Redesignation Demonstration and Maintenance Plan for the Hickory (Catawba County) and Greensboro/Winston-Salem/High Point (Davidson and Guilford Counties) Fine Particulate Matter Nonattainment Areas

Prepared by

North Carolina Department of Environment and Natural Resources

Division of Air Quality

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Preface: This document contains the technical support for North Carolina's Division of Air Quality to request the Hickory and Greensboro/Winston-Salem/High Point fine particulate matter nonattainment areas be redesignated as attainment for the annual fine particulate matter national ambient air quality standard pursuant to §§107(d)(3)(D) and (E) of the Clean Air Act, as amended.

EXECUTIVE SUMMARY

Introduction

Fine particulate matter, also known as fine particles and $PM_{2.5}$, refers to airborne particles less than or equal to 2.5 micrometers in diameter. Fine particles are treated as though they are a single pollutant, but they come from many different sources and are composed of many different compounds. $PM_{2.5}$ exposure adversely affects human health, especially respiratory and cardiovascular systems. Individuals particularly sensitive to $PM_{2.5}$ exposure include children, people with heart and lung disease, and older adults.

A variety of meteorological and geographic factors influence the concentration levels of fine particles, including both the regional and local distribution of urbanized areas, primary and precursor emissions sources, and natural features such as oceans and forests. $PM_{2.5}$ concentrations can also be high and exceed the national ambient air quality standards (NAAQSs) for fine particulate matter at any time of the year. Therefore, the United States Environmental Protection Agency (USEPA) mandates the year round monitoring of $PM_{2.5}$ concentrations throughout the country.

Nonattainment Designation

The nonattainment designation was an action taken by the USEPA under Section 107(d) of the Clean Air Act (CAA). The CAA requires that some areas be designated as nonattainment if a monitor is found to be in violation of a NAAQS. The USEPA took designation action in 2005 based on the ambient data from 2001-2003. At that time, the design value for Hickory area (Catawba County) was 15.6 micrograms per cubic meter ($\mu g/m^3$) and the design value for the Greensboro/Winston-Salem/High Point area (Davidson and Guilford Counties, referred to as the Triad area) was 15.9 $\mu g/m^3$.

Current Air Quality

The most recent three years of fine particulate monitoring data (2006-2008) for both the Hickory and Triad $PM_{2.5}$ nonattainment areas demonstrate compliance with the annual fine particulate matter NAAQS. The three year design value at the Hickory monitor is 14.2 $\mu g/m^3$. In the Triad nonattainment area, the three year design value at the Lexington monitor is 14.5 $\mu g/m^3$ and the three year design value at the Mendenhall monitor is 12.9 $\mu g/m^3$. Additionally, the annual design values at all three sites are trending downward.

Maintenance Plan Requirements

The State of North Carolina has implemented permanent and enforceable reductions in sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions, which are precursors to fine particulates. 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 air quality action days. In addition, there have been several State rules that have resulted in reductions in emissions within and surrounding the nonattainment area. These State actions include the NO_x State Implementation Plan (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 requirements, and off-road engine standards.

This combination of State and Federal actions has resulted in cleaner air in the $PM_{2.5}$ nonattainment areas, and the anticipated future benefits from these programs are expected to result in continued maintenance of the 1997 annual PM2.5 NAAQS in this region. A baseline year emissions inventory for NO_x, SO_2, and direct $PM_{2.5}$ was developed for 2008, since the design value for the 2006-2008 period showed attainment of the 1997 annual PM2.5 NAAQS. Future year emissions inventories were also developed for the interim years 2011, 2014, 2017, and a final year emission inventory was developed for 2021. The future year emissions were lower than the 2008 emissions in all cases. This demonstrates that the $PM_{2.5}$ nonattainment areas are expected to maintain the 1997 annual $PM_{2.5}$ NAAQS through 2021, since in no future year are the emissions expected to be greater than they were in the baseline year. The areas are 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 Hickory and Greensboro/Winston-Salem/High Point fine particulate matter nonattainment areas to attainment. The monitoring data clearly shows that the region has attained the annual fine particulate matter standard, and the maintenance demonstration shows that the future emission inventories are expected to be lower than the attainment year inventory through the implementation of the various control measures listed above.

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LIST OF ACRONYMS

Acronym	Definition
ºF	Degrees Fahrenheit
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CERR	Consolidated Emissions Reporting Rule
CFR	Code of Federal Regulations
CO	Carbon Monoxide
E-GAS 5.0	Economic Growth Analysis System version 5.0
FR	Federal Register
FRM	Federal Reference Method
GUAMPO	Greensboro Urban Area Metropolitan Planning Organization
HC	Hydrocarbons
I/M	Inspection and Maintenance
MVEB	Motor Vehicle Emission Budget
NAAQS	National Ambient Air Quality Standard
NCCSA	North Carolina Clean Smokestacks Act
NCDAQ	North Carolina Division of Air Quality
NCDENR	North Carolina Department of Natural Resources
NCDOT	North Carolina Department of Transportation
NO_x	Nitrogen Oxides
PM	Particulate Matter
$PM_{2.5}$	Fine Particulate Matter
ppm	Parts per million
QA	Quality Assure
SAFETY-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides
SUV	Sports Utility Vehicle
TIP	Transportation Improvement Program
TPD	Tons per Day
TSP	Total Suspended Particulates
USEPA	U.S. Environmental Protection Agency
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds
$\mu g/m^3$	Micrograms per cubic meter
µm	Micrometer

1.0 INTRODUCTION

1.1 WHAT IS FINE PARTICULATE MATTER?

Fine particulate matter, also known as fine particles and $PM_{2.5}$, refers to airborne particles less than or equal to 2.5 micrometers (μm) in diameter. Fine particles are treated as though they are a single pollutant, but they come from many different sources and are composed of many different compounds. $PM_{2.5}$ exposure adversely affects human health, especially respiratory and cardiovascular systems. Individuals particularly sensitive to $PM_{2.5}$ exposure include children, people with heart and lung disease, and older adults.

$PM_{2.5}$ can be liquid, solid, or can have a solid core surrounded by liquid. $PM_{2.5}$ can include material produced by combustion, photochemical reactions, and can contain salt from sea spray and soil-like particles. Particles are distinguished based on the method of formation. Primary particles are particles directly emitted into the atmosphere and retain the same chemical composition as when they were released. Secondary particles are those formed through chemical reactions involving atmospheric oxygen, water vapor, hydroxyl radical, nitrates, sulfur dioxide (SO_2), oxides of nitrogen (NO_x), and organic gases from natural and anthropogenic sources. $PM_{2.5}$ can therefore be composed of varying amounts of different species, including:

- Sulfates
- Nitrates (usually found in the form of ammonium nitrate)
- Ammonium
- Hydrogen ion
- Particle bound water
- Elemental carbon
- Organic compounds
    - Primary organic species (from cooking and combustion)
    - Secondary organic compounds
- Crustal material (includes calcium, aluminum, silicon, magnesium, and iron)
- Sea salt (generally only found at coastal monitoring sites)
- Transitional metals
- Potassium (generally from wood burning or cooking)

The most significant sources of $PM_{2.5}$ and its precursors are coal-fired power plants, industrial boilers and other combustion sources. These emissions are often transported over large distances. Other sources of $PM_{2.5}$ emissions include mobile sources, area sources, fires, windblown dust, and biogenic, i.e., naturally occurring emissions such as sea salt from oceans and organics from trees.

A variety of meteorological and geographic factors influence the concentration levels of fine particles, including both the regional and local distribution of urbanized areas, primary and precursor emissions sources, and natural features such as oceans and forests. $PM_{2.5}$ concentrations can also be high and exceed the national ambient air quality standards (NAAQSs) for fine particulate matter at any time of the year. Therefore, the United States Environmental Protection Agency (USEPA) mandates in the Code of Federal Regulations (CFR) the year round monitoring of $PM_{2.5}$ concentrations throughout the country (40 CFR 58.App. D, 4.7).

In 1997, the USEPA promulgated the primary (health) and secondary (welfare) NAAQSs for $PM_{2.5}$ (40 CFR 50.7), setting the standard at a 15.0 micrograms per cubic meter ($\mu g/m^3$) annual average and at a 65 $\mu g/m^3$ daily or 24-hour average. A violation of the annual $PM_{2.5}$ NAAQS occurs when the annual average $PM_{2.5}$ concentration averaged over a three consecutive year period is equal to or greater than 15.1 $\mu g/m^3$. A violation of the daily $PM_{2.5}$ NAAQS occurs when the annual 98^{th} percentile of daily $PM_{2.5}$ concentration averaged over a three consecutive year period is equal to or greater than 66 $\mu g/m^3$. The annual or daily $PM_{2.5}$ design value for a nonattainment area is the highest design value for any monitor in that 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 (CAAA). With the implementation of the $PM_{2.5}$ standard, areas could be designated under Section 172 of the CAAA (subpart 1) and have five years from designation to attain the standard.

1.3 AIR QUALITY HISTORY

On January 5, 2005, the USEPA designated the Hickory area (Catawba County) and the Greensboro/Winston-Salem/High Point area (referred to as the Triad area and consisting of Davidson and Guilford Counties) as "subpart 1" nonattainment for the annual $PM_{2.5}$ standard based on the ambient data from 2001-2003 (Figure 1-1). At that time, the design values for the

Hickory and Triad nonattainment areas were 15.6 µg/m^3 and 15.9 µg/m^3, respectively. The official designation and classification was published in the Federal Register (FR) on January 5, 2005 (70 FR 944) and became effective on April 5, 2005. Prior to the implementation of the new $PM_{2.5}$ standard, these areas had been in attainment of the coarse particulate matter (PM_{10}) and total suspended particulate matter (TSP) standards. All areas of North Carolina met the 1997 daily $PM_{2.5}$ standard.

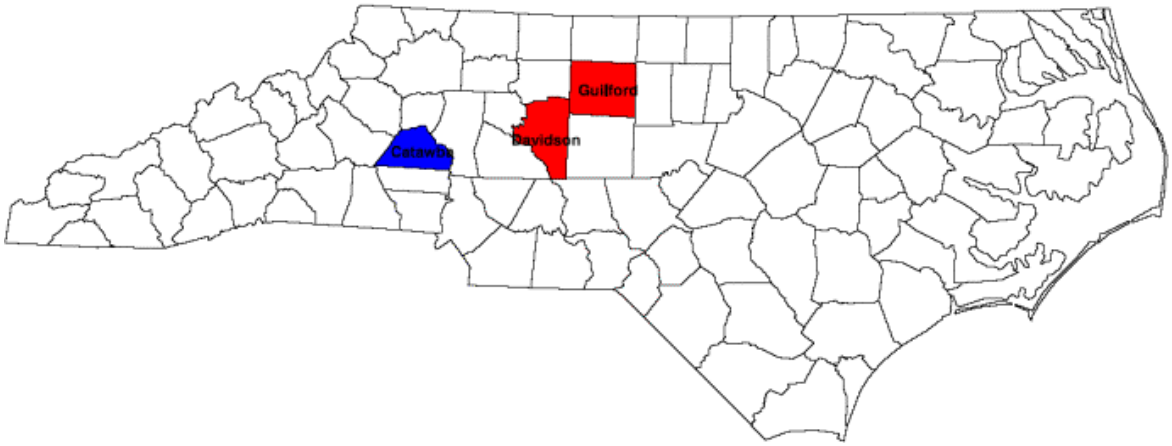

Figure 1-1. USEPA Designated Annual $PM_{2.5}$ Nonattainment Areas in North Carolina

All violating monitors were attaining the annual $PM_{2.5}$ standard with the inclusion of the 2008 ambient data. The 2006-2008 design values for the Hickory and Triad nonattainment areas are 14.2 µg/m^3 and 14.5 µg/m^3, respectively. Both areas continue to attain the daily $PM_{2.5}$ standard.

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 fine particulate matter, the areas must show that the average of the annual average values from three (3) consecutive calendar years of quality-assured air quality monitoring data must be 15.0 µg/m^3 or lower.

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 both the Hickory and Triad nonattainment areas have attained and are expected to maintain the annual fine particulate matter standard, and have 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 Catawba, Davidson, and Guilford Counties since 1999. At the time of fine particulate matter designations, there were three Federal Reference Method (FRM) monitors for fine particulate matter in the three counties; Hickory, Lexington, and Mendenhall (Figure 2-1). In late 2007, another $PM_{2.5}$ FRM monitor was installed in Guilford County, located in Colfax which is located just west of Greensboro. These monitors were installed in accordance with the 40 CFR 58.

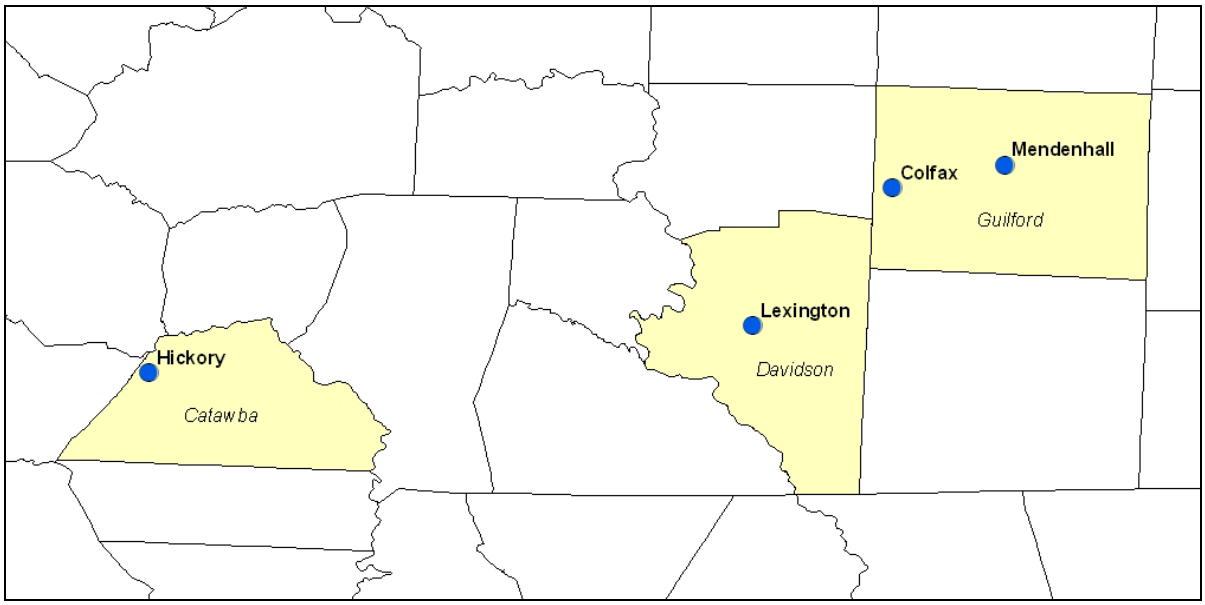

Figure 2-1. $PM_{2.5}$ Monitor Locations in the $PM_{2.5}$ Nonattainment Areas

Data from the fourth quarter of 2006 at Mendenhall is incomplete due to construction at the monitoring site and complications in relocating the site. The NCDAQ had to move the site since the school where the monitoring site is located constructed a two-story field house immediately adjacent to the monitoring site (letter to USEPA Region 4, Appendix D). The school had not notified the NCDAQ of its intention to build the field house. During a routine site visit, the NCDAQ discovered that construction had started within four meters of the monitoring site. At that point, the monitor no longer met the ambient monitoring siting criteria and had to be shut down and moved.

A new site was promptly found and appropriate permits were applied for. It took the NCDAQ four months (instead of an estimated 3 weeks) to resolve all the necessary permits and complete

the relocation of the monitor. This unfortunate circumstance resulted in most of the fourth quarter to go unmonitored.

The USEPA guidance does not address missing monitoring data for an entire quarter. The NCDAQ decided the best option was to develop regressive analysis between Mendenhall and surrounding monitors. Data from surrounding monitors was incorporated into the regressive analysis to obtain a best estimate for the fourth quarter at Mendenhall. Please see Appendix D for more details.

The Mendenhall monitor has never violated the $PM_{2.5}$ standards and has consistently had annual averages that were 1 – 2 $\mu g/m^3$ below the annual $PM_{2.5}$ NAAQS. The NCDAQ is confident that had the monitor been operating during the 2006 fourth quarter, the ambient air quality levels would have been consistent with the estimated values the NCDAQ has developed. The USEPA has also proposed to determine that the Greensboro/Winston-Salem/High Point nonattainment area has attained the 1997 $PM_{2.5}$ NAAQS (74 FR 51249).

Tables 2-1 and 2-2 below show the air quality data and corresponding design values, respectively, for the monitors in the both the Hickory and Triad nonattainment areas from 1999 to 2006. Table 2-2 indicates that the Hickory and Lexington monitors were in violation of the $PM_{2.5}$ NAAQS for this period, while the Mendenhall monitor was consistently below the annual $PM_{2.5}$ standard.

Table 2-1 Historic $PM_{2.5}$ Annual Averages (1999-2007)

Monitor	Fine Particulate Matter Annual Average ($\mu g/m^3$)								
	1999	2000	2001	2002	2003	2004	2005	2006	2007
Hickory Nonattainment Area									
Hickory AIRS ID #37-035-0004 Catawba County	17.42	17.63	15.98	15.36	15.04	15.00	15.95	15.17	14.54
Triad Nonattainment Area									
Lexington AIRS ID #37-057-0002 Davidson County	17.34	18.04	16.45	15.88	15.17	15.18	15.40	15.13	14.64
Mendenhall AIRS ID #37-081-0013 Guilford County				13.72	13.32	13.97	14.01	14.06*	13.05

*Estimated fourth quarter data

Table 2-2 Historic $PM_{2.5}$ Design Values (2000 – 2007)

Monitor	Design Value ($\mu g/m^3$)						
	99-01	00-02	01-03	02-04	03-05	04-06	05-07
Hickory Nonattainment Area							
Hickory AIRS ID #37-035-0004 Catawba County	**17.0**	**16.3**	**15.5**	**15.1**	**15.3**	**15.4**	**15.2**
Triad Nonattainment Area							
Lexington AIRS ID #37-057-0002 Davidson County	**17.3**	**16.8**	**15.8**	**15.4**	**15.3**	**15.2**	**15.1**
Mendenhall AIRS ID #37-081-0013 Guilford County				13.7	13.8	14.0*	13.7*

Note: Bolded values represent violations of the annual fine particulate matter standard.

*Estimated fourth quarter 2006 data used in Design Value calculation.

2.2 RECENT AIR QUALITY VALUES (2006 –2008)

The most recent three years of $PM_{2.5}$ monitoring data (2006-2008) for both the Hickory and Triad nonattainment areas demonstrate compliance with the annual fine particulate matter NAAQS. Table 2-3 is a summary of the annual averages for the monitors located in the nonattainment areas for 2006-2008 and their respective design values. The Colfax monitor only has data for 2008 and therefore does not have sufficient data to calculate a design value. However, the 2008 annual average is significantly below the annual $PM_{2.5}$ standard. Therefore, the NCDAQ is confident the area is in compliance of the NAAQS. The 2008 $PM_{2.5}$ monitoring data for both the Hickory and the Triad areas have been fully quality assured and were officially submitted to the USEPA on May 9, 2009.

As noted in the previous section, the fourth quarter data for 2006 at the Mendenhall monitoring site is incomplete. After an extensive analysis, the NCDAQ is confident that the Mendenhall monitor is not in violation of the $PM_{2.5}$ NAAQS (see Appendix D). It should be noted that the Mendenhall monitor has never violated the annual $PM_{2.5}$ NAAQS in the history of its operation.

Table 2-3 Current $PM_{2.5}$ Data (2006 -2008)

Monitor	Year	$PM_{2.5}$ Annual Average ($\mu g/m^3$)	Design Value ($\mu g/m^3$) 2006-2008
Hickory Nonattainment Area			
Hickory AIRS ID #37-035-0004 Catawba County	2006	15.17	14.2
	2007	14.54	
	2008	12.85	
Triad Nonattainment Area			
Lexington AIRS ID #37-057-0002 Davidson County	2006	15.13	14.5
	2007	14.64	
	2008	13.66	
Mendenhall AIRS ID #37-081-0013 Guilford County	2006	14.06*	12.9*
	2007	13.05	
	2008	11.45	
Colfax AIRS ID #37-081-0141 Guilford County	2006	N/A	N/A
	2007	N/A	
	2008	12.21	

*Estimated fourth quarter 2006 data used in Design Value calculation.

2.3 PERMANENT AND ENFORCEABLE EMISSIONS REDUCTIONS

There are several State and Federal measures that have been enacted in recent years that are resulting in permanent emissions reductions. Most of these emission reductions are due to regulations and thus are enforceable. However, a few measures are non-regulatory but will still result in emission reductions. A list of those measures that contributed to the permanent emission reductions are listed below and are more fully described in Section 3.2.

The federal measures that have been implemented include:

- Tier 2 vehicle standards: In addition to NO_x controls, the Tier 2 rule also reduced the sulfur content of gasoline to 30 parts per million (ppm) starting in January of 2006. Most gasoline sold in North Carolina prior to January 2006 had a sulfur content of about 300 ppm. These emission reductions are federally enforceable.

- Heavy-duty gasoline and diesel highway vehicle standards: Second phase of standards and testing procedures, which began 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. These emission reductions are federally enforceable.

- Nonroad spark-ignition engines and recreational engines standards: Tier 1 of this standard was implemented in 2004 and Tier 2 started in 2007, and will reduce particulate matter emissions. These emission reductions are federally enforceable.

- Large nonroad diesel engine standards: Promulgated in 2004, this rule is being phased in between 2008 and 2014. This rule will also reduce sulfur content in nonroad diesel fuel. When fully implemented, this rule will reduce NO_x and direct $PM_{2.5}$ emissions by over 90%. These emission reductions are federally enforceable.

The state measures that have been implemented include:

- Clean Air Bill: This State legislation expanded the inspection and maintenance (I/M) program from 9 counties to 48. It was phased-in in the Hickory and Triad nonattainment areas from July 1, 2002 through July 1, 2003. This program will reduce NO_x and Volatile Organic Compound (VOCs), and Carbon Monoxide (CO). These emission reductions are state enforceable.

- Open burning: This regulation prohibits the burning of man-made materials throughout the State. Additionally, this regulation prohibits open burning of yard waste in areas that the NCDAQ forecasts an air quality action day. The open burning regulation will reduce fine particulate matter emissions, as well as NO_x, VOCs and CO emissions. These emission reductions are state enforceable.

- 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 and will reduce PM emissions. These emission reductions are state enforceable.

- Clean Smokestack Act: This rule requires coal-fired power plants to reduce annual NO_x emissions by 77% by 2009 and to reduce annual sulfur dioxide emissions by 49% by 2009 and 73% by 2013. This legislation sets a cap on NO_x and SO_2 emissions, which the public utilities cannot meet by purchasing emission credits. These emission reductions are state enforceable.

- NO_x State Implementation Plan (SIP) Call rule: This rule was predicted to reduce summertime NO_x emissions from power plants and other industries by 68%. These emission reductions are state and federally enforceable.

- Diesel Retrofits: As part of the North Carolina Mobile Source Emission Reduction Grants program, a number of cities, counties and school districts have installed Diesel Oxidation Catalysts (DOCs) or Diesel Particulate Filters (DPFs) on their diesel equipment. The vehicles that have been retrofitted include schools buses, as well as county fleet trucks for solid waste pickup. These types of filters are designed to remove particulate matter, and when used with ultra low sulfur diesel fuel, NO_x and VOC emissions are also reduced. Even though these emission reductions are voluntary and not enforceable, they are still considered permanent reductions.

- Diesel Emissions Reduction Act (DERA): DERA provides new diesel emissions reduction grant authority for the USEPA. This funding is used to achieve significant reductions in diesel emissions that improve air quality and protect public health. The DERA funds that the NCDAQ have received have been used to retrofit, repower, or replace existing diesel engines from on-road and nonroad mobile source vehicles/equipment. This program will reduce PM, NOx, and VOC emissions. Even though these emission reductions are voluntary and not enforceable, they are still considered permanent reductions.

One of the largest components of $PM_{2.5}$ in the southeastern United States is sulfate. This is formed through various chemical reactions from the precursor SO_2. Another component of $PM_{2.5}$ is nitrate, which is formed from the precursor NO_x. Controls installed on coal-fired power plants over the past few years have significantly reduced these two precursor pollutants. Table 2-4 presents the annual emissions for the North Carolina sources that are in the USEPA's acid rain database. Since 2002, when the NO_x controls started coming on-line to meet the NO_x SIP Call and later to meet the North Carolina Clean Smokestacks Act (NCCSA), the NO_x emissions from subject sources have decreased over 54,000 tons per year. To meet the SO_2 emission caps in the NCCSA, the North Carolina public utilities started installing SO_2 controls late in 2005. Since then, the SO_2 emissions from the utilities in North Carolina have decreased nearly 274,000 tons. The decline in SO_2 emissions has coincided with the decline in annual $PM_{2.5}$ concentrations across North Carolina.

Table 2-4. Annual Emissions from NC Sources in USEPA Acid Rain Database

Year	Annual SO_2 Emissions (Tons)	Annual NO_x Emissions (Tons)
2002	462,993	145,706
2003	462,041	135,879
2004	472,320	124,079
2005	500,936	114,300
2006	462,143	108,584
2007	370,827	64,770
2008*	227,030	61,669

*Data from 2008 is considered preliminary.

As mentioned in Section 1.1, $PM_{2.5}$ is composed of many species from varying sources. Figure 2-2 presents the North Carolina statewide averaged $PM_{2.5}$ speciation data from the speciation trends network (STN) monitors for the year 2004. The figure presents sulfates and organic carbons as the main contributors to $PM_{2.5}$, each with 29% of the total $PM_{2.5}$ mass. The "other" portion of the $PM_{2.5}$ that accounts for 17% of the mass can be attributed to water, sea salts, and other trace materials captured with the STN monitors.

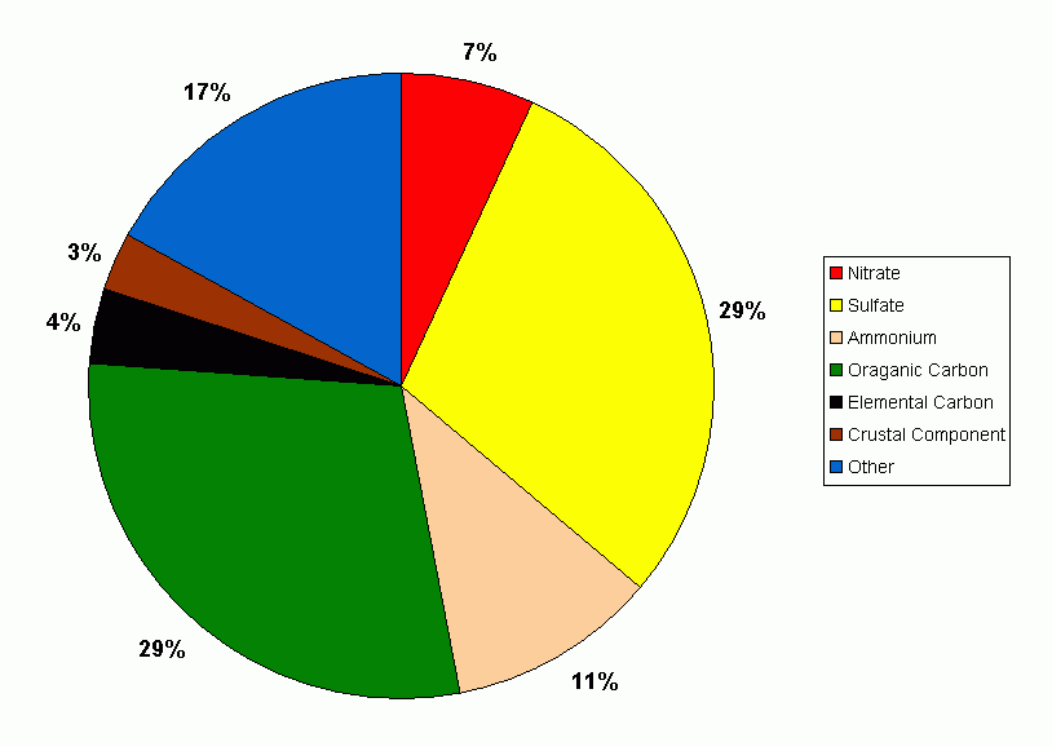

Figure 2-2. North Carolina $PM_{2.5}$ Speciation for 2004

Organic carbon is predominately attributed to biogenic emission sources and sulfate is associated with SO_2 emissions. When evaluated across North Carolina and also throughout both nonattainment areas and surrounding regions, the SO_2 is primarily from the point source sector. For this reason, reductions in SO_2 emissions will provide the greatest reductions in $PM_{2.5}$ ambient concentrations. Figure 2-3 displays the location of the major power plants located near the $PM_{2.5}$ nonattainment areas. Table 2-5 presents the SO_2 emissions from these nine power plants as reported from the USEPA acid rain database. It is clearly demonstrated that the annual emissions from these facilities have significantly decreased since 2005, with over 250,000 tons of SO_2 emission reduction in the 2008 compared to 2005. This is over a 50% reduction in utility SO_2 emissions that are permanent and enforceable. These reductions have taken place beginning in 2006, which includes the first year of the attaining 3-year design value. Since the final compliance date for the NCCSA SO_2 emissions caps is 2013, future design values are expected to continue to decline below the 2006-2008 attaining design values.

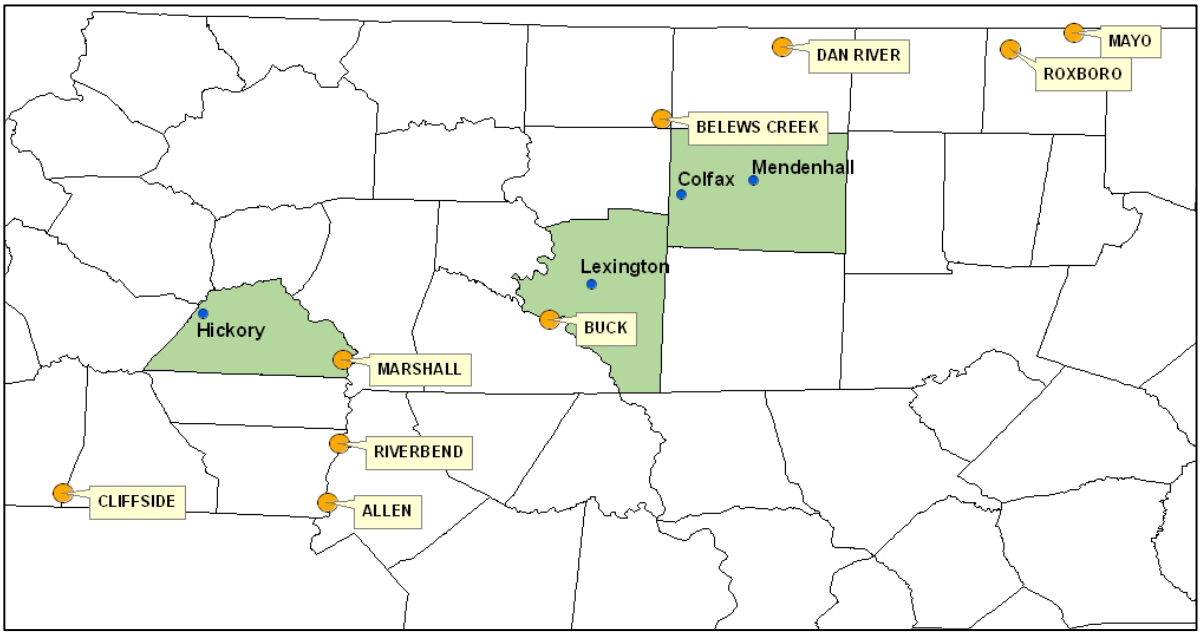

Figure 2-3. Location of Power Plants in the Vicinity of the $PM_{2.5}$ Nonattainment Areas

Table 2-5. Annual SO_2 Emissions for Utilities Near the $PM_{2.5}$ Nonattainment areas (tons/year)

Facility	County	2005	2006	2007	2008
Belews Creek	Rockingham	96,813	95,290	86,388	17,252
Buck	Rowan	9,582	9,560	10,261	7,353
Cliffside	Rutherford	28,209	29,128	27,566	29,421
Dan River	Stokes	4,248	7,068	7,672	6,687
Allen	Gaston	45,424	45,395	50,550	49,578
Marshall	Catawba	100,540	85,050	24,754	6,174
Mayo	Person	27,076	24,499	22,811	20,072
Riverbend	Gaston	13,964	15,148	15,907	15,942
Roxboro	Person	101,444	94,627	65,247	24,436
Total		427,301	405,765	311,155	176,914

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 annual fine particulate matter in the Hickory and Greensboro/Winston-Salem/High Point nonattainment areas 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 cleaner engine programs, and low sulfur gasoline and low sulfur diesel fuel programs. Additionally, although the federal Clean Air Interstate Rule (CAIR) has been remanded back to the USEPA, a replacement rule is expected to be promulgated in 2011. This new rule is expected to be as stringent as CAIR.

The NCDAQ has implemented programs that will remain enforceable and are hereby submitted as the plan to ensure that maintenance of the annual fine particulate matter 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 2008 was chosen since it is a year that falls within the attaining design value period of 2006-2008 and some emissions inventory data was already developed for this year. The interim years chosen were: 2011, 2014, and 2017 since the USEPA recommends three-year increments for interim years. The final year of the maintenance demonstration is 2021, since the CAA requires maintenance for at least ten years after redesignation. The maintenance demonstration consists of a comparison between the 2008 baseline emissions inventory and the projected emissions inventories (for 2011, 2014, 2017, and 2021), which consider economic and population growth as well as expected controls. 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 annual $PM_{2.5}$ 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 annual $PM_{2.5}$. The secondary trigger will be a monitored air quality pattern that suggests an actual annual $PM_{2.5}$ NAAQS violation may be imminent, such as repeated exceedances of the daily fine particulate matter standard.

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 and controls on power plants. State measures include the I/M program, the NO_x SIP Call rule, the NCCSA, and open burning and idle reduction regulations. The state measures also include additional programs that support maintenance of the $PM_{2.5}$ standard. Most of these emission reductions are due to regulations and thus are enforceable. However, a few measures are non-regulatory but will still result in emission reductions. 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 require all passenger vehicles in a manufacturer's fleet, including light-duty trucks and Sport Utility Vehicles (SUVs), to meet an average standard of 0.07 grams of NO_x per mile. Implementation began in 2004, with full compliance required by 2007. The Tier 2 standards also cover passenger vehicles over 8,500 pounds gross vehicle weight rating (the larger pickup trucks and SUVs), which are not covered by the Tier 1 regulations. For these vehicles, the standards were phased in beginning in 2008, with full compliance required by 2009. The new standards require vehicles to be 77% to 95% cleaner. The Tier 2 rule also reduced 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. Sulfur occurs naturally in gasoline and interferes with the operation of catalytic converters on vehicles, which results in higher NO_x emissions. Lower-sulfur gasoline is necessary to achieve the Tier 2 vehicle emission standards. These emission reductions are federally enforceable.

Heavy-Duty Gasoline and Diesel Highway Vehicles Standards

The USEPA standards designed to reduce NO_x and VOC emissions from heavy-duty gasoline and diesel highway vehicles began to take effect in 2004. The second phase of the standards and testing procedures began in 2007 and will reduce particulate matter from heavy-duty highway engines, and reduces 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 PM emissions and a 95% reduction in NO_x emissions for the new engines using low sulfur diesel, compared to engines using higher-content sulfur diesel. These emission reductions are federally enforceable.

Large Nonroad Diesel Engines Rule

In May 2004, the USEPA promulgated 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%. Prior to the fuel standard change, nonroad diesel fuel averaged about 3,400 ppm sulfur. The rule limits nonroad diesel sulfur content to 500 ppm by 2006 and 15 ppm by 2010. The combined engine and fuel rules is expected to reduce NO_x and PM emissions from large nonroad diesel engines by over 90%, compared to current nonroad engines using higher-content sulfur diesel. These emission reductions are federally enforceable.

Nonroad Spark-Ignition Engines and Recreational Engines Standard

The nonroad spark-ignition and recreational engine standards, effective in July 2003, regulates NO_x, hydrocarbons (HC) and CO for groups of previously unregulated nonroad engines. These engine standards apply to all new engines sold in the United States and imported after these standards began and applies 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 started in 2007. Like the large spark-ignition, recreational vehicles contribute to ozone formation and ambient CO and PM levels. For the off-highway motorcycles and all-terrain-vehicles, the exhaust emissions standard was phased-in. Fifty percent of model year 2006 engines had to meet the standard and for model years 2007 and later, all engines must meet the standard. 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 and recreational engine standards are fully implemented, an overall 72% reduction in HC, 80% reduction in NO_x, and 56% reduction in CO emissions are expected by 2020. These controls will help reduce ambient concentrations of ozone, CO, and $PM_{2.5}$. These emission reductions are federally enforceable.

NO_x SIP Call in Surrounding States

In October 1998, the USEPA made a finding of significant contribution of NO_x emissions from certain states and published a rule that set ozone season (May to September) NO_x budgets for the purpose of reducing regional transport of ozone (63 FR 57356). This rule, referred to as the NO_x SIP Call, required 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 NO_x emissions budget was set for each state and the states were required to develop rules that would assure that each state met its budget. A NO_x trading program was established, allowing sources to buy credits to meet their NO_x budget as opposed to actually installing controls. The emission budgets were to be met by the beginning of 2004. Even with the trading program, the amount of ozone season NO_x emissions has decreased significantly in and around North Carolina. These emission reductions are federally enforceable.

Clean Air Interstate Rule

On May 12, 2005, the USEPA promulgated the "Rule To Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule); Revisions to Acid Rain Program; Revisions to the NO_x SIP Call", referred to as CAIR. This rule established the requirement for States to adopt rules limiting the emissions of NO_x and SO_2 and a model rule for the states to use in developing their rules. The purpose of the CAIR is to reduce interstate transport of precursors of fine particulate and ozone.

This rule provides annual state caps for NO_x and SO_2 for large fossil-fuel-fired electric generating units in two phases, with the Phase I caps for NO_x and SO_2 starting in 2009 and 2010, respectively. Phase II caps become effective in 2015. The USEPA is allowing the caps to be met through a cap and trade program if a state so chooses to participate in the program. These emission reductions are federally enforceable.

Due to court challenges of CAIR in 2008, the USEPA will be making changes to the program by 2011. However, the existing CAIR rules will remain in place until the USEPA promulgates changes to the program. Additionally, the revisions to the CAIR program are expected to be as stringent as the existing program.

3.2.2 State Control Measures

North Carolina has adopted a number of regulations, legislation, and voluntary programs 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 in North Carolina from 9 counties to 48 counties, between July 1, 2002 through January 1, 2006 (Figure 3-1). Vehicles are tested using the onboard diagnostic system (OBDII), an improved method of testing, which ensures proper emission system operation for vehicles and light trucks during their lifetime by monitoring emission-related components and systems for malfunction and/or deterioration. An important aspect of OBDII is its ability to notify the driver of malfunction and/or deterioration by illuminating the "check engine light". If the vehicle is taken to a repair shop in a timely fashion, it can be properly repaired before any significant and prolonged emission increase occurs. The previously used tailpipe test (i.e., idle test) did not measure NO_x emissions; it only tested for VOC and CO emissions. By utilizing the OBDII test method, the NO_x emissions as well as other pollutants from motor vehicles are reduced. The effective dates for the counties in the $PM_{2.5}$ nonattainment area are listed below.

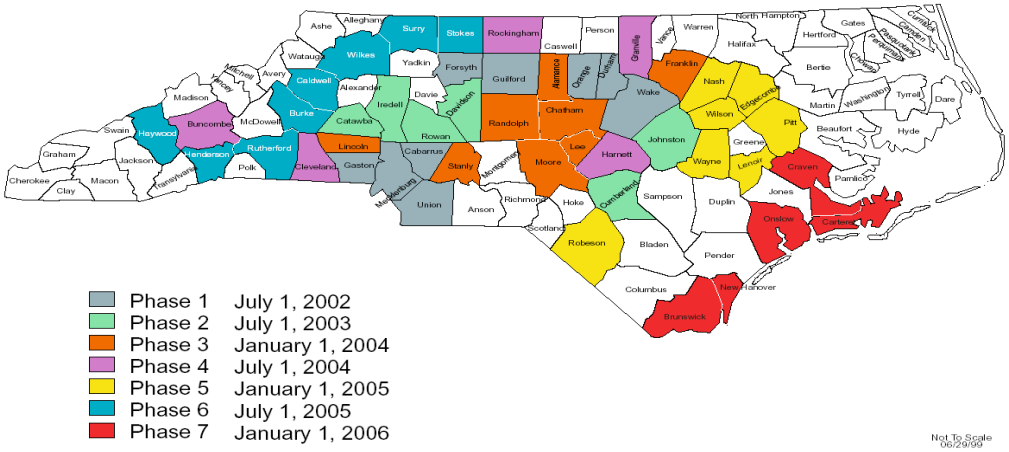

Figure 3-1. North Carolina's Inspection & Maintenance (I/M) Phase-In Map

Table 3-1 OBDII Phase-in Effective Dates

County	Date
Catawba	July 1, 2003
Davidson	July 1, 2003
Guildford	July 1, 2002

These emission reductions are state enforceable. The expected NO_x benefits for the maintenance years are listed in Table 3-2 below.

Table 3-2 I/M NO_x Benefits by County

NO_x I/M Benefit (Tons/year)	**2008**	**2011**	**2014**	**2017**	**2021**
Total NO_x for Catawba County	202	272	335	393	469
Total NO_x for Davidson County	207	273	329	382	452
Total NO_x for Guilford County	660	865	1,055	1,225	1,426

NO_x SIP Call Rule/CAIR

In response to the USEPA's NO_x SIP call, North Carolina adopted rules to control the emissions of NO_x 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 MW 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 to or greater than 2400 brake horsepower (3000 brake horsepower for diesel engines and 4400 brake horsepower for dual fuel engines). As part of the NO_x SIP Call, the USEPA rules established a NO_x budget for sources in North Carolina and other states. North Carolina has a Phase II budget (i.e., emission allowance) of 165,022 tons NO_x per ozone season.

Besides amending existing NO_x rules and adopting new NO_x rules specifically to address the USEPA NO_x SIP Call, the North Carolina rules also require new sources to control emissions of NO_x. The objective of this requirement is (1) to aid in meeting the NO_x 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 NO_x SIP Call rule was predicted to reduce summertime NO_x emissions from power plants and other industries by 68% by 2006. In October 2000, the North Carolina Environmental Management Commission (EMC) adopted rules requiring the reductions.

In 2009, the NO_x SIP Call program was replaced with the CAIR, a cap-and-trade program that will achieve reductions of emissions of SO_2 and NO_x in the eastern United States. NO_x sources that were regulated under the NO_x 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 annual SO_2 allowances as well as both ozone season and annual NO_x allowances for coal-fired electric generating units and other large combustion sources. These regulations are due to a Federal program and thus are both State and Federally enforceable.

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 the USEPA promulgates changes to the program.

Clean Smokestacks Act

In June 2002, the North Carolina General Assembly enacted the NCCSA, which requires coal-fired power plants in North Carolina to reduce annual NO_x emissions by 78% by 2009. These power plants must also reduce annual SO_2 emissions by 49% by 2009 and 74% by 2013. It is significant to note that this law sets a cap on NO_x and SO_2 emissions for the State which the North Carolina public utilities cannot meet by purchasing credits from sources outside of North Carolina. With requiring year-round NO_x controls and not allowing the purchase of NO_x credits to meet the caps, the NCCSA reduces NO_x emissions beyond the requirements of the NO_x 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. These emissions reductions are state enforceable.

Prevention of Significant Deterioration

All new major sources of SO_2 and NO_x will be evaluated under the prevention of significant deterioration program and are required to use best available control technology. These emissions reductions are state enforceable.

Open Burning

The North Carolina open burning regulation prohibits the burning of man-made materials statewide. In June 2004, the EMC approved revisions to the open burning regulation banning open burning of yard waste and land clearing debris on forecasted Code Orange or higher "air quality action days," for those counties that the NCDAQ or local air programs forecast ozone or fine particulate matter. The following counties in the Hickory area are subject to this rule**:** Alexander**,** Catawba**,** southeastern Burke and southeastern Caldwell. The following counties in

the Triad area are subject to this rule**:** Alamance**,** Caswell**,** Davidson**,** Davie**,** Forsyth**,** Guilford**,** Randolph**,** Rockingham and Stokes.

The open burning regulation reduces PM, NO_x, SO_2, VOC, and CO emissions and are state enforceable. The estimated emission reductions through the attainment and maintenance period are presented in Table 3-3. For a full explanation of how these emission reductions were estimated, please refer to Appendix C.2, the Area Source Emissions Inventory Documentation.

Table 3-3 Estimated Emission Reductions from Open Burning Regulation

Pollutant/County	2008	2011	2014	2017	2021
NOx Emissions (tons/year)					
Hickory Area					
Catawba	56	66	76	85	100
Triad Area					
Davidson	94	109	126	141	167
Guilford	79	91	105	119	140
Triad Total	173	200	231	260	307
SO_2 Emissions (tons/year)					
Hickory Area					
Catawba	10	11	12	14	17
Triad Area					
Davidson	16	18	21	23	28
Guilford	13	15	17	20	23
Triad Total	29	33	38	43	51
$PM_{2.5}$ Emissions (tons/year)					
Hickory Area					
Catawba	326	380	438	493	581
Triad Area					
Davidson	541	632	729	819	965
Guilford	454	530	612	688	809
Triad Total	995	1162	1341	1507	1774

Idle Reduction Regulation

The EMC adopted the Heavy-Duty Vehicle Idling Restrictions rule to reduce unnecessary idling of heavy-duty trucks on July 9, 2009. This rule has received several letters of objection and will undergo a legislative review in the Spring of 2010 before becoming effective. Once in effect,

this rule will be state enforceable and generally prevent any person who operates a heavy-duty vehicle to cause, let, permit, suffer or allow idling for a period of time in excess of 5 consecutive minutes in any 60 minute period. The expected emissions from this regulation were not included in the mobile source emissions estimated for this maintenance plan because of the uncertainty of the regulations.

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 though 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 air quality 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 year round daily air quality forecast. The NCDAQ produces a daily fine particulate matter forecasts and corresponding air quality index for the Hickory forecast area, while the Forsyth County Environmental Affairs Department provides daily fine particulate matter forecasts and the corresponding air quality index for the Triad region.

Transportation Conformity

The NCDAQ works closely with the North Carolina Department of Transportation (NCDOT) and local transportation agencies to assure that Transportation Improvement Programs (TIPs) in the nonattainment areas are consistent with and conform to the State's air quality program, including the SIP, and meet the Federal requirements on transportation conformity. This conformity review is performed for all federally funded and all other major projects contained in TIPs, regardless of source of funding. Technical analysis of transportation plans, programs, and projects for conformity are done cooperatively by the Statewide Planning Branch of the NCDOT and the NCDAQ. In the event that the NCDAQ disagrees with the NCDOT on a conformity determination or other conformity related issue, the NCDAQ and the NCDOT will present the issue to the Governor for resolution.

The public and interested parties are given an early and reasonable opportunity to comment on transportation plans, programs, projects and proposed conformity determinations in accordance with procedures adopted by metropolitan planning organizations pursuant to the requirements of

SAFETY-LU (the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users) as well as any updated transportation legislation and the CAA as amended.

Mobile Source Emission Reduction Grants

- Diesel Retrofits: As part of the North Carolina Mobile Source Emission Reduction Grants program, a number of cities, counties and school districts have installed Diesel Oxidation Catalysts (DOCs) or Diesel Particulate Filters (DPFs) on their diesel equipment. The vehicles that have been retrofitted include schools buses, as well as county fleet trucks for solid waste pickup. Although these types of filters are designed to remove fine particulate matter, when used with ultra low sulfur diesel fuel, NO_x and VOC emissions are also reduced.

- Diesel Emissions Reduction Act (DERA): DERA provides new diesel emissions reduction grant authority for the USEPA. This funding is used to achieve significant reductions in diesel emissions that improve air quality and protect public health. In response to DERA, the USEPA created grant and funding programs under the National Clean Diesel Campaign to build on the success of its regulatory and voluntary efforts to reduce emissions from diesel engines. The DERA funds that the NCDAQ have received have been used to retrofit, repower, or replace existing diesel engines from on-road and nonroad mobile source vehicles/equipment.

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 analysis using gridded photochemical modeling. The approach used by the NCDAQ is the comparison of emissions inventories for the years 2008 and 2021.

For the maintenance demonstration, the base year of 2008 was chosen since it is a year that falls within the attaining design value period of 2006-2008 and some emissions inventory data was in the process of being developed for this year. The maintenance demonstration is made by comparing the 2008 baseline emissions inventory to the 2021 projected emissions inventory. The baseline emissions inventory represents an emission level for a period when the ambient air quality standard was not violated, 2006-2008. 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 2008 baseline to demonstrate that these years are also expected to show continued maintenance of the annual fine particulate matter standard.

The emissions inventories are comprised of four major types of sources: point, area, on-road mobile and nonroad mobile. The projected emissions inventories have been estimated using projected rates of growth in population, traffic, economic activity, expected control programs, and other parameters. 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

There are four different man-made emission inventory source classifications: (1) stationary point, (2) area, (3) on-road mobile and (4) nonroad mobile sources.

Point sources are those stationary sources that require an Air Permit to operate. In general, these sources have a potential to emit more than 5 tons per year of CO, NO_x, PM, SO_2 and/or VOC from a single facility. The source emissions are tabulated from data collected by direct on-site measurements of emissions or mass balance calculations utilizing emission factors from the USEPA's AP-42. There are usually several emission sources for each facility. Emission data is collected for each point source at a facility and the data is entered into an in-house database system. For the projected year's inventory, point sources are adjusted by growth factors based on Standard Industrial Classification codes. The growth factors are generated using the USEPA's Economic Growth Analysis System version 5.0 (E-GAS 5.0) program or using growth patterns obtained from County Business Patterns. For detailed discussion on how the point sources emission inventory was developed, see Appendix C.1. A summary of the point source emissions are presented in Tables 3-4 to 3-6.

Table 3-4. Point Source NO_x Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	14,943	11,295	11,293	11,293	11,295
Davidson	841	865	892	920	961
Guilford	231	231	232	233	237
Triad Total	1,072	1,096	1,124	1,153	1,198

Table 3-5 Point Source SO_2 Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	10,978	10,976	10,970	10,969	10,968
Davidson	286	289	292	295	299
Guilford	449	451	453	455	458
Triad Total	735	740	745	750	757

Table 3-6. Point Source $PM_{2.5}$ Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	4,896	4,895	4,894	4,893	4,892
Davidson	179	178	177	176	175
Guilford	62	62	62	63	63
Triad Total	241	240	239	239	238

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. These types of emissions are estimated on the county level. For the projected year's inventory, area source emissions are changed by population growth, projected production growth, or when applicable, by E-GAS 5.0 growth factors. For detailed discussion on how the area source emission inventory was developed, see Appendix C.2. A summary of the area source emissions are presented in Tables 3-7 to 3-9.

Table 3-7. Area Source NO_x Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	662	614	566	520	454
Davidson	583	551	516	486	438
Guilford	1,243	1,210	1,177	1,146	1,099
Triad Total	1,826	1,816	1,693	1,632	1,537

Table 3-8. Area Source SO_2 Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	2,263	2,037	1,808	1,580	1,277
Davidson	983	838	692	548	353
Guilford	4,129	3,905	3,683	3,460	3,164
Triad Total	5,112	4,743	4,375	4,008	3,517

Table 3-9. Area Source $PM_{2.5}$ Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	682	658	629	606	559
Davidson	1,071	1,028	979	937	857
Guilford	697	663	623	590	524
Triad Total	1,768	1,691	1,602	1,527	1,381

For mobile sources, the USEPA's MOBILE6.2 mobile model is run to generate the twelve functional road class (i.e. urban interstate, rural interstate, rural local, etc.) emission factors. The emissions are calculated by multiplying the road class vehicle miles traveled (VMT) by the road class emission factor and summed to the county level. For the projected years' inventories, the on-road 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. For detailed discussion on how the on-road mobile emission inventory was developed, see Appendix C.3. A summary of the on-road mobile source emissions are presented in Tables 3-10 to 3-12.

Table 3-10. On-road Mobile Source NO_x Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	3,546	2,830	2,128	1,617	1,193
Davidson	3,954	3,060	2,243	1,679	1,216
Guilford	10,462	7,957	5,885	4,410	3,268
Triad Total	14,416	11,017	8,128	6,089	4,484

Table 3-11. On-road Mobile Source SO_2 Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	23	20	22	23	25
Davidson	24	20	21	22	24
Guilford	74	64	69	75	80
Triad Total	98	84	90	97	104

Table 3-12. On-road Mobile Source $PM_{2.5}$ Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	59	51	43	39	37
Davidson	64	53	43	38	36
Guilford	170	142	125	117	117
Triad Total	234	195	168	155	153

Nonroad 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 NONROAD2008a nonroad mobile model, with the exception of the railroad locomotives and aircraft engine. The railroad locomotive and aircraft engine emissions are estimated by taking activity data, such as landings and takeoffs, and multiply by an emission factor. These emissions are also estimated at the county level. For the projected years' inventories, the emissions are estimated using the USEPA's NONROAD2008a nonroad mobile model, E-GAS 5.0 growth factors or projected landing and takeoff data for aircraft. For detailed discussion on how the nonroad mobile emission inventory was developed, see Appendix C.4. A summary of the nonroad mobile source emissions are presented in Tables 3-13 to 3-15.

Table 3-13. Nonroad Mobile Source NO_x Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	1,173	922	700	551	453
Davidson	1,831	1,632	1,467	1,275	1,115
Guilford	3,864	3,371	2,816	2,350	1,980
Triad Total	5,695	5,003	4,283	3,625	3,095

Table 3-14. Nonroad Mobile Source SO_2 Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	18	6	4	3	4
Davidson	25	17	2	2	2
Guilford	96	51	42	42	43
Triad Total	121	68	44	44	45

Table 3-15. Nonroad Mobile Source $PM_{2.5}$ Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	70	67	57	46	38
Davidson	71	67	58	46	40
Guilford	264	252	220	186	157
Triad Total	335	319	278	232	197

3.3.3 Summary of Emissions

The sum total of these man-made emissions for the $PM_{2.5}$ nonattainment areas is tabulated in Tables 3-16 though 3-18.

Table 3-16. Total Man-Made NO_x Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	20,324	15,661	14,687	13,981	13,395
Davidson	7,209	6,108	5,118	4,360	3,730
Guilford	15,800	12,769	10,110	8,139	6,584
Triad Total	23,009	18,877	15,228	12,499	10,314

Table 3-17. Total Man-Made SO_2 Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	13,282	13,039	12,804	12,575	12,274
Davidson	1,318	1,164	1,007	867	678
Guilford	4,748	4,471	4,247	4,032	3,745
Triad Total	6,066	5,635	5,254	4,899	4,423

Table 3-18. Total Man-Made $PM_{2.5}$ Emissions (tons per year)

County	2008	2011	2014	2017	2021
Catawba	5,707	5,671	5,623	5,584	5,526
Davidson	1,385	1,326	1,257	1,197	1,108
Guilford	1,193	1,119	1,030	956	861
Triad Total	2,578	2,445	2,287	2,153	1,969

3.3.4 Maintenance Demonstration

As discussed above, maintenance is demonstrated when the future years total man-made emissions are less than the 2008 baseline emissions. The following tables summarized the SO_2, NO_x, and primary $PM_{2.5}$ emissions for both the Hickory and Triad nonattainment areas. The difference between the base year and the final year of the plan illustrates that the continued maintenance of the annual fine particulate matter NAAQS is expected.

Table 3-19 Maintenance Demonstration for Hickory $PM_{2.5}$ Nonattainment Area

Year	NO_x (tons per year)	SO_2 (tons per year)	$PM_{2.5}$ (tons per year)
2008	20,324	13,282	5,707
2011	15,661	13,039	5,671
2014	14,687	12,804	5,623
2017	13,981	12,575	5,584
2021	13,395	12,274	5,526
Difference from 2008 to 2021	-6,929	-1,008	-181

Table 3-20 Maintenance Demonstration for Triad $PM_{2.5}$ Nonattainment Area

Year	NO_x (tons per year)	SO_2 (tons per year)	$PM_{2.5}$ (tons per year)
2008	23,009	6,066	2,578
2011	18,877	5,635	2,445
2014	15,228	5,254	2,287
2017	12,499	4,899	2,153
2021	10,314	4,423	1,969
Difference from 2008 to 2021	-12,695	-1,643	-609

The difference between the attainment level of emissions (2008) from all man-made sources and the projected level of emissions from all man-made sources in the nonattainment areas are considered the "safety margin". The safety margin for each projected year is listed below in Table 3-21 and 3-22.

Table 3-21 Safety Margin for Hickory $PM_{2.5}$ Nonattainment Area

Year	NO_x (tons per year)	SO_2 (tons per year)	$PM_{2.5}$ (tons per year)
2011	-4,663	-243	-36
2014	-5,637	-478	-84
2017	-6,343	-707	-123
2021	-6,929	-1,008	-181

Table 3-22 Safety Margin for Triad $PM_{2.5}$ Nonattainment Area

Year	NO_x (tons per year)	SO_2 (tons per year)	$PM_{2.5}$ (tons per year)
2011	-4,132	-431	-133
2014	-7,781	-812	-291
2017	-10,510	-1,167	-425
2021	-12,695	-1,643	-609

For both nonattainment areas, there are significant safety margins from 2011 to 2021. In addition to the above safety margins within the $PM_{2.5}$ nonattainment areas, SO_2 emissions from nearby coal-fired power plants will be significantly reduced due to the NCCSA. This effectively gives the $PM_{2.5}$ nonattainment areas an even larger safety margin for SO_2. Table 2-5 shows the SO_2 reductions at nearby coal-fired power plants. These reductions will benefit both the Triad and Hickory nonattainment areas and will provide large safety margins through 2021.

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. There will be three potential triggers for the contingency plan. The primary trigger of the contingency plan will be a violation of the annual $PM_{2.5}$ NAAQS at any of the monitors in either $PM_{2.5}$ nonattainment area. The secondary trigger

will be a rolling 12 quarter average that exceeds the annual $PM_{2.5}$ NAAQS. The tertiary trigger will be a monitored annual average that exceeds the annual $PM_{2.5}$ NAAQS. Upon either the primary or secondary triggers being activated, the NCDAQ will commence analyses to determine what additional measures, if any, will be necessary to attain or maintain the annual $PM_{2.5}$ standard. If activation of either the primary or secondary triggers occurs, this plan provides a regulatory adoption process for revising emission control strategies. Activation of the tertiary trigger will result in an analysis to understand the cause of the exceedance and to identify voluntary measures if needed.

In addition, there will be a tracking mechanism that requires a comparison of the actual emissions inventory submitted under the Federal Consolidated Emissions Reporting Rule (CERR) and Air Emissions Reporting Rule (AERR) to the projected inventory, and to the attainment year inventory contained in this maintenance plan. The CERR and AERR reporting years coincide with the baseline, interim and final years of the emission inventory in this maintenance demonstration.

3.4.2 Primary and Secondary Triggers

The primary trigger of the contingency plan will be a violation of the annual $PM_{2.5}$ standard, or when the three-year average of the average annual ambient concentration is greater than 15.0 $\mu g/m^3$ at any monitor in the $PM_{2.5}$ nonattainment areas. The trigger date will be 60 days from the date that the State observes an annual average concentration that, when averaged with the two previous annual average $PM_{2.5}$ concentrations, would result in a three-year average greater than 15.0 $\mu g/m^3$.

The secondary trigger will apply where no actual violation of the annual $PM_{2.5}$ standard has occurred, but where the State finds that the rolling 12-quarter average monitored $PM_{2.5}$ levels exceed the $PM_{2.5}$ NAAQS. A pattern will be deemed to exist when the average $PM_{2.5}$ concentrations of any 12 consecutive quarters is greater than 15.0 $\mu g/m^3$ at any monitor within the $PM_{2.5}$ nonattainment areas. The trigger date will be 60 days from the date that the State observes a rolling 12-quarter average greater than 15.0 $\mu g/m^3$ at any monitor.

Similarly, the tertiary trigger will not be an actual violation of the annual $PM_{2.5}$ standard. This trigger will be a first alert as to a potential air quality problem on the horizon. The trigger will be activated when a monitor in either of the $PM_{2.5}$ nonattainment areas has an annual average greater than 15.0 $\mu g/m^3$, starting the first year after the maintenance plan has been approved. The trigger date will be 60 days from the date that the State observes an annual average greater than 15.0 $\mu g/m^3$ at any monitor.

3.4.3 Action Resulting From Trigger Activation

There are a number of programs that are still being implemented in North Carolina that will continue to reduce fine particulate matter and its precursors. The NCCSA has a final compliance year of 2013 by which the public utilities in North Carolina must meet their SO_2 emissions caps. It is estimated that an additional 133,320 tons of SO_2 will be reduced from the 2008 emission levels for the sources subject to the NCCSA. Additionally, the NCDAQ is still awarding grants for retrofits, replacement or repowering of diesel engines for on-road and nonroad mobile sources. Since it is possible that the speciation composition of fine particulate matter may change in the future years, it is important that the NCDAQ identify the pollutant or pollutants for which further reductions are needed in order to maintain the annual $PM_{2.5}$ NAAQS.

Once the primary or secondary trigger is activated, the Planning Section of the NCDAQ shall commence analyses including trajectory analyses of high $PM_{2.5}$ days, and emissions inventory assessment to determine those emission control measures that will be required for attaining or maintaining the annual $PM_{2.5}$ standard. Additionally, the $PM_{2.5}$ speciation data from the STN monitors will be reviewed to determine which species are the more predominant components for the period where a violation or exceedance of the NAAQS was observed.

If it is determined that the cause of the violation or exceedance of the $PM_{2.5}$ NAAQS is due to sources outside of North Carolina, then the NCDAQ will commence discussion with regulatory authorities responsible for upwind sources to determine additional actions to be implemented. 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, additional emissions reductions are anticipated for upwind TVA sources.

If it is determined that the violation or exceedance occurred due to sources within North Carolina, then by November 1 of the year following the year in which the primary or secondary trigger has been activated, North Carolina will complete sufficient analyses to begin adoption of necessary rules for ensuring attainment and maintenance of the annual $PM_{2.5}$ NAAQS. If the rules are still needed, then rules would become State effective by the following July 1, unless legislative review is required. Each adopted rule will include a schedule that will require compliance with the rule no later than 2 years after adoption of the rule.

The measures that will be considered for adoption upon a trigger of the contingency plan include: Reasonably Available Control Technology on stationary sources in the $PM_{2.5}$ nonattainment area counties, diesel inspection and maintenance program, implementation of

diesel retrofit programs, including incentives for performing retrofits, and additional controls in upwind areas.

Once the tertiary trigger is activated, the Planning Section of the NCDAQ shall commence analyses including meteorological evaluation, trajectory analyses of high $PM_{2.5}$ days, and emissions inventory assessment to understand why an annual exceedance of the standard has occurred. Once the analyses are completed, the NCDAQ will work with the local air awareness program and develop an outreach plan to identify any additional voluntary measures that can be implemented. NCDAQ will work with the local air awareness coordinator to implement the plan for the following summer.

3.4.4 Tracking Program for Ongoing Maintenance

In addition to the measures listed above, emissions inventory comparisons will be carried out. The large stationary sources are required to submit an emissions inventory annually to the NCDAQ. The NCDAQ will commit to review these emissions inventories to determine if an unexpected growth in NO_x, SO_2 or primary particulate matter emissions in the $PM_{2.5}$ nonattainment areas may endanger the maintenance of the annual $PM_{2.5}$ standard. Additionally, as new VMT data is provided by the North Carolina Department of Transportation (NCDOT), the NCDAQ commits to review this data and determine if any unexpected growth in VMT may endanger the maintenance of the annual $PM_{2.5}$ standard.

Additionally, under the CERR and AERR the NCDAQ is required to develop a comprehensive, annual, statewide emissions inventory every three years and is due twelve to eighteen months after the completion of the inventory year. The CERR and AERR inventory years coincide with the baseline, interim and final years of the maintenance plan. Therefore, the NCDAQ commits to compare these inventories as they are developed with the maintenance plan to determine if additional steps are necessary for continued maintenance of the annual $PM_{2.5}$ standard in this area.

4.0 MOTOR VEHICLE EMISSIONS BUDGET FOR CONFORMITY

4.1 TRANSPORTATION CONFORMITY

The purpose of transportation conformity is to ensure that Federal transportation actions occurring in nonattainment and maintenance areas do not hinder the area from attaining and maintaining the annual fine particulate matter standard. This means that the level of emissions estimated by the NCDOT or the metropolitan planning organizations for the TIP and Long Range Transportation Plan must not exceed the motor vehicle emission budgets (MVEBs) as defined in this maintenance plan.

4.2 POLLUTANTS TO BE CONSIDERED

40 CFR 93.119(f)(7) through (10) identifies the pollutants for $PM_{2.5}$ that regional emissions analysis needs to be performed for transportation conformity purposes. These parts of the rule are listed below:

> *§119(f)(7) – $PM_{2.5}$ in $PM_{2.5}$ areas;*
>
> *§119(f)(8) – Reentrained road dust in $PM_{2.5}$ areas only if the EPA [Environmental Protection Agency] Regional Administrator or the director of the State air agency has made a finding that emissions from reentrained road dust within the area are a significant contributor to the $PM_{2.5}$ nonattainment problem and has so notified the MPO and DOT [Department of Transportation];*
>
> *§119(f)(9) – NO_x [nitrogen oxides] in $PM_{2.5}$ areas, unless the EPA Regional Administrator and the director of the State air agency have made a finding that emissions of NO_x from within the area are not a significant contributor to the $PM_{2.5}$ nonattainment problem and has so notified the MPO and DOT; and*
>
> *§119(f)(10) – VOC, SO_2 and/or ammonia in $PM_{2.5}$ areas if the EPA Regional Administrator or the director of the State air agency has made a finding that any of such precursor emissions from within the area are a significant contributor to the $PM_{2.5}$ nonattainment problem and has so notified the MPO and DOT.*

Only primary, or direct $PM_{2.5}$, tailpipe emissions must be considered for transportation conformity regional emissions analysis. The other precursor pollutants and reentrained road dust only need to be considered if the State air agency and/or the USEPA have deemed the pollutant as a significant contributor to the $PM_{2.5}$ nonattainment problem. The following sections discuss

the significance of the precursor pollutants and reentrained road dust to the $PM_{2.5}$ nonattainment problem.

4.2.1 Precursor Pollutants NO_x, VOC, and Ammonia

The $PM_{2.5}$ precursor NO_x is presumed to be a significant contributor to the $PM_{2.5}$ nonattainment problem by the USEPA. The NCDAQ has determined that NO_x is a relatively minor contributor to the $PM_{2.5}$ concentrations in North Carolina. However, the NCDAQ is not asserting that NO_x is an insignificant precursor for the 1997 $PM_{2.5}$ standard. Therefore, the NCDAQ will establish county level MVEBs for NO_x for all three $PM_{2.5}$ nonattainment counties.

For the purpose of this attainment demonstration, VOC and ammonia are presumed to be insignificant contributors to the $PM_{2.5}$ nonattainment problem by the USEPA. The NCDAQ agrees with the USEPA that both VOC and ammonia are insignificant contributors to the $PM_{2.5}$ nonattainment problem in North Carolina. Since these precursors have been deemed insignificant, no MVEBs are being established for VOC or ammonia.

An affirmative insignificance finding from the USEPA only relieves the transportation partners from a regional emissions analysis for $PM_{2.5}$ emissions for these areas and does not relieve them of the other transportation conformity requirements. The transportation partners will need to note the VOC and Ammonia insignificance finding (if found adequate and approved by the USEPA) in future conformity determinations.

4.2.2 Reentrained Road Dust

The majority of the roads in North Carolina are paved so there is minimum road dust due to the paved roads. The factor to calculate reentrained road dust on paved roads is very small. What dust is generated, has been shown in the literature, *Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions for Regional and Urban Scale Air Quality Analyses, US EPA, August 3, 2005*, to be inconsequential.

This fact is affirmed by the small crustal component in the $PM_{2.5}$ speciated data which measures only 3% at Hickory monitoring site (Catawba County) in 2002 and only 2% at Lexington monitoring site (Davidson County) in 2004 (see Figure 4-1 below).

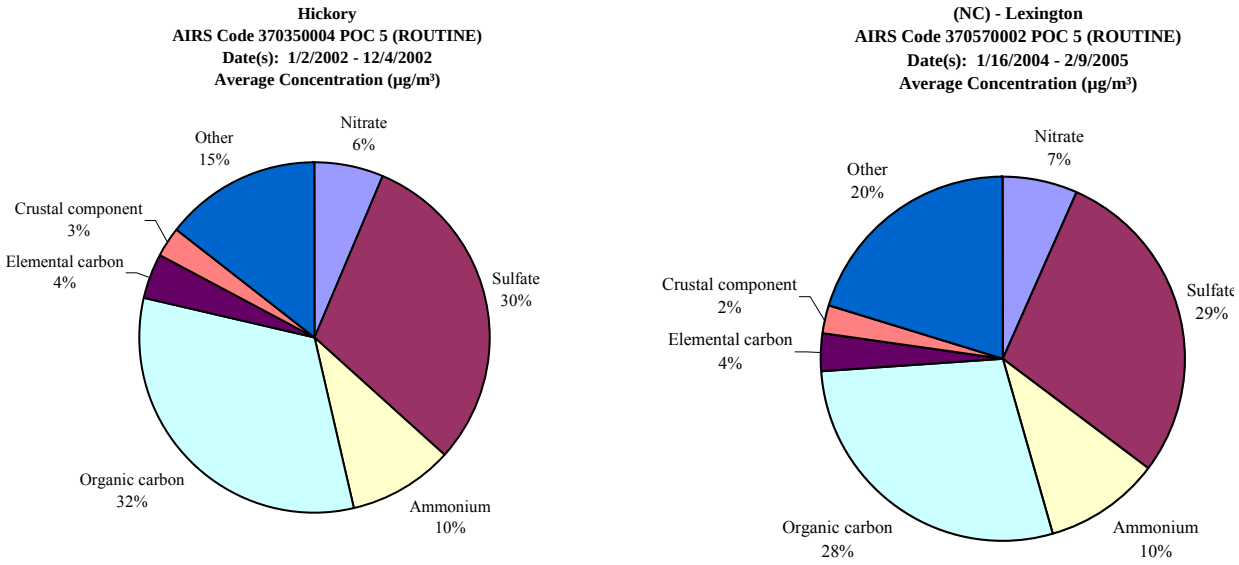

Figure 4-1. Speciated Data for the Hickory area (left) and the Triad area (right)

Since the reentrained road dust is not a significant contributor to the $PM_{2.5}$ nonattainment problem, the NCDAQ will not be establishing MVEBs for this source category. An affirmative insignificance finding from the USEPA only relieves the transportation partners from a regional emissions analysis for reentrained road dust emissions for these areas and does not relieve them of the other transportation conformity requirements. The transportation partners will need to note the reentrained road dust insignificance finding (if found adequate and approved by the USEPA) in future conformity determinations.

4.2.3 Precursor Pollutant SO_2

The $PM_{2.5}$ precursor SO_2 could not be deemed insignificant to the $PM_{2.5}$ nonattainment problem. However, the NCDAQ has determined that SO_2 emitted by the mobile source sector is insignificant. The USEPA in its Federal Register notice for $PM_{2.5}$ does not address the mobile sector in its listing of significant emissions. North Carolina agrees with the following statements addressing SO_2 from on-road mobile emissions as published in the May 6, 2005, Federal Register, (70 FR 24283):

> *"While speciated air quality data show that sulfate is a relatively significant component (e.g., ranging from nine to 40 percent) of $PM_{2.5}$ mass in all regions of the country, emissions inventory data and projections show that on-road emissions of SO_x constitute a ''de minimis'' (i.e., extremely small) portion of total SO_x emissions. Emissions inventory data for 1999 for the 372 potential $PM_{2.5}$ nonattainment counties for $PM_{2.5}$ (based on*

1999–2001 air quality data) show that on-road sources were responsible for only two percent of total SO_x emissions.

Furthermore, EPA has already adopted two regulations that will greatly reduce emissions of SO_x from on-road sources by the time such regulations are both in full effect in 2009. First, in 2004 the low sulfur gasoline program began to be phased in and will be fully effective in 2007 (February 10, 2000, 65 FR 6697). This regulation will reduce the sulfur content of gasoline by approximately 90 percent when fully effective. Second, in 2006 the low sulfur diesel program will begin to be phased in and will be fully effective by 2009 (January 18, 2001, 66 FR 5001). This regulation will reduce the sulfur content of diesel fuel by approximately 97 percent nationally when fully effective.

Projections of on-road emissions of SO_2 in 2020 indicate that on-road sources will be responsible for less than one percent of the total SO_2 emissions in 2020 in the 372 potential $PM_{2.5}$ nonattainment counties (based on 1999– 2001 air quality data). These projections confirm that the implementation of the fuel regulations discussed above will ensure that as a general matter of SO_2 emissions from on-road sources remain at insignificant levels in all areas."

Although sulfate is a significant component to the $PM_{2.5}$ nonattainment problem in North Carolina, the majority of the SO_2 emissions in 2009 come from the stationary point source sector (see Figure 4-2). The mobile source sector only contributes one half of one percent (0.5 %) of the 2009 statewide SO_2 emissions. This is consistent with what the USEPA stated above.

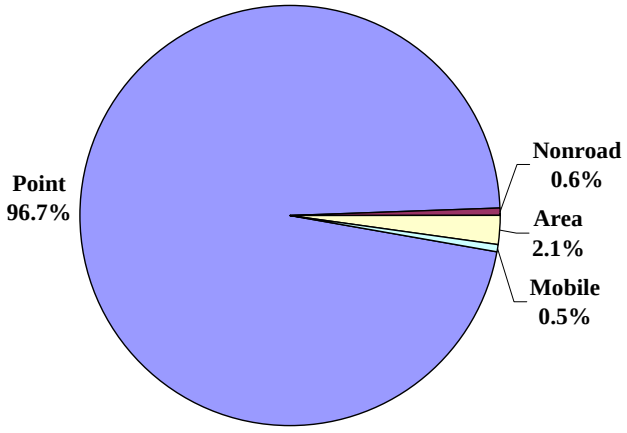

Figure 4-2. North Carolina's 2009 Statewide SO_2 Emissions

Since the mobile source SO_2 contribution is insignificant, the NCDAQ is not establishing MVEBs for this precursor. An affirmative insignificance finding from the USEPA only relieves the transportation partners from a regional emissions analysis for SO_2 emissions for these areas and does not relieve them of the other transportation conformity requirements. The transportation partners will need to note the SO_2 insignificance finding (if found adequate and approved by the USEPA) in future conformity determinations.

4.2.4 Direct $PM_{2.5}$ Emissions

40 CFR 93.109(k) in the Transportation Conformity Rule Amendments for the new 8-hour ozone and fine particulate matter NAAQSs addresses areas with insignificant motor vehicle emissions as follows,

> *"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 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. Although there is an inspection and maintenance program in the nonattainment areas, this control measure does not control primary $PM_{2.5}$, but rather is in place to reduce the ozone precursors.

The NCDAQ believes strongly that the primary $PM_{2.5}$ emissions from mobile sources do not contribute significantly to the $PM_{2.5}$ nonattainment problem. However, the USEPA has indicated they will not approve a SIP that does not set MVEBs for primary $PM_{2.5}$ for the Triad nonattainment area. Therefore, the NCDAQ will establish county level MVEBs for primary $PM_{2.5}$ for the Triad area. The sections that follow discuss the insignificance of $PM_{2.5}$ emissions.

The attainment modeling for the Hickory and the Triad $PM_{2.5}$ nonattainment areas was submitted to the USEPA on August 21, 2009. In conjunction with that modeling the NCDAQ examined the sources of $PM_{2.5}$ emissions and their contribution to $PM_{2.5}$ formation in the nonattainment counties. This was accomplished using the 2009 emissions inventories developed for the attainment demonstration modeling. Figure 4-3 provides the percent contributions from point, area, nonroad mobile and on-road mobile source sectors for the Hickory nonattainment area.

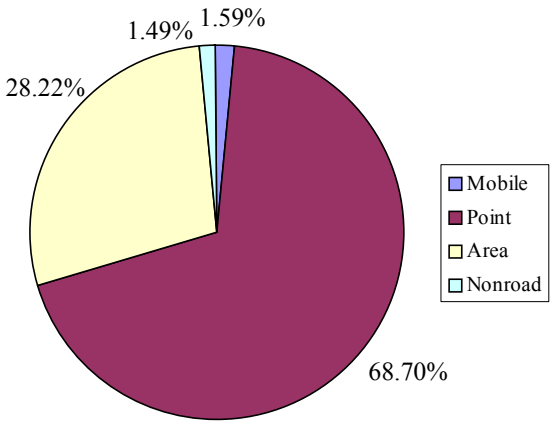

Figure 4-3. Hickory Area 2009 Primary $PM_{2.5}$ Emissions

The 2009 on-road mobile $PM_{2.5}$ emissions contributed only 1.6% of the total $PM_{2.5}$ emissions for the Hickory area. Therefore, it is demonstrated that the $PM_{2.5}$ emissions compared to the total $PM_{2.5}$ emissions are insignificant. It should be noted that the mobile source $PM_{2.5}$ emissions slightly decrease from 2002 to 2009 despite an increase in VMT.

The NCDAQ performed sensitivity modeling in order to address the challenge of Section 93.109(k) in the Transportation Conformity Rule Amendments, *"The SIP would have to demonstrate that it would be unreasonable to expect enough motor vehicle emissions growth in that pollutant/precursor for a NAAQS violation to occur"*. The sensitivity modeling showed that with a doubling of the mobile source $PM_{2.5}$ emissions there was no change in the air quality modeling results. This sensitivity modeling is discussed in more detail in Appendix C.3.

Based on the information discussed above, the NCDAQ believes that the on-road mobile $PM_{2.5}$ emissions are insignificant contributors to the $PM_{2.5}$ nonattainment problem. Emission estimates indicate that the on-road mobile $PM_{2.5}$ emissions are a small percentage of the total $PM_{2.5}$ emissions in the Hickory nonattainment area. On-road mobile $PM_{2.5}$ emissions are projected to

decrease into the future notwithstanding VMT increases. Air quality modeling sensitivities show that doubling the mobile source $PM_{2.5}$ emissions has very little effect on the future design values. The NCDAQ considers it unreasonable to expect that the Hickory $PM_{2.5}$ nonattainment area will experience enough motor vehicle $PM_{2.5}$ emissions growth for a future $PM_{2.5}$ violation to occur due to mobile sources.

Due to above analysis and agreement from the USEPA, budgets for direct $PM_{2.5}$ will not be set for the Hickory nonattainment area. An affirmative insignificance finding from the USEPA only relieves the transportation partners from a regional emissions analysis for $PM_{2.5}$ emissions for this area and does not relieve them of the other transportation conformity requirements. The transportation partners will need to note the $PM_{2.5}$ insignificance finding (if found adequate and approved by the USEPA) in future conformity determinations.

4.3 SAFETY MARGIN

As stated in Section 3.3.4, a safety margin is the difference between the attainment level of emissions from all source categories (i.e., point, area, on-road mobile and nonroad mobile) and the projected level of emissions from all source categories. The safety margins for both the Hickory and Triad areas are listed in Table 3-21 and 3-22. The State may choose to allocate some of the safety margin to the MVEB, for transportation conformity purposes, so long as the total level of emissions from all source categories remains below the attainment level of emissions.

The NCDAQ has decided to allocate a portion of the safety margin to the MVEB to allow for unanticipated growth in VMT, changes to vehicle mix assumptions, etc. that will influence the emission estimations. Since NO_x is a precursor to ozone, the NCDAQ has decided to limit the amount of the safety margin allocated to the MVEBs. For 2011 and 2021, the NCDAQ has added an additional 10% and 20%, respectively, to the NO_x MVEBs. This is consistent with how the NCDAQ has handled NO_X MVEBs in ozone maintenance plans.

Since the NCDAQ does not believe that mobile source $PM_{2.5}$ emissions are a significant contributor to $PM_{2.5}$ nonattainment, the 2011 and 2021 MVEBs for the Triad nonattainment area will be set at the 2008 mobile source $PM_{2.5}$ emission levels.

4.4 MOTOR VEHICLE EMISSION BUDGETS

As part of the consultation process on setting MVEBs, the NCDAQ sent out a request for comment on setting the geographic extent of the MVEBs to all of the transportation partners. A

copy of the letter can be found in Appendix B. In the letter, the NCDAQ expressed its preference for setting county level budgets and the reasons why the NCDAQ believed county level budgets were appropriate.

The NCDAQ received comments from the Greensboro Urban Area Metropolitan Planning Organization (GUAMPO) regarding the geographic extent of the MVEBs. The GUAMPO was in favor of having county level MVEBs. A copy of the letter received can be found in Appendix B. Therefore, the NCDAQ decided to move forward with setting county-by-county MVEBs.

Additionally, there was discussion through the interagency consultation process on the years to set MVEBs for the Hickory and Triad $PM_{2.5}$ maintenance plans. 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, 2021). Through the interagency consultation process, it was decided that MVEBs would be set for the year 2011 for both the Hickory and Triad $PM_{2.5}$ nonattainment areas.

Although the emissions up to this point have been expressed in terms of tons per year, the MVEBs will be set in terms of kilograms (kg) per year. The reason for the change is how the emission factors used to calculate mobile emissions are created. The MOBILE model generates the emission factors in grams per mile. In past conformity exercises, there have been some issues with conversion to tons, as well as concerns with how the MVEBs were rounded to the hundredth place. Setting MVEBs in kilograms will avoid these issues in future conformity determinations.

The table below shows the counties with their on-road mobile $PM_{2.5}$ and NO_x emissions expressed in kilograms per year and the corresponding tons per year values for 2011 and 2021.

Table 4-1. On-Road Mobile Source $PM_{2.5}$ Emissions

County	Kilograms/year		Tons/year	
	2011	2021	2011	2021
Davidson	47,665	32,394	53	36
Guilford	128,465	105,716	142	117
Triad Total	176,130	138,110	195	153

Table 4-2. On-Road Mobile Source NO_x Emissions

County	Kilograms/year		Tons/year	
	2011	2021	2011	2021
Catawba	2,567,557	1,082,209	2,830	1,193
Davidson	2,776,419	1,102,713	3,060	1,216
Guilford	7,218,360	2,964,834	7,957	3,268
Triad Total	9,994,779	4,067,547	11,017	4,484

The NCDAQ will set MVEB, for transportation conformity purposes, as county budgets within the Hickory and Triad maintenance areas for 2011 and 2021. Tables 4-3 through 4-5 below list out the MVEBs in kilograms per year, for transportation conformity purposes, by county for the years 2011 and 2021. Upon the USEPA's affirmative adequacy finding for these county level sub-area MVEBs, these MVEBs will become the applicable MVEBs for each county.

Table 4-3 Catawba County MVEB

	2011	2021
NO_x Emissions (kg/year)		
Base Emissions	2,567,557	1,082,209
Safety Margin Allocated to MVEB	256,756	216,442
NO_x Conformity MVEB	**2,824,313**	**1,298,651**

Table 4-4 Davidson County MVEB

	2011	2020
NO_x Emissions (kg/year)		
Base Emissions	2,776,419	1,102,713
Safety Margin Allocated to MVEB	277,642	220,543
NO_x Conformity MVEB	**3,054,061**	**1,323,256**
$PM_{2.5}$ Emissions (kg/year)		
Base Emissions	47,665	32,394
Safety Margin Allocated to MVEB	10,361	25,632
$PM_{2.5}$ Conformity MVEB	**58,026**	**58,026**

Table 4-5 Guilford County MVEB

	2011	2021
NO_x Emissions (kg/year)		
Base Emissions	7,218,360	2,964,834
Safety Margin Allocated to MVEB	721,836	592,967
NO_x Conformity MVEB	**7,940,196**	**3,557,801**
$PM_{2.5}$ Emissions (kg/year)		
Base Emissions	128,465	105,716
Safety Margin Allocated to MVEB	26,191	48,940
$PM_{2.5}$ Conformity MVEB	**154,656**	**154,656**

4.5 NEW SAFETY MARGINS

For the Hickory nonattainment area, a total of 256,756 kg/year (283 tons/year) and 216,442 kg/year (239 tons/year) of the 2011 and 2021 NO_x safety margins, respectively, were added to the NO_X MVEBs.

For the Triad nonattainment area, a total of 999,478 kg/year (1,102 tons/year) and 813,510 kg/year (897 tons/year) of the 2011 and 2021 NO_x safety margins, respectively, were added to the Triad NO_X MVEBs. For $PM_{2.5}$, a total of 36,552 kg/year (40 tons/year) and 74,572 kg/year (82 tons/year) of the 2011 and 2021 $PM_{2.5}$ safety margins, respectively, were added to the Triad $PM_{2.5}$ MVEBs.

Table 4-6 New Safety Margins for the Hickory $PM_{2.5}$ nonattainment area

Year	NO_x (tons/year)	$PM_{2.5}$ (tons/year)
2011	-4,380	-36
2014	-5,637	-84
2017	-6,343	-123
2021	-6,690	-181

Table 4-7 New Safety Margins for the Triad $PM_{2.5}$ nonattainment area

Year	NO_x (tons/year)	$PM_{2.5}$ (tons/year)
2011	-3,030	-93
2014	-7,781	-291
2017	-10,510	-425
2021	-11,798	-527

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 Hickory and Triad $PM_{2.5}$ nonattainment area.

5.2 EVIDENCE OF COMPLIANCE

The following rules regulating emissions of SO_2 and/or NO_x in $PM_{2.5}$ nonattainment area counties have been approved, or have been submitted with a request to be approved, as part of the SIP:

15A NCAC 2D .0530, Prevention of Significant Deterioration
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, NO_x SIP rules
15A NCAC 2D .1600, General Conformity
15A NCAC 2D .1900, Open Burning
15A NCAC 2D .2000, Transportation Conformity
15A NCAC 2D .2400 Clean Air Interstate Rules

Section 15A NCAC 2D .1000 also regulates emissions from motor vehicles in the counties near the Hickory and Triad nonattainment area and requires the use of the on board diagnostic system, which will indicate NO_x emissions as well as other pollutants.

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 require 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, which prohibits open burning of vegetative material during Air Quality Action Days of Code Orange or higher in forecasted areas of the State. Particle pollution forecasts are issued for the Hickory and Triad areas year-round; 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 NO_x SIP Call rules. This Section replaces the NO_x SIP Call rules beginning January 1, 2009.

Another important set of rules that may result in control of some particulates that are air toxics in North Carolina 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.

There are two other rules that control emissions of some particulates in these areas. They are 15A NCAC 2D .0524, New Source Performance Standards. Also, rule 2D.1111, Maximum Achievable Control Technology applies to control of emissions of HAP, some of which are particulates. 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 fine particulate matter monitors in the Hickory and Triad nonattainment areas, providing sufficient funding is available for continued operation. Any monitor shutdowns or relocations will only be made with the approval of the USEPA. No plans are underway to discontinue operation, relocation or otherwise affect the integrity of the ambient monitoring network in place. The current monitors are 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 fine particulate matter monitoring data for the both the Hickory and Greensboro/Winston-Salem/High Point (Triad) nonattainment areas demonstrate compliance with the NAAQS for annual fine particulate matter. Since the 1990's, there have been 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 both the Hickory and Triad areas. Additionally, the maintenance plan demonstrates that the projected emissions inventories for 2021, the final year of the maintenance plan and ten years beyond the expected redesignation year, as well as the interim years, are all less than the base year emissions inventory. Therefore, maintenance of the annual fine particulate matter NAAQS has also been demonstrated.

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