Appendix C
On-road Mobile Source Inventory Documentation

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1.0 INTRODUCTION AND SCOPE

The on-road mobile source inventory detailed in this section has been developed for the Rock Hill-Fort Mill Area Transportation Study (RFATS) Metropolitan Planning Organization (MPO) portion of York County, South Carolina within the Charlotte-Gastonia-Rock Hill, NC-SC nonattainment area (the York NA area) for the 1997 8-hour ozone NAAQS Redesignation Demonstration and Maintenance Plan. On-road mobile sources were identified from the United States Environmental Protection Agency (EPA) highway mobile model, MOVES2010a. On-road mobile sources consist of cars, trucks, and motorcycles that travel on the main roads and interstates.

Although the South Carolina Department of Health and Environmental Control (SCDHEC or Department) Bureau of Air Quality (BAQ) inventories all the criteria pollutants and a large number of toxic pollutants, only the nitrogen oxides (NO_x) and volatile organic compounds (VOC) are reported here since they are important for ozone formation. The emissions in this report were projected to the years 2010 (the base year), 2013, 2016, 2019, and 2022.

2.0 EMISSION ESTIMATION APPROACH

Mobile source emissions are estimated by the methodologies suggested in the EPA document 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), hereafter referred to as the Technical Guidance document.

For on-road mobile sources, the EPA mobile model MOVES2010a is used to generate emissions. The estimation of emissions from mobile sources involves multiplying an activity level by an emission factor. MOVES2010a is a computer model designed to estimate emission factors and emission inventories of VOCs, NO_x, CO, PM_{10}, $PM_{2.5}$ and other pollutants and precursors for cars, trucks, buses, and motorcycles. MOVES2010a, released in August 2010, was designed to replace the previous emissions model, MOBILE6.2, which was released in 2004 (69 FR 28830). MOVES2010a replaces MOBILE6.2 as the emissions model that EPA will maintain and support. MOVES2010a can be used to estimate exhaust and evaporative emissions as well as brake and tire wear emissions from all types of on-road vehicles.

3.0 QUALITY ASSURANCE MEASURES

The quality analysis (QA) for the on-road mobile source category can be broken into three components: 1) inputs, 2) MOVES2010a run specification (runspec), and 3) MOVES2010a output. Each of these components is detailed in the paragraphs below.

In all cases, input information being used for the MOVES2010a runs were not received in MOVES2010a format. Anytime data had to be manipulated to get it into the proper format, the final data was compared back to the original data to make sure there were no errors made and the values are represented correctly in the input files.

After the speed and vehicle miles traveled (VMT) information was acquired from the Charlotte Department of Transportation (CDOT), the data was checked for reasonableness against previous years' data for the area, where possible. The base year (2010) VMT was compared to actual whole county VMT data. Also, each year's estimated annual VMT was compared to each other to make sure they were all reasonable and consistent and no errors were made in generating the inputs. The speeds were all reviewed to make sure they were consistent with the road type and time of day.

Once the input files were prepared, a staff member not responsible for generating the inputs spot checked some of the files to make sure they looked reasonable and the values added up properly. This was especially helpful in reviewing the average speed distribution inputs as the development of the files was very tedious and errors could easily occur. If any discrepancies were found, they were noted back to the person who generated the input files for correction.

Since more than one staff member was responsible for doing the MOVES2010a runs, a template was created that outlined all selections and steps that needed to be included in the runspecs. This ensured consistency in the runspecs.

Once MOVES2010a was run, the output results were compared to each other to make sure they looked consistent. A couple of the years were run by more than one person to make sure the same output emissions were received.

A final QA step is to check the kilograms per day (kg/day) emissions developed using the input data and compare this to previous years to check for reasonableness.

4.0 DISCUSSION OF MOBILE SOURCE CATEGORIES

On-road mobile sources produce VOCs and NO_x, along with a host of other pollutants. Emissions of NO_x and VOC are estimated in the mobile source inventory required for the maintenance plan. The objective of the following section is to describe the source category and the emissions estimation procedures. This section also includes tables summarizing the estimated emissions for a typical July day for the York NA area.

4.1 Introduction and Scope

On-road mobile sources are considered those vehicles that travel on the roadways. Emissions from motor vehicles occur throughout the day while the vehicle is in motion, at idle, parked, and during refueling. All of these emissions processes need to be estimated in order to properly reflect the total emissions from this source category. It is important to note that emissions from vehicle refueling (Stage 2 refueling emissions) and spillage loss during refueling emissions are accounted for in the Area source portion of the inventory and are not included in the MOVES2010a runs.

The EPA developed the MOVES2010a model to estimate emissions based on more current information on the way vehicles are driven in a particular area. Key inputs for MOVES2010a include information on the age of vehicles on the roads, the average speed of those vehicles, what types of roads those vehicles are traveling, and any control technologies in place in an area to reduce emissions for motor vehicles (e.g., emissions inspection programs), temperature, and humidity data.

A very important component of the on-road mobile emissions estimation process is interagency consultation. The South Carolina interagency consultation partners involved in the development of the redesignation request and maintenance plan include EPA Region 4, South Carolina Department of Transportation (SCDOT), Federal Highways (FHWA), Federal Transit Authority (FTA), SCDHEC and the RFATS MPO. The interagency consultation partners consult on MOVES2010a modeling inputs as well as issues concerning the motor vehicle emission budgets (MVEBs) through monthly conference calls and via email.

4.2 MOVES2010a Runs

Runspecs and inputs were developed using the EPA's Technical Guidance document as guidance. Due to the size and the complexity of the MOVES2010a input and output files, the MOVES2010a input files and output files will be provided electronically. A complete listing of these files is referenced in Section 5.0.

4.2.1 Runspec Selections

In order to use MOVES 2010a to develop emissions for SIP purposes, certain criteria had to be met in selections made in the runspec. The following are selections made for each tab of the runspec:

<u>Scale:</u>

Domain/Scale= County

Calculation Type= Inventory

<u>Time Spans:</u>

Time Aggregation Level= Hour

Years= 2010 (Base Year); this was changed for successive runs to represent 2013, 2016, 2019, & 2022

Months= July (To represent an average summer month)

Days= Weekdays (Recommended for SIPs in the Technical Guidance document)

Hours= Start Hour= 00:00-00:59 End Hour= 23:00-23:59 (This represents all 24 hrs in a day)

<u>Geographic Bounds:</u>

York County, South Carolina

Domain Input Database appears at the bottom of this tab and provides access to the County Data Manager, where the actual York County specific inputs were imported for each run. These county specific inputs will be discussed in detail later in this document.

Vehicles/Equipment- Onroad Vehicle Equipment:

Gasoline and Diesel combinations with all source use types were selected (26 total fuel/source use type selections).

The Technical Guidance document indicates 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. It was confirmed that there are no transit buses using CNG in the nonattainment portion of York County, so CNG transit buses were not selected.

Road Type:

All 5 road types were selected.

The Technical Guidance document indicates 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 hydrocarbons).

Pollutants/processes:

All processes for total gaseous hydrocarbons, non-methane hydrocarbons, VOC and NO_x have been selected, except refueling and spillage emissions, since these are already captured in our area source inventory.

Strategies- Alternative vehicle fuels and technologies:

Since no CNG transit buses are present in our modeled area, the MOVES2010a default FuelEngFraction table was amended to shift all the VMT assigned to CNG buses to diesel transit vehicles. This amended file was imported to replace the default file in MOVES2010a.

Output- General Output:

Units: Mass units= Kilograms

Units: Energy units= Million BTU

Units: Distance units= Miles

Activity: ‘Population’ and ‘Distance Traveled’ were selected, as recommended by the Technical Document.

Kilograms have been selected because kg/day has been used since the RFATS Attainment Demonstration was originally submitted in 2007.

Output- Output Emission Detail:

Always: 24-Hour Day and County were selected.

For all vehicle equipment categories: No selections were made.

On Road: No selections were made.

Advanced Performance Features**:**

No selections were made.

4.2.2 Input Assumptions For MOVES2010a

Source Type Population

To develop source type population data, SCDHEC obtained a July 31, 2010, snapshot of vehicle population for the whole York County from the South Carolina Department of Motor Vehicles (SCDMV). This population data was not broken out by the MOVES2010a source type categories. Passenger vehicles and motorcycles were the only MOVES2010a source types that could be distinguished from all other vehicles. As the Technical Guidance document indicates, the 2010 default York County source type population data was exported from MOVES2010a and used to help apportion the actual vehicle type population. Using the ratio of MOVES2010a passenger cars and passenger trucks to each other, the actual York County passenger vehicle population was separated into passenger cars and passenger trucks. For the remaining non-passenger and non-motorcycle sources, the MOVES2010a ratio of each was calculated against all non passenger and non-motorcycle population. This ratio was then multiplied by the remaining actual York population (after the passenger cars, passenger trucks, and motorcycle populations had been subtracted). This methodology created MOVES2010a-ready source type population values for all of York County, but this effort is only dealing with the York NA area.

The ratio of the York NA area population to the county population was used to estimate emissions for the York NA area. Table 4.2-1 contains the 2005 population for York County. The York NA area population was determined from the RFATS MPO 2005 Baseline Socio-Economic Data (submitted to Charlotte in 2006). Using this data, the estimated York NA area population is 153,900, and 75.8 percent of York County's population is in the York NA area. This percentage was used to allocate the county-level emissions to the York NA area.

Table 4.2-1: Population Data

Population of York County	203,054
Population of York NA area	153,900
Percentage of Population in York NA area	75.8

Once the base year source type population was generated, the future year files for 2013, 2016, 2019, and 2022 needed to be estimated. The SCDMV was not able to provide future year vehicle population data, nor did they have any suggestions on expected annual growth in vehicle population values. In order to get an estimate of average annual vehicle population growth, SCDHEC collected two years of historical York County vehicle population data, 2004 and 2010. Using these two years the average annual increase percentage was calculated (Table 4.2-2). This data was used to grow the population for 2013, 2016, 2019, and 2022.

Table 4.2-2: Vehicle Average Annual Increase Percentage

2004	2010	# vehicles increased over 6 years	% increase from 2004	Avg annual increase over 6 years	Increase for a 3 yr period
167,235	197,331	30,096	17.99%	2.99%	8.97% or 0.0897

Note that the 2004 population data was obtained from the SC Statistical Abstract, found online at http://abstract.sc.gov/. This value includes all population data, even some categories that represent non-motorized vehicles. In order to compare the 2004 data to the 2010 data, the non-motorized vehicles were added back into the 2010 total population for this comparison only. The non-motorized vehicles are excluded in the source type population inputs for MOVES2010a. This growth analysis indicates an average 3 year growth rate of 8.97 percent or 0.0897. The base year 2010 source type population as multiplied by 1.0897 to generate the 2013 estimates. This was continued until all future years were calculated, as outlined in the following table:

Table 4.2-3: Vehicle Population Growth

Year Id	Source Type	Source Type Population	3yr adjustment ratio	2013 Source Type Population	2016 Source Type Population	2019 Source Type Population	2022 Source Type Population
2010	11	4,758	1.0897	51,85	5,650	6,157	6,709
2010	21	59,890	1.0897	65,263	71,117	77,496	84,447
2010	31	45,181	1.0897	49,233	53,650	58,462	63,706
2010	32	23,752	1.0897	25,883	28,205	30,735	33492
2010	41	121	1.0897	132	144	157	171
2010	42	63	1.0897	69	75	82	89
2010	43	822	1.0897	896	976	1,064	1,159
2010	51	70	1.0897	76	83	90	98
2010	52	4,760	1.0897	5,187	5,652	6,159	6,711
2010	53	612	1.0897	667	726	792	863
2010	54	1,101	1.0897	1,199	1,307	1,424	1,552
2010	61	1,015	1.0897	1,106	1,205	1,313	1,431
2010	62	1,214	1.0897	1,323	1,442	1,571	1,712

Vehicle Type VMT

Daily weekday VMT and speed data was obtained from CDOT (see Table 4.2-4). The CDOT data was used to compile the average daily VMT by MOVES2010a road type. VMT was distributed to the MOVES2010a source types according to the distribution in SCDOT's 2009 Functional Class Annual Report. To convert the daily VMT data to an annual value, which is required by MOVES2010a, the EPA's aadvmtcalculator_hpms.xls VMT converter tool was used. This tool used default monthly, daily, and hourly ratios to create an annual VMT profile from an average daily profile. The resulting files (filenames hpmsvtypeyear, monthvmtfraction, and dayvmtfraction) were exported from the converter tool and used in the MOVES2010a modeling. The MOVES2010a default table with filename hourvmtfraction was exported from MOVES2010a and used for each applicable year. 2016 is a leap year and it was confirmed that the converter tool did use leap year fractions tables to estimate the annual VMT for this year.

Table 4.2-4: York County Nonattainment Area VMT and Speed Data Provided by the Charlotte Department of Transportation

	AM Peak		Midday		PM Peak		Night		DAILY	
2010	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMTassn**	**Spd**
Rural Interstate	241,701	57	281,780	66	267,887	58	156,450	65	947,818	61
Rural Principal Art.	24,294	38	26,126	54	26,639	40	11,906	58	88,965	44
Rural Minor Art.	69,492	36	91,390	38	78,222	33	57,184	46	296,287	37
Rural Major Collect.	64,730	40	84,868	45	74,449	39	48,555	49	272,602	43
Rural Minor Collect.	8,071	20	10,251	22	9,026	14	5,439	31	32,787	19
Rural Local	86,802	27	126,624	27	105,812	28	64,874	27	384,112	27
Urban Interstate	224,233	56	266,933	63	249,241	59	147,122	63	887,529	60
Urban Frwy/Exprwy	22,100	41	34,213	43	25,670	40	16,112	45	98,095	42
Urban Principal Art.	198,097	30	292,454	34	225,320	29	167,218	40	883,089	32
Urban Minor Art.	178,520	30	268,069	33	207,788	29	153,477	40	807,853	32
Urban Collector	62,067	24	91,957	24	73,342	18	41,627	33	268,993	23
Urban Local	157,506	24	264,677	24	186,802	24	133,773	25	742,758	24
Rural	495,089		621,039		562,036		344,408		2,022,572	
Urban	842,523		1,218,304		968,162		659,330		3,688,318	
County	1,337,612		1,839,342		1,530,198		1,003,738		5,710,890	

	AM Peak		Midday		PM Peak		Night		DAILY	
2013	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMTassn**	**Spd**
Rural Interstate	249,203	56	292,919	66	275,743	56	162,092	66	979,956	60
Rural Principal Art.	25,604	36	27,496	53	28,117	38	12,952	58	94,169	43
Rural Minor Art.	74,079	35	97,224	37	82,489	33	60,708	45	314,500	37

Rural Major Collect.	68,746	40	89,600	45	78,067	40	51,077	49	287,491	43
Rural Minor Collect.	8,745	19	11,227	23	9,490	16	5,835	32	35,297	20
Rural Local	87,156	27	125,865	27	106,525	28	65,015	27	384,561	27
Urban Interstate	226,182	55	270,736	63	249,087	59	149,450	63	895,455	60
Urban Frwy/Exprwy	22,362	41	34,893	43	26,040	40	16,355	45	99,650	42
Urban Principal Art.	217,649	30	316,907	34	248,785	29	183,665	40	967,006	32
Urban Minor Art.	181,022	30	268,247	34	211,107	29	152,177	40	812,554	32
Urban Collector	63,214	25	90,797	25	74,981	19	41,714	33	270,706	23
Urban Local	159,900	24	265,963	24	189,537	24	135,297	25	750,697	24
Rural	513,533		644,331		580,431		357,678		2,095,974	
Urban	870,330		1,247,543		999,537		678,658		3,796,068	
County	1,383,863		1,891,874		1,579,968		1,036,336		5,892,041	

	AM Peak		**Midday**		**PM Peak**		**Night**		**DAILY**	
2016	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMTassn**	**Spd**
Rural Interstate	257,736	56	310,089	66	285,474	55	169,159	66	1,022,457	60
Rural Principal Art.	26,997	35	31,546	51	30,147	35	14,185	58	102,875	41
Rural Minor Art.	74,974	36	97,675	38	83,568	33	60,842	45	317,059	37
Rural Major Collect.	72,255	39	94,812	44	81,571	38	54,719	49	303,356	42
Rural Minor Collect.	9,094	18	11,747	22	9,839	16	6,089	32	36,768	20
Rural Local	89,483	27	128,595	27	109,770	28	66,935	27	394,782	27
Urban Interstate	232,891	56	284,716	63	256,266	58	156,166	63	930,039	60
Urban Frwy/Exprwy	23,269	41	36,981	43	27,250	40	17,078	45	104,578	42
Urban Principal Art.	218,268	30	320,130	34	250,038	28	187,695	40	976,132	32
Urban Minor Art.	179,631	30	266,258	34	208,632	29	152,350	40	806,871	32
Urban Collector	65,480	26	94,180	27	78,780	20	41,407	33	279,848	25
Urban Local	167,886	23	277,055	24	199,378	24	140,395	25	784,713	24
Rural	530,538		674,463		600,368		371,928		2,177,297	
Urban	887,425		1,279,321		1,020,344		695,091		3,882,181	
County	1,417,963		1,953,784		1,620,712		1,067,019		6,059,478	

	AM Peak		**Midday**		**PM Peak**		**Night**		**DAILY**	
2019	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMTassn**	**Spd**
Rural Interstate	269,281	54	328,319	66	297,646	53	178,311	66	1,073,557	58
Rural Principal Art.	27,776	35	33,408	50	30,874	35	14,947	58	107,005	41
Rural Minor Art.	78,675	36	102,522	37	87,434	32	63,594	45	332,226	36

Rural Major Collect.	76,613	38	101,276	43	86,615	37	58,569	49	323,074	41
Rural Minor Collect.	9,488	17	12,475	21	10,505	16	6,376	33	38,843	19
Rural Local	94,801	27	136,960	27	116,785	28	71,479	27	420,025	27
Urban Interstate	241,799	54	299,429	63	266,577	57	163,579	63	971,385	59
Urban Frwy/Exprwy	24,346	40	38,622	42	28,348	39	17,840	45	109,156	41
Urban Principal Art.	227,988	29	334,876	33	260,698	27	197,307	40	1,020,869	31
Urban Minor Art.	190,412	30	279,969	33	220,218	28	160,360	40	850,959	32
Urban Collector	69,833	25	100,339	27	83,841	20	44,717	33	298,729	25
Urban Local	177,870	23	293,013	24	210,727	24	148,467	25	830,078	24
Rural	556,635		714,960		629,860		393,275		2,294,729	
Urban	932,248		1,346,247		1,070,410		732,270		4,081,175	
County	1,488,882		2,061,207		1,700,270		1,125,545		6,375,905	

	AM Peak		**Midday**		**PM Peak**		**Night**		**DAILY**	
2022	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMT**	**Spd**	**VMTassn**	**Spd**
Rural Interstate	279,264	51	345,159	66	308,270	50	187,484	66	1,120,177	57
Rural Principal Art.	28,145	32	33,530	47	31,260	32	15,147	55	108,083	38
Rural Minor Art.	82,315	35	107,084	37	90,921	31	66,434	45	346,754	36
Rural Major Collect.	80,522	37	106,955	42	91,114	36	61,905	48	340,496	40
Rural Minor Collect.	9,952	17	13,108	20	11,038	15	6,898	25	40,996	18
Rural Local	101,266	27	145,909	27	124,398	27	76,013	27	447,586	27
Urban Interstate	251,027	53	314,121	63	276,377	55	171,873	63	1,013,398	58
Urban Frwy/Exprwy	25,604	39	40,218	42	29,494	38	18,417	44	113,733	41
Urban Principal Art.	236,594	28	346,840	32	271,332	27	204,410	39	1,059,176	31
Urban Minor Art.	201,312	29	294,954	32	231,712	27	169,331	39	897,308	31
Urban Collector	74,295	25	106,250	26	88,993	19	47,219	32	316,757	24
Urban Local	187,652	23	308,212	24	222,427	23	156,641	25	874,932	24
Rural	581,463		751,746		657,001		413,882		2,404,092	
Urban	976,483		1,410,595		1,120,334		767,891		4,275,303	
County	1,557,946		2,162,340		1,777,335		1,181,773		6,679,395	

Fuel Formulation and Supply

The Technical Guidance document states that changes should be made only where local volumetric fuel property information is available, except in the case of RVP where a user should change the value to reflect the regulatory requirements and differences between ethanol- and non-ethanol blended gasolines. South Carolina does not have local fuel parameter data so the

MOVES2010a default fuel supply data was used, except the applicable fuel parameters were changed to reflect the summer RVP regulatory requirement of 9.0.

Meteorology

For average summer day ozone for SIP or conformity purposes, the Technical Guidance recommends using average daily temperature profiles for July, or for the three month period that best represents the area's ozone season. For this effort, the surface hourly data for the Charlotte International Airport was acquired from the Integrated Surface Hourly (ISH) database maintained by the National Climatic Data Center. Hourly temperature and dew point data for the month of July for the years 2004-2010 was extracted from the database. Average hourly temperatures and relative humidity for each hour of the dataset were calculated.

Road Type Distribution

SCDOT's 2009 Functional Class Annual Report was used to allocate an appropriate fraction of each source type's VMT to each road type. This was used for all years.

Age Distribution

Actual age distribution data was not available in time for this analysis, therefore MOVES2010a defaults were used. The Technical Guidance document states that "If users are unable to acquire data to develop a local age distribution or have reason to believe that data about locally registered vehicles is not necessarily representative of that entire portion of the fleet then MOVES2010a national default age distributions can be used."

Average Speed Distribution

Speed data for a.m. peak hours (6:00 a.m. to 9:00 a.m.), midday (9:00 a.m. to 3:00 p.m.), p.m. peak hours (6:00 p.m. to 9:00 p.m.) and nighttime hours (9:00 p.m. to 6:00 a.m.) was obtained for all modeled years from the CDOT. Vehicle hours traveled (VHT) was calculated for each urban and rural road type by dividing VMT by speed. VHT for each road type was then assigned to a MOVES2010a speed bin. There are 16 speed bins, whose speed ranges are detailed in the Technical Guidance document. VHT for each of the four MOVES2010a on-road road types was totaled for each time period of the day and a fraction developed for each speed bin. Each road type (4 road types), source type (13 source types), and hour (24 hourdayIDs for weekdays) combination has a fraction totaling 1.0. These fractions were calculated and saved in the proper MOVES2010a format and used in the modeling.

FuelEngFraction (Engine Type and Fuel Used) Table

This MOVES2010a default table needed to be adjusted to account for the fact that there are no CNG transit buses operating in the RFATS area. The VMT assigned to CNG buses in the MOVES2010a default fuelEngFraction file was re-assigned to diesel buses. This file was saved and imported back into MOVES2010a for the model runs. This amended file was imported into

the Strategies-Alternative Vehicle Fuels & Technologies tab of the runspec for all the MOVES2010a runs.

4.2.3 Estimated Emissions From On-Road Mobile Sources

Using the outlined inventory approach, the MOVES2010a model gave a summary of emissions in kg per average summer day. A conversion factor was used to calculate the tons per day emissions from the kg per day value. Table 4.2-5 summarizes the NO_x and VOC emissions.

Table 4.2-5: On-road Mobile Source Average Summer Day NO_x and VOC Emissions York County Nonattainment Area

	2010		2013		2016		2019		2022	
	kg/day	Tons/day	kg/day	Tons/day	kg/day	Tons/day	kg/day	Tons/day	kg/day	Tons/day
NO_x	10,930	12.05	7,924	8.73	5,919	6.52	4,682	5.16	4,011	4.42
VOC	3,554	3.92	2,846	3.14	2,367	2.61	2,074	2.29	1,939	2.14

4.2.4 Motor Vehicle Emissions Budget for Conformity

Transportation Conformity

The purpose of transportation conformity is to ensure that federal transportation actions occurring in a nonattainment area do not hinder the area from maintaining the 8-hour ozone standard. This means that the level of emissions estimated for the MPO's Transportation Implementation Plan (TIP) and Long Range Transportation Plan (LRTP) must not exceed the Motor Vehicle Emissions Budget (MVEB) as defined in this maintenance plan.

4.3 On-road Mobile Source VOC Insignificance

The Transportation Conformity Rule Amendments for the 1997 8-hour ozone and fine particulate matter NAAQS addresses areas with insignificant motor vehicle emissions in Section 93.109(k) which states:

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

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

vehicle emissions. Also, in the EPA's approval of VOC insignificance for the Triangle area of North Carolina *(http://www.epa.gov/fedrgstr/EPA-AIR/2007/October/Day-03/a19513.htm)*, it states that the policy provides flexibility for areas where motor vehicle emissions have little or no impact on an area's air quality problem. Further, EPA states that the policy provides for state and local resources to be directed towards reducing emissions from those sources that contribute the most to an area's air quality problem.

SCDHEC has examined a NCDAQ study designed to determine the sources of VOC emissions and their contribution to ozone formation in North Carolina, since the results of the study would apply to the part of York County included in the Metrolina nonattainment area. Due to the generally warm and moist climate of the Carolinas, vegetation abounds in many forms, and forested lands naturally cover much of each state. The biogenic sector is the most abundant source of VOC emissions in both Carolinas and accounts for approximately 90 percent of the total VOC emissions (89 percent for Region IV states and 88 percent for North Carolina, as stated in the *VOC Insensitivity To Ozone Production In North Carolina* submitted to EPA on August 3, 2010). Due to the overwhelming abundance of biogenic VOC emissions, NCDAQ determined the vast majority of North Carolina a NO_x limited environment for the formation of ozone. This holds true for the Metrolina nonattainment area counties. Summaries from the VISTAS/ASIP 2002 and 2009 regional modeling effort were used to illustrate the abundance of the biogenic VOC emissions. Figures F4.3-1 and F4.3-2 provide the percent contributions from point, on-road mobile, off-road mobile, area, and biogenic sources to the total VOC emissions in the Metrolina nonattainment area in 2002 and 2009, respectively. For the two partial counties in the Metrolina nonattainment area, Iredell and York Counties, the whole county emissions were used since the modeling inventories are for whole counties.

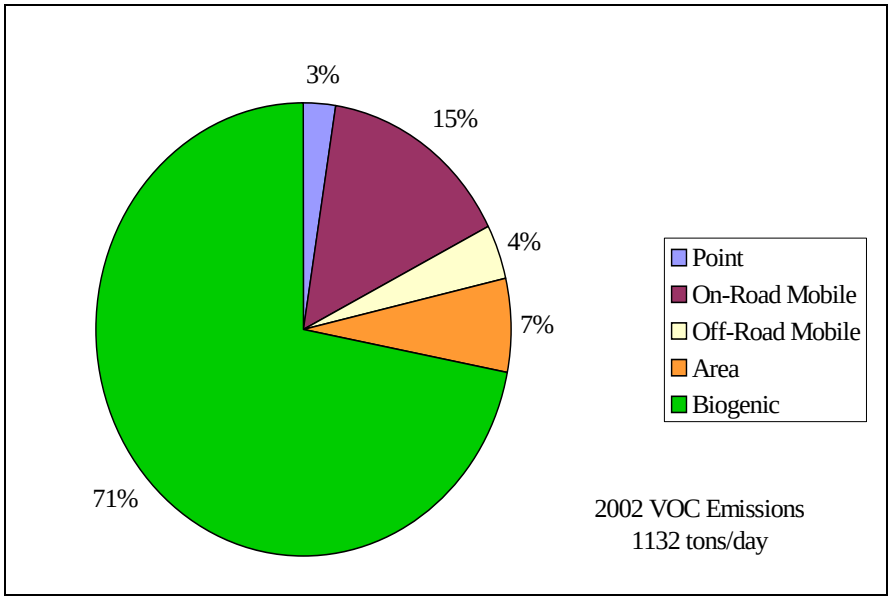

Figure F4.3-1: Metrolina Area 2002 Daily Summertime VOC Emissions

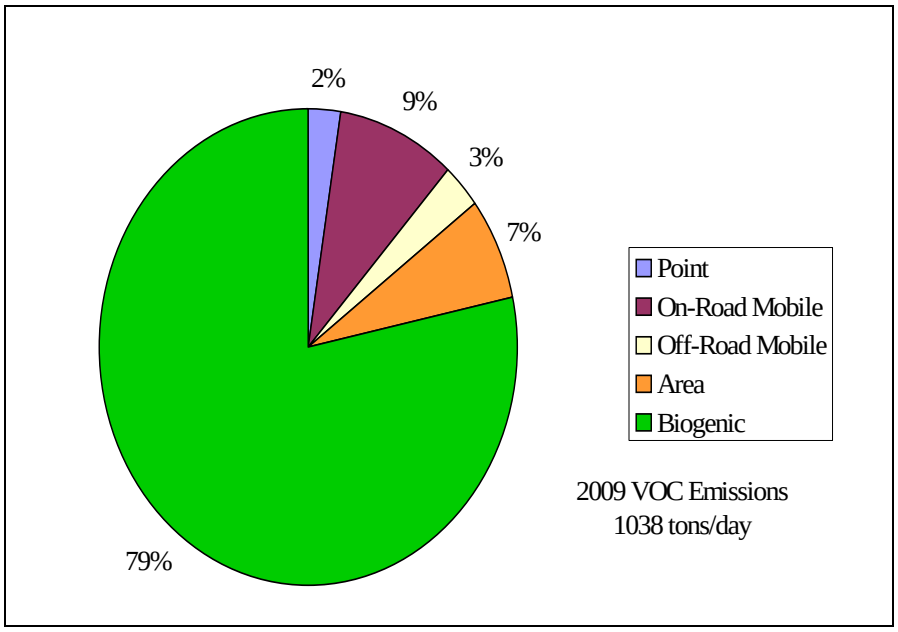

Figure F4.3-2: Metrolina Area 2009 Daily Summertime VOC Emissions

In the Metrolina nonattainment area, on-road mobile sources contribute only 15 and 9 percent of the 2002 and 2009 total VOC emissions, respectively. Also, on-road mobile sources are expected to contribute only 5 percent of total VOC emissions in 2011.

Also noteworthy are the projected decreases in on-road mobile VOC emissions. These reductions are due mainly to the retirement of older vehicles and the growing fleet of Tier 2

vehicles on the roads in future years. Some additional reductions are attributable to North Carolina's Inspection and Maintenance program in the Metrolina area.

A modeling sensitivity test was performed by ASIP that allows an analysis of VOC contributions to ozone concentrations in the Southeastern United States. One of the analyses conducted by ASIP is a series of emissions sensitivity modeling runs to quantify the contributions of various emission sources to ozone and fine particles. The modeling system used in this analysis consisted of 3 components: 1) the Penn State University/National Center for Atmospheric Research Mesoscale Model (MM5 version 3.6.1+), 2) the Sparse Matrix Operator Kernel Emissions Modeling System (SMOKE version 2.1), and 3) the Community Multiscale Air Quality (CMAQ version 4.4) model. Model configurations, input data, and modeling methods are consistent with those suggested by the EPA in *Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS*.

The emissions sensitivities are calculated by taking the difference between two air quality model simulations: one with base case emissions and another with reduced emissions inputs. The emissions sensitivity discussed here reduces all anthropogenic VOCs in the modeling domain by 30 percent from projected 2009 emission levels. Translating this to the Metrolina nonattainment area emissions, this 30 percent anthropogenic VOC reduction is equivalent to about a 70 percent reduction of all on-road mobile VOC emissions in the Metrolina nonattainment area for 2009. This emissions sensitivity was run for a 39 day period (June 1-July 9). In all 39 days of the modeling simulation, the 8-hour ozone maximum concentrations were unchanged in the Metrolina nonattainment area - a clear indicator that on-road mobile VOC is an insignificant contributor to ozone formation in that area. In fact, there was not an 8-hour ozone response as high as 1 part per billion (ppb) anywhere in either North or South Carolina during the sensitivity simulation. Figure F4.3-3 provides an example from the 30 percent anthropogenic VOC reduction modeling illustrating the lack of ozone response for North and South Carolina.

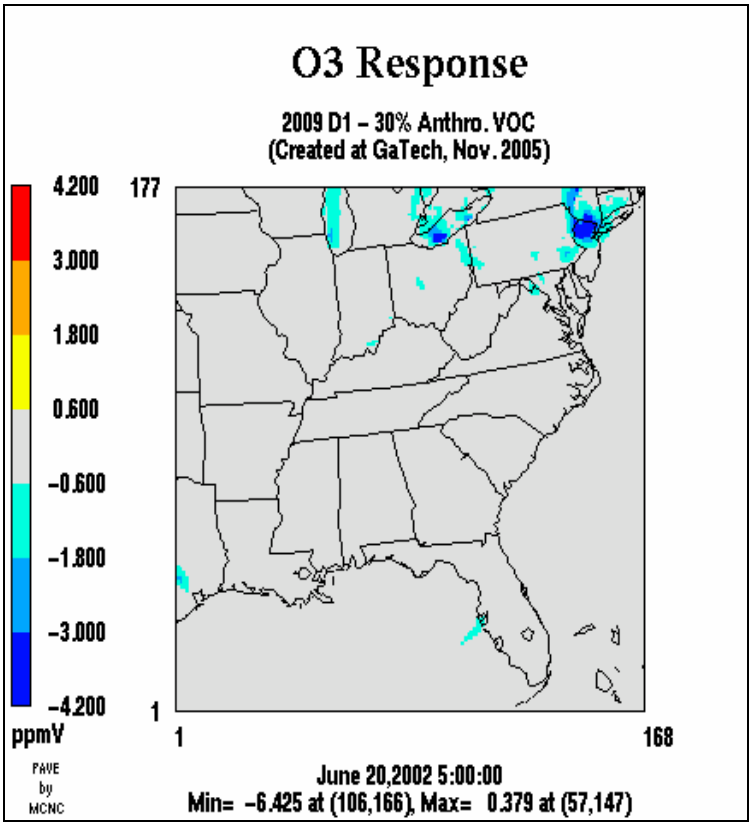

Figure F4.3-3: 8-hour Ozone response to 30% anthropogenic VOC reductions in 2009

Additional mobile source sensitivity simulations have been conducted by the NCDAQ. Although York County was not included in these model runs, it was determined by NCDAQ and SCDHEC that the sensitivity simulations would have the same impact in York County. These modeling runs focused specifically on the impact of mobile source VOC emissions on ozone. The sensitivity reduced mobile source VOC by 50 percent in the North Carolina counties in the Metrolina ozone nonattainment area (Cabarrus, Gaston, Iredell, Lincoln, Mecklenburg, Rowan and Union Counties) in the year 2008. This emissions sensitivity was run for a 7 day period (July 13-19). In all 7 days of the modeling simulation, the 8-hour ozone maximum concentrations were unchanged in the Metrolina nonattainment area, a clear indicator that on-road mobile VOC is an insignificant contributor to ozone formation in that area. Figure F4.3-4 provides an example of the lack of an 8-hour ozone response from the 50 percent mobile VOC reduction sensitivity modeling.

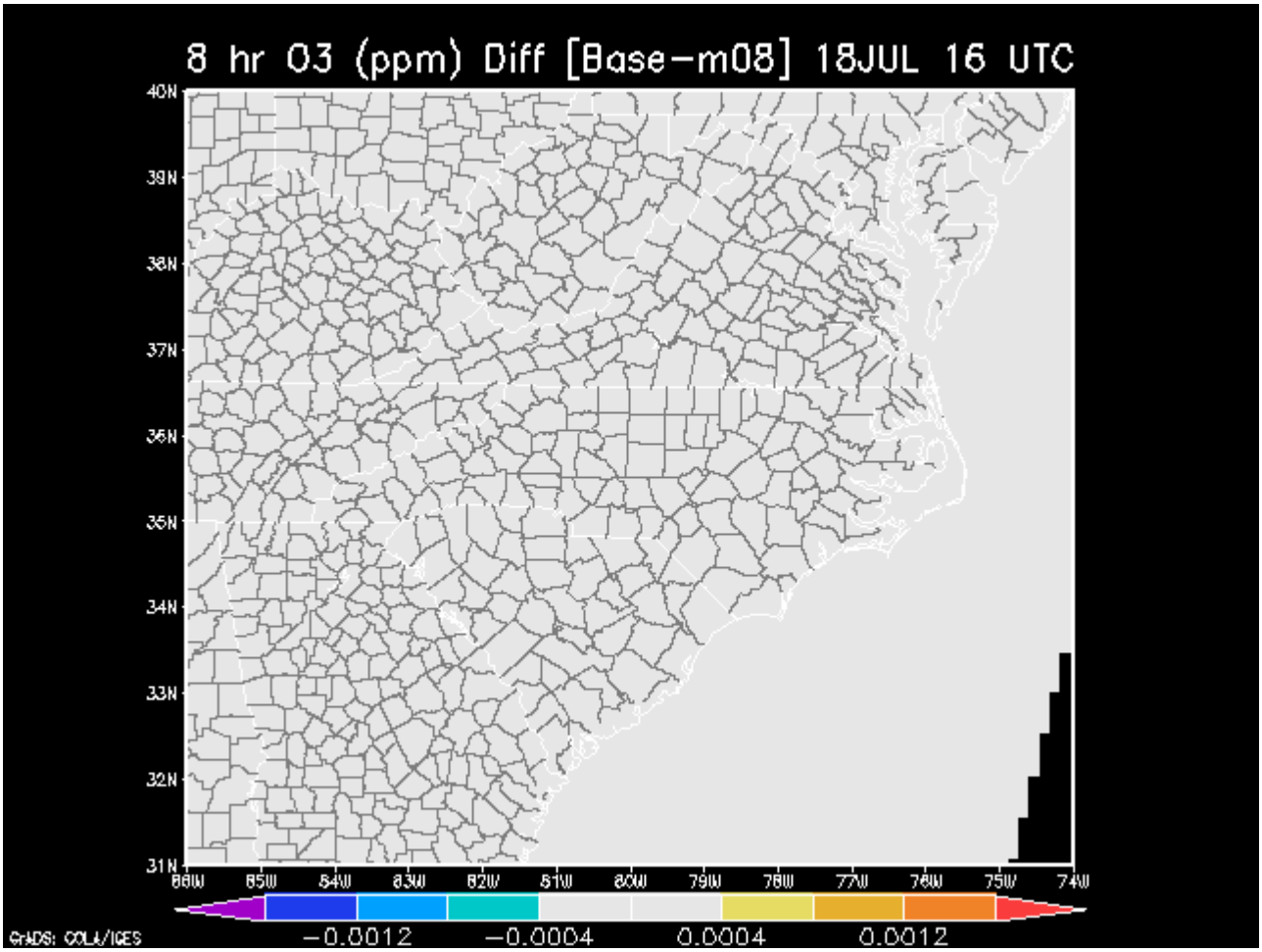

Figure F4.3-4: 8-hour Ozone Response to 50% mobile VOC decrease in 2008

Based on the information discussed above, the NCDAQ and SCDHEC steadfastly believe on-road mobile VOCs are insignificant contributors to ozone formation in the Metrolina nonattainment area. Emission estimates indicate on-road mobile VOC is a small percentage of the total VOC emissions inventory. On-road mobile VOC emissions are projected to decrease into the future notwithstanding VMT increases. The area is currently below the 1997 8-hour ozone NAAQS, and emission sensitivity modeling performed by ASIP and the NCDAQ indicates no change in future ozone concentrations when VOC emissions are significantly changed.

Since the NCDAQ considered it unreasonable to expect that the Metrolina nonattainment area would experience enough motor vehicle VOC emissions growth for a future ozone violation to occur, neither the NCDAQ, nor SCDHEC set a MVEB for VOC for the Metrolina nonattainment area in their first SIP submittal in 2007. The SCDHEC consulted with its interagency transportation partners prior to reaching this conclusion.

The EPA indicated by email on October 6, 2009, by phone on October 21, 2009 and again by phone on December 9, 2009, that it would not accept the justification presented for VOC insignificance for the Metrolina nonattainment area for the attainment demonstration. A VOC

budget for on-road mobile sources was then prepared and submitted with the 2010 attainment SIP. Therefore, the SCDHEC is again including a VOC MVEB with this submittal while preserving our position of VOC insignificance.

Although a VOC MVEB has been developed and is being submitted, SCDHEC believes that a finding of VOC Insignificance for this area is supported. For purposes of transparency and providing information to the public, the following information summarizes our assessment of the appropriateness of a finding of VOC insignificance for this area. Pursuant to 93.109(k), the York County nonattainment area meets the listed criteria as follows:

- The percentage of motor vehicle emissions in the context of the total SIP inventory. *On-road mobile emissions were projected to account for 9 percent of VOC emissions for 2009 in the attainment demonstration submitted in 2007. For 2011, on-road mobile emission sources were projected to account for 5 percent of VOC emissions. This is well within EPA's guideline of 10 percent, and continues to show a decreasing trend in the percentage of VOC emissions attributed to on-road mobile emissions. Further decreases beyond 2011 are expected due to fleet turnover and cleaner engine standards.*

- The current state of air quality as determined by monitoring data for the NAAQS. *As discussed above, the design value for the York monitor has remained below the 1997 8-hour ozone NAAQS since 2002. In fact the design value has decreased 20 percent over that period. Annual values have decreased 13 percent since 2000. The annual value for the 2010 ozone season was 0.066 ppm. The 2010 design value is 0.067 ppm, well below the1997 standard of 0.08 (effectively 0.084) ppm.*

- The absence of SIP motor vehicle control measures. *No SIP vehicle control measures have been needed and none proposed for the York County nonattainment area.*

- Historical trends and future projections of the growth of motor vehicle emissions. *As table 4.2-5 above indicates, the State projects decreases in motor vehicle emissions. This assertion is supported by EPA's discussion of its approval of VOC insignificance for the Triangle Area of North Carolina (http://www.epa.gov/fedrgstr/EPA-AIR/2007/October/Day-03/a19513.htm.) In this Federal Register notice, EPA comments on North Carolina's documentation showing an anticipated increase of 25-30 percent in VMT for the Triangle Area, during which time on-road VOC emissions are expected to decline by 50 percent. Although the York County nonattainment area may show an increase in VMTs in the future, the vehicle emissions are expected to decline similarly to the declines in the Triangle area.*

4.4 Motor Vehicle Emissions Budgets

According to Section 93.118 of the transportation conformity rule, a maintenance plan must establish MVEBs for the last year of the maintenance plan, in this case, 2022. Through the interagency consultation process, it was decided that interim MVEBs would also be set for the year 2013 in the RFATS area.

The MVEBs will be set in terms of kg/day. During the preparation of the York County nonattainment area attainment demonstration in 2007 it was determined through interagency consultation that kg per day would be the most appropriate unit to use for MVEBs and transportation conformity.

Table 4.4-1 shows the York County nonattainment area on-road mobile NO_x and VOC emissions expressed in tons per day and the corresponding kilograms per day values for 2013 and 2022.

Table 4.4-1: On-road Mobile Source NO_x and VOC Emissions
York County Nonattainment Area

	2013		2022	
Pollutant	**Tons/day**	**Kg/day**	**Tons/day**	**Kg/day**
NO_x	8.73	7,924	4.42	4,011
VOC	3.14	2,846	2.14	1,939

Upon the EPA's affirmative adequacy finding for the partial county MVEBs, as shown in Table 4.4-2, they will become the applicable MVEBs for the York County nonattainment area. Should EPA agree with SCDHEC that the contribution from on-road mobile VOC emissions is insignificant for the future attainment of the 1997 8-hour ozone NAAQS, no VOC budget will be required.

Table 4.4-2: York County Nonattainment Area
NO_x and VOC MVEBs for 2013 and 2022

Pollutant	MVEB (Kilograms/day)	
	2013	**2022**
NO_x	7,924	4,011
VOC	2,846	1,939

The MOVES Technical Guidance document directs that all processes, including refueling emissions, be included in MOVES work for SIPS or regional conformity analysis. In South Carolina, however, these processes are accounted for in the area source inventory and have not been included in previous budgets or conformity analysis. For this reason, these processes have not been included in the inventories or the MVEB for this redesignation demonstration and maintenance plan. Refueling emissions are included separately in Table 4.4-3 for the budget years of 2013 and 2022 for informational purposes only.

Table 4.4-3: York County Nonattainment Area
NO_x and VOC Refueling Emissions for 2013 and 2022

	Kilograms/day Refueling Emissions	
	2013	2022
NO_x	0	0
VOC	240.03	143.85

5.0 DATA FILES PROVIDED ON DVD

This section contains a list of all data files which were used in the MOVES2010a runs and are saved on the attached DVD. All of these files are in EXCEL (.xls) format, except the runspecs which come out of MOVES2010a and are saved as an .mrs file.

2010 DATA:
York_2011redesignation_2010_runspec.mrs
York_2011redesignation_2010_output.xls
York_2011redesignation_2010_hpmsvtypeyear.xls
York_2011redesignation_2010_monthvmtfraction.xls
York_2011redesignation_2010_dayvmtfraction.xls
York_2011redesignation_2010_hourvmtfraction.xls
York_2011redesignation_2010_sourcetypepopulation.xls
York_2011redesignation_2010thru2022_met.xls
York_2011redesignation_2010_avgspeeddistribution.xls
York_2011redesignation_2010_agedistribution.xls
York_2011redesignation_2010_fuel.xls
York_2011redesignation_2010thru2022_roadtypedistribution.xls
York_2011redesignation_2010thru2022_fuelengfraction.xls

2013 DATA:
York_2011redesignation_2013_runspec.mrs
York_2011redesignation_2013_output.xls
York_2011redesignation_2013_hpmsvtypeyear.xls
York_2011redesignation_2013_monthvmtfraction.xls
York_2011redesignation_2013_dayvmtfraction.xls
York_2011redesignation_2013_hourvmtfraction.xls
York_2011redesignation_2013_sourcetypepopulation.xls
York_2011redesignation_2010thru2022_met.xls
York_2011redesignation_2013_avgspeeddistribution.xls
York_2011redesignation_2013_agedistribution.xls
York_2011redesignation_2013thru2022_fuel.xls
York_2011redesignation_2010thru2022_roadtypedistribution.xls
York_2011redesignation_2010thru2022_fuelengfraction.xls

2016 DATA:
York_2011redesignation_2016_runspec.mrs
York_2011redesignation_2016_output.xls
York_2011redesignation_2016_hpmsvtypeyear.xls
York_2011redesignation_2016_monthvmtfraction.xls
York_2011redesignation_2016_dayvmtfraction.xls
York_2011redesignation_2016_hourvmtfraction.xls
York_2011redesignation_2016_sourcetypepopulation.xls
York_2011redesignation_2010thru2022_met.xls
York_2011redesignation_2016_avgspeeddistribution.xls

York_2011redesignation_2016_agedistribution.xls
York_2011redesignation_2013thru2022_fuel.xls
York_2011redesignation_2010thru2022_roadtypedistribution.xls
York_2011redesignation_2010thru2022_fuelengfraction.xls

2019 DATA:
York_2011redesignation_2019_runspec.mrs
York_2011redesignation_2019_output.xls
York_2011redesignation_2019_hpmsvtypeyear.xls
York_2011redesignation_2019_monthvmtfraction.xls
York_2011redesignation_2019_dayvmtfraction.xls
York_2011redesignation_2019_hourvmtfraction.xls
York_2011redesignation_2019_sourcetypepopulation.xls
York_2011redesignation_2010thru2022_met.xls
York_2011redesignation_2019_avgspeeddistribution.xls
York_2011redesignation_2019_agedistribution.xls
York_2011redesignation_2013thru2022_fuel.xls
York_2011redesignation_2010thru2022_roadtypedistribution.xls
York_2011redesignation_2010thru2022_fuelengfraction.xls

2022 DATA:
York_2011redesignation_2022_runspec.mrs
York_2011redesignation_2022_output.xls
York_2011redesignation_2022_hpmsvtypeyear.xls
York_2011redesignation_2022_monthvmtfraction.xls
York_2011redesignation_2022_dayvmtfraction.xls
York_2011redesignation_2022_hourvmtfraction.xls
York_2011redesignation_2022_sourcetypepopulation.xls
York_2011redesignation_2010thru2022_met.xls
York_2011redesignation_2022_avgspeeddistribution.xls
York_2011redesignation_2022_agedistribution.xls
York_2011redesignation_2013thru2022_fuel.xls
York_2011redesignation_2010thru2022_roadtypedistribution.xls
York_2011redesignation_2010thru2022_fuelengfraction.xls