Early Action Compact Milestone – December 31, 2003
Biannual Status Report

Unifour Air Quality Committee-Stakeholders Group
(Hickory-Morganton-Lenoir Metropolitan Statistical Area)

I. Document progress in developing stakeholder process, including, for example, roles and responsibilities of various stakeholder groups, list of stakeholders, brief summary of stakeholder meetings, stakeholder involvement in development of initial list of control measures, etc.

In May 1999, the Catawba Air Quality Committee (CAQC) was formed and began meeting on a monthly basis. Catawba County and the City of Hickory took the lead in the area to educate the citizens about Air Quality. The CAQC was a very active group dedicated to the importance of Air Quality issues in the county. The CAQC evolved into the Unifour Air Quality Committee (UAQC) after ten local governments (representing a larger geographical area) in the region signed the Early Action Compact in December 2002. The stakeholders represent organizations that include four counties (known as the Unifour Area). The Unifour Air Quality Committee (UAQC), the stakeholders group in the Unifour Area, has continued to work diligently since the June 30, 2003 Biannual Report was submitted.

Each local government has either begun working on the Air Quality Plan for their area, or they have completed the plan. It is our goal to have all the Air Quality Plans in place and incorporated by the beginning of the 2004 Ozone Monitoring Season. Catawba County, Caldwell County and the City of Hickory have taken the lead in preparing their Air Quality Plans, and are offering examples to the other local governments. The Western Piedmont Council of Governments (WPCOG) is assisting in plan development, and other aspects of Air Quality Planning as needed. The Air Quality Plans will be an important part of our strategies for developing methods to reduce Ozone pollution. The plans will be geared towards what employers, employees and citizens can do individually to help reduce the Ozone levels in the air.

The stakeholders are serious about the goal of reducing ozone in the Unifour Area. The members recognize that the health concerns are a top priority. We are fortunate to have an active member, Barry Blick, the Health Department Director of Catawba County, on our Stakeholders' Group that points out the importance of the health factor when discussing the production of ozone and the effects ozone has on people and their health. The members plan to continue to provide education and follow guidelines that can help reduce the levels of ozone in the air. The members are actively involved in attendance of the meetings, as well as taking action steps by making commitments to education, and assisting citizens in working together to make our air cleaner to breathe.

In the monthly meetings, members often discuss potential activities to help reduce ozone, (sharing ideas and expertise throughout the area). Recognizing that the health aspect is at times not always acknowledged appropriately, it is always brought back to the table, and recognized as the main reason for our concern and efforts.

Another topic that members recognize is the weather factor. The Unifour area had suffered approximately a five-year drought, until this year (2003) when the rains were abundant. The members believe since the drought appears to be over, that we will see reduced levels of ozone in the area. The rainy season can partially be credited for the lower levels of ozone for the 2003 Ozone Monitoring Season. Another reason for reduction in Ozone Values can be contributed to loss of manufacturing and textiles in the Unifour Area. The economy in the Unifour area has suffered dramatically from the loss of jobs, which has been another topic of discussion. The committee fears the negative impacts of penalties that could be placed on the area if labeled "Non-attainment".

The stakeholders recognize that Air Quality is a Regional Problem and the importance of working together cannot be stressed enough. The stakeholders also recognize that surrounding states will affect our levels of ozone, which is beyond our control. The stakeholders believe that state and federal regulations will have a positive impact on the levels of ozone as well. The numerous programs in place, and forthcoming programs should impact our Air Quality to an attainment level soon. The stakeholders believe the lower levels of ozone, (downward trend) is a sign that the Unifour Area will reach attainment levels at both the Lenoir and Taylorsville monitors soon (modeling indicates by 2007). The Lenoir monitor is already is attaining, and the Taylorsville monitor has reduced it's average to a level "just over the edge". The stakeholders believe the Taylorsville monitor will also be within attainment levels very soon.

The list of Control Measures were revised at the December 9, 2003 meeting to add Sustainable Building Design Standards and Renewable Energy Sources as actions to help reduce energy consumption. The Control Measures are being incorporated within all the Unifour Air Quality Plans. Obviously, some of the smaller, more rural areas will be limited to activities they can perform. Therefore, each area will decide which control measures they can incorporate into their local Air Quality Plans. All stakeholders are committed to reducing ozone in the Unifour Area. The ultimate goal is to achieve cleaner air sooner, and that is what the Unifour area plans to do.

2003 Stakeholders-UAQC Meeting Times and dates:
January 28th @ 3:00PM
February 25th @ 3:00PM
March 25th @ 1:00PM-Sub-committee and 2:00PM regular meeting
April 22nd @ 2:00PM
May 20th @ 4:00PM and Special Public Meeting 5:00PM
June 24th @ 2:00PM
July 22nd @ 2:00PM
August 26th @ 2:00 PM
September meeting canceled
October 28th @ 3:30PM
November @ 9:00AM
December 9th @ 1:00PM
All meetings are open to the public and the facility is handicap accessible.
Minutes to the meetings are kept at the WPCOG offices and are available for public review.
*The membership list is **Attachment A***

II. Report progress on evaluating and selecting emission reduction measures for the local control strategy.

*See December 31, 2003 List of Control Measures **Attachment B***

The Unifour Area Stakeholders group uses the Control Measures as a Tool Box that gives them direction and guidance within the Air Quality Plans. The Control Measures are distributed to many different groups to use as a guide for reducing ozone. As noted below in the stakeholders involvement, some of the Control Measures are already being implemented and incorporated into many of the various programs. Progress is being made.

III. Describe public outreach activities (press coverage, public presentations, websites, etc.)

The Stakeholders have assisted or been involved in all of the following:

- *The UAQC meets monthly often with press coverage, and the public is always welcome to attend and participate.*
- *Notice of meetings and Air Quality Coverage in the Regional and Local Papers (Hickory Daily Record, The Taylorsville Times, Lenoir News Topic, Observer News Enterprise, Charlotte Observer, The Morganton News Herald, and the Catawba Valley Neighbors)*
- *Local Coverage of the UAQC Meetings in newspapers*
- *EAC Members gave Air Quality Presentations at their regularly scheduled board meetings (City Council and County Board Meetings).*
- *The chairman (John Tippett) for the UAQC has been asked to speak to numerous groups and participate in several activities that promote air quality education.*
- *The members are actively participating in presentations and making themselves available to help educate the communities.*
- *Working with the local Radio and TV Stations to help with Alerts and Ozone Awareness during Weather Forecasts.*
- *Assist people daily with Ozone education (brochures, color guides, and other educational materials provided to us by the NC Division of Air Quality).*
- *We offer presentations at all opportunities.*
- *Met with Unifour School Bus Fleet Managers to discuss the use of Ultra Low Sulfur Diesel Fuel (ULSD) earlier than 2006 and applying for a grant to assist in proceeding.*
- *Signed up with "It All Adds up to Clean Air" Program-lots of useful resources*
- *Caldwell County High Ozone Day Flag Program*
- *Caldwell County presentation to EDC*
- *Met with Caldwell County Fire Departments presentation on High Ozone*
- **Private Construction Company**, *(Stakeholder-Neill Grading), on Code Orange or higher days, does not allow company vehicles to be driven to lunch. Employees are requested to bring their lunch and eat onsite if possible. The employees call a voicemail each night that gives them the Code Alert for the next day so they can be prepared. The employer cannot require but does encourage the employees to drive the minimum amounts on high ozone alert days.*

- *Ed Neill also leads up a Volunteer Program for other construction companies to voluntarily not burn on High Ozone Days (Pledge Program).*
- ***Catawba County Public Health Ozone Activities July-Nov 2003***
  Provided ozone presentations and/or information at:
  - *County Dept Heads meeting on 7/7/03.*
  - *County Employee Committee meeting on 7/8/03.*
  - *Valley Hills Mall on 7/16/03 for their mall walkers group.*
  - *DSS on 7/23/03 for their staff.*
  - *Goody's Back to School Information Fair on 8/2/03.*
  - *Valley Hills Mall on 8/9/03 for their Kids Club.*
  - *St. Joseph's Catholic Church Health Fair on 9/6/03*
  - *County employee's asthma group on 9/19/03.*
  - *Wal-Mart Health Fair on 9/19/03.*
  - *Alltel Safety Day on 10/3/03.*
  - *Asthma Walk during Hickory's October fest on 10/11/03.*
  - *Community Toolbox at Catawba Valley Community College on 11/1/03.*

  The Catawba County Employee Ozone Committee developed an ozone action plan for all orange or red ozone alert days for Catawba County employees and/or citizens including:
  - *All 3 Catawba County school systems adopted as procedure a School Ozone Policy for ozone alert days similar to the daycare policy which means all children in congregate care from birth to age 18 are protected during the day during ozone season while in child care centers or public schools in Catawba County*
  - *The Catawba County Chamber of Commerce had a "Meet Your Government Series" event in August that featured John Tippett, UAQC Chairman, on the EAC and ozone non-attainment, attended by 60 business and community leaders, and followed up with an article on Tippett's talk in our monthly newsletter, the Government Affairs Sentinel.*
  - *Buttons – all county employees would be asked to wear orange, red or purple buttons on ozone alert days*
  - *Banners – orange, red or purple banners could be placed on Fairgrove Church Road and Hwy 321 at the Government Center on ozone alert days*
  - *Flags – orange, red or purple flags could be flown at all county and municipal building on ozone alert days, municipalities could be asked to pay for their own*
  - *Completed and updated 3 more Air Quality Plans.   Other plans are still in the process and plan to be complete by 2004 Ozone Season.*
  - *Continue to read & gather information on ways to help reduce OZONE*
  - *Scheduled to e-mail out the ozone alerts on Alert Days.*
  - *Color Guides that explain the alert system available at the Catawba County Chamber's Visitor Information Center counter during the*

ozone season. We also distributed them to our Government Affairs Council members

Caldwell County Activities Included:

- *Met with the County Health Department to plan for the overall operation of the notification process.*
- *Compiled alert E-Mail distribution list of all county employees, municipalities, schools, corporate partners and the chamber.*
- *Distributed all ozone flags to all participating parties*
- *Letter to editor about the meaning of ozone alert flags published in News Topic*
- *Putting together systems to notify the public by flying high ozone flags*
- *Local Television Broadcast to explain flying the alert flags*
- *Compiled list of county vehicle information for submittal to the state.*
- *Posted ozone alert information at the Health Department and the Planning Department.*
- *Met with the Supervisor of Public Health Education, to plan for the process of educating the 5th grade classes*
- *Hired a PE in August 2003 to oversee an environmental program, that includes the Ozone Action Plan*
- *Putting together systems to notify the public by flying high ozone flags*
- *Local Television Broadcast to explain flying the alert flags*

City of Hickory-*noted a period of unprecedented growth in the 1990s was accompanied by an increased reliance on non-public transportation. The increase in Vehicle Miles Travel (VMT) that resulted, contributed to such challenges as congestion and air pollution. In addition, non-mobile source emissions are contributing factors in the region's violation of the Federal air quality standards. Thus, beginning in the summer of 1998, the City of Hickory has been in the forefront in the fight against air pollution in the Unifour Area.* ***Some of Hickory's activities include the following:***

- *City of Hickory has adopted an Air Quality Action Plan. Employees are notified via email of impending forecasts of high ozone and initiate steps necessary to implement the plan.*
- *The City of Hickory has 7 alternative fuel vehicles (CNG) and a compressed natural gas fueling station. Plans are to continue to expand the fleet of CNG vehicles as vehicles are replaced and CNG is a suitable alternative fuel.*
- *The City of Hickory continues to educate its citizens through public information pieces contained in utility bills and other direct mailings to our citizens about the effects of ozone and the steps they can take to reduce the generation of ozone.*
- *The City of Hickory continues to provide public transit services within the Newton, Conover and Hickory urban area thereby offering an alternative to the single occupancy vehicle.*
- *The City of Hickory has adopted new Land Development Regulations that require connectivity between developments and encourage mixed use developments thereby reducing the length and number of vehicle trips necessary to meet daily needs.*
- *The City of Hickory is using fiber-optic cable telephone lines, close circuit television cameras installed along miles of freeways and roads, to relay information about traffic*

congestion (and incidents) to a control center at the Public Services Department in Hickory.

- *Staff members from the City of Hickory Planning Department have periodically participated in workshops and meetings that were sponsored by the Department of Transportation in Raleigh and Asheville on alternate transportation issues.*
- *City of Hickory Planning Department staff has met with some area Human Resources Directors, as a group and individually, to alert them to the importance of recognizing air quality issues and encouraging them to adopt policies and support actions that reduce ozone such as encouraging their employees to use alternative modes of transportation and discouraging the use of single occupancy vehicles.*
- *The City fully supports Transportation Demand Management (TDM) strategies as an important tool in reducing VMT. City staff continues to participate in seminars and forums on TDM sponsored by the NC Department of Transportation-Public Transportation Division.*
- *City of Hickory Planning Department staff continues to make themselves available to area private businesses and industries that are seeking information on how they can contribute to air quality improvements.*
- *The City of Hickory has also sought to form partnerships with other local municipalities and the county, through the Piedmont Wagon Managers' Consortium, in providing public transit as an alternative means of transportation and as one of our key strategy for improving air quality.*
- *Through its participation in Federal and State grant programs, the City has also sought to form partnerships with local organizations, such as the Boys' and Girls' Clubs and neighborhood associations to promote clean air and alternate modes of transportation by implementing greenway trails and extending bicycle routes. The City expects to begin the process of developing a comprehensive Greenways and Trails Master Plan in FY2004-2005.*
- *The activities continue to increase and awareness is becoming more prevalent within the Unifour Area. We all continue to work towards cleaning our air.*

IV. ***Provide update on modeling/technical planning activities.***

These activities are the responsibility of the state.

See Attachment from the State Office

Attachment A

Unifour Air Quality Committee

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Attachment A

Unifour Air Quality Committee

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F:HOME/DIVPLAN/MBRSPLST

PROPOSED OZONE CONTROL MEASURES FOR THE UNIFOUR EARLY ACTION COMPACT
HICKORY-MORGANTON-LENOIR MSA, North Carolina

Air Quality Goal: Governments within the Unifour Area of North Carolina desire to achieve and maintain clean healthful air as determined by national, state and local ambient air quality standards for the well being of its citizens and the economic vitality of the region. These governments shall act proactively at the county and municipal levels to achieve this goal.

	Priority	Action	Air Quality Improvement Action	Action Steps	Purpose & Outcome
1	1	Behavior Modification	Local governments join and participate with the private sector in the NC Air Awareness Program	Division of Air Quality (DAQ) and WPCOG will encourage local governments and the private sector to join the Air Awareness Program. WPCOG will coordinate annual Care for the Air Race.	Avoid EPA non-attainment designation Modify activities that result in Ozone Formation
2	1	Behavior Modification	Enhanced Ozone Awareness (Outreach-Communication): assign a local agency to develop and implement an aggressive program to educate and motivate individuals and businesses/organizations, to take actions to minimize ozone pollution. Can include a wider distribution of educational materials, increased media alerts, promoting NC Air Awareness program, etc.	All EAC members will coordinate program.	Educate citizens on Ozone pollution activities
3	1	Energy	Evaluate the benefits of participation in the Clean Cities program	WPCOG will coordinate program if UAQC desires to participate	Increase use of alternative fuels
4	2	Energy	City and County Energy Plan (Energy Conservation Plan): An energy plan could be developed that directs city & county departments to reduce energy use. This could include new construction standards for new buildings, retrofitting city/county buildings, schools, & street lights for energy efficiency, and energy renewable sources i.e. Sustainable Building Design Stds. "Energy Star" Program, white roofs, etc., promoting transportation alternatives, and encouraging recycling & composting.	Local governments will develop their own energy plan (possibly involve Cooperative Extension Service)	Reduce energy consumption
5	1	Government	Assign staff to become air quality contact	Local governments will designate staff member as air quality contact person	Increase personnel that are familiar with air quality issues
6	1	Government	Adopt a local clean air policy & appoint a stakeholder group to identify & recommend locally feasible air improvement actions	Unifour Air Quality Committee (UAQC) will continue to serve as this group	UAQC is focal point for air quality policy & planning activities
7	2	Land Use	Landscaping Standards: Planted trees and vegetative landscaping reduce the need for air conditioning, reduce the heat island effect in urban areas, and reduce energy usage. Landscaping and tree ordinances could be drafted to establish minimum tree planting standards for new development; and to promoted strategic tree planting, street trees, and parking lot trees "Urban Forests Program"	All local governments should develop tree and landscaping ordinances. Local governments should educate and encourage citizen participation with tree and other vegetative plantings. Riparian buffer regulations should also be supported.	Expand vegetation plantings through land use ordinances
8	2	Land Use	Implement Smart Growth, mixed use, and infill development policies.	Encourage compact development to reduce travel and promote Smart Growth concepts and redevelopment activities	Reduction in vehicle miles traveled
9	1	Transportation	Develop plans to encourage bicycle and pedestrian usage.	Each EAC member will develop plans within a regional context.	Reduction in vehicle miles traveled
10	1	Land Use	Discourage Open Burning on Ozone Action Days (Pledge Program)	Request all major land development and grading businesses to sign pledges to not engage in open burning activities on high ozone days.	Minimize ozone forming activities on high ozone days
11	1	Transportation	Support Coordination of Metropolitan Planning Organization (MPO) and Rural Planning Organization (RPO) efforts	MPO and RPO will coordinate transportation and air quality planning efforts	Integrate regional land use & transportation planning activities
12	1	Transportation	Encourage the use of compressed work weeks or flexible work hours, which helps reduce traffic congestion during the peak driving hours by spreading out the number of vehicles on the roadway over a longer period of time	MPO and RPO will promote benefits of telecommuting, flexible work hours and staggered work schedules	Reduce traffic congestion
13	1	Transportation	Expand Transit and Ridesharing programs (carpooling/vanpooling). These are options where employers living in the same area agree to ride to work together rather than to drive their individual vehicles to work.	MPO and RPO and local governments will educate and promote these benefits Produce Maps to locate employees to assist with ridesharing programs	Expand transit and ridesharing programs to reduce traffic congestion and vehicle miles traveled.
14	1	Transportation	Improve traffic operational planning, engineering and maintenance for existing and future transportation infrastructure.	MPO, RPO, NCDOT, and municipalities, will expand traffic operational and engineering technologies (signal timing, signing, message boards, etc., and other intelligent transportation strategies).	Reduce traffic congestion and idling time

NOTE: These Control Measures and emission reduction strategies were developed based upon guidance from the Unifour Air Quality Committee, other stakeholder involvement and input at public meetings.

1 INTRODUCTION

As a requirement of the Unifour Early Action Compact (EAC), the progress report due December 31, 2003, must include a status report regarding the air quality modeling. This report satisfies this requirement. The Unifour area includes Alexander, Burke, Caldwell, and Catawba Counties. Discussed in this report is an overview of the air quality in the Unifour area, the health effects and sources of ozone, Federal and state control measures, and emissions modeling and results.

The modeling analysis is a complex technical evaluation that begins by selection of the modeling system and selection of the meteorological episodes. North Carolina Division of Air Quality (NCDAQ) decided to use the following modeling system:

- Meteorological Model: MM-5 – This model generates hourly meteorological inputs for the emissions model and the air quality model, such as wind speed, wind direction, and surface temperature.

- Emissions Model: Sparse Matrix Operator Kernel Emissions (SMOKE) - This model takes daily county level emissions and temporally allocates across the day, spatially locates the emissions within the county, and transfers the total emissions into the chemical species needed by the air quality model.

- Air Quality Model: MAQSIP (Multi-Scale Air Quality Simulation Platform) – This model takes the inputs from the emissions model and meteorological model and predicts ozone hour by hour across the modeling domain, both horizontally and vertically.

The modeling system being used for this demonstration and the episodes being modeled were discussed in detail in the June 30, 2003 progress report and will not be discussed further in this progress report.

The following historical episodes were selected to model because they represent typical meteorological conditions in North Carolina when high ozone is observed throughout the State:

- July 10-15, 1995
- June 20-24, 1996
- June 25-30, 1996
- July 10-15, 1997

The meteorological inputs were developed using MM5 and were discussed in detail in the June 30, 2003 progress report and will not be discussed further in this progress report.

The precursors to ozone, Nitrogen Oxides (NOx), Volatile Organic Compounds (VOCs), and Carbon Monoxide (CO) were estimated for each source category. These estimates were then spatially allocated across the county, temporally adjusted to the day of the week and hour of the day and speciated into the chemical species that the air quality model needs to predict ozone.

The emission inventories used for the current year and future year modeling are discussed in detail in Section 4.

The State and Federal control measures currently in practice and those being implemented in the future to reduce point and mobile (highway and nonroad) source emissions are discussed in Section 5.

The status of the modeling work is discussed in Section 6.

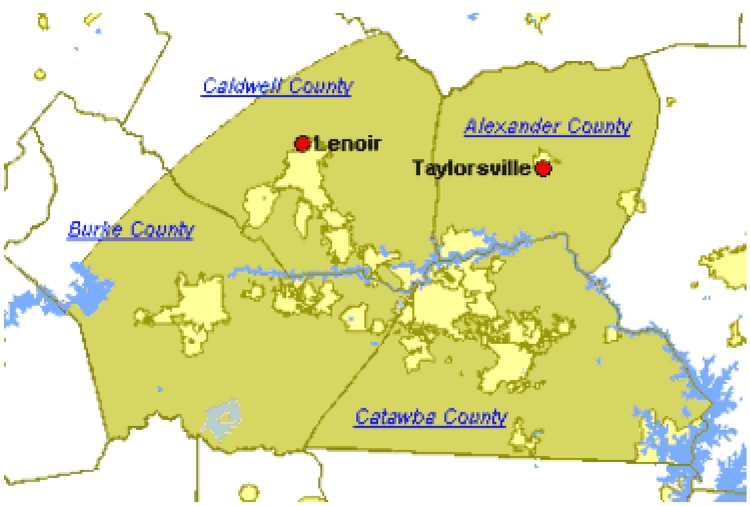
2 Overview of Air Quality In The Unifour Area

The U.S. Environmental Protection Agency (EPA), under the authority of the Federal Clean Air Act, regulates outdoor air pollution in the United States. The EPA sets National Ambient Air Quality Standards (NAAQS) for six "criteria pollutants" that are considered harmful to human health and the environment.[1] These six pollutants are carbon monoxide, lead, ozone, nitrogen dioxide, particulate matter and sulfur dioxide. Particulate matter is further classified into two categories: PM 10, or particles with diameters of 10 micrometers or less, and PM 2.5, particles with diameters of 2.5 micrometers or less. Levels of a pollutant above the health-based standard pose a risk to human health.

The NCDAQ monitors levels of all six criteria pollutants in the Unifour area and reports these levels to the EPA. According to the most recent data, the Unifour area is meeting national ambient standards for four of the pollutants, but is not meeting the Federal 8-hour standard for ground-level ozone and fine particulate matter. Federal enforcement of the ozone NAAQS is based on a 3-year monitor "design value". The design value for each monitor is obtained by averaging the annual fourth highest daily maximum 8-hour ozone values over three consecutive years. If a monitor's design value exceeds the NAAQS, that monitor is in violation of the standard. The EPA may designate part or all of the metropolitan statistical area (MSA) as nonattainment even if only one monitor in the MSA violates the NAAQS.

There are two ozone monitors in Unifour EAC area. These monitors are: Lenoir, located in Caldwell County; and Taylorsville, Alexander County. The location of these monitors are shown in Figure 2-1.

Figure 2-1: Unifour Area's Ozone Monitor



For the 3-year period 2000 – 2002, both monitors were violating the 8-hour ozone NAAQS. However, the most recent 3-year period 2001 – 2003 shows the Lenoir monitor attaining the standard and the Taylorsville violating the 8-hour ground-level ozone NAAQS, see Table 2-1.

Table 2-1: Ozone Monitor Design Values in parts per million (ppm)

Monitor Name	County	00-02	01-03
Lenoir	Caldwell	0.086	0.084
Taylorsville	Alexander	0.091	0.088

NCDAQ forecasts ozone levels on a daily basis from May 1 – September 30 for Unifour EAC area. This forecast is issued to the public using EPA's Air Quality Index (AQI) color code system. Table 2-2 lists the ozone regulatory standard and AQI breakpoints with their corresponding health risks.

Table 2-2: Air Quality Index Color Code System

		Pollutant concentration (ppm) ranges for AQI color codes				
Pollutant/ Standard	**Standard Value**	**Green AQI 0– 50 Good**	**Yellow AQI 51-100 Moderate**	**Orange AQI 101-150 Unhealthy for Sensitive Groups**	**Red AQI 151-200 Unhealthy**	**Purple AQI 201-300 Very Unhealthy**
Ozone/ 8-hour average	0.08 ppm averaged over 8 hours	0-0.064	0.065-0.084	0.085-0.104	0.105-0.124	0.125-0.374

The AQI color codes standardize the reporting of different pollutants by classifying pollutant concentrations according to relative health risk, using colors and index numbers to describe pollutant levels. The AQI is also used to report the previous day's air quality to the public. In the Unifour area, the forecast and previous day air quality reports appear on the weather page of local newspapers and NCDAQ's website: http://daq.state.nc.us/airaware/forecast. Additionally, the ozone forecast is broadcasted during the local news on television and radio.

3 Ozone And Its Health Effects And Sources

3.1 Overview of Ozone

Ozone (O_3) is a tri-atomic ion of oxygen. In the stratosphere or upper atmosphere, ozone occurs naturally and protects the Earth's surface from ultraviolet radiation. Ozone in the lower atmosphere is often called ground-level ozone, tropospheric ozone, or ozone pollution to distinguish is from upper-atmospheric or stratospheric ozone. Ozone does occur naturally in the lower atmosphere (troposphere), but only in relatively low background concentrations of about 30 parts per billion (ppb), well below the NAAQS. The term "smog" is commonly used to refer to ozone pollution. Although ozone is a component of smog; smog is a combination of ozone and airborne particles having a brownish or dirty appearance. It is possible for ozone levels to be elevated even on clear days with no obvious "smog".

In the lower atmosphere, ozone is formed when airborne chemicals, primarily nitrogen oxides (NOx) and volatile organic compounds (VOCs), combine in a chemical reaction driven by heat and sunlight. These ozone-forming chemicals are called precursors to ozone. Man-made NOx and VOC precursors contribute to ozone concentrations above natural background levels. Since ozone formation is greatest on hot, sunny days with little wind, elevated ozone concentrations occur during the warm weather months, generally May through September. In agreement with EPA's guidance, North Carolina operates ozone monitors from April 1 through October 31 to be sure to capture all possible events of high ozone.

3.2 Ozone Health Effects

The form of oxygen we need to breathe is O_2. When we breathe ozone, it acts as an irritant to our lungs. Short-term, infrequent exposure to ozone can result in throat and eye irritation, difficulty drawing a deep breath, and coughing. Long-term and repeated exposure to ozone concentrations above the NAAQS can result in reduction of lung function as the cells lining the lungs are damaged. Repeated cycles of damage and healing may result in scarring of lung tissue and permanently reduced lung function. Health studies have indicated that high ambient ozone concentrations may impair lung function growth in children, resulting in reduced lung function in adulthood. In adults, ozone exposure may accelerate the natural decline in lung function that occurs as part of the normal aging process. Ozone may also aggravate chronic lung diseases such as emphysema and bronchitis and reduce the immune system's ability to fight off bacterial infections in the respiratory system.

Asthmatics and other individuals with respiratory disease are especially at risk from elevated ozone concentrations. Ozone can aggravate asthma, increasing the risk of asthma attacks that require a doctor's attention or the use of additional medication. According to the EPA, one reason for this increased risk is that ozone increases susceptibility to allergens, which are the most common triggers for asthma attacks. In addition, asthmatics are more severely affected by the reduced lung function and irritation that ozone causes in the respiratory system. There is increasing evidence that ozone may trigger, not just exacerbate, asthma attacks in some individuals. Ozone may also contribute to the development of asthma. A recent study published in the British medical journal *The Lancet* found a strong association between elevated ambient ozone levels and the development of asthma in physically active children.[2]

All children are at risk from ozone exposure because they often spend a large part of the summer playing outdoors, their lungs are still developing, they breathe more air per pound of body weight, and they are less likely to notice symptoms. Children and adults who frequently exercise outdoors are particularly vulnerable to ozone's negative health effects, because they may be repeatedly exposed to elevated ozone concentrations while breathing at an increased respiratory rate.[3]

3.3 Ozone Sources

Ozone-forming pollutants, or precursors, are nitrogen oxides (NOx) and volatile organic compounds (VOCs).

3.3.1 Volatile Organic Compounds

Volatile organic compounds (VOCs) are a class of hydrocarbons, and therefore are sometimes referred to as hydrocarbons. However, it is important to note that hydrocarbons, as a class of chemical compounds, include less-reactive compounds not considered VOCs. In other words, although all VOCs are hydrocarbons, not all hydrocarbons are VOCs.

In North Carolina, large portions of precursor VOCs are produced by natural, or biogenic, sources, which are primarily trees. Man-made, or anthropogenic, VOCs also contribute to ozone production, particularly in urban areas. Sources of anthropogenic VOCs include unburned gasoline fumes evaporating from gas stations and cars, industrial emissions, and consumer products such as paints, solvents, and the fragrances in personal care products.

3.3.2 Nitrogen Oxides

Nitrogen oxides (NOx) are produced when fuels are burned, and result from the reaction of atmospheric nitrogen at the high temperatures produced by burning fuels. Power plants, highway motor vehicles, the major contributor in urban areas, and off-road mobile source equipment, such as construction equipment, lawn care equipment, trains, boats, etc., are the major sources of NOx.

Other NOx sources include "area" sources (small, widely-distributed sources) such as fires (forest fires, backyard burning, house fires, etc.), and natural gas hot water heaters. Other residential combustion sources such as oil and natural gas furnaces and wood burning also produce NOx, but these sources generally do not operate during warm-weather months when ground-level ozone is a problem. In general, area sources contribute only a very small portion of ozone-forming NOx emissions.

Generally, North Carolina, including the Unifour area, is considered "NOx-limited" because of the abundance of VOC emissions from biogenic sources. Therefore, current ozone strategies focus on reducing NOx. However, VOC reduction strategies, such as control of evaporative emissions from gas stations and vehicles, could reduce ozone in urban areas where the biogenic VOC emissions are not as high.

3.3.3 Sources of NOx and VOCs

The following lists the sources, by category, what contribute to NOx and VOC emissions.

Biogenic: Trees and other natural sources.

Mobile: Vehicles traveling on paved roads: cars, trucks, buses, motorcycles, etc.

Nonroad: Vehicles not traveling on paved roads: construction, agricultural, and lawn care equipment, motorboats, locomotives, etc.

Point: "Smokestack" sources: industry and utilities.

Area: Sources not falling into above categories. For VOCs, includes gas stations, dry cleaners, print shops, consumer products, etc. For NOx, includes forest and residential fires, natural gas hot water heaters, etc.

4 Emissions Inventories

4.1 Introduction

Emissions modeling performed by NCDAQ estimates NOx and VOC emissions for an average summer day, given specific meteorological and future year conditions and using emission inputs based on emission inventories that include anticipated control measures. The biogenic emissions are kept at the same level as the episodic biogenic emissions since these emissions are based on meteorology. Projections for 2007 take into account all State and Federal control measures expected to operate at that time, including Federal vehicle emissions controls, NOx SIP Call controls, and North Carolina Clean Smokestacks controls.

There are various types of emission inventories. The first is the base year or episodic inventory. This inventory is based on the year of the episode being modeled and is used for validating the photochemical model performance.

The second inventory used in this project is the "current" year inventory. For this modeling project it will be the 2000 emission inventory, which is the most current. This inventory is processed using all of the different meteorological episodes being studied. The photochemical modeling is processed using the current year inventory and those results are used as a representation of current air quality conditions for the meteorological conditions modeled.

Next is the future base year inventory. For this type, an inventory is developed for some future year for which attainment of the ozone standard is needed. For this modeling project the future years will be 2007 and 2012. It is the future base year inventories that control strategies and sensitivities are applied to determine what controls, to which source classifications, must be made in order to attain the ozone standard.

The base year inventories used for each source classifications were discussed in the previous progress report date June 30, 2003. This progress report will focus on the 2000 current year and the 2007 future year inventories. In the sections that follow, the inventories used for the current and the future years are discussed. Emission summaries by county for the entire State are in Appendix A.

4.2 Current Year Inventories

For the large utility sources, year specific Continuous Emissions Monitoring (CEM) data is used for base year episode specific modeling. However, it did not make sense to use 2000 CEM data for the current year inventory since the meteorology used for the current year modeling runs are the 1995, 1996, and 1997 episode specific meteorology. The concern is that the utility day specific emissions for 2000 would not correspond to the meteorology used in the modeling. After discussing this issue with EPA, the decision was made to continue to use the episodic CEM data for the current year inventory. Since only NOx emissions are reported to the EPA, Acid Rain Division (ARD), the CO and VOC emissions are calculated from the NOx emissions using emission factor ratios (CO/NOx and VOC/NOx) for the particular combustion processes at the utilities.

The inventory used to model the other point sources is the 1999 National Emissions Inventory (NEI) release version 2.0 obtained from the EPA's Clearinghouse for Inventories and Emission Factors (CHIEF) website (http://www.epa.gov/ttn/chief/net/1999inventory.html). In addition, North Carolina emissions for forest fires and prescribed burns are treated as point sources and are episode specific similar to CEM data. These emissions were kept the same as the episodic emissions.

Similar to the other point source emissions inventory, the inventory used to model the stationary area sources is the 1999 NEI release version 2.0 obtained from the EPA's CHIEF website. The exception to this is for North Carolina where a 2000 current year inventory was generated by NCDAQ following the current methodologies outlined in the Emissions Inventory Improvement Program (EIIP) Area Source Development Documents, Volume III (http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html).

For the nonroad mobile sources that are calculated within the NONROAD mobile model, a 2000 current year inventory was generated for the entire domain. The model version used is the Draft NONROAD2002 distributed for a limited, confidential, and secure review in November 2002. If the final version or any newer draft versions of this model is released by the EPA, an assessment of the difference in the emission estimations will be made to determine if a new inventory must be generated and processed through the photochemical model.

The nonroad mobile sources not calculated within the NONROAD model include aircraft engines, railroad locomotives and commercial marine vessels. The 2000 current year inventory used for these sources is the 1999 NEI release version 2.0 obtained from the EPA's CHIEF website. The exception to this is for North Carolina where a 2000 current year inventory was generated by NCDAQ following the methodologies outlined in the EPA guidance document EPA-450/4-81-026d (Revised), Procedures for Inventory Preparation, Volume IV: Mobile Sources.

In order to accurately model the mobile source emissions in the EAC areas, the newest version of the MOBILE model, MOBILE6.2, was used. This model was released by EPA in 2002 and differs significantly from previous versions of the model. Key inputs for MOBILE include information on the age of vehicles on the roads, the speed of those vehicles, what types of road those vehicles are traveling on, any control technologies in place in an area to reduce emissions for motor vehicles (e.g., emissions inspection programs), and temperature. The development of these inputs was discussed in detail in the June 30, 2003 progress report and will not be discussed in this report.

Biogenic emissions used in the 2000 current year modeling are the same as those used in the base year episodic modeling. This is due to the use of the same meteorology for the current year modeling runs. The development of this source category was discussed in detail in the June 30, 2003 progress report and will not be discussed in this report.

The emissions summary for the 2000 current year modeling inventories for the Unifour EAC area is listed in Table 4.2-1. These emissions represent typical weekday emissions and are reported in tons per day.

Table 4.2-1 2000 Current Year Modeling Emissions

Source	CO	NOX	VOC
Point	8.09	98.29	47.26
Area	17.51	1.20	21.57
Nonroad Mobile	82.37	10.14	7.85
Highway Mobile	238.51	34.67	21.02
Biogenic	0.00	0.40	213.80
Total Emissions	346.48	144.70	311.50

4.3 2007 Future Year Inventories

The inventory used for the initial 2007 point source inventory is the EPA's May 1999 release of the NOx SIP call future year modeling foundation files, obtained from the EPA Office of Air Quality Planning and Standards (OAQPS). This is a 2007 emissions inventory, projected from a 1995 base year inventory and controlled in accordance to the NOx SIP call rule. The decision to use this inventory for initial 2007 future year modeling runs was made since all of the point sources required to have controls due to the NOx SIP call rule making are reflected in this inventory. The exception to this is for North Carolina. For the major North Carolina utility sources, NCDAQ obtained estimated future year hour specific data for the two largest utility companies within North Carolina, Duke Energy and Progress Energy. Additionally, the day specific forest fires and prescribed fires inventory were the episodic emissions.

NCDAQ plans to re-run the 2007 future year point source inventory, using the EPA's 1999 NEI inventory grown to 2007 using growth factors from the EPA's Economic Growth Analysis System (EGAS) version 4.0. The exception to this is for North Carolina, where State specific growth factors, and where available source specific growth factors, will be used to grow the North Carolina 1999 inventory. Additionally, NCDAQ will create a new control file that will reflect how the states surrounding North Carolina plan to implement the NOx SIP call rule as well as all other rules that are on the books.

The inventory used to model the stationary area sources is the 1999 NEI release version 2.0 obtained from the EPA's CHIEF website and were grown to 2007 using growth factors from the EPA's Economic Growth Analysis System (EGAS) version 4.0. The exception to this is for North Carolina, where the 2000 current year inventory was grown using a mixture of EGAS growth factors and state-specific growth factors for the furniture industry.

For the nonroad mobile sources that are calculated within the NONROAD mobile model, a 2007 future year inventory was generated for the entire domain using the same model used to generate the current year inventory. If a final version or any newer draft versions of the NONROAD model is released by the EPA, an assessment of the difference in the emission estimations will be made to determine if a new inventory must be generated and processed through the photochemical model. The remaining nonroad mobile source categories, the 1999 NEI release version 2.0 obtained from the EPA's CHIEF website and were grown to 2007 using growth factors from the EPA's Economic Growth Analysis System (EGAS) version 4.0. The exception to this is for North Carolina, where the 2000 current year inventory was grown with EGAS growth factors.

The same MOBILE model was used to create the 2007 future year highway mobile source inventory. The vehicle miles traveled (VMT) were projected using the methodologies prescribed by EPA. The exception to this was for North Carolina. In the urban areas of North Carolina VMT from travel demand models (TDM) for future years was available. The 2007 VMT was estimated by interpolating between the TDM future year estimates. Additionally, estimated future year speeds were obtained from the North Carolina Department of Transportation (NCDOT).

Biogenic emissions used in the 2007 future year modeling are the same as those used in the base year episodic modeling. This is due to the use of the same meteorology for the future year modeling runs. The development of this source category was discussed in detail in the June 30, 2003 progress report and will not be discussed in this report.

The emissions summary for the 2007 future year modeling inventories for the Unifour EAC area is listed in Table 4.3-1. These emissions represent typical weekday emissions and are reported in tons per day.

Table 4.3-1 2007 Future Year Modeling Emissions

Source	**CO**	**NOX**	**VOC**
Point	21.54	52.61	63.94
Area	18.36	1.24	21.98
Nonroad Mobile	92.80	10.08	7.68
Highway Mobile	140.31	23.18	13.13
Biogenic	0.00	0.40	213.80
Total Emissions	273.01	87.51	320.53

4.4 Comparison of Inventories

The total predicted NOx emissions for the Unifour area decreased by 40%, from 145 tons per day (TPD) in 2000 to 88 TPD in 2007. This data is tabulated in Table 4.4-1. This same data is displayed in Figures 4.4-1 and 4.4-2 as pie charts with the percent contribution by each source category.

Table 4.4-1: Estimated NOx and VOC emissions, in tons per day

Source	NOx Emissions		VOC Emissions	
	2000	2007	2000	2007
Point	98.29	52.61	47.26	63.94
Area	1.20	1.24	21.57	21.98
Nonroad	10.14	10.08	7.85	7.68
Mobile	34.67	23.18	21.02	13.13
Biogenic	0.40	0.40	213.80	213.80
Total Emissions	144.70	87.51	311.50	320.53

Figure 4.4-2: 2000 Unifour Area NOx Emissions by Source

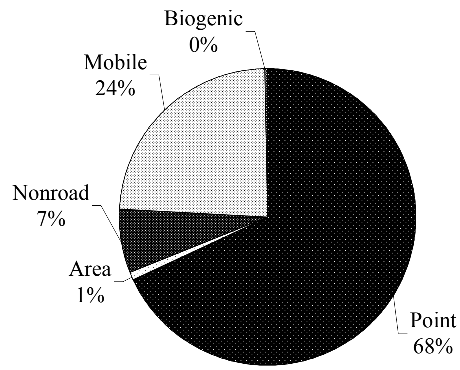
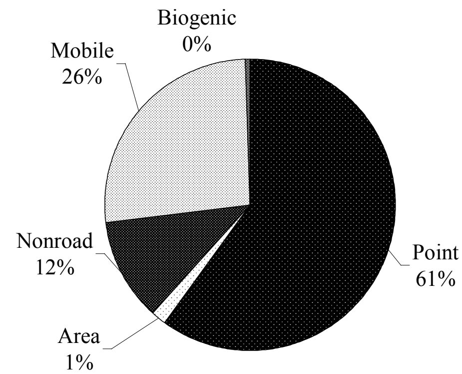


Figure 4.4-2: 2007 Unifour Area NOx Emissions by Source



The total predicted VOC emissions for the Unifour area increased by 3%, from 312 TPD in 2000 to 321 TPD in 2007. This data is also tabulated in Table 4.4-1. This same data is displayed in Figures 4.4-3 and 4.4-4 as pie charts with the percent contribution by each source category.

Figure 4.4-3: 2000 Unifour Area VOC Emissions by Source

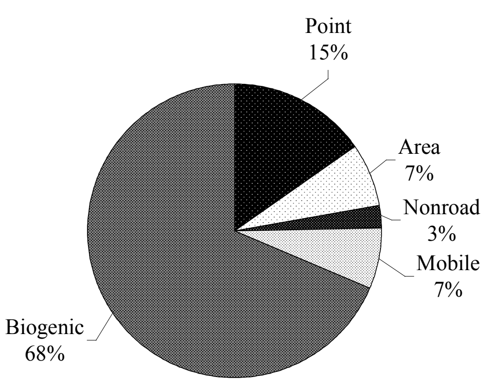
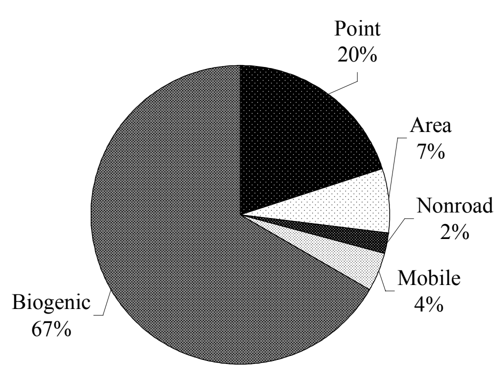


Figure 4.4-4: 2007 Unifour Area VOC Emissions by Source



There are few VOC control measures expected for area and point sources in the Unifour area, resulting in an increase of emissions between the two years. However, the Unifour area contains a power plant, resulting in the point source NOx emissions decrease significantly due to the NOx SIP Call rule. Additionally, there are significant decreases in highway mobile source VOC and NOx emissions, however the decrease in highway mobile VOC was not enough to offset the point source increase. Thus the overall region has a decrease in NOx and a slight increase in VOC emissions.

For both, highway and nonroad mobile sources, diesel vehicles contribute the majority of NOx emissions. Figures 4.4-5 and 4.4-6 show the relative contributions of vehicle types for the highway mobile source category in 2000 and 2007 for the Unifour area. As shown in these figures, the relative contributions from vehicle types change slightly between 2000 and 2007, with heavy duty diesel vehicles still contributing more than 50% of the overall emissions. The estimated emissions for each vehicle type is tabulated in Table 4.4-2.

Figure 4.4-5: 2000 Unifour Area Highway Mobile NOx Sources

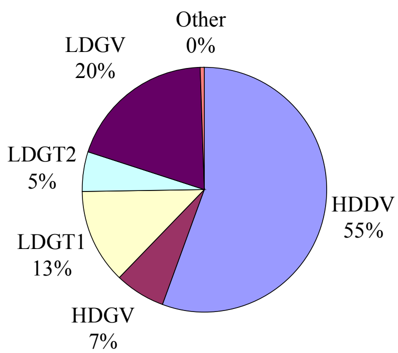
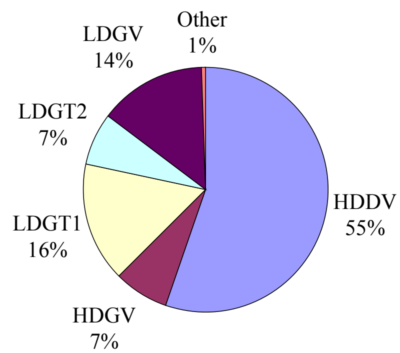


Figure 4.4-6: 2007 Unifour Area Highway Mobile NOx Sources



HDDV = Heavy-duty diesel vehicles (trucks)
HDGV = Heavy-duty gasoline vehicles (trucks)
LDGT (1&2) = Light-duty gasoline trucks
LDGV = Light-duty gasoline vehicles
Other = Motorcycles, light-duty diesel vehicles & trucks

Table 4.4-2: Estimated Highway NOx Emissions, by vehicle type

Source	NOx Emissions in TPD	
	2000	2007
Heavy-duty diesel vehicles	25.85	17.44
Light-duty gasoline vehicles	3.07	2.28
Light-duty gasoline trucks(1)	5.91	4.95
Light-duty gasoline trucks(2)	2.40	2.21
Heavy-duty gasoline vehicles	9.11	4.45
Other	0.20	0.18
Total	46.54	31.51

Figures 4.4-7 and 4.4-8 show the relative contributions of equipment types for the nonroad mobile source category in 2000 and 2007 for the Unifour area. As can be seen in these figures, diesel construction equipment and liquid propane gas (LPG) equipment contributes the majority of the nonroad mobile source NOx emissions for both years. The estimated emissions for each equipment type is tabulated in Table 4.4-3.

Figure 4.4-3: 2000 Unifour Area Nonroad Equipment NOx sources

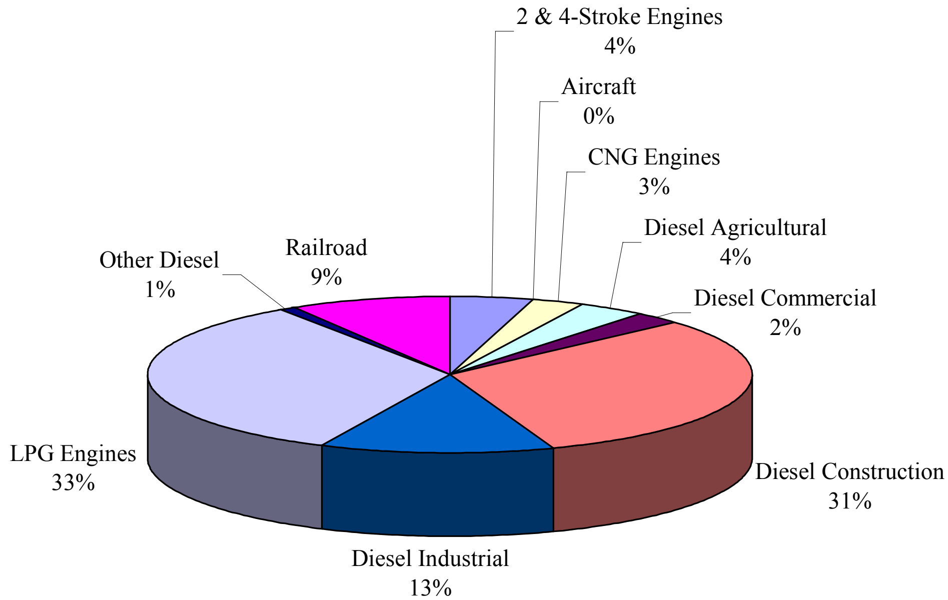


Figure 4.4-4: 2007 Unifour Area Nonroad Equipment NOx sources

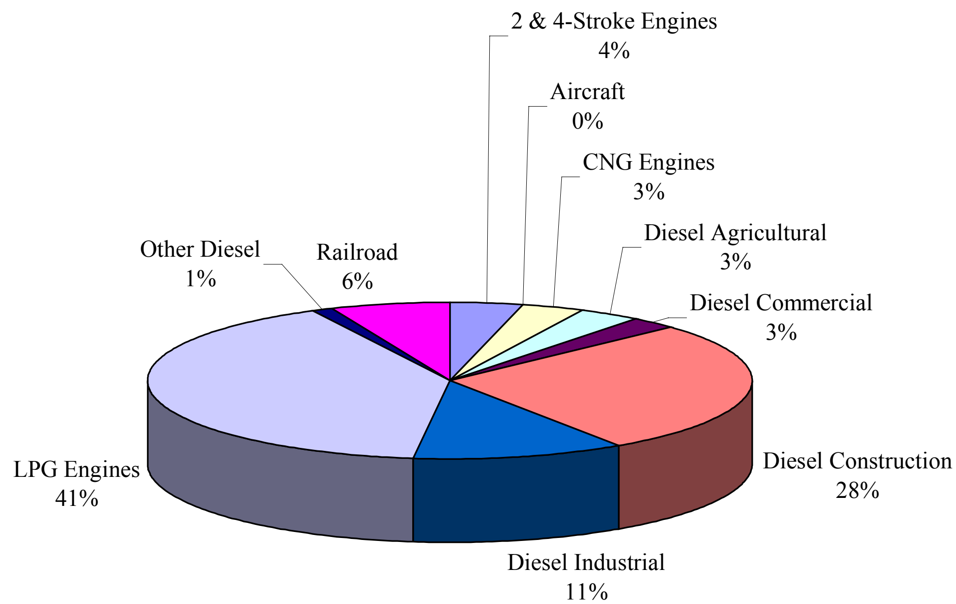


Table 4.4-3. Estimated Nonroad Mobile NOx Emissions by Equipment Type

Source	NOx Emissions in TPD	
	2000	2007
2 & 4-Stroke Engines	0.44	0.38
Aircraft	0.01	0.02
CNG Engines	0.27	0.32
Diesel Agricultural	0.38	0.34
Diesel Commercial	0.23	0.25
Diesel Construction	3.17	2.77
Diesel Industrial	1.27	1.15
LPG Engines	3.38	4.08
Other Diesel	0.10	0.11
Railroad	0.87	0.65
Total	10.12	10.07

5 Control Measures

Several control measures already in place or being implemented over the next few years, will reduce point, highway mobile, and nonroad mobile sources emissions. These control measures were modeled for 2007 and are discussed in the Sections below.

5.1 State Control Measures

5.1.1 Clean Air Bill

The 1999 Clean Air Bill expanded the vehicle emissions inspection and maintenance program from 9 counties to 48, phased in between July 1, 2002 through January 1, 2006. Vehicles will be tested using the onboard diagnostic system, an improved method of testing, which will indicate NOx emissions, among other pollutants. The previously used tailpipe test did not measure NOx. The inspection and maintenance program will be phased in from July 1, 2003 through July 1, 2005, in the Unifour area. Table 5.1.1-1 lists the phase in dates for the Unifour area.

Table 5.1.1-1 Phase-In Dates for the Unifour Area

County	Phase-In Date
Burke	July 1, 2005
Caldwell	July 1, 2005
Catawba	July 1, 2003

5.1.2 NOx SIP Call Rule

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

5.1.3 Clean Smokestacks Act

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

5.2 Federal Control Measures

5.2.1 Tier 2 Vehicle Standards

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

5.2.2 Heavy-Duty Gasoline and Diesel Highway Vehicles Standards

New EPA standards designed to reduce NOx and VOC emissions from heavy-duty gasoline and diesel highway vehicles will begin to take effect in 2004. A second phase of standards and testing procedures, beginning in 2007, will reduce particulate matter from heavy-duty highway engines, and will also reduce highway diesel fuel sulfur content to 15 ppm since the sulfur damages emission control devices. The total program is expected to achieve a 90% reduction in PM emissions and a 95% reduction in NOx emissions for these new engines using low sulfur diesel, compared to existing engines using higher-content sulfur diesel.

5.2.3 Large Nonroad Diesel Engines Proposed Rule

The EPA has proposed new rules for large nonroad diesel engines, such as those used in construction, agricultural, and industrial equipment, to be phased in between 2008 and 2014. The proposed rules would also reduce the allowable sulfur in nonroad diesel fuel by over 99%. Nonroad diesel fuel currently averages about 3,400 ppm sulfur. The proposed rules limit nonroad diesel sulfur content to 500 ppm in 2007 and 15 ppm in 2010. The combined engine and fuel rules would reduce NOx and particulate matter emissions from large nonroad diesel engines by over 90 %, compared to current nonroad engines using higher-content sulfur diesel.

5.2.4 Nonroad Spark-Ignition Engines and Recreational Engines Standard

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

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

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

6 MODELING STATUS

6.1 Status of Current Modeling

Modeling completed to date include: the base case model evaluation/validation runs, the current year modeling runs and the initial 2007 future year modeling runs. The results of these modeling runs can be viewed at the NCDAQ modeling website:

http://www.cep.unc.edu/empd/projects2/NCDAQ/PGM/results/

NCDAQ plans to re-run the 2007 future year modeling run with the updates described in the emissions inventory section. Additionally, NCDAQ still needs to complete the 2012 future year and the local control strategies modeling runs. Additionally, some errors were found in the base year modeling inventories outside of North Carolina. The magnitude of the errors will be evaluated and, if warranted, the base year model evaluation/validation runs may be re-run.

6.2 Preliminary Modeling Results

The base case model runs for all three episodes met the validation criteria set by the EPA. The model evaluation statistics can be viewed at the NCDAQ modeling website cited above.

Figures 6.2-1 and 6.2-2 display the modeling results for 8-hour ozone episodic maximum for the 2000 current year and the 2007 future year, respectively, for the 1996 modeling episode. One can see a significant decrease in the 8-hour ozone episode maximum between the current year and the future year. This is better visualized with Figure 6.2-3, the difference plot between the 2007 future year and the 2000 current year 8-hour ozone episodic maximum for the 1996 episode (i.e., 2007 modeling result minus 2000 modeling results). In this figure cool colors, the blues and greens, represents decreases in the 8-hour ozone episodic maximum. These decrease were the results of the all of the controls listed in Section 5 that are expected to be in place by 2007.

The 1997 episode shows similar results. Figures 6.2-4 through 6.2-5 are the 8-hour ozone episodic maximum for the 2000 current year and the 2007 future year, respectively, for the 1997 episode and Figure 6.2-6 is the difference plot between the 2007 future year and the 2000 current year 8-hour ozone episodic maximum for the 1997 episode.

Additional modeling results can be viewed on the NCDAQ modeling website cited above.

Figure 6.2-1 2000 current year 8-hour ozone episodic maximum for the 1996 episode.

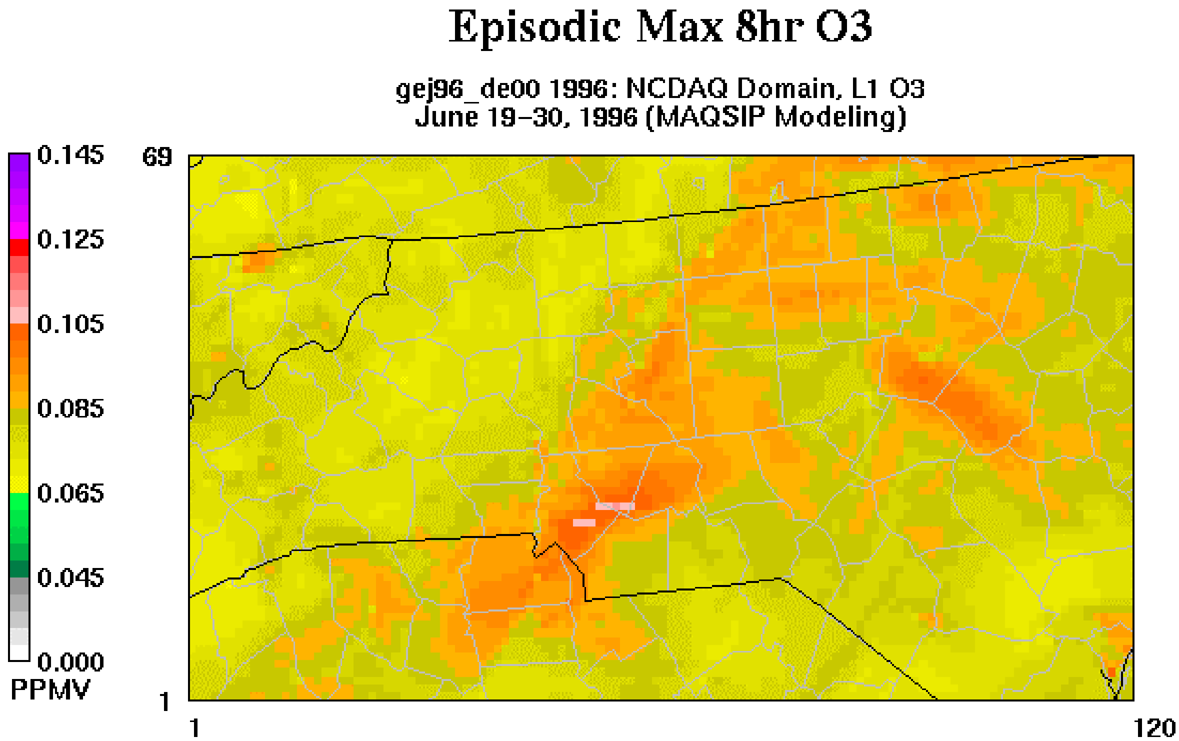


Figure 6.2-2 2007 future year 8-hour ozone episodic maximum for the 1996 episode.

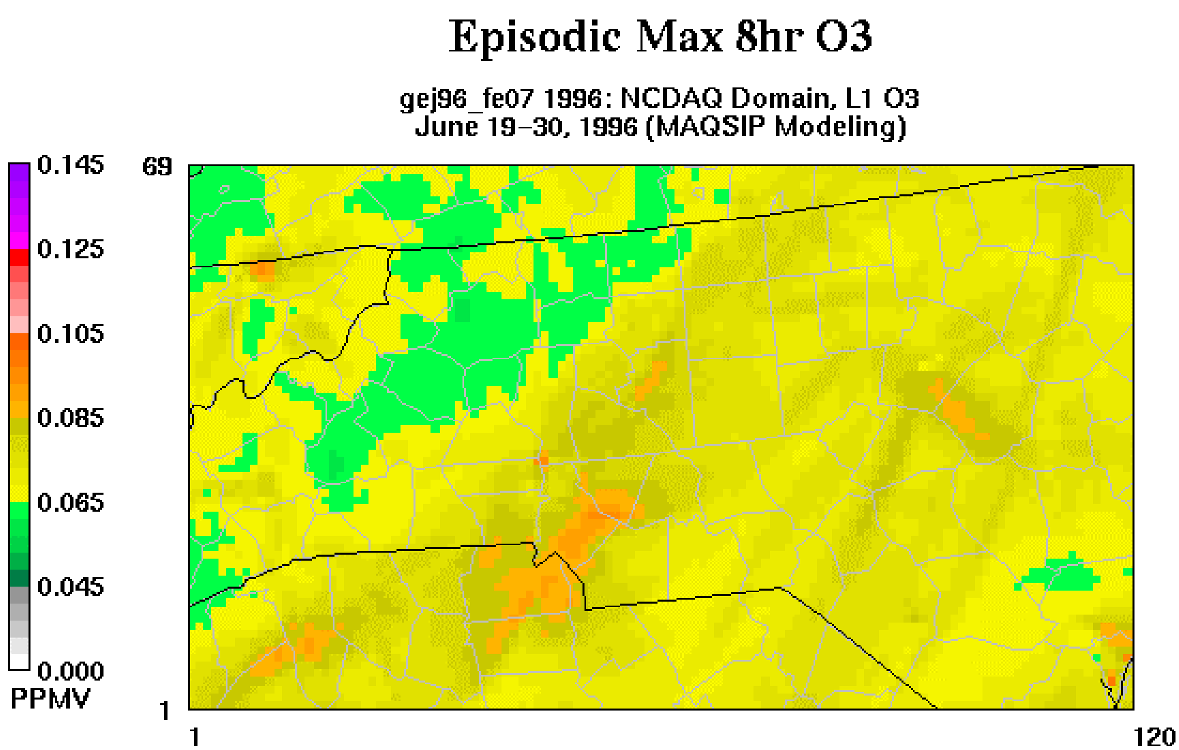


Figure 6.2-3 Difference plot between the 2007 future year and the 2000 current year 8-hour ozone episodic maximum for the 1996 episode.

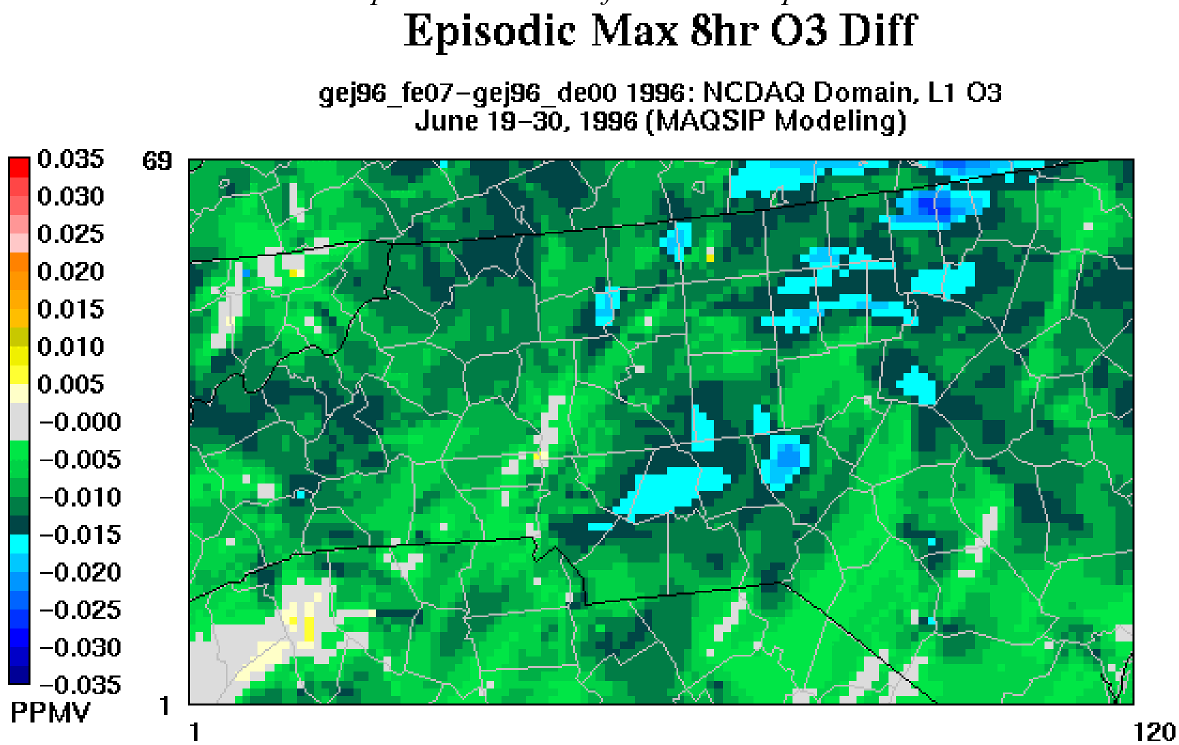


Figure 6.2-4 2000 current year 8-hour ozone episodic maximum for the 1997 episode.

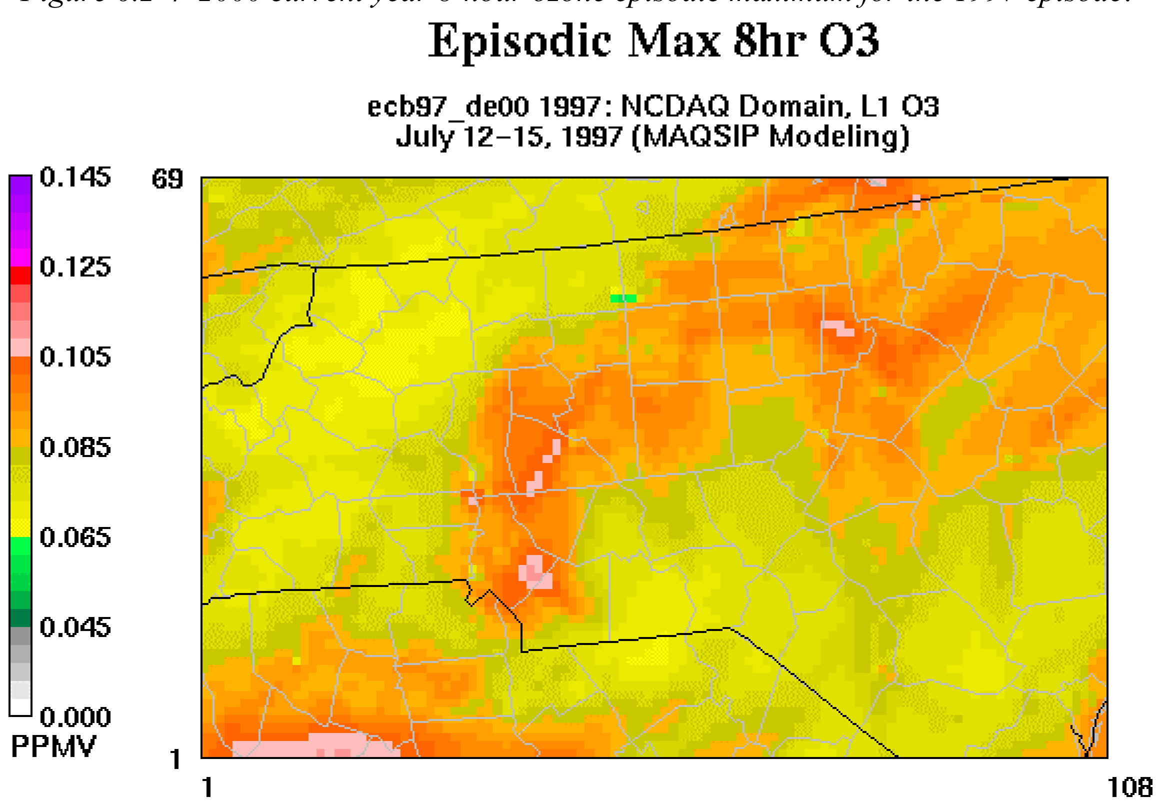


Figure 6.2-5 2007 future year 8-hour ozone episodic maximum for the 1997 episode.

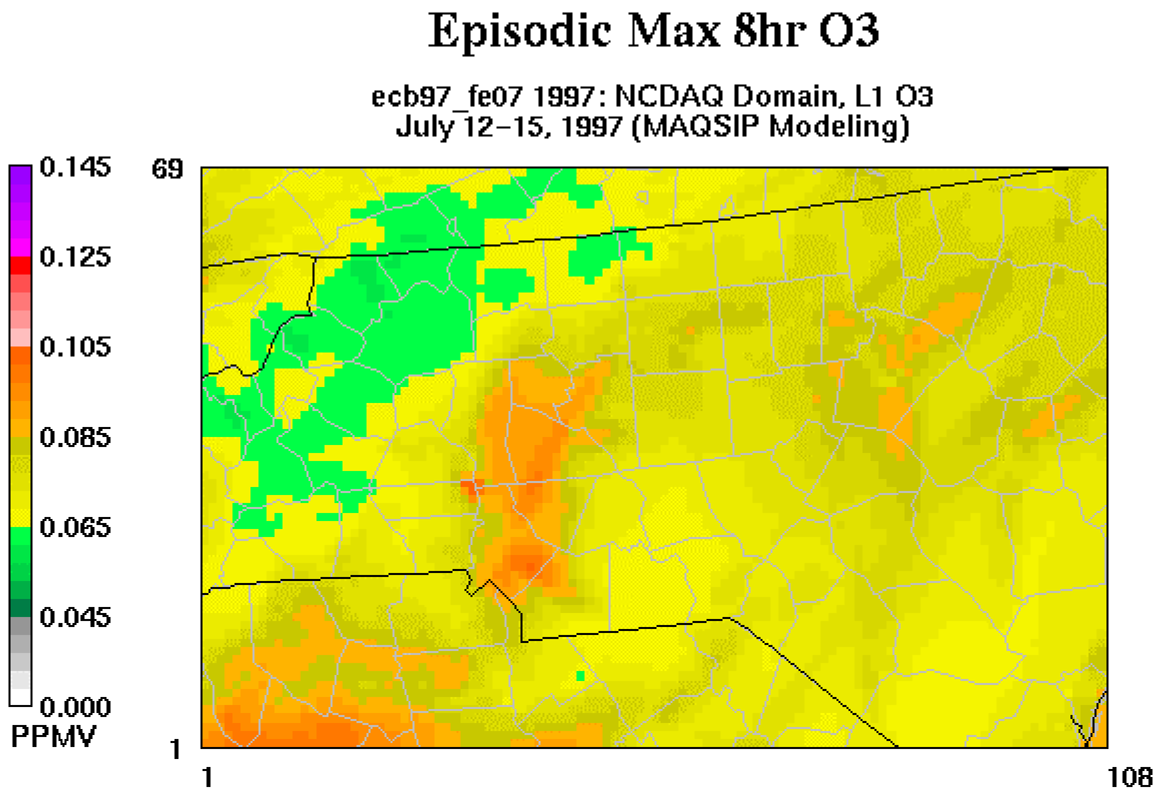
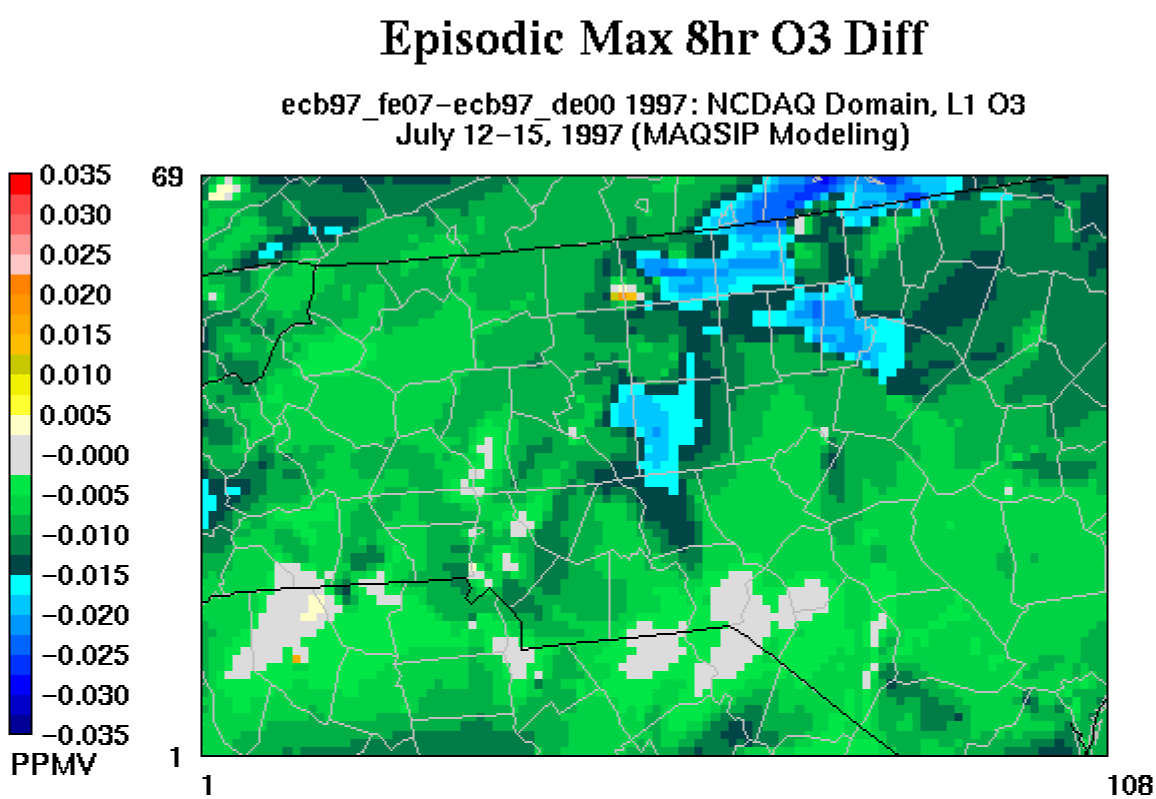


Figure 6.2-6 Difference plot between the 2007 future year and the 2000 current year 8-hour ozone episodic maximum for the 1997 episode.



6.3 Geographic Area Needing Further Controls

The current draft version of EPA's attainment test was applied to the modeling results. In very basic and general language the attainment guidance states if the future year design value for a given monitor is below 0.085 parts per million (ppm) then the monitor passes the attainment test. The future year design value of a monitor is calculated by multiplying the current year design value of a monitor by a relative reduction factor (Equation 6.3-1).

$$DVF = DVC \times RRF \qquad \text{Equation 6.3-1}$$

Where DVF is the Future year Design Value,
DVC is the Current year Design Value, and
RRF is the relative reduction factor.

The Current year Design Value (DVC) in the attainment test framework is defined as the higher of: (a) the average 4th highest value for the 3-yr period used to designate an area "nonattainment", and (b) the average 4th highest value for the 3-yr period straddling the year represented by the most recent available emissions inventory. In this exercise, the DVC used to designate an area nonattainment will be 2001-2003 and the DVC straddling the year represented by the most recent available emissions inventory is 1999-2001. The higher of those two values is shown in Table 6.3-1 as the DVC.The relative reduction factor (RRF) is calculated by taking the ratio of the future year modeling 8-hour ozone daily maximum to the current year modeling 8-hour ozone daily maximum "near" the monitor averaged over all of the episode days (Equations 6.3-2).

$$RRF = \frac{\text{mean future yr. 8-hr daily max "near" monitor "x"}}{\text{mean current yr. 8-hr daily max "near" monitor "x"}} \qquad \text{Equation 6.3-2}$$

The results of applying the attainment test showed all monitors in the Unifour EAC area in attainment of the 8-hour ozone NAAQS in 2007. These results are displayed in Table 6.3-1 below.

Table 6.3-1 Attainment Test Results for the EAC Area

Monitor Name	DVC (ppm)	RRF	DVF (ppm)
Lenoir	0.088	0.88	0.077
Taylorsville	0.087	0.89	0.077

It appears from these preliminary results that the expected controls already in place will result in attainment of the 8-hour ozone NAAQS. However, NCDAQ does not know what the future year design values will be for 2012 and additional control may be needed to continue to attain the standard in 2012.

6.4 Anticipated Resource Constraints

The resource constraint of most concern is the funding needed to implement some of the local control measures. NCDAQ and the local EAC areas are both looking for grant opportunities to help fund EAC initiatives.

References:

1. U.S. EPA. National Ambient Air Quality Standards. http://www.epa.gov/airs/criteria.html.

2. McConnell et al. 2002. Asthma in exercising children exposed to ozone: a cohort study. Lancet 359: 386-391.

3. U.S. EPA. "Smog – Who Does It Hurt? What You Need to Know about Ozone and Your Health" http://www.epa.gov/airnow/health/index.html.

7 APPENDIX A

Stationary Point Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Alamance	0.68	0.66	1.60	0.07	0.76	1.03
Alexander	0.03	0.04	1.38	0.02	0.00	1.66
Alleghany	0.00	0.01	0.03			
Anson	0.13	0.46	0.38	0.00	0.00	0.00
Ashe	0.23	0.16	0.34	0.03	0.01	1.23
Avery	0.00	0.01	0.00			
Beaufort	0.04	0.20	0.30	1.48	2.48	0.34
Bertie	0.69	0.36	0.57	0.18	0.27	1.04
Bladen	0.40	1.19	0.49	0.23	2.33	0.58
Brunswick	14.55	6.64	3.87	4.78	9.81	2.79
Buncombe	1.25	53.32	3.60	13.78	13.79	3.10
Burke	2.55	0.84	5.18	7.87	0.61	13.73
Cabarrus	0.82	3.03	4.06	0.18	2.10	3.60
Caldwell	1.35	1.19	21.88	0.51	0.16	28.09
Camden	0.00	0.00	0.00			
Carteret	0.15	0.22	0.30	0.01	0.11	0.00
Caswell						
Catawba	4.16	96.23	18.81	13.14	51.84	20.46
Chatham	4.51	21.19	2.21	7.90	4.72	2.16
Cherokee	0.02	0.02	0.22			
Chowan	0.03	0.21	0.37	0.03	0.15	0.01
Clay						
Cleveland	0.82	1.70	1.04	0.80	4.46	1.62
Columbus	20.82	15.41	6.93	15.75	9.05	2.53
Craven	4.94	4.21	3.73	4.54	4.94	1.85
Cumberland	1.22	3.16	4.08	0.51	3.76	6.86
Currituck	0.08	0.01	0.00			
Dare	0.05	0.19	0.01	0.01	0.34	0.00
Davidson	3.31	12.16	15.05	3.02	6.34	20.47
Davie	0.17	0.20	1.98	0.09	0.04	3.79
Duplin	0.24	1.10	0.14	1.11	2.41	0.02
Durham	1.00	1.58	1.19	0.30	1.03	5.73
Edgecombe	0.49	5.95	0.90	0.43	7.29	0.02
Forsyth	2.09	6.15	9.76	1.96	6.78	19.96
Franklin	0.28	0.21	1.71	0.01	0.13	0.12
Gaston	3.67	86.48	5.40	21.44	38.21	7.51

Stationary Point Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Gates	0.08	0.03	0.10			
Graham	0.09	0.08	1.29	0.02	0.02	1.38
Granville	0.34	0.36	1.79	0.37	0.13	1.92
Greene	0.00	0.07	0.00			
Guilford	1.59	1.83	18.13	0.17	0.88	39.44
Halifax	6.22	10.72	1.71	17.11	12.80	0.41
Harnett	0.20	0.33	1.12	0.23	0.63	0.62
Haywood	7.85	12.48	5.00	9.26	16.05	2.44
Henderson	0.25	0.31	3.79	0.03	0.43	4.53
Hertford	1.33	0.47	1.13	0.02	0.17	0.24
Hoke	0.08	0.25	0.40	34.24	1.00	10.35
Hyde	0.00	0.04	0.00			
Iredell	3.58	9.98	20.42	3.63	11.15	4.37
Jackson	0.60	0.52	0.38	0.00	0.05	0.00
Johnston	0.80	0.46	1.80	0.02	0.15	2.46
Jones						
Lee	1.37	0.42	1.27	1.14	0.28	0.75
Lenoir	0.63	2.27	1.30	0.14	3.10	0.23
Lincoln	0.76	5.82	2.73	8.90	14.26	2.18
McDowell	2.12	1.04	3.87	0.78	0.71	1.33
Macon	0.11	0.08	0.05			
Madison	0.02	0.07	0.00			
Martin	10.72	10.38	3.24	31.74	9.97	3.18
Mecklenburg	5.49	2.30	11.99	3.32	3.73	23.26
Mitchell	0.41	0.50	2.49	0.13	0.02	2.09
Montgomery	0.24	0.32	1.99	0.05	0.01	0.02
Moore	0.17	0.14	2.29	0.02	0.00	1.74
Nash	9.02	0.97	2.67	0.50	1.06	0.56
NewHanover	35.65	31.96	6.52	46.31	49.30	6.49
Northampton	1.10	0.30	0.86	0.14	0.30	0.10
Onslow	0.34	1.77	0.16	0.09	1.22	0.02
Orange	2.86	1.80	0.37	3.37	0.78	0.01
Pamlico						
Pasquotank	0.10	0.07	0.07	0.01	0.02	0.03
Pender	0.00	0.00	0.05	0.02	0.03	0.01
Perquimans						
Person	5.79	205.34	1.36	13.83	32.70	1.22
Pitt	1.06	0.88	1.95	0.37	0.75	1.11
Polk	0.02	0.03	0.00			
Randolph	0.53	0.38	4.01	0.02	0.07	2.33
Richmond	0.33	0.26	0.17	323.38	11.45	10.71
Robeson	0.92	17.43	1.12	1.64	13.56	2.28
Rockingham	5.60	34.09	16.65	17.02	16.47	8.01

Stationary Point Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Rowan	2.28	37.52	8.27	15.19	19.17	11.65
Rutherford	3.24	49.60	2.56	4.66	13.67	3.45
Sampson	0.24	0.23	0.22			
Scotland	0.38	6.14	3.60	0.57	8.50	7.33
Stanly	26.81	1.15	1.79	17.59	1.36	1.94
Stokes	8.15	324.10	1.01	5.16	22.79	0.62
Surry	3.28	1.09	6.10	6.10	1.06	4.12
Swain	0.00	0.00	0.12			
Transylvania	0.21	5.00	2.83	0.25	7.01	2.55
Tyrrell						
Union	0.81	0.68	1.81	0.03	0.17	2.54
Vance	0.34	1.52	1.16	0.04	1.45	0.00
Wake	1.59	1.49	4.24	0.27	0.94	10.08
Warren	0.18	0.08	0.07			
Washington	0.00	0.00	0.00	0.00	0.01	0.00
Watauga	0.17	0.18	0.13	0.02	0.05	0.00
Wayne	5.08	19.84	3.38	24.50	27.43	1.85
Wilkes	1.88	0.97	5.69	3.68	0.83	6.11
Wilson	0.51	1.48	3.74	0.22	2.51	1.99
Yadkin	0.01	0.03	0.26	0.00	0.00	0.03
Yancey						

Stationary Area Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Alamance	6.21	0.47	5.78	6.65	0.50	6.17
Alexander	3.26	0.20	2.96	3.42	0.21	2.93
Alleghany	1.00	0.08	0.79	1.03	0.08	0.81
Anson	3.83	0.16	1.40	4.14	0.17	1.47
Ashe	2.29	0.17	1.42	2.36	0.17	1.50
Avery	1.61	0.12	0.85	1.66	0.13	0.90
Beaufort	22.68	0.30	5.75	25.28	0.31	5.93
Bertie	6.46	0.16	3.25	7.09	0.17	3.20
Bladen	5.37	0.25	3.08	5.79	0.25	3.13
Brunswick	5.25	0.39	3.12	5.47	0.40	3.26
Buncombe	5.74	0.55	8.11	5.91	0.58	8.66
Burke	4.02	0.32	3.48	4.15	0.33	3.64
Cabarrus	5.81	0.38	5.88	6.26	0.41	6.52
Caldwell	3.19	0.25	3.91	3.32	0.25	4.05
Camden	7.54	0.05	1.35	8.43	0.05	1.40
Carteret	5.22	0.20	2.96	5.67	0.20	3.10
Caswell	3.96	0.18	1.69	4.24	0.19	1.71

Stationary Area Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Catawba	7.04	0.43	11.22	7.48	0.44	11.37
Chatham	4.82	0.34	2.46	5.18	0.36	2.58
Cherokee	2.29	0.19	1.15	2.35	0.20	1.19
Chowan	2.70	0.09	1.61	2.96	0.09	1.65
Clay	0.83	0.08	0.46	0.85	0.08	0.51
Cleveland	8.89	0.43	4.45	9.53	0.45	4.70
Columbus	10.62	0.41	5.37	11.52	0.42	5.36
Craven	6.34	0.28	4.92	6.87	0.29	5.06
Cumberland	6.32	0.51	11.54	6.76	0.54	12.12
Currituck	8.37	0.14	1.61	9.27	0.14	1.71
Dare	0.86	0.08	1.21	0.89	0.08	1.30
Davidson	9.36	0.65	7.74	9.81	0.67	7.96
Davie	4.37	0.19	1.76	4.69	0.20	1.87
Duplin	17.79	0.37	5.91	19.65	0.38	5.95
Durham	2.25	0.35	7.67	2.42	0.39	8.18
Edgecombe	4.60	0.25	5.60	4.96	0.26	5.50
Forsyth	3.94	0.40	11.46	4.18	0.44	12.21
Franklin	7.51	0.36	3.18	8.19	0.37	3.25
Gaston	5.05	0.52	6.85	5.35	0.56	7.35
Gates	1.82	0.08	1.14	1.95	0.09	1.12
Graham	0.75	0.06	0.35	0.77	0.06	0.37
Granville	7.05	0.27	3.27	7.65	0.28	3.34
Greene	5.83	0.15	2.95	6.40	0.16	2.88
Guilford	10.99	0.95	19.33	11.77	1.04	20.36
Halifax	9.79	0.30	5.16	10.73	0.31	5.19
Harnett	8.91	0.51	5.74	9.49	0.52	5.80
Haywood	2.44	0.21	2.08	2.51	0.21	2.18
Henderson	4.02	0.37	3.51	4.14	0.38	3.72
Hertford	5.54	0.13	2.34	6.11	0.13	2.38
Hoke	3.54	0.16	1.85	3.82	0.16	1.88
Hyde	4.91	0.05	1.45	5.48	0.05	1.45
Iredell	9.47	0.51	6.14	10.19	0.54	6.46
Jackson	2.45	0.21	1.23	2.52	0.21	1.30
Johnston	12.71	0.73	9.46	13.78	0.76	9.42
Jones	4.70	0.08	1.81	5.20	0.09	1.78
Lee	4.54	0.21	2.57	4.90	0.22	2.68
Lenoir	8.28	0.26	5.44	9.09	0.27	5.45
Lincoln	6.50	0.30	2.82	7.01	0.31	3.04
McDowell	2.28	0.20	1.30	2.35	0.21	1.37
Macon	1.85	0.14	0.98	1.90	0.14	1.02
Madison	1.87	0.18	1.41	1.93	0.18	1.42
Martin	5.52	0.23	3.59	5.93	0.24	3.54
Mecklenburg	4.61	0.99	25.87	4.97	1.12	28.14

Stationary Area Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Mitchell	1.47	0.11	0.91	1.52	0.11	0.93
Montgomery	2.44	0.18	1.81	2.53	0.19	1.83
Moore	4.97	0.35	3.49	5.20	0.37	3.66
Nash	9.24	0.42	7.76	10.02	0.44	7.75
NewHanover	0.77	0.12	6.04	0.79	0.13	6.51
Northampton	5.09	0.16	2.65	5.55	0.17	2.60
Onslow	6.21	0.34	5.99	6.59	0.35	6.29
Orange	5.03	0.40	4.54	5.42	0.43	4.79
Pamlico	6.27	0.10	1.38	6.95	0.11	1.44
Pasquotank	12.97	0.14	3.18	14.47	0.14	3.37
Pender	5.90	0.28	2.47	6.30	0.29	2.61
Perquimans	6.91	0.09	1.76	7.68	0.09	1.79
Person	6.29	0.23	2.42	6.85	0.24	2.49
Pitt	9.95	0.46	9.13	10.78	0.47	9.36
Polk	1.57	0.13	0.70	1.61	0.13	0.74
Randolph	10.44	0.66	9.38	11.07	0.68	9.47
Richmond	2.58	0.20	2.01	2.71	0.21	2.11
Robeson	28.32	0.70	9.95	31.17	0.72	10.19
Rockingham	8.86	0.46	4.47	9.48	0.48	4.64
Rowan	9.50	0.46	5.66	10.28	0.49	6.08
Rutherford	4.44	0.31	2.68	4.64	0.33	2.96
Sampson	17.24	0.43	7.57	18.96	0.44	7.53
Scotland	7.55	0.17	2.36	8.33	0.17	2.47
Stanly	8.31	0.32	3.28	9.01	0.33	3.42
Stokes	4.56	0.26	2.42	4.82	0.27	2.45
Surry	6.15	0.37	4.01	6.47	0.38	4.16
Swain	1.22	0.10	0.50	1.26	0.10	0.52
Transylvania	1.75	0.16	1.08	1.80	0.17	1.14
Tyrrell	10.04	0.03	1.72	11.27	0.04	1.79
Union	23.79	0.55	7.20	26.31	0.58	7.68
Vance	4.19	0.19	2.43	4.52	0.19	2.51
Wake	10.49	1.24	24.71	11.31	1.35	26.08
Warren	4.18	0.16	1.44	4.52	0.16	1.47
Washington	12.80	0.08	2.51	14.34	0.09	2.60
Watauga	2.41	0.20	1.82	2.48	0.20	1.91
Wayne	16.32	0.48	7.91	17.91	0.49	8.07
Wilkes	4.79	0.37	3.35	4.95	0.38	3.49
Wilson	5.47	0.29	6.51	5.92	0.30	6.46
Yadkin	6.30	0.23	2.77	6.82	0.23	2.85
Yancey	1.67	0.12	0.90	1.72	0.13	0.92

Nonroad Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Alamance	29.54	2.98	2.37	33.64	2.91	2.04
Alexander	4.00	0.51	0.37	4.36	0.53	0.33
Alleghany	2.49	0.36	0.18	2.78	0.33	0.14
Anson	4.19	1.13	0.50	4.55	0.95	0.39
Ashe	3.91	0.44	0.41	4.54	0.43	0.44
Avery	5.37	0.52	0.59	6.39	0.47	0.65
Beaufort	13.85	2.81	2.74	15.07	2.51	2.30
Bertie	6.43	1.66	1.12	6.78	1.48	0.88
Bladen	8.96	1.81	1.44	10.50	1.59	1.66
Brunswick	27.00	2.10	4.70	30.90	1.88	4.16
Buncombe	48.93	4.51	4.43	57.45	4.28	4.27
Burke	14.79	2.10	1.51	16.50	2.05	1.51
Cabarrus	44.68	4.19	3.28	51.35	3.78	2.38
Caldwell	16.55	2.38	1.77	18.65	2.34	1.89
Camden	2.84	0.41	0.99	2.90	0.39	0.80
Carteret	49.17	1.82	14.18	54.95	1.90	12.43
Caswell	2.26	1.07	0.23	2.51	0.85	0.17
Catawba	47.03	5.15	4.20	53.29	5.17	3.95
Chatham	12.91	1.83	1.40	14.40	1.68	1.09
Cherokee	3.99	0.40	0.56	4.58	0.40	0.57
Chowan	4.05	0.47	1.14	4.45	0.46	1.03
Clay	2.19	0.15	0.43	2.72	0.14	0.54
Cleveland	21.51	2.13	1.75	24.58	2.08	1.52
Columbus	9.85	2.12	1.11	11.13	1.89	1.00
Craven	24.08	2.20	2.66	27.45	1.94	1.98
Cumberland	59.31	6.51	4.85	68.38	5.86	3.84
Currituck	15.63	0.77	4.69	17.55	0.77	4.24
Dare	46.18	1.33	18.14	49.76	1.54	15.68
Davidson	30.96	4.24	2.64	35.03	3.90	2.24
Davie	6.77	0.61	0.88	8.20	0.61	1.12
Duplin	10.19	2.36	0.97	11.18	2.13	0.73
Durham	70.50	9.63	6.04	79.17	9.06	5.09
Edgecombe	11.11	2.57	0.97	12.27	2.28	0.78
Forsyth	91.57	6.94	6.70	105.60	6.76	5.27
Franklin	8.37	1.05	0.78	9.71	0.93	0.70
Gaston	54.10	4.77	3.98	61.82	4.70	3.33
Gates	1.58	0.50	0.21	1.69	0.45	0.16
Graham	1.40	0.13	0.25	1.55	0.12	0.20
Granville	13.73	1.39	1.23	15.64	1.32	1.03
Greene	2.31	0.70	0.21	2.52	0.64	0.16
Guilford	194.02	14.69	14.06	226.39	13.97	10.89

Nonroad Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Halifax	8.68	2.13	0.92	9.77	1.86	0.83
Harnett	22.07	1.84	1.65	25.33	1.72	1.21
Haywood	11.35	1.08	1.15	13.38	1.00	1.19
Henderson	31.53	2.07	3.82	38.22	1.95	4.41
Hertford	4.08	0.54	0.48	4.74	0.50	0.48
Hoke	3.35	0.64	0.28	3.61	0.62	0.24
Hyde	25.38	1.93	11.68	25.59	1.94	9.56
Iredell	21.67	2.88	2.10	24.69	2.78	1.97
Jackson	6.55	0.51	0.75	7.75	0.46	0.76
Johnston	35.04	3.41	2.84	40.55	3.09	2.26
Jones	1.83	0.46	0.15	2.05	0.41	0.12
Lee	16.81	2.46	1.35	18.80	2.29	1.07
Lenoir	16.43	2.14	1.31	18.63	2.00	1.01
Lincoln	14.00	1.49	1.27	16.03	1.38	1.10
McDowell	7.93	1.84	1.14	9.18	1.61	1.36
Macon	10.89	0.53	0.97	12.89	0.50	0.91
Madison	1.73	0.56	0.17	1.96	0.45	0.13
Martin	4.71	1.32	0.51	5.37	1.16	0.51
Mecklenburg	351.64	23.31	24.93	298.78	21.99	18.42
Mitchell	3.61	1.02	0.51	4.27	0.85	0.61
Montgomery	4.89	0.71	0.58	5.34	0.66	0.48
Moore	27.52	1.89	1.95	31.86	1.73	1.41
Nash	21.77	2.69	1.71	24.83	2.47	1.32
NewHanover	58.02	4.59	5.80	67.25	4.20	4.55
Northampton	4.56	0.97	0.71	5.20	0.86	0.65
Onslow	26.34	3.52	3.92	29.60	3.21	3.31
Orange	31.55	3.66	3.18	37.13	3.19	3.09
Pamlico	9.11	0.88	3.58	9.63	0.85	3.09
Pasquotank	9.56	0.93	1.42	10.86	0.88	1.12
Pender	13.17	1.02	1.77	15.00	0.95	1.44
Perquimans	3.95	0.65	1.27	4.10	0.60	1.02
Person	8.34	0.85	0.80	9.41	0.82	0.64
Pitt	25.16	4.26	1.98	28.79	3.78	1.53
Polk	2.69	0.46	0.22	3.03	0.39	0.17
Randolph	27.23	2.82	2.20	30.77	2.85	1.94
Richmond	14.38	4.66	1.43	15.38	4.02	1.05
Robeson	19.63	5.97	1.91	21.45	5.21	1.62
Rockingham	15.35	2.44	1.55	17.39	2.26	1.63
Rowan	28.37	5.47	2.59	31.85	4.75	2.11
Rutherford	13.10	2.19	1.27	14.86	2.00	1.27
Sampson	10.67	2.15	0.92	11.89	1.96	0.70
Scotland	8.59	1.82	0.75	9.46	1.64	0.63
Stanly	16.77	2.09	1.54	19.02	1.96	1.29

Nonroad Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Stokes	8.18	0.68	0.72	9.54	0.61	0.64
Surry	30.76	1.96	2.43	35.44	1.98	2.05
Swain	4.84	0.35	1.35	6.47	0.32	1.88
Transylvania	15.89	0.68	2.79	20.28	0.67	3.77
Tyrrell	6.72	0.61	2.94	6.76	0.61	2.38
Union	47.65	3.89	3.56	55.34	3.56	2.71
Vance	6.24	1.24	0.75	6.84	1.14	0.62
Wake	242.05	18.83	17.61	281.90	17.33	12.59
Warren	3.51	0.70	0.58	3.85	0.56	0.43
Washington	5.43	1.03	1.44	5.68	0.95	1.16
Watauga	9.79	0.50	1.19	12.02	0.48	1.41
Wayne	26.05	3.51	2.10	29.98	3.27	1.71
Wilkes	16.62	1.37	1.38	19.09	1.32	1.17
Wilson	23.57	2.99	1.95	27.15	2.67	1.56
Yadkin	6.59	0.89	0.52	7.45	0.83	0.40
Yancey	7.75	0.37	0.87	9.32	0.34	0.94

Highway Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Alamance	93.84	13.48	8.34	54.81	9.52	5.01
Alexander	15.87	1.75	1.41	10.67	1.27	1.02
Alleghany	6.87	0.74	0.61	3.84	0.45	0.37
Anson	22.65	2.93	1.90	14.23	2.00	1.25
Ashe	15.28	1.61	1.36	8.98	1.03	0.86
Avery	13.78	1.66	1.18	7.98	1.05	0.73
Beaufort	31.89	3.55	2.81	19.36	2.35	1.81
Bertie	19.81	2.38	1.70	12.41	1.61	1.14
Bladen	29.89	3.22	2.65	18.60	2.18	1.78
Brunswick	67.90	8.19	5.82	39.68	5.53	3.69
Buncombe	149.98	23.51	13.10	87.96	16.25	7.83
Burke	65.51	12.34	5.64	36.98	7.79	3.38
Cabarrus	69.09	12.04	6.19	50.62	8.59	4.20
Caldwell	44.10	5.01	3.89	25.98	3.41	2.48
Camden	7.47	0.90	0.64	4.68	0.61	0.43
Carteret	43.77	5.41	3.74	22.53	3.19	2.10
Caswell	16.69	2.00	1.44	10.41	1.34	0.95
Catawba	113.03	15.57	10.08	66.68	10.71	6.25
Chatham	45.51	5.79	3.85	27.65	4.01	2.55
Cherokee	17.05	2.25	1.42	12.85	1.73	1.15
Chowan	8.16	0.92	0.72	4.87	0.60	0.45
Clay	6.05	0.68	0.53	3.81	0.46	0.36

Highway Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Cleveland	68.95	10.19	5.97	37.44	6.17	3.49
Columbus	43.72	5.12	3.80	27.16	3.52	2.47
Craven	57.77	6.75	5.06	34.07	4.53	3.19
Cumberland	197.16	28.43	17.85	108.27	18.56	10.31
Currituck	21.48	2.50	1.86	14.09	1.77	1.33
Dare	37.56	4.27	3.27	20.22	2.55	1.89
Davidson	105.57	17.25	9.73	61.60	11.04	6.06
Davie	32.17	7.98	2.67	20.32	5.05	1.78
Duplin	46.97	8.80	4.00	32.00	6.34	2.86
Durham	130.59	24.00	11.93	90.71	14.51	7.74
Edgecombe	41.11	4.72	3.61	23.96	3.17	2.28
Forsyth	188.14	33.73	18.97	125.17	19.34	12.44
Franklin	32.41	3.79	2.81	19.70	2.63	1.89
Gaston	87.61	16.61	8.66	56.34	9.20	5.28
Gates	8.85	1.12	0.75	5.30	0.73	0.47
Graham	4.84	0.50	0.43	3.31	0.39	0.32
Granville	48.49	9.82	5.02	27.96	5.43	3.29
Greene	14.77	1.63	1.30	9.41	1.14	0.89
Guilford	274.08	47.66	27.88	179.81	26.94	18.09
Halifax	48.63	11.44	4.09	31.41	7.19	2.75
Harnett	58.38	9.34	5.01	34.75	6.19	3.25
Haywood	58.30	14.16	4.81	33.85	8.92	2.99
Henderson	59.39	10.05	5.15	34.27	6.56	3.17
Hertford	15.08	1.71	1.32	9.26	1.14	0.87
Hoke	18.56	2.22	1.60	12.36	1.62	1.13
Hyde	4.39	0.48	0.39	2.61	0.32	0.25
Iredell	119.96	29.26	10.08	71.75	18.66	6.42
Jackson	36.42	4.77	3.04	23.49	3.29	2.08
Johnston	123.04	28.31	10.21	81.29	19.92	7.25
Jones	14.67	1.89	1.23	8.62	1.19	0.76
Lee	39.67	4.49	3.51	23.25	3.03	2.21
Lenoir	44.38	4.70	4.04	23.50	2.85	2.31
Lincoln	37.27	4.27	3.28	21.48	2.82	2.08
McDowell	42.05	9.85	3.48	26.32	3.48	2.37
Macon	24.61	3.09	2.08	15.13	2.02	1.37
Madison	13.33	1.64	1.14	8.25	1.10	0.75
Martin	25.08	3.06	2.15	15.47	3.65	1.34
Mecklenburg	341.23	67.76	34.75	222.60	36.34	21.26
Mitchell	9.55	1.09	0.83	5.95	0.75	0.55
Montgomery	26.55	3.60	2.27	18.18	2.61	1.66
Moore	53.39	5.90	4.73	29.76	3.77	2.87
Nash	93.59	17.62	7.97	53.90	10.92	4.94
NewHanover	81.67	9.12	7.49	48.41	6.14	4.72

Highway Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
Northampton	23.32	4.79	1.95	13.92	2.79	1.24
Onslow	67.91	7.55	6.03	35.66	4.56	3.41
Orange	62.40	18.80	5.30	44.95	11.91	3.63
Pamlico	9.21	0.93	0.83	5.79	0.64	0.56
Pasquotank	17.53	1.94	1.57	11.15	1.36	1.03
Pender	40.59	8.15	3.41	28.50	5.88	2.53
Perquimans	9.69	1.24	0.82	6.19	0.86	0.54
Person	21.02	2.25	1.89	12.96	1.51	1.23
Pitt	78.82	8.47	7.05	43.54	5.36	4.24
Polk	19.00	4.60	1.56	13.94	3.39	1.19
Randolph	97.79	13.69	8.46	57.60	9.14	5.31
Richmond	40.70	4.98	3.52	24.96	3.35	2.22
Robeson	107.26	20.38	9.20	61.34	12.86	5.62
Rockingham	66.14	7.51	5.82	37.21	4.86	3.57
Rowan	89.79	17.34	7.75	53.43	11.46	4.96
Rutherford	40.07	4.52	3.53	20.79	2.69	2.01
Sampson	51.06	8.35	4.42	32.73	5.69	2.97
Scotland	29.90	3.44	2.64	18.93	2.37	1.73
Stanly	37.66	4.01	3.39	20.69	2.53	2.03
Stokes	24.78	2.82	2.17	13.71	1.79	1.32
Surry	64.94	12.67	5.54	37.68	7.79	3.49
Swain	13.82	1.69	1.18	7.71	1.01	0.70
Transylvania	22.41	2.47	1.99	14.04	1.68	1.33
Tyrrell	3.78	0.49	0.32	2.31	0.33	0.20
Union	56.79	7.70	5.15	39.75	5.00	3.48
Vance	33.57	6.29	2.89	22.07	4.29	1.95
Wake	306.82	59.29	27.61	224.96	39.69	18.67
Warren	15.84	3.56	1.32	10.53	2.39	0.92
Washington	11.19	1.43	0.94	6.82	0.95	0.60
Watauga	25.14	3.08	2.17	15.08	2.02	1.34
Wayne	68.83	7.28	6.20	39.66	4.84	3.87
Wilkes	47.93	5.55	4.18	25.57	3.39	2.45
Wilson	61.49	10.12	5.37	35.49	6.44	3.32
Yadkin	34.98	7.13	2.92	21.93	4.42	1.92
Yancey	11.33	1.45	0.96	6.74	0.93	0.60