Redesignation Demonstration

and

Maintenance Plan

for

The North Carolina
Great Smoky Mountains National Park,
8-Hour Ozone Nonattainment Area
For the 1997 8-Hour Ozone Standard

Prepared by
North Carolina Department of Environment and Natural Resources
Division of Air Quality

July 24, 2009

Preface: This document contains the technical support for North Carolina's Division of Air Quality to request the Great Smoky Mountains National Park 8-hour ozone nonattainment area be redesignated as attainment for the 8-hour ozone national ambient air quality standard pursuant to §§107(d)(3)(D) and (E) of the Clean Air Act, as amended.

EXECUTIVE SUMMARY

Introduction

Ozone is formed by a complex set of chemical reactions involving volatile organic compounds (VOCs), nitrogen oxides (NOx) and to a lesser extent carbon monoxide. These gases are generated by utilities, combustion processes, certain industrial processes and even by natural sources such as trees. Tailpipe emissions from highway mobile sources (vehicles) are also significant sources of these pollutants. Even the emissions from such sources as boat engines, lawn mowers and construction equipment contribute to the formation of ozone. Ozone formation is promoted by strong sunlight, warm temperatures and light winds and is hence a problem predominantly during the hot summer months.

The 1997 8-hour ozone national ambient air quality standard (NAAQS) is 0.08 parts per million (ppm). An exceedance of the 1997 8-hour ozone NAAQS occurs when a monitor measures ozone above 0.084 ppm on average for an eight-hour period. A violation of this NAAQS occurs when the average of the annual fourth highest daily maximum 8-hour ozone values over three consecutive years is greater than or equal to 0.085 ppm. This three-year average is termed the "design value" for the monitor. The design value for a nonattainment area is the highest monitor's design value in the area.

Great Smoky Mountains National Park Nonattainment Designation

The North Carolina portion of the Great Smoky Mountains National Park (GSMNP), located in Haywood and Swain Counties in western North Carolina, was designated nonattainment for the 1997 8-hour ozone NAAQS on April 30, 2004 (69 Federal Register 23858). The nonattainment designation was an action taken by the U. S. Environmental Protection Agency (USEPA) under Section 107(d) of the Clean Air Act (CAA). The CAA requires that some area be designated as nonattainment if a monitor is found to be in violation of a NAAQS. The USEPA took designation action in 2004 based on the ambient data from 2001-2003. At that time, the design value for the GSMNP area was 0.085 ppm.

Current Air Quality

There is currently one ozone monitor located in the North Carolina GSNMP nonattainment area. The latest design value for the nonattainment area is 0.077 ppm based on the data from 2006-2008, and is therefore in attainment of the 1997 8-hour ozone NAAQS, and the area is eligible to be considered for redesignation to attainment.

Maintenance Plan Requirements

The State of North Carolina has implemented permanent and enforceable reductions in ozone precursor emissions that impact the GSMNP area. These actions include implementing the on-board diagnostic vehicle inspection and maintenance program that began on July 1, 2002, and an open burning ban during ozone action days. In addition, there have been several State rules that have resulted in reductions in emissions in areas surrounding the nonattainment area. These State actions include the NOx SIP Call, the Clean Smokestacks Act legislation, and heavy-duty engine stop-gap rule for model years 2005 and 2006. Finally, several actions at the Federal level by the USEPA have resulted in lower emissions throughout the eastern portion of the country. These Federal actions include the Tier 2 engine standards for light and medium duty vehicles, heavy-duty engine standards, the low sulfur gasoline and diesel fuel requirements, off-road engine standards, and the NOx SIP Call in the surrounding states.

This combination of State and Federal actions have resulted in cleaner air in the GSMNP area, and the anticipated future benefits from these programs are expected to result in continued maintenance of the 8-hour ozone NAAQS in this region. A baseline year emissions inventory for NOx and VOCs was developed for 2005, since the design value for the 2004-2006 period showed attainment of the 8-hour ozone NAAQS. Future year emissions inventories are projected to be lower for the years 2008, 2011, 2014, 2017, and 2020. This demonstrates that the GSMNP area is expected to maintain the 8-hour ozone NAAQS through 2020, since in no future year are the emissions expected to be greater than they were in the baseline year. The area is also in compliance with Section 110 and Part D requirements of the CAA.

Conclusion and Request for Redesignation

Based on the information above and criteria established in Section 107(d)(3)(E) of the CAA, North Carolina is requesting that the USEPA redesignate the GSMNP nonattainment area to attainment. The monitoring data clearly shows that the region has attained the 1997 8-hour ozone standard, and the maintenance demonstration shows that the area has a very low probability of exceeding the 1997 8-hour ozone NAAQS in the future.

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Acronym	Definition
AIRS	Aerometric Information Retrieval System
AQADP	Air Quality Action Day Program
ASIP	Association for Southeastern Integrated Planning
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Database
CFR	Code of Federal Regulations
CMAQ	Community Multiscale Air Quality
CO	Carbon Monoxide
GSMNP	Great Smoky Mountains National Park
FR	Federal Register
HC	Hydrocarbons
I/M	Inspection and Maintenance
MM5	Penn State University/National Center for Atmospheric Research Mesoscale Model
NAAQS	National Ambient Air Quality Standard
NCDAQ	North Carolina Division of Air Quality
NOx	Nitrogen Oxides
NPS	National Park Service
PM	Particulate Matter
Ppm	Parts per million
QA	Quality Assurance
SESARM	Southeastern States Air Resource Managers, Inc.
SIP	State Implementation Plan
SMOKE	Sparse Matrix Operator Kernel Emissions Modeling System
SO2	Sulfur Dioxide
SUV	Sport Utility Vehicle
USEPA	U.S. Environmental Protection Agency
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

1.1 WHAT IS TROPOSPHERIC OZONE?

Ozone, a strong chemical oxidant, adversely impacts human health through effects on respiratory function and can also damage forests and crops. Ozone is not emitted directly by the utilities, industrial sources or motor vehicles but instead, is formed in the lower atmosphere, the troposphere, by a complex series of chemical reactions involving nitrogen oxides (NOx) and reactive volatile organic compounds (VOCs). NOx emissions result from the electric generating utilities, combustion processes and motor vehicles while VOCs are emitted from industrial solvents use, gasoline evaporation, motor vehicles and natural sources such as trees.

Ozone formation is promoted by strong sunlight, warm temperatures, and light winds. High concentrations tend to be a problem in the eastern United States only during the hot summer months when these conditions frequently occur. Therefore, the U. S. Environmental Protection Agency (USEPA) mandates seasonal monitoring of ambient ozone concentrations in North Carolina only from April 1 through October 31 (40 CFR 58 App. D, 2.5).

In 1997, the USEPA revised the primary (health) and secondary (welfare) national ambient air quality standards (NAAQS) for ozone by establishing 8-hour standards. An exceedance of the 1997 8-hour ozone NAAQS occurs when a monitor measures ozone above 0.084 parts per million (ppm) on average for an eight-hour period. A violation of this NAAQS occurs when the average of the annual fourth highest daily maximum 8-hour ozone values over three consecutive years is greater than or equal to 0.085 ppm. This three-year average is termed the “design value” for the monitor. The design value for a nonattainment area is the highest monitor’s design value in the area.

1.2 CLEAN AIR ACT OF 1990

Since the 1977 amendments to the Clean Air Act (CAA), areas of the country that had not attained the ambient standard for a particular pollutant were formally designated as nonattainment for that pollutant. This formal designation concept was retained in the 1990 CAA Amendments.

1.3 GREAT SMOKY MOUNTAINS NATIONAL PARK AIR QUALITY HISTORY

On April 15, 2004, the USEPA designated the North Carolina portion of the Great Smoky Mountain National Park (GSMNP) as “basic” nonattainment for the 1997 8-hour ozone standard based on the ambient data from 2001-2003 (Figure 1-1). At that time, the design value for the

North Carolina GSMNP nonattainment area, located in Haywood and Swain Counties, was 0.085 ppm. The GSMNP is located partly in North Carolina and partly in Tennessee. The USEPA treated the North Carolina portion and the Tennessee portion of the GSMNP as two distinct nonattainment areas. The official designation and classification was published in the Federal Register (FR) on April 30, 2004 (69 FR 23858). The designation became effective on June 15, 2004. Prior to the implementation of the 1997 8-hour ozone standard, this area had always been attainment for the 1-hour ozone standard.

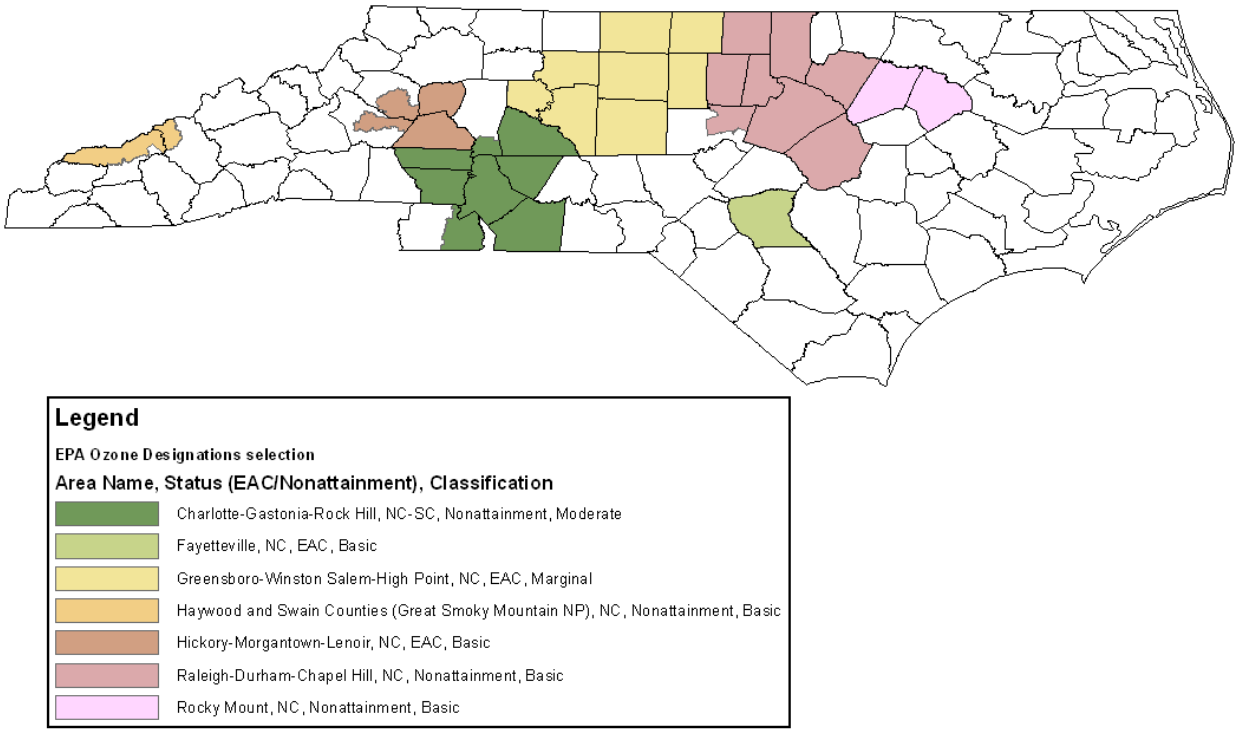


Figure 1-1. USEPA Designated 8-Hour Ozone Nonattainment Areas in North Carolina

There is currently one ozone monitor in the North Carolina GSMNP nonattainment area, Purchase Knob, located in the northwest portion of the GSMNP at 5085 feet above sea level. In 2004, this monitor attained the 1997 8-hour ozone NAAQS and has continued to maintain the standard since. The current design value for the North Carolina GSMNP nonattainment area is 0.077 ppm based on the 2006-2008 data.

1.4 CLEAN AIR ACT REDESIGNATION CRITERIA

Section 107(d)(3)(E) of the CAA, as amended, states an area can be redesignated to attainment if the following conditions are met:

1. The USEPA has determined that the NAAQS have been attained. For ozone, the areas must show that the average of the fourth highest 8-hour ozone values from three (3) complete, consecutive calendar years of quality-assured air quality monitoring data must be below 0.085 ppm.

2. The applicable implementation plan has been fully approved by the USEPA under section 110(k).

3. The USEPA has determined that the improvement in air quality is due to permanent and enforceable reductions in emissions. To demonstrate this, the State should estimate the percent reduction (from the year used to determine the design value for designation and classification) achieved from Federal, State, and local measures.

4. The State has met all applicable requirements for the area under section 110 and Part D.

5. The USEPA has fully approved a maintenance plan, including a contingency plan, for the areas under section 175A.

In the sections to follow, the North Carolina Department of Environment and Natural Resources, Division of Air Quality (NCDAQ) will provide the technical data necessary to show that the North Carolina GSMNP nonattainment area has attained and is expected to maintain the 1997 8-hour ozone standard, and has met the requirements for redesignation set forth above.

2.0 AIR QUALITY

2.1 HISTORIC AIR QUALITY (1999 – 2007)

The NCDAQ has collected ambient monitoring data for the GSMNP area since June 1995. At the time of the 1997 8-hour ozone designations, there was one ozone monitor located in the North Carolina GSMNP nonattainment area (Figure 2-1). This monitor was installed in accordance with the Code of Federal Regulations (CFR) 40 CFR Part 58.

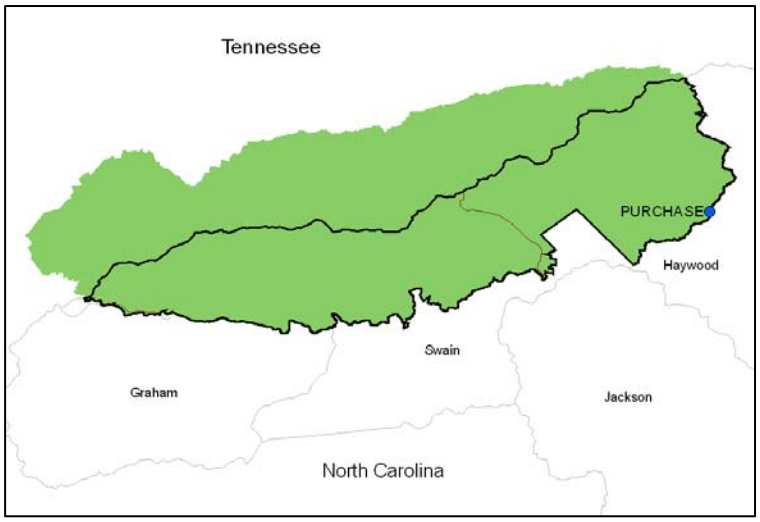


Figure 2-1. Ozone Monitor Location in the North Carolina GSMNP Nonattainment Area

Tables 2-1 and 2-2 below show the air quality data and corresponding design values for the monitor in the North Carolina GSMNP nonattainment area, respectively, from 1999 to 2007. As you can see from Table 2-1, ozone values dropped discernibly in 2003, and the area continued to have fourth highest ozone values below the standard since this period. This reduction in ozone is reflected in Table 2-2, which shows the historic design values based on three successive years of ozone season data. With violations of the 1997 8-hour ozone standard noted in bold, Table 2-2 shows that since the 2001-2003 period, the Purchase Knob monitor has been below the 1997 8-hour ozone standard.

Table 2-1 GSMNP Historic 4th Highest 8-hour Ozone Values (1999-2007)

Monitor	4th Highest 8-hour Ozone Values (ppm)								
	1999	2000	2001	2002	2003	2004	2005	2006	2007
Purchase Knob AIRS ID #37-087-0036 Haywood County	0.093	0.087	0.082	0.094	0.081	0.071	0.084	0.073	0.078

Table 2-2 GSMNP Historic Design Values (1999 - 2007)

Monitor	Design Value (ppm)						
	99-01	00-02	01-03	02-04	03-05	04-05	05-07
Purchase Knob AIRS ID #37-087-0036 Haywood County	**0.087**	**0.087**	**0.085**	0.082	0.078	0.076	0.078

Note: Bolded values represent violations of the 8-hour ozone standard.

2.2 RECENT AIR QUALITY VALUES (2006 –2008)

The most recent three years of ozone monitoring data (2006-2008) for the North Carolina GSMNP nonattainment area demonstrate compliance with the 1997 8-hour ozone NAAQS. Table 2-3 is a summary of the fourth highest 8-hour average at the monitor in the nonattainment area for 2006-2008 period and the corresponding design value.

Table 2-3 GSMNP Area's Current Air Quality Data (2006 -2008)

Monitor	Year	4th Highest 8-hour ozone values (ppm)	Design Value (ppm) 2006-2008
Purchase Knob AIRS ID #37-087-0036 Haywood County	2006	0.073	0.077
	2007	0.078	
	2008	0.080	

The 2008 8-hour ozone monitoring data has been fully quality assured (QA'ed) and officially submitted to the USEPA. Since this area has maintained the 1997 8-hour ozone standard since 2004, the NCDAQ is confident that the GSMNP area will continue to demonstrate attainment of this standard.

2.3 CAUSE OF OZONE EXCEEDANCES IN THE GSMNP

As stated earlier, ozone is formed in the presence of strong sunlight and the precursor pollutants NOx and VOCs. The NCDAQ has examined the sources of VOC emissions and their contribution to ozone formation in North Carolina. Due to the generally warm and moist climate of North Carolina, vegetation abounds in many forms, and forested lands naturally cover much of the state. The biogenic sector, natural sources of emissions, is the most abundant source of VOC emissions in North Carolina and accounts for approximately 90% of the total VOC emissions statewide. The overwhelming abundance of biogenic VOC emissions makes the majority of North Carolina a NOx limited environment for the formation of ozone. This holds especially true in the North Carolina GSMNP nonattainment area. The NOx emissions within the North Carolina GSMNP nonattainment area are extremely low; total manmade emissions are currently about a quarter ton per day of NOx (see Section 3.3.3).

The time of day that the exceedances occur indicates that the exceedances in the GSMNP are due to transport. Ozone exceedances within the GSMNP tend to occur at night, which suggests that the monitored ozone exceedances are the result of ozone transported into the nonattainment area from outside regions.

For ozone to form, the presence of strong sunlight is required in addition to the precursor pollutants. Once the sun goes down, ozone formation ceases and the ozone remaining in the air can be transported downwind. Additionally, in urban areas, where NOx emissions are released throughout the day and night, the NOx emissions titrate the ozone after the sun sets and the ozone levels decrease dramatically. This is not what is seen in the GSMNP. Figure 2-2 below shows the typical diurnal patterns observed at a high elevation site, like Purchase Knob, and at a low elevation site. This figure demonstrates that the ozone levels at high elevations tend to have a relatively flat diurnal pattern, with a minimum occurring during the daytime and the maximum occurring during early morning (before sunrise) or late evening (after sunset). At low elevation, the minimum occurs just before sunrise and the maximum peaks during early afternoon.

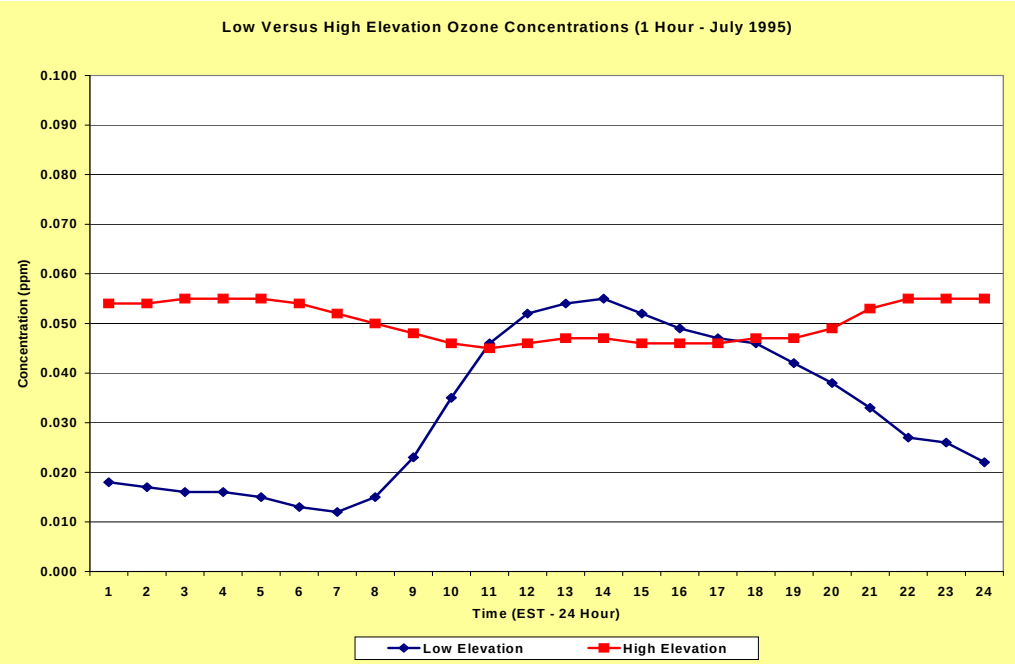


Figure 2-2. Diurnal ozone patterns for high and low elevation monitoring sites

Since the ozone exceedances in the GSMNP occur at night and the NOx emissions are so low, the GSMNP's man-made emissions are not the cause of ozone exceedances but rather the cause is transported ozone. The USEPA recognized this by designating only the GSMNP, and not all of the counties in which the GSMNP is located, as nonattainment.

2.4 PERMANENT AND ENFORCEABLE EMISSIONS REDUCTIONS

As stated above, the GSMNP man-made emissions are not the cause of the ozone exceedances within the GSMNP. The NCDAQ looked at back trajectories for high ozone days in 2002 to understand what sources and regions may have impacted the area during the period when exceedances occurred. The figures below show the patterns of atmospheric airflow on two ozone exceedance days in 2002 and the large NOx sources in the area. It is clear that the airflow that transported high ozone into the GSMNP passed over large utility sources where high ozone is often observed downwind, as well as large urban areas known to have high ozone. Although there may be other large industrial sources that contribute to the ozone transport into the GSMNP, NCDAQ focused its analysis on the utility sector. This sector has been regulated such that the emission reductions can be demonstrated to be both permanent and enforceable; thus meeting the requirements for redesignation.

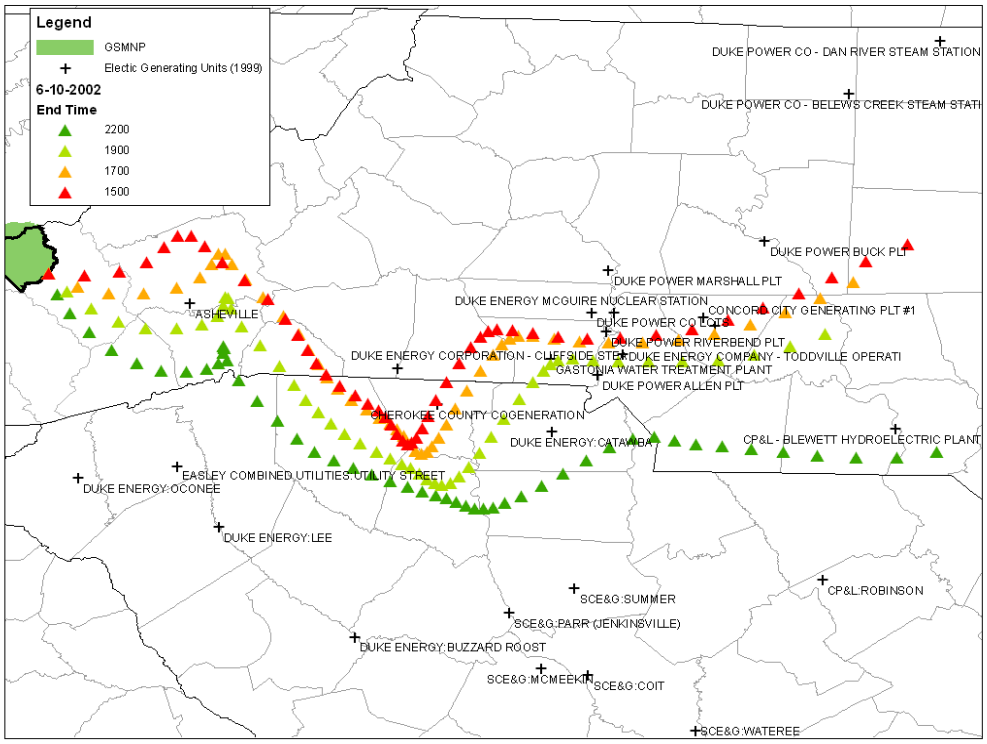


Figure 2-3: June 10, 2002 Ozone Exceedence Back Trajectory

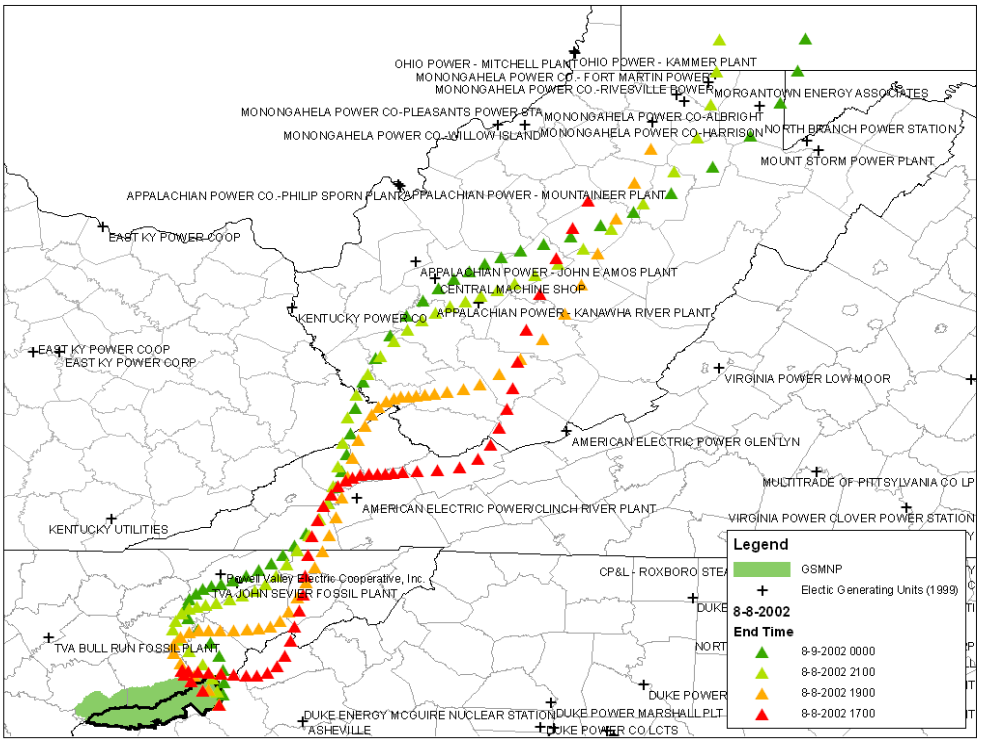


Figure 2-4: August 8, 2002 Ozone Exceedence Back Trajectory

Figure 2-5 displays the 2002 to 2007 ozone season NOx emissions, reported to the USEPA's Clean Air Markets Database (CAMD), for the utility sources located in North Carolina that the June 10, 2002 back trajectory analysis indicated may have contributed to the ozone transported into the GSMNP.

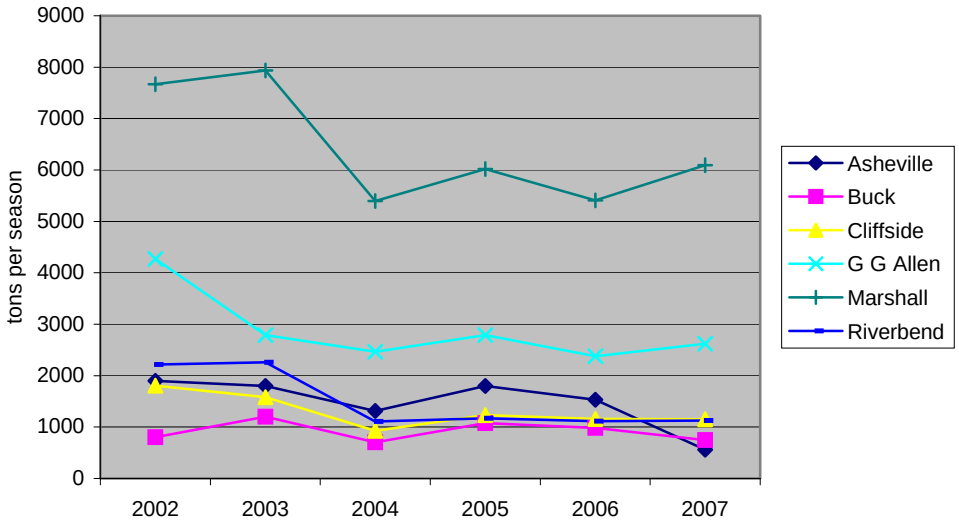


Figure 2-5: Facilities Contributing to June 10, 2002 Ozone Exceedance

Likewise, Figure 2-6 displays the ozone season NOx emissions for the same period for the large facilities that may have contributed to the August 8, 2002, ozone exceedance based on the back trajectory analysis displayed in Figure 2-4 above. A clear downward trend in NOx emissions since 2002 is demonstrated. This decrease in NOx emissions helps explain why the North Carolina GSMNP nonattainment area has observed lower ozone values since 2002.

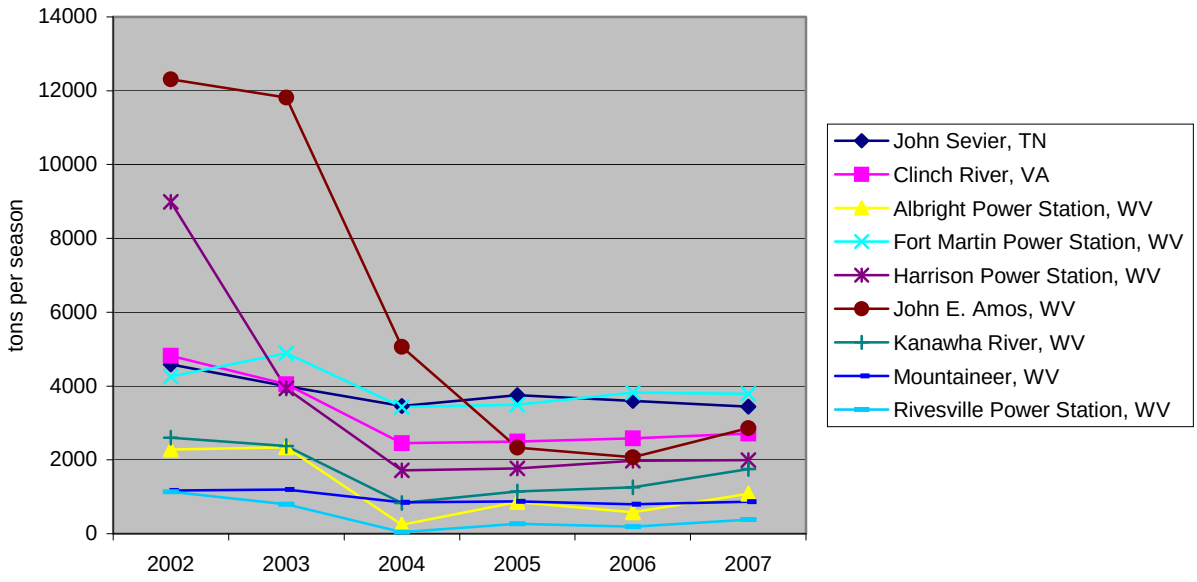


Figure 2-6: Facilities Contributing to August 8, 2002 Ozone Exceedance

Figure 2-7, displays the USEPA's CAMD ozone season NOx emissions trend, by state, for the utility sources located close to the GSMNP and in the more commonly prevailing wind directions determined from the back trajectory analysis. This figure displays the significant emission reductions that occurred in 2003 and then again in 2004, after which the NOx emissions leveled off. This corresponds nicely to the stepwise drop in monitored ozone values in 2003 and again in 2004. The utility sources used to develop Figure 2-7 are listed in Table 2-4.

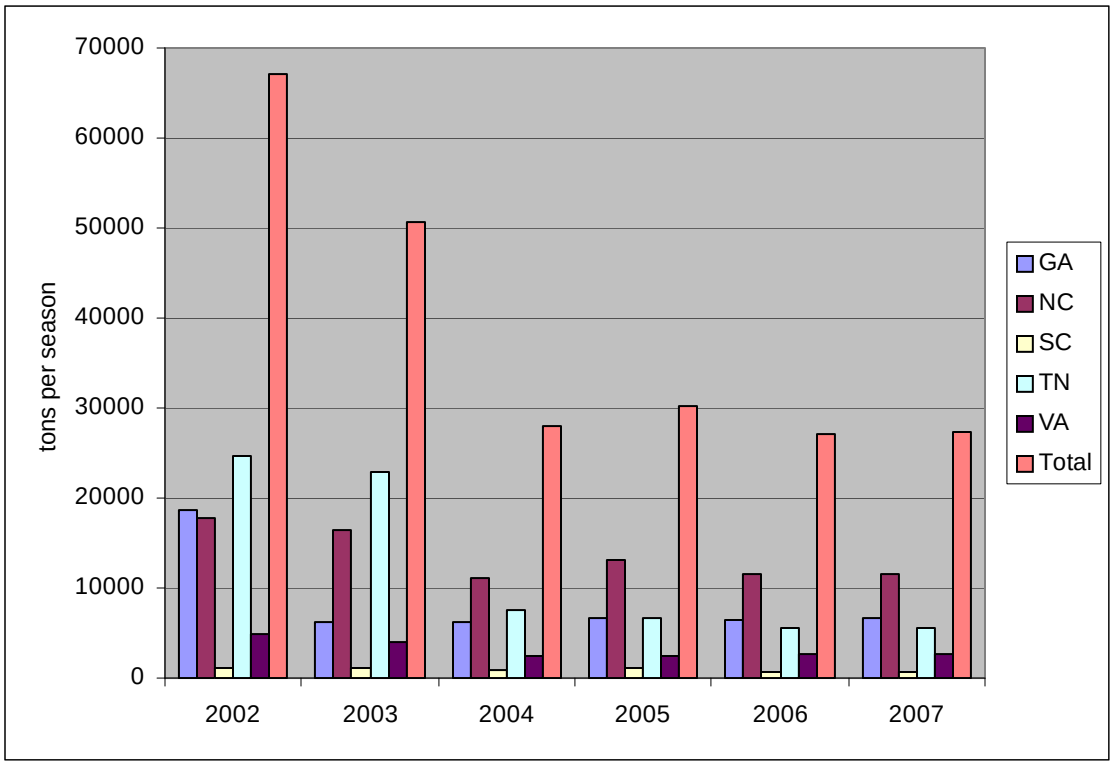


Figure 2-7: NOx Emission Trends by State for Large Sources Impacting the GSMNP

Table 2-4 Facilities Considered in NOx Emissions Trends

State	Facility	State	Facility
		South Carolina	W S Lee
Georgia	Bowen	Tennessee	Bull Run
	Hammond		Kingston
	Jack McDonough		John Sevier
North Carolina	Allen	Virginia	Clinch River
	Asheville		
	Cliffside		
	Marshall		
	Riverbend		

Understanding the cause of the ozone exceedances within the GSMNP helps with the demonstration of showing permanent and enforceable emission reductions that resulted in ozone design values that meet the 1997 8-hour ozone standard. Emission reductions in the GSMNP itself will not affect the observed ozone values within the GSMNP; these reductions must come from sources upwind of the nonattainment area.

There are several State and Federal measures that have been enacted in recent years that are resulting in permanent and enforceable emissions reductions. A list of those measures that contributed to the permanent and enforceable emission reductions are listed below and are more fully described in Section 3.5.

The federal measures that have been implemented include:

- Tier 2 vehicle standards: Began implementation in 2004 and will require all passenger vehicles in the manufacturers' fleet to meet an average standard of 0.07 grams of NOx per mile. Additionally, in January 2006 the sulfur content of gasoline was required to be on average 30 ppm, which will assist in lowering the NOx emissions.

- Heavy-duty gasoline and diesel highway vehicle standards: Began to take effect in 2004 and are designed to reduce NOx and VOC emissions.

- Nonroad spark-ignition engines, recreational vehicle, and diesel marine engines standards: Began to take effect in 2003 and will reduce NOx and VOC emissions.

- NOx State Implementation Plan (SIP) Call: This rule required 22 states in the East to meet ozone season NOx budgets by the beginning of 2004. These reductions were to come from primarily large utility sources, large industrial boilers and internal combustion engines. A trading program was implemented, allowing some sources to buy credits as opposed to putting on controls, but overall there has been a reduction in NOx emissions across the Eastern part of the United States.

The state measures that have been implemented include:

- Clean Air Bill: Expanded the inspection and maintenance (I/M) program from 9 counties to 48. It was implemented in the mountain area counties, near the GSMNP nonattainment area, from July 1, 2004 through July 1, 2005.

- Open burning ban: The rule prohibits open burning on ozone action days, and will reduce NOx and VOC emissions, as well as carbon monoxide (CO) and fine particulate matter.

- Air toxics control program: The rule was effective in 1990 and reduces VOCs, along with other toxic emissions, across the state.

- Heavy duty diesel engine gap filling rule: This rule requires engine manufacturers to perform the supplemental testing requirements for heavy duty diesel engines for model years 2005 and 2006 due to delays in the USEPA's rule. It was estimated to reduce the 2005 emissions in North Carolina by 5.3 tons per day and 10.9 tons per day in 2006.

- NOx SIP Call rule: This rule had a target of a 68 percent reduction in NOx emissions from the State's large stationary combustion sources by 2006.

A recent review of the NOx emissions in the USEPA's CAMD shows a reduction of about 32,400 tons of ozone season NOx emissions from the utilities in North Carolina between 2002 and 2007. Table 2-5 presents the annual and ozone season NOx emissions for the North Carolina sources in the USEPA's CAMD.

Table 2-5. NOx Emissions from North Carolina Sources in the USEPA Clean Air Markets Database

Year	Annual NOx Emissions (Tons)	Ozone Season NOx Emissions (Tons)
2002	145,706	61,059
2003	135,879	51,943
2004	124,079	27,731*
2005	114,300	32,888
2006	108,584	30,655
2007	64,770	28,664

* 2004 had a shortened ozone season due to compliance issues and represents only 4 months.

Table 2-6 displays the NOx emission reductions, as the result of the NOx SIP Call rule, from power plants that most likely impact the North Carolina GSMNP nonattainment area. There are seven facilities located in North Carolina and four facilities located in Tennessee. This data is also from the USEPA's CAMD and represents the second and third quarters of the year (April through September), the period during which ozone levels are the highest. It is clearly demonstrated that the emissions from these facilities have significantly decreased during the ozone season since 2002, with almost 52,431 tons of NOx reductions in the 2007 ozone season compared to 2002. This is a 67% reduction in utility NOx emissions that are permanent and enforceable.

Table 2-6: April – Sept. NOx Emissions for Utilities Impacting the GSMNP (tons/period)

Facility	2002	2003	2004	2005	2006	2007
North Carolina Sources						
Asheville	2,252	2,158	2,205	2,156	1,931	598
Belews Creek	21,269	13,871	7,102	3,803	3,769	1,559
Buck	1,084	1,468	1,089	1,286	1,262	870
Cliffside	1,944	2,149	1,738	1,782	1,540	1,311
G G Allen	5,011	3,643	4,002	3,589	3,001	3,053
Marshall	9,283	9,101	8,243	7,558	6,370	7,253
River Bend	2,556	2,703	1,844	1,379	1,417	1,296
Total NC	43,399	35,093	26,223	21,553	19,290	15,940
Tennessee Sources						
Bull Run	10,554	9,234	1,670	2,468	692	1,513
Gallatin	5,894	6,043	4,556	3,933	3,647	3,124
John Sevier	5,438	4,911	5,343	4,437	4,504	4,187
Kingston	13,335	13,882	5,660	3,444	1,344	1,425
Total TN	35,221	34,070	17,229	14,282	10,187	10,249
Total Combined	**78,620**	**69,163**	**43,452**	**35,835**	**29,477**	**26,189**

3.0 MAINTENANCE PLAN

3.1 CONCEPT OF NORTH CAROLINA'S MAINTENANCE PLAN

The State's plan for maintaining compliance with the ambient air quality standard for 8-hour ozone in the GSMNP nonattainment area consists of three major parts: a foundation control program, a maintenance demonstration, and a contingency plan. The foundation control program consists of the current Federal and State control measures already in effect, as well as the future benefits of the federal Clean Air Interstate Rule, cleaner engine programs, and low sulfur gasoline and low sulfur diesel fuel programs.

The NCDAQ has implemented programs that will remain enforceable and are hereby submitted as the plan to ensure that maintenance of the 8-hour ozone standard will continue. Sources are prohibited from reducing emission controls (anti-backsliding) following the redesignation of the area unless such a change is first approved by the USEPA as a revision to the North Carolina SIP that is consistent with Section 110(l) of the Clean Air Act.

For the maintenance demonstration, the base year of 2005 was chosen since it is a year that falls within the attaining design value period of 2004-2006 and some emissions inventory data was already developed for this year. The interim years chosen were 2008, 2011, 2014, and 2017 since the USEPA recommends three-year increments for interim years. The final year of the maintenance demonstration is 2020, since the CAA requires maintenance for at least ten years after redesignation. The maintenance demonstration consists of a comparison between the 2005 baseline emissions inventory and the projected emissions inventories (for 2008, 2011, 2014, 2017 and 2020), which considers any expected growth in activity levels. The comparison shows that the total emissions in each of the interim years and the final year will be lower than in the base year, which demonstrates maintenance of the 8-hour ozone standard. The reductions in emissions are due to the foundation control programs outlined below.

The North Carolina contingency plan involves tracking and triggering mechanisms to determine when contingency measures are needed and a process of implementing appropriate control measures. The primary trigger of the contingency plan will be a violation of the ambient air quality standard for 8-hour ozone. The secondary trigger will be a monitored air quality pattern that suggests an actual 8-hour ozone NAAQS violation may be imminent.

3.2 FOUNDATION CONTROL PROGRAM

The main element of the maintenance plan is the foundation control program. The foundation control program contains the controls necessary to maintain the ambient air quality standards. The purpose of the foundation control program is to prevent the ambient air quality standards from being violated and thereby eliminate the need for more costly controls being imposed on industry and the general public. Each component of the State's foundation control program is essential in demonstrating maintenance of the air quality standards.

The foundation control program consists of Federal and State measures. The Federal measures include the cleaner fuel programs and the federal highway motor vehicle and off-road equipment control program. State measures include the I/M program, the air toxics program, the NOx SIP Call rule, the Clean Smokestacks Act, heavy duty diesel engine gap filling requirements and an open burning regulation. All of these programs have already been implemented or are in the process of being implemented.

3.2.1 Federal Control Measures

Tier 2 Vehicle Standards

Federal Tier 2 vehicle standards will require all passenger vehicles in a manufacturer's fleet, including light-duty trucks and Sports Utility Vehicles (SUVs), to meet an average standard of 0.07 grams of NOx per mile. Implementation began in 2004, and most vehicles will be phased in by 2007. The Tier 2 standards will also cover passenger vehicles over 8,500 pounds gross vehicle weight rating (the larger pickup trucks and SUVs), which are not covered by the current Tier 1 regulations. For these vehicles, the standards will be phased in beginning in 2008, with full compliance in 2009. The new standards require vehicles to be 77% to 95% cleaner than those on the road today. The Tier 2 rule also reduces the sulfur content of gasoline to 30 ppm starting in January of 2006. Most gasoline sold in North Carolina prior to January 2006 had a sulfur content of about 300 ppm. The sulfur in gasoline interferes with the operation of catalytic converters on vehicles resulting in higher NOx emissions. Lower-sulfur gasoline is necessary to achieve the Tier 2 vehicle emission standards.

Heavy-Duty Gasoline and Diesel Highway Vehicles Standards

New USEPA standards designed to reduce NOx and VOC emissions from heavy-duty gasoline and diesel highway vehicles began to take effect in 2004. A second phase of standards and testing procedures, beginning in 2007, will reduce particulate matter from heavy-duty highway engines, and will also reduce highway diesel fuel sulfur content to 15 ppm since the sulfur

damages emission control devices. The total program is expected to achieve a 90% reduction in particulate matter (PM) emissions and a 95% reduction in NOx emissions for these new engines using low sulfur diesel, compared to existing engines using higher-content sulfur diesel.

Large Nonroad Diesel Engines Rule

The USEPA promulgated in May 2004 new rules for large nonroad diesel engines, such as those used in construction, agricultural, and industrial equipment, to be phased in between 2008 and 2014. The nonroad diesel rules also reduce the allowable sulfur in nonroad diesel fuel by over 99%. Nonroad diesel fuel currently averages about 3,400 ppm sulfur. The rule limits nonroad diesel sulfur content to 500 ppm in 2006 and 15 ppm in 2010. The combined engine and fuel rules would reduce NOx and PM emissions from large nonroad diesel engines by over 90%, compared to current nonroad engines using higher-content sulfur diesel.

Nonroad Spark-Ignition Engines and Recreational Engines Standard

The new standard, effective in July 2003, regulates NOx, HC and CO for groups of previously unregulated nonroad engines. The new standard will apply to all new engines sold in the United States and imported after these standards begin and will apply to large spark-ignition engines (forklifts and airport ground service equipment), recreational vehicles (off-highway motorcycles and all-terrain-vehicles), and recreational marine diesel engines. The regulation varies based upon the type of engine or vehicle.

The large spark-ignition engines contribute to ozone formation and ambient CO and PM levels in urban areas. Tier 1 of this standard was implemented in 2004 and Tier 2 is scheduled to start in 2007. Like the large spark-ignition, recreational vehicles contribute to ozone formation and ambient CO and PM levels. They can also be a factor in regional haze and other visibility problems in both state and national parks. For the off-highway motorcycles and all-terrain-vehicles, model year 2006, the new exhaust emissions standard was phased-in by 50% and for model years 2007 and later at 100%. Recreational marine diesel engines over 37 kilowatts are used in yachts, cruisers, and other types of pleasure craft. Recreational marine engines contribute to ozone formation and PM levels, especially in marinas. Depending on the size of the engine, the standard began phasing-in in 2006.

When all of the nonroad spark-ignition engines and recreational engines standards are fully implemented, an overall 72% reduction in HC, 80% reduction in NOx, and 56% reduction in CO emissions are expected by 2020. These controls will help reduce ambient concentrations of ozone, CO, and fine PM.

NOx SIP Call in Surrounding States

In October 1998, the USEPA made a finding of significant contribution of NOx emissions from certain states and published a rule that set ozone season NOx budgets for the purpose of reducing regional transport of ozone (63 FR 57356). This rule, referred to as the NOx SIP Call, called for ozone season controls to be put on utility and industrial boilers, as well as internal combustion engines in 22 states in the Eastern United States. A NOx emissions budget was set for each state and the states were required to develop rules that would allow the state to meet their budget. A NOx trading program was established, allowing sources to buy credits to meet their NOx budget as opposed to actually putting on controls. The emission budgets were to be met by the beginning of 2004. Even with the trading program, the amount of ozone season NOx emissions has decreased significantly in and around North Carolina.

Clean Air Interstate Rule in Surrounding States

In 2009, the NOx SIP Call program was replaced with the Clean Air Interstate Rule (CAIR), a cap-and-trade program that will achieve reductions of emissions of sulfur dioxide (SO2) and nitrogen oxides (NOx) in the eastern United States. North Carolina benefits from surrounding States' NOx reductions. Due to the Court challenges of CAIR in 2008, the USEPA will be making changes to this program soon. However, the existing CAIR rules will remain in place until USEPA promulgates changes to the program.

3.2.2 State Control Measures

North Carolina has adopted a number or regulations and legislation to address pollution issues across the State. These are summarized below.

Clean Air Bill

The 1999 Clean Air Bill expanded the vehicle emissions I/M program from 9 counties to 48, phased in between July 1, 2002 through January 1, 2006 (see Figure 3-1). Vehicles are tested using the onboard diagnostic system, an improved method of testing, which indicates excessive NOx emissions, among other pollutants. The previously used tailpipe test did not address NOx. The effective date for Haywood County, one of the counties the North Carolina GSMNP nonattainment area is located in, was July 1, 2005. The I/M program in Buncombe County, located near the GSMNP, started in July 1, 2004.

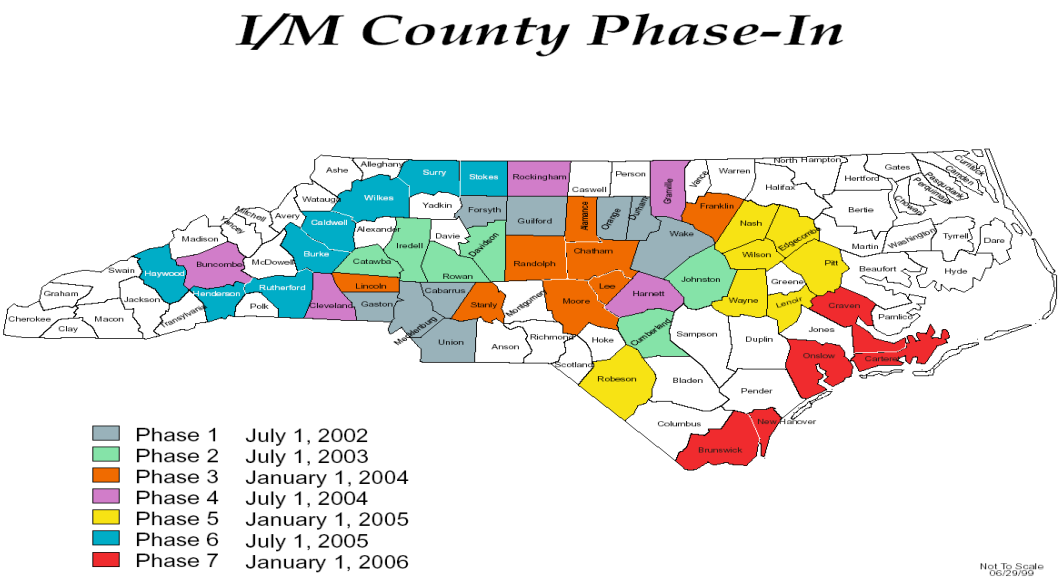


Figure 3-1. North Carolina's NOx Inspection & Maintenance Phase-In Map

NOx SIP Call / Clean Air Interstate Rule

In response to the USEPA's NOx SIP call, North Carolina adopted rules to control the emissions of NOx from large stationary combustion sources. These rules cover (1) fossil fuel-fired stationary boilers, combustion turbines, and combined cycle systems serving a generator with a nameplate capacity greater than 25 megawatts electrical and selling any amount of electricity, (2) fossil fuel-fired stationary boilers, combustion turbines, and combined cycle systems having a maximum design heat input greater than 250 million British thermal units per hour, and (3) reciprocating stationary internal combustion engines rated at equal or greater than 2400 brake horsepower (3000 brake horsepower for diesel engines and 4400 brake horsepower for dual fuel engines). As part of the NOx SIP call, the USEPA rules established a NOx budget for sources in North Carolina and other states. North Carolina has a Phase II budget (i.e., emissions allowance) of 165,022 tons of NOx per ozone season.

Besides amending existing NOx rules and adopting new NOx rules specifically to address the USEPA NOx SIP call, the North Carolina rules also require new sources to control emissions of NOx. The objective of this requirement is (1) to aid in meeting the NOx budget for North Carolina for minor sources and (2) to aid in attaining and maintaining the ambient air quality standard for ozone in North Carolina.

North Carolina's NOx SIP Call rule was predicted to reduce summertime NOx emissions from power plants and other industries by 68% by 2006. The North Carolina Environmental Management Commission adopted rules requiring the reductions in October 2000.

In 2009, the NOx SIP Call program was replaced with the Clean Air Interstate Rule (CAIR), a cap-and-trade program that will achieve reductions of emissions of sulfur dioxide (SO2) and nitrogen oxides (NOx) in the eastern United States. NOx sources that were regulated under the NOx SIP Call are now regulated under the CAIR program. North Carolina adopted the CAIR rules in 2006 (amended in 2008). North Carolina's CAIR rules set both ozone season and annual NOx allowances for coal fired electric generating units and other large combustion sources. Due to the Court challenges of CAIR in 2008, the USEPA will be making changes to this program soon. However, the existing CAIR rules will remain in place until USEPA promulgates changes to the program.

Clean Smokestacks Act

In June 2002, the North Carolina General Assembly enacted the Clean Smokestacks Act, requiring coal-fired power plants to reduce annual NOx emissions by 78% by 2009. These power plants must also reduce annual sulfur dioxide emissions by 49% by 2009 and by 74% by 2013. The Clean Smokestacks Act reduces NOx emissions beyond the requirements of the NOx SIP Call Rule. One of the first state laws of its kind in the nation, this legislation provides a model for other states in controlling multiple air pollutants from older coal-fired power plants.

Open Burning Bans

The Environmental Management Commission approved revisions to the open burning regulation banning open burning on forecasted code orange and higher air quality action days for those counties that the NCDAQ forecasts ozone and fine particulate matter. Since 1999, the NCDAQ has forecasted ozone for the mountain area. Therefore, the following counties in the mountain area are subject to this rule: Buncombe, Haywood, Henderson, Jackson, Madison, Swain, Transylvania and Yancey.

Air Toxics Control Program

Although the purpose of North Carolina's air toxic program is to control toxic air pollutants rather than volatile organic compounds, it will also reduce emissions of volatile organic compounds because many toxic air pollutants are also volatile organic compounds. The air toxic program was effective May 1, 1990. All new facilities are required to comply with the air toxic

rules before beginning operation. Existing facilities that are modified such that there are additional emissions of toxic air pollutants are required to comply with the air toxic rules.

Prevention of Significant Deterioration

All new major sources of VOCs and NOx will be evaluated under the prevention of significant deterioration program and are required to use best available control technology.

Heavy Duty Diesel Engine Gap Filling Requirements

In October of 2001, the Environmental Management Commission adopted a rule to fill a gap in federal requirements for improved heavy duty diesel engine emissions testing in order to prevent excess NOx emissions from occurring over the lengthy life of such vehicles. Without the rule, estimated excess NOx emissions of 5.3 tons per day would occur in 2005 and 10.91 tons per day in 2006 from heavy-duty diesels registered in North Carolina. The rule requires that all model year 2005 and 2006 heavy-duty diesel engines sold, leased, or registered in North Carolina to be of the type which have been certified by the California Air Resources Board as meeting supplemental test procedures that are more representative of actual on-road operating conditions than the federal test procedures for those model years. On January 1, 2002, the rule became effective.

3.2.3 Additional Programs Supporting Maintenance

Air Awareness Program

The North Carolina Air Awareness Program is a public outreach and education program of the NCDAQ. The goal of the program is to reduce air pollution through voluntary actions by individuals and organizations. The program seeks to educate individuals about (1) the sources of air pollution; (2) the health effects of air pollution and how these effects can be mitigated by modification of outdoor activities on ozone action days; and (3) simple "action tips", such as carpooling, vehicle maintenance, and energy conservation, that reduce individual contributions to air pollution. One of the major program components is the ozone forecast. The NCDAQ produces the 8-hour ozone forecasts and corresponding air quality index for the mountain forecast area from May 1 through September 30 of each year. Since there can be differences in the ozone levels between the ridge tops of mountains versus the valley areas, the NCDAQ produces two separate ozone forecasts for the two regions in the mountains. Individuals and businesses are encouraged to take action on days forecasted to be code orange or higher to reduce pollution during these potentially high ozone events.

3.3 EMISSIONS INVENTORIES AND MAINTENANCE DEMONSTRATION

3.3.1 Theory of Approach

There are two basic approaches used to demonstrate continued maintenance. The first is the comparison of a projected emissions inventory with a baseline emissions inventory. The second approach involves complex analyses using gridded dispersion modeling. The approach used by the NCDAQ for the GSMNP maintenance demonstration is the comparison of emissions inventories for the years 2005 and 2020.

For the maintenance demonstration, the base year of 2005 was chosen since it is a year that falls within the latest attaining design value period of 2004-2006 and some emissions inventory data was already developed for this year. It should be noted that the North Carolina GSMNP nonattainment area was attaining the 8-hour ozone NAAQS for the design value period 2003-2005 as well. Therefore, since emissions inventory data was partially available for 2005, this inventory year was deemed the most appropriate base year for the maintenance plan.

The maintenance demonstration is made by comparing the 2005 baseline emissions inventory to the 2020 projected emissions inventory. The baseline emissions inventory represents an emissions level for a period when the ambient air quality standard was not violated, 2004-2006. If the projected emissions remain at or below the baseline emissions, continued maintenance is demonstrated and it then follows, if the projected emissions remain at or below the baseline emissions, then the ambient air quality standard should not be violated in the future. In addition to comparing the final year of the plan, all of the interim years are compared to the 2005 baseline to demonstrate that these years are also expected to show maintenance of the 8-hour ozone standard.

The emissions inventories are usually comprised of four major types of sources: point, area, highway mobile and off-road mobile. However, there are no permitted point sources located within the North Carolina GSMNP nonattainment area. Projected emissions inventories are generally estimated using projected rates of growth in population, traffic, activity levels, and other parameters. In the case of the GSMNP, the National Park Service (NPS) has indicated that no increase in the area and off-road mobile sources activity levels are expected over the next ten years. Naturally occurring, or biogenic, emissions are not included in the emissions inventory comparison, as these emissions are outside the State's span of control.

3.3.2 Emission Inventories

In the North Carolina GSMNP nonattainment area, there are three different manmade emission inventory source classifications: (1) area, (2) highway mobile and (3) off-road mobile sources.

Area sources are those stationary sources whose emissions are relatively small but due to the large number of these sources, the collective emissions could be significant (i.e., dry cleaners, service stations, etc.). For area sources, emissions are estimated by multiplying an emission factor by some known indicator of collective activity such as production, number of employees, or population. For the North Carolina GSMNP nonattainment area, the NPS provided the NCDAQ with a 2000 emissions inventory that documented the sources of emissions occurring within the GSMNP boundary (Appendix B). Working with the NPS, the sources located within the North Carolina portion of the GSMNP were determined. Additionally, the NPS indicated that the activity levels for the area source categories are not expected to increase over the next ten years, therefore these emissions were held constant for all of the future years. The emissions from this source category is so small that the combined emissions for the area sources totals to less than 0.01 tons per day, and are therefore effectively zero.

For highway mobile sources, the USEPA's MOBILE6.2 mobile model is run to generate the emission factors. The emissions are calculated by multiplying the vehicle miles traveled (VMT) by the emission factors and the emissions were summed for the whole GSMNP. For the projected years' inventories, the highway mobile sources emissions are calculated by running the MOBILE6.2 mobile model for the future year to generate emission factors that take into consideration expected Federal tailpipe standards, fleet turnover and new fuels. The new emission factors are multiplied by the projected VMT. The base year and projected VMT was provided by the North Carolina Department of Transportation and approved by the NPS.

Off-road mobile sources are equipment that can move but do not use the roadways, i.e., lawn mowers, construction equipment, railroad locomotives, aircraft, etc. The emissions from this category are calculated using the USEPA's NONROAD2005c nonroad mobile model. The NPS provided the type of equipment used in the North Carolina GSMNP nonattainment area and the estimated annual hours the equipment is used. The emissions factors were then obtained from the NONROAD2005c model to estimate the emissions. The emissions from this source category is so small that the combined emissions for the off-road equipment totals to less than 0.01 tons per day, and are therefore effectively zero.

A complete description of how these inventories were developed is discussed in detail in Appendix C.

3.3.3 Summary of Emissions

The table below summarizes the estimated emissions from all of the emission source sectors represented in the GSMNP, i.e. area, highway mobile and off-road mobile, as well as totals for the manmade emissions for the GSMNP nonattainment area.

Table 3-1 Emissions for the North Carolina GSMNP Nonattainment Area

Source	2005	2008	2011	2014	2017	2020
VOC Emissions (tons/day)						
Area	0.17	0.17	0.17	0.17	0.17	0.17
Highway Mobile	0.41	0.36	0.32	0.27	0.24	0.22
Off-Road Mobile	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.58	0.53	0.49	0.44	0.41	0.39
NOx Emissions (tons/day)						
Area	0.00	0.00	0.00	0.00	0.00	0.00
Highway Mobile	0.26	0.23	0.20	0.17	0.15	0.14
Off-Road Mobile	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.26	0.23	0.20	0.17	0.15	0.14

3.3.4 Maintenance Demonstration

As discussed above, maintenance is demonstrated when the future years total man-made emissions are less than the 2005 baseline emissions. The following table summarizes the VOC and NOx emissions for the North Carolina GSMNP nonattainment area. All of the interim years show a decrease in emissions from the base year 2005. The difference between the base year and the final year of the plan illustrates that the continued maintenance of the 8-hour ozone NAAQS is expected in the GSMNP over the next ten years.

Table 3-2 Maintenance Demonstration for GSMNP

Year	VOC TPD	Reduction from 2005	NOx TPD	Reduction from 2005
2005	0.58	NA	0.26	NA
2008	0.53	-0.05	0.23	-0.03
2011	0.49	-0.09	0.20	-0.06
2014	0.44	-0.14	0.17	-0.09
2017	0.41	-0.17	0.15	-0.11
2020	0.39	-0.19	0.14	-0.12
Maintenance Demonstration (2020-2005)	-0.19		-0.12	

3.4 CONTINGENCY PLAN

3.4.1 Overview

The two main elements of the North Carolina contingency plan are tracking and triggering mechanisms to determine when contingency measures are needed and a process of developing and adopting appropriate control measures. The NCDAQ will closely track the ambient air quality year-to-year in and around the North Carolina GSMNP nonattainment area. The primary trigger of the contingency plan will be a violation of the 1997 8-hour ozone NAAQS at the North Carolina GSMNP nonattainment area monitor. The secondary trigger will be a monitored air quality pattern that suggests an actual 1997 8-hour ozone NAAQS violation may be imminent. Upon either of these triggers being activated, the NCDAQ will commence analyses to determine what additional measures, if any, will be necessary to attain or maintain the 1997 8-hour ozone standard. If activation of either of the triggers occurs, this plan provides a regulatory adoption process for revising emission control strategies. Each adopted rule will include a schedule that will require compliance with the rule no later than 3 years after adoption of the rule.

Normally, the NCDAQ would include at least one measure that could be implemented within the maintenance area should a future violation be due to emissions within the maintenance area. Such measures might include implementation of Stage 1 vapor recovery at gasoline stations within the park or implementation of voluntary, episodic control measures through an Air Quality Action Day Program (AQADP), to name a few. The NCDAQ considered what additional measures could be implemented; however, as mentioned earlier, exceedances are at night and are the result of ozone transported into the nonattainment area from outside regions. Additionally, the park is already taking measures to reduce emissions within the park to include Stage 1 vapor recovery on gasoline stations located in the park, along with having an AQADP in place that includes the following measures:

a. Encouraging employees to decrease vehicle use by car pooling and reducing the number of non-essential trips;

b. Fuel switching using biodiesel;

c. Postponing or decreasing the use of mowers and other gasoline engine equipment until ozone levels drop;

d. Encouraging refueling of vehicles in the early morning or late evening hours.

Therefore the NCDAQ believes the maintenance area is meeting the requirements of contingency measures. However, should one of the triggers occur, the NCDAQ will commence discussion amongst the stakeholders in the maintenance area to discuss additional measures that could be implemented. Such measures would likely relate to mobile sources within the maintenance area.

3.4.2 Explanation of Contingency Plan Triggers

The primary trigger of the contingency plan will be a violation of the 1997 8-hour ozone standard, or when the three-year average of the 4th highest values is equal to or greater than 0.085 ppm. The trigger date will be 60 days from the date that the State observes a 4th highest value that, when averaged with the two previous ozone seasons' fourth highest values, would result in a three-year average equal to or greater than 0.085 ppm.

The secondary trigger will apply where no actual violation of the 1997 8-hour ozone standard has occurred, but where the State finds monitored ozone levels indicating that an actual ozone NAAQS violation may be imminent. A pattern will be deemed to exist when there are two consecutive ozone seasons in which the 4th highest values are 0.085 ppm or greater. The trigger date will be 60 days from the date that the State observes a 4th highest value of 0.085 ppm or greater, following a season in which the 4th highest value was 0.085 ppm or greater.

3.4.3 Action Resulting From Trigger Activation

Once one of the triggers is activated, the Planning Section of the NCDAQ shall commence analyses including trajectory analyses of high ozone days, and emissions inventory assessment to determine the cause of the ozone transport into the GSMNP. Since there are very few emission sources that occur within the GSMNP and the GSMNP has already committed to reduce their emissions through such programs as bio-diesel fuel use, the State is forced to look outside the GSMNP for emission reductions. The NCDAQ will commence discussion with regulatory authorities responsible for upwind sources to determine additional actions to be implemented. These actions may include one or more of the following measures:

* RACM for sources of NOx
* RACT for existing point sources of NOx
* Mobile Source Measures
* Additional NOx reduction measures yet to be identified

If the cause of the ozone transport is due to sources within North Carolina, then by May 1 of the year following the ozone season in which the trigger has been activated, North Carolina will complete sufficient analyses to begin adoption of necessary rules for ensuring attainment and

maintenance of the 1997 8-hour ozone NAAQS. The rules would become State effective by the following January 1, unless legislative review is required.

If the cause of the ozone transport is from sources outside of North Carolina, then the NCDAQ will begin working with our neighboring states to resolve the ozone transport issues. The State of North Carolina has already filed a Section 126 petition in order to ensure that neighboring states reduce their utility emissions in a timely manner. As a result of the recent court decision in the State of North Carolina vs. Tennessee Valley Authority (TVA), additional emissions reductions are anticipated for upwind TVA sources.

3.4.4 Ongoing Maintenance Strategy Program

The GSMNP ozone exceedances are due to ozone transport. With the abundance of natural forming VOC emissions in the Southeast, the manmade pollutant of concern is NOx. The largest source of NOx emissions in and around the GSMNP nonattainment area is the utility sector. Therefore, in addition to the measures listed above, the NCDAQ commits to review the NOx emissions from the utility sector in North Carolina and the surrounding states to ensure that the summertime NOx emissions do not start to increase to a level that may result in ozone exceedances in the GSMNP. These emissions will be obtained from the USEPA's CAMD as they become available. It should be noted that North Carolina and the surrounding states, with the exception of Georgia, all have ozone season NOx emissions budgets for the utility sector and many of the large industrial sources under the Federal NOx SIP call rule, so significant increases in NOx emissions from utilities and large industrial boilers is not expected.

If increases in NOx emissions are discovered and there have been exceedances of the 1997 8-hour ozone NAAQS in the North Carolina GSMNP nonattainment area, the NCDAQ will work with its sources or with neighboring states to understand why the increase in emissions has occurred.

4.0 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 by the NCDOT or the MPOs for the Transportation Implementation Plan and Long Range Transportation Plan must not exceed the MVEB as defined in this maintenance plan.

Highway Mobile Source VOC Insignificance

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

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

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

The NCDAQ has examined the sources of VOC emissions and their contribution to ozone formation in North Carolina. Because of the generally warm and moist climate of North Carolina, vegetation abounds in many forms, and forested lands naturally cover much of the state. The biogenic sector is the most abundant source of VOCs in North Carolina and accounts for approximately 90% of the total VOCs statewide. The overwhelming abundance of biogenic VOCs makes the majority of North Carolina a NOx limited environment for the formation of ozone. This holds especially true in the GSMNP, where biogenics make up about 99% of VOC emissions. Biogenic emissions are estimated using models developed by the USEPA. Since biogenic emissions were not generated specifically for this maintenance plan, the biogenic

emissions were obtained from modeling used for the Charlotte-Gastonia-Rock Hill 8-hour ozone nonattainment area since it was readily available and should not change significantly from year to year. A typical summer day's emissions were obtained from the modeling, which used 2002 meteorology. Since these emissions are reported at the county level, the biogenic emissions for the GSMNP were estimated by taking the county area fraction of the GSMNP in Haywood and Swain Counties, respectively.

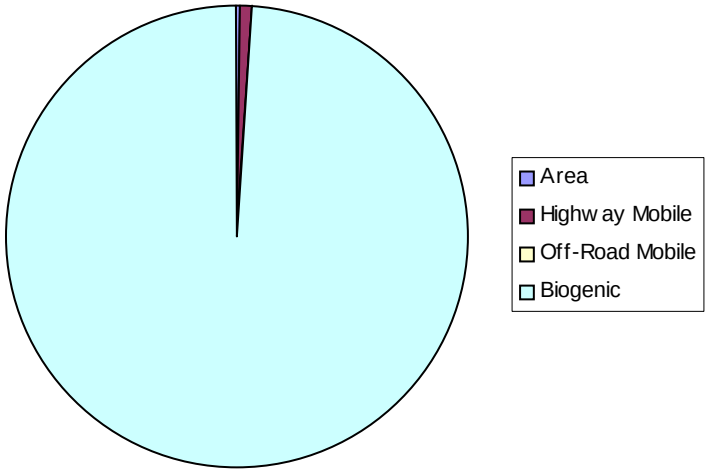
The table below summarizes the estimated VOC emissions from all of the emission source sectors represented in the GSMNP.

Table 4-1 2005 Emissions for the North Carolina GSMNP Nonattainment Area Tons/Day

Source	VOC tons/day
Area	0.17
Highway Mobile	0.41
Off-Road Mobile	0.00
Biogenic	48.50
Total	49.08

Figures 4.1 provides the percent contributions from point, highway mobile, area, off-road mobile and biogenic sources to the total VOC emissions in Haywood and Swain Counties in 2005.

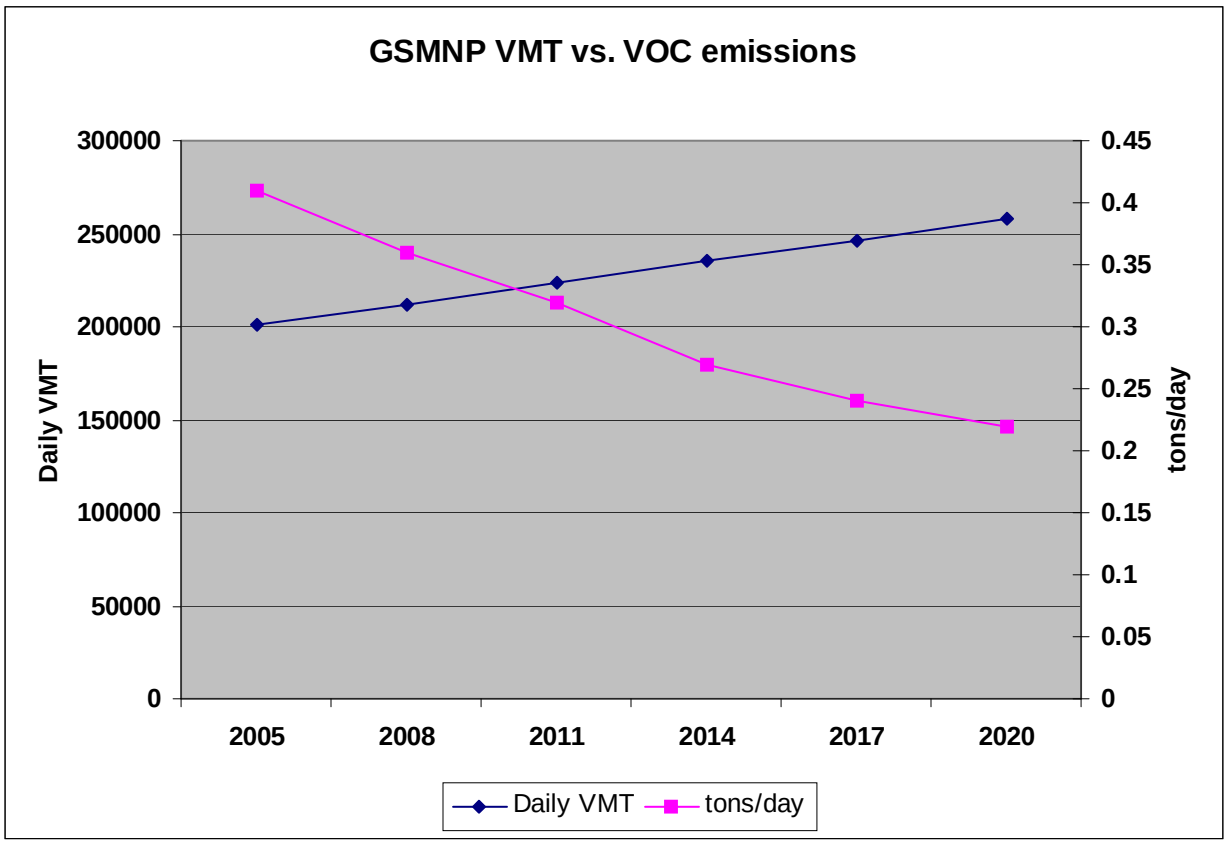
Figure 4-1 Haywood and Swain County 2005 VOC Emissions



In Haywood and Swain Counties, highway mobile sources contribute less than one percent of the 2005 total VOC inventory.

Also noteworthy are the projected decreases in highway mobile VOC emissions through the year 2020 despite projected VMT increases. These reductions are due mainly to the retirement of older vehicles and the growing fleet of Tier 2 vehicles on the roads in future years. Some additional reductions are attributable to North Carolina's I/M program in Haywood County. The VMT and highway mobile VOC projections are summarized in Figure 4-2 below.

Figure 4-2 GSMNP VMT and VOC emissions growth



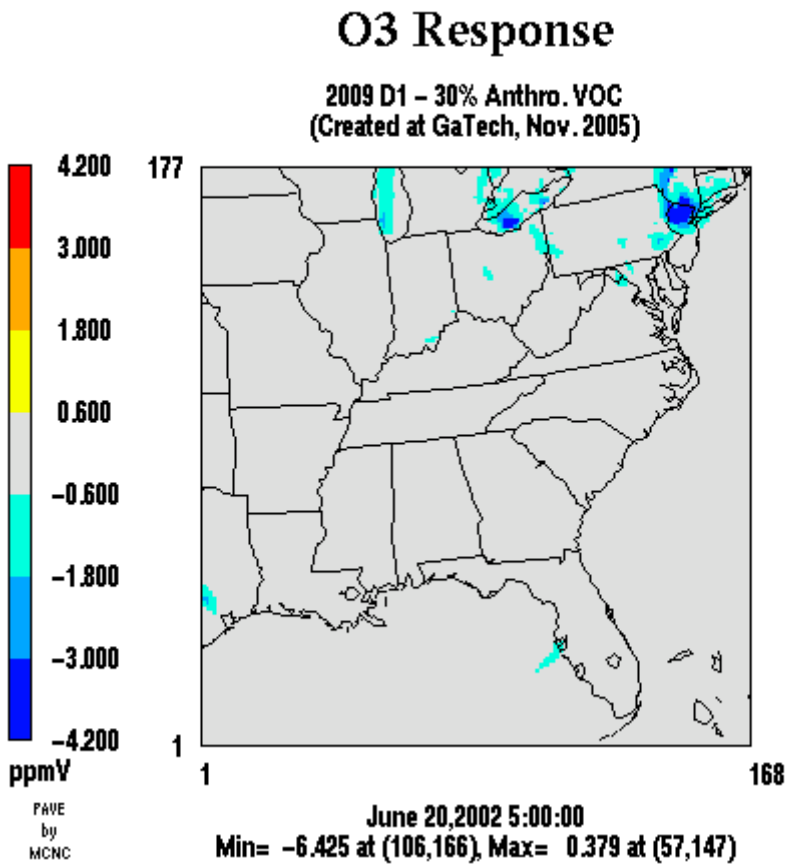
The current state of air quality in the GSMNP nonattainment area is steadily improving. The current ozone design value in the GSMNP nonattainment area is 0.077 ppm based on data from 2006-2008. This is well below the NAAQS of 0.084 ppm.

A recent modeling sensitivity test, performed by the Association for Southeastern Integrated Planning (ASIP), allows an analysis of VOC contributions to ozone concentrations in the Southeastern United States. ASIP is a regional collaborative, set up by the Southeastern States Air Resource Managers, Inc. (SESARM), focused on the coordination of planning activities

associated with the analysis of fine particulate matter and 8-hour ozone nonattainment areas and development of options for attaining and maintaining the NAAQS. One of the analyses conducted by ASIP is a series of emissions sensitivity modeling runs to quantify the contributions of various emission sources to ozone and fine particles. The modeling system used in this analysis consisted of 3 components: 1) the Penn State University/National Center for Atmospheric Research Mesoscale Model (MM5 version 3.6.1+), 2) the Sparse Matrix Operator Kernel Emissions Modeling System (SMOKE version 2.1), and 3) the Community Multiscale Air Quality (CMAQ version 4.4) model. Model configurations, input data, and modeling methods are consistent with those suggested by USEPA in "Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS".

The emissions sensitivities are calculated by taking the difference between two air quality model simulations: one with base case emissions and another with reduced emissions inputs. The emissions sensitivity discussed here reduces *all* anthropogenic VOCs in the modeling domain by 30% from 2009 emission levels. Translating this to the GSMNP emissions, this 30% anthropogenic VOC reduction is equivalent to a 33% highway mobile VOC reduction in 2009. This emissions sensitivity was run for a 39-day period (June 1-July 9). In all 39 days of the modeling simulation, the 8-hour ozone maximum concentrations were unchanged in Haywood and Swain Counties – a clear indicator that highway mobile VOC is an insignificant contributor to ozone formation in that area. In fact, there was not an 8-hour ozone response as high as 1 ppb anywhere in North Carolina during the sensitivity simulation. Figure 4-3 provides an example from the 30% anthropogenic VOC reduction modeling illustrating the lack of ozone response in North Carolina.

Figure 4-3-hour Ozone response to 30% athropogenic VOC reductions in 2009



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

NOx Motor Vehicle Emission Budgets

According to Section 93.118 of the transportation conformity rule, a maintenance plan must establish a MVEB for the last year of the maintenance plan (in this case, 2020). Through the interagency consultation process, it was decided that another MVEB would be set for the interim year of 2011 in the GSMNP maintenance plan.

The NCDAQ will set regional MVEB, for transportation conformity purposes, within the North Carolina portion of GSMNP maintenance area (includes portions of Haywood and Swain Counties) for 2011 and 2020. Table 4-2 below lists out the NOx MVEBs, for transportation conformity purposes, for the years 2011 and 2020. Upon the USEPA's affirmative adequacy finding for MVEBs, these MVEBs will become the applicable MVEBs for the GSMNP area. The enforceable budget is in terms of kg/day. To compare the budgets to the inventory, the conversion factor to use is 907.1847 kg per ton, rounded to two decimal places for tons.

Table 4-2 GSMNP MVEB

	2011	2020
NOx Emissions (kg/day)		
NOx Conformity MVEB	179.9	127.0

Speeds and VMT

In communications with Jim Renfro, Air Quality Specialist for GSMNP, there is only one roadtype, arterial. A universal speed of 25 miles per hour will be used throughout the park. VMT for GSMNP was provided by the North Carolina Department of Transportation.

Table 4-3 GSMNP VMT in miles per day

Year	2005	2008	2011	2014	2017	2020
VMT	200,830	212,277	223,725	235,172	246,619	258,067

5.0 STATE IMPLEMENTATION PLAN APPROVAL

5.1 INTRODUCTION

For an area to be redesignated and have an approved maintenance plan, the SIP must include evidence of compliance with the rules relied on to show maintenance of the standard. This section provides the evidence of compliance with such rules for the GSMNP 8-hour ozone nonattainment area.

5.2 EVIDENCE OF COMPLIANCE

The North Carolina GSMNP nonattainment area has not been required to make a SIP revision, since they have not been designated nonattainment for ozone prior to the 1990 CAA. Therefore, North Carolina has a fully approved SIP for this area. However, the following rules regulating emissions of VOCs and NOx in North Carolina have been approved, or have been submitted with a request to be approved, as part of the SIP:

15A NCAC 2D .0958, Work Practices For Sources of Volatile Organic Compounds,
15A NCAC 2D .0530, Prevention of Significant Deterioration,
15A NCAC 2D .0925, Petroleum Liquid Storage in Fixed Roof Tanks,
15A NCAC 2D .0926, Bulk Gasoline Plants,
15A NCAC 2D .0927, Bulk Gasoline Terminals,
15A NCAC 2D .0928, Gasoline Service Stations Stage I,
15A NCAC 2D .0932, Gasoline Truck Tanks and Vapor Collection Systems,
15A NCAC 2D .0933 Petroleum Liquid Storage in External Floating Roof Tanks
15A NCAC 2D .1000, Motor Vehicle Emission Control Standards.
15A NCAC 2D .1200, Control and Emissions from Incinerators
15A NCAC 2D .1409(b), Stationary Internal Combustion Engines
15A NCAC 2D .1416 - .1423, NOx SIP rules
15A NCAC 2D .1600, General Conformity
15A NCAC 2D .1700, Municipal Solid Waste Landfills, and
15A NCAC 2D .1900, Open Burning
15A NCAC 2D .2000, Transportation Conformity
15A NCAC 2D .2400 Clean Air Interstate Rules

Although 15A NCAC 2D .0925, .0926, .0927, .0928, .0932, and .0933, have been approved as part of the SIP, their applicability to these counties has not been submitted to the USEPA for approval as part of the federally-approved state implementation plan. These rules are, however, state enforceable in these counties. The extension of these rules to these counties was part of the State's air toxic program and not part of any federally mandated program.

Section 15A NCAC 2D .1000 regulates emissions from motor vehicles in the counties near the North Carolina GSMNP nonattainment area and requires the use of the on board diagnostic system, which will reduce NOx emissions as well as other pollutants. Additionally, these regulations fill a gap in federal requirements for improved heavy-duty diesel engine emissions testing in order to prevent excess NOx emissions. Effective September 1, 2009, the 2D .1000 regulations will include idle restrictions for heavy-duty vehicles.

Section 15A NCAC 2D .1200 regulates the controls and emissions from incinerators. Part of this rule has been submitted as part of the SIP, while .1205, .1206 and .1210 are part of the CAA Section 111(d) plans.

Two rules are conformity related, 15A NCAC 2D .1600 and .2000. General conformity related projects are covered under Section .1600, while transportation conformity related projects are covered under Section .2000. Although neither of these rules requires reduction in emissions, they do ensure that federal actions do not hinder attainment or maintenance of the NAAQS.

North Carolina has adopted an open burning rule, 15A NCAC 2D .1900, that prohibits open burning of vegetative material during Air Quality Action Days of Code Orange or higher in forecasted areas of the State. Ozone forecasts are issued for the mountain area from April 1st through September 30th, therefore this area is covered by this rule.

Section 15A NCAC 2D .2400 regulates nitrogen oxide emissions from electric generating units with a nameplate capacity of 25 megawatts or more producing electricity for sale. Section 15A NCAC 2D .2400 also covers industrial boilers that are covered under the NOx SIP rules. This Section replaces the NOx SIP rules beginning January 1, 2009.

Another important set of rules that control volatile organic compound emissions in these counties is Section 15A NCAC 2D .1100, Control of Toxic Air Pollutants. These rules, however, have not been submitted to the USEPA to be approved as part of the SIP since the rules are not a federal requirement.

There are two other rules that control emissions of volatile organic compounds in these areas. They are 15A NCAC 2D .0524, New Source Performance Standards, and 2D .1110, National Emission Standards for Hazardous Air Pollutants. Also, rule 2D .1111, Maximum Achievable Control Technology applies to control of emissions of volatile organic compounds. They are not part of the SIP, but the USEPA has delegated the State enforcement authority for standards that have been adopted by the State. The standards adopted by the State are state-enforceable regardless of the USEPA delegation.

6.0 STATE COMPLIANCE WITH CLEAN AIR ACT REQUIREMENTS

Section 107(d)(3)(E)(v) of the CAA requires that the provisions of Section 110 and part D of the Act be met within the area to be redesignated. This means that North Carolina must meet all requirements, if any, that had come due as of the date of the redesignation request.

The USEPA in its latest guidance on meeting redesignation requirements as contained in a memorandum from John Calcagni, Director, Air Quality Management Division, Office of Air Quality Planning and Standards to the USEPA Regional Offices dated September 4, 1992, (See Appendix A), states that "For the purposes of redesignation, a State must meet all requirements of Section 110 and Part D that were applicable prior to submittal of the complete redesignation request. When evaluating a redesignation request, Regions should not consider whether the State has met requirements that come due under the Act after submittal of a complete redesignation request."

Monitoring is one of the requirements of Section 110. The NCDAQ commits to continue operating the current ozone monitor in the North Carolina GSMNP 8-hour ozone nonattainment area, providing sufficient funding is available for continued operation. Any monitor shutdowns or relocations will only be made with the approval of USEPA. No plans are underway to discontinue operation, relocate or otherwise affect the integrity of the ambient monitoring network in place. The current monitor is operated consistent with 40 CFR Part 58 and any changes will only be made if they are consistent with 40 CFR Part 58.

NCDAQ believes that North Carolina has met all of the requirements of Section 110 and part D.

7.0 CONCLUSION

The most recent three years of ozone monitoring data for the GSMNP nonattainment area demonstrate compliance with the NAAQS for 1997 8-hour ozone. Since the 1990's, there have been many major programs enacted in North Carolina that have led to significant actual, enforceable emissions reductions, which have led to improvements in the air quality in the GSMNP area.

The required attainment emissions inventory has been provided (Section 3.3) as well as a contingency plan (Section 3.4). The criteria for an approved attainment plan and Section 110 and Part D CAA requirements are discussed in Section 5 and the commitment of continued monitoring is discussed in Section 6.

This redesignation demonstration and maintenance plan has been prepared to meet the requirements of the 1990 Clean Air Act Amendments.