TRIAD EARLY ACTION COMPACT

December 31, 2003 Progress Report

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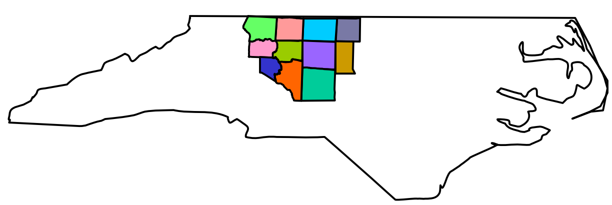

TRIAD EARLY ACTION COMPACT – December 31, 2003 PROGRESS REPORT

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Part A

Local and Regional Progress

Control Measures, Implementation, Emissions Reduction Estimates, Geographic Scope

Introduction

Part A of this Progress Report contains ozone reduction strategies (control measures) approved in December 2003 by 46 local governments in North Carolina's Piedmont Triad region. Where available, information is provided on quantification of emissions reductions, along with implementation dates.

There may be some adjustments in these control measures before the region's Early Action Plan is submitted in March 2004. Additional quantification information should also be available by then. However, given the significant investment of education and participation by government and business leaders, the overall direction of these initiatives will be sustained and potentially strengthened. In pursuing these strategies, some may be determined infeasible. On the other hand, we expect the level of interest in air quality to generate new initiatives, such as the application from Guilford County schools for school bus retrofits. (See Strategy C5.)

The same control measures were adopted by jurisdictions in all 11 counties. A few control measures, such as A10, A11, and A12 apply principally in the urban areas. They relate to public transportation and are applicable in Greensboro, Winston-Salem and High Point which operate municipal bus systems. With these few exceptions, the geographic scope of the proposed strategies is regionwide

The work of the Triad EAC continues to generate public support. An illustrative article from the Greensboro *News and Record* is attached.

As we being 2004, the EAC will concentrate on quantifying the measurable control strategies and developing a reporting system to account for the commitments made when these strategies were approved.

Greensboro News and Record, Dec. 22, 2003 (page B1)

Air-quality plan moves ahead

12-22-03

By Paul Muschick Staff Writer
Greensboro News & Record

The 31 local governments that promised a year ago to work together to reduce ozone pollution have followed through and all endorsed a plan to send to the Environmental Protection Agency early next year.

Elected officials in the 11 counties and 20 cities and towns have voted over the past month to support the plan, which if approved by the EPA could help the region escape penalties for its pollution.

Want to know more?

To read more about the Piedmont Triad's ozone problem and potential solutions, go to www.ptcog.org/eac.html or www.nwpcog.org/EAC/

"It's a big step," said Ginger Booker, assistant director of the Piedmont Triad Council of Governments, which coordinated the effort. "I have been very pleased with the level of commitment."

The EPA did not require that all of the governments stick with the process, but if a large community such as Greensboro or Guilford County had dropped out, it could have scuttled the effort because those areas are large contributors to the ozone problem.

The region is expected to be among several in the state that could violate stricter ozone limits that will be enforced early next year. Failure to clean up the air could result in penalties such as restrictions on new industry or the expansion of industry, and the loss of federal road money.

Last December, the 31 local governments signed an agreement with the EPA that could spare them from those potential penalties. The governments agreed to write a plan showing how they would collectively reduce ozone to acceptable levels by 2007. If the plan works and ozone pollution drops, the EPA will not punish the region.

The plan endorsed by local leaders calls for steps such as reducing traffic, conserving energy, using cleaner-burning engines and fuels and reducing emissions from factories. Among the actions that it has triggered is an application by Guilford County Schools for a state grant to retrofit bus engines to run on cleaner-burning, low-sulfur diesel fuel, Booker said.

"It would significantly lower the emissions that these buses have," Booker said.

Preliminary projections by state scientists show that new state and federal requirements, such as tougher car inspections in some North Carolina counties, would decrease ozone to acceptable levels by 2007 at all but one of the region's monitors -- at Cooleemee in Davie County.

Solving pollution there is problematic because some of the ozone measured at that site is actually produced in the Charlotte area and blown north, the state says. Local leaders have no way to enforce pollution regulations in Charlotte.

The next step will be for local leaders to measure how much ozone pollution would be reduced by their plan, and to factor that into the future ozone estimates.

Ozone is caused when pollutants from sources of burning fuel such as cars, airplanes and factories are heated by the sun.

Gases emitted naturally by trees also contribute to the problem.

Ozone pollution can cause breathing problems, according to the EPA. Earlier this year, the American Lung Association ranked the Piedmont Triad as having the 17th-worst ozone pollution in the nation.

In addition to the 31 governments that signed the EPA agreement, several other local governments have also endorsed the pollution-reduction plan as a show of support.

"It's been very well-received," said Matthew Dolge, executive director of the Northwest Piedmont Council of Governments, which also is coordinating the ozone effort.

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Triad EAC Regional Strategies to Reduce Ozone Adopted by 46 Local Governments, December 2003

A. LOCAL GOVERNMENT INITIATIVES

Buy Low Emissions Vehicles and Equipment

A1. Replace, As Needed, Gasoline Powered Vehicles for On-Road Fleets and/or Reduce Dependence on Old Higher Emissions Vehicles (i.e. cars and trucks). Purchase lower-emissions replacement vehicles such as hybrid (gasoline/electric) vehicles or alternatively fueled vehicles (AFVs) such as bio-diesel, electricity, hydrogen, natural gas, and other low emission, new engine technology options. Quantifiable

A2. Replace, As Needed, Aging Equipment In Heavy Duty Non-Road Diesel Fleets and/or Reduce Dependence on Old Higher Emissions Equipment (i.e. bulldozers, excavators, backhoes, graders, forklifts and similar machinery). Purchase equipment with new engine technology being introduced in 2001 - 2005 (Tier 2) and 2006 - 2008 (Tier 3). Quantifiable

A3. Replace, As Needed, Vehicles In Heavy Duty On-Road Diesel Fleets and/or Reduce Dependence on Old Higher Emissions Vehicles (i.e. dump trucks, garbage trucks, busses). Purchase vehicles with new engine technology scheduled for introduction in 2004 and 2007. Quantifiable

A4. Replace, As Needed, Gasoline Powered Equipment and/or Reduce Dependence on Old Higher Emissions Equipment. (i.e. chainsaws, lawnmowers, and generators). Purchase new equipment that meets California standards. Quantifiable

Quantification: These strategies will lower NOx emissions through replacement of high emissions vehicles and equipment with cleaner burning lower emissions vehicles. One of the first tasks of the EAC in January 2004 is to design a reporting system for local governments to identify new purchases and retrofits, mileage, and trips per day along with equipment/vehicles replaced. This inventory will allow us to measure emissions reductions and maintain a running account of progress being made by EAC participating jurisdictions.

Implementation: Beginning January 2004.

Reduce Emissions on Large Public Construction Projects

A5. Specify Emission Reductions For Heavy Duty Off-Road Equipment In Construction Contracts – Develop and implement policies by the end of 2004 for the use of lower-emission off-road vehicles and equipment in major construction projects, especially road construction, and including NCDOT. Policies to be developed include incentives within public contract specifications for the use of lower-emission vehicles and equipment. Quantifiable

Quantification: State DOT highway projects are the major construction projects employing heavy duty off-road equipment. Local governments will follow the lead of state DOT in adopting and implementing this strategy for local construction and street projects. State DOT staff is developing a proposal for contract requirements and/ or incentives for heavy equipment emissions reductions to submit to the State Board of Transportation.

Implementation: Target date, October-November 2004.

Use and Support Public Transportation

A6. Increase ridership on municipal and regional bus services (PART Express) – Piedmont Authority for Regional Transportation (PART) and local governments to provide all feasible increases in services, coupled with local government and private sector support for these services. (The regional bus service travels from downtown transit centers in Greensboro, Winston-Salem and High Point to the PART regional bus station. There, shuttles travel to hotels and businesses in the airport business area and to the airport itself.) Quantifiable

A7. Park and Ride – Create park and ride lots with safe parking areas and enhancements. PART has a Federal Transit Adm. grant to establish multiple regional park and ride lots by 2007. Quantifiable

Quantification: See below

Promote Options to Single Occupancy Vehicles

A8. Expand PART Ride Sharing and Vanpooling of the Piedmont (RSVP) –Provides vanpool and ride-match services to employers and employees. Program has served commuters in region for 10 years. As of 2003, 75 vehicles in fleet. Quantifiable

A9. Carpool – Continue to promote PART program to assist employers to facilitate establishment of more carpool programs to supplement situations for employees who live in proximity and work at the same or closely located sites. Quantifiable

Quantification: A6, A8, A9. Quantification can begin immediately based upon PART inventories of vehicles and daily miles traveled.

Implementation: Beginning January 2004

Quantification: A7. PART has funds on hand to build 20 park and ride lots. Plans are underway for construction of several lots in Greensboro, Winston-Salem and High Point. Others will be built in surrounding counties, contingent upon 10% local match.

Implementation: Minimum of 5 lots to be built or leased in core urban area (Greensboro, Winston-Salem, High Point) in 2004. Additional lots expected to be built or leased in Alamance, Davidson and Rockingham counties in 2004. PART is working with participating counties so that funds can be used quickly and parking facilities made available to the commuting public.

Additional Public Transportation Measures

A10. More Bus Stops - Add bus stops for municipal bus systems at employers. (This is in addition to employers served by PART Express, the regional bus service.) Nonquantifiable

A11. Mass Transit Passes or Allowance - Promote purchase and use of bus passes to minimize use of individual vehicles. Employers purchase or provide an allowance for ozone season bus passes to give unlimited use of bus service on every ozone hazard day. Nonquantifiable

A12. Mass Transit Enhancements - Improve existing transit systems with bus shelters, web based schedules, etc. Nonquantifiable

Implementation: Strategies such as web based schedules and new bus shelters can be implemented in 2004. Others depend upon ridership, which has been down in some areas due to manufacturing job losses in the region.

B. EMISSIONS REDUCTIONS REPORTED AND IN PROCESS BY INDUSTRIES & UTILITIES

Reduce Emissions from Boilers

B1. The ad hoc Triad Business and Industry Air Quality Group recommends that DAQ's model take into account updated and most likely conditions for stationary emissions sources, including: Quantifiable

- Duke Power has communicated to DAQ its most likely NOx emissions rate for Belews Creek
- R. J. Reynolds Tobacco Co. communicated to DAQ its most likely ozone season NOx emissions rate for its Tobaccoville site (including boilers) on 10/6/03.

Quantificaton : *This recommendation improves the accuracy of the Division of Air Quality (DAQ) model. While we believe the likely emissions are less than DAQ's default projection, this recommendation does not include an enforceable emission reduction.*
Implementation : *Immediate*

B2. DAQ should remove from the future projected (2007) source inventory any businesses that have closed during the unprecedented downturn in NC's manufacturing sector. No one anticipates that any of the closed businesses will re-open. A list of closed facilities was transmitted to DAQ on 11/5/03. Quantifiable

Quantification: *Of the closed facilities in the Triad, the one with the highest emissions is RJRT Bailey Power in downtown Winston-Salem. The boilers were retired in 1997. Since the modeling is based on the 1995 inventory, these boilers should be removed. Their projected 2007 NOx emissions are 1.33 tons per day.*
Several other facilities have closed in the Triad. Their closures should be accounted for in the model by updating the growth factors for the respective industry sectors.
Implementation: *To be determined by DAQ. More information available by March 2004.*

B3. R. J. Reynolds Tobaccoville facility in Forsyth County will eliminate use of the coal-fired boilers identified in Title 15A of the North Carolina Administrative Code Chapter 2D, Section 1416 during the ozone seasons in 2004 through 2007. The "ozone season" shall be those defined in Title 15A of the North Carolina Administrative Code Chapter 2D Section 1401(a)(18) as "the period beginning May 31 and ending September 30 for 2004 and beginning May 1 and ending September 30 for all other years." The Facility's NOx allocations listed in Title 15A of the North Carolina Administrative Code, Chapter 2D, Section 1417 that will not be needed for compliance purposes may be traded in the NOx trading program in accordance with the requirements of Section 1419. Quantifiable

Quantification:

Ozone Season NOx Emissions

RJRT Tobaccoville

NOx SIP seasonal tons	**2004**	**2005**	**2006**	**2007**	**2008**
Boiler 1	194	243	64	64	64
Boiler 2	218	273	64	64	64
Boiler 3	178	223	64	64	64
Boiler 4	190	238	64	64	64
Total	780	977	256	256	256
Days per season	122	153	153	153	153
SIP tons per day	6.39	6.39	1.67	1.67	1.67
Max. emissions gas boilers	0.95	0.95	0.95	0.95	0.95
Reductions tons per day	5.44	5.44	0.72	0.72	0.72

Implementation: *This emission reduction will take place before the 2004 ozone season.*

Reduce Emissions at Specific Business and Industry Sites (Boiler and non-boiler)

B5. Syngenta Crop Protection: (Guilford County) Quantifiable

1) Delivery vehicles are not allowed to idle in shipping and receiving area during deliveries or during pick ups.

2) Instituted temperature adjustments to reduce operations of the boilers since 2001. Temperatures are raised in the buildings after hours during the summer months. Temperatures are lowered in the buildings after hours during the winter months.
3) Improved the efficiency of boiler operations and removed one of the boilers from one of the buildings in 2001.
4) Boilers go through annual tunings as part of the preventive maintenance program to increase the efficiency of operations.

Quantification: *Not available at this time. Reductions will not be significant but do support the overall direction of EAC strategies.*
Implementation : *Completed between 2001 and 2003.*

B6. Energizer Battery Company, Inc.: (Randolph County) Quantifiable

1) Reduced fleet of vehicles by 57%.
2) 90% of fork lift trucks are now battery powered.
3) Planning to use the smaller of two natural gas fired boilers during the months of June through October as the weather permits.
4) Test diesel powered fire pumps and natural gas powered emergency generators during the cooler morning hours only.

Quantification: *Not available at this time. Reductions will not be significant but do support the overall direction of EAC strategies.*
Implementation: *Strategies 1, 2, and 4 already complete. Strategy 3 to be implemented in June 2004.*

B7. Duke Energy (Regionwide) Quantifiable

1) Mobile meter reading program will yield a reduction of 56 pick-up trucks per day that would normally be running or idling 6 out of 8 hours per day.

Quantification: *1308 pounds of NOx per ozone season. (56 routes eliminated@ 90 miles per day) NOx emissions per vehicle: 1.1grams per mile (per DAQ estimate for Forsyth County for 2003 based on MOBILE6 2)Ozone Season May 1-September 30 = 153 days. Week days=153 x 5/7 = 109 days*
NOx reduced = 12 pounds per day x 109 days = 1308 pounds
Implementation: *Completed*

2) Plans to institute idling reduction guidelines in addition to the mobile meter reading program.

Quantification: *Estimate 133 diesel truck engines and 483 gasoline truck engines reduce 30 minutes per day of idling. Reduced idling is assumed to produce an overall benefit in the form of lower NOx emissions but the extent can not be quantified based on available information at this time. DAQ does not have any reliable emissions factor but does recommend idling reduction as directionally correct with ozone attainment planning.*
Implementation: Summer 2004

B8. Plans Expected to be Submitted**:**
Thomas Built Buses, Forsyth Medical Center, Degussa Stockhausen, Winston-Salem / Forsyth Co. Schools

C. SUPPORT FOR STATE AND REGIONAL INITIATIVES

Enforce State Regulations

C1. Open Burning – Enforce and strengthen open burning restrictions. Statewide rule to prohibit open
burning on code red and code orange days will go to public hearing this fall. Quantifiable

Quantification: NC Division of Air Quality is developing data on estimated NOx and PM2.5 emissions from open burning.

Implementation: 2004. EAC regions and DAQ will be cooperating on open burning outreach efforts. Status of statewide rule to prohibit open burning on code red and orange days to be determined by March 2004.

Promote Regional Approaches to Ozone Reduction

C2. Participate in regional initiative to bring ultra-low sulfur fuels to the southeast earlier than scheduled date (September 1, 2006 for ultra low diesel fuels.) Ultra-Low sulfur fuel can be available now if market demands are adequate (Current legal limit for sulfur in diesel fuel is 500 ppm; new EPA rulemaking imposes a limit of 15 ppm.) Quantifiable

Quantification: The Triad EAC is working with DAQ and other NC jurisdictions to identify willingness to purchase ULSD early at an increased price. In response to a DAQ survey, Greensboro has stated a willingness to purchase ULSD at an additional 10¢ (possibly more) per gallon. Greensboro uses 1,500,000 gallons annually. Other Triad cities have expressed interest, but cost is a barrier. Representatives of DAQ will continue negotiating with other southeastern states to determine the feasibility of bringing ULSD to the region before 2006.

Implementation: Determination of demand in light of costs is currently under way. If participation is sufficient, implementation would be in late 2004.

C3. Support Our Regional Consortium - Continue the Early Action Compact as a regional air quality consortium involving county and municipal governments to initiate and carry out initiatives to improve air quality in the region. Nonquantifiable

Implementation: Ongoing.

C4. Seek Grant Funds to Foster a Regional Clean Cities Designation - Sponsored by the U.S. Department of Energy (DOE), the Clean Cities Program supports public and private partnerships that deploy low emissions vehicles and build supporting infrastructure. Funds awarded competitively to designated Clean Cities coalitions for specific projects related to developing alternative fuel vehicle infrastructure,; acquiring AFV school buses; and acquiring commercially available AFVs, particularly for niche market activities. Nonquantifiable

Implementation: 2005, depending up level of local government interest.

Participate in State Initiated Pilot Projects

C5. Diesel Retrofits on School Busses – If DAQ's EPA grant application is funded, retrofit or replace old diesel school buses in selected fleets with cleaner running buses. Quantifiable

Quantification: Depending upon grant funding, retrofits and resulting emissions reductions in the Triad can be quantified.

Note: In the meantime, the Guilford County School System has applied for a Mobile Source Emissions Grant for up to $250,000 funded through the NC Clean Air Program. This program is supported by a 1/64 cent per gallon tax on gas sold in NC. The county has 107 school buses and 80 activity busses, all diesel. They travel 1,894,000 miles annually. The school system consumes 1.4 million gallons of diesel fuel per year. Quantification depends upon retrofits made possible through funds received.

Implementation: 2004 if funds received.

C6. Diesel Retrofits on Other Vehicles - Promote pollution control retrofits on other diesel vehicles in public and private sector. Nonquantifiable

C7. Truck Stop Electrification (TSE) – Division of Air Quality will seek grant funds for a pilot project at truck stops along Triad (and other regions') interstate highways. An inverter/charger system would allow standard 110V AC appliances to be powered from either the truck's electrical system or an electrified truck stop. To realize the benefits of TSE, trucks would ideally be equipped with a DC/AC inverter connected to the truck's batteries and charging system to allow use of the AC appliances while en route or for short durations while parked. For longer duration overnight stops, the truck would be plugged into the local electric utility, similar to existing arrangements at RV parks and boat marinas. Quantifiable

C8. Idling Reduction Efforts – Division of Air Quality to see grant funds to install idling-reduction systems on trucks. Each fleet can choose which system will work best for them, whether it is an auxiliary power unit, a generator, an inverter-charger paired with an electrical HVAC system, or something else. "Shore power connections" allow truckers to utilize AC power at truck stops and terminals. Quantifiable

Quantification: C7 & C8 Depending upon grant funding and idling reduction equipment installed, emissions reductions in the Triad can be quantified. However, this would be a pilot program and emissions reductions would be small.

Implementation: Date to be determined in conjunction with DAQ; depends on receipt of grant funds.

Promote Efficient Freight Transport

C9. Explore potential for electrification of rail switching yards to reduce lengthy engine idling time in rail yards. Nonquantifiable

D. Air Quality Education and Outreach

Expand Air Quality Education in the Region

D1. Support and Expand Existing Programs - Supplement regional services provided through the Forsyth County Environmental Affairs Department and the Triad Air Awareness Program - On a county level implement outreach programs with added emphasis on ozone season (May – September) and ozone episodes. Nonquantifiable

D2. PSAs - Place PSAs on ozone reduction methods and green products in movie theaters, TV

D3. Ads and Special Events - Place media ads and develop special events highlighting ozone reduction strategies and green products. Nonquantifiable

D4. Targeted Outreach - Develop special communications designed for Hispanic outreach program. Nonquantifiable

D5. Go into the Schools – Develop school based outreach to educate children, who, in turn can inform their families. Similar to the approach that worked when children educated their families about recycling. Nonquantifiable

D6. Media Reports - Increase Air Quality reports to TV, radio, newspaper, web sites, air bulletins. Nonquantifiable

Implementation: Ozone season 2004 under leadership of Triad Air Awareness Program.

E. Context Issues

Operate Energy Efficient Buildings and Systems

E1. Implement energy efficiency in operation and design of facilities, purchase and use of equipment. (e.g. Guilford County Schools, Davidson County Public Buildings energy savings contracts) Some strategies quantifiable

- Use design and construction standards for energy efficient buildings
- Retrofit public buildings and schools for energy efficiency
- Seek out and purchase energy efficient products.
- Use programmable thermostats and lighting to lessen use when the office is closed.
- Practice energy efficient vehicle operating tips: shut off engine when parked; limit idling; operate vehicle only as needed; avoid travel through congested areas.
- Reschedule nonessential operations (lawn maintenance, outdoor painting, paving) to non-peak ozone times
- Promote solar water heating, passive solar design, photovoltaic and other renewable energy
- Green Buildings - Promote environmentally sustainable and healthy building practices. Green buildings encourage reduction of air pollution through energy efficiency, renewable non-polluting energy, protection of existing landscapes, native plant conservation, and low VOC finishes.

Implementation: Completed, as noted above, in public buildings in several counties or school systems. To be implemented in other locations throughout 2004 and 2005.

Other Energy Savings, Emissions Reduction Strategies

E2. E-government / increase available locations. Provide web-based services, both for information and transactions and/or multiple locations for payments, etc Nonquantifiable

E3. Intelligent Transportation Systems (ITS) – Local transportation departments to use detection loops and other systems which monitor traffic. The system provides drivers with information such as lane closures, traffic delays and is used to reduce non-recurring congestion and associated emissions. Nonquantifiable

E4. Employer Programs to Reduce Commuting - Encourage employers to establish voluntary bus and carpool programs with vehicle miles traveled goals and incentives. Nonquantifiable

E5. Flex or compressed work time - Promote compressed work weeks or flexible work hours across work sectors. This reduces traffic congestion during peak driving hours by spreading out number of vehicles on the roadway over a longer period of time. Also grant flexibility for additional time needed to ride mass transit. Nonquantifiable

E6. Employer Tax Credits – Promote use of federal tax credit for employer offered tax-free transit/vanpool benefits. Nonquantifiable

E7. Telecommuting - Promote telecommuting as an option in which an employer allows an employee to perform their job tasks either from home or from a designated telework center. Nonquantifiable

E8. Direct Deposit - Offer employees direct deposit which saves at least one vehicle errand per pay period. Nonquantifiable

Implementation: Strategies implemented at various levels throughout the region. For example, direct deposit (#E8) has been available in larger jurisdictions for years. It is now beginning to be implemented in smaller towns. Strategy #E3, ITS, is on-going in Greensboro, Winston-Salem and High Point with annual improvements made to signal systems including messaging system upgrades, and the addition of new cameras and sensors.

F. Maintenance Strategies

Strategies with Implications After 2007

Continue to Promote Automobile Alternatives

F1. Proceed with Plans for Commuter and Intercity Rail – PART has completed a Major Investment Study for regional commuter rail in the urban area. NC DOT is studying feasibility of intercity rail from eastern to western NC, through the Triad. Initiatives will be implemented post 2007. Quantifiable

F2. Encourage Non-Motorized Transportation - Shifts from automobile to nonmotorized transportation can impact energy conservation and emission reductions by reducing short motor vehicle trips which have high per-mile fuel consumption and emission rates. (e.g. Winston-Salem and Greensboro bike patrol and bike commuters) Nonquantifiable

F3. Encourage walking and cycling by improving pedestrian and bike infrastructure – Provide sidewalks, crosswalks, paths and bike lanes, and improve maintenance. Nonquantifiable

F4. Increase bicycle parking and create changing facilities. Nonquantifiable

Coordinated and Pedestrian Friendly Land Use

F5. Correct hazards – Repair roadway hazards specific to nonmotorized transport. Nonquantifiable

F6. Provide Street Furniture – such as benches and design features such as human-scale street lights Nonquantifiable

F7. Security - Address security concerns of pedestrians and cyclists. Nonquantifiable

F8. Pedestrian Commercial Streets - Make pedestrian-oriented commercial streets where driving is discouraged or prohibited. Nonquantifiable

F9. Non-auto Park Access – Design parks that encourage or require non-automotive access. Nonquantifiable

F10. PART Coordinated Land Use Plan – Continue regional transportation initiatives based on the Coordinated Land Use and Transportation Policies adopted by PART and endorsed by 27 jurisdictions throughout the region. Nonquantifiable

F11. Adopt Planned Growth Measures Including Pedestrian Friendly and Sound Transportation Strategies - Continue to apply and expand these principles throughout jurisdictions in the region, thereby intentionally altering the urban environment to improve air quality. Nonquantifiable

Principles include:

- Transportation-related land use strategies that reduce vehicle miles traveled,
- Multi-modal mobility including biking and walking
- Increase infill development
- Strengthen downtowns
- Balance location of housing and employment opportunities.
- Provide for transit oriented development, locating high-density development around transit stations).
- Locate employment, retail and public services close together in walkable commercial centers
- Revise land use ordinances to put maximums on parking lot size
- Plan subdivisions with streets that interconnect – encourage walking, biking – minimize driving

F12. Manage Traffic to affect the relative speed, convenience and safety of nonmotorized transportation.

Principles include: Nonquantifiable

- Traffic Calming - roadway design features that reduce vehicle traffic speeds and volumes.
- Roundabouts replace stop signs and traffic signals to improve traffic flow.
- Traffic signal timing to limit stop-and-go driving that reduces vehicle efficiency (i.e., below 20 mph)

- Manage roadway access by limiting number and location of curb cuts and driveways. Consolidate access to multiple businesses to reduce congestion, vehicle delay and emissions.

F13. Green communities - Promote tree ordinances, open space, greenways and significant landscaping/buffer requirements in all jurisdictions establishing minimum tree preservation and planting standards for new development; and promote strategic tree planting, street trees, and parking lot trees and buffers, increase acreage for greenways and open space. Nonquantifiable

Part B

State of North Carolina

Air Quality Modeling

Status Report

1. INTRODUCTION

As a requirement of the Triad 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 Triad area includes Alamance, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Rockingham Stokes, Surry and Yadkin Counties. Discussed in this report is an overview of the air quality in the Triad 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 Triad 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 Triad area and reports these levels to the EPA. According to the most recent data, the Triad 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 nine ozone monitors in Triad EAC area. These monitors are: Bethany, located in Rockingham County; Cherry Grove, located in Caswell County; McLeansville, located in Guilford County; Sophia, located in Randolph County; Cooleemee, located in Davie County; and Hattie Ave, Pollirosa, Shiloh Church and Union Cross, all located in Forsyth County. The location of these monitors is shown in Figure 2-1.

Figure 2-1: Triad EAC Area's 8-hour Ozone Monitor

For the 3-year periods 2000 – 2002 and 2001 – 2003, all but one monitor, Pollirosa, is 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
Bethany	Rockingham	0.090	0.091
Cherry Grove	Caswell	0.091	0.088
Cooleemee	Davie	0.095	0.093
Hattie Avenue	Forsyth	0.094	0.093
McLeansville	Guilford	0.093	0.089
Pollirosa	Forsyth	0.084	0.082
Shiloh Church	Forsyth	0.092	0.088
Sophia	Randolph	0.088	0.085
Union Cross	Forsyth	0.092	0.089

The Forsyth County Environmental Affairs Department (FCEAD) forecasts ozone levels, as well as fine particulate levels, on a daily basis year round for the Triad 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 Triad area, the forecast and previous day air quality reports appear on the weather page of local newspapers and FCEAD's website: http://www.co.forsyth.nc.us/envAffairs/DlyAirQualRpt.htm. 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 Triad 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 Triad 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	25.42	380.68	74.54
Area	75.14	4.82	70.81
Nonroad Mobile	443.23	39.32	34.30
Highway Mobile	999.12	165.92	93.94
Biogenic	0.00	2.20	446.00
Total Emissions	1,542.91	592.94	719.59

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 Triad 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	33.62	55.19	99.82
Area	80.00	5.07	73.86
Nonroad Mobile	511.95	37.51	28.39
Highway Mobile	620.26	101.23	59.95
Biogenic	0.00	2.20	446.00
Total Emissions	1,245.83	201.20	708.02

4.4 Comparison of Inventories

The total predicted NOx emissions for the Triad area decreased by 66%, from 593 tons per day (TPD) in 2000 to 201 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	380.68	55.19	74.54	99.82
Area	4.82	5.07	70.81	73.86
Nonroad	39.32	37.51	34.30	28.39
Mobile	165.92	101.23	93.94	59.95
Biogenic	2.20	2.20	446.00	446.00
Total Emissions	592.94	201.20	719.59	708.02

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

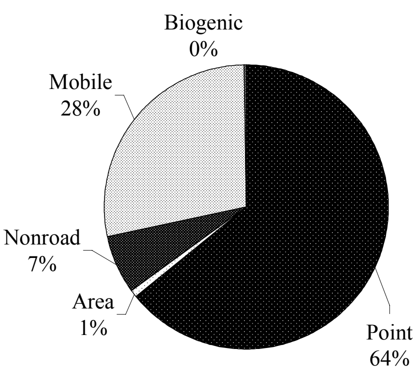
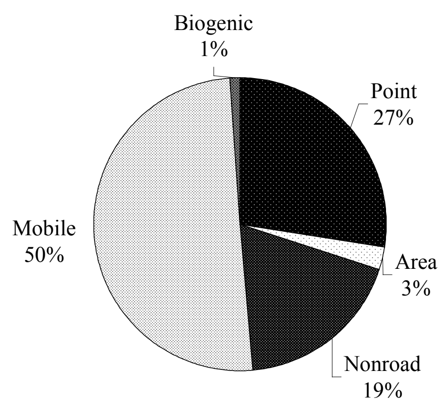


Figure 4.4-2: 2007 Triad Area NOx Emissions by Source



The total predicted VOC emissions for the Triad area decreased by 1.6%, from 720 TPD in 2000 to 708 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 Triad Area VOC Emissions by Source

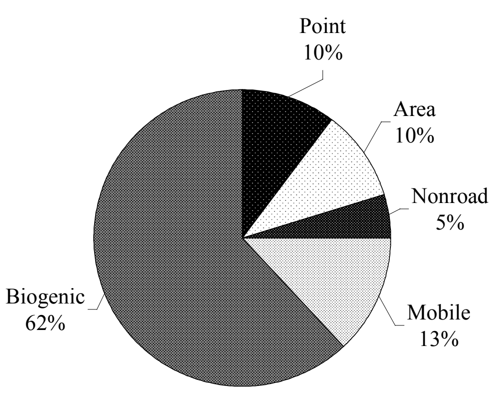
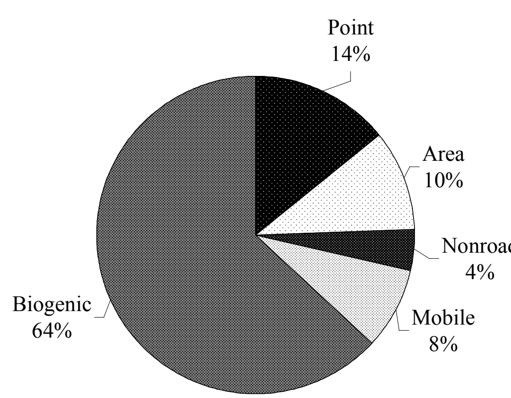


Figure 4.4-4: 2007 Triad Area VOC Emissions by Source



There are few VOC control measures expected for area and point sources in the Triad area, so the continue to grow. However, since the Triad area contains the largest power plant in North Carolina, the point source NOx emissions decrease significantly due to the NOx SIP Call rule. Additionally, there are significant decreases in both highway and nonroad mobile source VOC and NOx emissions. Thus the overall region has a 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 the Triad 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 Triad Area Highway Mobile NOx Sources

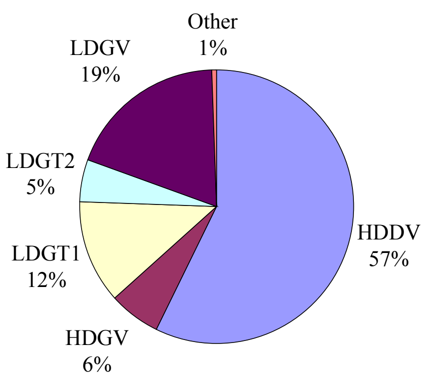
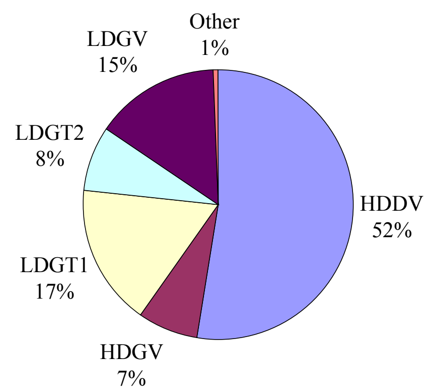


Figure 4.4-6: 2007 Triad Area Highway Mobile NOx Sources



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	95.13	53.16
Light-duty gasoline vehicles	31.66	15.31
Light-duty gasoline trucks(1)	20.50	17.43
Light-duty gasoline trucks(2)	7.99	7.67
Heavy-duty gasoline vehicles	10.41	7.34
Other	0.84	0.60
Total	333.06	203.02

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 Triad area. As can be seen in these figures, diesel construction equipment contributes the majority of the nonroad mobile source NOx emissions for both years. The estimated emissions for each equipment type are tabulated in Table 4.4-3.

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

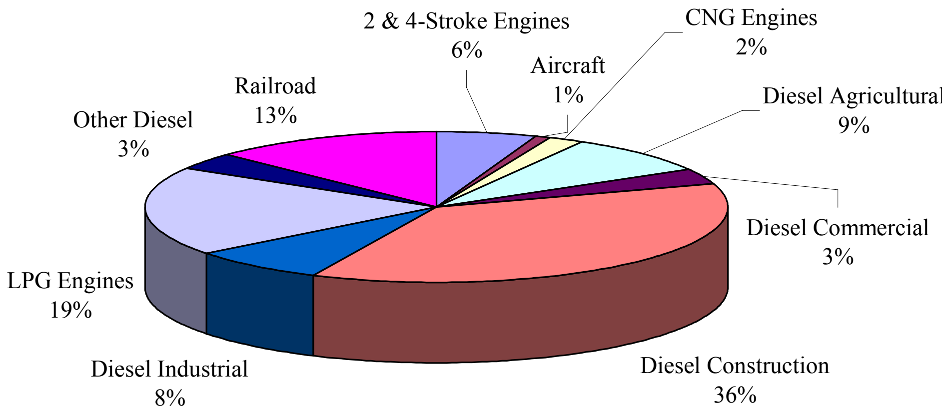


Figure 4.4-4: 2007 Triad Area Nonroad Equipment NOx sources

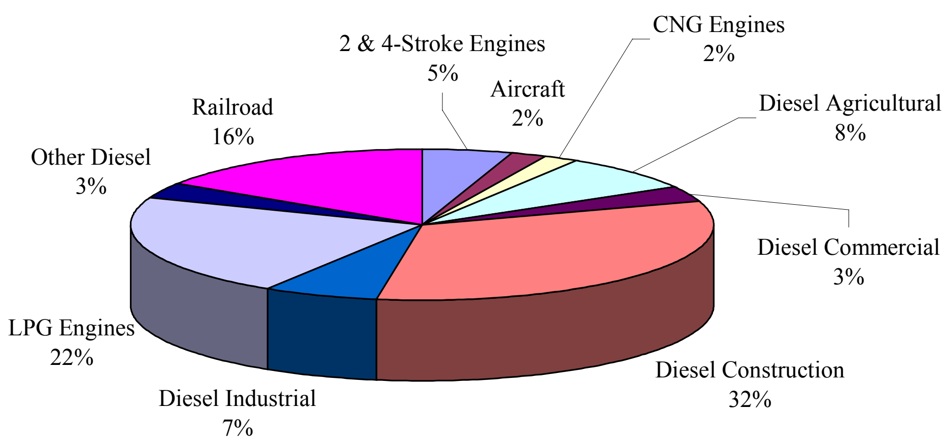


Table 4.4-3. Estimated Nonroad Mobile NOx Emissions by Equipment Type

Source	NOx Emissions in TPD	
	2000	2007
2 & 4-Stroke Engines	2.44	2.02
Aircraft	0.35	0.77
CNG Engines	0.75	0.79
Diesel Agricultural	3.65	3.12
Diesel Commercial	1.33	1.35
Diesel Construction	15.94	13.20
Diesel Industrial	3.23	2.64
LPG Engines	8.17	8.83
Other Diesel	1.48	1.39
Railroad	5.53	6.38
Total	42.87	40.49

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, 2002 through July 1, 2005, in the Triad area. Table 5.1.1-1 lists the phase in dates for the Triad area.

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

County	Phase-In Date
Alamance	January 1, 2004
Davidson	July 1, 2003
Forsyth	July 1, 2002
Guilford	July 1, 2002

County	Phase-In Date
Randolph	January 1, 2004
Rockingham	July 1, 2004
Stokes	July 1, 2005
Surry	July 1, 2005

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.

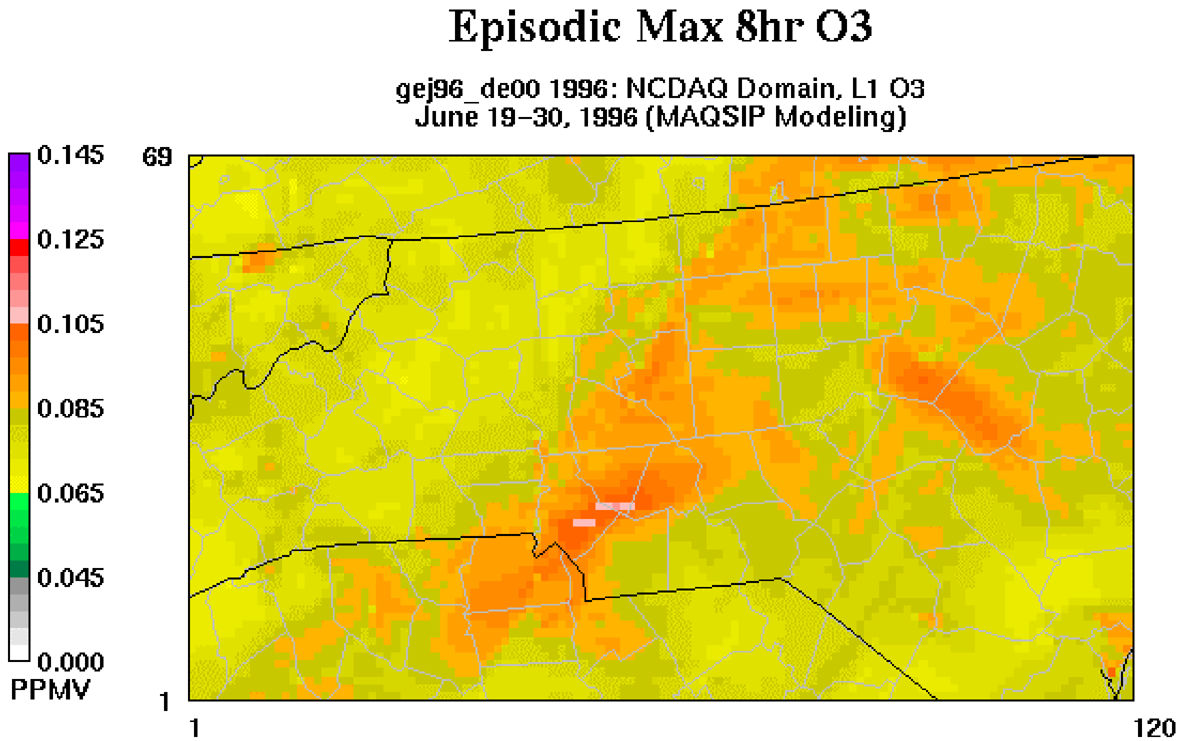


Figure 6.2-2 2007 future year 8-hour ozone episodic maximum for the 1996 episode.

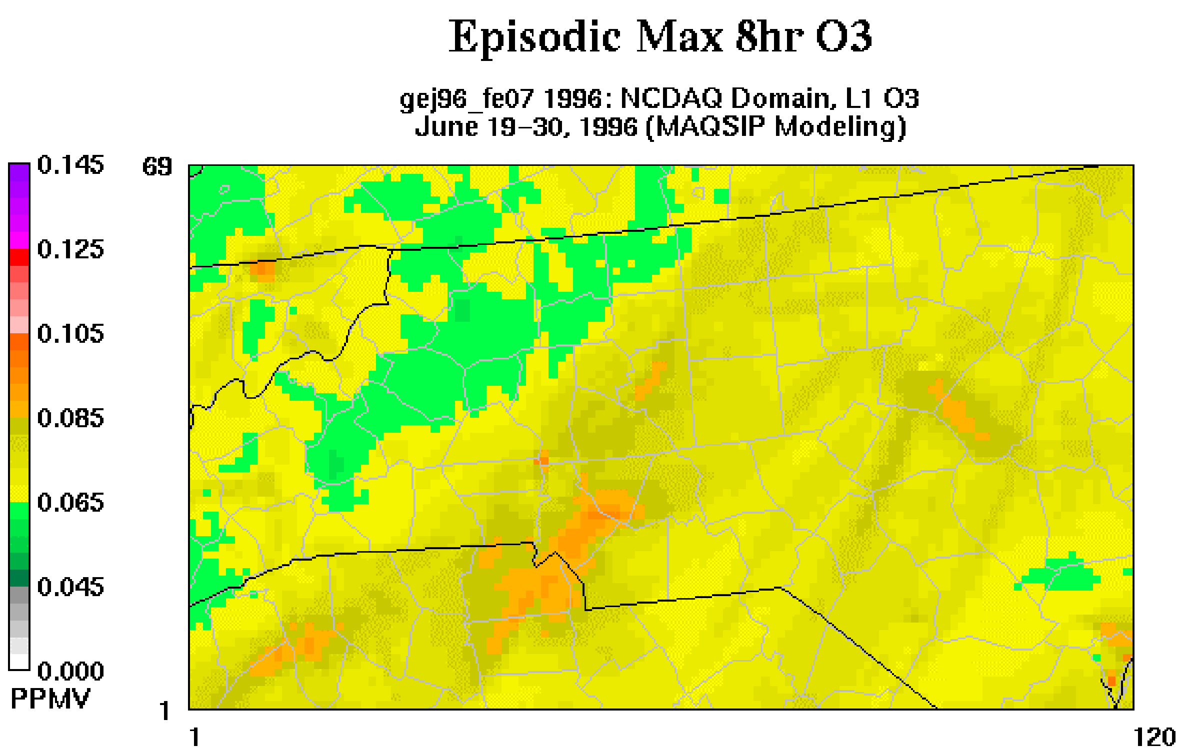


Figure 6.2-3 Difference plot between the 2007 future year and the 2000 current year 8-hour ozone episodic maximum for the 1996 episode.

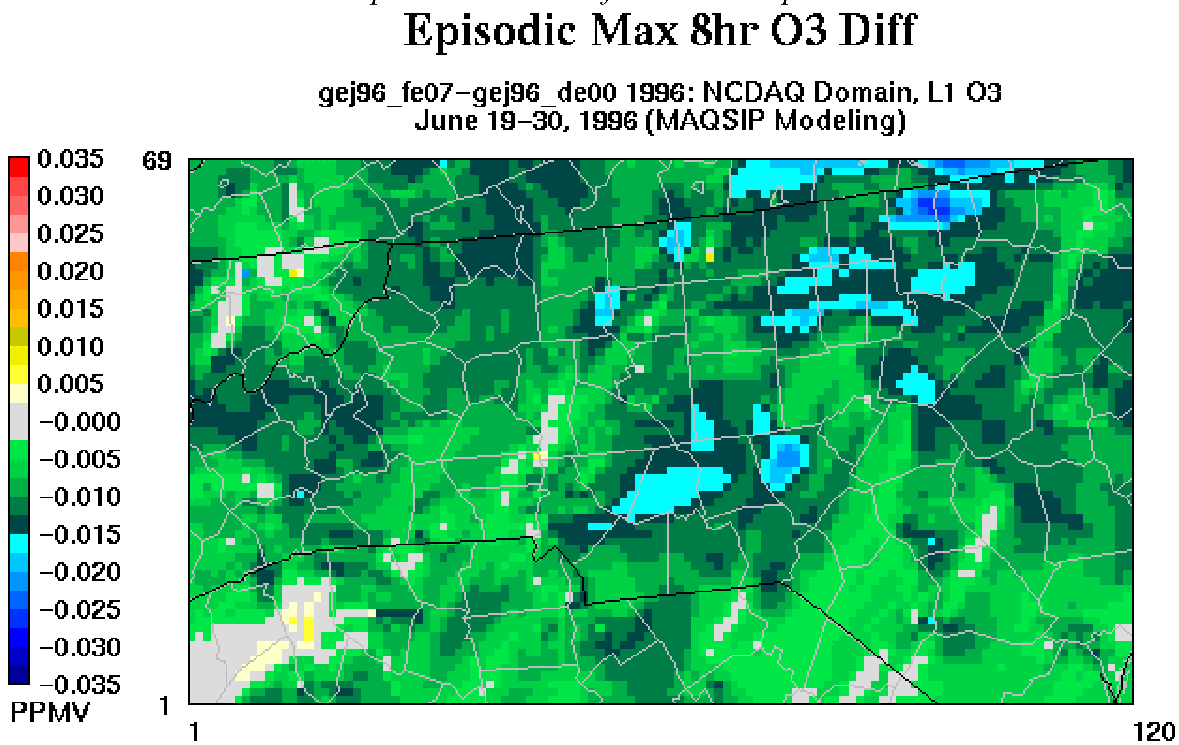


Figure 6.2-4 2000 current year 8-hour ozone episodic maximum for the 1997 episode.

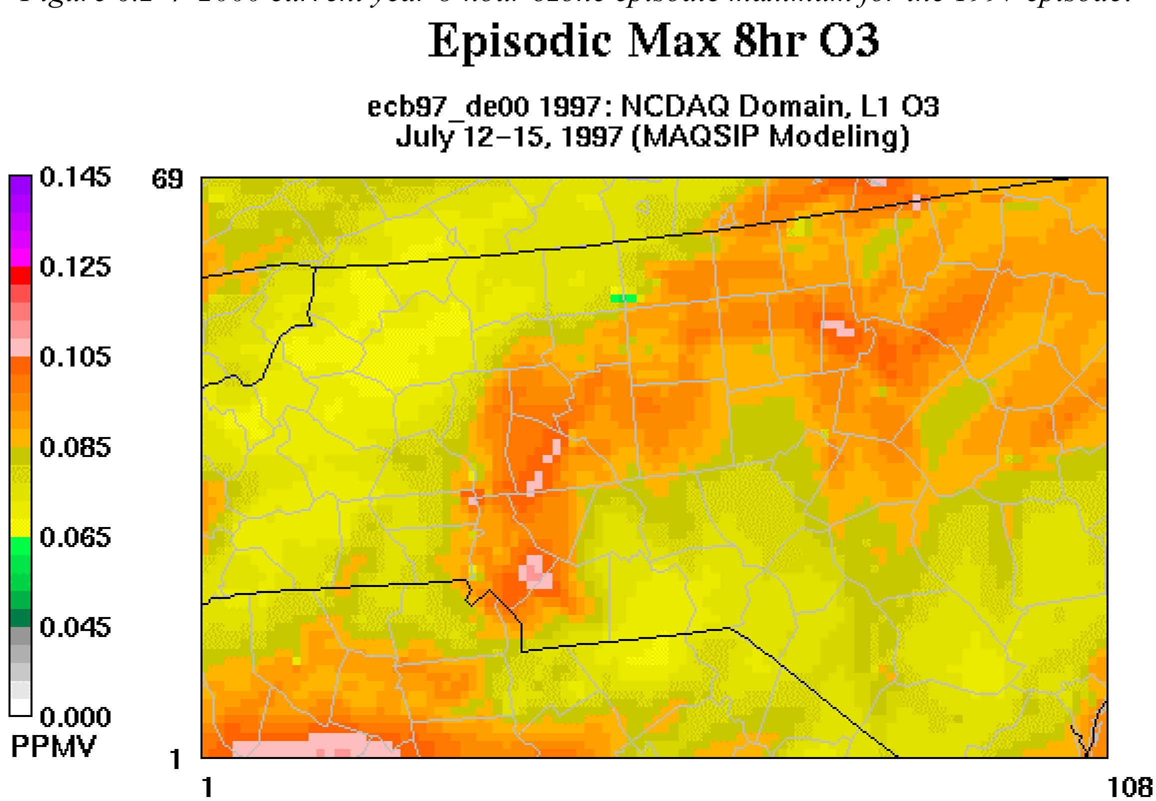


Figure 6.2-5 2007 future year 8-hour ozone episodic maximum for the 1997 episode.

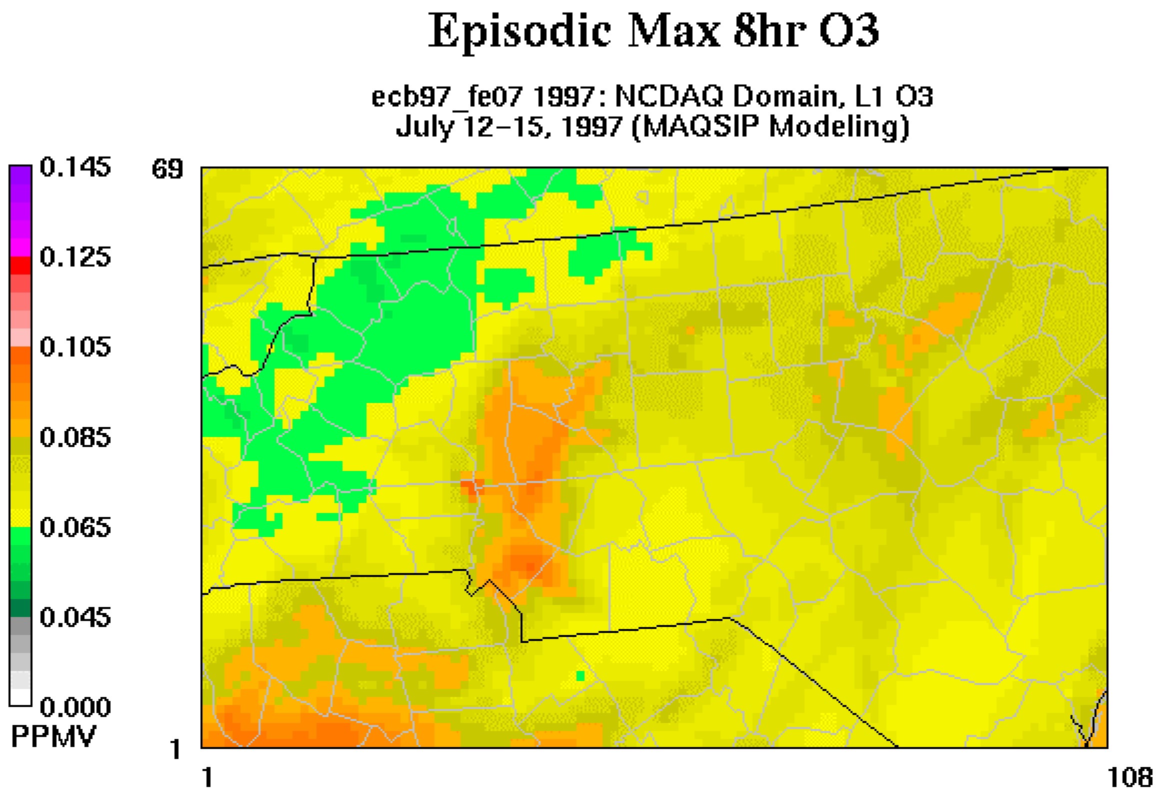
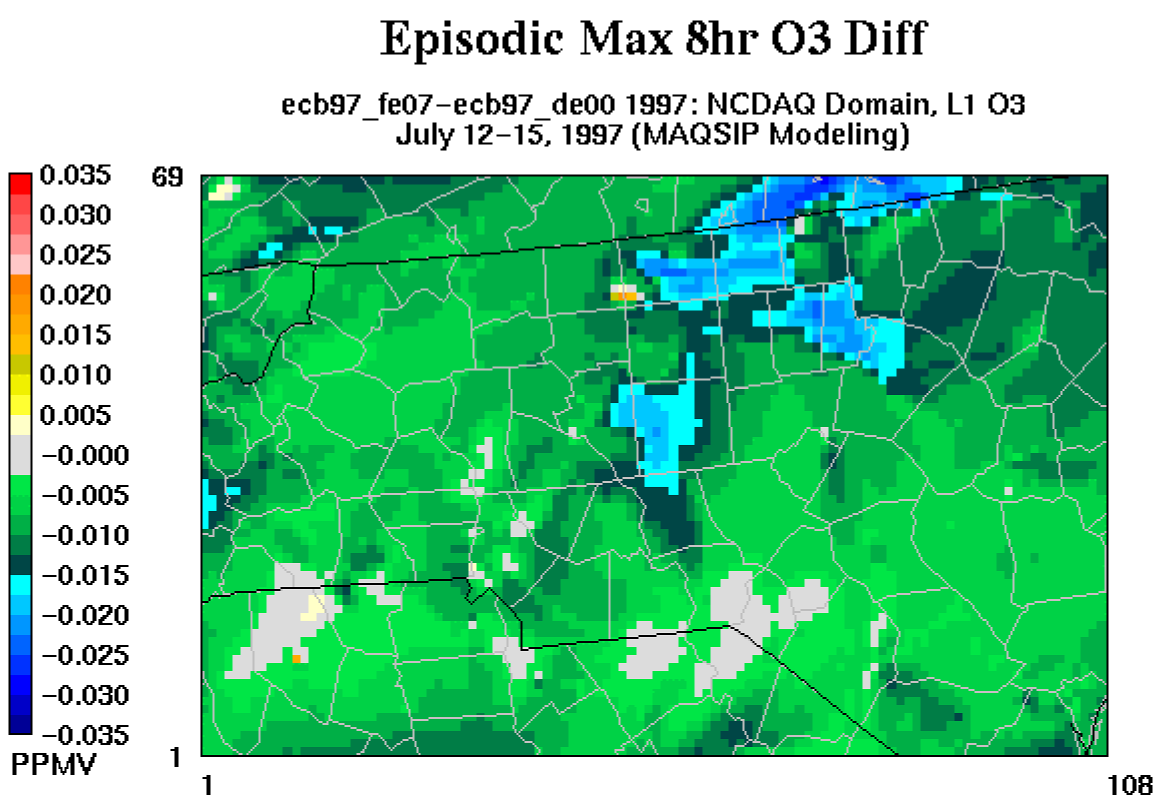


Figure 6.2-6 Difference plot between the 2007 future year and the 2000 current year 8-hour ozone episodic maximum for the 1997 episode.



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 but one in the Triad EAC area in attainment of the 8-hour ozone NAAQS in 2007. These results are displayed in Table 6.3-1 below. The one monitor still now showing attainment of the standard is Cooleemee. This monitor is located in the southern portion of Davie County and borders the Charlotte, NC MSA. In general, this monitor is influenced by emissions generated in the Charlotte area on a significant number of days. NCDAQ is still investigating possible solutions to bring this monitor into attainment, including working with the Charlotte area to determine controls the area is planning on implementing by 2007.

Table 6.3-1 Attainment Test Results for the EAC Area

Monitor Name	DVC (ppm)	RRF	DVF (ppm)
Bethany	0.091	0.880	0.080
Cherry Grove	0.090	0.860	0.077
Cooleemee	0.096	0.910	0.087
Hattie Avenue	0.094	0.880	0.082
McLeansville	0.090	0.860	0.077
Pollirosa	0.082	0.880	0.072
Shiloh Church	0.089	0.870	0.077
Sophia	0.085	0.870	0.073
Union Cross	0.093	0.870	0.080

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

Stationary Area Sources Emissions

Nonroad Mobile Sources Emissions

Highway Mobile Sources Emissions

By County

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
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			

Stationary Point Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
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
New Hanover	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
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

Stationary Point Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
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
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

Stationary Area Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
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
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

Stationary Area Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
New Hanover	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
Halifax	8.68	2.13	0.92	9.77	1.86	0.83

Nonroad Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
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
New Hanover	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
Stokes	8.18	0.68	0.72	9.54	0.61	0.64

Nonroad Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
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
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

Highway Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
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
New Hanover	81.67	9.12	7.49	48.41	6.14	4.72
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

Highway Mobile Sources Emissions in tons/day

County	2000			2007		
	CO	NOx	VOC	CO	NOx	VOC
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

Appendix B. Local Government Resolutions Approving Strategies

(Copies inserted in hard copy of Progress Report)

- Alamance County
- Caswell County
- Davidson County
- Davie County
- Guilford County
- Forsyth County
- Randolph County
- Rockingham County
- Stokes County
- Surry County
- Yadkin County
- Archdale
- Asheboro
- Burlington
- Clemmons
- Denton
- Elkin
- Elon
- Gibsonville
- Graham
- Greensboro
- High Point
- Jamestown
- Lexington
- Kernersville
- King
- Lewisville
- Liberty
- Madison
- Mayodan
- Mebane
- Mocksville
- Oak Ridge
- Pleasant Garden
- Ramseur
- Reidsville
- Rural Hall
- Stoneville
- Thomasville
- Tobaccoville
- Trinity
- Troy
- Walnut Cove
- Whitsett
- Winston-Salem
- Yanceyville