions from railroad locomotives operating at rail yards are now also reported as point sources since they occur at a fixed location (see Appendix B.1).

For this Charlotte marginal ozone nonattainment area inventory, emissions of oxides of nitrogen (NOx) and volatile organic compounds (VOC) are reported for the base year of 2011. Reported values developed from NONROAD2008a data are stated in tons per July day. Emissions from railroads are stated in tons per day. All emissions reported here from the 2011 NEI version 1.

2. OVERALL METHODOLOGY

2.1 SOURCE CATEGORY IDENTIFICATION

Nonroad mobile sources were identified from the EPA guidance document EPA-450/4-91-016, *Procedures for the Preparation of Emissions Inventories for Carbon Monoxide and Precursors of Ozone* (Procedures document). Nonroad mobile source emissions were estimated by the methodologies suggested in the EPA document, EPA-454/R-05-001, *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations*; EPA-450/4-81-026d (Revised) *Procedures for Emission Inventory Preparation, Volume IV; Mobile Sources* (Mobile Source Procedures); from the EPA's nonroad mobile model NONROAD2008a released July 6, 2009; and from the Emissions and Dispersion Modeling System 5.1 (EDMS 5.1) model developed by the EPA and the Federal Aviation Administration (FAA).

2.2 EMISSION ESTIMATION APPROACH

For this inventory, the starting point was version 1 of the 2011 NEI. Reports of emissions for railroads (including rail yards) and aircraft at airports were downloaded from the NEI at the

EPA's Emission Inventory System Gateway (EIS Gateway). The North Carolina NONROAD model output was obtained from an EPA file transfer protocol (FTP) site (ftp://ftp.epa.gov/EmisInventory/2011v6/v1platform/2011emissions/nonroad_by_state/).

Since airports and railyards have a fixed location their map coordinates were used to determine if they are inside or outside the partial county nonattainment areas. Those inside the nonattainment areas were then summarized at the county level and the values reported in the point emissions inventory (see Appendix B.1).

Emissions for the NONROAD model equipment categories and for railroad locomotive emissions on railroad tracks (i.e. other than rail yards) were obtained at the county level. Since parts of all but one of the nonattainment counties are classified as attainment, the population fraction that is in the nonattainment part of the county was used to determine the emissions for the nonattainment part. More information about the population fractions may be found in the narrative.

The *2011 National Emission Inventory, version 1 Technical Support Document*, found at http://www.epa.gov/ttn/chief/net/2011inventory.html#inventorydoc, should be consulted for additional information about inventory development.

3. QUALITY ASSURANCE MEASURES

Since the nonroad inventory emissions originated from the EPA's 2011 NEI version 1, they were developed with the NEI quality assurance measures. Documentation of the EPA's quality assurance measures and additional information about the 2011 NEI may be found at http://www.epa.gov/ttn/chief/net/2011inventory.html#inventorydoc and in the *2011 National Emission Inventory, version 1 Technical Support Document*.

Once inventory data was gathered from the EPA it was summarized for the tables produced in the following pages. Summaries and calculations were performed using Access databases and Excel files. These files were examined by a person not involved in their production. No problems were identified.

4. EMISSIONS AND DETAILED METHODOLOGY

4.1 TOTAL NONROAD EMISSIONS

Emissions of nonroad sources reported as nonroad emissions are shown in Table 4.1-1 below. Airport emissions (aircraft and ground support equipment) and rail yard emissions are reported in the point source appendix. The asterisk (*) indicates a partial county.

Table 4.1-1 Total All Nonroad (tons/day)

County	NOX	VOC
Cabarrus*	2.43	1.62
Gaston*	2.30	1.83
Iredell*	0.96	0.84
Lincoln*	0.88	0.83
Mecklenburg	16.31	14.76
Rowan*	1.94	1.96
Union*	3.93	2.56
Total	**28.75**	**24.40**

4.2 CATEGORIES FROM THE NONROAD MODEL

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

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

The eleventh category, aircraft ground support equipment, was not calculated with the NONROAD model because the method of calculation performed by EDMS 5.1 (also used for aircraft emissions) was judged to be superior. Additionally, the emissions are estimated for five different engine types, these include: 2-stroke and 4-stroke spark ignition engines, diesel engines, liquid propane gas and compressed natural gas fueled engines.

The NONROAD2008a model was run by the EPA within the National Mobile Inventory Model (NMIM) as it simplifies the calculation process when emissions for a large number of counties are calculated at the same time. This latest version of the model was released to the public on July 6, 2009.

NONROAD2008a is the latest release of the EPA NONROAD model that was first released in June 2000, and incorporates many revisions to improve the model's predictive ability. This model revision accounts for emission reductions from the Diesel Recreational Marine standards in the Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder final rule published in the Federal Register (FR) (73 FR 25098) and the Small Spark Ignition Engines and Spark Ignition Recreational Marine Engines final rule (73 FR 59034).

There are a number of additional improvements including the ability to model the effects of ethanol blends on fuel tank and hose permeation losses.

Instead of options files (wherein all the modeling variables are set) used in the NONROAD2008a model when run by itself, NMIM uses relational database files that specify temperatures and fuel properties to be used for each county for each month of the year. The EPA developed fuel specifications for all counties and months for North Carolina. For Mecklenburg and Gaston Counties for July, the gasoline RVP was 8.71, the ethanol percent was 10 and the ethanol market share was 0.91. For the other counties the RVP was 9.61, the ethanol percent was 10, and the ethanol market share was 0.91. For all counties, nonroad gasoline sulfur was 30 parts per million and nonroad diesel sulfur was 31 parts per million. The seasonal file for the model was modified to place North Carolina in the Southeast states group rather than the Mid-Atlantic group. This change was made because the North Carolina Division of Air Quality (DAQ) had reviewed temperature data for North Carolina compared to states in the Southeast and the Mid-Atlantic. The results of this comparison indicated that North Carolina temperatures are more in-line with the Southeast States.

The nonroad results file for North Carolina posted by the EPA at ftp://ftp.epa.gov/EmisInventory/2011v6/v1platform/2011emissions/nonroad_by_state/ was downloaded and placed in an ACCESS database file for manipulation. The emissions data was reported by county, equipment type, and pollutant with annual values and monthly values. A file of source classification codes (SCC) for each of the equipment categories was produced and used for grouping the emissions of NOx and VOC by county and equipment category for the month of July. Division by 31 produced daily emissions values which were then adjusted by the population fraction in the nonattainment portions of the counties.

The summary of the model results expressed in tons emitted per typical July day are tabulated in Table 4.2-1 through Table 4.2-10. Emissions shown for all but Mecklenburg County are those for the nonattainment portion and are marked with an asterisk (*).

Table 4.2-1 Agricultural Equipment (tons/day)

County	NOX	VOC
Cabarrus*	0.14	0.02
Gaston*	0.06	0.01
Iredell*	0.12	0.01
Lincoln*	0.10	0.01
Mecklenburg	0.03	0.00
Rowan*	0.24	0.03
Union*	0.50	0.06
Total	**1.19**	**0.14**

Table 4.2-2 Commercial Equipment (tons/day)

County	NOX	VOC
Cabarrus*	0.14	0.20
Gaston*	0.15	0.20
Iredell*	0.07	0.10
Lincoln*	0.04	0.06
Mecklenburg	1.83	2.56
Rowan*	0.09	0.12
Union*	0.17	0.26
Total	**2.49**	**3.50**

Table 4.2-3 Construction and Mining Equipment (tons/day)

County	NOX	VOC
Cabarrus*	1.15	0.17
Gaston*	0.78	0.11
Iredell*	0.44	0.06
Lincoln*	0.25	0.04
Mecklenburg	9.86	1.42
Rowan*	0.34	0.05
Union*	1.79	0.26
Total	**14.61**	**2.11**

Table 4.2-4 Industrial Equipment (tons/day)

County	NOX	VOC
Cabarrus*	0.29	0.06
Gaston*	0.49	0.10
Iredell*	0.17	0.03
Lincoln*	0.14	0.03
Mecklenburg	1.28	0.24
Rowan*	0.38	0.08
Union*	0.34	0.07
Total	**3.09**	**0.61**

Table 4.2-5 Lawn and Garden Equipment (Commercial) (tons/day)

County	NOX	VOC
Cabarrus*	0.19	0.70
Gaston*	0.12	0.42
Iredell*	0.02	0.06
Lincoln*	0.04	0.13
Mecklenburg	1.72	6.18
Rowan*	0.04	0.15
Union*	0.33	1.22
Total	**2.46**	**8.86**

Table 4.2-6 Lawn and Garden Equipment (Residential) (tons/day)

County	NOX	VOC
Cabarrus*	0.04	0.42
Gaston*	0.06	0.51
Iredell*	0.02	0.16
Lincoln*	0.02	0.16
Mecklenburg	0.25	2.25
Rowan*	0.04	0.37
Union*	0.03	0.33
Total	**0.46**	**4.20**

Table 4.2-7 Logging Equipment (tons/day)

County	NOX	VOC
Cabarrus*	0.00	0.00
Gaston*	0.00	0.00
Iredell*	0.00	0.00
Lincoln*	0.00	0.00
Mecklenburg	0.01	0.00
Rowan*	0.01	0.01
Union*	0.00	0.00
Total	**0.02**	**0.01**

Table 4.2-8 Railway Maintenance (tons/day)

County	NOX	VOC

Cabarrus*	0.00	0.00
Gaston*	0.00	0.00
Iredell*	0.00	0.00
Lincoln*	0.00	0.00
Mecklenburg	0.00	0.00
Rowan*	0.00	0.00
Union*	0.00	0.00
Total	**0.00**	**0.00**

Table 4.2-9 Recreational Equipment (tons/day)

County	NOX	VOC
Cabarrus*	0.00	0.00
Gaston*	0.01	0.29
Iredell*	0.01	0.24
Lincoln*	0.01	0.24
Mecklenburg	0.06	1.53
Rowan*	0.03	0.84
Union*	0.01	0.27
Total	**0.13**	**3.41**

Table 4.2-10 Recreational Marine (tons/day)

County	NOX	VOC
Cabarrus*	0.00	0.02
Gaston*	0.03	0.16
Iredell*	0.03	0.18
Lincoln*	0.03	0.15
Mecklenburg	0.09	0.52
Rowan*	0.05	0.27
Union*	0.01	0.05
Total	**0.24**	**1.35**

4.3 RAILROAD LOCOMOTIVES

Freight railroad companies are categorized by size (Class I, Class II, or Class III). There are also passenger service railroads. Class I railroad companies are long-haul operations, consisting of Norfolk Southern Corporation and CSX Corporation. Class II and Class III railroad companies

are short lines serving localized markets. Amtrak and the North Carolina Department of Transportation (NCDOT) Rail Division provide passenger service.

Railroad locomotive emissions for classes I, II, and III plus rail yards were calculated for all of North Carolina for 2008 as part of the Eastern Regional Technical Advisory Committee (ERTAC) railroad emission inventory developed for the 2008 NEI. Some of the details of the ERTAC work are based on proprietary information provided by the railroad companies. The calculation methodologies followed procedures acceptable to the EPA. Additional detail can be found in *Documentation for Locomotive Component of the National Emissions Inventory Methodology*, ERG No.: 0245.03.402.001, Contract No.: EP-D-07-097. The 2008 emissions were then grown to 2011 values as described in the *2011 National Emission Inventory, version 1 Technical Support Document*.

Passenger railroad emissions were developed by the DAQ for 2011. This was done using information supplied by the NCDOT Rail Division, maps of rail links and their lengths provided by the EPA (Federal Railway Administration data), and emission factors from *Emission Factors for Locomotives*, EPA-420-F-09-025. These 2011 emissions were added to the 2011 NEI to supplement the grown ERTAC estimates reported by the EPA. This was done for Amtrak routes and for the trains run by the NCDOT.

Reports of railroad emissions in the 2011 NEI were downloaded from the EPA's EIS Gateway web site. Emissions at rail yards operating in the nonattainment area (identified by map coordinates) were separated, summarized, and reported in the point source inventory (see Appendix B.1). Emissions from the class I, II, and III railroads plus the passenger railroad emissions in the nonattainment counties were summarized, adjusted to ton per day values, and then adjusted by county population fraction in the nonattainment portion. Railroad emissions are shown in table 4.3-1 below. Partial county emissions are indicated with *.

Table 4.3-1 Railroads (tons/day)

County	NOX	VOC
Cabarrus*	0.48	0.03
Gaston*	0.60	0.03
Iredell*	0.08	0.00
Lincoln*	0.25	0.01
Mecklenburg	1.18	0.06
Rowan*	0.72	0.04
Union*	0.75	0.04
Total	**4.06**	**0.21**