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Planning Today for Clean Air Tomorrow

AIR QUALITY STAKEHOLDERS OF CUMBERLAND COUNTY

GEORGE BREECE
CHAIRMAN
(910) 484-5430

MAYOR EDWIN S. DEAVER
VICE-CHAIRMAN
(910) 424-4555

December 30, 2003

Ms. Kay Prince
US Environmental Protection Agency
Region 4
61 Forsyth St. S.W.
Atlanta, GA 30303-8960

Dear Ms. Prince:

On behalf of the Air Quality Stakeholders of Cumberland County, I am submitting our Bi-Annual Progress Report.

If you have any questions or if I can provide any additional information please contact me or Mrs. Maurizia Chapman at the above address.

Sincerely,

Nancy Roy, AICP
Director, Cumberland County Planning & Inspections Department
Technical Committee Chair

CC: Richard Schutt, USEPA w/enclosures
Sheila Holman, NCDAQ w/enclosures
Air Quality Stakeholders of Cumberland County
Air Quality Technical Committee Members

Bi-Annual Progress Report
Of the
Early Action Compact
In the Fayetteville Metropolitan Statistical Area
North Carolina

Planning Today for Clean Air Tomorrow

An Agreement of Partnership by USEPA Region 4, North Carolina Department of Environment and Natural Resources, and the Cumberland County Board of Commissioners

December 31, 2003

Introduction

The Fayetteville Metropolitan Statistical Area Early Action Compact requires that a semiannual report of activities undertaken by the state and local partners be submitted to the Environmental Protection Agency as part of milestones determination. The December 31, 2003 report will outline dates and times of Stakeholders and Technical Committee members' activities, public outreach, strategies still being considered for implementation, jurisdictions adopting the remaining strategies, implementation schedule and, when possible, preliminary emission reductions. The second part of this report includes the information provided by the North Carolina Department of the Environment and Natural Resources, Division of Air Quality.

Many of the most important and beneficial strategies are not readily quantifiable, due to the type of activities they entail, or to the fact that actual data is not readily available at this time. The awareness strategies will likely have the higher impact, but no actual NOx reductions can be quantified because these strategies will require a behavioral change, rather than a regulatory change. We believe that, through a good awareness campaign combined with the other strategies we are proposing, this area will reach the maximum allowed emission reductions for voluntary measures of 3%.

Meetings and Public Involvement activities

Staff attended the following meetings or participated in:

- Stakeholders Meetings (minutes available upon request)

  July 10, 2003

  October 16, 2003

- Technical Committee Meetings (minutes available upon request)

  July 2, 2003

  August 26, 2003

  September 30, 2003

  October 28, 2003

  December 9, 2003

- Meetings with Governing Bodies – Selection and/or presentation of Local Strategies

Town of Falcon	August 4, 2003
Town of Linden	August 19, 2003
Town of Stedman	September 4, 2003
Town of Spring Lake	September 8, 2003

Town of Wade	September 9, 2003
Town of Godwin	September 15, 2003
Town of Hope Mills	September 15, 2003
City of Fayetteville	September 22, 2003

- Meetings with Cumberland County Commissioners

  October 6, 2003

  December 15, 2003

- Air Quality Presentations

Rotary Club of Haymount	July 28, 2003
Joint City/County Planning Meeting	July 29, 2003
Cumberland County Business Group	December 9, 2003
Pine Forest High School	December 16, 2003
(Advanced Placement Ecology Class)	

- Public Outreach Meetings

  One (1) Walmart Super Store

  Five (5) Fire Stations

  One (1) Transit Transfer Point

- Public Events

Umoja Festival	August 23, 2003
Cumberland County Fair	September 9 – 14, 2003
Environmental Field Day	September 13, 2003
(at Cross Creek Mall)	
Fayetteville Urban Ministries	October 4, 2003
Fayetteville State University	
Commuters Orientation	August 15, 2003
New Student Orientation	August 18, 2003
Health Fair	September 10, 2003
Fayetteville Technical Community College	
Holiday Health Fair	November 12, 2003
Health Department	
Local Church Health Fair	September 28, 2003

Planning Today for Clean Air Tomorrow

AIR QUALITY STAKEHOLDERS OF CUMBERLAND COUNTY SELECTED OZONE CONTROL STRATEGIES AND IMPLEMENTATION SCHEDULE DECEMBER 2003

AIR QUALITY STAKEHOLDERS OF CUMBERLAND COUNTY
SELECTED OZONE CONTROL STRATEGIES AND IMPLEMENTATION SCHEDULE
DECEMBER 2003

STRATEGY	STRATEGY DESCRIPTION	ESTIMATE OF NOX REDUCTIONS (if available)	DRAFT IMPLEMENTATION DATE	ADOPTING JURISDICTIONS
LAND USE				
Landscape Ordinance	Require landscaping of major nonresidential developments within the MSA, including retrofitting older developments	It is believed that this strategy will lower NO_X emissions. The emission reductions are not currently quantifiable, but this strategy is directionally correct.	**December 2005** – County-wide **December 2003** – Fort Bragg implements the Sustainable Installation Design Guide.	Cumberland County City of Fayetteville* Falcon Godwin Hope Mills Linden Spring Lake Stedman Wade Fort Bragg
Conduct a Smart Growth Audit	Conduct a benchmark land use assessment and compare it with Smart Growth policies. To complete in conjunction with new Zoning Ordinance and Land Use Plans	It is believed that this strategy will lower NO_X emissions. The emission reductions are not currently quantifiable, but this strategy is directionally correct.	**December 2005**	Cumberland County City of Fayetteville* Falcon Godwin Hope Mills Linden Spring Lake Stedman Wade
Transit/Pedestrian/Mixed Use Oriented Development	Add a mixed-use alternative to zoning ordinance along transit lines and include sidewalks, shade trees, benches, and landscaping as well as bike paths/lanes which will increase the desirability of walking and biking and promote the use of transit. Work with schools and parks to facilitate pedestrian crossing from subdivisions to schools. Fort Bragg is building upon existing mixed used development by adding pedestrian trails and sidewalks.	Can be quantified – Page 26 of "Improving Air Quality Through Land Use Activities" www.epa.gov/otaq/transp/landguid.htm Portland Oregon study supports 8% decrease in VMT and NOX emissions decrease of 6%.	**December 2005** **Ongoing at Fort Bragg**	Cumberland County City of Fayetteville* Falcon Godwin Hope Mills Linden Spring Lake Stedman Wade Fort Bragg

Infill Development	Promote infill and brownfield development in urban areas, to utilize existing infrastructure and to decrease and/or maintain VMTs. Strengthening the downtown area. Economic Incentives are available for businesses in the downtown area through the Downtown Loan Program and Historic Properties, a public/private partnership.	It is believed that this strategy will lower NO_X emissions by decreasing VMT (promotes Pedestrian Transit and Mass Transit Use). The emission reductions are not currently quantifiable, but this strategy is directionally correct.	**Ongoing** City of Fayetteville allows Zero Lot Line Subdivision Development encouraging infill development. Fort Bragg will continue to redevelop existing urban land use. The majority of projects are built on the currently developed sites instead of new, undisturbed sites.	Cumberland County City of Fayetteville* Falcon Godwin Hope Mills Linden Spring Lake Stedman Wade Fort Bragg
Shared Parking Facilities and Connectivity	This will reduce the amount of impervious surface, which contributes to the heat island effect and reduces the amount of stop and go traffic.	It is believed that this strategy will lower NO_X emissions by decreasing VMT. The emission reductions are not currently quantifiable, but this strategy is directionally correct.	**December 2005**	Cumberland County City of Fayetteville* Falcon Godwin Hope Mills Linden Spring Lake Stedman Wade
Urban Reforestation/ Green Space	Public Works Commission has policies to maintain tree coverage in watershed areas and seek to expand land acquisition for preservation of the watershed. NC Forest Services is seeking grant funding to plant at least 100 trees. Cumberland County to complete a public green space inventory of the entire county. Conservation Subdivision Option	It is believed that this strategy will lower NO_X emissions by reducing the heat island affect. The emission reductions are not currently quantifiable, but this strategy is directionally correct.	**Ongoing** **Ongoing** **March 2004** **Under Investigation**	Cumberland County City of Fayetteville* Falcon Godwin Hope Mills Linden Spring Lake Stedman Wade

MOBILE SOURCES				
Alternative Fuels and AF Vehicles	Fort Bragg has developed a plant to convert its fleet to Bio-Diesel 20 and Ethanol E85. This project includes an AF fueling station. 185 vehicles will be converted to B20 (100,000 gallons of diesel fuel). 158 Flexible Fuel vehicles to use approximately 55,000 gallons of E84 per year.	Mobile 6.2 will be used to calculate the emission reductions using data provided.	**December 2005**	Fort Bragg
Idling Restrictions	Festival Park will include electrical outlets for use to reduce truck idling during festivals.	It is expected that this project will decrease NOx emissions. Emission reductions will be quantified upon project completion and based upon events scheduled.	**October 2005**	City of Fayetteville* Falcon Godwin Linden Stedman Wade
Retrofitting Diesel School Buses	Fort Bragg has submitted a grant application to receive funding to retrofit the school buses serving the Fort Bragg Schools.	It is expected that this project will decrease NOx emissions. Emission reductions will be quantified in the January 2004 report.	**Spring 2004**	Fort Bragg
GOVERNMENT				
Discourage Open Burning on Ozone Alert Days (orange or above)	Representation on OBOT (NC DAQ Open Burning Outreach Team). Will assist NCDAQ in distributing outreach material targeted to reduce open burning.	OBOT will provide assistance in quantifying emission reductions.	**Ongoing** The initial meeting is December 18, 2003.	Cumberland County City of Fayetteville* Falcon Godwin Linden Spring Lake Stedman Wade

TRANSPORTATION				
Using Intelligent Transportation Systems (ITS) and Dynamic Message Signs (DMS) for Congestion Management and Ozone Alerts	Project U-3635 Closed Loop Signal System will provide a new area-wide closed loop signal system. Dynamic Message Signs will be installed at congested intersections/corridors. Expansion of existing continuous flow right turn lanes in the urbanized area.	It is expected that this project will decrease NOx emissions by decreasing traffic congestion. Emission reductions will be quantified in the January 2004 report.	**2004** is expected completion year for Project U-3635.	Cumberland County City of Fayetteville* Hope Mills
Enhance Mass Transit System	Redesign routes to be more convenient to riders. Increase frequency of transit services to 15 minutes. Fort Bragg initiated a shuttle service providing service around the post and connecting with municipal transit.	It is believed that this strategy will lower NO_X emissions by decreasing VMT. Quantification will be provided when implemented.	**December 2005 - FAST** **June 2003 – Fort Bragg**	City of Fayetteville* Fort Bragg
Formulate Car and Van Pooling Increase Rural Transportation Paratransit	Development of Database to connect riders. Vanpooling and carpooling programs are being advertised by transit provider. Rural transportation is currently being expanded to connect outlying areas of the county and smaller municipalities.	It is believed that this strategy will lower NO_X emissions. Quantification will be provided when implemented.	**December 2004**	City of Fayetteville* Falcon Godwin Stedman Wade
Encourage Park and Ride for Large Events	FAST and Private Transportation providers (i.e. Festival of Flight) are providing shuttle at nominal cost to public. For Bragg provides internal transportation services for large on-post events at no cost to the rider.	Emission reductions will be quantified for each event and included in semi-annual updates.	**Ongoing**	City of Fayetteville* Fort Bragg

CONSERVATION				
Use renewable energy sources when available (i.e. solar and methane)	Cumberland County Landfill harvests methane and through a contract with Biomass Energy, sells the energy to Cargill Inc., a local industry. Cargill Inc. is using 1000 cubic feet/minute of landfill gas. Biomass Energy estimates that this usage can be increased to 1600 cubic feet/minute over the next 4-5 years. Encourage residents and businesses to support NC Green Power, a nonprofit program working to encourage development of renewable energy sources. A $4.00 contribution purchases one block of green power (equivalent to 100 kilowatt-hours).	This strategy will lower NOx emissions. Emission reductions will be quantified for the January 31, 2004 report.	**Ongoing** **Spring 2004** – Promote during AQ outreach, include link on County website.	Cumberland County
Retrofitting of public buildings. Encourage construction of energy efficient buildings.	Through the "Guaranteed Energy Savings Contract", the County will engage a company to evaluate and upgrade buildings equipment and material to increase energy efficiency. PWC is a member of the "Good Cents" Housing Program. Participating builders receive heat pump rebates and free listing of energy efficient homes for sale in the local newspaper and on the PWC website. Smaller municipalities are also promoting the "Good Cents" Housing Program. Fort Bragg is currently implementing energy reduction per Executive Order 13123 and as part of its Sustainability Plan by partnering with Honeywell Corporation to retrofit buildings on Fort Bragg (replacing inefficient interior/ exterior lighting, installing new HVAC systems with energy controls for optimum building performance. Fort Bragg also constructs new homes and retrofits older homes to meet "ENERGY STAR" standards.	It is believed that this strategy will lower NO_X emissions by reducing the output needed from fossil fuel plants to heat and cool homes and public building. We are still trying to quantify emission reductions, but feel this strategy is directionally correct.	**December 2004 –** "Guaranteed Energy Savings Contract" **Ongoing –** Promotion of "Good Cents" Housing Program **Ongoing –** Fort Bragg	Cumberland County City of Fayetteville* Falcon Godwin Linden Spring Lake Stedman Wade Fort Bragg
Encourage Construction and Use of Energy Efficient Equipment. Promote Purchase of "Green"/ less polluting products.	Fort Bragg is implementing energy reduction strategies including low NOX burners in new major emission sources, is increasing the use of water-based paints to reduce VOC emissions and has installed a paint booth which uses only water-based paint, and is researching alternatives to replace two incinerators.	These strategies will lower NOx and VOC emissions. Emission reductions will be quantified for the January 31, 2004 report. Research efforts will include emission reductions.	**Ongoing** – specified under current contract. **Summer 2004** –initiate research on alternatives for the incinerators.	Fort Bragg.

AWARENESS				
Student Outreach through Education Systems	Ongoing effort using the "GLOBE" program, a worldwide hands-on, primary and secondary school-based educational science program. This is a cooperative effort, led in the US by a federal interagency program supported by NASA (National Aeronautics & Space Administration), NSF (National Science Foundation), EPA (Environmental Protection Agency) and the U.S. State Department. There are currently 9,000 teachers in our area who are trained and present the program that promotes environmental stewardship and research. Staff, Air Quality Stakeholders, and Technical Committee members are also providing classroom presentations upon request.	It is believed that this strategy will lower NO_X emissions. The emission reductions are not currently quantifiable, but this strategy is directionally correct.	**Ongoing**	Cumberland County City of Fayetteville* Falcon Godwin Linden Stedman Wade
Public Education/Outreach at Community Events & Churches	Ongoing effort through the Speakers Bureau. Staff and volunteers participate in festivals, fairs, community meetings, etc to provide information on air quality and the individual measures that can be taken to improve the air we breathe.	It is believed that this strategy will lower NO_X emissions. The emission reductions are not currently quantifiable, but this strategy is directionally correct.	**Ongoing**	Cumberland County City of Fayetteville* Falcon Godwin Linden Spring Lake Stedman Wade
Speakers Bureau	Participation in radio/television programs to reach the general public with air quality information and tips, advertise meetings and involve the local newspapers and churches in disseminating information to increase public awareness and participation in implementing voluntary reduction strategies.	It is believed that this strategy will lower NO_X emissions. The emission reductions are not currently quantifiable, but this strategy is directionally correct.	**Ongoing**	Cumberland County City of Fayetteville* Falcon Godwin Linden Spring Lake Stedman Wade
Air Quality Web Page	Maintained and updated by FAMPO (Fayetteville Metropolitan Planning Organization). Provides information on upcoming meetings, seasonal air quality tips, the Early Action Compact program and other relevant topics.	It is believed that this strategy will lower NO_X emissions. This strategy is directionally correct.	**Ongoing**	Cumberland County

Promote Bus Ridership for Youth	Fayetteville Area System of Transit (FAST) is promoting bus tours for children of all ages, educating them on how to use the transit system and the benefits of using transit (including air quality and health issues). Various organizations have tours for groups (i.e. Boys and Girls Club) which includes giving them free bus passes.	It is believed that this strategy will lower NO_X emissions by increasing future mass transit use and decreasing VMT. The emission reductions are not currently quantifiable, but this strategy is directionally correct.	**Summer 2003** **Ongoing Effort**	City of Fayetteville*
Air Quality Educational System at the local libraries.	Air Quality handouts and flyers available at all branches. Children's summer program.	It is believed that this strategy will lower NO_X emissions. The emission reductions are not likely quantifiable, but this strategy is directionally correct.	**Ongoing** **Summer of 2004**	Cumberland County
Air Quality poster/essay contest for schools.	Air Quality related contest to raise air awareness.	It is believed that this strategy will lower NO_X emissions. The emission reductions are not likely quantifiable, but this strategy is directionally correct.	**Spring 2004** (public schools) **Spring 2005** (public and private schools)	Cumberland County Fort Bragg

- **City of Fayetteville is scheduled to review and adopt strategies in the second week of January 2004.**

NORTH CAROLINA DEPARTMENT OF THE ENVIRONMENT AND NATURAL RESOURCES DIVISION OF AIR QUALITY SEMIANNUAL REPORT FOR THE FAYETTEVILLE METROPOLITAN STATISTICAL AREA

DECEMBER 2003

1 INTRODUCTION

As a requirement of the Fayetteville 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. Discussed in this report is an overview of the air quality in Cumberland County, 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.

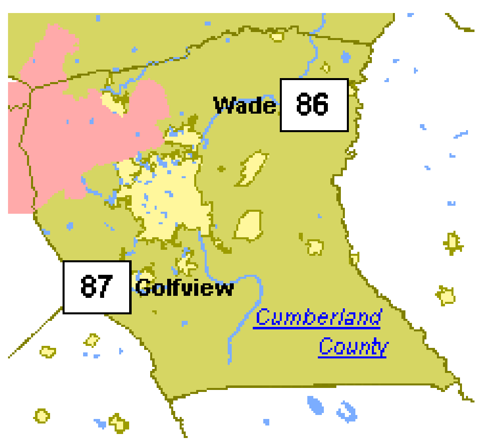
2 Overview of Air Quality In Cumberland County

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 Cumberland County and reports these levels to the EPA. According to the most recent data, Cumberland County is meeting national ambient standards for five of the pollutants, but is not meeting the Federal 8-hour standard for ground-level ozone. 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 Cumberland County. One of the monitors is located northeast of Fayetteville (Wade) and the other is southeast of Fayetteville (Golfview), as shown in Figure 2-1.

Figure 2-1: Cumberland County 8-hour Ozone Monitor Design Values 2001 – 2003



For the 3-year periods 2000 – 2002 and 2001 – 2003, both monitors marginally violated the 8-hour ground-level ozone NAAQS, see Table 2-1.

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

Monitor Name	County	00-02	01-03
Wade	Cumberland	0.086	0.086
Golfview (Hope Mills)	Cumberland	0.087	0.087

NCDAQ forecasts ozone levels on a daily basis from May 1 – September 30 for Fayetteville. 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 Fayetteville 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 Fayetteville 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 Fayetteville 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	1.22	3.16	4.08
Area	6.32	0.51	11.54
Nonroad Mobile	59.31	6.51	4.85
Highway Mobile	197.16	28.43	17.85
Biogenic	0.0	0.40	46.20
Total Emissions	264.01	39.01	84.52

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 Fayetteville 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	0.51	3.76	6.86
Area	6.76	0.54	12.12
Nonroad Mobile	68.38	5.86	3.84
Highway Mobile	108.27	18.56	10.31
Biogenic	0.0	0.40	46.20
Total Emissions	183.92	29.12	79.33

4.4 Comparison of Inventories

The total predicted NOx emissions for Cumberland County decreased by 25%, from 39 tons per day (TPD) in 2000 to 29 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	3.16	3.76	4.08	6.86
Area	0.51	0.54	11.54	12.12
Nonroad	6.51	5.86	4.85	3.84
Mobile	28.43	18.56	17.85	10.31
Biogenic	0.40	0.40	46.20	46.20
Total Emissions	39.01	29.12	84.52	79.33

Figure 4.4-2: 2000 Cumberland County NOx Emissions by Source

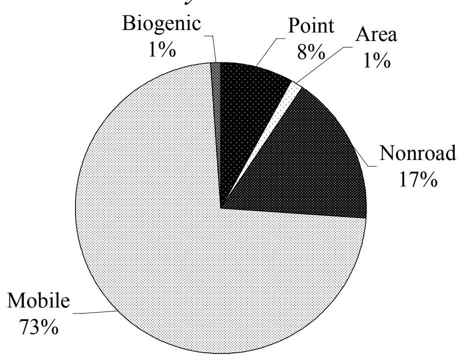
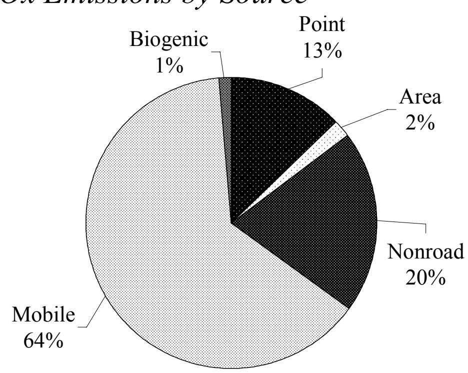


Figure 4.4-2: 2007 Cumberland County NOx Emissions by Source



The total predicted VOC emissions for Cumberland County decreased by 7%, from 85 TPD in 2000 to 79 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. The percent of each source category

Figure 4.4-3: 2000 Cumberland County VOC Emissions by Source

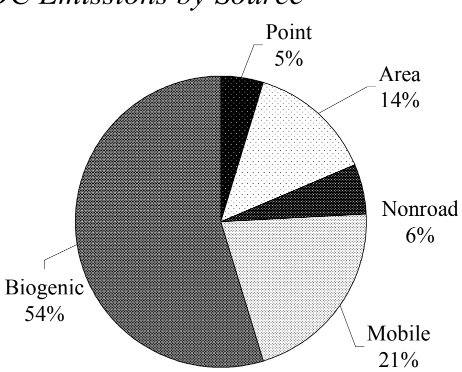
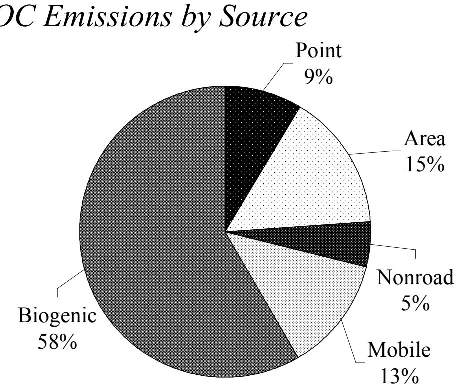


Figure 4.4-4: 2007 Cumberland County VOC Emissions by Source



There are few control measures expected for area and point sources in Cumberland County, so they continue to grow, however, there are significant decreases in highway and nonroad mobile source emissions to produce an overall decrease in both NOx and 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 Cumberland County. As shown in these figures, the relative contributions from vehicle types do not change greatly between 2000 and 2007. The estimated emissions for each vehicle type is tabulated in Table 4.4-2.

Figure 4.4-5: 2000 Cumberland County Highway Mobile NOx Sources

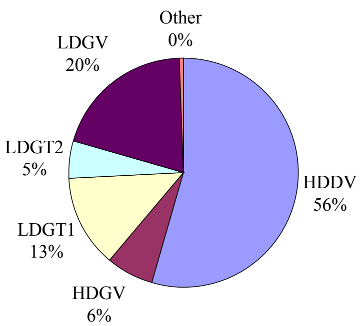
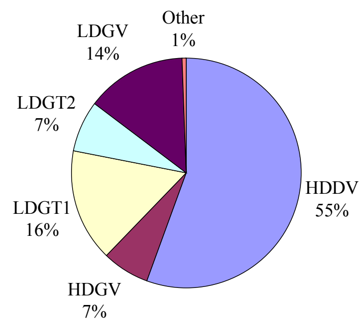


Figure 4.4-6: 2007 Cumberland County Highway Mobile NOx Sources



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	15.5	0.3
Light-duty gasoline vehicles	5.8	3.4
Light-duty gasoline trucks(1)	3.7	4.3
Light-duty gasoline trucks(2)	1.5	1.8
Heavy-duty gasoline vehicles	1.9	0.5
Other	0.1	0.1
Total	28.5	10.4

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 Cumberland County. As can be seen in these figures, diesel construction equipment contributes about half of nonroad mobile source NOx for both years. The estimated emissions for each equipment type is tabulated in Table 4.4-3.

Figure 4.4-3: 2000 Cumberland County Nonroad NOx sources

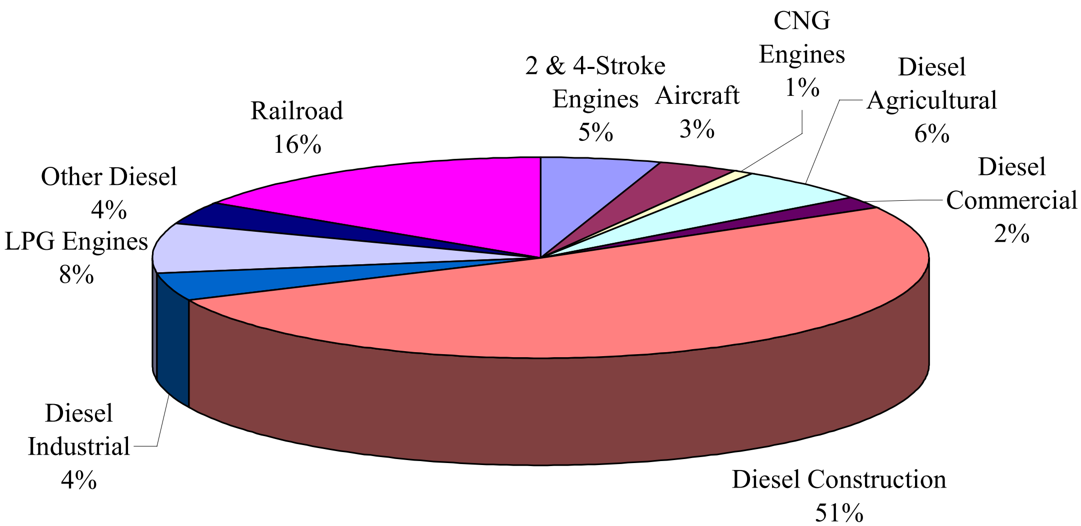
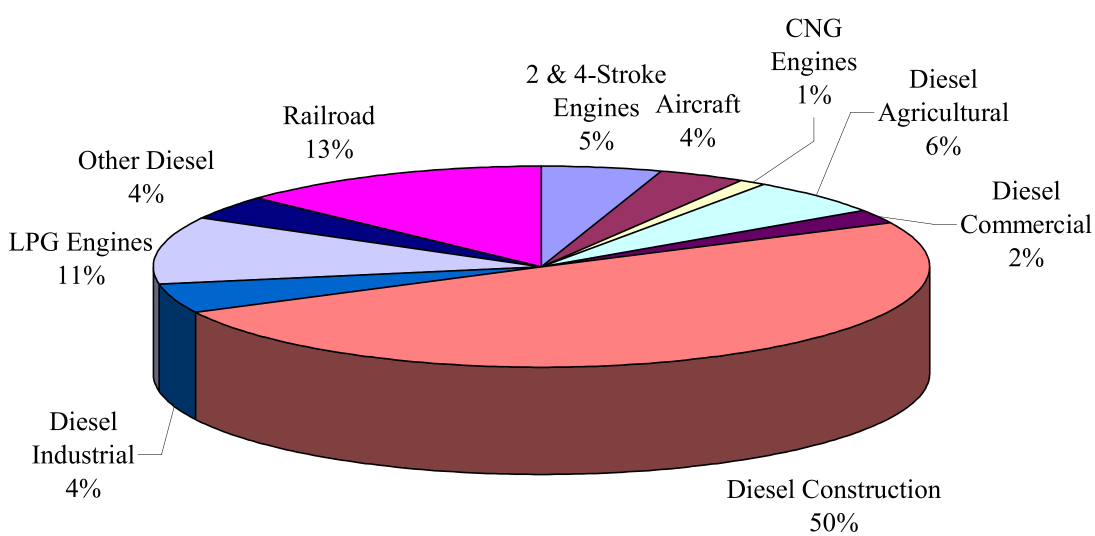


Figure 4.4-4: 2007 Cumberland County Nonroad NOx sources



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, and improved the testing method. Vehicles will be tested using the onboard diagnostic system, which will indicate NOx emissions, among other pollutants. The previously used tailpipe test did not measure NOx. The inspection and maintenance program was instituted in Cumberland County on 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.

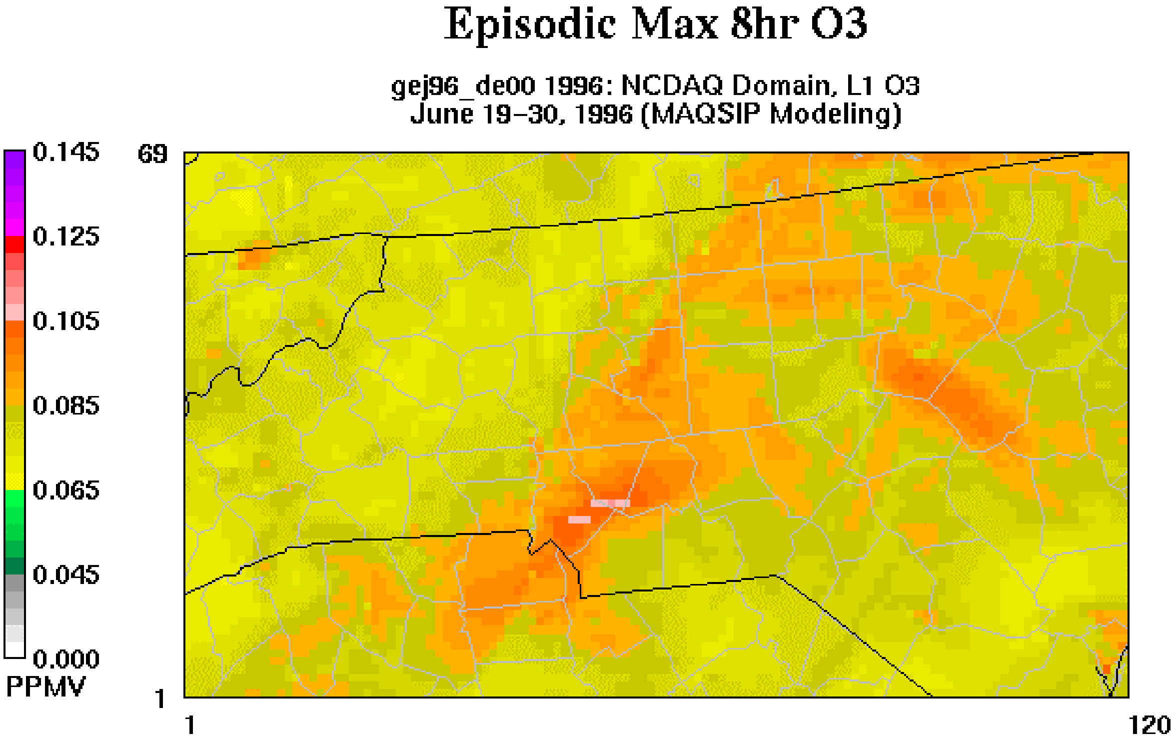


Figure 6.2-2 2007 future year 8-hour ozone episodic maximum for the 1996 episode.

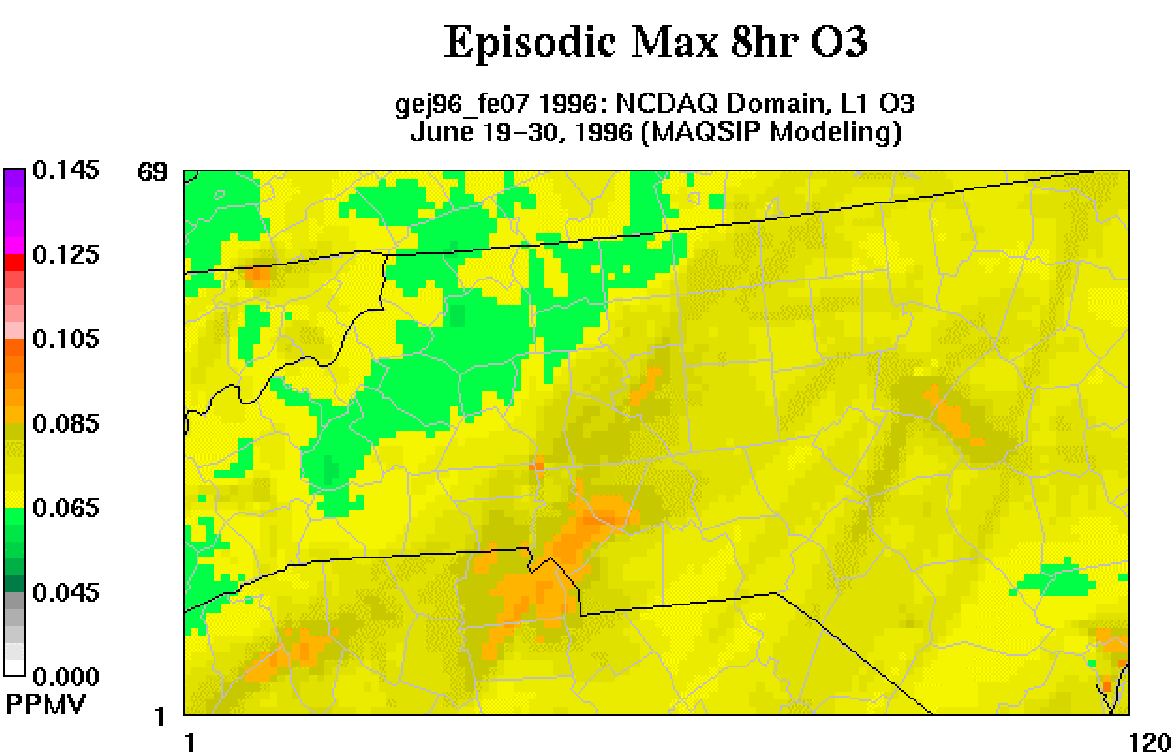


Figure 6.2-3 Difference plot between the 2007 future year and the 2000 current year 8-hour ozone episodic maximum for the 1996 episode.

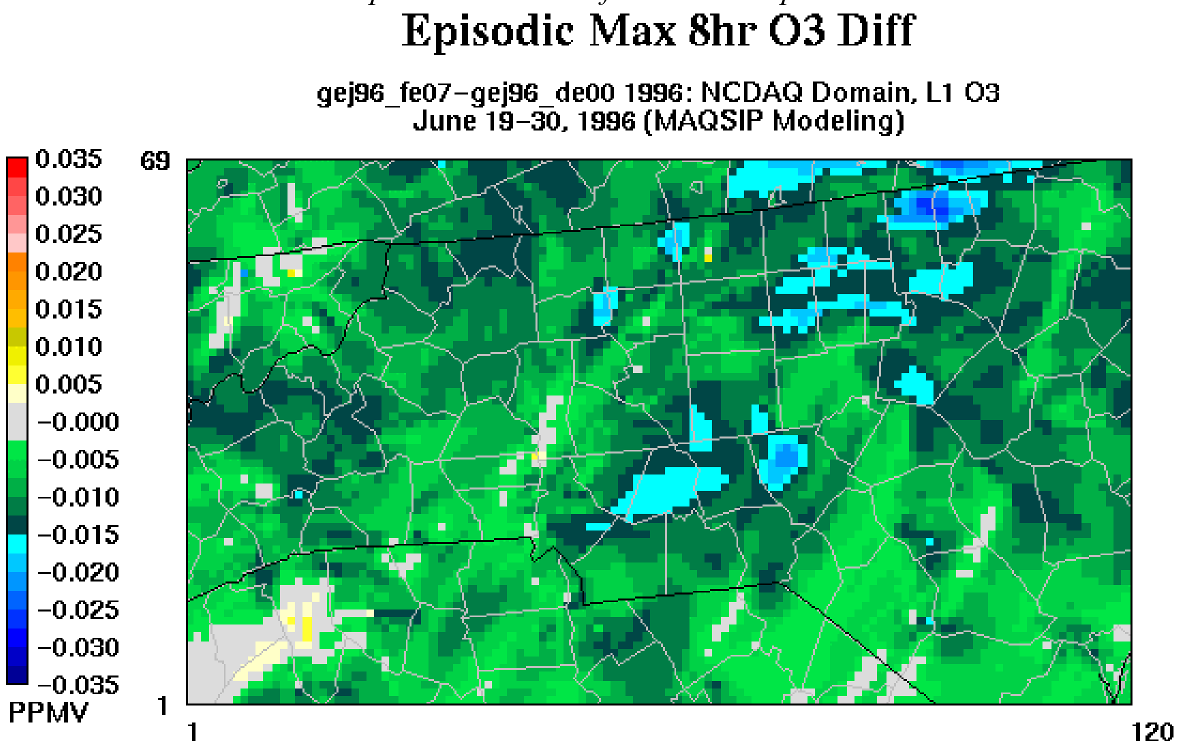


Figure 6.2-4 2000 current year 8-hour ozone episodic maximum for the 1997 episode.

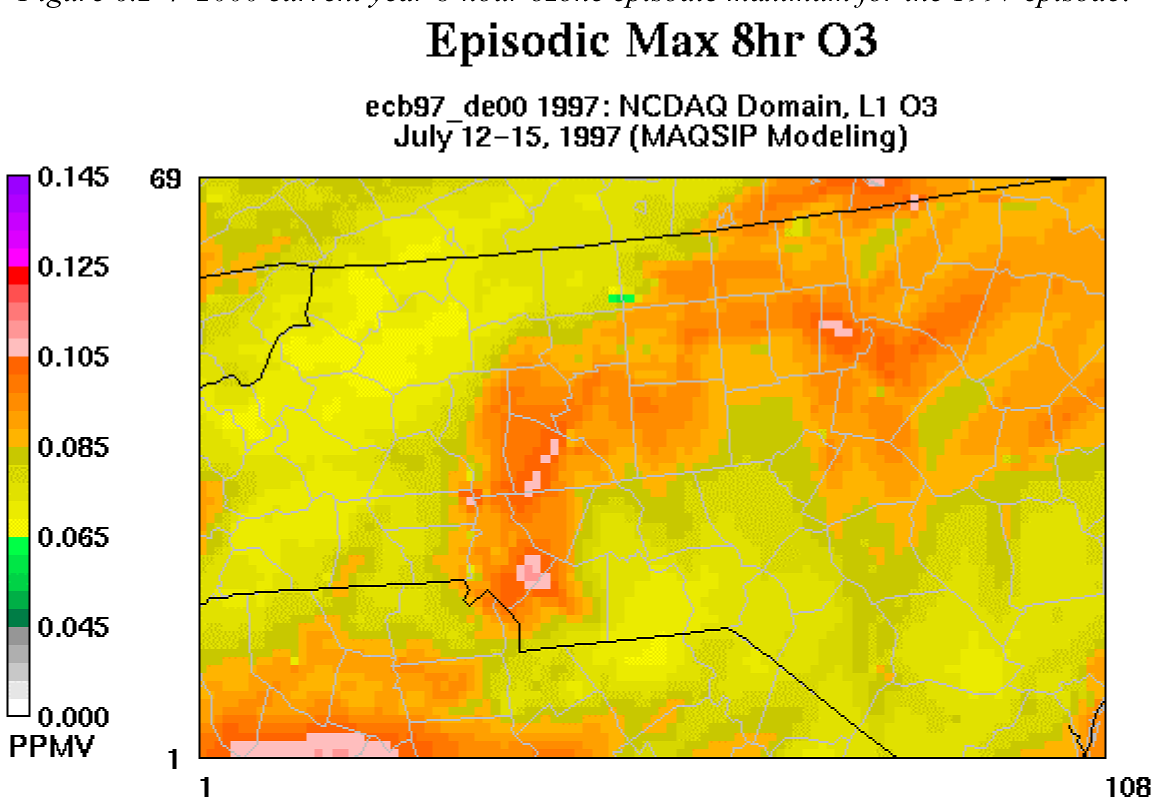


Figure 6.2-5 2007 future year 8-hour ozone episodic maximum for the 1997 episode.

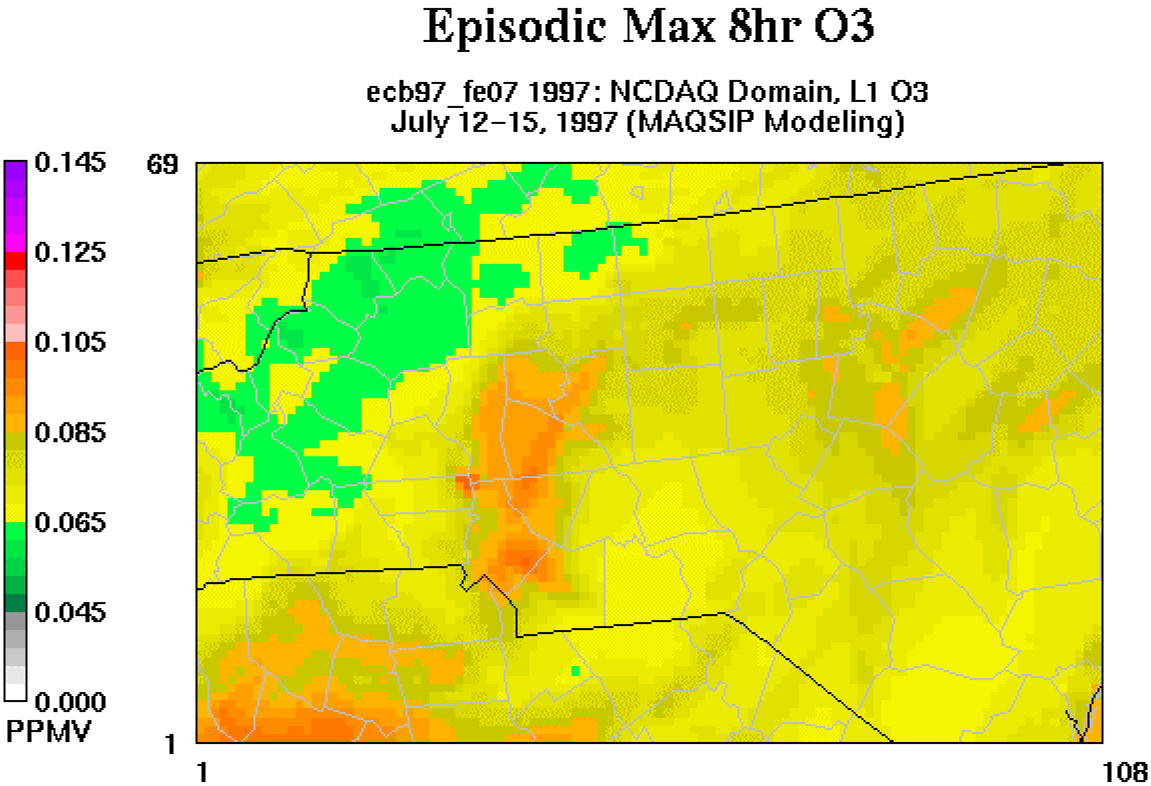
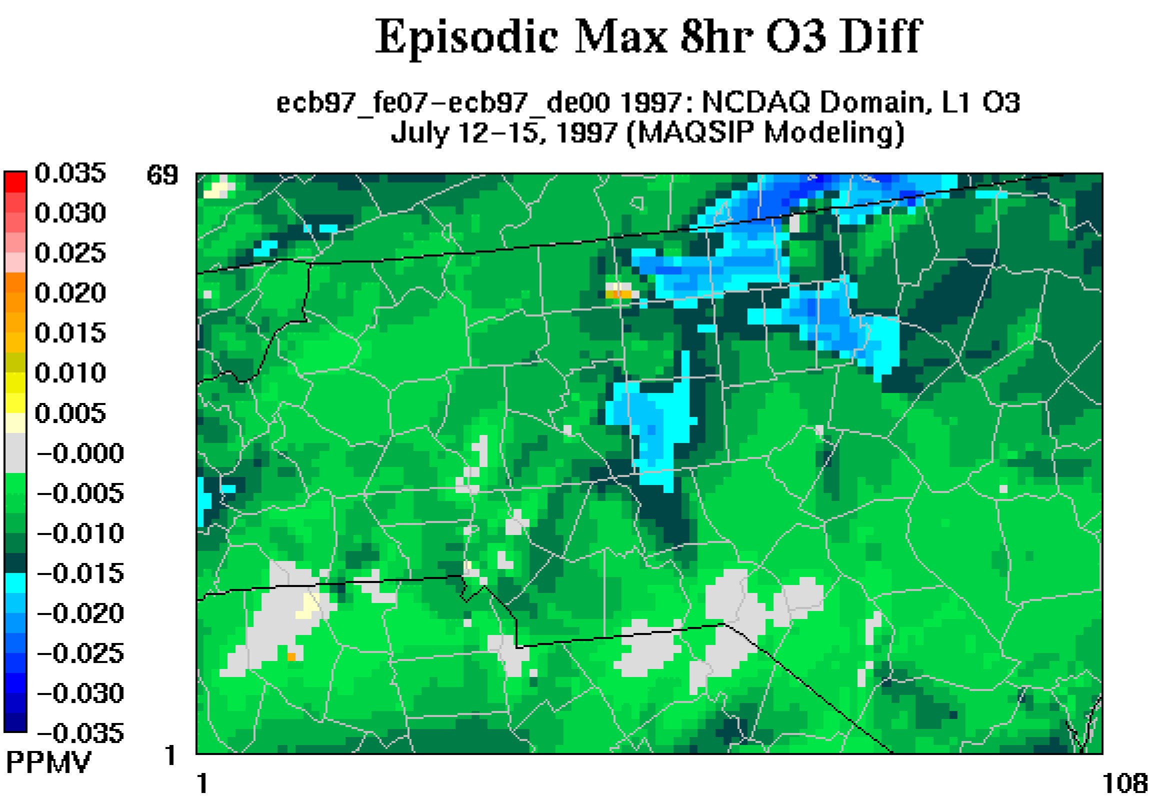


Figure 6.2-6 Difference plot between the 2007 future year and the 2000 current year 8-hour ozone episodic maximum for the 1997 episode.



6.3 Geographic Area Needing Further Controls

The current draft version of EPA's attainment test was applied 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 both monitors in the Cumberland County 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 Cumberland County EAC Area

Monitor	DVC (ppm)	RRF	DVF (ppm)
Wade	0.088	0.91	0.080
Golfview (Hope Mills)	0.087	0.90	0.078

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