North Carolina's Air Quality Multi-Pollutant Process

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Table of Contents

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Chapter 1. Introduction

The United States Environmental Protection Agency (USEPA) is working with three areas on a pilot project to integrate non-traditional planning into air quality management: (1) Illinois and Missouri; (2) New York; and (3) North Carolina. Many state, local and tribal governments are moving away from single-pollutant planning towards multi-pollutant strategies that address future air quality needs. The USEPA's Air Quality Multi-Pollutant (AQMP) pilot project is an effort that encourages state and local governments to create comprehensive air quality plans that will provide a more efficient air pollution management process. Air quality management plans address air quality concerns and goals such as nonattainment and maintenance of criteria pollutant standards, sector-based emissions, regional haze, visibility, ecosystem health, and risk reductions of hazardous air pollutants (HAP). These plans may address other considerations such as land-use, transportation, energy and climate change. The goal is to integrate the requirements of the current state implementation plan (SIP) process into a more comprehensive plan for air quality in a manner consistent with the 2004 NAS report, "Air Quality Management in the United States," and the 2007 Clean Air Act Advisory Committee recommendations. The goal is also to develop a process that will be more efficient than the current air management process and produce the same, if not more environmental benefits.

Overview

The overall purpose of the AQMP pilot project is to define the process by which an integrated air planning process will be developed in North Carolina, including the implementation steps and timeline for such a process. The North Carolina Division of Air Quality (DAQ) will strive to develop a process under which the various air quality issues of the state can be addressed.

The fundamental characteristics of the North Carolina AQMP pilot project are: (1) it comprehensively covers all pollutants affecting the state; (2) it covers all of the state, both non-attainment and attainment areas with regard to the NAAQS pollutants; (3) it involves partnerships with local elected officials, business and industry, environmental groups, the general public and any other interested groups; (4) and the technical steps needed to develop an AQMP are an ongoing, pre-planned set of actions that will recur on an established schedule. The technical steps include: emission inventory development, assessments of growth including population, vehicle use, energy use, meteorological modeling, air quality modeling, control strategy assessments and periodic reports of results of the analyses. The DAQ is currently developing a comprehensive, multi-pollutant implementation plan.

State implementation plans have traditionally focused on the need to respond to a non-attainment situation when there is a revision to a NAAQS. This is not the most effective approach to SIP development because the current process is burdensome on both staff and resources due to the amount of work necessary to satisfactorily complete statutory requirements within the specified deadlines. Unless there is a change in the Clean Air Act, such a "surgical" response for a portion of the state that is designated as non-attainment is still required. The North Carolina AQMP is a continuous process whereby ongoing technical work is done under a comprehensive, statewide plan that is designed to address multiple pollutants instead of the current SIP process, which is done on a pollutant-by-pollutant basis that is inefficient.

A comprehensive, statewide air quality management process provides a holistic approach designed to mitigate multiple pollutants. The AQMP process will resolve having multiple SIP submittal schedules, overlapping of reporting requirements and duplication of analysis. Employing control strategies with co-benefits of addressing multiple pollutants results in an effective and efficient method to address air quality issues. Adhering to a continuous process schedule (see Appendix G) has many advantages because it supports ongoing refinement and enhancement of technical analyses for improved accuracy and robustness. Our collaborative efforts with the Visibility Improvement-State and Tribal Association of the Southeast (VISTAS) and the Association for Southeastern Integrated Planning (ASIP) have established a framework for modeling multi-pollutants; therefore, transitioning from modeling a single pollutant to modeling for multi-pollutants will require minimal effort. It also encourages stakeholders to be a part of the entire process which promotes greater input and involvement. The advantage of a continuous AQMP is having the groundwork for the air quality technical analyses, stakeholder involvement and policies already established, so when SIPs are due, they are incorporated into the ongoing process. Additionally, a state is better able to respond to various legislative inquiries when such technical information and evaluation are readily available.

The following topic areas are addressed:

1. Introduction
2. Air Quality Issues and Concerns
3. Greenhouse Gases and Climate Action Planning
4. Clean Energy Generation and Energy Efficiency Improvements
5. Ecosystem Health
6. Public Health Related Issues and How They Relate to the Air Quality Multi-Pollutant Process
7. Growth Issues and How They will be Addressed in the Air Quality Multi-Pollutant Process
8. Stakeholder Involvement in the Air Quality Multi-Pollutant Process
9. Communication Strategy
10. Process for Implementing the Air Quality Multi-Pollutant Process
11. Other planning Efforts Impacting the Air Quality Multi-Pollutant Process
12. Regional and neighboring State Issues
13. Geographic and Meteorological Inferences on Air quality in North Carolina
14. Air Quality Issues of Concern
15. Developing a Multi-Pollutant Emissions Inventory
16. Technical tools
17. Potential Control Strategies
18. Control Strategy Assessment
19. Control Evaluation Strategy
20. Potential Roadblocks
21. Air Quality Multi-Pollutant Plan Timeline and Document Outline

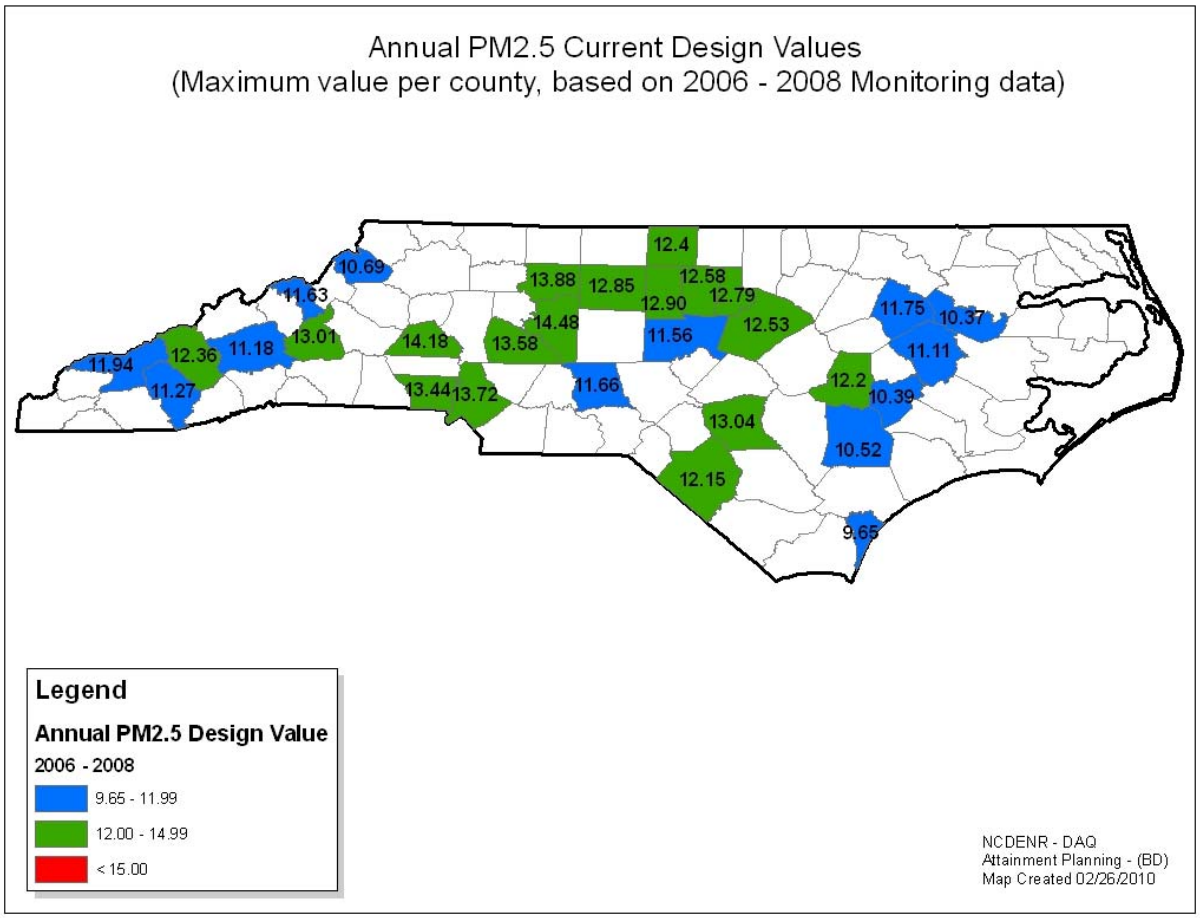
Chapter 2. Air Quality Issues and Concerns

Currently, North Carolina is in attainment in all counties for the following criteria pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide and lead. North Carolina has some counties designated nonattainment for the 1997 8-hour ozone National Ambient Air Quality Standard (NAAQS) and the annual fine particle standard ($PM_{2.5}$).

$PM_{2.5}$

For the annual $PM_{2.5}$ standard, three counties are currently designated nonattainment: Catawba, Davidson and Guilford. Currently, these counties are measuring compliance with the annual $PM_{2.5}$ standard. Figure 2.1 below displays the 2006-2008 design values for North Carolina.

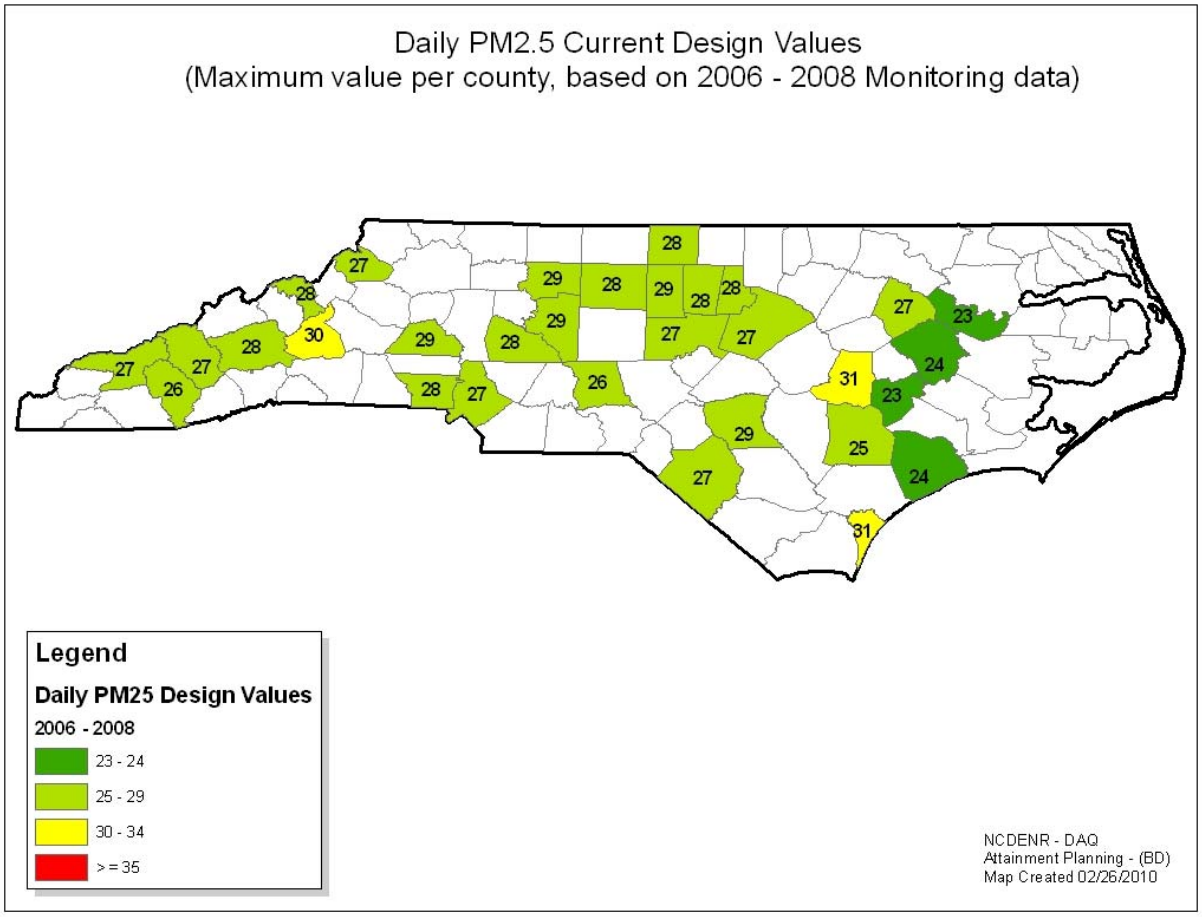
Figure 2.1: Annual $PM_{2.5}$ Design Values for 2006-2008 for North Carolina



As a result, the North Carolina Division of Air Quality (DAQ) prepared a redesignation and maintenance plan for these counties. It should be noted that North Carolina recommended that no areas be designated nonattainment for the daily $PM_{2.5}$ standard since no monitors in the state violated the standard. The USEPA agreed with this recommendation and therefore, North Carolina has no daily $PM_{2.5}$ nonattainment areas. Figure 2.2 below presents the $PM_{2.5}$ data from

2006-2008. The monitors in New Hanover and Wayne Counties have a design value of 31 micrograms per cubic meter (µg/m^3), which is below the daily standard of 35 µg/m^3.

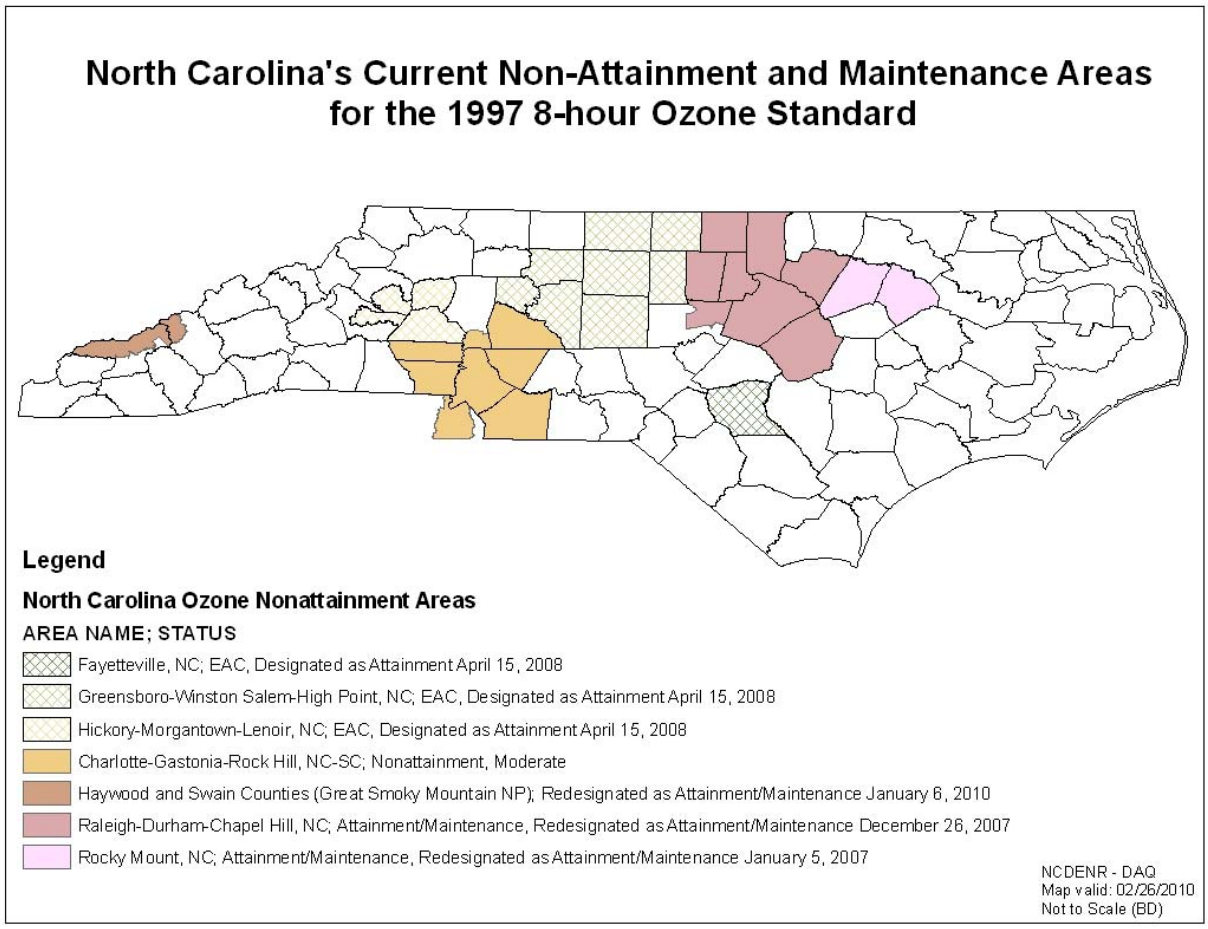
Figure 2.2: Daily $PM_{2.5}$ Design Values for 2006-2008 for North Carolina



Ozone

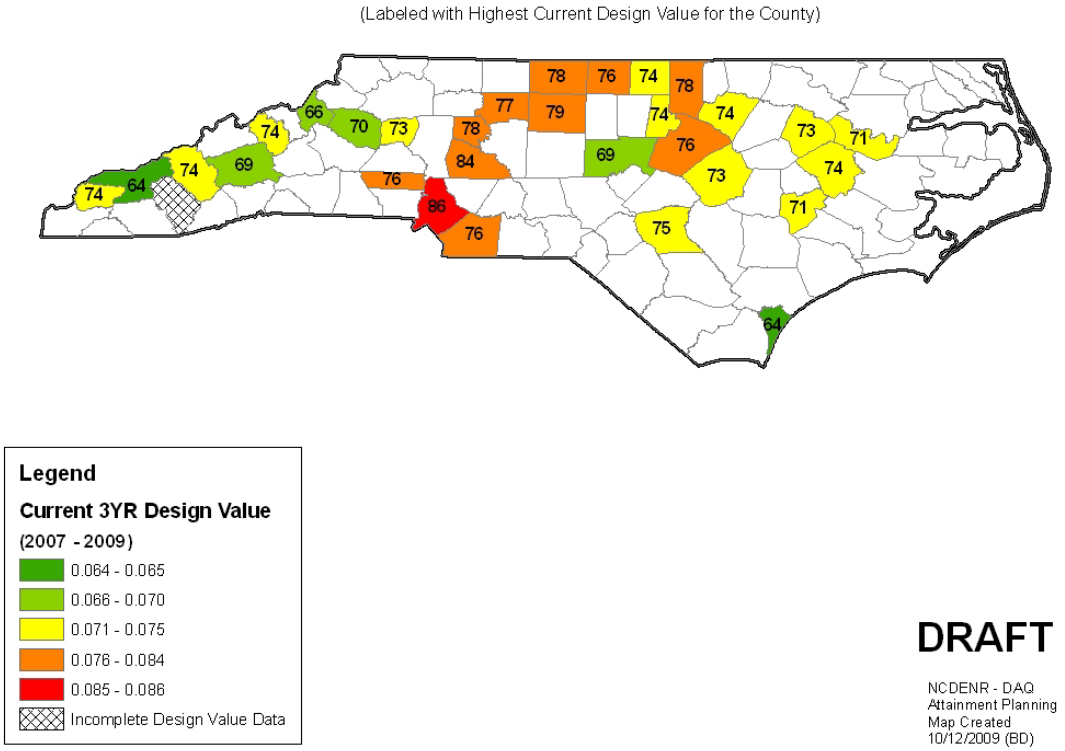
With regard to the 1997 8-hour ozone standard of 0.08 parts per million (ppm), all of the state has attained except for one. Figure 1.3 shows the various areas that were designated as nonattainment, and their applicable redesignation dates. The Metrolina area is designated as a moderate nonattainment area, with a required attainment date of June 15, 2010. The Charlotte-Gastonia-Rock Hill (Metrolina) area has one monitor that violates the standard as of the end of the 2009 ozone season. The area did have clean data for 2009, i.e., the 4th highest observed value at all of the monitors was below the 1997 ozone standard. The DAQ plans to request a one-year extension of the attainment date. The map in Figure 2.3 presents the ambient data for the 2007-2009 period.

Figure 2.3: Current Designation of North Carolina Areas under the 1997 8-Hour Ozone Standard



On January 6, 2010, the USEPA proposed to further strengthen the 8-hour ozone NAAQS. The USEPA is proposing to strengthen the standard to a level within the range of 0.060-0.070 ppm. The proposed revisions result from a reconsideration of the ozone standard set at 0.075 ppm in 2008. The USEPA will issue the final 8-hour ozone standard by August 31, 2010. Figure 2.4 shows the current 3-year (2007-2009) design values at the monitoring sites across North Carolina.

Figure 2.4. Design Values for North Carolina based on 2007 - 2009 Data



Like the 1997 ozone standard, the revised standard is based on the average of the fourth highest design value at a given ambient monitor over a three-year period. The USEPA will use data from 2008- 2010 to designate areas as nonattainment under the revised 8-hour ozone standard. If the revised 8-hour ozone standard is established at 0.060 ppm, all of the ambient monitors across the state would violate the standard based on the 2007-2009 design values. If the revised 8-hour ozone standard is set at 0.065 ppm, only two ambient monitors do not show violation, which are the monitors in Swain and New Hanover Counties. Although several counties have monitors that would attain an ozone standard of 0.070 ppm, many of these counties would be designated nonattainment since the region would likely be considered to contribute to violations in neighboring counties with violating monitors. Needless to say, the revised ozone standard will have a large impact on the state.

Air Toxics

Regulatory Program

The North Carolina Division of Air Quality's air toxics program is a "risk-based" regulatory program designed to protect the public health by limiting emissions of toxic air pollutants from point and area sources.[1]Emission limits of specific chemicals, toxic air pollutants (TAPs), are called Acceptable Ambient Levels, or (AALs). By their nature, AALs are intrinsically different from measured air concentrations because allowable emissions are determined using air dispersion modeling and compliance with the AAL occurs at the facility property boundary. North Carolina's air toxics program differs from the overall national air quality program in several ways:

- The AALs are not applied as in the NAAQS and criteria pollutants are not included as North Carolina TAPs. Since compliance with the AAL is based on an air dispersion modeling analysis, an extensive air monitoring network is not needed. Facilities do not demonstrate compliance based on monitoring since there are other contributors to toxic air pollution; therefore the AAL represents a modeling increment. Compliance with the AALs is based on a dispersion modeling increment at and beyond the facility property boundary. Any needed control of TAPs becomes a facility-specific choice and since the AALs are risk-based, a risk assessment is implicit for permit actions.
- The North Carolina program does not generally develop regulations based on source categories. Although there are rule provisions that allow the State flexibility in this area, air toxics issues are usually localized in their effects and solutions usually address local problems. The group of regulated TAPs differs from those at the national level. The program currently regulates 97 contaminants or contaminant groups, of which 21 are unique to North Carolina and are not included in the national program.
- The North Carolina program is generally focused more on local toxic air pollutant issues, such as community problems, and the North Carolina TAPs include pollutants that are not regulated under the national program.
- Generally, state reviews for compliance with AALs occur after the promulgation of national rules for source categories. This allows the state to evaluate potentially 'risky' emissions sooner than residual risk requirements of the national program.
- AALs are health and risk-based guidelines.

The Science Advisory Board (SAB) on TAPs was created by the Secretary of the Department of Environment and Natural Resources (DENR) to make recommendations to the Environmental Management Commission (EMC) to minimize the potential health hazards resulting from exposures to TAPs. The DAQ is delegated the responsibility for managing the agenda of the SAB and their final recommendations are considered by DENR in drafting rules for AALs.

The SAB risk assessments for noncarcinogen AALs are often based on the No Observed Adverse Effect Level (NOAEL) reported in the peer-reviewed literature. If there is not a NOAEL

[1] In the Federal air toxics program, the USEPA describes stationary sources as "major sources" emitting above the 10/25 tpy threshold and 'area source' to describe stationary sources emitting below the 10/25 tpy. In the North Carolina context, a stationary source is a point source in any major, minor or small category. Area sources are those numerous, spatially distributed, stationary sources emitting toxic air pollutants.

reported, the Lowest Observed Adverse Effect Level (LOAEL) may be converted to a NOAEL using uncertainty factors. Uncertainty factors might be utilized to compensate for potential differences between human and animal body size, metabolic rate and lifespan. Since there is also a widely recognized variability in inter-individual sensitivity, an additional uncertainty factor may be employed to protect subpopulations that are more sensitive. For TAPs known to cause cancer in humans, AALs are based on a "one-in-a-million" risk; that is, if a population of 1 million is continuously exposed to a known human carcinogen over a lifetime at an airborne concentration equal to the AAL, one cancer due to that exposure would be predicted to result. Of those air toxics that are cancer-causing, not all are known human carcinogens. Some are "probable human carcinogens" and some are "possible human carcinogens." The risk associated with these air toxics are set at the following levels:

(1) "probable human carcinogen": 1-in-100,000 and
(2) "possible human carcinogen" : 1-in-10,000.

An important issue in the regulation of source emissions occurs where several TAPs are present. Although it is recognized that effects from the interaction of multiple pollutants may occur, mechanisms of interaction between multiple pollutants, or differing pollutants emitted from multiple nearby facilities, are not well characterized. As implemented in the North Carolina program, each TAP cannot exceed its particular AAL.

Non-regulatory Functions of the Air Toxics Program

There are additional functions implemented as part of the non-regulatory requirements of the State's air toxics program. One of these is the Risk Management Program promulgated under Section 112(r) of the Clean Air Act. North Carolina adopted the national rule and its implementation is based solely on the USEPA requirements; no state-only requirements exist.

The North Carolina air toxics program conducts ambient monitoring in urban areas of the state through a network of trends sites. The program also features monitoring as a part of community problem resolution because of the presence and ability within the air toxics analytical laboratory. Additionally, the program includes a unique ability to respond to incidents requiring emergency air monitoring.

Challenges for the North Carolina Air Toxics Program

The North Carolina air toxics program is facing challenging issues for the future. The following is a brief description of some of these topics.

Federal Air Toxics Program

It may be unusual to think that a national program can cause difficulties for a state implementing a state –only program. In North Carolina, this is the case with the air toxics regulatory program. The state program seeks to 'fill in the gaps' where there are TAP issues of importance to the state and its citizens. These issues range from the state's need to evaluate risks from pollutants not covered by the national program to evaluating statewide risk. The promulgation of federal standards resulted in major challenges by industry to the continued operation of the state program. In the absence of strong support from the USEPA for states operating a complimentary

program, the State Air Toxics Program faces an uncertain future. A loss of the program could have more effect on the citizens than on the regulated community.

Area source regulations have created a "perfect storm" of implementation challenges because of a compressed court-ordered schedule for the USEPA to promulgate final standards for area source categories. Rules often have little-to-no lead time in advance of compliance deadlines. Area source rules can affect hundreds of unpermitted sources or activities in North Carolina. In some cases, the cumulative impact on air quality from these many small sources may be significant, but the resource allocation to follow through with traditional permitting or inspection actions is intensive. Even so, the DAQ takes the area source program seriously and although traditional regulatory actions are not an option in cases where emission control equipment is not specified, outreach to affected sources in certain categories has been fruitful. Area source compliance strategies are generally complaint-driven. Currently, authorities under the State's air toxics rules exist that allow the Director of DAQ to issue a 'call' for a permit or permit review for a specific facility or source sector.

Funds for Toxic Air Pollutant Monitoring

States were encouraged to begin monitoring for toxic and hazardous air pollutants with the advent of the 1999 USEPA Air Toxics Monitoring Concept Paper. Part of the strategy stemmed from an attempt to implement the Urban Air Toxics (UAT) strategy under Section 112(k) of the Clean Air Act. In North Carolina, federal funds were granted to implement ambient monitoring for toxic and hazardous air pollutants specified by the USEPA through the UAT as the biggest risk drivers across the nation. Subsequently, some limited funds were made available for community issues requiring ambient investigation of toxic air pollutants. These funds are distributed on a competitive basis, but for states like North Carolina without huge urban areas and whose need is more oriented to evaluating ambient air across the state, these grants are not helpful. As available monitoring funds dwindle, the state must choose where their resources are best used. Currently, with the difficult economic outlook and federal funding difficult to obtain, monitoring not specifically associated with the overall air program requirements has all but been eliminated. The effect on the UAT network has resulted in stopping sample collection and analysis for critical urban pollutants like formaldehyde.

When fully operational, North Carolina toxic air pollutant monitoring capabilities can be extensive. Although a state issue, responses to emergency toxic air pollutant releases that rely on sampling and analytical assessment may also be disrupted.

Other Air Quality Issues

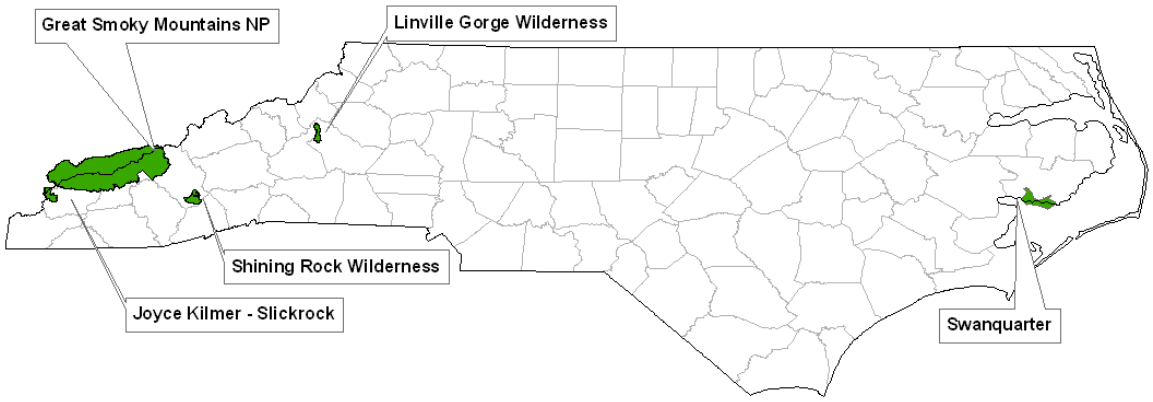
Regional haze is pollution that impairs visibility over a large region, including national parks, forests and wilderness areas (many Class I areas). Regional haze is caused by sources and activities emitting fine particles and their precursors, often transported over large distances and across state borders. Particles affect visibility through the scattering and absorption of light. Reducing fine particles in the atmosphere is an effective method of improving visibility. In the southeast, the most important sources of haze-forming emissions are coal-fired power plants, industrial boilers and other combustion sources, but also include mobile source emissions, area sources, fires and wind blown dust.

States are required to submit SIPs to the USEPA that set out each states' plan for meeting the national goal of a return to natural visibility conditions by 2064. The plan includes the states' reasonable progress goals, expressed in deciviews, for visibility improvement at each affected Class I area for each 10-year period until 2064. The DAQ completed the first regional haze SIP and submitted it to the USEPA on December 17, 2007. The DAQ is now working on the tracking progress report that is due in December 2012.

Visibility has important implications for the state's tourist economy, because haze can obscure views and detract from scenery - a critical issue in the mountains. In addition, haze impacts the quality of life of those citizens living in the mountains, as well as all across the state, since urban visibility and coastal visibility can also be issues on certain days.

North Carolina has five Class I areas within its borders: Great Smoky Mountains National Park, Joyce Kilmer-Slickrock Wilderness Area, Linville Gorge Wilderness Area, Shining Rock Wilderness Area and Swanquarter Wildlife Refuge. Both the Great Smoky Mountains National Park and Joyce Kilmer-Slickrock Wilderness Area are located in both North Carolina and Tennessee. Figure 2.5 below illustrates the location of these Class I areas.

Figure 2.5. Map of North Carolina's Class I Areas



Open Burning

Smoke emitted from outdoor burning pollutes the air and is unhealthy to breathe. An USEPA study found that backyard burning of trash from a family of four can emit as much pollutants as a well-controlled municipal incinerator serving tens of thousands of households. Open burning is the DAQ's most widespread enforcement problem. The open burning rule prohibits most outdoor burning, with exceptions allowed for campfires, land-clearing under certain conditions, disposing of vegetative storm debris and agricultural pest control.

Animal Odors

Animal odors are a significant concern in North Carolina, largely due to the explosive growth of the hog industry. In 1999, the EMC adopted rules for controlling odors from animal operations, one of the first rules of this type in the nation. The DAQ is responsible for enforcing these rules, which apply to livestock operations that use liquid waste-management systems and meet certain size thresholds. The rules set minimum guidelines that eligible operations must follow and give the DAQ the authority to require "best management plans" and equipment for controlling odors at farms where the DAQ staff have documented an objectionable odor problem.

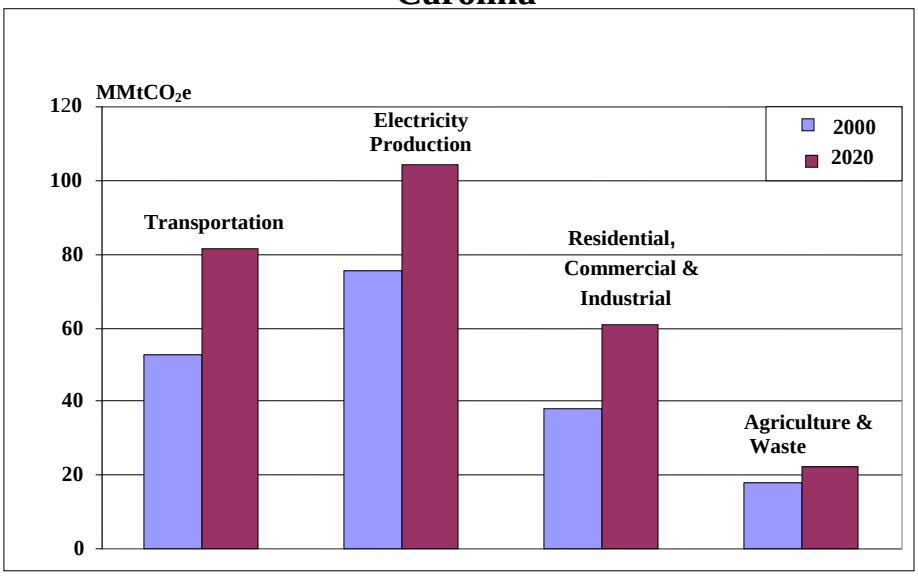
Chapter 3. Greenhouse Gases and Climate Action Planning

It was determined to be prudent by the leaders in the DAQ and the State of North Carolina to examine the steps that could and should be taken by North Carolina to address climate change and the man-made components contributing to the problem. In 2002, the Clean Smokestack Act (CSA) was passed which has and will continue to require major reductions in sulfur dioxide (SO_2) and oxides of nitrogen (NOx) emissions from coal fired power plants in North Carolina. The CSA also charged the DAQ with studying and reporting on controls to reduce carbon dioxide (CO_2) emissions from coal fired power plants and other sources. The DAQ completed a series of studies and made recommendations for reducing North Carolina's carbon emissions. In the final CSA report, submitted to the North Carolina General Assembly in September of 2005, the DAQ recommended that the state continue greenhouse gas (GHG) mitigation planning through a public stakeholder process. The North Carolina Climate Action Plan Advisory Group (CAPAG) was formed in an open and publicized process to assemble a diverse group of stakeholders to identify and assess mitigation options that might be appropriate, carry out analysis, and make recommendations that state policy makers could consider for a state-level Climate Action and Implementation Plan.

The CAPAG consisted of 43 volunteer stakeholders representing North Carolina business, industry, public utilities, environmental groups, community organizations and government. Workgroups under the direction of the CAPAG were formed with the directed task to focus on specific sectors of North Carolina. The five workgroups of the CAPAG were: residential, commercial & industrial; energy supply; transportation & land-use; agriculture; forestry & waste; and cross cutting issues. Each technical workgroup was tasked with developing and evaluating mitigation options specifically for the reduction of GHG in their respective sector.

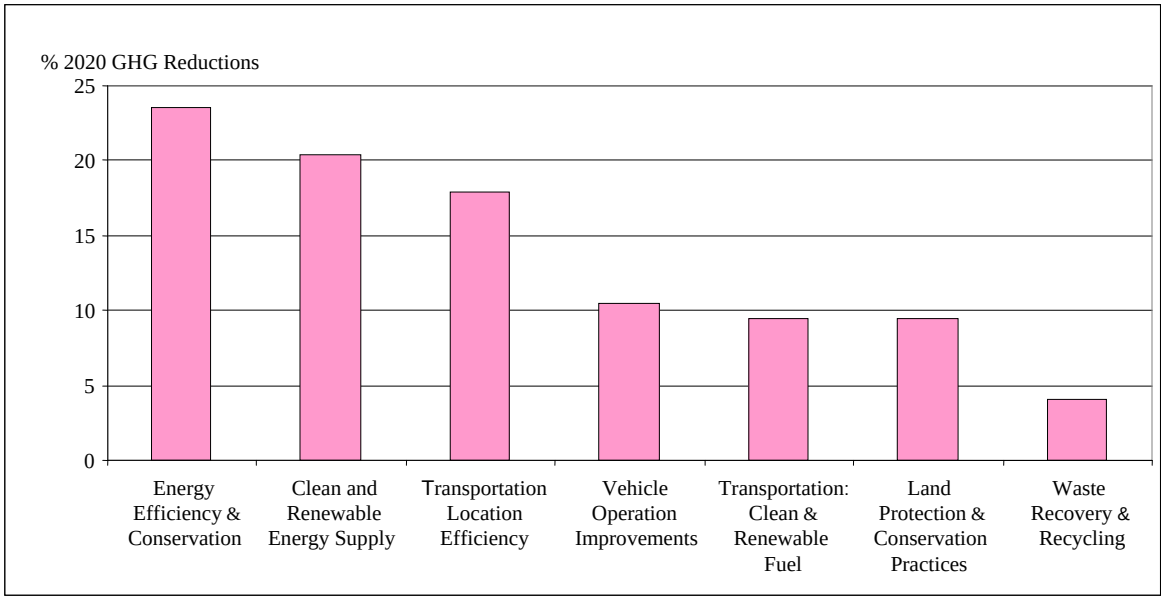
The CAPAG issued several reports, one of which included a summary of the state's historical GHG emissions from 1990 to 2000 and projections up to 2020. Figure 2.1 shows the projected growth in GHG emissions by sector. On a net emissions basis (i.e., including carbon sinks), North Carolina accounted for approximately 156 million metric tons carbon dioxide equivalent ($MMtCO_2e$) of emissions in 2000, an amount equal to 2.4 of total U.S. GHG emissions. The state's GHG emissions are projected to rise faster than the nation as a whole, and reach 232 $MMtCO_2e$ by 2020.

Figure 3.1. Projected Growth in Greenhouse Gas Emissions in North Carolina



The two-year effort of the CAPAG developed 56 recommended mitigation options (Appendix J) for controlling and reducing GHG emissions in North Carolina. These broad reaching recommended options for potential adoption are believed to be the most effective in reducing GHG emissions in North Carolina. The potential impact resulting from the full adoption of the recommended mitigation options is estimated to reduce North Carolina's GHG emissions to within 1% of 1990 levels by the year 2020. If complete adoption and implementation of each recommended option occurs, the gross projected GHG emissions in 2020 would be reduced from a projected 256 $MMtCO_2e$ to 137 $MMtCO_2e$ or by 47%. The cumulative reduced emissions (from 2007-2020) through the full implementation period would reduce North Carolina's GHG emissions by 828 $MMtCO_2e$. Figure 3.2 below presents seven major areas where substantial reductions in GHG emissions could be realized.

Figure 3.2. Percent 2020 GHG Emission Reductions Projected by Category (relative to 1990 levels)



In addition to significant emission reductions estimated to be realized, the CAPAG recognized that many options have the long term potential to stimulate economic growth and create much needed jobs in the state, regardless of, and in addition to the impacts upon climate change. The comprehensive analysis and mitigation options developed by the CAPAG provide a roadmap for North Carolina in reducing GHG emissions. A full, detailed description of the 56 recommended mitigation options is available in the final CAPAG report, which is available for download at www.ncclimatechange.us.

In 2005, the General Assembly of North Carolina established the Legislative Commission on Global Climate Change (LCGCC) with the purpose of studying issues related to global warming, the emerging carbon economy and to determine whether or not it is appropriate and desirable for the state to establish a global warming pollutant reduction goal. Two extensions have been granted, with the most recent (Session Law 2009-306, Senate Bill 835) extending the LCGCC to October 1, 2010. The LCGCC is expected to release a final report detailing the commission's recommendations.

As a direct consequence of the activities initiated by the CAPAG, LCGCC, and others, the North Carolina General Assembly enacted Session Law 2007-397 (Senate Bill 3), commonly referred to as the Renewable Energy and Energy Efficiency Portfolio Standard (REPS), making North Carolina the first state in the southeast to adopt a renewable portfolio standard. The REPS requirement can be met through a combination of renewable energy generation and energy efficiency savings. This significant legislation requires that investor owned utilities meet up to 12.5% of their energy needs through renewable energy resources or energy efficiency measures by 2021 and rural cooperatives and municipalities to meet up to 10% of their electricity needs by 2018.

In addition, the General Assembly also passed Senate Bill 668, which establishes specific performance criteria and goals for sustainable, energy efficient public buildings. Both of these actions were recommended in the final CAPAG report, and represent the first of many initiatives to reduce GHG in the state. All state agencies, including the Department of Environment and Natural Resources (DENR) (DAQ is one of 27 divisions within DENR) are required to develop and implement a strategic energy plan to reduce energy consumption throughout their operations. This mandate coincides with DENR's strategic goal to respond to climate change using both mitigation and adaptation strategies to reduce vulnerability, increase adaptive capacity, and improve resiliency of climate-sensitive resources. The following table summarizes current activities underway.

Table 3.1. Department of Environment and Natural Resource's Climate Change Activities

Mitigation Strategies Reduce GHG contributions to climate change, as recommended by CAPAG	**Adaptation Strategies** Proactively prepare for and adapt to changes we can't prevent
• GHG regulation and emissions tracking • GHG emission reductions and energy conservation • Green energy development • Heavy-duty vehicle idle reduction • Diesel retrofits and clean fuels	• Sea level rise adaptation • Climate-sensitive ecosystems • Water management • Public health impacts • Emergency management preparedness • Land use planning and development

DENR has also established a Climate Change Steering Committee to provide oversight for implementation of DENR's Climate Change Initiative. The team will develop a focused approach to address climate change policy actions at state, regional and federal levels, while coordinating strategies with other state, federal and nongovernmental partners.

Many additional efforts are being undertaken to conserve energy and directly address GHG emissions by doing so. A few examples of the major efforts presently underway in North Carolina to quantify and reduce GHG emissions in North Carolina include:

- The DAQ is developing a state-wide GHG emissions inventory tool to track multi-pollutant emissions data. Key sources for the data include: USEPA's mandatory GHG Reporting system, DAQ's voluntary GHG reporting initiative, and DAQ's point source emissions inventory system developed for the USEPA National Emissions Inventory program.
- The DENR is reporting its annual carbon footprint to The Climate Registry. The data are used to develop DENR's annual energy plan, identify cost cutting measures, and reduce electricity, heating fuel, and motor vehicle fuel usage.
- The North Carolina State Energy Office, which leads many state efforts in alternative fuels, renewable energy, residential and industrial energy savings programs, and awareness and education, is developing a new State Energy Plan.

- Major utilities have expanded existing demand-side management programs in the residential, commercial and industrial sector.
- The North Carolina Utilities Commission has authorized the collection of a public benefits charge on electricity sales of which a portion is managed by the Advanced Energy Corporation and used to fund energy efficiency and development programs.
- North Carolina Green Power coordinates a voluntary program of green power purchasing for consumers in the governmental, residential, commercial and industrial sectors.
- The requirement for the State motor fleet to meet goals in the purchasing of flex-fueled vehicles, hybrid technology, and other high mileage low emitting vehicles continues to expand.
- Many additional bills have been passed by the State legislature and ratified by the Governor. The list is posted on the DAQ website at http://daq.state.nc.us/monitor/eminv/gcc/init_mitigate.shtml.

Chapter 4. Clean Energy Generation and Energy Efficiency Improvements

With the exception of the recent downturn in the economy, North Carolina is generally experiencing a period of sustained economic growth, with related growth in industry and population - growth that is projected to continue well into the future. With changes come competing challenges to satisfy increased energy demand yet maintain a healthy environment.

To meet these challenges, significant legislation has been passed by the North Carolina General Assembly. The Clean Smokestacks Act is cleaning up existing coal-fired power plants, while the Renewable Energy and Energy Efficiency Portfolio Standard (REPS) address future electrical generation.

Following the passage of the REPS, North Carolina is experiencing a surge in interest in the development of renewable energy facilities throughout the state. These facilities would generate electric power and other forms of energy through the use of renewable energy resources including solar, wind, methane capture and biomass (animal waste, wood waste and agricultural waste).

Section 2(c) of Session Law 2007-397 (REPS) provides the Environmental Management Commission with the authority to establish standards to ensure that the consumption of natural resources and renewable energy technologies do not harm the environment and to evaluate whether existing regulatory programs are sufficient to implement these standards.

Accordingly, the EMC established an Renewable Energy Committee and launched a scoping process to lay the groundwork for evaluating whether North Carolina has in place the proper regulatory framework to guide the development of renewable energy facilities.

The DAQ recently approved a permit to construct a new coal-burning power plant, but included state-of-the-art control equipment and a requirement to completely offset the plant's CO_2 emissions – believed to be the first such requirement in the nation.

In 2009, North Carolina House Bill 1481 revitalized the State Energy Policy Council as the central energy policy planning body that recommends to the Governor and General Assembly the needed energy legislation and modifications to energy policy, plans, and programs. It consists of two members of the North Carolina House, two members of the North Carolina Senate and twelve public members. Its duties and responsibilities include:

- Develop and recommend long-term state energy policy
- To assess opportunities and constraints
- To review and coordinate State government research, education, and management programs
- To recommend to the Governor and General Assembly needed energy legislation and modifications of energy policy, plans, and programs.

The Energy Policy Council plans to issue a Phase One report on April 30, 2010 which will detail a work plan for developing comprehensive Energy Legislation by January 1, 2011 and recommendations for Executive Orders. The Phase Two report, expected to be released on January 1, 2011, will identify draft comprehensive Energy Bill to be considered by the General Assembly. The methodology employed by the Council assumes that carbon constraints will be imposed. Three subcommittees are tasked to examine policies in the low carbon energy supply, low carbon transportation and energy efficiency sectors.

Chapter 5. Ecosystem Health

The main ecosystems at risk due in part to air pollution are the aquatic ecosystems in the state. For example, the mountain streams in the western part of North Carolina are stressed due to acid deposition. The eastern estuaries such as the Neuse and the Tar-Pamlico river basins are impacted by nitrogen deposition. Finally, mercury deposition is an issue in the streams across the entire state. There are significant control programs underway that will begin to mitigate the impact that air emissions are having on these streams. The NOx control strategy for ozone will result in significant NOx reductions from mobile sources, utility and industrial boilers. The Clean Smokestacks Act and Clean Air Interstate Rule will result in NOx, SO_2 and mercury emission reductions from utility boilers. The DAQ will work with the Division of Water Quality and the Federal Land Managers to evaluate what additional air emission reductions may be needed to help these ecosystems recover.

Chapter 6. Public Health Related Issues and How They Relate to the Air Quality Multi-Pollutant Process

The NAAQS are set to protect the public's health. As North Carolina develops and implements attainment plans for ozone and fine particulate matter under the AQMP, it is expected that the respiratory and cardiovascular health issues associated with those two pollutants will decrease. Mercury reductions achieved through the implementation of the Clean Smokestacks Act will shall result in less mercury deposition into North Carolina's waterways, and therefore less bioaccumulation of mercury in fish. The North Carolina Air Toxics Program will continue to require sources to evaluate and mitigate any impacts that are over the AAL's in the state. Through the DAQ's efforts to improve air quality, it is expected that the public health of the citizens of North Carolina will also improve.

Environmental Justice Policy

Ensuring the health of all citizens of North Carolina is protected is a primary concern to the DAQ. In order to achieve this goal, the DENR developed the Environmental Equity Initiative policy in October 2000 to support the mission of protecting North Carolina's human and natural resources. This is done by ensuring clean air and clean water for our citizens as well as proper and safe disposal of pollutants in a manner consistent with sustainable development. The key focus is to address issues as they arise, establish lines of communication with industries and affected communities and bridge the gap of misunderstanding that often becomes a barrier in problem resolution. The DENR's Environmental Equity Initiative attempts to create opportunities for successful and productive communication between agency, local community and neighboring industries. Providing all citizens the opportunity for meaningful input into decision-making processes is critical to effective government. The goals of the Environmental Equity Initiative are,

- To ensure that agency programs substantially affecting human health and environment operate without discrimination,
- To provide information for citizens and neighborhood groups to allow meaningful participation in regulatory processes,
- To respond in a meaningful manner to allegations of environmental injustice,
- To provide a link for communication and information between the community, industries and the government,
- To increase awareness of environmental conditions in minority and low-income communities.

To meet the goals outlined in the Environmental Equity Initiative policy, DENR will:

- Inform potentially affected and protected communities about the Environmental Equity Initiative which seeks first to fully understand environmental issues as raised by the community, staff, industry or other interested parties, and then attempts to address them in an environmentally sensitive manner that is consistent with sustainable economic development,

- Address environmental equity issues in permitting decisions for projects potentially having a disparate impact on communities protected by Title VI of the Civil Rights Act of 1964,
- Promote greater use and analysis of demographic information to identify communities that may be disproportionately impacted by sources of pollution,
- Use demographic information to determine whether there is 1) a need for greater outreach to community in order to encourage more meaningful participation, or 2) special health risks based on the nature of the population,
- Develop guidelines for assessing the cumulative effects of permitted facilities,
- Provide opportunities for interested parties to raise concerns on environmental equity in DENR's decisions,
- Develop a process for intervention or mediation that is specific for each instance with a focus on mutually acceptable solutions,
- Resolve environmental equity complaints, consistent with the protection afforded by Title VI of the Civil Rights Act of 1964,
- Develop a full record of environmental equity issues.

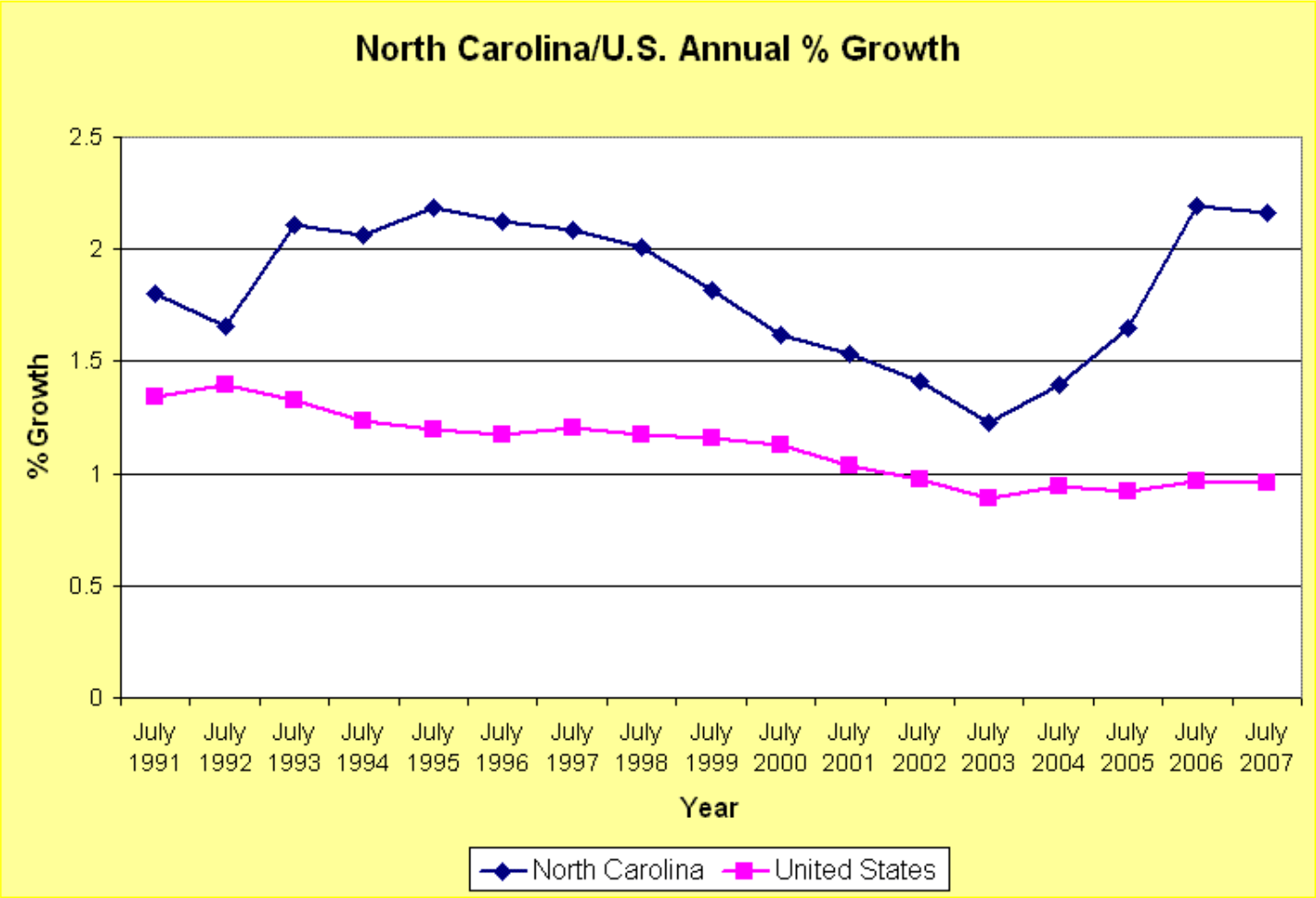
Chapter 7. Growth Issues and How They will be Addressed in the Air Quality Multi-Pollutant Process

North Carolina is a growing state, particularly in terms of population. As of July 1, 2007, North Carolina had a total population of 9,061,032. Based on this statistic, North Carolina is currently the 10th largest state by population. By 2010, North Carolina is projected to have a total population of 9,450,494. By 2020, North Carolina is projected to have a total population of 10,850,228. By 2030, North Carolina is projected to have a total population of 12,274,433, and is projected to be the 7th largest state by population. The county-by-county population projections are contained in Appendix A.

From April 1, 2000 to July 1, 2007, North Carolina had a population increase of 12.6%. This increase gives North Carolina the 6th largest state increase in actual population and the 9th largest state increase in percent of population. During this time period, the average population increase for all states was 6.2%. The highest was 28.4% (Nevada) and the lowest was -3.9% (Louisiana.)

From July 1990 to July 2007, North Carolina had an average annual population increase of 1.83%. The average annual increase in the U.S. population was 1.12% over that same period. Appendix A contains a table showing the year-by-year differences in population growth between North Carolina and the United States. Figure 7.1 presents the different growth rates in a line graph.

Figure 7.1. Comparison of Population Growth Rates between North Carolina and the United States

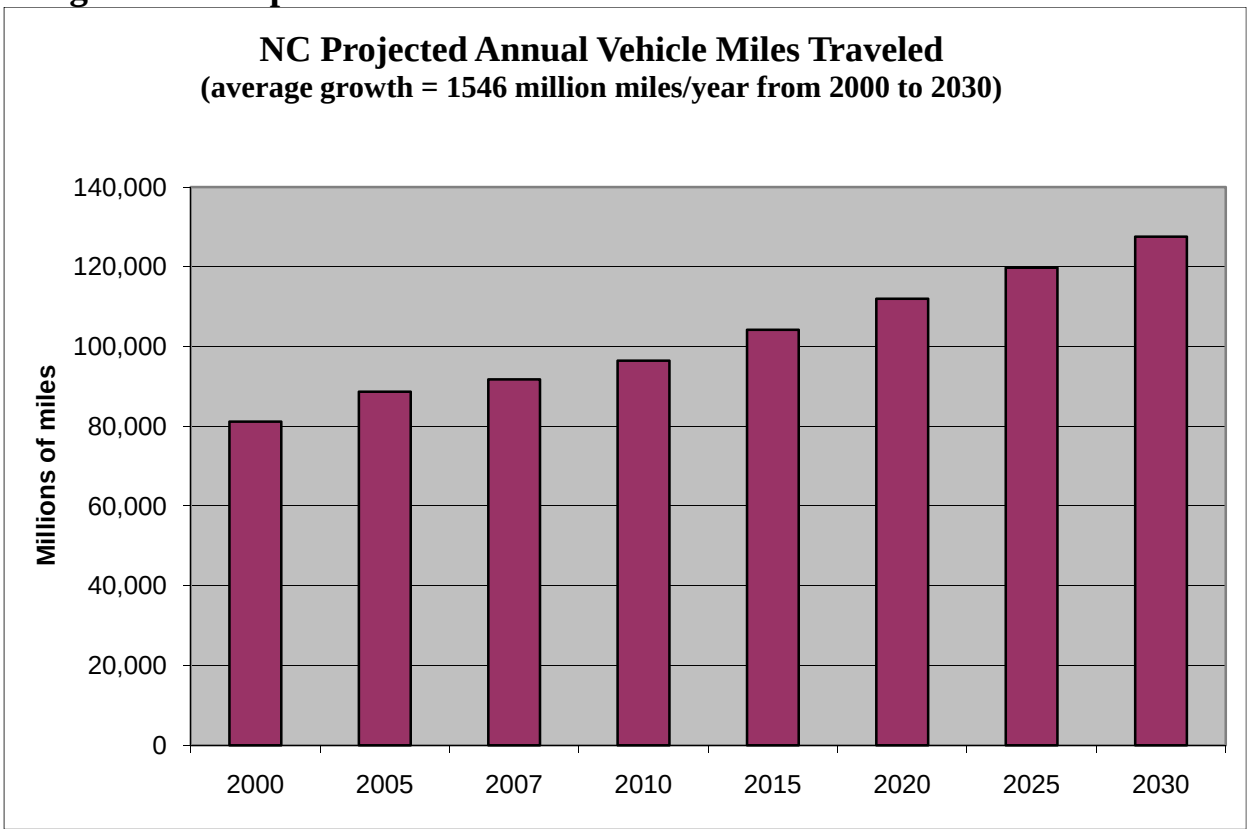


Included in Appendix B are population density maps for North Carolina for1990 and 2000, as well as projected population density for 2010. Additionally, maps showing the percent population growth by county between 1990 and 2000, and the projected population growth between 2000 and 2010 are included in Appendix B.

With population growth comes additional issues that impact air quality such as growth in vehicle miles traveled (VMT) and growth in electricity demand. How the state and local communities handle this growth could have significant impacts on future air quality in North Carolina. Figure 7.2 below shows the expected VMT growth for North Carolina. It is expected that VMT will grow about two percent per year between 2000 and 2030. Mobile emissions represent a significant portion of the emissions of oxides of nitrogen, the limiting precursor for ozone formation in North Carolina.

Appendix C contains the commuting ratio data derived from the 1990 and 2000 census data, which helps predict the driving patterns and future VMT for particular counties. The data, provided by the North Carolina State Data Center, are used to help define vehicle inspection and maintenance program penetration by county, since the program is currently only operational in 48 counties across the state.

Figure 7.2. Expected Growth in Vehicle Miles Traveled in North Carolina



In the next ten years, the emissions reductions from a number of control programs including Clean Smokestacks Act, Clean Air Interstate Rule (CAIR), cleaner engine and fuel standards for a variety of fleets, both on-road and non-road, will help offset the growth in population and activity in North Carolina. Appendix D shows the emission density changes between 2002, 2009 and 2018 for oxides of nitrogen and sulfur dioxide emissions due to the control programs listed above. Finally, Appendix E presents the modeling results for 2009 and 2018 for ozone and $PM_{2.5}$. In order to fully realize the benefits of the control programs, however, North Carolina needs to deal effectively with growth. This issue is a significant challenge to the air quality planning process.

Chapter 8. Stakeholder Involvement in the Air Quality Multi-Pollutant Process

The AQMP is a comprehensive process will have challenges, such as how to balance between various pollutants and strategies when certain control measures could result in improvements in one pollutant and degradation in another. Another challenge is ensuring the stakeholder involvement is successful. Stakeholders will include, but are not limited to, federal partners, other state agencies, local air quality agencies, local and state elected officials, environmental groups, regulated community, rural and metropolitan planning organizations, local and state transportation partners and the general public.

To adequately address a multi-pollutant management process, the stakeholders' involvement becomes far reaching. A broader range of organizations and agencies, i.e., State Energy Office, Toxics Protection Branch, etc., have to be included in the process. The challenge is making sure the stakeholders are involved and engaged such that everyone is working toward the same goal without pursuing individual agendas of the organization they are representing.

The stakeholder process should be continuous and ongoing to prevent interruption of the technical work that is being updated on a regular schedule. This is specifically a challenge given the number of pollutants and the geographic scope of the AQMP. The DAQ will provide technical data and analysis as well as tools so stakeholders can be fully engaged in the decision making process.

The DAQ recognizes that stakeholder involvement is an integral part of the AQMP. Their input is invaluable to meet the challenges of developing and implementing multi-pollutant control strategies. Stakeholders will support a variety of roles during the AQMP. Stakeholders can provide data on local initiatives to mitigate air pollution as well as provide feedback on potential control strategies. Another task of stakeholders is to provide emissions data used to create profiles in emissions inventory development, which is a key component to developing an emissions inventory as accurately as possible. Local stakeholders will play an important role in implementing local control strategies, especially in the mobile source sector because federal and state control strategies have been exhausted in this sector. Areas of particular concern are Metrolina (Charlotte metropolitan area), the Triad (Greensboro-Winston Salem-High Point metropolitan area), the Triangle (Raleigh-Durham-Chapel Hill metropolitan area) and the Mountains (western portion of the state). One of the challenges of working with local officials will be to champion control strategies that may not yield large emissions reductions but are imperative for these areas to improve air quality.

In addition, there are a number of local stakeholder groups, some growing out of the Early Action Compact process, and another out of the Sustainable Environment for Quality of Life project in the Metrolina area. The DAQ will continue to interact with and engage these groups in addressing air quality issues. Additionally, the DAQ will help form and foster additional local stakeholder groups, where appropriate. The following list is a starting point for identifying all of the stakeholders in the process:

Other North Carolina State Agencies – Department of Transportation, Department of Commerce, Department of Agriculture and Consumer Services, Department of Administration, Department of Public Instruction, Department of Health and Human Services

Other State Air Agencies – Representatives from the states participating in the Southeast Regional Modeling (Alabama, Florida, Georgia, Kentucky, Mississippi, South Carolina, Tennessee, Virginia, West Virginia)

Other Agencies within the Department of Environment and Natural Resources – Division of Forest Resources, Division of Water Quality, Division of Pollution Prevention and Environmental Assistance

Federal Agencies – Environmental Protection Agency, Federal Highway Administration, Federal Transit Administration, National Park Service, Department of Agriculture Forest Service, Fish and Wildlife Service, Department of Energy, Fort Bragg, Camp Lejeune, Seymour-Johnson Air Force Base

Local Agencies – Local Air Programs, Metropolitan Planning Organizations, Rural Planning Organizations, Councils of Government, Elected Officials

Regulated Community

Environmental Groups.

The DAQ will develop a list serve for the project so that all stakeholders can be informed of meetings and can choose whether or not to participate in particular meetings or other events.

Stakeholder involvement with neighboring states is also an essential component of the stakeholder process. Many of North Carolina's neighboring states have similar air quality issues. Regional planning and cooperation is a key element to successfully addressing air quality issues. A collaborative effort such as the Southeast Modeling, Analysis and Planning (SEMAP) focuses on a regional technical analysis versus individual state efforts resulting in significant cost savings and a superior technical product. Regional collaboration also provides additional resources and expertise to support these efforts.

The stakeholder involvement will be intensive and time consuming. Elected officials at all levels will need to be engaged in the effort at various times. Other implementing agencies such as the Department of Transportation, the State Energy Office, the Department of Agriculture and Consumer Services, the Department of Commerce, the Division of Forest Resources, Federal Land Managers, local air agencies and staff in the local governments across the state will need to be consulted on a regular basis. The environmental groups, regulated community and general public will need routine briefings on the efforts involved in developing an air quality management plan. A communication strategy will be developed to propose schedules for meetings, briefings and other communication efforts. A list serve will be developed such that interested parties across the state can subscribe and receive routine updates as well.

The DAQ currently conducts monthly stakeholder meetings with transportation partners, the State Interagency Consultation Meetings (SICM), whose primary focus is mobile related issues and serves as a forum for various local, state and federal agencies to disseminate information. In addition to the SICM, the DAQ has another stakeholder group, the Outside Involvement Committee (OIC), which consists of the public, private industry and environmental groups. The OIC meets quarterly and is a conduit for exchanging information on all subject matter related to air quality. The DAQ can utilize the foundation already established through the SICM and OIC to involve stakeholders in the AQMP. For other stakeholders such as elected officials, meetings could be conducted on an annual basis or a time frame agreed upon by all parties. As an extension of the stakeholder process, the local communities are needed to effectively address air quality issues that will take the support of the local communities to solve, attaining the revised 8-hour ozone NAAQS, maintaining the annual $PM_{2.5}$ NAAQS, reducing toxics such as mercury and achieving GHG emissions reductions. These issues will require local initiatives and help from local communities for the educational effort as to why personal action is important. Certain local areas already have ongoing committees that meet on a regular basis, for example, the Unifour Air Quality Committee in the Hickory area. Such committees also exist in Asheville, Fayetteville, Metrolina, the Triad and the Triangle. The DAQ will collaborate with these local committees as a means of information exchange during the AQMP. As the stakeholders' process evolves, the process will serve as a forum for various areas to strategize, share methodologies used to quantify emission benefits and engage in problem solving sessions. Local programs and municipalities are the catalysts for implementing some of these control strategies because the state may not have the authority to implement such programs.

On October 7, 2009, the DAQ initiated the stakeholders' process by conducting the first stakeholders involvement meeting conducted at the DAQ Central Office in Raleigh. Stakeholders from various industries and organizations were invited to participate. To kick-off this inaugural stakeholders' involvement meeting, participants were invited from the local air programs (Buncombe County, Mecklenburg County and Forsyth County), the DAQ Regional Offices and members of the OIC, the SICM distribution list and the Rules Development distribution list. The meeting was broadcast live via teleconferencing at all of the DAQ Regional Offices as well as made available to individuals who were unable to attend the meeting at the DAQ Central Office or any of the DAQ Regional Offices. There were a total of 36 participants representing the DAQ, other state agencies and private industry. The focus of this meeting was to provide information on the history and the purpose of the AQMP pilot project and share with the stakeholders the documents the DAQ has developed for the AQMP pilot project – Lay of the Land, Conceptual Model, Communication Strategy and Control Evaluation Strategy. The DAQ solicited feedback from the stakeholders on the AQMP documents and the AQMP process. Letters from stakeholders' feedback are in Appendix M. Overall, the feedback from stakeholders was positive and many of them looked forward to future opportunities for stakeholders to be engaged and participate in the process as it evolves. However, some stakeholders did express concern about the ability to move forward given the statutory mandate hurdles. They cautioned the DAQ to not pursue the AQMP process if these hurdles were not adequately addressed.

Chapter 9. Communication Strategy

There will be several levels of stakeholder involvement during the AQMP process. The DAQ will communicate with a variety of stakeholders. Some of the challenges are to keep the stakeholders engaged throughout the process and determine the most effective ways to disseminate information.

As previously stated in Chapter 8. Stakeholder Involvement in the Air Quality Multi-Pollutant Process, the DAQ has an infrastructure already established to use as a foundation for determining stakeholders. This is the first step in the communication process, which is identifying potential stakeholders. Additionally, the DAQ is involved with established workgroups and committees that can be avenues for communicating with stakeholders. An example of a few of these committees and workgroups are the Outside Involvement Committee, Unifour Air Quality Committee, State Interagency Consultation Workgroup, Sustainable Environment for Quality of Life, Triad Early Action Compact Workgroup and Fayetteville Early Action Compact Workgroup. Due to the varied interests and expertise of the stakeholders, an integral part of the process is going to be developing conduits for disseminating information effectively and in a manner that keeps the various stakeholders engaged in the process. One means of achieving this is to create "subgroups" –group the stakeholders based on need and interests. For example, for the development of the mobile sources control strategies, the local, State and federal transportation partners, metropolitan planning organizations, rural planning organizations, environmental groups and local elected officials are needed to provide input for mobile emissions inventory development as well as evaluate potential control strategies. Generating "subgroups" is one potential way to foster effective communication among a diverse group of stakeholders.

Due to the broad scope of material that will be covered during the stakeholder process, another challenge is determining what information to provide to the stakeholders. Any success from the communication strategy starts with providing information that is useful to the stakeholders. One means of achieving this is to survey the stakeholders to determine what information the DAQ can provide so the stakeholders have the information they need to provide input and feedback to remain fully engaged in the process. Some of the basic information that will be provided is potential multi-pollutant control strategies, control strategy evaluation process and implementation strategies. As previously stated, the stakeholders are diverse and of varying expertise and focus so not all of the information available is going to be pertinent to all of the stakeholders. Determining how much information to provide is a key component to capturing and maintaining the interest level of all of the stakeholders. In an effort to address this issue, the DAQ will solicit comments from the stakeholders regarding how much information should the DAQ provide, how often should information be disseminated, what is the most efficient and effective means of distributing information, and what is the best way for the DAQ to advertise updates, milestones and other pertinent information.

With the technology available today, there are many tools available for communicating. The DAQ intends to utilize the various methods available to communicate with the stakeholders. The DAQ has a link on our website (http://daq.state.nc.us/planning/nc_aqmp.shtml) to specifically

address the AQMP. The information on the website will target a wide audience and will contain reports, progress status, milestones, modeling results and meeting information.

In addition to the website, a list serve or list serves (depending on feedback from the stakeholders) will be created. The list serve(s) will provide stakeholders with more detailed information such as comprehensive progress reports, more frequent updates on modeling results, control strategies and evaluation process.

In order to encourage one-on-one communication, the DAQ may conduct meetings and webinars in the Coastal, Piedmont and Mountain regions. The focal point will be brainstorming sessions on potential control strategies, the most effective control strategy evaluation tools, sharing information among the stakeholders and DAQ, control strategy implementation, specifically in local communities and their impacts on industry and citizenry, and communicate modeling results and milestones.

Press releases may be distributed to venues in the Coastal, Piedmont and Mountain regions to advertise stakeholder meetings, modeling results and other pertinent information, as needed.

Every effort will be made to communicate and disseminate information to all interested parties. Below is an outline summarizing the key points of the communication strategy:

- Use existing infrastructure to determine stakeholders,
- Create stakeholder "subgroups" to help keep stakeholders engaged in the process,
- Determine what, when and how information should be disseminated to the stakeholders,
- Obtain feedback from the stakeholders on the best ways DAQ can communicate pertinent information, and
- Utilize the various tools available for communication
    - DAQ website
    - List serve
    - Meetings
    - Webinars
    - Press releases.

Chapter 10. Process for Implementing Air Quality Management

There are a number of steps and many parties involved in various aspects at different stages in the rulemaking process in North Carolina. Several key parties are described below.

The Environmental Management Commission (EMC) is a 19-member Commission appointed by the Governor, the Senate Pro Tempore and the Speaker of the House. The Commission is responsible for adopting rules for the protection, preservation and enhancement of the state's air and water resources. Commission members are chosen to represent various interests, including the medical profession, agriculture, engineering, fish and wildlife, groundwater, air and water pollution control, municipal or county government, and the public at large. The Commission oversees and adopts rules for several divisions of the DENR, including the DAQ, Land Resources, Water Quality and Water Resources.

The DAQ provides staff recommendations to the Air Quality Committee (AQC) of the EMC for new rules and rule updates. In addition, the DAQ takes direction from the AQC and the EMC as to new rule initiatives the members want the DAQ to undertake. The actual rulemaking process can be lengthy, due to the North Carolina Administrative Procedures Act, which must be followed. This legislation instructs the regulatory agencies as to the official process for introducing a new rule through the public hearing and adoption phase. A new or revised rule can take up to 2 years from initial concept stage through final adoption and legislative review.

The actual steps in the rulemaking process are numerous and can be lengthy. A concept for a rule is developed and presented to the AQC for approval for DAQ to move forward with drafting a rule. A draft rule is then developed and distributed internally for review by the various DAQ workgroups, staff and management. In addition, a state and local fiscal note and economic assessment are developed. The draft rule is posted on the DAQ website and sent to the rulemaking stakeholders' list. Stakeholder meetings are conducted where appropriate. At a subsequent meeting of the AQC, the draft rule and associated economic assessment are presented for approval to proceed to the full EMC with a request to proceed to public hearing. Typically the draft rule and request to proceed to hearing are presented to the full EMC and voted upon at a meeting that occurs at least 30 days after presentation of the concept to the AQC. The AQC must take a vote in order for the draft rules to proceed to the EMC with a request to take the rules to public hearing. This vote typically occurs at the AQC meeting immediately preceding the EMC meeting. The EMC meets regularly every other month beginning in January on the second Thursday of the month and the AQC and other subcommittees meet on the Wednesday prior to the EMC meetings.

The draft rule, fiscal notes, economic assessment and other paperwork are submitted to the DENR Rulemaking Coordinator who distributes the package to the Office of State Budget and Management (OSBM) and the DENR fiscal analyst for review and approval. At this point in the process, the DAQ also submits the draft rule package including the fiscal notes and economic assessment to the League of Municipalities, the Association of County Commissioners and Fiscal Research Division of the legislature. The package must also be sent to the Governor's Office at least 30 days prior to publication in the *North Carolina Register* (NCR) if the fiscal note concludes that local governments' expenditures or revenues will be impacted. In addition,

the package must be sent to the North Carolina Department of Transportation (DOT) at least 30 days prior to publication in the NCR if adoption of the rule would result in increased costs to DOT. Note that rules involving fees must also be submitted for review to the Governmental Operations Committee of the legislature.

Once approval to proceed to hearing is obtained, members of the EMC are appointed by the Chair of the EMC as hearing officers, arrangements are made for a hearing, and a hearing announcement is filed for publication in the NCR. A public notice is also published in several newspapers across the state. The DAQ distributes the public notice package to its regional offices, USEPA Region 4, local programs, the rulemaking stakeholders' mailing list and posts it on the DAQ webpage. No sooner than 15 days after publication in the NCR, the DAQ can conduct the hearing.

Following the hearing and close of the 60 day comment period, the DAQ staff prepares responses to the comments received, make any necessary adjustments to the draft rule, review the record with the DAQ Director and hearing officers, and schedule the hearing officers' presentation for a subsequent EMC meeting. At the EMC meeting, the hearing officers present a summary of the record and their recommendations and the EMC votes on whether to approve the rules.

Once the rules are adopted by the EMC, they are reviewed by the Rules Review Commission (RRC) at its next meeting, which is typically the following month. Once the RRC approves the rule, it becomes effective the first day of the following month. If the RRC receives ten letters of objection requesting review by the legislature by no later than 5:00 p.m. the day following the day the RRC adopts the rule, the rule is sent to the legislature for review. Such rules sent to the legislature for review become effective on the earlier of the thirty-first legislative day or the day of adjournment of the next regular session of the General Assembly that begins at least 25 days after the date the Commission approved the rule if a bill specifically disapproving the rule is not introduced before the thirty-first legislative day.

A worksheet for rule adoption is included as Appendix F. This document describes the various steps of the rule adoption process in North Carolina.

The administrative review is conducted by the Rules Review Commission. The RRC consists of ten members appointed by the General Assembly, five upon the recommendation of the President Pro Tempore of the Senate, and five upon the recommendation of the Speaker of the House of Representatives. The RRC reviews all state rules adopted by agencies such as the EMC to ensure:

1. the rule is within the authority delegated to the agency by the General Assembly;
2. the rule is clear and unambiguous;
3. the rule is reasonably necessary to implement or interpret an enactment of the General Assembly, or of Congress, or a regulation of a federal agency considering the cumulative effect of all rules adopted by the agency related to the specific purpose for which the rule is proposed; and

4. the rule was adopted in accordance with the North Carolina Administrative Procedures Act.

Several counties in North Carolina operate their own local air quality programs. In these areas, the local program is responsible for enforcing state or federal air quality regulations. Local Programs in North Carolina include the:

- Forsyth County Environmental Affairs Department
- Mecklenburg County Air Quality
- Western North Carolina Regional Air Quality Agency.

These local programs each have their own local environmental boards. After a rule is adopted by the local program's board, then it is submitted to the DAQ for review and submittal to the USEPA.

It should be noted that the above discussion covers only the regulatory process. The DAQ also relies on other implementation processes, such as education and outreach, voluntary initiatives, permitting, and enforcement and compliance to fully administer the air quality program in North Carolina.

Chapter 11. Other Planning Efforts Impacting the AQMP

There are a number of other planning efforts that can impact the DAQ's effort in implementing the AQMP. These efforts can include planning processes by transportation planners and watershed planners and legislative actions on climate change.

Transportation Planners
Across the state there are numerous Metropolitan Planning Organizations (MPOs) that work with the North Carolina Department of Transportation to develop long range transportation plans (LRTPs) that go out at least 25 years into the future. The LRTPs analyze a set number of years within the planning period, usually in ten-year increments, and they must be updated at least every four years. Additionally, the DOT develops the Statewide Transportation Improvement Program, which is currently updated every two years and is developed for a six-year period for which funding is available.

Issues can occur in obtaining the on-road mobile source relevant data from transportation partners in a timely manner to meet the air quality modeling needs. Not all of the MPOs are on the same schedule for their planning process and the future years that are analyzed may not be the same for all planning organizations. This makes it difficult to get the actual years that will be needed for both the base year modeling, as well as the various future years that will need to be modeled.

Additionally, it would be a benefit to the air quality modeling to obtain the transportation networks from the MPOs so that spatial surrogates for air quality modeling could be developed for the base year and the future years. As part of the AQMP pilot project, the University of North Carolina – Carolina Environmental Programs (CEP) provided training on how to use a special allocator tool to create spatial surrogates for emissions modeling. This tool has the capabilities to take travel demand model data and create a spatial surrogate for any modeling grid specified. Additionally, a different gridding surrogate can be created for the base year and the future years. This will allow the mobile emissions to be allocated where future roads are expected to be. This tool will assist the DAQ in modeling mobile emissions more accurately in the future.

Legislative Actions on Climate Change
Being a progressive state, the North Carolina General Assembly has created a legislative commission to look into Global Climate Change and consider economic opportunities for action to reduce the state's greenhouse gas emissions. As a first step, the North Carolina General Assembly passed into law in 2007 a requirement for the use of renewable energy. The Commission is currently reviewing recommendations from the North Carolina Climate Action Plan Advisory Group as to other measures from various source sectors that will reduce the state's GHG emissions.

Issues can occur in determining how industry will respond to the legislative actions. For instance, the renewable energy bill requires a certain percentage of the energy demand to come from renewable energy sources including solar, wind, biomass and animal waste. It is difficult to develop future year emissions inventories without knowing where the renewable energy source

will be located and if there will be emissions associated with it. If most of the energy is from burning biomass or animal waste, what will be the air quality impact from these sources?

Additionally, some of the measures being considered by the Commission may result in adaptation measures as well as emission reduction measures. It is difficult to plan without knowing what the Commission may present to the General Assembly to consider for legislative action.

Watershed Planners

It is well known that nitrogen deposition can cause problems in watersheds, resulting in increased acidity, which can harm both plant and animal life. Some of the nitrogen deposited into watersheds comes from air emissions of oxides of nitrogen and ammonia. Only recently have efforts been made to try and couple air quality modeling results with watershed models. In addition to the nitrogen deposition issue, the Division of Water Quality is currently considering the need to establish a mercury TMDL for the state, or possibly certain river basins.

Issues occur when the watershed modelers need data at a different grid resolution than what the air quality models were run. Additionally, the base year modeling needed for the two modelers may not be consistent. Trying to address the needs of multiple users of the data may lead to many additional years needing to be modeled as well as multiple grid resolutions. This can cause a strain on the air quality modeling resources.

Chapter 12. Regional and Neighboring State Issues

Many of our neighboring states have similar issues as North Carolina, primarily ozone, $PM_{2.5}$, visibility, mercury and climate change issues. We have learned through the regional haze, ozone and $PM_{2.5}$ planning process for the SIPs that have been submitted over the last several years, that regional planning and cooperation is essential. The technical work performed through such collaborations as SEMAP represent the best collaborative effort to date. The benefit of all the states focusing on a single technical analysis versus individual state efforts resulted in a significant cost savings and a superior technical product. Such efforts will continue to be needed as states work on designing strategies for the revised ozone standard and daily $PM_{2.5}$ standard, tackle climate change and prepare for the next round of regional haze SIPs. States and the USEPA need to support such collaborative endeavors, as it is in the best interest of the public's health and welfare, and is a better use of public monies. The DAQ intends to work with the neighboring states as the technical work is performed for the AQMP.

Chapter 13. Geographic and Meteorological Inferences on Air Quality in North Carolina

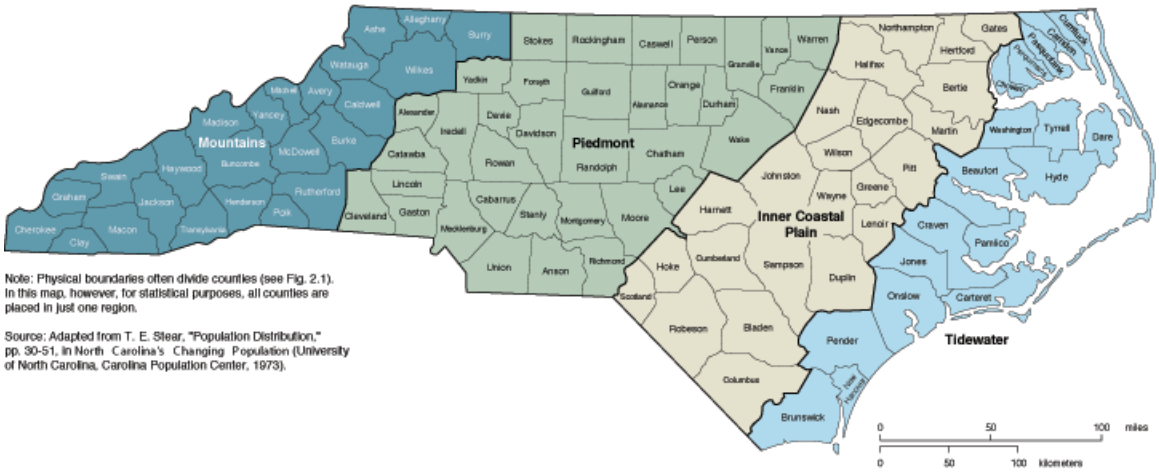
North Carolina has geographical characteristics that influence air quality. These geographical regions include the Coastal Plain, Piedmont and Appalachian Mountains. The coastal plain is influenced by the coastal front and sea breeze that occurs due to daytime heating over land. As the air over land warms, a gradient is formed between the cooler air over the ocean and the warmer air over land. This gradient forms a circulation that causes winds to blow consistently inland, effectively mixing the atmosphere and cleaning the air. The opposite occurs overnight, where air over water is warmer than air over land and an offshore breeze occurs. By continuously circulating air, the atmosphere is kept clean relative to the central portions of the state.

The Piedmont region, however, is less affected by climatology than by population density. Major population centers exist within the central portion of the state. As such, poorer air quality is expected due to an increase in anthropogenic emissions, which lead to increases in ozone and particulate matter (primary and secondary). Typically, the Piedmont region is dominated by a southwesterly flow, with the main cleaning component being synoptic scale frontal boundaries.

Air quality in the Appalachian Mountains is most often degraded during the overnight hours. This pattern is different from normal pollutant profiles as ozone formation occurs during daylight hours. Because the highest ozone levels typically occur overnight and there are significantly less intense local pollution sources, it can be concluded that transport is the main cause rather than local formation.

Appendix H contains maps displaying the location of stationary sources and highway networks across the seven regional areas in North Carolina. The stationary sources' emissions are shown in tons per year. As shown in the maps, North Carolina has several major highways that traverse through the larger metropolitan areas across the state, specifically through the Piedmont Crescent. There are also electric generating utilities operating within these areas. As indicated by the maps, the resulting emissions in these areas are significant total. In addition, there are electric generating utilities in the Asheville and Wilmington areas, but the emissions are not as significant in these areas.

Figure 13.1. Map of the Mountain, Piedmont and Coastal Regions Across North Carolina



Impacts of Meteorology on Ozone, $PM_{2.5}$ and Regional Haze

Ozone

Periods of elevated ozone formation are typically found in slow-moving, high-pressure weather systems. These systems are characterized by sinking air, which upon sinking works to create a pronounced thermal inversion (temperature increasing with altitude). As this inversion becomes stronger, vertical mixing of the atmosphere is hindered, allowing sufficient conditions for ozone precursors (NOx and VOCs) to react accordingly. Because stagnant air, decreased cloud formation and warm temperatures often identify these systems, major ozone formation occurs during the hot summer season. However, as the ozone standard has changed through the years, the definition of peak ozone season has changed in North Carolina. For example, with the one hour standard of 0.12 ppm, the peak ozone season was June through August, while the 8-hour average of 0.08 ppm standard resulted in the peak ozone season being extended to include May and September.

Generally, ozone formation is hindered when incoming ultraviolet radiation is restricted, because ozone formation is a photochemical process. The lack of ultraviolet rays is generally caused by cloud formations associated with frontal boundaries and low-pressure systems.

$PM_{2.5}$

The impact of meteorological variables on fine particulate is a little less straightforward. Particles can be formed two ways: (1) Direct release into the atmosphere and (2) Secondary formation due to atmospheric processes. Typically, periods of elevated particle pollution in North Carolina involve high-pressure systems similar to those mentioned previously. In any case, a well-mixed atmosphere is typically much cleaner. As high-pressure systems remain stagnant, particles can remain over an area for an extended period of time.

However, because particles can also serve as condensation nuclei, formation can occur when a higher relative humidity is achieved. As atmospheric moisture content increases, so does the moisture's ability to condense on a particle (nuclei). Particles are removed from the atmosphere in two ways: (1) deposit onto surfaces (dry deposition) or (2) removal through incorporation into cloud droplets during precipitation (wet deposition). It follows naturally that periods where particles decrease are during rain events. In North Carolina, the highest daily values of $PM_{2.5}$ tend to occur in the summer months, and the lowest values in the winter months.

Regional Haze

Regional haze is defined as impaired visibility caused by one or more atmospheric pollutants that contribute to what is known as light extinction. One of the primary pollutants associated with regional haze is particulate matter (fine and coarse). Particulate matter less than 10 μm in diameter contributes to light scattering. Elevated levels of particulates are typically seen in similar stagnant high-pressure systems noted above. Regional haze will be at its highest during warm, relatively moist, calm weather conditions. The problem, meteorologically, is mitigated during periods of turbulent weather (low-pressure systems). The worst visibility impairment tends to occur in the summer months, and the periods of best visibility tend to occur in the winter.

Chapter 14. Air Quality Issues of Concern

As North Carolina develops the AQMP, one of the most critical elements will be the process to identify control strategies across multiple pollutants and addressing multiple air quality objectives. The first step in this process is to identify the air quality issues of concern in North Carolina. The significant criteria pollutants of concern across the state are fine particulate matter ($PM_{2.5}$) and ozone (O_3).

North Carolina currently has one area, the Charlotte-Gastonia-Rock Hill area (Metrolina), in nonattainment for the 1997 8-hour ozone NAAQS. There are three other areas in maintenance for the 1997 8-hour ozone NAAQS, the Triangle (Durham, Granville, Wake, Chatham(partial county), Franklin, Johnston, Orange and Person Counties), Rocky Mount (Nash and Edgecombe Counties) and the Great Smoky Mountains National Park (Swain(partial county) and Haywood(partial county) Counties). Also, there were several areas that participated in the Early Action Compact process – the Triad (Alamance, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Stokes, Surry, Yadkin and Rockingham Counties), Fayetteville, the Mountains (Buncombe, Haywood and Madison Counties) and the Unifour area (Alexander, Burke, Caldwell and Catawba Counties), all of which attained the 1997 8-hour ozone standard early.

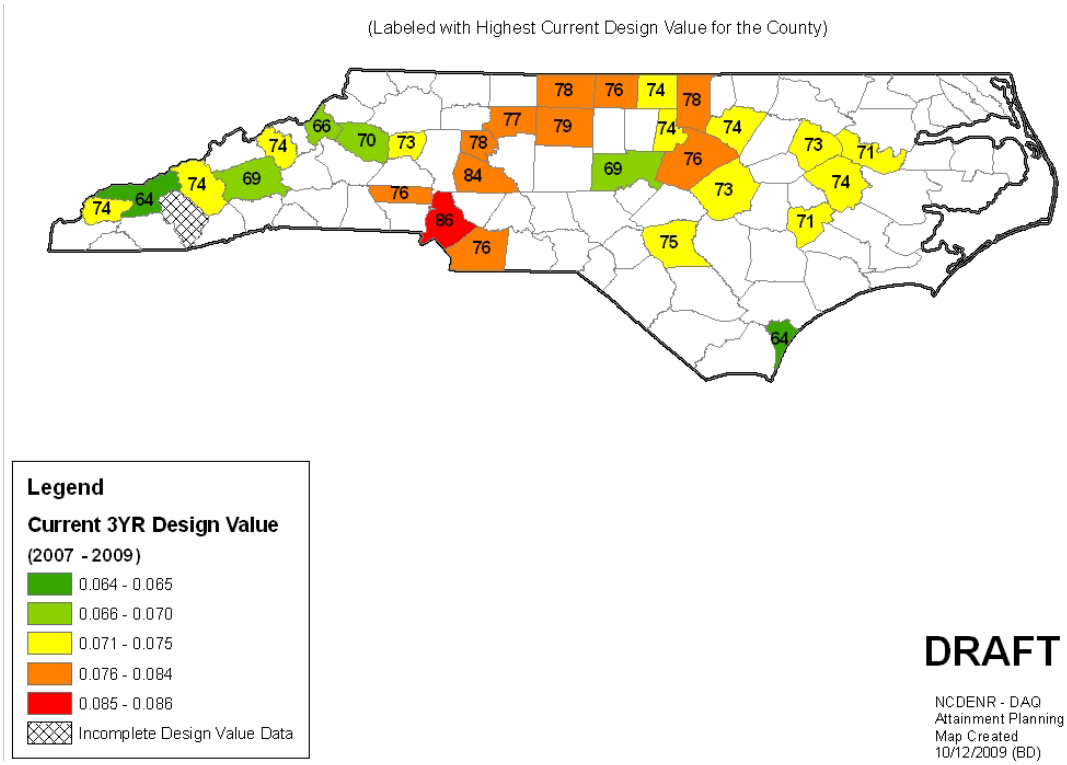
Ozone

Ozone forms through the reaction of NOx and volatile organic compounds (VOC) emissions in the presence of sunlight. NOx are emitted from the utilities, combustion processes and motor vehicles. VOCs are emitted from many industrial solvents as well as from evaporation from the gasoline used by motor vehicles and off-road engines or emitted through the tailpipe following combustion. Additionally, VOCs are emitted by natural sources such as trees and crops. Due to the generally warm and moist climate of North Carolina, vegetation abounds in many forms. The emissions from natural sources, such as vegetation, are referred to as biogenic emissions and account for approximately 85% (based on 2002 annual emissions) of the total VOC emissions in North Carolina. This results in North Carolina (which are predominately manmade) being a NOx limited environment, which means that reductions in NOx emissions will have the greatest impact on reducing ozone formation in North Carolina.

North Carolina's most populous metropolitan regions are located in the central portions of the state (Piedmont). The three largest cities (Charlotte, Greensboro and Raleigh) form a partial crescent extending from the southwest to the northeast. This combination of metropolitan regions is often referred to as the Piedmont Crescent. A network of interstate and intrastate highways interconnects these three largest cities and further extends into adjoining states in a general southwest to northeast pattern. The mobile-based NOx emissions follow these highway networks with the highest emissions occurring in or near the city centers. The industrial point sources with both anthropogenic NOx and VOC emissions are also generally located in close proximity to the cities and the major road networks. Finally, North Carolina's largest NOx point sources are electric generating facilities, which are spatially scattered around the state but are most heavily concentrated near the Piedmont Crescent. By combining each of the major emission source categories, VOC emissions for biogenic source and NOx emissions from mobile sources and electric generating facilities, the highest concentrations of precursor pollutants for ozone formation are focused throughout the Piedmont Crescent.

On January 6, 2010, the USEPA proposed to further strengthen the 8-hour ozone NAAQS. The EPA is proposing to strengthen the standard to a level within the range of 0.060-0.070 ppm. The proposed revisions result from a reconsideration of the ozone standard set at 0.075 ppm in 2008. The USEPA will issue the final 8-hour ozone standard by August 31, 2010. The following figure shows the current 3-year (2007-2009) design values at the monitoring sites across North Carolina.

Figure 14.1. Current Highest 3-year Design Values for 2007-2009



The following figures show the proposed presumptive nonattainment boundaries if the 8-hour ozone standard is set at 0.060 ppm, 0.065 ppm and 0.070 ppm. The presumptive nonattainment boundaries are based on combined statistical areas (CSAs). The USEPA will make final designations for the 2010 ozone standard by August 2011. The following maps are presented as potential nonattainment areas and do not represent the State's recommended nonattainment areas. The ozone SIPs to address the 2010 ozone standard are due by December 2013.

Figure 14.2. Presumptive Nonattainment Boundaries - Standard under 0.060ppm

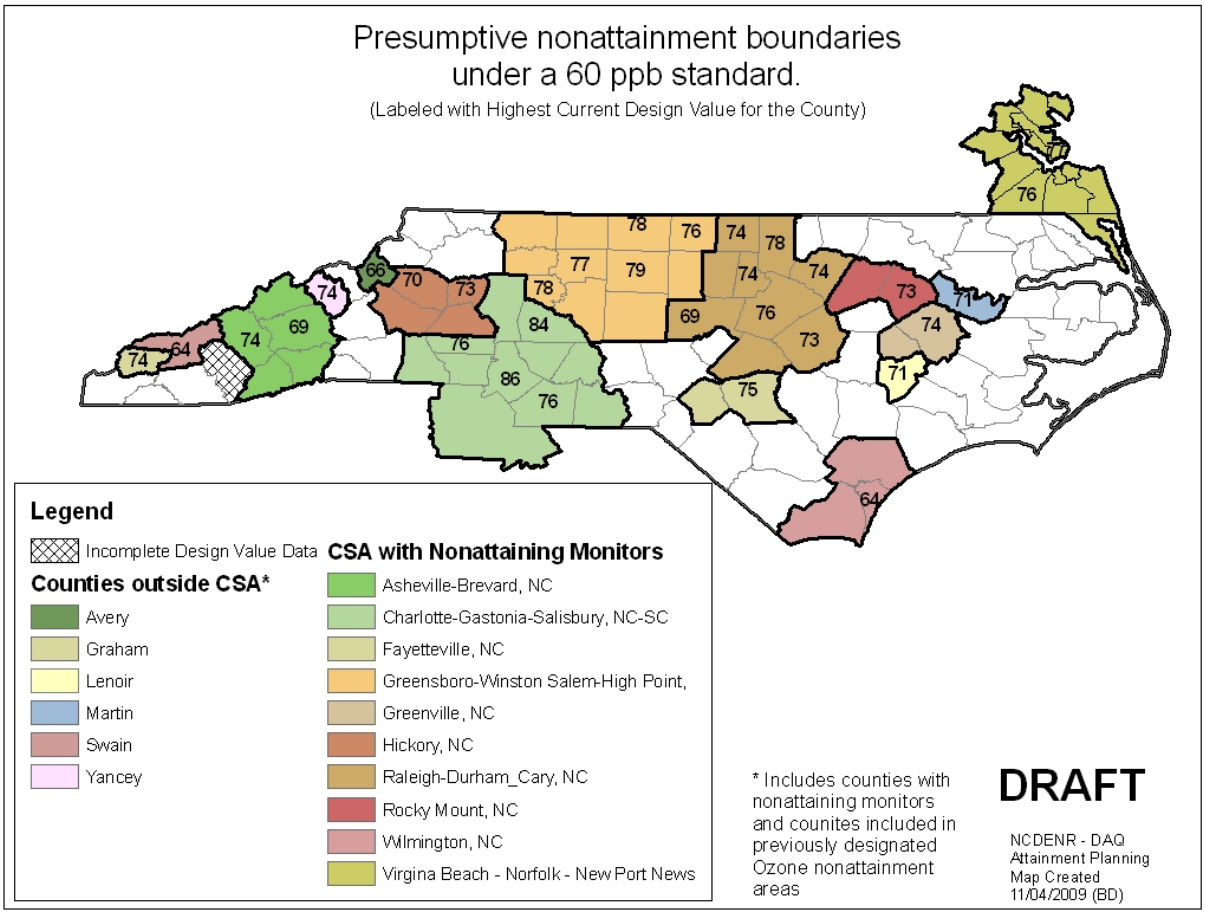


Figure 14.3. Presumptive Nonattainment Boundaries - Standard under 0.065ppm

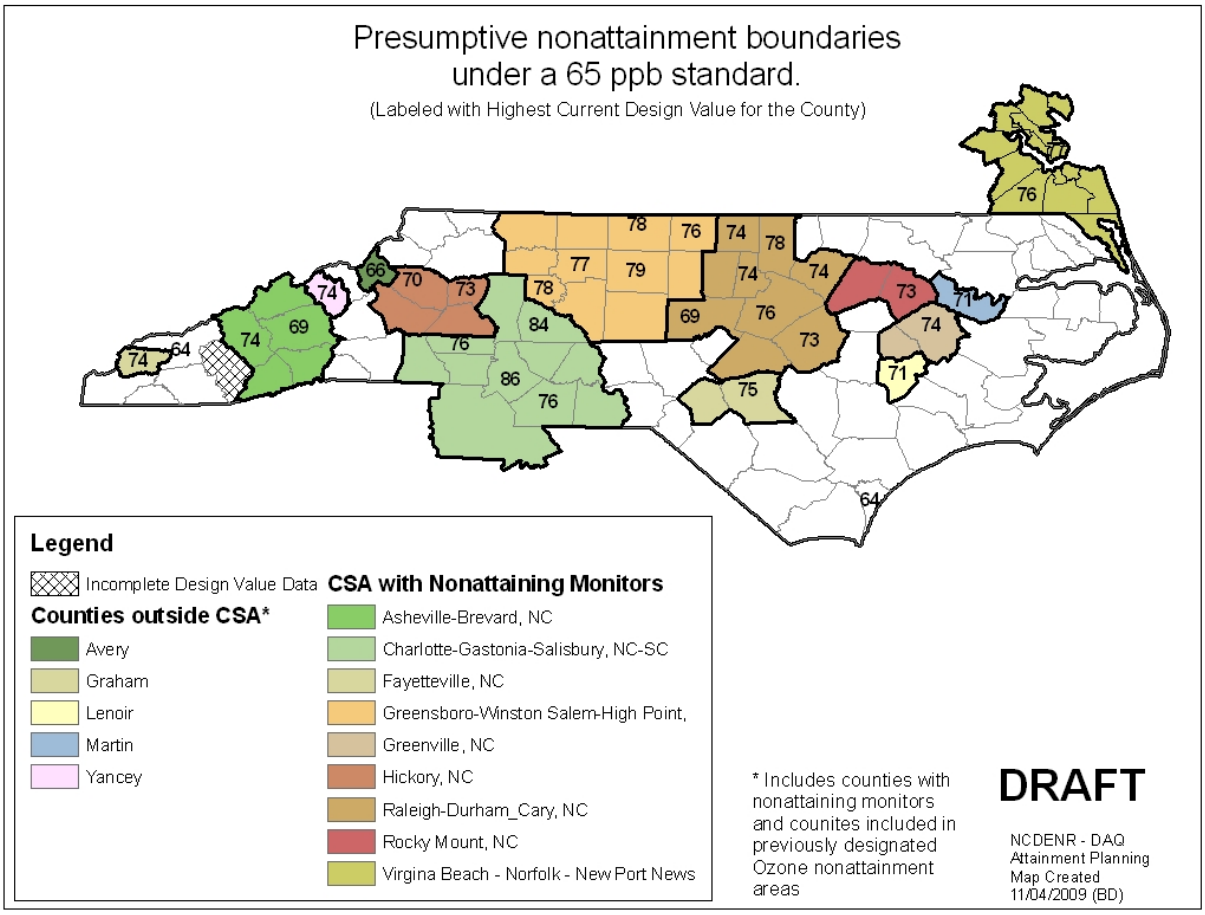
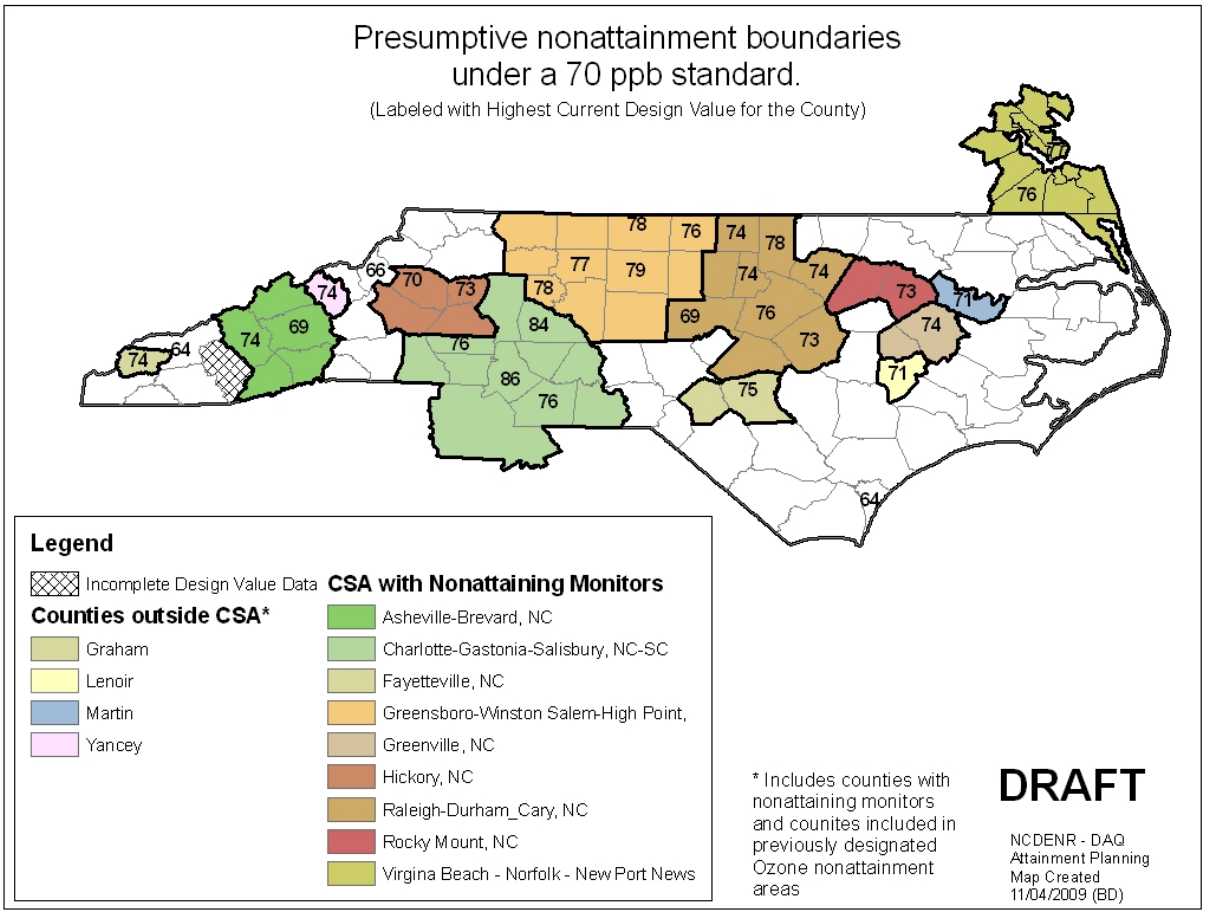


Figure 14.4. Presumptive Nonattainment Boundaries - Standard under 0.070ppm



Particulate Matter

$PM_{2.5}$ can be either gaseous or solid particles formed in the atmosphere via complex reactions. As previously stated, $PM_{2.5}$ is another significant pollutant of concern in North Carolina. High $PM_{2.5}$ concentrations have been a concern in several of our urban areas - Catawba, Guilford and Davidson Counties. However, the 2006-2008 data shows that all of the monitors in North Carolina have come into compliance with both, the annual and the daily $PM_{2.5}$ standards, 15.0 µg/m^3 and 35 µg/m^3 respectively.

Figure 14.5. 2006-2008 Design Values for the Daily $PM_{2.5}$ NAAQS Nonattainment Areas

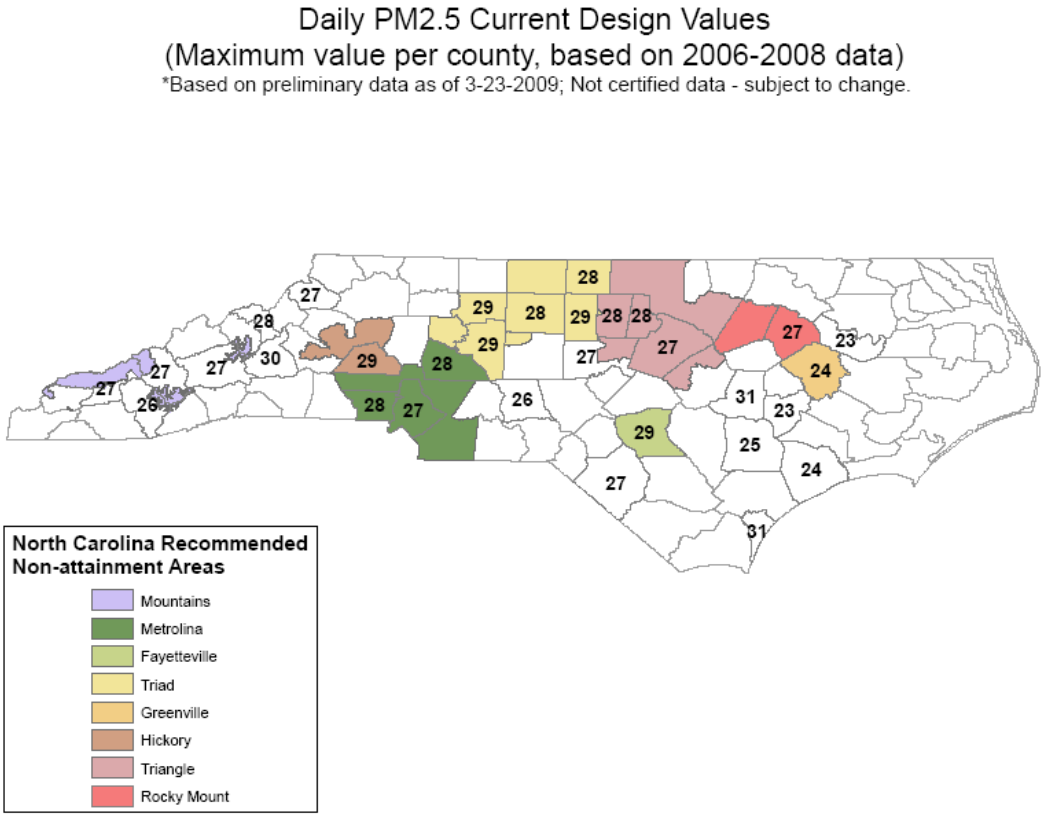
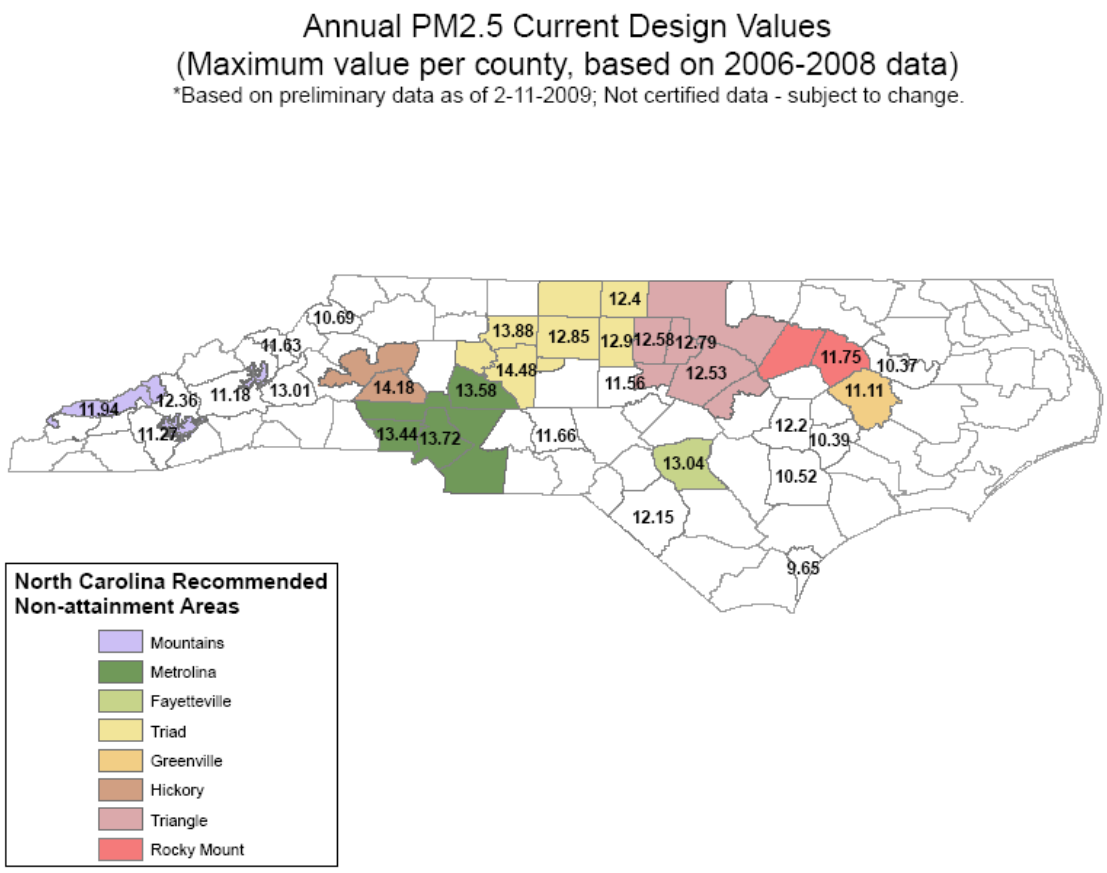


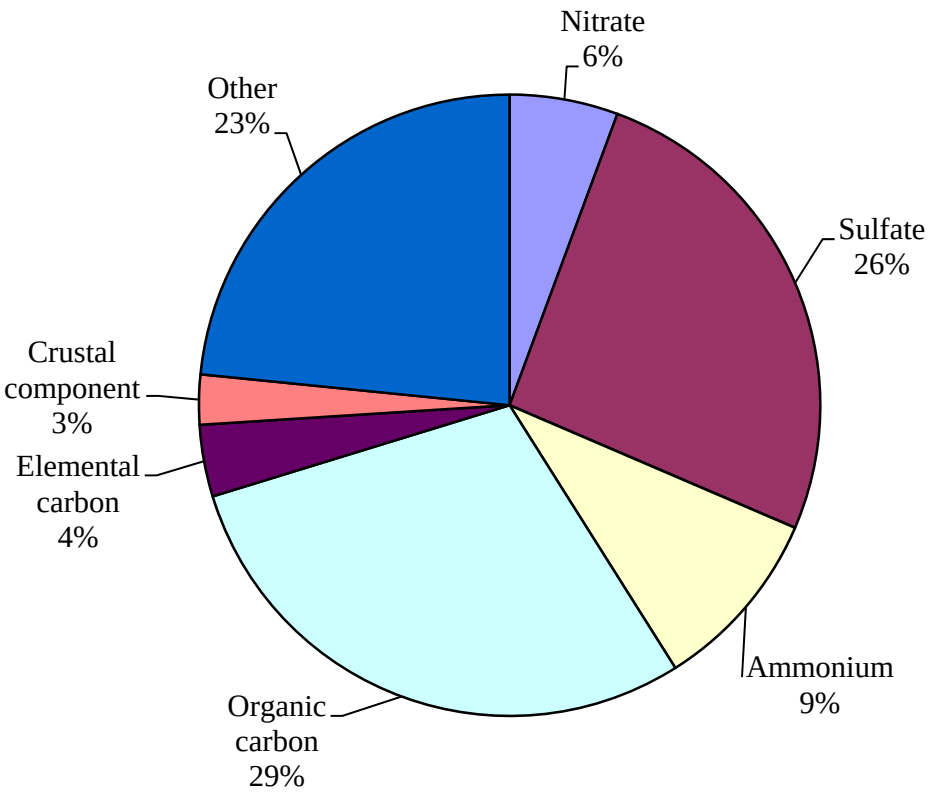
Figure 14.6. 2006-2008 Design Values for the Annual $PM_{2.5}$ NAAQS Nonattainment Areas



While the monitors in the state currently attain the $PM_{2.5}$ standards, the DAQ will continue evaluating the ambient data and modeling to determine necessary steps in the event the standards are revised again. In addition, the DC Circuit Court recently remanded the $PM_{2.5}$ NAAQS to the USEPA for reconsideration of levels of the annual and daily standards. Such reconsideration could result in tighter standards in the future. There are currently two monitors, one in Hickory (Catawba County) and one in the Triad (Davidson County), which are close to the annual $PM_{2.5}$ NAAQS.

In addition to the monitoring of total $PM_{2.5}$ mass as discussed above, the DAQ also operates several speciated sites across the state. Figure 14.7 shows the results from the analysis of the speciated or Chemical Speciation Network (CSN) filters, which is the average of all of the DAQ monitors across the state. The results for 2006 show sulfates (SO_4) and organic carbon (OC) as the main contributors to $PM_{2.5}$, with 26% and 28%, respectively; ammonium (NH_4) contributes 10%; nitrates (NO_3) contribute 6%; elemental carbon (EC) is approximately 4%; and crustal material is 3% of the total $PM_{2.5}$ mass. The "other" portion of the $PM_{2.5}$ that accounts for 23% of the mass can be attributed to water (H_2O), sea salts and other trace materials captured with the CSN monitors.

Figure 14.7. North Carolina $PM_{2.5}$ Speciation for 2006



The percentages of species contribution fluctuate throughout the year with the most significant changes to SO_4 and NO_3. Sulfates are more pronounced during the summertime or warm season months than during the wintertime and NO_3 fluctuates from almost undetectable in the summertime to as much as ten percent in the winter. Ammonium and particle bound water are less dominant than SO_4 and OC and are reasonably consistent throughout the year. Elemental carbon and crustal material are less prevalent throughout the year.

Organic carbon is a major contributor to $PM_{2.5}$ mass. There are varied source contributions to carbon mass, which are mobile sources and emissions from fires. However, there is not a clear understanding of the relative contributions to organic carbon due to the uncertainty in emissions profiles for those sources. The DAQ has funded two separate studies with the goal to better understand the organic carbon component of the $PM_{2.5}$ total mass, one with Georgia Institute of Technology and one with University of Wisconsin. Since those studies were completed, there have been more source apportionment activities conducted throughout the United States. One core component integral to the results of the source apportionment work is the assumption of the source profiles used in the analysis. As part of this AQMP pilot project, the DAQ worked with the USEPA and Sonoma Technology, Inc. (STI) to evaluate and improve the accuracy of emissions profiles used for source attributions of ambient measurements and atmosphere chemical transport modeling. Carbon has proven difficult to adequately model so a better

understanding of organic carbon formation and which emission sources are controllable versus uncontrollable are needed. Controlling carbon from anthropogenic sources of carbon will likely be more effective in reducing $PM_{2.5}$ emissions in urban areas. Through this effort, the DAQ hoped to gain insight on which source sectors contribute the most to the organic carbon portion of $PM_{2.5}$ total mass, so that the most effective control strategies can be devised to address future violations of the $PM_{2.5}$ standards.

The main sources of carbon mass include mobile emissions, biomass burning and biogenic emissions. Unfortunately, there is uncertainty in the emissions profiles used to characterize carbon from these emission sources. The main task of STI was to evaluate the accuracy of the positive matrix factorization and chemical mass balance profile models used for source attribution of ambient measurements. One of the results of STI's findings is that woodsmoke and mobile source emission profiles are the most variable from study-to-study; therefore, additional investigation is needed. The other STI result was that secondary organic aerosol contributions are difficult to quantify in $PM_{2.5}$ data because results are highly variable on an urban vs. rural basis as well as a seasonal basis. Based on these results, STI concluded the following:

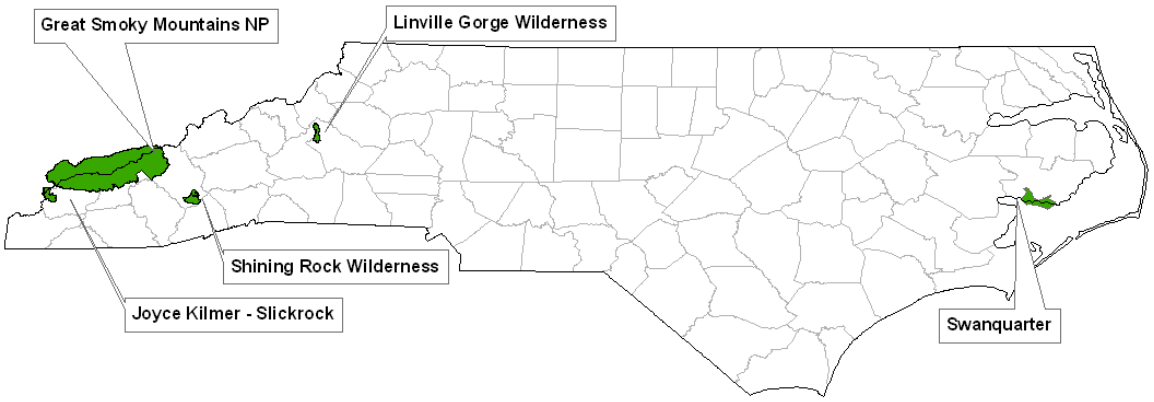
- Control strategies will likely focus on mobile gasoline and diesel emissions and woodsmoke emissions, which are sources of particulate matter, particulate matter precursors and ozone precursors,
- Modeling efforts will continue to attempt to improve understanding of secondary organic aerosols and inclusion of woodsmoke emissions, and
- Source profile development is still needed for speciated organics from mobile sources, woodsmoke and secondary organic aerosols.

Sulfate particles are formed in the atmosphere from SO_2 emissions. The largest sources of SO_2 emissions come from electric generating units and industrial point sources, specifically coal-fired utilities, industrial boilers and other combustion sources. Through the implementation of the CSA in North Carolina and the CAIR throughout the eastern United States, the emissions of SO_2 are expected to decrease by approximately seventy percent. Due to the implementation schedule of the CSA, significant reductions in SO_2 have already occurred. The DAQ observed a reduction in the design values between 2005-2007 and 2006-2008 by as much as 1 $\mu g/m^3$ at some monitors. This reduction in $PM_{2.5}$ total mass seems to correlate well with the reduction in SO_2 emissions in the state and region. Industrial and natural sources contribute to NH_4 emissions and nitrogen oxides from combustion sources contribute to NO_3.

Regional Haze

Another air quality concern is regional haze. Regional haze is not a pollutant but is caused by natural and manmade sources emitting fine particles and their precursors, often transported over large distances and across state borders. Regional haze is an issue because it degrades the visibility in our Class I areas - Great Smoky Mountains National Park, Joyce Kilmer-Slickrock Wilderness Area, Linville Gorge Wilderness Area, Shining Rock Wilderness Area and Swanquarter Wildlife Refuge. Figure 14.8 below illustrates the location of the Class I areas in North Carolina.

Figure 14.8. Map of North Carolina's Class I Areas



Regional haze is particularly a concern in the western part of North Carolina, where all but one of our Class I areas are located. In the southeastern portion of the United States, the most important sources of haze-forming emissions are coal-fired power plants, industrial boilers and other combustion sources, mobile source emissions, area source emissions, fires and wind blown dust. Sulfates are the largest contributor to regional haze. Particulate organic matter is the second most important contributor to fine particle mass and light extinction at the North Carolina Class I areas. Elemental carbon is a minor contributor to visibility. Elemental carbon levels are higher at urban monitors than at the Class I areas and suggest controls of fossil fuel combustion sources would be more effective to reduce $PM_{2.5}$ in urban areas than to improve visibility in Class I areas. Ammonium nitrate (NH_4NO_3) is formed in the atmosphere by a chemical reaction of ammonia (NH_3) and NOx. At elevated temperatures nitric acid remains in gaseous form, for this reason, particle nitrate levels are very low in the summer and a minor contributor to visibility impairment. Particle nitrate concentrations are higher on winter days and are more important for the coastal Class I site where a higher percentage of worst days can occur on winter days. The peak hazy days occur in the summer under stagnant weather conditions with high relative humidity, high temperatures and low wind speeds. The 20% best visibility days at the Southern Appalachian sites can occur at any time of year. At Swanquarter and other coastal sites, the 20% worst and best visibility days are distributed throughout the year. Ammonium nitrate formation is limited by NH_3 concentrations, which suggest that for winter days, controlling NH_3 sources would be more effective in reducing ammonium nitrate levels than controlling NOx. Soil fine particles are minor contributors to visibility impairment on most days; therefore, no control strategies are needed for fine soil at this time. Figures 14.9 and 14.10 display the average light extinction for the 20% haziest days and 20% clearest days, respectively.

Figure 14.9. Average light extinction for the 20% Haziest Days in 2000-2004 at VISTAS and neighboring Class I areas using new IMPROVE equation

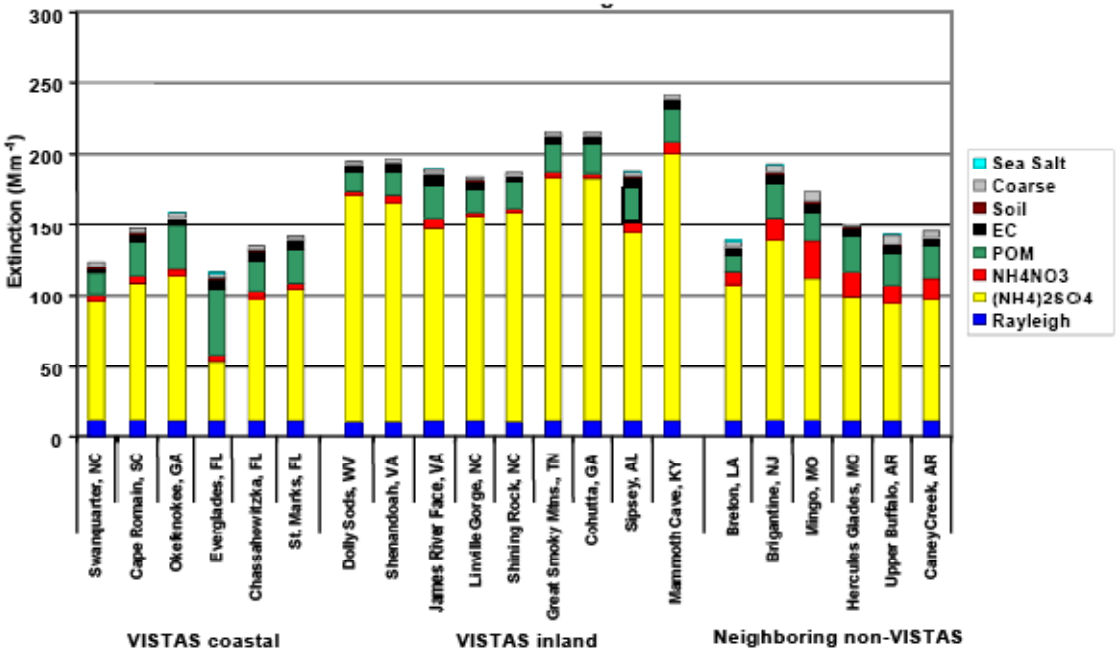
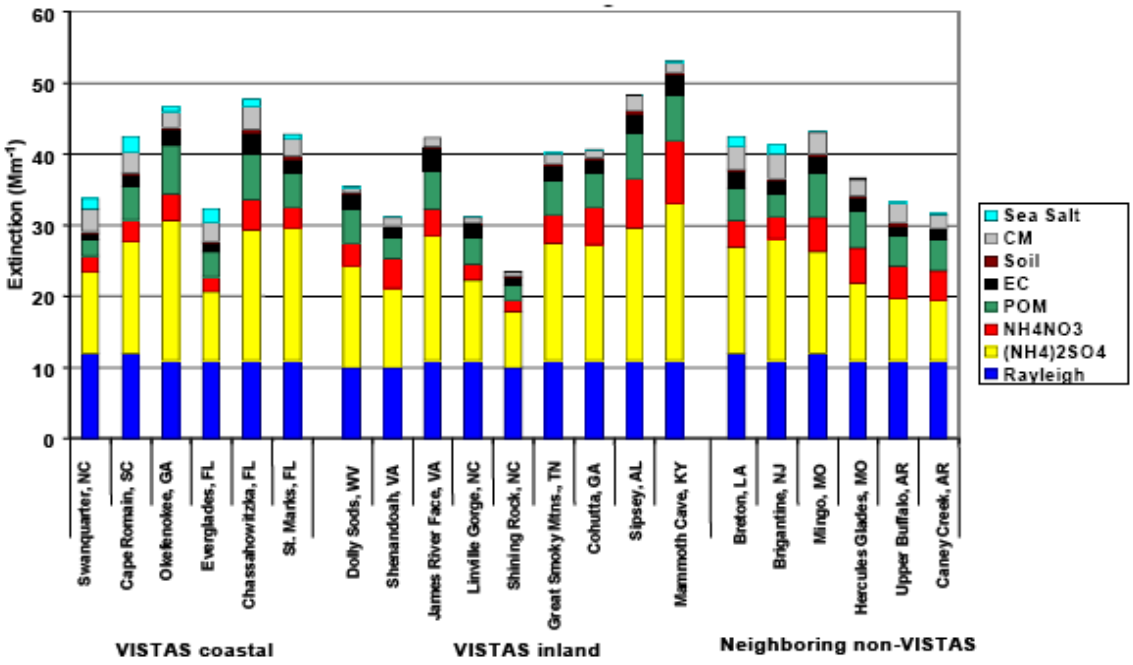


Figure 14.10. Average light extinction for the 20% Clearest Days in 2000-2004 at VISTAS and neighboring Class I areas using new IMPROVE equation



Air Toxics

The primary goal of air toxics regulatory programs, whether state or federal, is the protection of public health and the environment. In air toxics programs, a major measure of progress is the reduction in risk stemming from exposures to toxic chemicals due to their release in the environment. Our program faces challenges in obtaining data—inventory and monitoring—to accomplish appropriate risk analyses to help focus our energies.

Factors involved in exposure to toxic air pollutants include the quantity of chemicals released, fate and transport of the chemicals in the environment, the amount of time and concentrations of the chemical to which people are exposed and the toxicity of the chemical. People react to chemical exposures in different ways. Some people may have no reaction. Chemical characteristics, length of exposure and toxicity are controlling factors in types of reactions: a minor exposure with reversible effects, an exposure that can be debilitating or exposures resulting in a fatal response. Many different types of sources can release these toxic air pollutants, but in North Carolina, controlling these releases focuses on emissions from point sources. Managing toxic air pollutants in the environment requires an approach that leverages traditional and contemporary information gathering techniques, risk assessment and pollution control strategies.

Assessing emission quantity is typically accomplished through an emission inventory. Characterizing toxic air pollutants is typically accomplished using sampling and analytical techniques. Assessing toxic air pollutants on a statewide or local scale include using newer tools such as multimedia and human exposure modeling. Additionally, the state of science surrounding the classification of toxic air pollutants is continually evolving; therefore, updates are important to developing relevant regulatory limits. The goal in using these assessment tools is to characterize risk or perform a risk assessment.

Risk assessment is a process using methods for:

- Evaluating sources of air toxics released into the environment
- What happens to the chemicals once released
- Who may be exposed and at what levels
- How exposure occurs
- The toxicity and potency of chemicals
- The probability that exposed individuals will experience harm.

Performing risk assessments can be detailed, challenging and time-intensive depending on the goal of the assessment, level of detail needed for decision making and uncertainties or variability in the information used. The initial step in characterizing risk is to characterize the toxic air pollutant—which one, where and how.

In 1999, the USEPA developed the *National Ambient Monitoring Network to Support the (federal) Air Toxics Program* as described in the USEPA's Air Toxics Monitoring Concept Paper[2]. Although some form of federal toxic air pollutant monitoring existed as far back as 1988, as the Urban Air Toxics Monitoring Program (UATMP), the *National Network* was

[2] Air Toxics Monitoring Concept Paper, USEPA OAQPS, October, 1992.

intended to revitalize a previous long-term monitoring effort for toxic air pollutants. The UATMP initially focused on 30 urban hazardous air pollutants and to launch the monitoring effort, the USEPA provided monetary incentives for states to take on the task. North Carolina established a number of sites to support the UATMP. Even when the USEPA changed its air toxics monitoring strategy to focus mostly on community assessment through a competitive grant process, the state continued to operate these sites for trends data. Monitoring and community assessment do not always need or require active participation in the monitoring or assessment of toxic air pollutants. In some cases, the state has a need to evaluate toxic air pollution without the need to mobilize a community. It is understood that the USEPA has a responsibility to establish national air toxics monitoring priorities. However, the competitive grant process makes it more difficult for states such as North Carolina with lesser urbanized or industrialized areas than states such as Georgia (Atlanta) or Alabama (source sector) to compete for projects.

Currently, the favored monitoring approach for toxic air pollutants exists through the NAATS program, but North Carolina is not required to operate a NAATS site. Another issue is relating national monitoring objectives with those of the particular state. The handful of toxic air pollutants being monitored through the NAATS program may or may not be the toxic air pollutant issues in North Carolina. Through the NAATS effort the USEPA may obtain data on spatial variability for only a handful of pollutants. Sites established based only on the spatial representativeness for a contaminant could have the effect of further isolating state air toxics monitoring needs, which are typically localized.

The challenge in light of the current economic climate is resource availability in order to continue operating sites and analyzing samples. Monitoring data is used as a surrogate for population exposure and is coupled with data from other areas—such as inventory and modeling—to compile an assessment of risk from air toxics. An example of how it all works together can be described using the results for benzene monitoring from the UAT sites. Benzene in North Carolina has been and continues to be measured in concentrations across the state exceeding the 1 in a 1,000,000 cancer risk level or at a level above the state's AAL. Although a risk can be quantified, reduction strategies may not be feasible and in the case of benzene, the vast majority of emissions are mobile sources, not point sources. For the air toxics program in North Carolina, a benzene reduction strategy from mobile sources is not feasible until there is a national effort.

One of the results of monitoring is to provide real-world data and shed light on possible pollutant issues. For example, recent $PM_{2.5}$ data raises questions about arsenic and cadmium as future toxic air pollution issues for the state, see Figures 14.11 and 14.12. Subjecting these data to the risk assessment process can help to prioritize the state's focus. Determining what drives the emissions, such as assessments and projections of emissions inventory data, and further scrutiny of the monitoring data informs pollutant reduction strategies.

Figure 14.11. Ratio of Arsenic Concentrations to AAL per Sampling Location

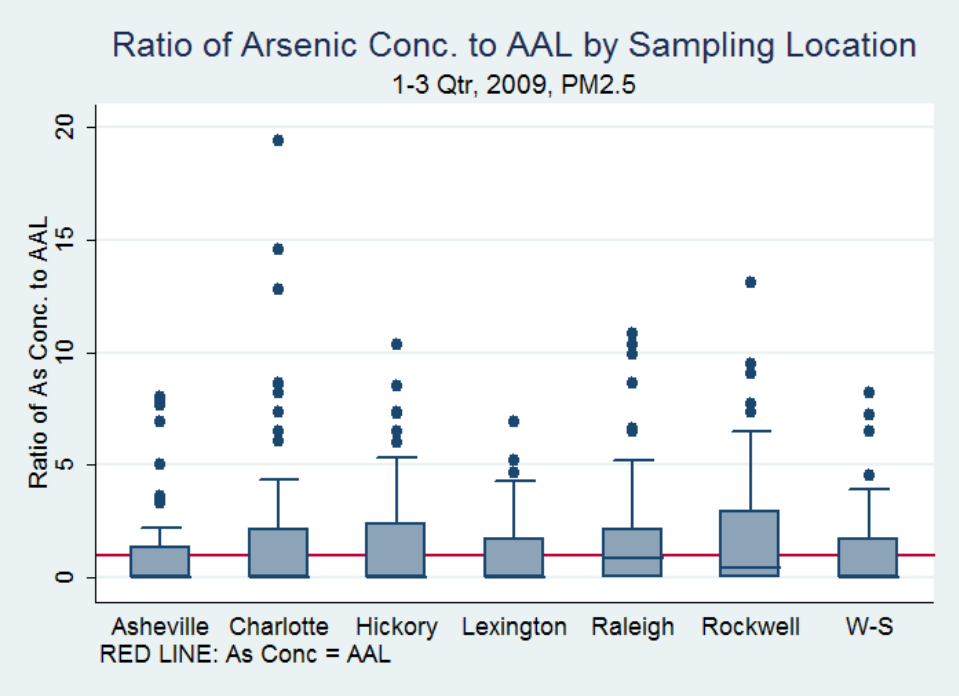
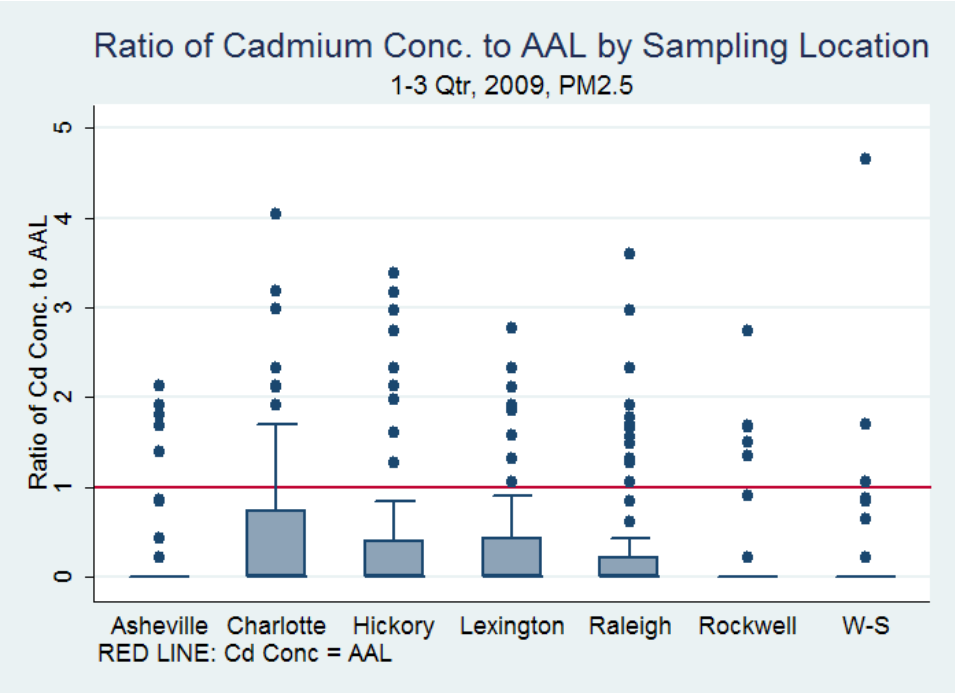


Figure 14.12. Ratio of Cadmium Concentrations to AAL per Sampling Location



Mercury releases have been one of the most significant air toxics issues in North Carolina. Mercury is a persistent and bioaccumulative toxic air pollutant (PBT). Mercury monitoring was initiated in North Carolina around 1999 at the request of the Department of Health and Human Services and the Division of Water Quality over concerns about mercury air deposition in areas of the state with sensitive ecosystems—acid waters rich in dissolved carbon and a bacterial mechanism to convert elemental mercury to the more toxic methylated form. The public health concern is that subsistence fishers were being exposed to unacceptable levels of methyl mercury from the fish they were catching and consuming from the affected ecosystems. The DAQ responded by monitoring mercury different ways. Atmospheric mercury monitoring for elemental and reactive forms of mercury was initiated in one area of the state with a known mercury source, a chloralkali plant that was the largest contributor in an area where subsistence fishing occurred. Simultaneously, the DAQ became a participant in the National Atmospheric Deposition Program, Mercury Deposition Network (MDN), establishing two sites in eastern North Carolina, and has remained a participant for nearly ten years. The MDN provides information about mercury in wet deposition and now that the chloralkali plant is no longer operational, combustion from coal-fired power plants has become the leading source of mercury releases. Although the state is no longer engaged in atmospheric mercury monitoring, the MDN sites are still operational. In order to participate in the MDN, the state has to operate the sites, pay for equipment and the cost of analyses. The state's biggest challenge with the pollutant remains keeping resources to continue the monitoring effort and formulating appropriate reduction strategies.

The overall challenge for air toxics in North Carolina is to acquire exposure information, accomplish data analysis and perform risk assessments to identify the air pollutant areas needing priority attention.

Greenhouse Gases

To address greenhouse gases, it is important to understand historical emission levels and projected emission trends. North Carolina is in the process of developing a state-wide emissions inventory model. The model is intended to quantify annual GHG emissions from stationary, area and mobile sources. It will also project emission levels for future years as a result of state or federal legislative actions, regulations and voluntary measures. The model will incorporate "top-down" emissions inventory method as well as source specific emissions data expected to be released by the USEPA under the recently promulgated Mandatory GHG Emissions Reporting Rule (MRR). North Carolina had been working on a state-wide mandatory reporting rule for GHGs, but that rule is not going forward due to the release of the USEPA's MRR. The DAQ is encouraging voluntary reporting through the same reporting system used for collecting criteria and hazardous air pollutants, and is working with the USEPA on the Data Exchange for the MRR with the hope of getting the MRR data in a format that could be imported into the DAQ reporting system. The voluntary program is intended to capture sources that are below the reporting thresholds of the USEPA MRR program. The DAQ plans to develop a multi-pollutant emissions inventory that combines data reported under the USEPA Air Emissions Reporting Requirements, MRR and the DAQ voluntary program. The GHGs being reported are carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), sulfur hexafluoride (SF_6), perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs).

On April 2, 2007, the U.S. Supreme Court found that GHGs, including carbon dioxide, are air pollutants covered by the CAA (*Massachusetts v. EPA*, 549 U.S. 497 (2007)). The U.S. Supreme Court found that the USEPA must determine whether or not emissions of GHGs from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. On December 7, 2009, the USEPA Administrator signed two distinct findings regarding GHGs under Section 202(a) of the Clean Air Act. Under the Endangerment Finding, the USEPA concluded that "the current and projected concentrations of the six key well-mixed greenhouse gases--CO_2, CH_4, N_2O, HFCs, PFCs and SF_6--in the atmosphere threaten the public health and welfare of current and future generations." Under the Cause or Contribute Finding, the USEPA concluded that "the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution which threatens public health and welfare." These findings did not themselves impose any requirements on industry or other entities; however, the action is a prerequisite to requiring controls under the CAA.

On September 15, 2009, the USEPA and the Department of Transportation's National Highway Safety Administration (NHTSA) proposed a National Program that would reduce greenhouse gas emissions and improve fuel economy for new cars and trucks sold in the United States. The combined USEPA and NHTSA standards that make up this proposed National Program would apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2012 through 2016. The affected vehicles must meet an estimated combined average emissions level of 250 grams of carbon dioxide per mile, equivalent to 35.5 miles per gallon if the automobile industry were to meet this carbon dioxide level solely through fuel economy improvements. The final rule is expected to be released in March 2010. This action will trigger Clean Air Act permitting requirements under the Prevention of Significant Deterioration (PSD) and Operating Permit (Title V) programs for GHG emissions. It will be the first time GHGs would be subject to either of these CAA permitting programs.

The current thresholds for criteria pollutants such as lead, sulfur dioxide and nitrogen dioxide, are 100 and 250 tons per year (tpy). These thresholds are in effect now, and are appropriate for criteria pollutants. However, if GHGs are regulated at these levels under the CAA upon promulgation of the light duty vehicle rule, millions of small emitting facilities would be affected. On September 30, 2009, the USEPA proposed a tailoring rule that focused on large facilities emitting over 25,000 tons of GHGs per year. Without the tailoring rule, these lower thresholds defined in the statute would take effect automatically for GHGs with the adoption of any USEPA rule that controls or limits GHG emissions. The Tailoring Rule proposes new thresholds for GHG emissions that define when CAA permits under the New Source Review (NSR) and Title V operating permits programs would be required for new or existing industrial facilities. The proposed thresholds would "tailor" the permit programs and would cover nearly 70 percent of the national GHG emissions that come from stationary sources, including those from the large emitters such as power plants, refineries, and cement production facilities. These facilities would be required to obtain permits that would demonstrate they are using the best practices and technologies to minimize GHG emissions.

The GHG Tailoring Rule is expected to be promulgated in March 2010. State and local air agencies that administer the PSD and Title V program must comply with the final rule. This requirement is expected to significantly impact the DAQ operations, starting with revising multiple state rules to align with federal requirements. In addition, implementing the PSD program for GHGs will require information and guidance to be developed concerning the technical, economic and environmental performance characteristics of potential best available control technologies (BACT). The DAQ must apply BACT criteria in a consistent, practical, and efficient manner for all affected pollutants. A thorough examination of co-benefits and dis-benefits of non-GHGs must be performed to ensure emissions back-sliding do not occur.

In addition to the USEPA's activities, climate change legislations recently passed in the U.S. House and proposed in the U.S. Senate are intended to cap GHG emissions from major sources. If such legislations are ratified, GHG emission reduction goals will be established and new programs intended to monitor and implement reduction activities will be established.

The regulatory environment for greenhouse gases and climate change is evolving on a continuous basis. Future air quality planning activities must be flexible to accommodate new requirements.

Other Criteria Pollutants

Although the AQMP is a comprehensive plan focusing on multi-pollutant solutions, due to statutory requirements, the DAQ will address what control programs are necessary to attain the revised 8-hour ozone standard, as well as those measures necessary to maintain both the daily and annual $PM_{2.5}$ standards. As shown in Table 14.1, there are ambient monitoring sites across the state that will violate a revised 8-hour ozone NAAQS. North Carolina is attaining the NAAQS for CO, NO_2, PM_{10} and SO_2 so they will not be the primary focus of the AQMP, but the projected emissions and air quality information will be evaluated to ensure that the state will continue to maintain these standards. North Carolina does not yet monitor for lead, but the state expects to address the new monitoring requirements for lead. In addition, the DAQ has completed a preliminary evaluation of the surrogate data for lead and believes that the state will be in attainment of the revised lead standard.

Table 14.1. Summary of Maximum 2009 Pollutant Levels across North Carolina

Pollutant	Highest Pollutant Value	Primary Standard Level	Averaging Time
CO	1.8	9.0 ppm	8-hour
NO_2	0.014	0.053 ppm	Annual (Arithmetic Mean)
PM_{10}	37	150 $\mu g/m^3$	24-hour
$PM_{2.5}$	13.66	15.0 $\mu g/m^3$	Annual (Arithmetic Mean)
	25.4	35 $\mu g/m^3$	24-hour
SO_2	0.0053	0.03 ppm	Annual (Arithmetic Mean)
	0.042	0.14 ppm	24-hour
Ozone	0.073	0.060-0.070 ppm(proposed)	8-hour

Note: **The following table lists the maximum pollutant level and not the design values that are used to demonstrate attainment**.

Note: **The pollutant values for $PM_{2.5}$ and PM_{10} are for 2008.**

To the extent that North Carolina discovers attainment or maintenance issues with other criteria pollutant NAAQS, the AQMP will address how those pollutants can be incorporated into the process. The overall AQMP will address how these emissions can be reduced using multi-pollutant control strategies.

Chapter 15. Developing a Multi-Pollutant Emissions Inventory

The measures the DAQ will take toward development of a multi-pollutant emissions inventory involves several phases. The Community Multi-scale Air Quality (CMAQ) photochemical model will be used to estimate future ozone, particulate matter, regional haze and nitrogen deposition levels. CMAQ developers are currently in the process of beta testing a mercury deposition module and as soon as this module is available, the DAQ will explore this as an option for modeling mercury deposition. The CMAQ model currently does not have the capabilities to model GHG; therefore, other models are needed to address GHG.

The USEPA's State Inventory and Projection Tool will be used as a starting point for determining North Carolina's GHG emissions. The USEPA tool is an interactive spreadsheet model that helps states develop GHG emissions inventories. The tool gives users the option of applying state-specific data or using default data pre-loaded for each state. The default data is gathered by federal agencies and other sources covering fossil fuels, agriculture, forestry, waste management and industry. Source specific emissions data reported through the USEPA MRR system and the DAQ Air Emissions Reporting system will be utilized, along with tools utilized by local communities to determine impacts of various control strategies. In addition, the USEPA has developed a new comprehensive mobile emissions model, Motor Vehicle Emissions Simulator (MOVES), which encompasses both the on-road and nonroad mobile source sectors. The MOVES mobile model will eventually have a component that addresses greenhouse gases - Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET). The new MOVES mobile model will be used to generate criteria pollutants, toxic and GHG emissions for the on-road and nonroad mobile source sectors. Currently the Carnegie Mellon University ammonia emissions model is used to generate an ammonia emissions inventory for various source sectors. Lastly, future emissions forecasting will include criteria air pollutants, toxics and GHG. The DAQ plans on utilizing all of these tools to develop a comprehensive, multi-pollutant emissions inventory.

North Carolina will continue to collaborate with the Southeast states through the SEMAP project in order to obtain emission inventories from the surrounding states. Additionally, SEMAP is continuing to work closely with Northeast and Midwest Regional Planning Organization to gather emissions inventories from outside the SEMAP region.

Chapter 16. Technical Tools

The technical tools that are intended for use at this point in the development of the technical products to support an air quality management plan include:

i. MM-5 or WRF meteorological model
ii. SMOKE emissions model for preparing emissions to be used in an air quality model
iii. MOVES on-road mobile emission factor model
iv. NONROAD or MOVES nonroad emissions factor model
v. CMAQ or CAM-x are potential candidates for the air quality model
vi. IPM or similar model for projecting future emissions from the utility sector
vii. GEOSCHEM or similar model to provide international transport information will be used to better understand international issues and ascertain the role of North Carolina with respect to these issues.
viii. BENMAP or similar model to show exposure and risk associated with various control strategies.
ix. AirControlNET or similar tool will be used to evaluate possible control strategies.
x. EGAS growth factor model or similar tool
xi. EDMS emissions model for aircraft, or similar tool
xii. Accepted GHG emissions protocols
xiii. PAVE and GIS are visualization tools used to display emissions and air quality model output.

The DAQ is also using Dr. Ivar Tombach's recommendations as outlined in his technical paper, *Recommendations for Modeling of Meteorology, Emissions, and Air Quality to Support State Regulatory Decisions for Ozone, Fine Particles, and Regional Haze, January 21, 2009*, as guidance for developing a multi-pollutant modeling strategy. As a result, the DAQ will evaluate some of the current modeling tools and features available to determine their effectiveness for multi-pollutant modeling. The following briefly illustrates some of the tools, modeling parameters and approaches under consideration:

- Update to the most recent version of CMAQ or CAMx,
- Use a grid scale of 4 km or less when modeling urban areas and complex terrain,
- Implement the new downscaling approach that has been developed for calculating GEOS-Chem boundary conditions,
- Become familiar with the WRF model and explore whether its use would improve air quality simulations,
- Become familiar with the different source apportionment tools provided in CMAQ and evaluate which ones would be most useful for future development of emission control strategies,

- Evaluate what information will be needed for air pollution management decisions and which analytical approaches would be most useful for supporting those decisions (hybrid apportionment approach),
- Become familiar with the MEGAN biogenic emissions model and the CONCEPT emissions model and evaluate whether they are useful modeling tools, and
- Review the current state of ammonium models.

Chapter 17. Potential Control Strategies

Since the early 1990's, North Carolina has implemented numerous control strategies to address ozone and carbon monoxide. In recent years, the focus included particulate matter and regional haze. As the NAAQS continue to be strengthened, the number of control measures available for adoption at the state level decline. As a result, many future measures will need to be more local in nature. The DAQ will continue to evaluate what can be done on a statewide basis, but more efforts will need to occur at a local level. One core challenge will be to work effectively with local governments to identify and adopt appropriate local measures that will provide the most benefit for their communities. A critical element of the process will be how the trade-offs will be addressed. One potential way is to utilize tools such as BENMAP, and take the exposure and risk into account when one pollutant will be improved but another will be degraded.

For ozone, it is likely that North Carolina will need to continue to address NOx emission reductions since North Carolina is a NOx limited area. The main issue will be identifying control measures that have not already been implemented that will provide multi-pollutant solutions.

For $PM_{2.5}$, the state will need to assess whether further SO_2 reductions are feasible and what potential controls are available to address the organic carbon contribution to the total $PM_{2.5}$ mass. Another precursor pollutant of concern for controlling $PM_{2.5}$ levels is NH_3. The most intense NH_3 emissions are in the eastern part of the state because of the large concentration of animal operations in that area. One question that may need to be answered is whether cost effective controls exist to reduce NH_3 emissions from these animal operations, particularly swine operations that utilize the lagoon system for treating waste and the extent to which control of these emissions is necessary or beneficial. One potential co-benefit of reducing NH_3 is the likelihood of reducing methane (CH_4), which results in GHG benefits. Appendix I contains maps displaying the various permitted animal operations across the state.

Similar to $PM_{2.5}$, improving regional haze will begin with reducing SO_2 emissions since sulfates, the largest contributor to regional haze, are formed from SO_2. NH_3 emissions and direct $PM_{2.5}$ are also important to regional haze so focusing on reducing these emissions will have a multi-pollutant benefit of addressing both regional haze and $PM_{2.5}$.

For the mercury investigation, the issue of hotspots is being evaluated by conducting an assessment of mercury deposition both before and after installation of scrubbers at the larger power plants.

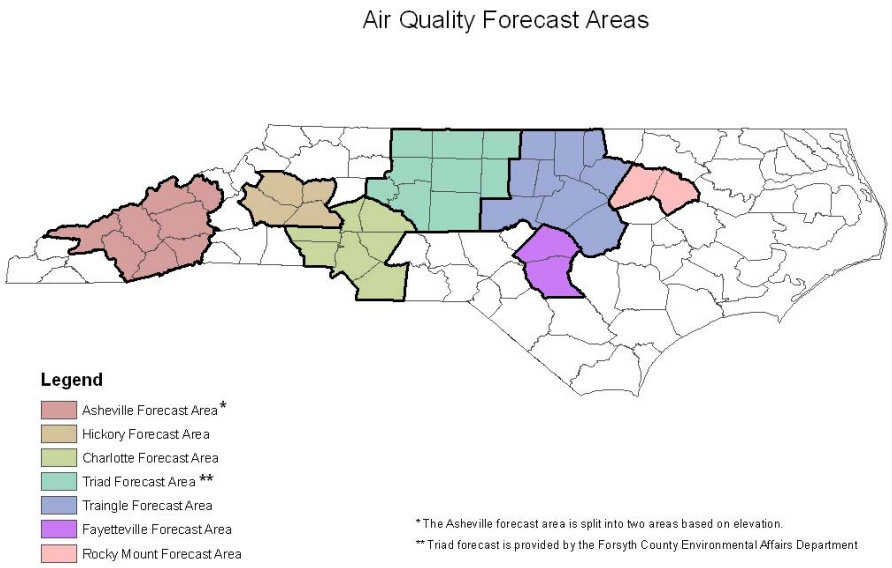
North Carolina has passed several rules to address these air quality issues. A landmark rulemaking in the state is the NOx SIP Call Rule, which is designed to reduce NOx emission form large stationary combustion sources. Passing the Clean Smokestacks Act was another monumental pathway to improving air quality in North Carolina. The Clean Smokestacks Act is a beneficial control strategy with far reaching co-benefits. The Clean Smokestacks Act requires coal-fired power plants to reduce their NOx and SO_2 emissions, with significant mercury co-benefits when a selective catalytic reduction unit and a wet scrubber are installed on a coal-fired boiler. Additionally, the Clean Air Interstate Rule addresses NOx and SO_2 emissions by placing

a cap on SO_2 and NOx emissions from stationary sources. The reductions of SO_2 from these programs provide co-benefits of potentially reducing $PM_{2.5}$ and improving visibility. An issue to explore is whether the co-benefit from controlling emissions from coal-fired power plants is sufficient to address the mercury deposition in the state. Reducing NOx, SO_2 and mercury deposition will benefit many of North Carolina's ecosystems. One of the co-benefits of controlling mercury deposition is to reduce mercury because it is harmful to the fisheries across the entire state. Decreasing SO_2 and NOx emissions, respectively, will reduce acid deposition that is detrimental to the mountain streams in the western part of the state and reduce nitrogen deposition, which is harmful to the estuaries in the eastern part of the state.

Another potential state program intended to reduce NOx and $PM_{2.5}$ emissions is the anti-idling rule. The anti-idling rule will reduce NOx and $PM_{2.5}$ emissions from heavy-duty trucks (both diesel and gasoline) through reducing unnecessary idling. As with the Clean Smokestacks Act, this program will have co-benefits of reducing both ozone precursors, particulate matter and greenhouse gases.

The North Carolina open burning regulation has been in place since 1971 and prohibits the burning of man-made materials statewide. The open burning ban rule is aimed at reducing emissions that contribute to ozone and particle pollution when the air quality is expected to be poor. In June 2004, the EMC approved revisions to the open burning regulation banning open burning of yard wasted and land clearing debris on forecasted code orange or higher "air quality action days," for those counties that the DAQ or local air programs forecast ozone or fine particulate matter. The open burning regulation reduces $PM_{2.5}$, NOx, SO_2, VOC, CO and air toxic emissions. Figure 17.1 displays the air quality forecast areas.

Figure 17.1. Map of the Forecast Areas in North Carolina



Other potential programs (focusing on the Hickory and Triad areas) intended to reduce $PM_{2.5}$ include a woodstove change-out program, a "burn it right" campaign and diesel retrofit initiatives. These programs will also benefit our Class I areas in the western part of the state affected by regional haze due to the decrease in particulate matter. Such programs may be implemented if they are determined to be effective multi-pollutant strategies.

Reducing emissions from the transportation sector is more of a challenge because the reductions will have to be initiated by local programs. Federal and state control measures that have yielded the most reductions have already been implemented. Further local strategies are needed such as diesel retrofits, transportation control measures, expanding transit systems and promoting fuel efficiency. Such measures individually do not have a huge impact, but collectively they have the potential to produce significant reductions.

As for GHG emissions, transportation and utilities are the primary sources of emissions. Energy efficiency and conservation, as emphasized in the recommendations from the Climate Action Plan Advisory Group, are the most effective in mitigating GHG. Appendix J summarizes the policy recommendations from the Climate Action Plan Advisory Group presented to the DAQ as potential mitigation options for reducing GHG in North Carolina. Many of these measures, if adopted, would also benefit the efforts to reduce criteria pollutants because they will result in reductions in NOx and SO_2. Additionally, implementing conservation efforts in the utilities sector also provides co-benefits for regional haze due to the reductions in SO_2. New low carbon energy policy recommendations expected by the newly formed North Carolina Energy Policy Council may result in legislations and Executive Orders that may have a profound effect on the energy production and transportation sector.

As discussed earlier, under the GHG Tailoring Rule, new or modified facilities with GHG emissions that trigger PSD permitting requirements would need to apply for a revision to their operating permits to incorporate the best available control technologies and energy efficiency measures to minimize GHG emissions. These controls are determined on a case-by-case basis during the PSD process. Under the Title V operating permits program, existing facilities with GHG emissions greater than 25,000 tons per year that already have operating permits would be required to include estimates of their GHG emissions in their permit applications.

The DAQ will develop programs and make recommendations to the EMC regarding policies to implement these measures as well as the criteria for prioritizing them based upon air quality and public health concerns. The biggest challenges facing North Carolina will be attaining the revised 8-hour ozone NAAQS, maintaining the annual $PM_{2.5}$ NAAQS, improving visibility in the Class I areas, reducing mercury deposition and reducing GHG. North Carolina has developed several regulations to address these air quality issues that are beneficial because of their potential as multi-pollutant control strategies. The initiatives, conservation and energy efficiency, recommended to mitigate GHG in the transportation and stationary source sectors focus on reducing NOx and SO_2 emissions that will also benefit the efforts to reduce ozone, $PM_{2.5}$ concentrations and regional haze. Energy efficiency measures will also provide co-benefits of reducing toxics. Although, there are other state programs, the Clean Smokestacks Act in conjunction with the GHG mitigation efforts, are clearly the two programs that could potentially provide the most co-benefits when addressing the most important air quality issues in North Carolina, however, there are other state and local programs that provide additional air quality benefits as well.

State Programs

House Bill 1912 - Diesel Emissions Reduction Act

House Bill 1912 provides some of the funds needed to allow school systems in the 24 nonattainment and maintenance areas in North Carolina to install diesel retrofit filters (or best available technology) and crank case filters on their school buses. The purpose of the project is to retrofit school buses in nonattainment or maintenance areas with particulate matter controls. Priority is given to devices offering the highest levels of particulate matter controls.

Leading to Early Adoption of Diesel Emission Reductions (LEADER)

In October 2008, the DAQ was awarded a Diesel Emission Reduction Act (DERA) Grant by the USEPA. These funds were awarded to establish the North Carolina Clean Construction Leading to Early Adoption of Diesel Emission Reductions (LEADER) Program. The purpose of the LEADER program is to help clean up North Carolina's legacy fleet of Tier 0 (unregulated) nonroad diesel engines through the funding of equipment replacements or engine repowers or engine upgrade group solutions or retrofits.

Mobile Source Emissions Reduction Grants (MSERG)

The purpose of the MSERG is to achieve actual reductions from on- and off- road mobile source related emissions in North Carolina to assist the state in maintaining the NAAQS for primarily ozone and fine particulate matter. In general, the grant funds a range of projects. In the last few

years, there has been an emphasis on diesel projects. In 2009 and presently, the projects have been all diesel projects.

Federal Stimulus Funds

In February 2009, President Barack Obama signed the American Recovery and Reinvestment Act (ARRA). The DAQ was granted $1.73 million for the use of reducing emissions from diesel engines as part of President Obama's ARRA. The DAQ established two programs with the stimulus funds. The first program provides funds for a rebate program for auxiliary power units or heavy-duty diesel replacements for heavy duty trucks. The bulk of the grant, however, was used to solicit and select worthy "shovel ready" projects to reduce mobile emissions from diesel engines. This program was called the North Carolina Diesel Emissions-Economic Recovery (DEER) Grant. The DENR awarded approximately $1.1 Million in North Carolina DEER Grant funds.

Department of Environment and Natural Resources Strategic Plan

The DENR 2009-2013 Strategic Plan (http://portal.ncdenr.org/c/document_library/get_file?uuid=42ff6a91-b342-48e2-b941-2bdc0b430e98&groupId=17388) identifies goals for the department that will support conserving and protecting the state's natural resources, while maintaining a high quality of life and fostering economic development. Broad supporting actions accompany each of the goals. These supporting actions serve as a starting point for divisions and programs to create measurable accomplishments. The plan has been developed with an emphasis on accountability, demonstrating that DENR is responsible for ensuring that these action items are completed. In addition, the plan complements and supports the challenging work and new initiatives underway in other departments in state government.

Emissions Reduction and Sustainability Efforts in North Carolina Government

The North Carolina government has incorporated sustainability in its operations since 1993, when Governor Jim Hunt signed Executive Order #8 directing State agencies to reduce solid waste, recycle and purchase recycled products. In April 1999, DENR's Division of Pollution Prevention and Environmental Assistance worked with the Governor's office to develop a State Government Environmental Sustainability Plan. Thirteen State agencies, including DENR, developed their own sustainability plans the same year. In July 1999, Governor Hunt signed Executive Order # 156 directing State agencies to implement sustainable practices as part of normal operations. Many emission reductions and sustainability measures have subsequently been enacted as State law, including the following:

- 1999 Session Law 328 (Senate Bill 953) sets goals for the purchase of alternative-fuel and low-emission vehicles for state fleets, and for reduction of commuting vehicle miles traveled for state employees.
- North Carolina General Statute 143-64:10-12, enacted in 2001, requires State agencies and universities to develop energy management plans and reduce energy consumption 20% by 2010.
- 2005 Session Law 276 (Senate Bill 622) requires state-owned vehicle fleets to reduce or displace 20% of petroleum products by 2010.

- 2007 Session Law 546 (Senate Bill 668) requires all new state-owned building to be constructed and certified to at least a 30% greater energy efficiency than the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. standard. This law also requires state purchasing practices to improve energy efficiency and consider life-cycle costs.

In April 2000, DENR established 39 department-wide projects to implement the Sustainability Plan. The DENR Sustainability Team was formed in September 2000 to help accomplish these projects and aid management and employees in sustainability efforts. The team has partially or wholly accomplished 27 of the original 39 projects. The team currently has 42 members, comprising at least one liaison from each DENR division and regional office. Subcommittees investigate barriers and best practices for topics ranging from recycling and employee transit incentives to facilities cleaning practices and energy use, and members promote sustainability practices within their divisions. In recent years, just a few of the team's accomplishments have included:

- Researching and championing sustainable features in the design of DENR's new Green Square headquarters (projected for completion in 2011)
- Increasing the availability of recycling to employees
- Expanding teleworking in state government
- Promoting employee transit use through coordination with local transit agencies
- Recognizing and encouraging exceptional employee sustainability efforts through annual Sustainability Awards.

Another program, the North Carolina Project Green, housed within DENR's Division of Pollution Prevention and Environmental Assistance, aids sustainability efforts of State agencies and universities by collecting policies and best practices, and acting as a central point of contact and clearinghouse.

Local Programs

Grants to Replace Aging Diesel Engines (GRADE)

GRADE, first launched in 2007, is a grant program funded by the American Recovery and Reinvestment Act for the purpose of replacing or re-powering heavy duty non-road construction equipment. Mecklenburg County Air Quality (MCAQ), a local air quality agency in the Metrolina area, for 2 years has administered a sub-grant program to provide incentive funding to organizations that replace, re-power, or retrofit their heavy-duty non-road construction equipment. GRADE specifically targets oxides of nitrogen (NOx) that contribute to the ozone problem in the Metrolina region. Based on the success of GRADE and the programs that followed, MCAQ recently received $1,100,000 in funding from the American Recovery and Reinvestment Act to expand the program. GRADE now includes 13 counties in North and South Carolina and has been expanded to include construction, agricultural, industrial and commercial sectors operating non-road diesel, on-road mobile heavy duty diesel and stationary diesel equipment. Since the start of the program, GRADE has achieved a cost effectiveness of less than

$3,500/ton of NOx reduced and will remove 255 tons of NOx over the next five years as a result of the selected projects.

Sustainable Environment for Quality of Life (SEQL)

SEQL is an integrated environmental initiative for the 15-county metropolitan Charlotte region in North and South Carolina. It is funded by a grant from the USEPA to the Centralina Council of Governments in cooperation with Catawba Regional Council of Governments. The purpose of the program is to implement and expand regional efforts to protect the quality of life in the bi-state metropolitan Charlotte region. This will be the first such integrated strategy in the nation. Centralina serves Anson, Cabarrus, Gaston, Iredell, Lincoln, Mecklenburg, Rowan, Stanly and Union Counties in North Carolina. Catawba Regional serves Chester, Lancaster, Union Counties in North Carolina and York County in South Carolina. In addition, Catawba and Cleveland Counties have been invited to participate. The greater Charlotte/Gastonia/Rock Hill region encompasses 15 counties with over 75 political jurisdictions and a population base of 2.1 million people. With such a densely populated region, the area faces many air quality challenges. SEQL will address these challenges by:

- Implementation of the Sustainability Demonstration Project "commitment action items,"
- Design of a regional database for improved decision-making,
- Government/public/stakeholder orientation to the concept of integrated cross-sectoral planning and development of methods to implement it, and
- Institutionalization of consideration of integrated environmental impacts in local and regional planning and decision-making.

Early Action Compact

The concept of the Early Action Compact (EAC) was developed between Texas and the USEPA in June 2002. The option to participate in the process was made available to other areas across the United States and in November 2002 an EAC protocol was agreed upon. To be eligible to participate in an EAC, an area had to be designated attainment for the 1-hour ozone standard, as well as still meeting that standard. Additionally, all major local partners, such as county and city officials, must agree to endorse and participate in the process. Finally, the compact had to be approved and signed by all local officials, state air quality officials and USEPA regional administrators, by December 31, 2002.

North Carolina had four areas sign compacts: the Cumberland County (Fayetteville) Area; the Mountain Area (Buncombe, Haywood, Henderson, Madison and Transylvania Counties); the Triad Area (Alamance, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Rockingham, Stokes, Surry and Yadkin Counties); and the Unifour Area (Alexander, Burke, Caldwell and Catawba Counties). Two counties, Henderson and Transylvania Counties, dropped out of the Mountain Area EAC when the area was designated as attainment in April 2004. The other counties in the Mountain Area EAC decided to continue on with the process since they believed in the benefits of the program.

Although the EAC process does not require a maintenance plan to be submitted with the attainment demonstration, North Carolina decided to implement a maintenance plan similar to what is required in Section 175A of the Clean Air Act.

To redesignate an area to attainment, Section 175A of the Clean Air Act requires that the State develop a maintenance plan that shows how the area will maintain the respective NAAQS for at least ten years after the redesignation. Normally, the maintenance plan is submitted after the attainment demonstration SIP has been submitted and implemented, typically 3 to 5 years later, depending on the actual attainment date. However, the process is different under the EAC SIP. North Carolina will prescribe that the EAC SIP covers not only the attainment demonstration through 2007, but also the first ten-year period of the maintenance plan, 2007-2017, including a mid-point evaluation of 2012.

In addition to the 10-year maintenance plan requirement, Section 175A also requires an updated maintenance plan 8 years after the area is redesignated to attainment. The updated maintenance plan must cover the 10 years following the expiration of the first 10-year period of the original maintenance plan. The DAQ will develop the maintenance plan for the period 2017 – 2027 on the following schedule:

1. 2013: Begin emission inventory and air quality modeling work. This start date will allow the DAQ to use the 2010 U.S. Census information in the emission inventory development.

2. 2015: Complete emission and modeling work, submit updated maintenance plan to the USEPA.

North Carolina's maintenance plan does not include contingency measures in the EAC SIP since the provisions in the EAC SIP are to address both attainment and maintenance needs and will remain as part of the SIP throughout the attainment and 20-year maintenance periods. North Carolina will not remove any of the measures that are in the EAC SIP upon the USEPA's determination that the areas have attained the 8-hour ozone NAAQS. Further, the modeling analysis for 2012 and 2017 show a downward trend in emissions, as well as expected air quality values. The DAQ believes that the contingency measure adoption approach as outlined in the following annual tracking for growth mechanisms is the most appropriate way to address the contingency provision requirements of Section 175A.

Annual Tracking for Growth

The EAC requires the following elements be tracked in order to ensure that the standard is maintained:

1. An annual review of growth (especially highway mobile and stationary point source) to ensure emission reduction strategies and growth assumptions are adequate;

2. Identification and quantification of federal, state, and/or local measures indicating sufficient reductions to offset growth estimates.

Point Sources Annual Analysis

To meet the annual review of growth of stationary point sources, the DAQ will do the following analysis. The obligation to conduct these analyses and, where indicated adopt and implement additional control measures based on the result of the analyses, lasts throughout the maintenance period (that is, through 2027).

> Beginning with the December 2005 biannual progress report, every year the DAQ will evaluate the most recent annual stationary source emission inventory. The stationary point source emission inventory for NOx will be compared to the 2000 annual inventory used in the air quality modeling analyses for the attainment demonstration (e.g., for the December 2005 report, this inventory would be for 2003). The comparison will be done on both a county-by-county basis, and a composite for the entire EAC area.

Action Trigger:

If the actual stationary source NOx emissions are greater than 10% higher than those emissions used in the modeling analysis either for an individual county or for the entire area and there has also been a corresponding increase in the ozone levels in the area such that the latest 3-year design value is greater than 0.080 ppm, North Carolina will identify and implement additional controls on stationary sources sufficient to offset the growth in stationary source NOx emissions. North Carolina believes that this is an appropriate trigger since at 0.080 ppm design value is an indicator that an area is approaching the NAAQS and measures should be taken to address the increase. The analysis may involve additional modeling runs before control measures are adopted as part of the SIP. Any additional rules would be effective as soon as practicable, but no later than two years of the finding that emissions growth were exceeding those used in the air quality modeling analyses. Any voluntary measures would be effective as soon as practicable, but no later than one year of the finding that emissions growth or growth rates were exceeding those used in the air quality modeling analyses.

Highway Mobile Annual Analysis**:**

To meet the annual review of growth in highway mobile sources, the DAQ will do the following analyses:

> Beginning with the December 2005 biannual progress report, each year the DAQ will evaluate the most recent annual VMT data available. The actual annual growth rate from 2000 will be compared to the average annual growth rate used in the modeling analysis from 2000 through 2007 (e.g., For the December 2005 report, this VMT data would be for 2004.) The comparison will be done on both a county-by-county basis, and a composite for the entire EAC area.

Action Trigger:

If the VMT growth rate is greater than 10 percent higher than the average annual growth rate used in modeling either for an individual county or for the entire area and there has also been a corresponding increase in the ozone levels in the area such that the latest 3- year design value is greater than 0.080 ppm, North Carolina will then estimate highway mobile emissions and evaluate whether the emissions are higher than those used in modeling. If the highway mobile

emissions are greater than 10 percent higher than those emissions used in the modeling analysis either for an individual county or for the entire area and there has also been a corresponding increase in the ozone levels in the area such that the latest 3 year design value is greater than 0.080 ppm, North Carolina will identify and implement additional controls on highway mobile sources sufficient to offset the growth in emissions. North Carolina believes that this is an appropriate trigger since at 0.080 ppm design value is an indicator that an area is approaching the NAAQS and measures should be taken to address the increase. Additionally, the current long range transportation plans and transportation improvement programs will be evaluated to determine what changes might be needed to offset the growth in VMT and corresponding degradation in air quality. The analysis may involve additional modeling runs before control measures are adopted as part of the SIP. Any additional rules would be effective as soon as practicable, but no later than two years of the finding that emissions growth or growth rates were exceeding those used in the air quality modeling analyses. Any voluntary measures would be effective as soon as practicable, but no later than one year of the finding that emissions growth or growth rates were exceeding those used in the air quality modeling analyses.

Air Quality Analysis

For the purposes of determining if an area has a corresponding increase in ozone, North Carolina will review as part of the biannual December reports,

- **Design Value Trends** – Most recent design values (3-year average of the 4th highest 1997 8-hour ozone average), compared to the trend in design values from the 1994-1996 timeframe to present,
- **8-Hour Ozone Exceedances** – Number of exceedances of the 1997 8-hour ozone standard at each monitor in the EAC areas for the most recent ozone season, compared to the number of exceedances at each monitor from 1994 to present,
- **1-Hour Ozone Design Value Trends** – Most recent 1-hour ozone design values compared to the trend in 1-hour ozone design values from the 1994-1996 timeframe to present,
- **4th Highest Value Trends** – 4th Highest 1-hour ozone value compared to the 4th highest 1-hour ozone value from 1994 to present,
- **1-Hour Ozone Exceedances** – Number of exceedances of the 1-hour ozone standard at each monitor in the EAC areas for the most recent ozone season, compared to the number of exceedances at each monitor from 1994 to present,
- **Weather Patterns** – Discussion of weather patterns and climatology in most recent ozone season.

Chapter 18. Control Strategy Assessment

The measures that will be used to gauge improvement in air quality or success of the air quality management process will include environmental indicators, such as number of exceedance days per year by area, levels of exceedances when they do occur and the change in the design value for the criteria pollutants. For the GHG initiatives, the emission reductions will be tracked via the voluntary greenhouse gas emissions reporting and the data the USEPA collects from the MRR and other efforts taken to develop a state-wide GHG inventory. As for mercury, the change in mercury deposition will be tracked. Another indicator of success will be the impact on the actual process, i.e., how the resources of the State are impacted. This metric is harder to track than the environmental indicators. It is not clear yet what measures will be used to assess this aspect of the process. Another tool to gauge the effectiveness of various programs is using graphical display programs such as PAVE, which is used to display air quality modeling output. Bar graphs and pie charts are also useful in showing emission trends across various source sectors, time periods, pollutants, etc. Programs to reduce emissions are constantly evolving.

In order to evaluate these programs, the DAQ will strategically assess the programs based on various parameters. This information will be shared with stakeholders to use as a guide to evaluate program effectiveness. Chapter 19. Control Evaluation Strategy provides examples of the types of parameters that will be used for the strategic assessment. The table will be populated based on technical analysis and input from stakeholders that will be used as a tool for stakeholders and the DAQ staff to utilize to determine which control strategies yield the most co-benefits and should be implemented.

Chapter 19. Control Evaluation Strategy

The DAQ will use several tools to evaluate potential control strategies for the AQMP. Some of the key variables for consideration for the control strategies are feasibility of implementation, cost benefits, pollutants impacted, environmental justice, amount of emissions changed and air quality impacts. The major focus when considering potential control strategies are their multi-pollutant benefit at a reasonable cost and ease of implementation. The control strategy evaluation process is flexible and dynamic and driven by the needs of a particular area.

One of the challenges in evaluating potential control strategies is prioritization. It can be difficult to prioritize or rank multi-pollutant control strategies because of the potential adverse effects of local vs. regional impacts in areas of emission decreases, i.e., local air quality benefits to meet air quality standards vs. benefits to reduce health risk. For example, toxic air pollutants are a locally specific issue, criteria air pollutants are generally source sector driven, and regional haze and greenhouse gases are broader issues. When prioritizing potential control strategies, any particular control strategy may cause regional, multi-state reductions in one pollutant and an increase in another pollutant. Additionally, when considering potential control strategies, important variables are the area of influence the control strategy covers, implementation and desired air quality benefits. One of the components to consider when evaluating control strategies is the technology penetration rate, which takes into account the probability of technology implementation within an affected industry segment or emission source category. Another key variable in the evaluation process is determining an acceptable “balance” when weighing the benefits and possible detriments of a given control strategy. When evaluating the control strategies, part of the evaluation process will be to determine the suite of options that work synergistically to achieve the most multi-pollutant reductions feasible while still meeting the overall air quality goals.

Another variable for consideration during the evaluation process is the cost benefit. The cost per tonnage of pollutant reduced should be reasonable. High cost per tonnage may cause a high financial burden on industry that yields minimal reductions or air quality benefits. However, the cost benefit analysis should include the gains from lower health costs. Improving air quality typically has a direct correlation with improving overall health benefits because of the decrease in health costs that are associated with health issues resulting from poor air quality.

The stakeholders will be given the information and tools needed to evaluate potential control strategies. During the control strategy evaluation process, the DAQ will engage in open dialogue with the stakeholders. The DAQ will encourage feedback and input from the stakeholders throughout the process.

The following tables will be provided as evaluative tools to assist stakeholders in prioritizing and ranking potential control strategies.

Table 19.1a: Parameters for Evaluating Potential Control Strategies

Control Strategy	Pollutants Reduce		Emissions Reduced	GHG Reductions	Air Quality Impacts	Other Environmental Impacts	Area Covered
	NAAQS	HAPs					
Heavy-Duty Engine OBD Program							

Table 19.1b: Parameters for Evaluating Potential Control Strategies

Control Strategy	Potential EJ Issues	BENMAP Risk Assessment	Implementation Concerns	Cost Benefits	% of Affected Population	% Emission Contribution	Voluntary vs. Regulatory
Heavy-Duty Engine OBD Program	N/A						Regulatory

Table 19.2: Parameters for Evaluating Implementation of Air Quality Rules

Rule	Compliance Rate	Enforcement	Public Awareness & Outreach	Overseeing Agency
Anti-idling	N/A	DAQ will establish a hotline for citizens to report violators	Stakeholder meetings, posters and signage	DAQ

Chapter 20. Potential Roadblocks

The potential roadblocks in the air quality management plan effort include the statutory deadlines for the various criteria pollutants, the seeming lack of support by the USEPA for an early action compact process and the management of multiple objectives in a single plan. Another roadblock is the "moving target" in terms of meeting the USEPA guidance. For a structured AQMP effort to work, the USEPA would need to acknowledge that not all "state of the art" tools, information, recently released guidance, etc., can be used in the development of the technical analysis. There has to be an understanding that a future version of the technical analyses will address the developments that occur after a certain point in the planning process.

Another core challenge is making the AQMP work in view of the various statutory deadlines for SIP submittals to attain the various NAAQS. Additional SIP requirements due to revisions to the NAAQS have resulted in a more complex SIP process for states to adhere to. For example, the USEPA is in the process of revising the NAAQS for lead, SO_2, NO_2 and ozone, all of which have unique requirements. Meeting the various NAAQS SIP schedules is challenging, especially when states are required to submit SIPs 18 months after designation and each of the NAAQS have different designation schedules. Meeting the requirements and schedules of the different NAAQS is extremely taxing on state resources. One of the biggest advantages of an AQMP is addressing all of the NAAQS within one comprehensive air quality plan resulting in less of a burden on states and their resources. Additionally, states rely on federal programs, such as CAIR, to help attain the NAAQS. When these rules are vacated, states are left scrambling to develop rules to compensate for the void resulting from the vacatur of such rules. Typically when federal rules are vacated, there is little guidance on how states can proceed in lieu of the vacatur of such rules.

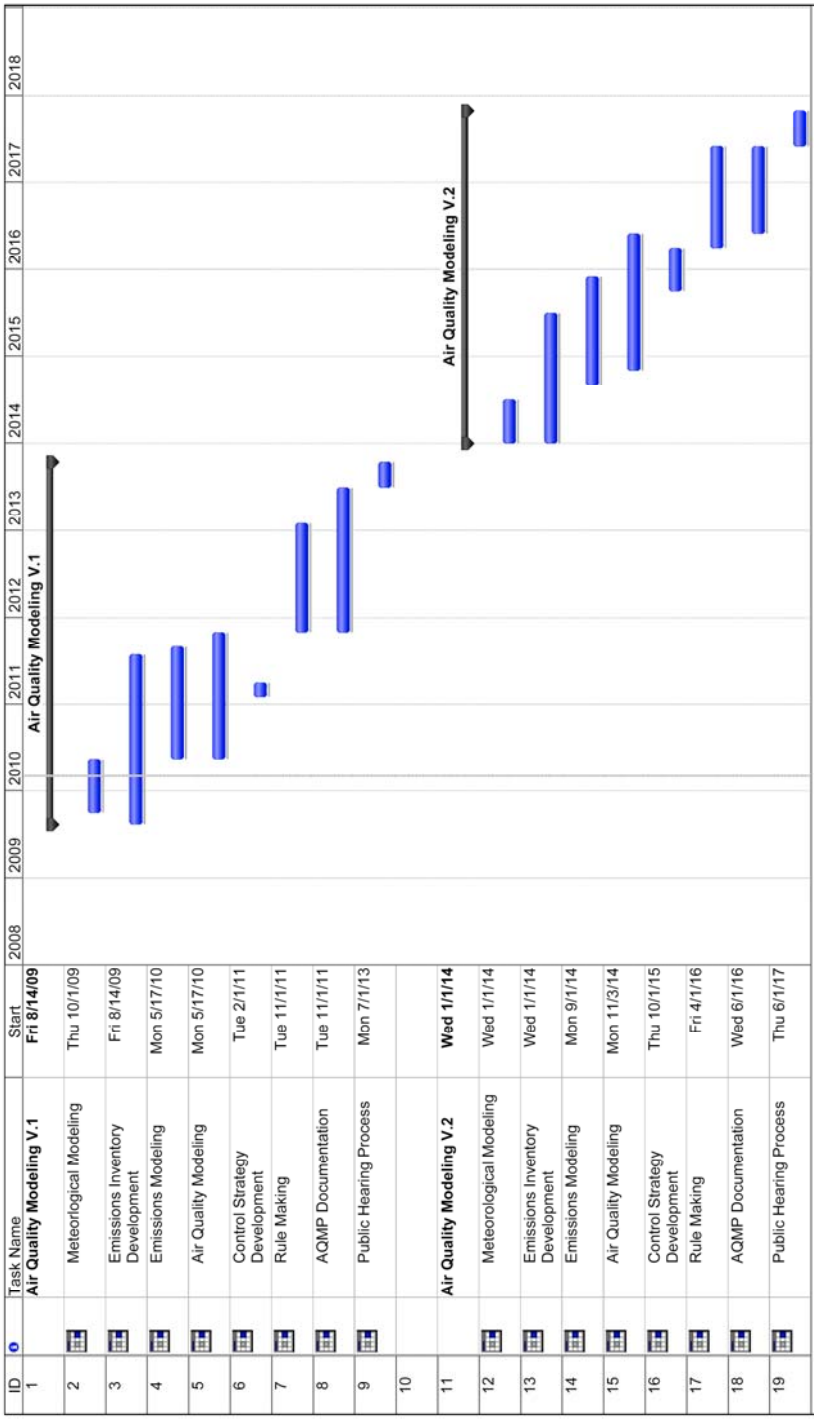
Stakeholder buy-in is also a hurdle the DAQ faces with the implementation of an AQMP. During the stakeholders meeting conducted by the DAQ in October 2009, some of the stakeholders expressed the following concerns,

- Ensure the AQMP does not add to the workload of other agencies, such as transportation and local air agencies, for the purposes of updating the AQMP on a regular schedule
- The AQMP does not make transportation conformity harder, riskier or more costly
- The Clean Air Act needs amending in order to implement an AQMP
- Inefficient use of limited resources required for the AQMP, which are exacerbated by the additional financial burdens on the DAQ
- Due to the requirement that the USEPA re-evaluate the NAAQS every 5 years, states do not have ample time for implementation of the many requirements to attain the NAAQS; therefore, more time is needed for implementation in order to meet these requirements.

Chapter 21. Air Quality Multi-Pollutant Plan Timeline and Document Outline

The DAQ intends to begin implementing this AQMP process with the revised ozone standard SIP submittal which is due December 31, 2013. The timeline for this process is shown in Figure 21.1.

Figure 21.1. Air Quality Multi-Pollutant Process Timeline



The draft outline of the AQMP plan will contain the following:

1.0 Introduction
- 1.1 What is an AQMP
- 1.2 Air Quality Issues of Concern
  - 1.2.1 NAAQS
  - 1.2.2 Regional Haze
  - 1.2.3 Air Toxics
  - 1.2.4 Climate Change
  - 1.2.5 Ecosystem
- 1.3 Nature of the Situation in NC
  - 1.3.1 Emissions Inventory Trends/Pie Charts
  - 1.3.2 Current Ambient Levels
  - 1.3.3 Nonattainment areas
  - 1.3.4 Class I areas' Glidepaths & Reasonable Progress Goals
- 1.4 Monitoring Network Description
- 1.5 Stakeholder Consultation Process

2.0 Regulatory Framework
- 2.1 Rule Making Process
- 2.2 Permitting Process
- 2.3 Clean Air Act Requirements
- 2.4 State Only Regulations
- 2.5 Legislative Actions

3.0 Control Strategy Pathways and Options
- 3.1 Electric Generating Sources
- 3.2 Industrial Sources
- 3.3 Area Sources
- 3.4 Highway Mobile Sources
- 3.5 Off-Road Mobile Sources

4.0 Technical Evaluation
- 4.1 Addressed through Regional Modeling
- 4.2 Carbon Monoxide
- 4.3 Lead
- 4.4 Greenhouse Gases
- 4.5 Air Toxics
- 4.6 Uncertainties and Variability

5.0 Evaluation Results
- 5.1 Ozone
  - 5.1.1 Introduction
  - 5.1.2 Current Air Quality
  - 5.1.3 Modeling Results
  - 5.1.4 Clean Air Act Requirements

- 5.8.5 Adaptation
  - Anticipated Impact
  - Sector Specific Response
- 5.9 Air Toxics
  - 5.9.1 Introduction
  - 5.9.2 Ambient Air Monitoring Results—Urban Air Toxics
  - 5.9.3 Future EPA MACT/ GACT/ Residual Risk Rules Requirements
  - 5.9.4 NC State Rules Requirements / Control Measures Applied
  - 5.9.5 Emission Inventory Results and Trends
    - Stationary Sources
    - Mobile Sources
  - 5.9.6 Risk Assessment (Model)
    - Toxic/Hazardous Air Pollutants
    - Community/Areas
    - Industries / Sources
  - 5.9.7 Reasonable Progress Assessment
    - Toxic/Hazardous Air Pollutants
    - Community/Areas
    - Industries / Sources
    - Emerging Alternative / BioFuels

6.0 Commonality/Synergy Analysis Between Criteria and Toxic Pollutant Issues
- 6.1 Community/Areas
- 6.2 Industries / Sources
- 6.3 (NC State Rules) Requirements for Alternative /Bio Fuels
- 6.4 Health Effects / Visibility Benefits

7.0 Chemical Accidental Release Program (112(r))
- 7.1 Technical Hazards
- 7.2 Toxics of Most Concern
- 7.3 Emission Density Plots or Population Exposure Plots

8.0 Ecosystem Health
- 8.1 Acid Deposition
- 8.2 Nitrogen Deposition
- 8.3 Mercury Deposition

9.0 Education and Outreach

10.0 Next Steps
- 10.1 Emerging Issues
  - 10.1.1 What is happening now that will be reviewed next plan
  - 10.1.2 Temperature rise impacts on air quality
  - 10.1.3 Emergence of Alternative and Bio-Fuels
- 10.2 Lessons Learned
- 10.3 Periodic Update Schedule