The North Carolina
8-Hour Ozone Attainment Demonstration
for the

Cumberland County Early Action Compact Area,
Mountain Area Early Action Compact Area,
(Buncombe, Haywood & Madison Counties)
Triad Early Action Compact Area,
(Alamance, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Rockingham, Stokes, Surry and Yadkin Counties)
and
Unifour Early Action Compact Area
(Alexander, Burke, Caldwell & Catawba Counties)

December 17, 2004

NCDENR

Prepared by:

North Carolina Department of Environment and Natural Resources
Division of Air Quality
Planning Section

PREFACE

This document contains North Carolina's modeling demonstration that the 8-hour ozone Early Action Compact (EAC)/Nonattainment areas will meet the National Ambient Air Quality Standard (NAAQS) for 8-hour tropospheric ozone by December 31, 2007. These areas include the Cumberland County EAC area, the Mountain area EAC area (Buncombe, Haywood and Madison Counties, NC), the Triad EAC area (Alamance, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Rockingham, Stokes, Surry and Yadkin Counties, NC), and the Unifour EAC area (Alexander, Burke, Caldwell & Catawba Counties)

EXECUTIVE SUMMARY

INTRODUCTION

Ozone is a strong chemical oxidant that adversely impacts human health through effects on respiratory function. Ozone can also damage forests and crops. Ozone is not emitted directly by industrial sources or motor vehicles but instead, is formed in the lower atmosphere, the troposphere. Ozone is formed by a complex series of chemical reactions involving nitrogen oxides (NOx), the result of combustion processes, and reactive organic gases. Organic gases, also termed volatile organic compounds (VOCs), include many industrial solvents, toluene, xylene and hexane as well as the various hydrocarbons that are evaporated from the gasoline used by motor vehicles or emitted through the tailpipe following combustion. Additionally, VOCs are emitted by natural sources such as trees and crops.

Ozone formation is promoted by strong sunlight, warm temperatures and light winds. High concentrations tend to be a problem in the eastern United States only during the hot summer months when these conditions frequently occur. Therefore, the U. S. Environmental Protection Agency (USEPA) mandates seasonal monitoring of ambient ozone concentrations in North Carolina from April 1 through October 31 (40 CFR 58 App. D, 2.5).

NATIONAL AMBIENT AIR QUALITY STANDARD (NAAQS)

The USEPA promulgated a new 8-hour ozone NAAQS in June 1997. The new NAAQS is 0.08 parts per million (ppm) averaged over 8 hours. An exceedance of the 8-hour ozone NAAQS occurs when a monitor measures ozone above 0.084 ppm (per the rounding convention). A violation of the NAAQS occurs when the average of the annual fourth highest daily maximum 8-hour ozone values over three consecutive years is greater than or equal to 0.085 ppm. This three year average is termed the design value for the monitor.

Since the 1977 amendments to the Clean Air Act (CAA), areas of the country that violated the ambient standard for a particular pollutant were formally designated as nonattainment for that pollutant. This formal designation concept was retained in the 1990 Amendments (CAAA), but additionally, areas designated as nonattainment for the 1-hour ozone NAAQS were to be classified as to the degree of nonattainment. Five categories were created (section 181 of the 1990 CAAA). In increasing severity, these were marginal, moderate, serious, severe and extreme. The attainment dates for these areas were based upon this classification. The highest monitor design value in an nonattainment area was used to determine its classification.

With the implementation of the 8-hour ozone standard, an area could be designated under section 172 of the 1990 CAAA (subpart 1) as “basic” and would have 5 years from designation to attain the standard. An area also could be designated under section 181 (subpart 2) and classified as one of the five categories listed above with attainment dates based on the classification. Areas with an 1-hour ozone design value greater than 0.121 ppm were classified under subpart 2 and all other areas were classified under subpart 1.

EARLY ACTION COMPACT

The Early Action Compact (EAC) process gives certain local areas the opportunity to develop local control strategies to meeting the 8-hour ozone standard earlier than would be required by the Clean Air Act. The early reduction in emission would benefit the citizens in the area since the air quality would improve sooner than would otherwise be required. By local EAC areas agreeing to implement these local control strategies early, the USEPA agreed to defer the effective date of the nonattainment designation. If an EAC area attains the 8-hour standard by December 31, 2007 and meets all of the EAC milestones, then the USEPA will designate the area as attainment.

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

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

The USEPA will defer the effective date of the nonattainment designations in three intervals. The first deferral was made in April 2004 to September 30, 2005. If an area has met all of the milestones required by September 30, 2005 then the designation will be deferred until December 31, 2006. Contingent on meeting all milestones required, in December 2006 the USEPA will defer the designations to April 15, 2008. If an area attains the 8-hour ozone standard by December 2007 and all other milestones have been met, then in April 2008 the USEPA will designate the EAC area as attainment for the 8-hour ozone standard. However, if at any time an area misses a milestone or is not attaining the standard by December 2007, then the deferral for the area is withdrawn and all applicable nonattainment requirements are due within one year.

NATURE OF PROBLEM IN NORTH CAROLINA

In April 2004, the USEPA designated areas as nonattainment for the 8-hour ozone NAAQS based upon air quality monitoring data measured during the 2001, 2002 and 2003 ozone seasons. These designations became effective on June 15, 2004. In North Carolina, there were seven areas designated as nonattainment (see Figure 1).

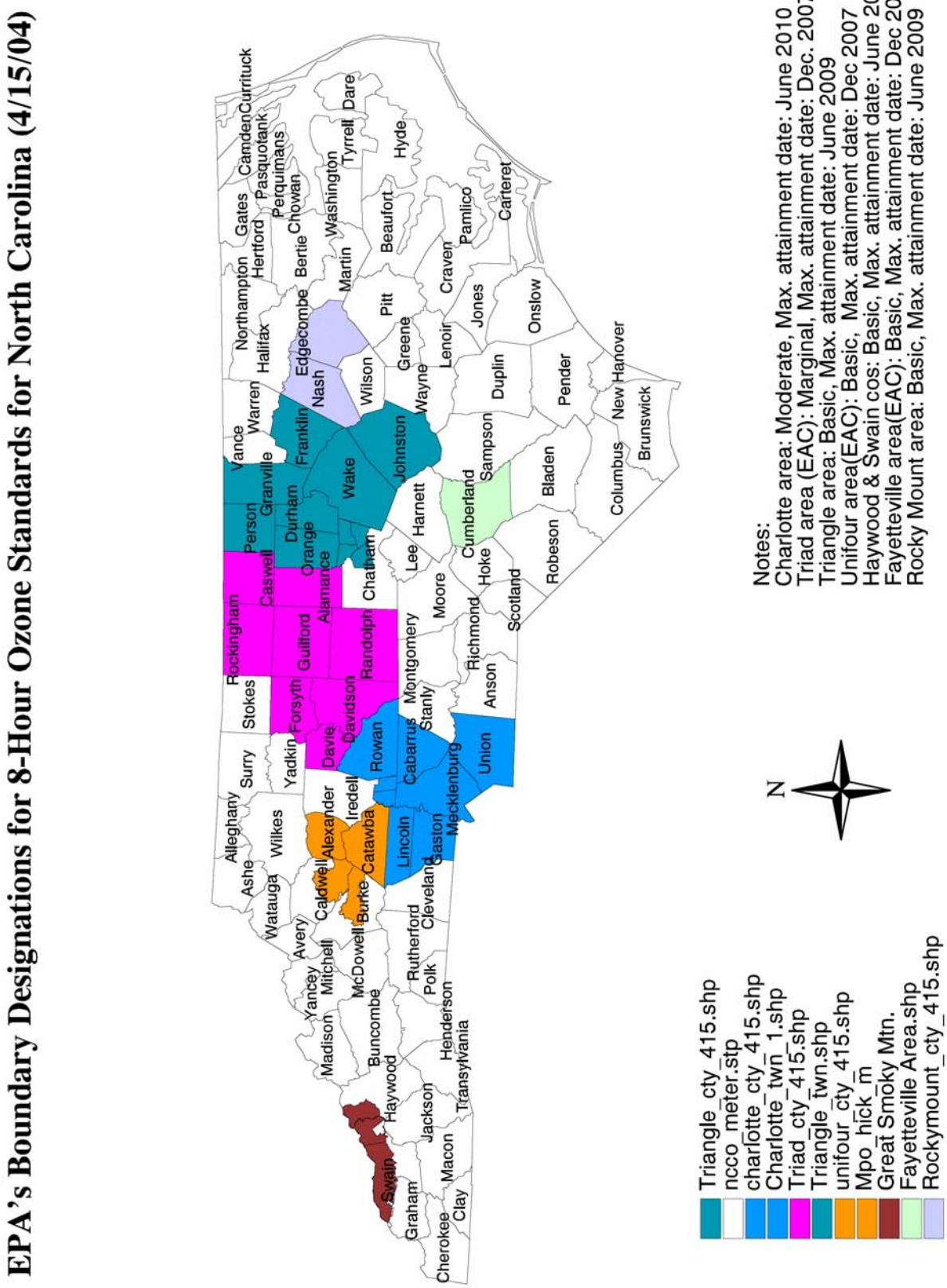

Figure 1. 8-hour Ozone Nonattainment Boundaries for North Carolina

This submittal covers four areas in North Carolina that participated in the EAC process. These areas are listed in Table 1 along with the designation classification and the attainment date. The Mountain area EAC was attaining the 8-hour ozone standard when designations were made, but three counties opted to continue with the EAC process.

Table 1 Nonattainment Classifications and Attainment Dates

Region/County		Classification	Attainment Date
Fayetteville EAC Area Cumberland		Basic	December 31, 2007
Hickory EAC Area Alexander Burke (Partial)	 Caldwell (Partial) Catawba	Basic	December 31, 2007
Greensboro/Winston-Salem/High Point EAC Area Alamace Caswell Davidson Davie	 Forsyth Guilford Randolph Rockingham	Marginal*	December 31, 2007
Mountain Area EAC Buncombe Haywood	 Madison	Attainment	N/A

*Designated Moderate on April 15, 2004, but reclassified to Marginal on September 22, 2004 with an effective date of November 22, 2004.

CONTROLS APPLIED

Several control measures already in place or being implemented over the next few years will reduce point, highway mobile, and nonroad mobile sources emissions. The Federal and State control measures were modeled for the future years.

The Federal control measures that were modeled included the Tier 2 vehicle standards, which affects all passenger vehicles in a manufacturer's fleet; the heavy-duty gasoline and diesel highway vehicle standards, which is designed to reduce NOx and VOC emissions from heavy-duty gasoline and diesel highway vehicles; large nonroad diesel engines standards, for equipment such as those used in construction, agricultural, and industrial equipment; and nonroad spark-ignition engines and recreational engines standard, which will regulate NOx, HC and CO for groups of previously unregulated nonroad engines.

The State control measures that were modeled included the Clean Air Bill, in which the vehicle emissions inspection and maintenance program was expanded from 9 counties to 48, phased in between July 1, 2002 through January 1, 2006. Another State measure was the NOx SIP Call Rule, which will reduce summertime NOx emissions from power plants and other industries by 68% by 2006. The Clean Smokestacks Act will reduce NOx emissions beyond the requirements of the NOx SIP Call Rule and will require coal-fired power plants to reduce annual NOx emissions by 78% by 2009. This is 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.

The only EAC measure that was modeled was the fuel switching at one of the RJ Reynolds facilities in the Triad EAC area. Details of the EAC control measures can be found in Appendix Q.

ATTAINMENT TEST RESULTS

The attainment test is not based on absolute modeling results but rather relative reductions of ozone and is only applied at the monitors. However, reviewing the modeling results of how the predicted ozone decreases in the future years and how wide spread the reductions are plays an important role for the State in determining if additional controls should be considered. The modeling results for each day used in the relative reduction factor calculations are available in Appendix M. Additionally, discussions about how this modeling demonstration meets the screening test for areas away from the monitoring sites and additional matrices performed to support the attainment test results are in Appendix N.

As stated above, the air quality modeling is used in a relative sense by determining what the relative reduction in ozone occurred between the current year and the future year. This 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 1).

$$\text{RRF} = \frac{\text{mean future yr. 8-hr daily max "near" monitor "x"}}{\text{mean current yr. 8-hr daily max "near" monitor "x"}} \qquad \text{Equation 1}$$

The RRF is then multiplied by the current design value for a monitory in order to calculate the future design values (Equation 2).

$$(\text{DVF}) = (\text{RRF}) \times (\text{DVC}) \qquad \text{Equation 2}$$

Table 2 lists the attainment test results by EAC area. The first column is the monitoring site, followed by the current design value used for the test. The next series of columns are the calculated relative reduction factor and the resulting future design value for each of the future years, i.e., the attainment year 2007 and the two maintenance years 2012 and 2017. The orange colored design values are values above the 8-hour ozone NAAQS. As you can see, all of the monitors in the EAC areas attain the NAAQS by 2007 and continue to maintain the standard 5 and 10 years beyond the attainment year.

Table 2 Attainment Test Results

Monitoring Site	DVC (ppm)	2007		2012		2017	
		RRF	DVF (ppm)	RRF	DVF (ppm)	RRF	DVF (ppm)
Fayetteville EAC Area							
Wade	0.088	0.890	0.078	0.830	0.073	0.790	0.069
Golfview	0.087	0.890	0.077	0.830	0.072	0.790	0.068
Mountain EAC Area							
Fry Pan	0.087	0.890	0.077	0.850	0.073	0.840	0.073
Purchase Knob	0.087	0.870	0.075	0.810	0.070	0.780	0.067
Bent Creek	0.083	0.900	0.074	0.840	0.069	0.820	0.068
Waynesville	0.080	0.890	0.071	0.840	0.067	0.820	0.065
Triad EAC Area							
Cooleemee	0.096	0.880	0.084	0.830	0.079	0.790	0.075
Hattie Ave.	0.094	0.860	0.080	0.800	0.075	0.760	0.071
Union Cross	0.093	0.850	0.079	0.790	0.073	0.760	0.070
Bethany	0.091	0.840	0.076	0.790	0.071	0.780	0.070
Cherry Grove	0.090	0.850	0.076	0.800	0.072	0.770	0.069
McLeansville	0.090	0.850	0.076	0.790	0.071	0.760	0.068
Shiloh Church	0.089	0.860	0.076	0.810	0.072	0.770	0.068
Sophia	0.085	0.850	0.072	0.790	0.067	0.760	0.064
Pollirosa	0.082	0.850	0.069	0.800	0.065	0.770	0.063
Unifour EAC Area							
Taylorsville	0.088	0.860	0.075	0.790	0.069	0.770	0.067
Lenoir/Caldwell Co.	0.087	0.850	0.073	0.790	0.068	0.770	0.066

Shaded area represents data from the 12-km grid modeling domain since the monitor is not within the 4-km grid modeling domain.

The modeling results clearly show reductions in expected future year ozone levels, although one monitor is close to the standard. However, the majority local EAC control measures were not included in the modeling. These expected emission reductions further support the conclusion that the EAC areas will attain and maintain the 8-hour ozone standard in the future.

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1.0 INTRODUCTION

1.1 What is tropospheric ozone?

Ozone is a strong chemical oxidant that adversely impacts human health through effects on respiratory function. Ozone can also damage forests and crops. Ozone is not emitted directly by industrial sources or motor vehicles but instead, is formed in the lower atmosphere, the troposphere. Ozone is formed by a complex series of chemical reactions involving nitrogen oxides (NOx), the result of combustion processes, and reactive organic gases. Organic gases, also termed volatile organic compounds (VOCs), include many industrial solvents, toluene, xylene and hexane as well as the various hydrocarbons that are evaporated from the gasoline used by motor vehicles or emitted through the tailpipe following combustion. Additionally, VOCs are emitted by natural sources such as trees and crops.

Ozone formation is promoted by strong sunlight, warm temperatures and light winds. High concentrations tend to be a problem in the eastern United States only during the hot summer months when these conditions frequently occur. Therefore, the U. S. Environmental Protection Agency (USEPA) mandates seasonal monitoring of ambient ozone concentrations in North Carolina from April 1 through October 31 (40 CFR 58 App. D, 2.5).

1.2 What is the National Ambient Air Quality Standard?

In 1997 the U. S. Environmental Protection Agency (USEPA) revised the national ambient air quality standard (NAAQS) for ground-level ozone (40 CFR 50.9), setting the standard at 0.08 parts per million (ppm) averaged over an 8-hour period. The USEPA was sued on this action and in May 1999 the U. S. Court of Appeals for the D. C. Circuit remanded the 8-hour ozone standard back to the USEPA. In 2001, the USEPA proposed a response to the remand and reaffirmed the standard. Finally, in 2003 the 8-hour ozone standard became effective. The USEPA made nonattainment designations for the 8-hour ozone standard on April 30, 2004 with an effective date of June 15, 2004. The previous standard was a 1-hour standard of 0.012 ppm averaged over 1-hour. The new 8-hour standard is considered much more stringent than the previous standard and it is expected to replace the 1-hour standard one year from the effective dated of the nonattainment designations.

An exceedance of the 8-hour ozone NAAQS occurs when a monitor measures ozone above 0.084 ppm (per the rounding convention). A violation of the NAAQS occurs when the average of the annual fourth highest daily maximum 8-hour ozone values over three consecutive years is greater than or equal to 0.085 ppm. This three year average is termed the design value for the monitor.

Since the 1977 amendments to the Clean Air Act (CAA), areas of the country that violated the ambient standard for a particular pollutant were formally designated as nonattainment for that pollutant. This formal designation concept was retained in the 1990 Amendments (CAAA), but additionally, areas designated as nonattainment for the 1-hour ozone standard were to be classified as to the degree of nonattainment. Five categories were created (section 181 of the

1990 CAAA). In increasing severity, these were marginal, moderate, serious, severe and extreme. The attainment dates for these areas were based upon this classification. The highest monitor design value in an nonattainment area was used to determine its classification.

With the implementation of the 8-hour ozone standard, an area could be designated under section 172 of the 1990 CAAA (subpart 1) as "basic" and would have 5 years from designation to attain the standard or could be designated under section 181 (subpart 2) and classified as one of the five categories listed above with attainment dates based on the classification. Areas with an 1-hour ozone design value greater than 0.121 ppm were classified under subpart 2 and all other areas were classified under subpart 1.

1.3 What is an Early Action Compact?

The Early Action Compact (EAC) process gives certain local areas the opportunity to develop local control strategies to meet the 8-hour ozone standard earlier than would be required by the Clean Air Act. The early reduction in emissions would benefit the citizens in the area since the air quality would improve sooner than would otherwise be required. By local EAC areas and the state agreeing to implement control strategies early, the USEPA agreed to defer the effective date of the nonattainment designation. The state would submit, by December 31, 2004, modeling to demonstrate the EAC area would attain the standard by December 31, 2007 and if the EAC area attains the 8-hour standard by December 31, 2007 and meets all of the EAC milestones, then the USEPA will designate the area as attainment.

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

The EAC requires that areas meet several milestones to be eligible for a deferral of the effective date of the 8-hour ozone designations. These milestones include:

- *December 31, 2002 - Compact signed by all parties in MSA (local officials, state air quality agency, and EPA Region)*
- *June 16, 2003 - Submit list of local control measures being considered*
- *March 31, 2004 - Local plan submitted to the state*
- *December 31, 2004 - State adopts control measures into SIP & submits measures and attainment demonstration to EPA for approval*
- *2005 – Areas implement control measures*
- *June 30, 2006 - Progress assessment and report to EPA*
- *December 31, 2007 – Areas attain 8-hr ozone NAAQS*

The USEPA will defer the effective date of the designations in three intervals. The first deferral was made in April 2004 when the USEPA announced the 8-hour ozone nonattainment boundaries. The first deferral was based on the submittal of the March 31, 2004 local plans. The nonattainment designation for EAC areas was deferred until September 30, 2005. If an area has met all of the milestones required by September 30, 2005, and the USEPA determines that the EAC SIP for each area is appropriate, then the designation will be deferred until December 31, 2006. Contingent on meeting all milestones required including the implementation of the EAC control measures, in December 2006 the USEPA will defer the designations to April 15, 2008. If an area attains the 8-hour ozone standard by December 2007 and all other milestones have been met, then in April 2008 the USEPA will designate the EAC area as attainment for the 8-hour ozone standard. However, if at any time an area misses a milestone or is not attaining the standard by December 2007, then the deferral for the area is withdrawn and all applicable nonattainment requirements are due within one year.

North Carolina had four areas sign compacts: the Cumberland County (Fayetteville) Area; the Mountain Area (Buncombe, Haywood, Henderson, Madison and Transylvania Counties); the Triad Area (Alamance, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Rockingham, Stokes, Surry and Yadkin Counties); and the Unifour Area (Alexander, Burke, Caldwell and Catawba Counties). Two counties, Henderson and Transylvania Counties, dropped out of the Mountain Area EAC when the area was designated as attainment in April 2004. The other counties in the Mountain Area EAC decided to continue on with the process since they believed in the benefits of the program. Figure 1.3-1 is a map of the original EAC areas in North Carolina.

1.4 Nature of Problem in North Carolina

In April 2004, the USEPA designated areas as nonattainment for the 8-hour ozone NAAQS based upon air quality monitoring data measured during the 2001, 2002 and 2003 ozone seasons. These designations became effective on June 15, 2004. In North Carolina, there were seven areas designated as nonattainment (Figure 1.4-1).

This submittal covers four areas in North Carolina that took part in the EAC process. These areas are listed in Table 1.4-1 along with the designation classification and the attainment date. The Mountain area EAC was attaining the 8-hour ozone standard when designations were made, but three counties opted to continue with the EAC process.

Table 1.4-1 Nonattainment Classifications and Attainment Dates

Region/County		Classification	Attainment Date
Fayetteville EAC Area Cumberland		Basic	December 31, 2007
Hickory EAC Area Alexander Burke (Partial)	Caldwell (Partial) Catawba	Basic	December 31, 2007
Greensboro/Winston-Salem/High Point EAC Area Alamace Caswell Davidson Davie	Forsyth Guilford Randolph Rockingham	Marginal*	December 31, 2007
Mountain Area EAC Buncombe Haywood	Madison	Attainment	N/A

*Designated Moderate on April 15, 2004, but reclassified to Marginal on September 22, 2004 with an effective date of November 22, 2004.

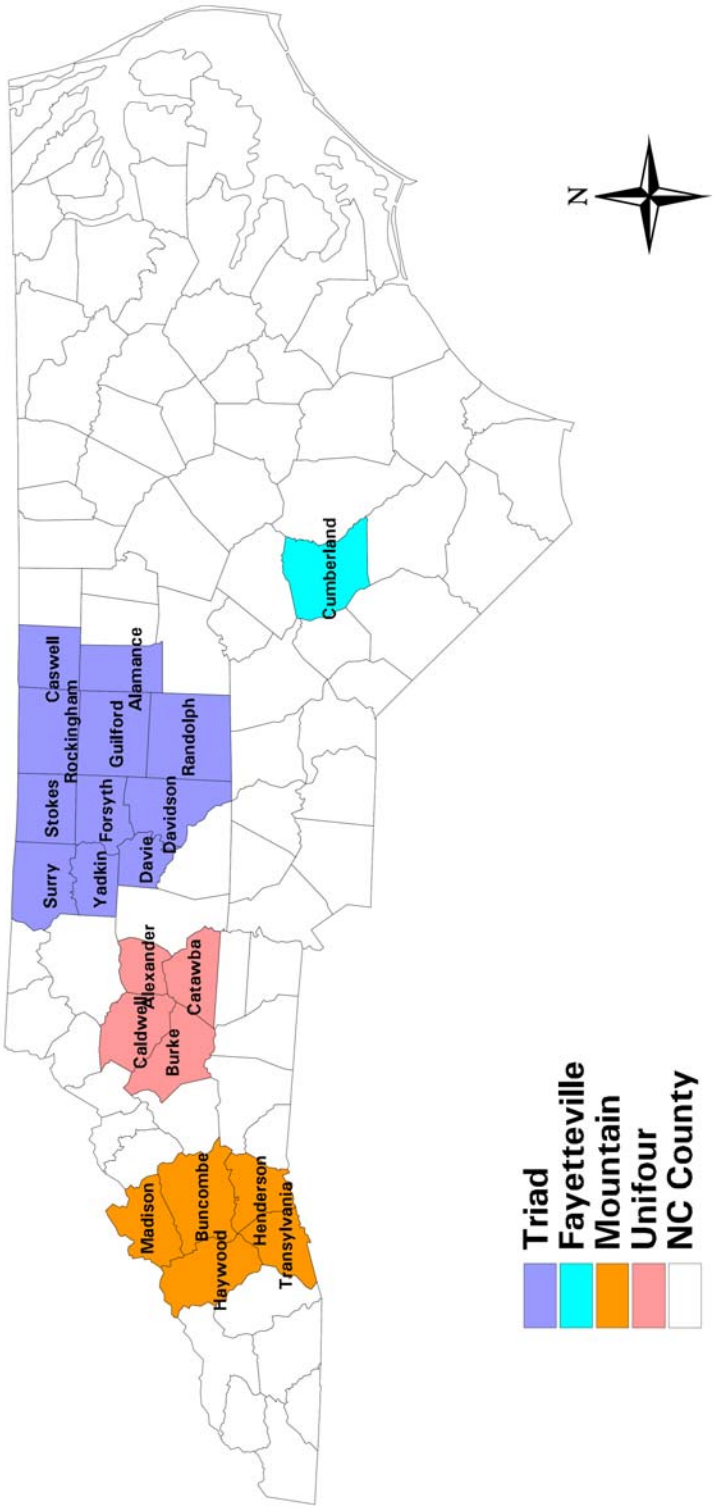

Figure 1.3-1 North Carolin Early Action Compact Areas

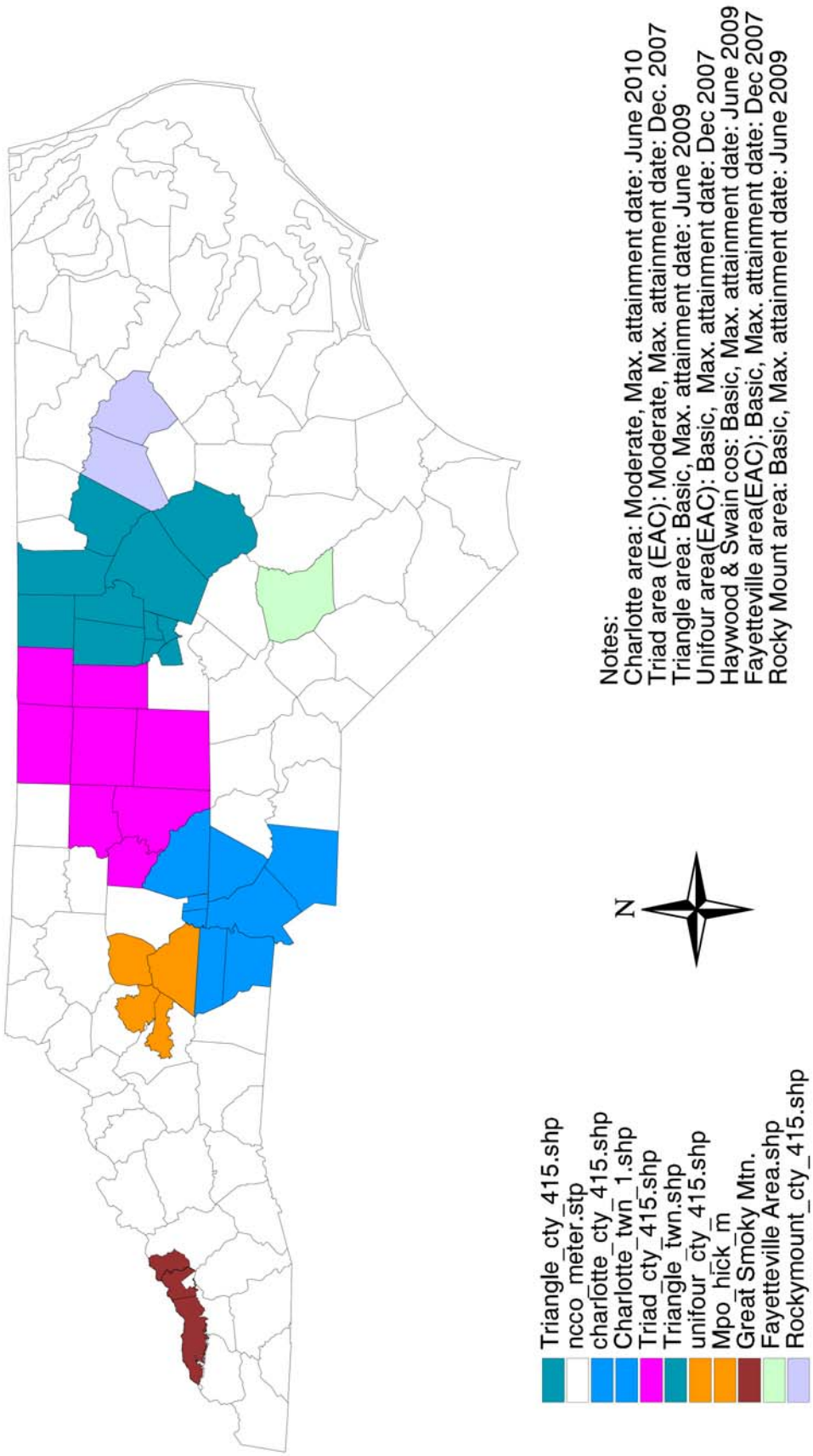

Figure 1.4-1 8-hour Ozone Nonattainment Boundaries for North Carolina

The air quality data that the designations were based on is listed in Table 1.4-2. This table includes all of the monitors within the EAC areas. The historic air quality data for the EAC areas are listed in Appendix E.

Table 1.4-2 Air Quality Data Designations are Based Upon

Monitor	County	4th Highest 8-hour Ozone Value			2001-2003 Design Value
		2001	2002	2003	
Fayetteville EAC Area					
Wade	Cumberland	0.080	0.094	0.086	0.086
Hope Mills	Cumberland	0.084	0.095	0.082	0.087
Mountain EAC Area					
Bent Creek	Buncombe	0.076	0.090	0.070	0.078
Fry Pan	Haywood	0.081	0.090	0.077	0.082
Purchase Knob*	Haywood	0.082	0.094	0.081	0.085
Waynesville	Haywood	0.075	0.084	0.079	0.079
Triad EAC Area					
Cooleemee	Davie	0.094	0.098	0.089	0.093
Hattie Ave.	Forsyth	0.094	0.099	0.087	0.093
Union Cross	Forsyth	0.094	0.093	0.081	0.089
Shiloh Church	Forsyth	0.096	0.094	0.074	0.088
Cherry Grove	Caswell	0.087	0.095	0.083	0.088
McLeansville	Guilford	0.086	0.104	0.079	0.089
Bethany	Rockingham	0.094	0.096	0.083	0.091
Sophia	Randolph	0.085	0.092	0.078	0.085
Pollirosa	Forsyth	0.082	0.088	0.078	0.082
Unifour EAC Area					
Taylorsville	Alexander	0.088	0.095	0.081	0.088
Lenoir	Caldwell	0.082	0.092	0.079	0.084

*The Purchase Knob monitor is located in the Great Smoky Mountain National Park and only the park boundary was designated as “basic” nonattainment and is not covered by the Mountain EAC.

2.0 ATTAINMENT DEMONSTRATION METHODS AND INPUTS

2.1 Analysis Method

The modeling analysis is a complex technical evaluation that begins by selection of the modeling system. The 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.

Additionally, historical episodes are selected to model that represent typical meteorological conditions in North Carolina when high ozone is observed throughout the State. Once episodes are selected, meteorological inputs are developed using the meteorological model. Emission inventories are also developed for the episodes and processed through the emissions model. These input are used in the air quality model to predict ozone and the results are compared to the historic data. The model performance is evaluated by comparing the modeled predicted data to the historic air quality data.

Once model performance is deemed adequate, the current and future year emissions are processed through the emissions model. For this demonstration, the current year was 2000, the attainment future year was 2007, and the two maintenance future years were 2012 and 2017. These emissions are processed through the air quality model with the episodic meteorological inputs. The air quality modeling results are used to determine a relative reduction in future ozone which is used in the attainment demonstration.

The complete modeling protocol used for this analysis can be found in Appendix F.

2.2 Model Selection

To ensure that a modeling study is defensible, care must be taken in the selection of the models to be used. The models selected must be scientifically appropriate for the intended application and be freely accessible to all stakeholders. Scientifically appropriate means that the models address important physical and chemical phenomena in sufficient detail, using peer-reviewed methods. Freely accessible means that model formulations and coding are freely available for

review and that the models are available to stakeholders, and their consultants, for execution and verification at no or low cost.

The following sections outline the criteria for selecting a modeling system that is both defensible and capable of meeting the study's goals. North Carolina used this criteria in selecting the modeling system used in the development of the EAC attainment demonstration SIP.

2.2.1 Selection of Photochemical Grid Model

Criteria

For a photochemical grid model to qualify as a candidate for use in an attainment demonstration of the 8-hour ozone NAAQS, a State needs to show that it meets several general criteria:

- The model has received a scientific peer review
- The model can be demonstrated applicable to the problem on a theoretical basis
- Data bases needed to perform the analysis are available and adequate
- Available past appropriate performance evaluations have shown the model is not biased toward underestimates or overestimates
- A protocol on methods and procedures to be followed has been established
- The developer of the model must be willing to make the source code available to users for free or for a reasonable cost, and the model cannot otherwise be proprietary.

Overview of MAQSIP

The photochemical model selected for this study is the Multiscale Air Quality SImulation Platform (MAQSIP). References for MAQSIP, demonstrating that this modeling system has received a scientific peer review, can be found in Appendix F. MAQSIP is a fully modularized three-dimensional system with various options for representing the physical and chemical processes describing regional- and urban-scale atmospheric pollution. The governing model equations for tracer continuity are formulated in generalized coordinates, thereby providing the capability of interfacing the model with a variety of meteorological drivers. The model employs flexible horizontal grid resolution with multiple multi-level nested grids with options for one-way and two-way nesting procedures. In the vertical, the capability to use non-uniform grids is provided. Current applications have used horizontal grid resolutions from 18-80 km for regional applications and 2-6 km for urban scale simulations, and up to 30 layers to discretize the vertical domain.

The MAQSIP framework with the detailed gas-phase and aerosol model provides a modeling system that can be used for investigating the various processes that govern the loading of chemical species and anthropogenic aerosols at various scales of atmospheric motions from urban, regional to intercontinental scales. For example, MAQSIP has been used to support the Southeastern States Air Resources Management (SESARM) project to produce seasonal simulations of ozone over eastern United States. The gas-aerosol version of the MAQSIP

(hereinafter the MAQSIP-PM) has been used in urban-to-regional-scale applications over the eastern and western United States, and western Europe, to study the production and distribution of fine and coarse PM, and its effects on visibility and the radiation budget.

For regulatory application, a specific configuration of MAQSIP has been used in this study. This configuration of MAQSIP follows a series a sensitivity tests to determine the best performing modules. This configuration has the following components:

- Horizontal Coordinate System: *Lambert Conformal Projection*
- Vertical Coordinate System: *Non-Hydrostatic Sigma-Pressure Coordinates*
- Gas Phase Chemistry: *Carbon Bond IV with Isoprene updates*
- Aqueous Phase Chemistry: *Included in cloud package*
- Chemistry Solver: *Modified QSSA*
- Horizontal Advection: *Bott*
- Cloud Physics: *Kain-Fritsch parameterization and explicit, as needed*
- Horizontal Turbulent Diffusion: *Fixed* K_h
- Vertical Turbulent Diffusion: *K-Theory*
- Photolysis Rates: *Madronich*
- Dry Deposition: *Resistance*
- Wet Deposition: *Included in cloud package*

2.2.2 Selection of Meteorological Model

Criteria

Meteorological models, either through objective, diagnostic, or prognostic analysis, extend available information about the state of the atmosphere to the grid upon which photochemical grid modeling is to be carried out. The criteria for selecting a meteorological model are based on both the models ability to accurately replicate important meteorological phenomena in the region of study, and the model's ability to interface with the rest of the modeling systems -- particularly the photochemical grid model. With these issues in mind, the following criteria were established for the meteorological model to be used in this study:

- Non-Hydrostatic Formulation
- Reasonably current, peer reviewed formulation
- Simulates Cloud Physics
- Publicly available on no or low cost
- Output available in I/O API format
- Supports Four Dimensional Data Assimilation (FDDA)

- Enhanced treatment of Planetary Boundary Layer heights for AQ modeling

Overview of MM5

The meteorological model selected for this study is the nonhydrostatic PSU/NCAR Mesoscale Model Version 5 (MM5). MM5 (Dudhia 1993; Grell et al. 1994) is one of the leading three-dimensional prognostic meteorological models available for air quality studies. It uses an efficient split semi-implicit temporal integration scheme and has a nested-grid capability that can use up to ten different domains of arbitrary horizontal resolution. This allows MM5 to simulate local details with high resolution (as fine as ~1 km), while accounting for influences from great distances, using horizontal resolutions ranging to about 200 km.

MM5 uses a terrain-following nondimensionalized pressure, or “sigma”, vertical coordinate similar to that used in many operational and research models. In the nonhydrostatic MM5, the sigma levels are defined according to the initial hydrostatically balanced reference state so that these levels are also time-invariant. The meteorological fields also can be used in other photochemical grid models with different coordinate systems by performing a vertical interpolation followed by a mass-consistency reconciliation step.

The model contains two types of planetary boundary layer (PBL) parameterizations suitable for air-quality applications, both of which represent subgrid-scale turbulent fluxes of heat, moisture, and momentum. A modified Blackadar PBL (Zhang and Anthes 1982) uses a first-order eddy diffusivity formulation for stable and neutral environments and a nonlocal closure for unstable regimes. The Gayno-Seaman PBL (Gayno, 1994) uses a prognostic equation for the second-order turbulent kinetic energy, while diagnosing the other key boundary layer terms. This is referred to as a 1.5-order PBL, or level-2.5, scheme (Mellor and Yamada 1974).

Initial and lateral boundary conditions are specified for real-data cases from mesoscale 3-D analyses performed at 12-hour intervals on the outermost grid mesh selected by the user. Surface fields are analyzed at three-hour intervals. A Cressman-based technique is used to analyze standard surface and radiosonde observations, using the National Meteorological Center's spectral analysis, as a first guess (Benjamin and Seaman 1985). The lateral boundary data are introduced using a relaxation technique applied in the outermost five rows and columns of the coarsest grid domain.

For most traditional (1-hour standard) high-ozone episodes, precipitation is not the dominant factor. On the other hand, precipitation events may have a greater impact on 8-hour average ozone episodes. The MM5 contains five convective parameterization schemes (Kuo, Betts-Miller, Fritsch-Chappell, Kain-Fritsch, and Grell). It also has an explicit resolved-scale precipitation scheme (Dudhia 1989) that solves prognostic equations for cloud water/ice (q_c) and larger liquid or frozen hydrometeors (q_r). In addition the model contains a short- and long-wave radiation parameterization (Dudhia 1989).

2.2.3 Selection of Emissions Processing System

Criteria

The principal criterion for an emissions processing system is that it accurately prepares emissions files in a format suitable for the photochemical grid model being used. The following list includes clarification of this criterion and additional desirable criteria for effective use of the system.

- File System Compatibility with the I/O API
- File Portability
- Ability to grid emissions on a Lambert Conformal projection
- Report Capability
- Graphical Analysis Capability
- MOBILE6 Mobile Source Emissions
- BEIS-2 Biogenic Emissions
- Ability to process emissions for the proposed domain in a day or less.
- Ability to process control strategies
- No or low cost for acquisition and maintenance
- Expandable to support other species and mechanisms

Overview of SMOKE

The emissions processing system selected for this study is the Sparse Matrix Operator Kernel Emissions (SMOKE). SMOKE was developed to reduce the large processing times required to prepare emissions data for photochemical grid models. SMOKE processes both anthropogenic and biogenic emissions. Biogenic emissions are processed using an implementation of BEIS-3.

The modular structure of SMOKE (see Appendix A) removes much of the redundant processing found in other systems. This will provide even greater savings of CPU time and disk space when SMOKE is used to process control strategies. Unlike other emission processing systems, SMOKE's structure makes each process (i.e., gridding, speciation, temporal allocation, and control application) independent from the others. For example, to run a new control strategy, only the control model must be rerun, and the time-stepped emissions multiplied by the matrices. This whole process takes only a few minutes to process a new point source strategy and a few additional minutes if area and mobile sources are also changed.

SMOKE has undergone an extensive process of testing and validation. It has been validated on a regional scale against EMS-95 using the OTAG 1990 inventory, and on a large urban scale against EPS 2.0 using North Carolina's State Implementation Plan (SIP) inventory. SMOKE can be driven with inputs in either EMS-95, EPS 2.0 or IDA format, and it can produce photochemical grid model-ready emissions in forms suitable to drive UAM-IV, UAM-V,

MAQSIP, CMAQ and SAQM. SMOKE has adopted the Models-3 Input/Output Application Program Interface (I/O API) so the emissions files created by SMOKE are directly readable by Models-3, MCNC's MAQSIP, and the supporting analysis tools developed for these systems.

2.3 Episode Selection

The episode selection process is critical to the success of the modeling study. Correctly identifying representative ozone episodes to model for several areas in North Carolina allows an evaluation, with confidence, of various control strategies for maintaining the NAAQS for ozone. Several factors influenced episode selection for this modeling study. In the following sections the factors and considerations are outlined for episode selection, followed by a detail discussion of the episodes selected for this modeling study.

2.3.1 Factors Influencing Episode Selection

Several factors influenced episode selection for this modeling study. The primary factor influencing episode selection was the promulgation of an 8-hour standard for ozone and the litigation that followed. This led to uncertainties surrounding the implementation of the standard. Also, the form of the new 8-hour standard makes it less dependent on extreme events than the 1-hour standard. Therefore, meteorological scenarios associated with 8-hour exceedances were reviewed and considered for modeling. A combination of these factors led to choosing episodes where both the 1-hour and 8-hour standards were exceeded.

An analysis of episodes with exceedances of 1-hour and 8-hour standards will allow an assessment of the differences that the two standards may have on control strategy development and will indicate whether control strategies designed to meet the 8-hour standard will also be effective at reducing ozone levels below the 1-hour standard. The "dual" need to model 1-hour and 8-hour exceedances was a primary criterion in the episode selection process.

A second factor affecting the selection process was the form of the new standard. The 1-hour standard allowed 1 exceedance per year in a region on average with the design value being the 4th highest 1 hour value in that region over 3 years. This means that, in theory, only the 3 worst case episodes in a 3-year period can be removed from consideration for modeling. The design value under the 8-hour standard is calculated differently. It is the yearly 4th highest 8-hour value at each monitor, averaged over 3 years. With the new standard it is possible to “throw out” the 3 worst case episode days of each year, or approximately 9 days over 3 years for each monitor. Because the 4th high value is determined for each individual monitor, discarding days with higher values can result in the removal of more than 9 worst case days if the high readings for all monitors do not occur on the same days. For example, exceedances may be measured north of a city during days when the wind blows predominately from the south, but measured at monitors south of the city on other days when winds are northerly. Discarding days above the 4th highest measurement in this example could result in removal of more than 9 worst case episode days in three years. This makes the standard less dependent on extreme events.

2.3.2 Episode Selection Considerations

The methodologies suggested in the USEPA's draft guidance for episode selection is the same for both the 1-hour and 8-hour standards. These methodologies were applied to the extent possible when attempting to choose episodes. The episode selection criteria was compromised to some extent by the need to simultaneously model multiple areas in North Carolina.

First, we considered a mix of episodes reflecting a variety of meteorological scenarios which frequently correspond with observed 8-hour daily maxima > 0.084 ppm at different monitoring sites. An analysis of each ozone episode was made using several sources of air quality and meteorological data to determine the episodes that would contribute the most to the modeling effort.

Secondly, we considered periods in which observed 8-hour daily maximum concentrations were within ±0.010 ppm of each area's design value. Since modeling for the new 8-hour standard may capture some 1-hour exceedances, 8-hour averaged ozone concentrations were given primary consideration. The 8-hour design values were calculated statewide, with a focus on the three major urban areas of North Carolina; Charlotte/Gastionia, Greensboro/Winston-Salem (the Triad), and Raleigh/Durham (the Triangle), using monitored values from 1994-2002. The average of each year's fourth highest daily 8-hour averaged maximum concentration for each monitor statewide was calculated and used as a guide for determining the episodes with concentrations within ±0.010 ppm of the area's design value.

Finally, the temporal and spatial distribution of ozone throughout North Carolina was also an important consideration. The new 8-hour standard brings areas such as Fayetteville, Rocky Mount and Hickory into nonattainment. Therefore, it was necessary to choose episodes affecting those areas as well as the three major urban areas mentioned above. Episodes containing widespread ozone exceedances were given priority over those containing isolated exceedances. Also, the need to study the cumulative effects of ozone build-up over a number of days was recognized, so episodes of extended duration were given preference over single day exceedances.

Meeting all of the criteria in all areas is sometimes difficult. For example, during many "moderate" ozone events, ozone exceedances are not widespread throughout North Carolina. Selection of these episodes can dramatically increase the number of modeled episodes needed to complete a thorough analysis of all nonattainment areas across the state. On the other hand, episodes with exceedances in all nonattainment areas often contain scattered extreme values.

To reduce the number of episodes to a manageable number, while also performing a complete analysis on each major urban area of North Carolina, we made some compromise in the selection criteria. Ideally, no days with concentrations well above an area's design value would have been included in the selected episodes. However, on some days concentrations in one or two areas were found to be ideal for modeling while another area had observed concentrations well above its' ozone design value. Days such as these were included in the selected episodes due to the days' overall positive attributes.

2.3.3 Episode Selection Procedures

Ambient data was used to determine the days that exceedances of the 1-hour and/or 8-hour standard occurred in any of the major urban areas of North Carolina from 1995 through 1997. These days were grouped into episodes and evaluated using the selection criteria discussed in the preceding section. An analysis of each ozone episode was made using several sources of air quality and meteorological data to determine the episodes that would contribute the most to the modeling effort.

Sets of ambient ozone data from 1995-1997 for the eastern US were plotted using Voyager Viewer software. The data were plotted for the eastern US using both hourly and 8-hour peak ozone concentrations. This permitted easy assessment of the spatial and temporal distribution of ozone throughout North Carolina as well as other areas of the eastern US and made it possible to easily determine whether the event was regional, sub-regional, or local in nature. These plots combined with meteorological plots also indicated the potential for recirculation. In one episode, shifts in wind direction corresponded to shifts in the location of ozone peaks in the Charlotte area, suggesting that recirculation may have contributed to exceedances of both ozone standards.

In addition to the ambient data plots, several surface and upper air meteorological data sets were used to assess the atmospheric conditions contributing to the build-up of ozone in each episode. Local Climatological Data sheets were used to collect diurnal data on temperatures, precipitation, and wind speed and direction. Daily weather maps were used to determine the location of surface fronts, troughs, and ridges as well as daily peak temperatures, precipitation, and the location of high and low pressure areas. Analysis charts (0000 Z and 1200 Z) for the surface, 850 mb, 700 mb, and 500 mb levels from the National Oceanic and Atmospheric Administration – National Centers for Environmental Prediction (NOAA-NCEP) Eta meteorological computer model were also used to assess conditions such as surface and upper air wind fields, temperatures, moisture, and the location of ridges and troughs. The conditions contributing to high levels of ozone were determined through chart analysis, and the type of meteorology was used to group episodes.

2.3.4 Episode Selection

All days with ozone exceedances in any of the major urban areas of North Carolina were considered in the episode selection process. These days were divided into episodes based on the distribution of measured ozone and the meteorological conditions that occurred throughout the period of exceedance. The meteorological characteristics of each episode were studied using the tools outlined in the previous section. All episodes will have some common characteristics. Warm temperatures, little or no precipitation, and relatively light winds are needed to produce ozone episodes. Typically, those conditions are characteristic of a surface high-pressure area. The differences in the position, strength, and movement of the surface high-pressure areas, along with differences in the mid-to-upper level wind patterns, discern several meteorological scenarios in which ozone episodes are likely. These meteorological scenarios are discussed in the following paragraphs.

Conditions that traditionally lead to large-scale exceedances of the 1-hr standard result from the development of a broad surface high pressure area sprawled over the eastern third of the US and a large mid-to-upper level high pressure area near the Midwest (Scenario 1 – Eastern Stacked High). The mid-to-upper level ridge blocks the movement of fronts into the Eastern US and often results in very hot temperatures, little precipitation, and the buildup of high 1-hr and 8-hr ozone concentrations over much of the Midwest, Northeast, and South. As the mid-to-upper level ridge slowly slides eastward, it situates itself over the surface high-pressure creating a "stacked high" over the Eastern US. The resulting large-scale subsidence leads to very low vertical mixing heights prohibiting dispersion of precursor pollutants. The stagnant air mass from the "stacked high" scenario is prime for ozone episodes in the Eastern US. A trough can develop in east/central North Carolina during this scenario producing south-southwesterly flow east of the trough and causing a large ozone concentration gradient. The presence of the trough can limit ozone readings east of the trough axis below the 1-hour and 8-hour standards throughout the episode. An example of these conditions is recorded in the July 14, 1995 Daily Weather Map [Figure 2.3.4-1]. The 500-mb chart clearly shows the presence of a large high pressure area over the Midwest.

The most frequently occurring meteorological scenario (Scenario 2 – Frontal Approach) is characterized by the movement of cold fronts toward North Carolina and the presence of high pressure to the south or southwest of the state. Cold fronts often move toward North Carolina during the summer months but are typically not strong enough to move completely through the state. They commonly become east-west oriented and stall as far south as southern Virginia or northern sections of North Carolina. The front may dip into northern portions of North Carolina and then retreat as a warm front creating wind shifts or re-circulation patterns. A southwesterly surface flow predominates as the front approaches, but as the front moves into northern sections of North Carolina, winds become more northerly. When the front retreats back to the north as a warm front, southwesterly winds return to the entire state. In the meantime, a zonal flow exists in the mid-to-upper levels. High temperatures range from the low to upper 90's and dew points are in the upper 60's to mid 70's. Scattered exceedances of the 1-hour standard and widespread exceedances of the 8-hour standards may be realized in North Carolina during these conditions. These conditions can be seen in the June 23, 1996 Daily Weather Map in [Figure 2.3.4-2]. Note the presence of a stationary front along the North Carolina/Virginia border.

A third meteorological scenario (Scenario 3 – Canadian High) resulting in high buildups of ozone in North Carolina is characterized by a surface high-pressure area building in from the north, and a mid-to-upper level ridge that builds and sprawls to the west of North Carolina in the Mid-Mississippi Valley area. The position of the mid-to-upper level ridge produces a northerly flow aloft throughout this scenario. As the Canadian-born surface high-pressure builds into North Carolina, it brings with it milder and drier air by means of a north-northeasterly breeze. These conditions can lead to scattered exceedances of the 8-hour standard in North Carolina. Temperatures are typically in the low to mid 80's, with dew points in the low to mid 60's, during the beginning of this type of episode. However, as the center of the surface high-pressure slides into North Carolina, and the winds become light and variable, highs may reach the upper 80's to low 90's, with dew points in the upper 60's to low 70's. Scattered exceedances of the 1-hour standard and widespread exceedances of the 8-hour standards may be realized in North Carolina

during these conditions. An example of these conditions is shown in Figure 2.3.4-3 [June 28, 1996].

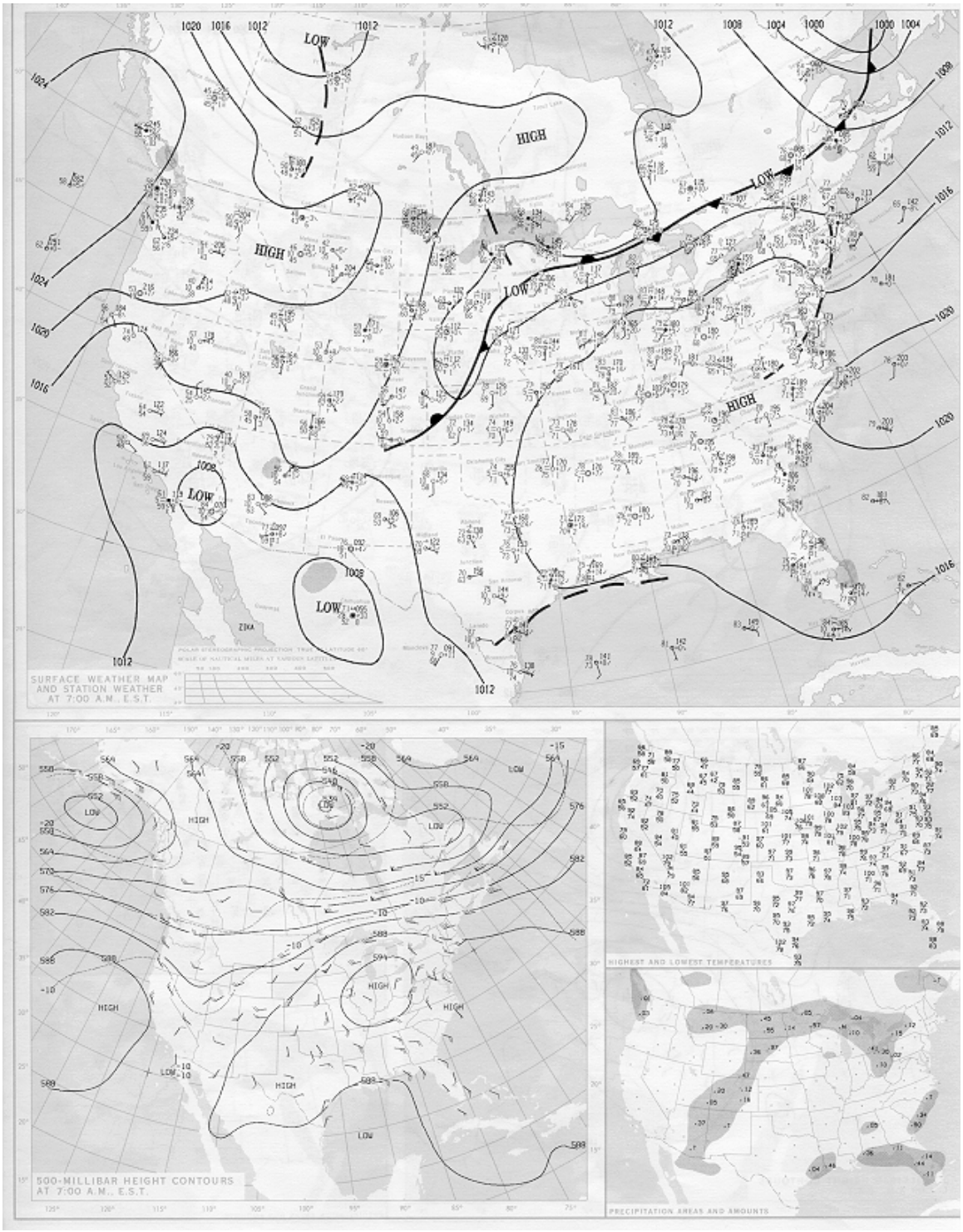

Figure 2.3.4-1 Daily Weather Maps for July 14, 1995

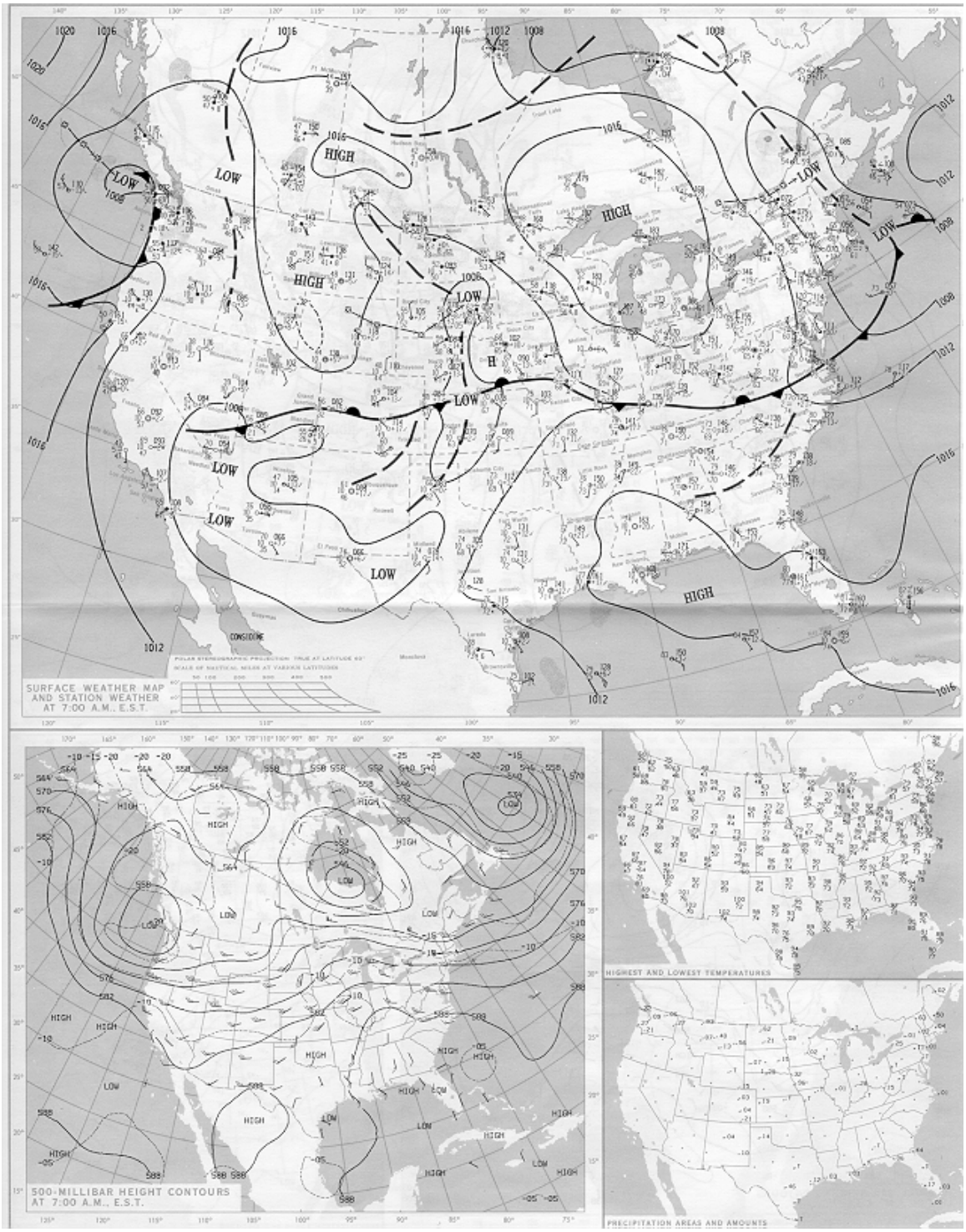

Figure 2.3.4-2 Daily Weather Maps for June 23, 1996

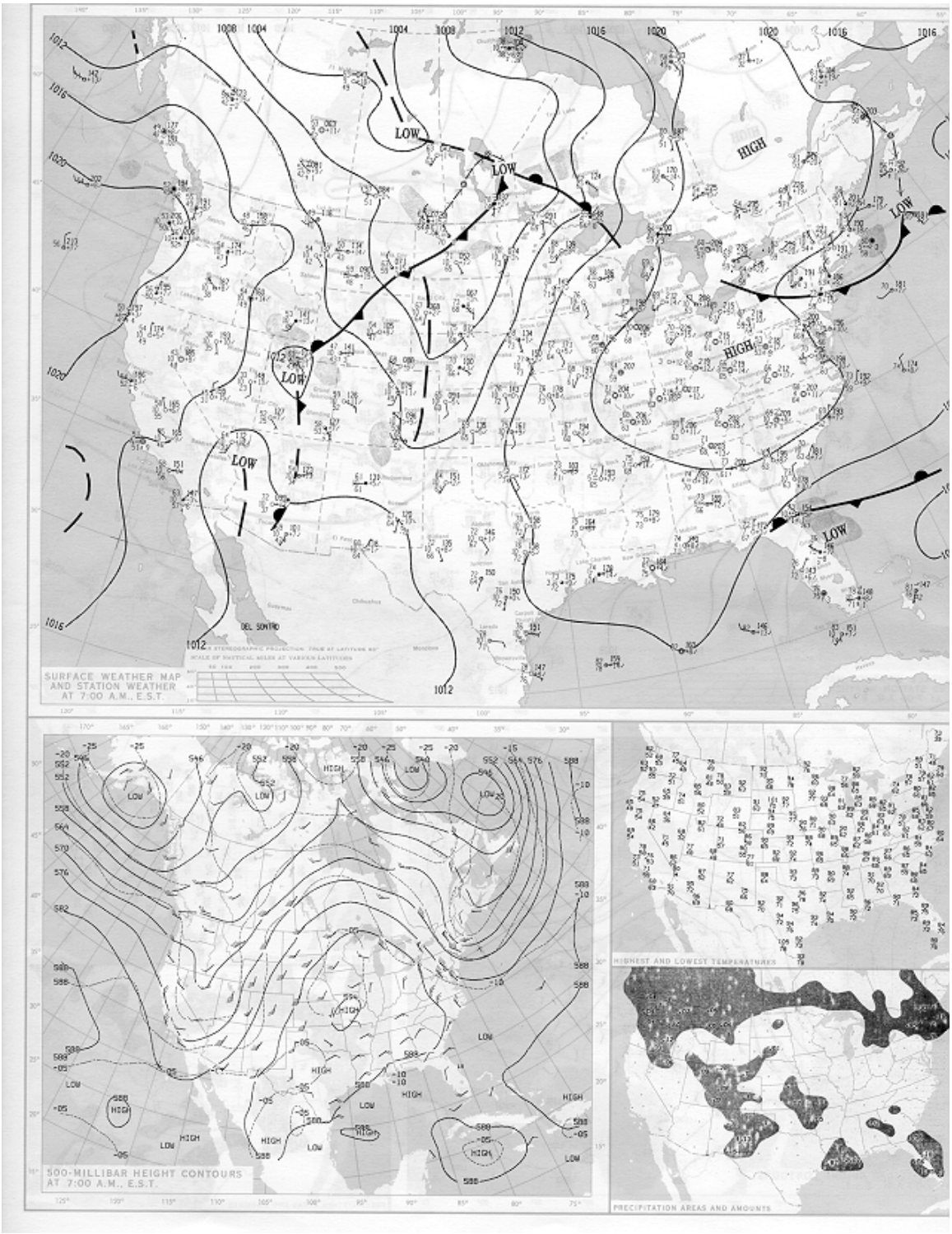

Figure 2.3.4-3 Daily Weather Maps for June 28, 1996

The fourth meteorological scenario (Scenario 4 – Modified Canadian High with slight Tropical Influence), initially, is very similar to Scenario 3 above. Canadian born surface high-pressure builds into North Carolina delivering lower dew points and milder temperatures with a light north-northeasterly wind. This cool down is short-lived however. As the high-pressure center moves south of North Carolina, a light southwesterly flow dominates, temperatures soar, and dew points increase. A mid-to-upper level ridge slowly sprawls eastward across the country, resulting in a very weak flow aloft. Occasionally, when the mid-to-upper level flow is very weak along the East Coast during the mid-to-late summer, tropical systems that work their way across the Atlantic Ocean can approach the Southeast US. Although it does not occur frequently, a tropical system lurking off the Carolina coast may influence conditions over North Carolina in the form of subsidence in the mid-to-upper levels. Subsidence is usually distributed over a wide area away from tropical systems, and leads to cloudless skies and hot dry weather. The strength and proximity of the tropical system will influence the magnitude and extent of the subsidence and its' role in ozone formation in North Carolina. An example of these conditions is shown in Figure 2.3.4-4 [July 14, 1997].

Meteorological scenarios other than the four identified above can result in ozone episodes. These "other" episodes, however, commonly do not meet the temporal or spatial requirements of the episode selection criteria for modeling defined in the USEPA's Draft Modeling Guidance for Ozone Attainment Demonstrations. One-day ozone episodes can occur during a progressive meteorological pattern (Scenario 5 – Continental High in a progressive pattern). A surface high-pressure area moving across the US and into North Carolina for one day characterizes this scenario. This results in clear skies, light winds, and isolated 8-hour ozone exceedances.

An initial analysis of ambient data and Daily Weather Maps was used to place each of the ozone episodes into one of the four meteorological scenarios identified above. A list of the number of monitors with exceedances of the 8-hour standard in each of the major urban areas was compiled and reviewed. This information was used to exclude those episodes from each category that did not have sufficient spatial or temporal distribution to justify further study. A more detailed analysis of each of the remaining episodes was made using all sources of air quality and meteorological data to select the episodes that would best meet modeling objectives.

To better understand the impact of emission controls under the full range of meteorological conditions, one episode from each meteorological scenario was selected for modeling. The four episodes were selected because they represented a good cross-section of events from both an air quality and meteorological perspective. They were also selected because observed ozone concentrations were close to the areas design value, and high ozone values were widespread throughout North Carolina. One episode was selected from 1995 (Scenario-1), two from 1996 (Scenario-2 & Scenario-3), and one from 1997 (Scenario-4). The two episodes selected from 1996 were separated by only two days during which time a strong cold front cleaned out the atmosphere as it passed through the state. The two episodes were modeled continuously. This presents a good opportunity to test the ability of the air quality model to produce clean conditions in the middle of an episode.

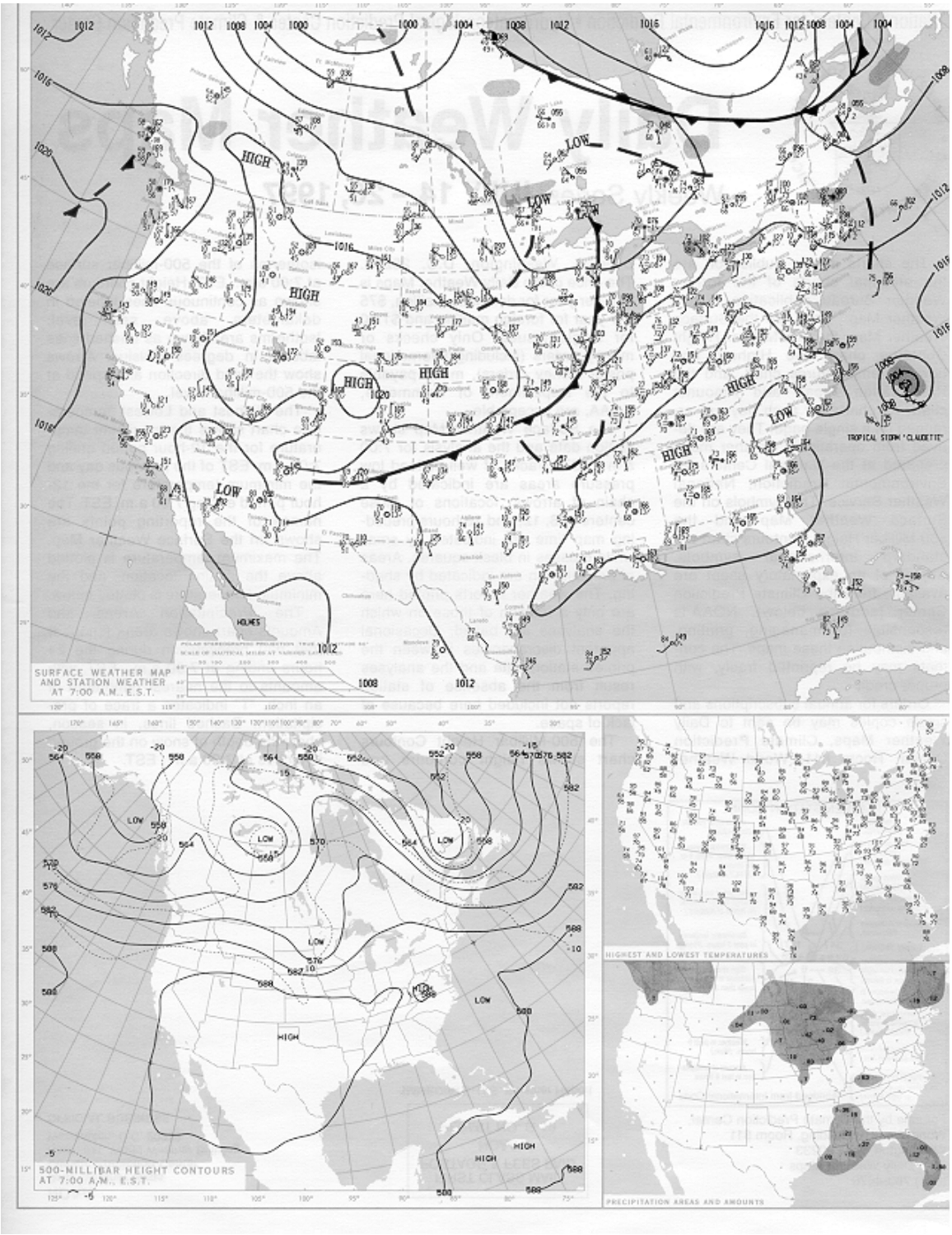

Figure 2.3.4-4 Daily Weather Maps for July 14, 1997

These episodes provide a wide range of conditions that will provide the basis for a thorough analysis of the variety of factors that lead to ozone exceedances in North Carolina. Control strategies can be tested under conditions that range from short duration ozone peaks above the 1-hour standard to extended periods of moderate levels of ozone producing widespread exceedances of the 8-hour standard. These episodes also range from multi-regional to exceedances confined primarily to the state of North Carolina.

The first episode (Episode-E1) is a 3-day episode that occurred from July 13 – 15, 1995. (See the July 14 Daily Weather Map in Figure 2.3.4-1.) This episode was modeled by the Northeast Modeling Center as part of the OTAG study of ozone transport. This episode is a traditional ozone episode with high 1-hour and 8-hour averages throughout almost all areas of the South, East, and Midwest. A very strong upper level ridge developed to the west of North Carolina and moved slowly to the east throughout the episode. On July 15th, the 1-hour peak reached 0.166 ppm in Atlanta, 0.179 ppm in Baltimore, and 0.154 ppm near Chicago. The highest readings were recorded in North Carolina on July 14th were 0.129 ppm in Charlotte (0.099 ppm 8-hour) and 0.130 ppm in the Triad area (0.112 ppm 8-hour). A trough developed in eastern North Carolina on July 14th producing south-southwesterly flow east of the trough and causing a large ozone concentration gradient. Although a 1-hour peak of 0.129 ppm was measured in Charlotte, the peak ozone was only 0.039 ppm 100 miles to the east. The presence of the trough kept ozone readings in the Triangle area below the 1-hour and 8-hour standards throughout the episode. The trough moved to the west on July 15th and dropped 1-hour averages in Charlotte and the Triad below the standard; however, 8-hour concentrations remained above 0.085 ppm.

The first 1996 episode (Episode-E2) occurred June 21 – 24 1996. It is primarily a North Carolina episode. (See the June 23 Daily Weather Map in Figure 2.3.4-2.) Concentrations in most other areas of the South and East were lower than those in North Carolina. This episode is dominated by the presence of a front to the north and high pressure to the southwest of the state. The movement of the front and the monitored ozone readings indicate possible recirculation during the episode. Light southwesterly flow was present on 22 June and resulted in a 1-hour/8-hour peak of 0.133/0.110 ppm and 0.113/0.099 ppm northeast of Charlotte and the Triangle, respectively. As the front moved into northern portions of North Carolina on the 23rd, winds became more northerly and concentrations in the Triad and the Triangle area's fell. Ozone and precursor pollutants were pushed back into Charlotte and resulted in exceedances of the 1-hour and 8-hour standard at all three Mecklenburg county ozone monitors. On the 24th, the front retreated north as a warm front and southwesterly winds returned to the entire state. Ozone levels increased throughout northern portions of North Carolina and 8-hour averaged concentrations between 0.090 and 0.100 ppm were recorded in the major urban areas of the Piedmont. One exceedance of the 1-hour standard (0.134 ppm) was measured at the Rockwell site, northeast of Charlotte.

A stronger front moved toward North Carolina on the 25th touching off storms and dropping ozone readings. The front passed through the state by the 26th and concentrations remained low. An upper level ridge began to build to the west of North Carolina and surface high pressure over Canada moved southward throughout episode (Episode-E3) (June 27 – 29, 1996) and settled into western North Carolina by the 29th. (See the June 28 Daily Weather Map in Figure 2.3.4-3.) Northerly winds were predominant at the surface and upper levels. High temperatures remained

90 and below in North Carolina and much of the eastern half of the US during this period. Dew point temperatures were relatively low and winds were light enough to produce 8-hour exceedances in many areas of North Carolina on the 28th and 29th. As high pressure remained over western North Carolina, ozone concentrations continued to rise throughout the episode. Exceedances of the 1-hour standard were measured at two monitors in Charlotte on the 29th.

The final episode selected for analysis (Episode-E4) occurred July 11 – 15, 1997. (See the July 14 Daily Weather Map in Figure 2.3.4-4.) The previous three episodes did not capture typical ozone behaviors in the center city areas of the Triad and the Triangle. The selection of this episode also was driven by the need to model an episode that captured ozone events in areas such as Greenville, Fayetteville, and Hickory. The most distinctive aspect of this episode, however, is that a 1-hour exceedance occurred in the Triangle area on the July 14th. No other episode captures a 1-hour exceedance in this region. On the first three days of the episode, meteorological conditions were very similar to those in episode E3. On the 14th and 15th, however, the surface high-pressure center moved over North Carolina, the mid-to-upper level flow relaxed, and a tropical depression off the North Carolina coast strengthens into Tropical Storm "Claudette". It is possible that the tropical system influenced conditions in North Carolina (especially Eastern North Carolina) on the 14th and 15th. Temperatures soared into the mid 90's with dew points in the mid-to-upper 60s. The backward air parcel trajectories from Rocky Mount, North Carolina (shown in Figure 2.3.4-5), illustrates the possible influence from the tropical system (Note the subsidence at mid-levels from 0Z –20Z on the 14th.) Exceedances of the 8-hour standard were recorded in North Carolina, South Carolina and Virginia as the surface high-pressure center moved over North Carolina, the mid-to-upper level flow aloft weakened, and the tropical system made it's nearest approach.

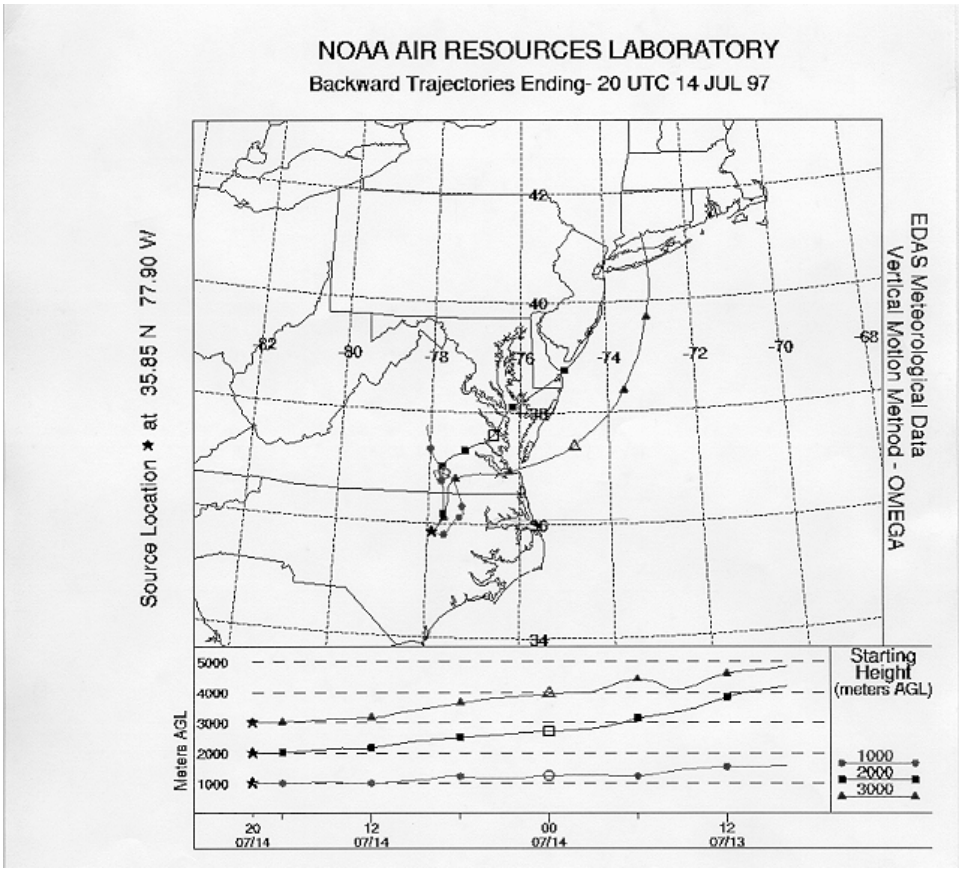

Figure 2.3.4-5 Backward Air Parcel Trajectories for July 14, 1997

Table 2.3.4-1 summarized the meteorological features of the four episodes that were selected for this modeling demonstration.

Table 2.3.4-1 Features of Each Selected Episode

	E1	E2	E3	E4
Synoptic Feature	Large blocking upper level High over Midwest slides eastward over the large surface High over Eastern US.	Front to the north. High pressure center SW of NC. Front moves into NC, then retreats as a warm front.	Canadian surface High moves south into NC. Upper level ridge over middle of country.	Canadian surface High moves south of NC. Upper level flow weakens. Possible influence from tropical system of the coast.
Scale	Multi-regional exceedances of 1-hr & 8-hr standard.	Primarily NC.	Primarily NC.	Multi-regional exceedances of 1-hr and 8-hr standard.
Temperature	Mid - upper 90's in NC. 90's to 100's throughout MW, NE, & South.	Low - mid 90's in NC and South. mid 80's - low 90's MW & NE.	Upper 80's in NC. Mid - upper 80's NE & MW. Low 90's in South.	Initially upper 80's, then mid-to-upper 90's for NC and Mid-Atlantic.
Dew Point Temperature	Upper 60's - low 70's in NC. As high as low 80's NE & MW.	Low 70's.	Low-to-mid 60's.	Upper 60's – low 70's in NC and Mid-Atlantic.
Local Feature	North to South trough over east/central NC. Clean air east of trough effects O3 in CLT & RDU.	Front dips into northern NC & retreats as warm front creating wind shifts and re-circulation patterns.	Influence of Canadian High. Dry air & northerly winds at surface & upper levels.	Stagnating winds throughout atmosphere. Possible influence from tropical system in eastern NC.
Ozone Concentration	1-hr around 130 in GSO, CLT. 170's in Baltimore, 160's in Atlanta, 150's in MW.	Multi-day exceedances of 8-hr in 3 major areas of NC. 1-hr exceedances on 3 days in CLT.	Multi-day exceedances of 8-hr in 3 major areas of NC. 1-hr exceedances in GSO & CLT on last day.	Multi-day exceedances of 8-hr in all major NC metro areas. 1-hr exceedances on 2 days (1 RDU & 1 CLT).

CLT – Charlotte Area
RDU – Raleigh/Durham Area
GSO – Greensboro/Winston-Salem/High Point Area

2.4 Modeling Domains

The modeling domain boundaries and grid sizes were selected in an attempt to balance model flexibility, location of nonattainment areas, processing time. MAQSIP allows selection of multiple nested grids with a 3 to 1 size ratio between grids. Therefore, North Carolina chose to have three nested grids; a 36-km coarse outer grid, a 12-km medium, nested grid, and a 4-km fine inner, nested grid. The modeling domains to be used are shown in Figures 2.4-1, 2.4-2 and 2.4-3 for the 1995 episode, the 1996 episodes and the 1997 episode, respectively.

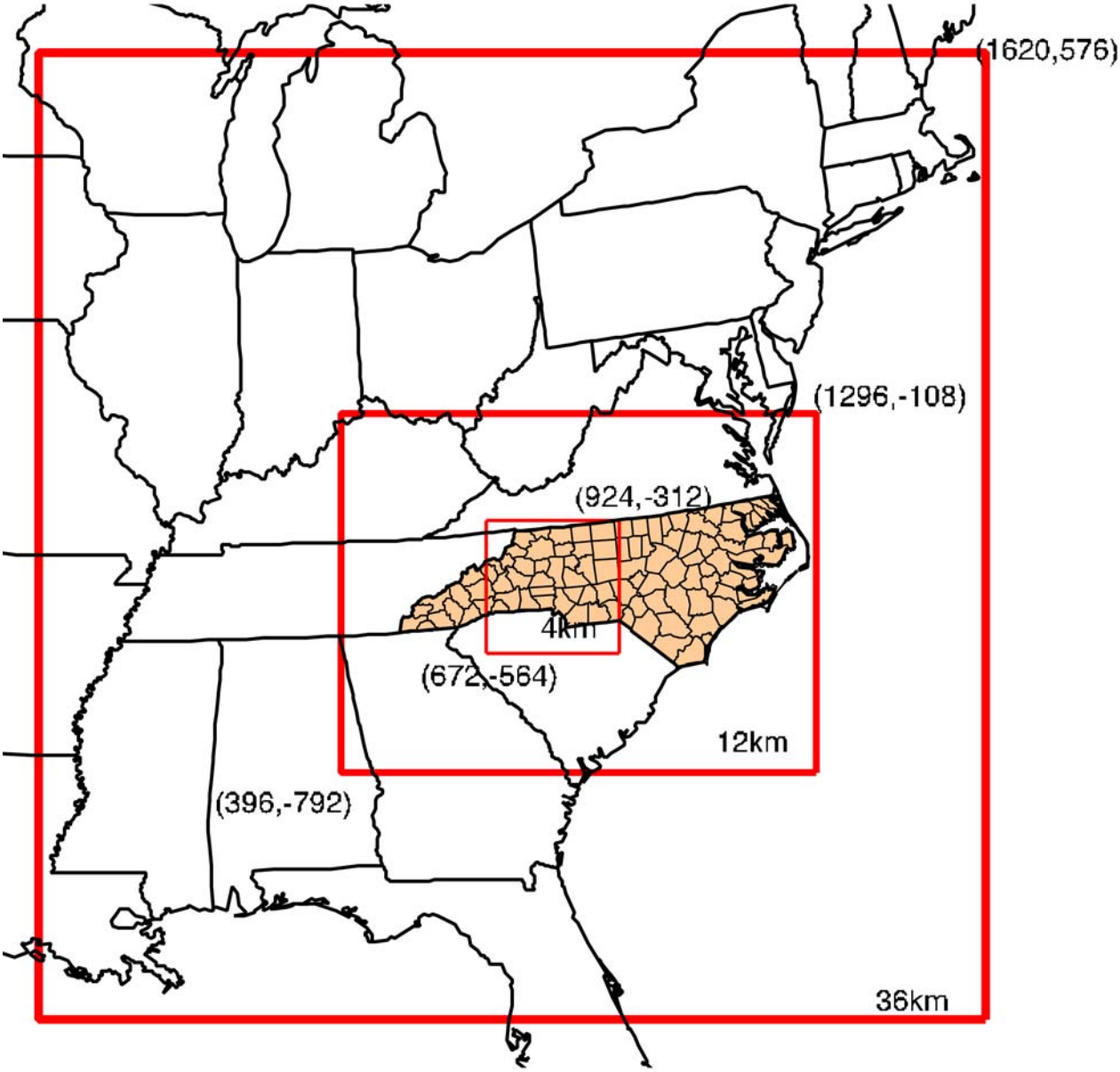

Figure 2.4-1 Modeling domains for the 1995 modeling episode

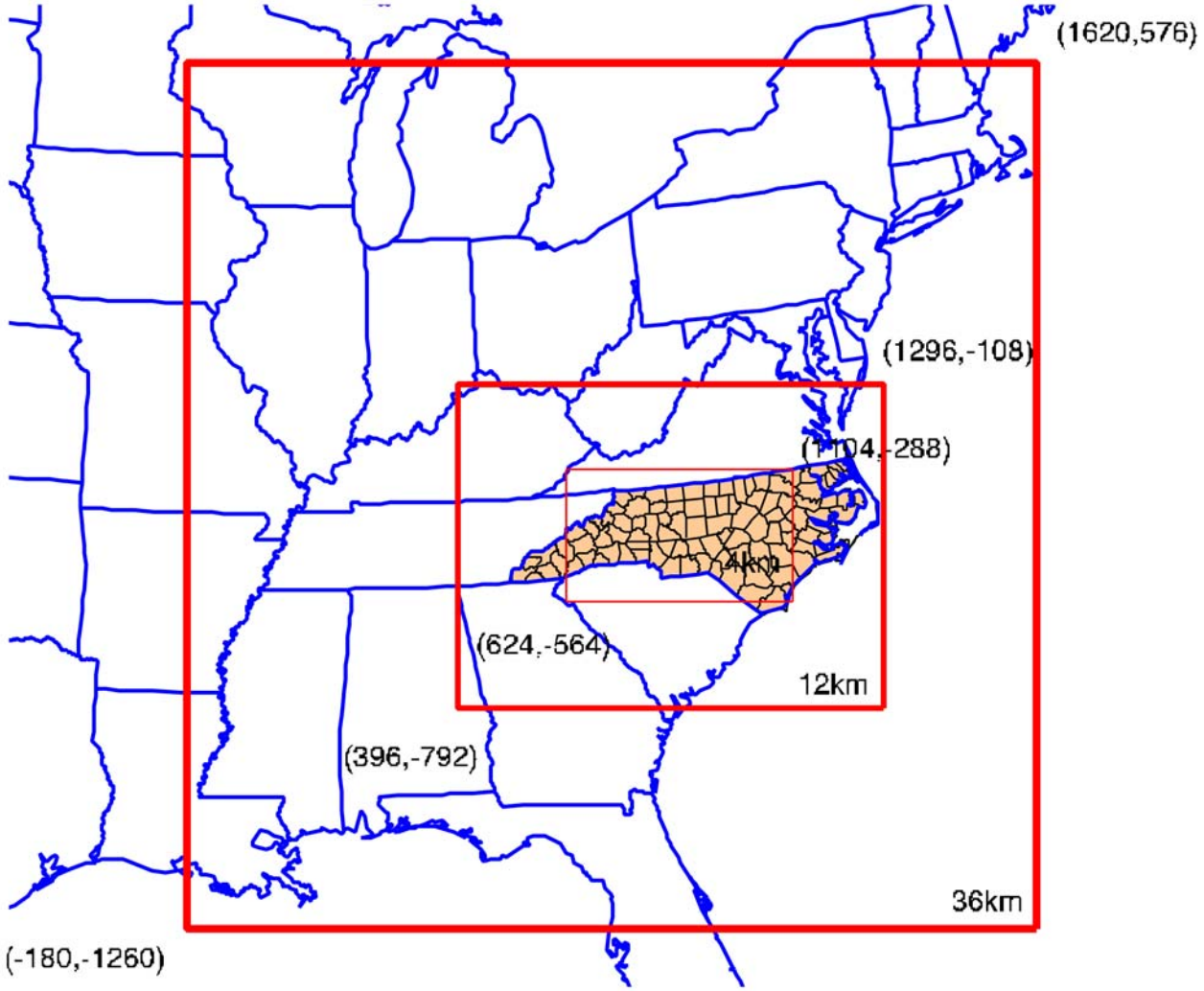

Figure 2.4-2 Modeling domains for both modeling episodes in 1996

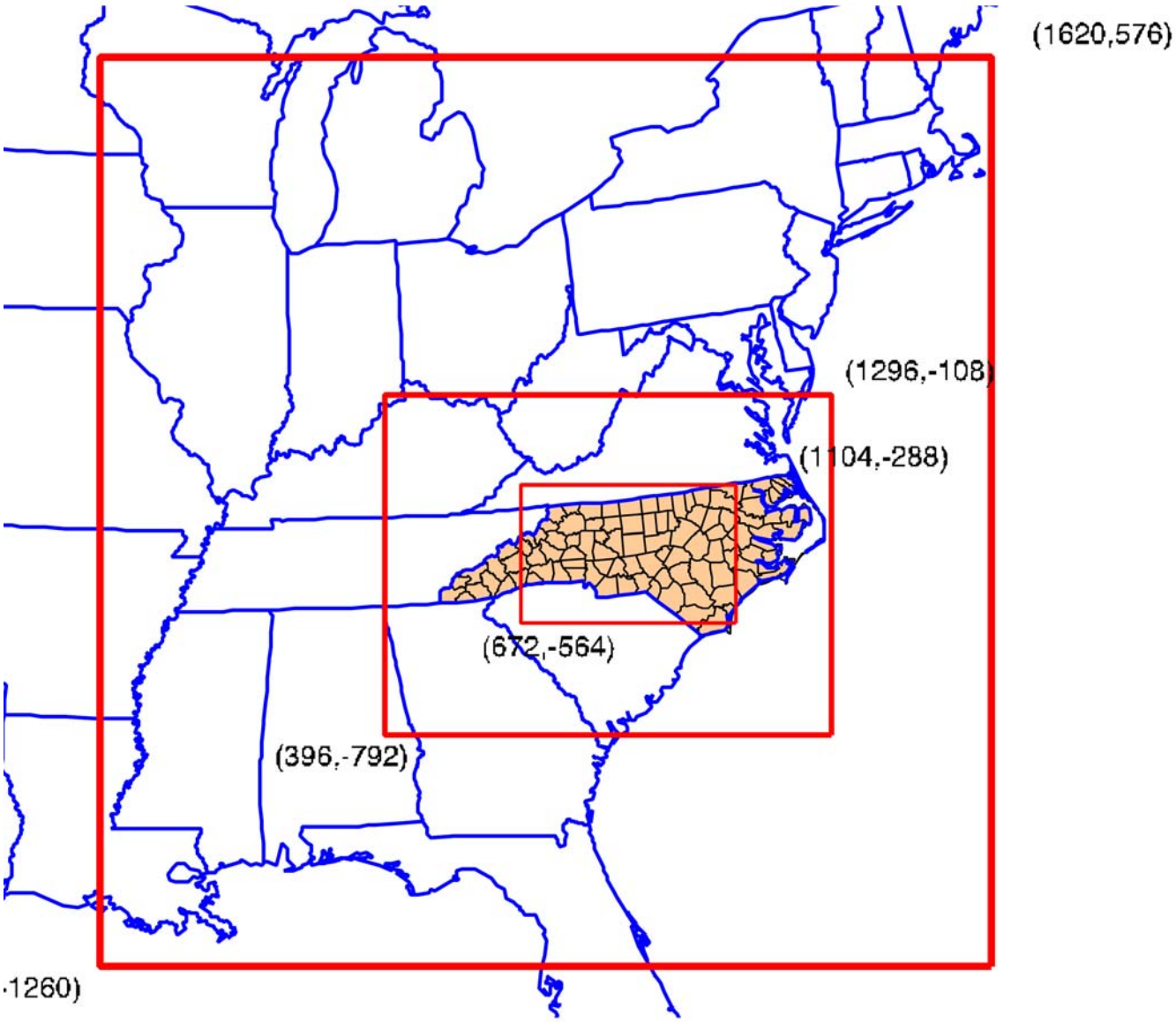

Figure 2.4-3 Modeling domains for the 1997 modeling episode

The finest grid size of 4-km provides a slight improvement over the previous North Carolina photochemical modeling that used a single 5-km horizontal grid. It was decided not to do a grid size smaller than 4-km for several reasons, the main one being processing time requirements. Due to the use of an increased vertical resolution in this modeling project, an increase in number of horizontal grid cells would be so computer resource intensive that it would take too long to process a run for practical application. Additionally, there could be problems producing meteorological inputs for grid sizes much smaller than 4-km.

The MAQSIP model was run in one-way nested grid mode. This allowed the larger outer domains to feed concentration data to the inner nested domain. One-way nesting is believed to be appropriate for the generally stagnant conditions experienced during North Carolina ozone episodes. Two-way nesting was not considered due to numerical and computational uncertainty associated with the technique.

The 36-km outer modeling domain (referred to as G1) is used for all four modeling episodes. This domain is slightly smaller than the grid used in the Ozone Transport Assessment Group (OTAG) modeling project. The western border is just west of the Mississippi river and the eastern border is just east of the coast in the Atlantic Ocean. The northern border reaches as far north to include part of Maine and the southern border bisects Florida. The size of G1 was chosen so to reduce the impact of the boundary and initial conditions on the urban areas within North Carolina and its surrounding States.

The medium, nested 12-km modeling domain (referred to as G2) is also used for all four modeling episodes. It stretches from Atlanta in the Southwest corner to Richmond near the Northeast. It includes all of North Carolina, most of South Carolina and Virginia, and parts of Tennessee, Kentucky, and West Virginia. It is felt that G2 will be large enough to contain all of the emissions sources important to ozone formation and transport in and around North Carolina. This domain is intended to provide accurate boundary conditions to the finer 4-km grids, as well as give a reasonable approximation of pollutant levels outside of the core nonattainment areas.

There will be three different fine, inner nested modeling domains used, one for each of the episode modeling years (see Figures 2.4-1 through 2.4-3). For the 1995 modeling episode, the domain is centered around the Charlotte Metropolitan Statistical Area (MSA) and the Greensboro/Winston-Salem MSA. The Raleigh/Durham area was not included in this fine grid because the 1995 episode was not an ozone event for the area.

For both of the 1996 modeling episodes, the 4-km fine grid domain is over twice the size of the 1995 4-km modeling domain. This modeling domain stretches to the west of Asheville and to the east of the Rocky Mount area. The southern boundary is the same as the 1995 4-km domain, but the northern boundary is higher so that all counties north of the Raleigh/Durham MSA are included.

The 1997 modeling episode's 4-km fine grid domain is just slightly smaller than the 1996 4-km domain. The western boundary is to the east of the Asheville area since this episode was not an ozone event in Asheville. All other boundaries are the same.

2.5 Emission Inventory

There are five different emission inventory source classifications, stationary point and area sources, off-road and on-road mobile sources, and biogenic sources.

Stationary point sources are those sources that emit greater than a specified tonage per year and the data is provided at the facility level. Stationary area sources are those sources whose

emissions are relatively small but due to the large number of these sources, the collective emissions could be significant (i.e., dry cleaners, service stations, etc.) These types of emissions are estimated on the county level. Off-road mobile sources are equipment that can move but do not use the roadways, i.e., lawn mowers, construction equipment, railroad locomotives, aircraft, etc. The emissions from these sources, like stationary area sources, are estimated on the county level. On-road mobile sources are automobiles, trucks, and motorcycles that use the roadway system. The emissions from these sources are estimated by vehicle type and road type and are summed to the county level. Biogenic sources are the natural sources like trees, crops, grasses and natural decay of plants. The emissions from these sources are estimated on a county level.

In addition to the various source classifications, there are also 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 demonstration 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.

Next is the future year base inventory. For this type, an inventory is developed for some future year for which attainment or maintenance of the ozone standard is needed. For this modeling demonstration the future attainment year is 2007 and the future maintenance years are 2012 and 2017. It is the future year base 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.

In the sections that follow, a synopsis of the inventories used for each source classifications are discussed. The detail discussion of the emissions inventory development can be found in Appendix H and emission summaries by county for each EAC area as well as the State are in Appendix G.

2.5.1 Stationary Point Sources

Point source emissions are emissions from individual sources having a fixed location. Generally, these sources must have permits to operate and their emissions are inventoried on a regular schedule. Large sources having emissions of 100 tons per year (tpy) of a criteria pollutant, 10 tpy of a single hazardous air pollutant (HAP), or 25 tpy total HAP are inventoried annually. Smaller sources have been inventoried less frequently. The point source emissions data can be grouped into the large electric utility sources and the other point sources.

Large Utility Sources

The inventory used for the large utility sources is the May 1999 release of the NOx SIP call base year modeling foundation files obtained from the USEPA Office of Air Quality Planning and Standards (OAQPS). The base year for this utility data is 1996. The emissions data for the

utilities is episode specific Continuous Emissions Monitoring (CEM) data and is specific for each source for each hour of the modeling episode. This data comes from the USEPA Acid Rain Division (ARD). Since only NOx emissions are reported in the CEM database, 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.

For the current year inventory, it did not make sense to use 2000 CEM data 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 the USEPA, the decision was made to continue to use the episodic CEM data for the current year inventory.

For the future year inventories, the USEPA's 2010 Clear Skies modeling files were used. These files projected utility usage into the future and applied the controls required to meet the NOx SIP Call rule making. Additionally, any new generation that is expected was included in the USEPA's utility files. 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. The utility companies use load projection models to estimate what the future energy demand will be and reflected controls that are required for the NOx SIP call as well as the North Carolina Clean Smokestacks Act.

Other Point Sources

The inventory used to model the other point sources is the May 1999 release of the NOx SIP call base year modeling foundation files obtained from the USEPA OAQPS. This data is based on 1995 emissions. For the 1996 and 1997 modeling episode, emissions were grown using Bureau of Economic Analysis (BEA) growth factors. The North Carolina sources were an exception. These emissions are actual reported 1996 and 1997 emissions for the larger VOC and NOx sources. In addition, emissions for forest fires and prescribed burns are treated as point sources and are episode specific.

For the current year inventory, the inventory used to model the other point sources is the 1999 National Emissions Inventory (NEI) release version 2.0 obtained from the USEPA's Clearinghouse for Inventories and Emission Factors (CHIEF) website (http://www.epa.gov/ttn/chief/net/1999inventory.html). The exception to this was for North Carolina's other point source inventory where a pseudo 2000 inventory was created using 2000 data for the large sources that reported emissions for 2000 and 1999 emissions data for the smaller sources. In addition, North Carolina emissions for forest fires and prescribed burns were kept the same as the episodic emissions.

The future years point source inventories were based on the USEPA's 1999 NEI inventory and grown to 2007, 2012 and 2017 using projection factors from the USEPA's Economic Growth Analysis System (EGAS) version 4.0. The exception to this is for North Carolina, where State specific projection factors, and where available source specific projection factors, were used to

project the North Carolina pseudo 2000 inventory. The concept of projection factors is that it takes into consideration growth or decline of emissions from a specific source sector. Therefore, new sources are assumed to be accounted for in the projection factors. This projection technique is accepted as an appropriate practice since the location and size of new sources are impossible to predict without submitted permit applications. Additionally, NCDAQ created new control files 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. These control files account for any modifications to existing sources that are known.

2.5.2 Stationary Area Sources

The base year inventory for the stationary area sources is the May 1999 release of the NOx SIP call base year modeling foundation files obtained from the USEPA OAQPS. This data is based on 1995. For the 1996 and 1997 base years, the NOx SIP call foundation files weregrown to the respective year by use of BEA growth factors or projected population growth obtained from the US Census Bureau. The exception to this is for North Carolina where a 2000 base 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). This data was backcasted to the base years via growth factors developed with the USEPA's EGAS model.

For the current year 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 the 2000 current year inventory generated by NCDAQ was used.

For the future year inventories, the stationary area source inventory was the 1999 NEI release version 2.0 obtained from the EPA's CHIEF website and were grown to 2007, 2012 and 2017 using growth factors from the USEPA's EGAS model. The exception to this is for North Carolina, where the 2000 current year inventory was grown using a mixture of EGAS projection factors and state-specific projection factors for the furniture industry.

2.5.3 Off-Road Mobile Sources

The off-road mobile sources can be broken down into two types of sources; those calculated within the USEPA NONROAD mobile model and those that are not. For the sources that are calculated within the NONROAD mobile model, a base year inventories (i.e., 1995, 1996 and 1997) as well as the current year and future year inventories (2000, 2007, 2012 and 2017) were generated for the entire domain using the Draft NONROAD2002.

The sources not calculated within the NONROAD model include aircraft engines, railroad locomotives and commercial marine vessels. The base year inventory for these sources was the May 1999 release of the NOx SIP call base year modeling foundation files obtained from the USEPA OAQPS. This data is based on 1995. For the 1996 and 1997 base years, the NOx SIP call foundation files were grown to the respective year by use of BEA growth factors. The exception to this was for North Carolina where a 1995 base year inventory was generated by NCDAQ for aircraft engines and railroad locomotives. This data was then grown to the other

base years via BEA growth factors for the locomotive engines and airport specific growth factors for the aircraft engines.

The 2000 current year inventory used for non-NONROAD model sources was 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.

For the future years, the 1999 NEI release version 2.0 obtained from the EPA's CHIEF website were grown to 2007, 2012 and 2017 using growth factors from the USEPA's EGAS model. The exception to this is for North Carolina, where the 2000 current year inventory was grown with EGAS projection factors for locomotives and airport specific growth factors for aircraft engines.

2.5.4 Highway 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 the USEPA 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 same MOBILE model was used to create all of the on-road mobile source emissions. The vehicle miles traveled (VMT) data was obtained from the near by States or from the USEPA OAQPS. The exception to this was for North Carolina where in the urban areas of North Carolina VMT from travel demand models (TDM) was used and for other areas in North Carolina the data was obtained from the North Carolina Department of Transportation (NCDOT). The future year VMT was projected using the methodologies as prescribed by the USEPA.

Emissions from motor vehicles vary with the manner in which the vehicle is operated. Vehicles traveling at 65 mph emit a very different mix of pollutants than the car that is idling at a stoplight. In order to estimate emissions from vehicles for a typical day, the NCDOT provided speeds for each of the urban areas across the state and in some cases for different times of the day. To reflect the most current assumptions on the speed of vehicles in different areas across the state, the latest conformity report was used which reflected speeds developed through travel demand modeling for the urban areas. For areas where area-specific data was not available, NCDAQ chose to use the Wake County off-peak speed profile developed in 1998. This was assumed to be a conservative estimate of speeds in areas that do not have a travel demand model.

The vehicle age distribution comes from annual registration data from the NCDOT. The NCDOT provided registration data specific to the area. For this analysis, the data was from 2000. The NCDOT provided the data by vehicle type; however, these types did not match the USEPA MOBILE model vehicle types. Therefore, the data is manipulated to match the input requirements. Details of how this was accomplished are in Appendix H.

For all of North Carolina, vehicle mix assumptions incorporated the increase in sales of sport utility vehicles and minivans for all years of evaluation. To calculate the vehicle mix to account for the large percentage of sport utility vehicles and minivans being purchased, NCDAQ used the USEPA's document Fleet Characterization Data for MOBILE6: Development and Use of Age Distributions, Average Annual Mileage Accumulation Rates, and Projected Vehicle Counts for Use in MOBILE6 (EPA420-P-99-011).

The temperatures used to estimate the emissions for this modeling demonstration were extracted from the MM5 meteorological model files via the SMOKE emission model.

Existing control strategies were also incorporated into the on-road mobile inventory. In the early 1990's, North Carolina adopted emissions inspection requirements for vehicles in 9 urban counties. This program tests emissions at idle for 1975 and newer gasoline powered light duty vehicles. The program is a basic, decentralized tailpipe test for Hydrocarbon (HC) and CO only. The waiver rates are consistent with the SIP. However, the compliance rates have been changed to more accurately reflect what is happening at the stations. Compliance rates have been changed from 98 percent in the SIP to 95 percent. In addition, the inspection stations are required to administer an anti-tampering check to ensure that emissions control equipment on any vehicle 1968 and newer has not been altered. For the future year inventories, North Carolina's NOx inspection and maintenace program was modeled. This is a phased in program between 2002 and 2006. After 2006, all 48 counties required to have inspections will be OBDII type inspections.

Reid vapor pressure (RVP) reflects a gasoline's volatility, so as a control measure North Carolina has adopted the Phase II RVP of 7.8 psi in the 1-hour ozone maintenance counties.

2.5.5 Biogenic Emission Sources

Biogenic emissions were prepared with the SMOKE-BEIS3 (Biogenic Emission Inventory System version3) preprocessor. SMOKE-BEIS3 is basically the Urban Airshed Model (UAM)-BEIS3 model but also includes modifications to use Meteorological Model version 5 (MM5) data, gridded land use data, and one important science update. The emission factors that are used in SMOKE-BEIS3 are the same as the emission factors in UAM-BEIS3.

The emission rates within SMOKE-BEIS3 are adjusted for environmental conditions prevailing during the episode days with meteorological data supplied by the MM5 model. The gridded data used from MM5 include the estimated temperature at 10 meters above the surface and short-wave radiation reaching the surface. Ten meters temperatures were used instead of the ground temperatures because it was believed that 10 meters above the surface was a better approximation of the average canopy height temperatures. The use of 10 meters temperatures was discussed with and approved by the USEPA Office of Research and Development (ORD).

The gridded land use data was obtained from Alpine Geophysics at the 4-km resolution for the entire domain. The basis for the gridded data is the county land use data in the Biogenic Emissions Landcover Database version 3 (BELD3) provided by the USEPA. A separate land classification scheme, based upon satellite (AVHRR, 1 km spatial resolution) and census

information, aided in defining the forest, agriculture and urban portions of each county. The 12-km and 36-km domains will be created by aggregating the 4-km resolution data up to the respective grid sizes.

3.0 Model Performance Evaluation

There are many aspects of model performance. This section will focus primarily on the methods and techniques recommended by the USEPA for evaluating the performance of the air quality model. The meteorological modeling evaluation is documented in Appendix K and will not be discussed here.

The first step in the modeling process is to verify the model's performance in terms of its ability to predict the ozone in the right locations and at the right levels. To do this, the model predictions are compared to the ambient data observed in the historical episode. This verification is a combination of statistical and graphical evaluations. If the model appears to be producing ozone in the right locations for the right reasons, then the model can be used as a predictive tool to evaluate various control strategies and their effects on ozone. The purpose of the model performance evaluation is to assess how accurately the model predicts ozone levels observed in the historical episode. The key statistical measures that were used to evaluate model performance are as follows:

1. Comparison of modeled mean of ozone to the observed mean of ozone. This metric is an evaluation of how, on average across the episode, the model compares to the observed values.
2. Bias in the model which is calculated by taking the difference between the modeled mean and the observed mean.
3. Normalized bias is calculated by taking the bias for each observation/prediction pair, and then dividing by the number of pairs that are used in the calculations. EPA recommends that normalized bias fall between ± 5 – 15 percent.
4. Gross error. For the entire modeling domain, gross error for all pairs above 60 ppb of ozone was calculated. For the EAC areas, the gross error was calculated on the daily 8-hour ozone maximums. US EPA guidance suggests that gross error can be interpreted as precision of the model. This metric is typically used to compare various modeling applications. EPA recommends that the gross error of all pairs >60 ppb be less than 30-35 percent.

These statistics will be presented in the sections that follow for the entire modeling domain and for each EAC area.

Another method of evaluating model performance is reviewing spatial plots and time series plots of the modeled versus observed data. These graphical plots aid in getting a better understanding of how the model is performing over the whole domain.

3.1 Domain-Wide Performance

The 8-hour ozone statistical data calculated for the 4-km and 12-km domains are presented in Tables 3.1-1 and 3.1-2. The normalized bias was well within the recommended ± 5-15 percent,

and the gross error was significantly below the 30-35 percent range at the 40 and 60 ppb thresholds. These statistical metrics were used as a first screening of the model performance.

Table 3.1-1. Model Statistics at 4 km

Episode/Domain, Threshold	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Nbias (%)	Gross Error (%)
1995/4 km, 60 ppb	75.67	78.95	-3.27	3.1	16.0
1995/4 km, 40 ppb	70.84	70.62	0.23	-3.3	19.4
1996/4 km, 60 ppb	71.24	75.85	-4.61	4.8	14.9
1996/4 km, 40 ppb	65.48	64.43	1.04	-4.9	21.2
1997/4 km, 60 ppb	70.69	79.27	-8.58	10.3	17.5
1997/4 km, 40 ppb	63.96	68.51	-455	4.3	21.1

Table 3.1-2. Model Statistics at 12 km

Episode/Domain, Threshold	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Nbias (%)	Gross Error (%)
1995/12 km, 60 ppb	72.27	77.12	-4.85	0.05.3	18.6
1995/12 km, 40 ppb	67.41	67.53	-0.12	-3.0	22.6
1996/12 km, 60 ppb	70.86	74.95	-4.09	4.5	17.4
1996/12 km, 40 ppb	63.89	63.41	0.49	-3.3	23.2
1997/12 km, 60 ppb	76.25	76.55	-0.29	-0.2	17.8
1997/12 km, 40 ppb	69.06	65.82	3.23	-7.3	23.3

3.2 1995 Episode

Spatial Plots

Below are the domain-wide spatial plots of modeled 1-hr and 8-hr max ozone with the observations overlaid for July 12-15 of the 1995 episode (Figures 3.2-1 and 3.2--2). Overall, the model does well with the spatial extent of the higher ozone concentrations. The model does under predict the 1-hr max ozone concentration in the northeast portion of the domain on the 15th, but does a fairly good job capturing the higher ozone concentrations near the Charlotte region on the 14th. Model performance for the 8-hr max ozone is similar to that for the 1-hr max.

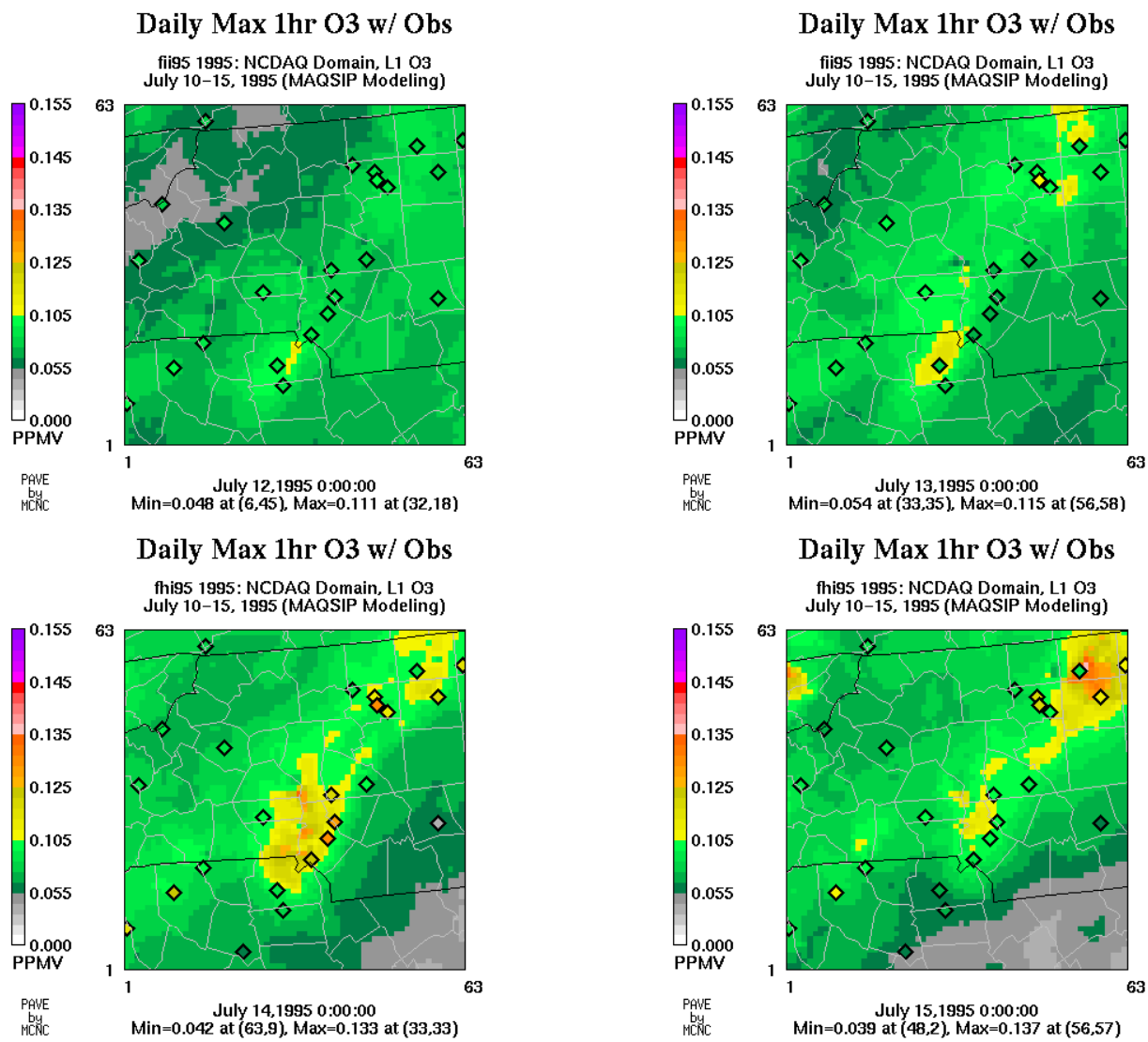

Figure 3.2-1 Spatial plots for model predicted and observed peak 1-hour ozone concentrations for July 12-15, 1995.

The model did over predict ozone in the Charlotte region on the 13th and in the Triad on the 15th, but model performance was relatively good throughout the most of the domain. In general, the model does not have any major over predictions or under predictions, and we believe the model does an acceptable job capturing the spatial distribution and concentration of ozone.

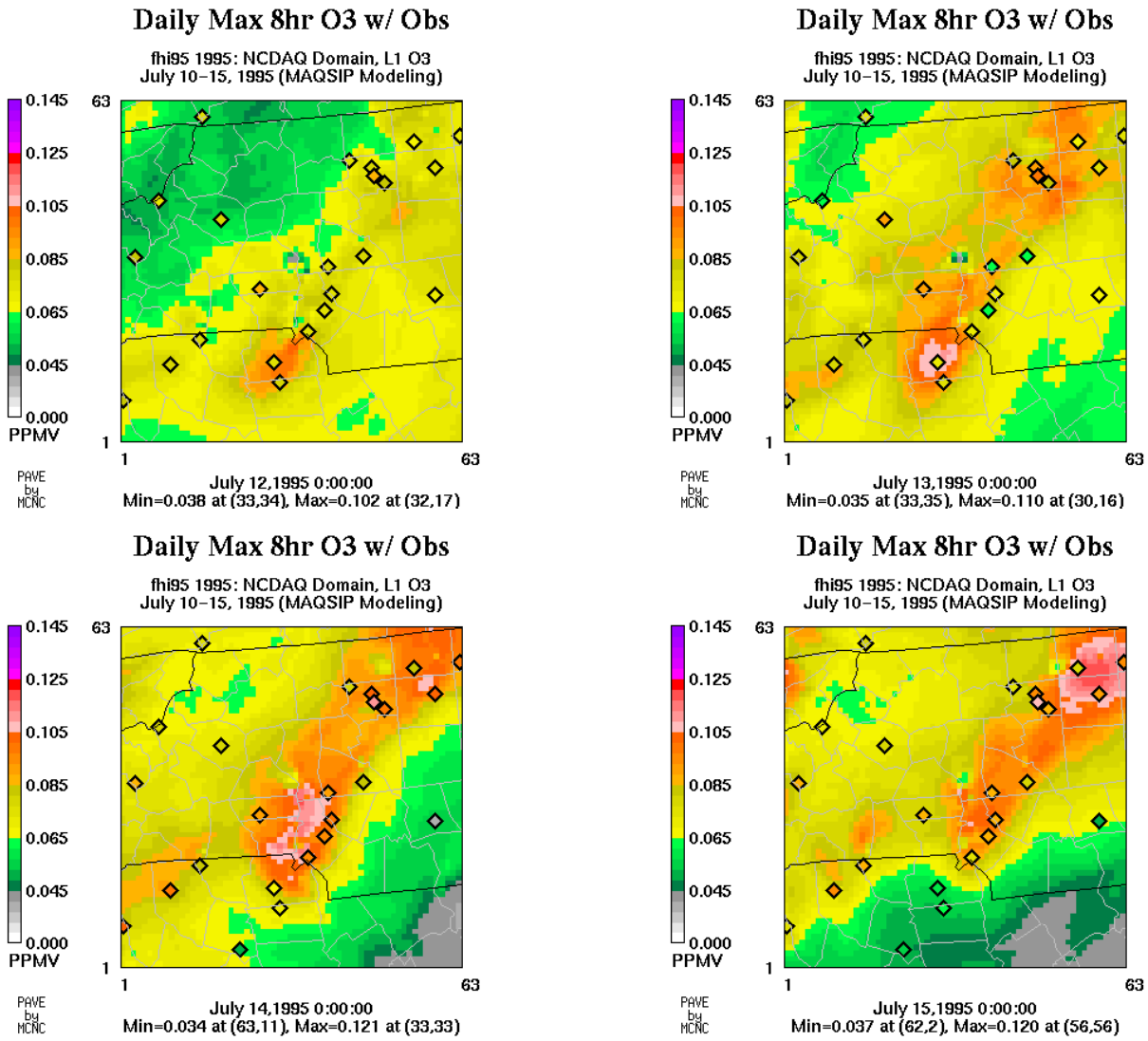

Figure 3.2-2 Spatial plots for model predicted and observed peak 8-hour ozone concentrations for July 12-15, 1995.

Scatter Plots

Below are scatter plots of modeled predicted ozone versus observed ozone for 1-hr and 8-hr model performance for July 12-15, 1995 (Figure 3.2-3). The green lines on the scatter plots represent the ±25% bounds of the 1:1 line. Although there are some outliers, the overall performance is good for the 1995 episode. The majority of the points fall with the acceptable limits of good model performance.

4 km Domain Time Series

Below are time series plots of model predicted ozone (green) and observed ozone (red) for the entire 1995 episode (Figures 3.2-4 through 3.2-6). The first plot represents an ozone

concentration threshold of 60 ppb, the second plot of 40 ppb, and the third plot of 5 ppb. The model tends to under predict ozone on the 12th and 14th, while doing a good job capturing the peak ozone on the 13th and 15th. The model does a good job capturing the ozone cycle on several days at the 40 ppb threshold, while at the 5 ppb threshold the model over predicts ozone during the overnight hours.

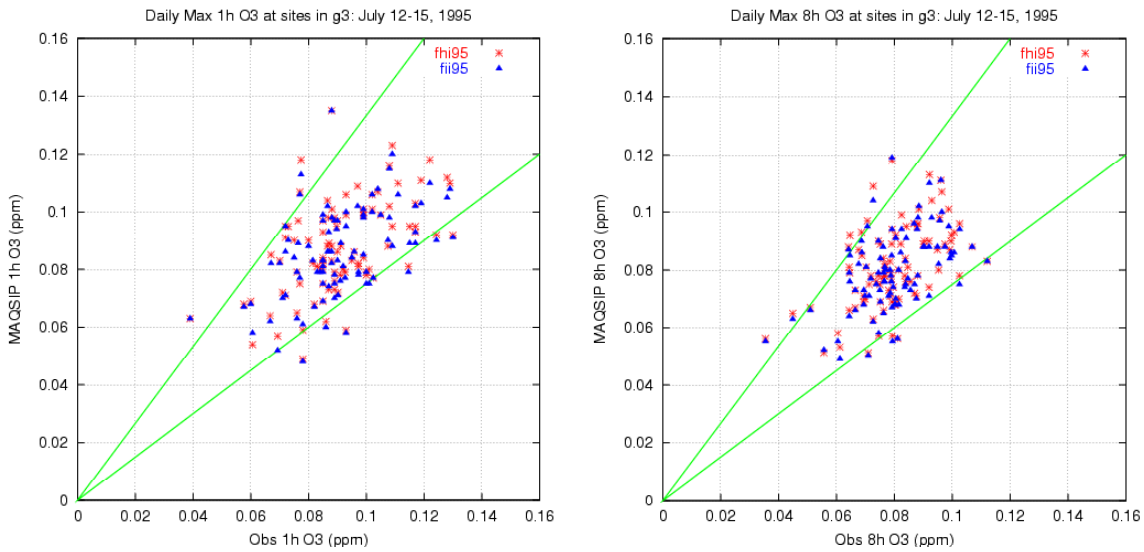

Figure 3.2-3 Scatter plot of model predicted versus observed 1-hour and 8-hour maximum ozone for July 12-15, 1995.

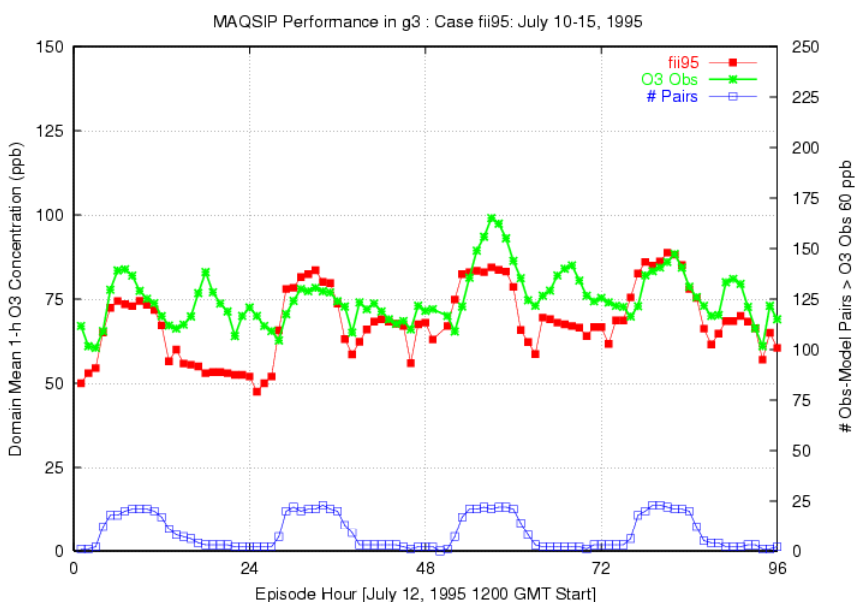

Figure 3.2-4 Time series plot of model predicted versus observed mean 1-hr observed.

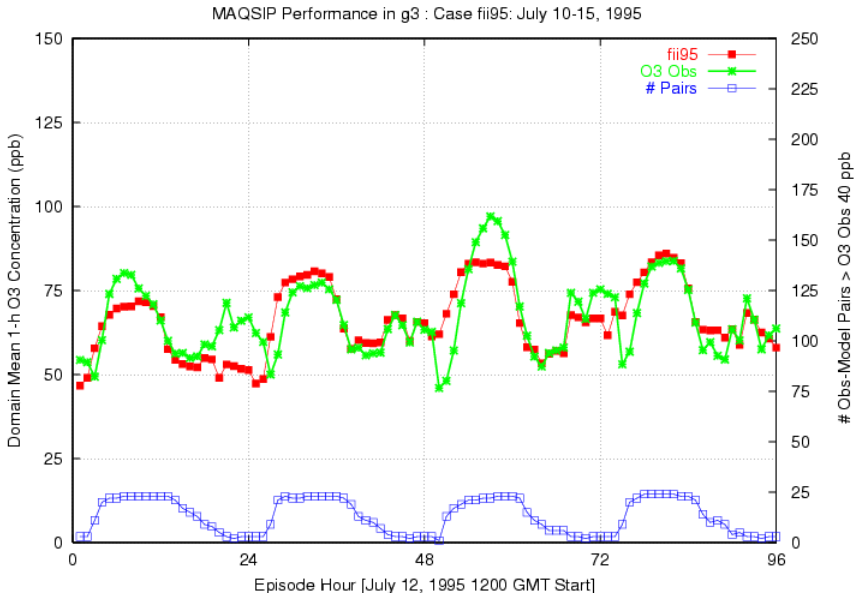

Figure 3.2-5 Time series plot of model predicted versus observed mean 1-hr observed.

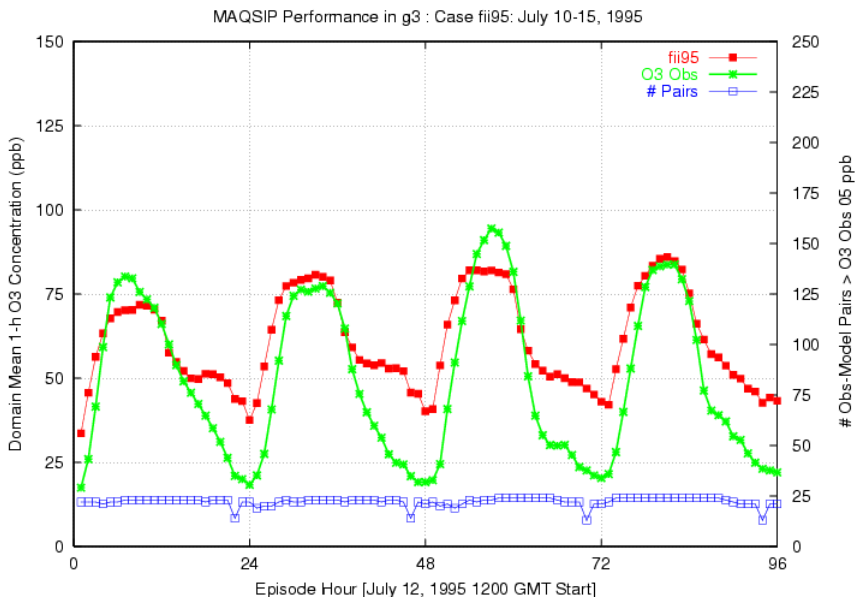

Figure 3.2-6. Time series plot of model predicted versus observed mean 1-hr observed ozone concentrations for observed concentrations greater than 05 ppb.

3.3 1996 Episodes

Spatial Plots

Below are the domain-wide spatial plots of modeled 1-hr and 8-hr max ozone with the observations overlaid for the first episode in 1996, June 21-24 (Figures 3.3-1 and 3.3-2) and the second episode June 27-30 (Figures 3.3-3 and 3.3-4). Again, the model does perform will predicting the spatial extent of the higher ozone concentrations. The model slightly over predicts ozone in the Charlotte region, but performance in the Triad and other EAC areas appears to be fairly good. Model performance for 8-hr ozone appears to be fairly good as well, with the exception of some over prediction in the Triad and Fayetteville regions.

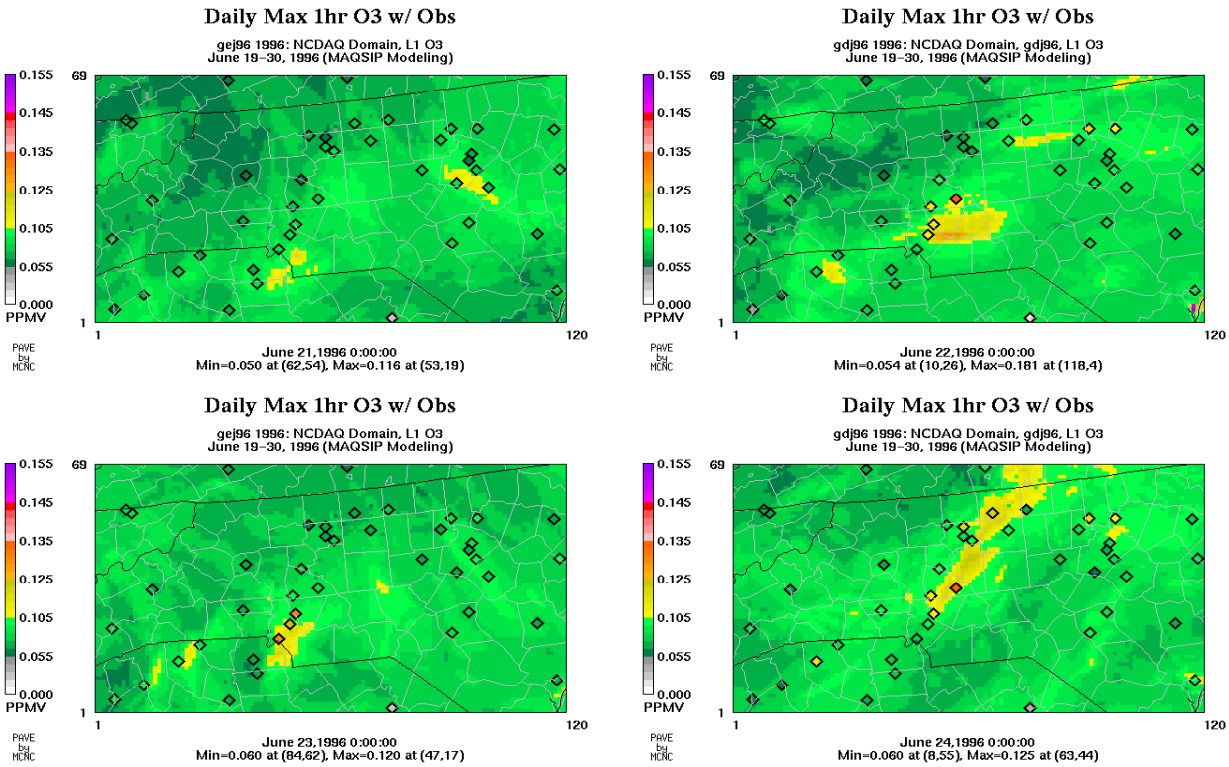

Figure 3.3-1. Spatial plots for model predicted and observed peak 1-hr ozone concentrations for June 21-24, 1996.

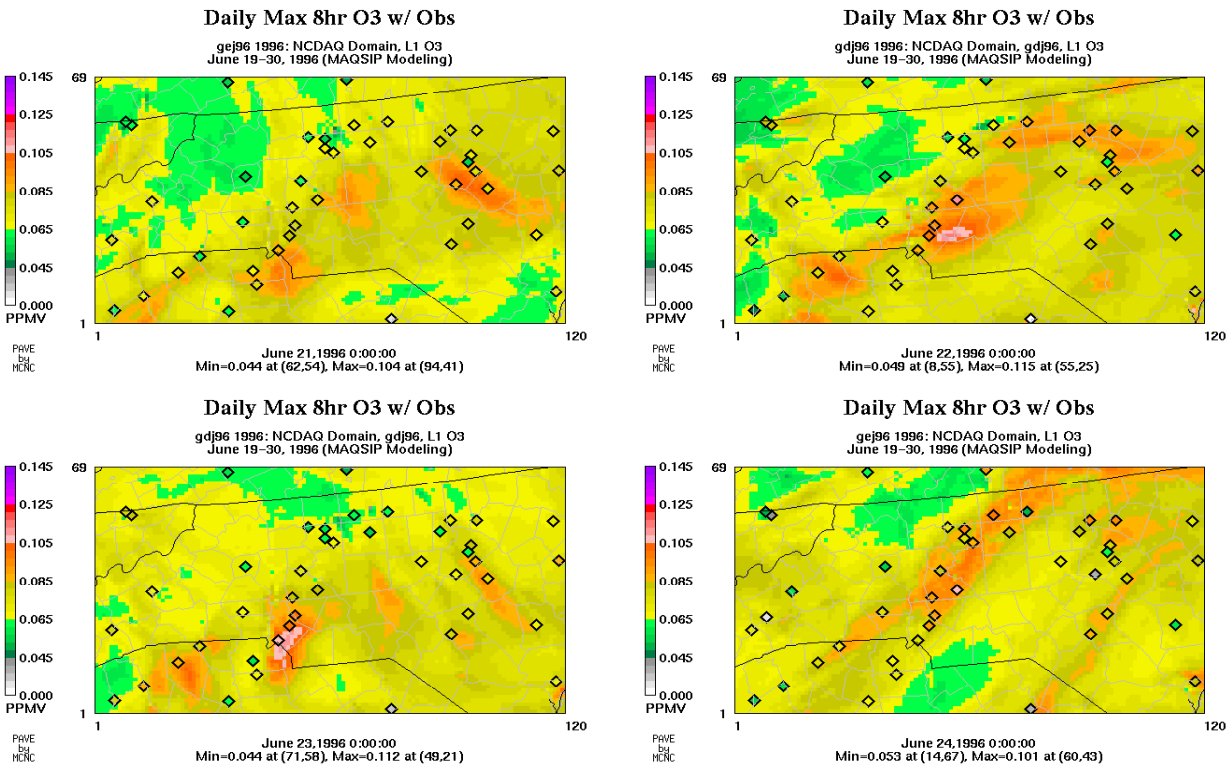

Figure 3.3-2. Spatial plots for model predicted and observed peak 8-hr ozone concentrations for June 21-24, 1996.

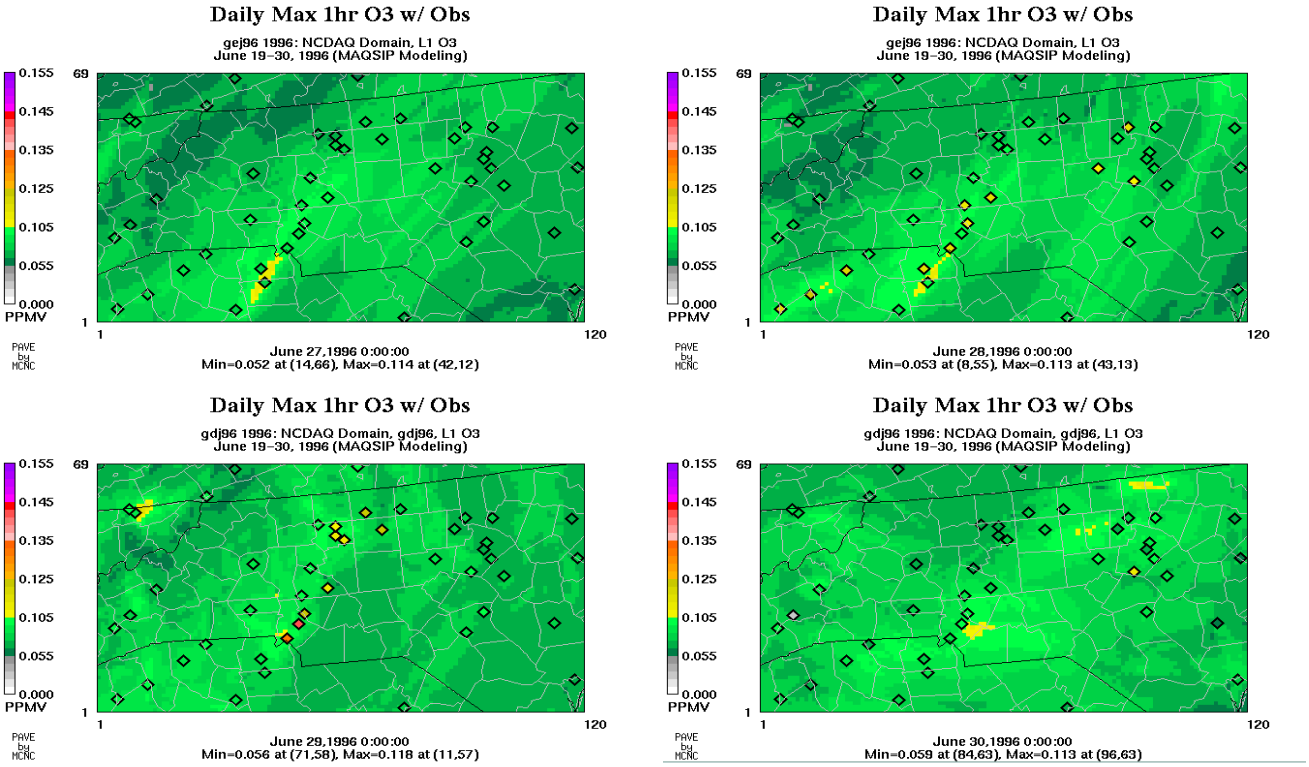

Figure 3.3-3. Spatial plots for model predicted and observed peak 1-hr ozone concentrations for June 27-30, 1996.

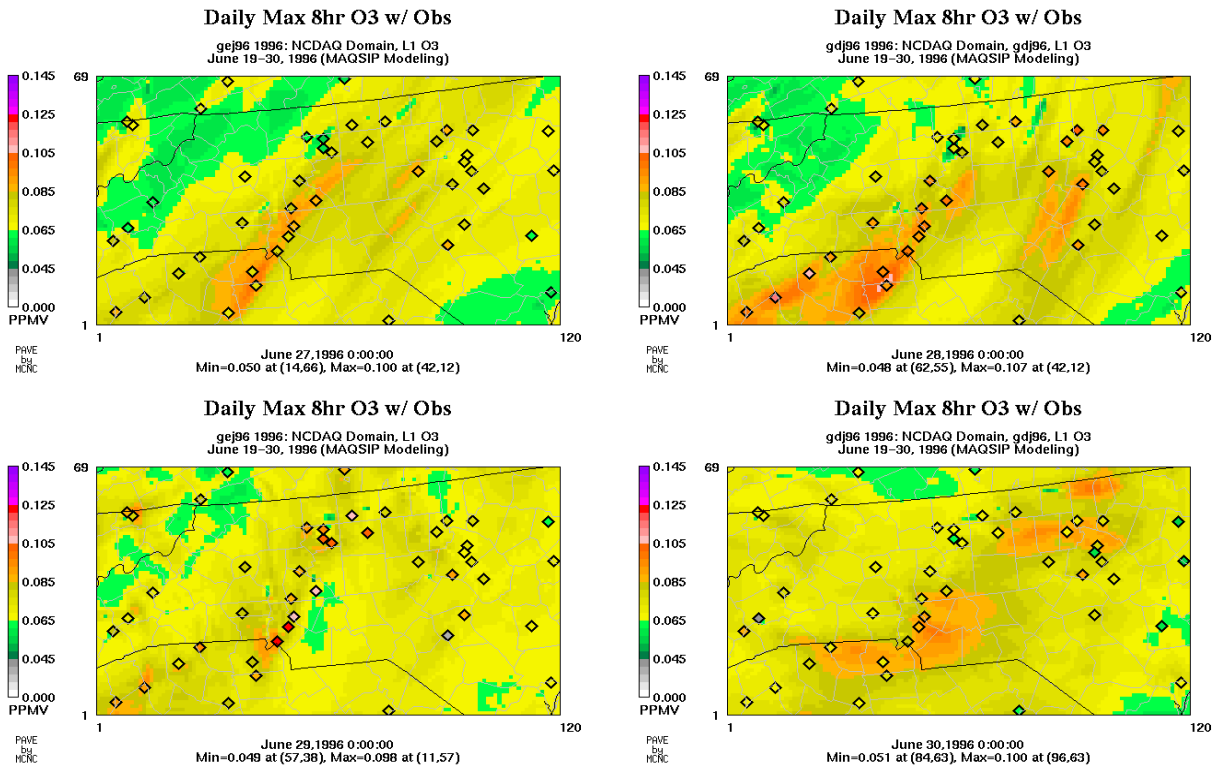

Figure 3.3-4. Spatial plots for model predicted and observed peak 8-hr ozone concentrations for June 27-30, 1996.

Scatter Plots

The scatter plots below show that while there are some over predictions, most of the model predicted concentrations are within acceptable limits for performance (Figure 3.3-5).

4 km Domain Time Series

The time series plots for the 1996 episode show that throughout the whole domain the overall model performance was good, with the model generally doing a good job capturing the max ozone peaks (Figures 3.3-6 through 3.3-8). The model tended to perform better at the 40 and 5 ppb thresholds as opposed to the 60 ppb threshold. However, the model did capture the ozone peaks at the 60 ppb threshold fairly well.

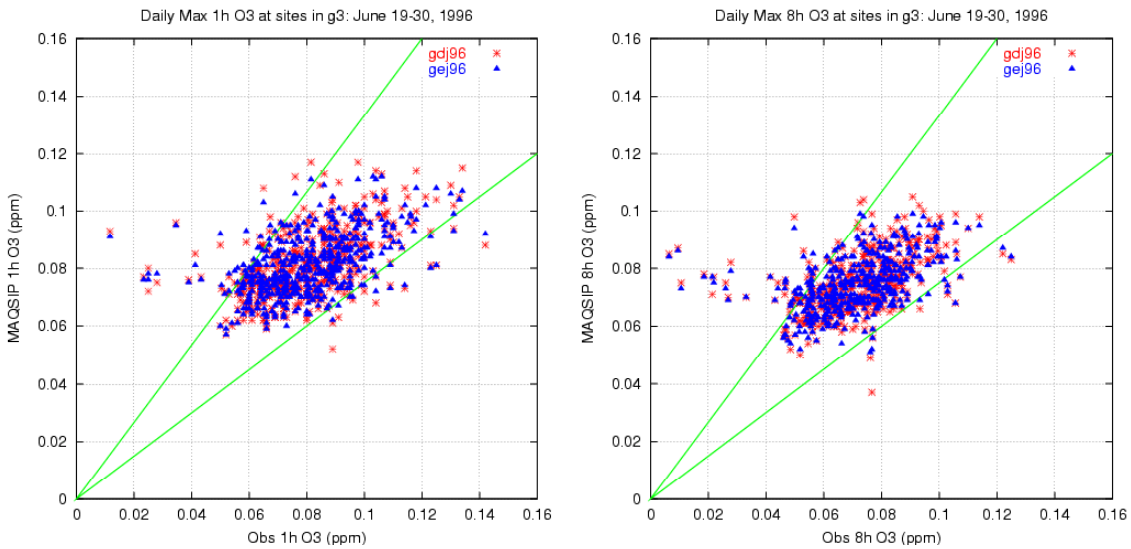

Figure 3.3-5. Scatter plot of model predicted versus observed 1-hr and 8-hr max ozone for June 19-30, 1996.

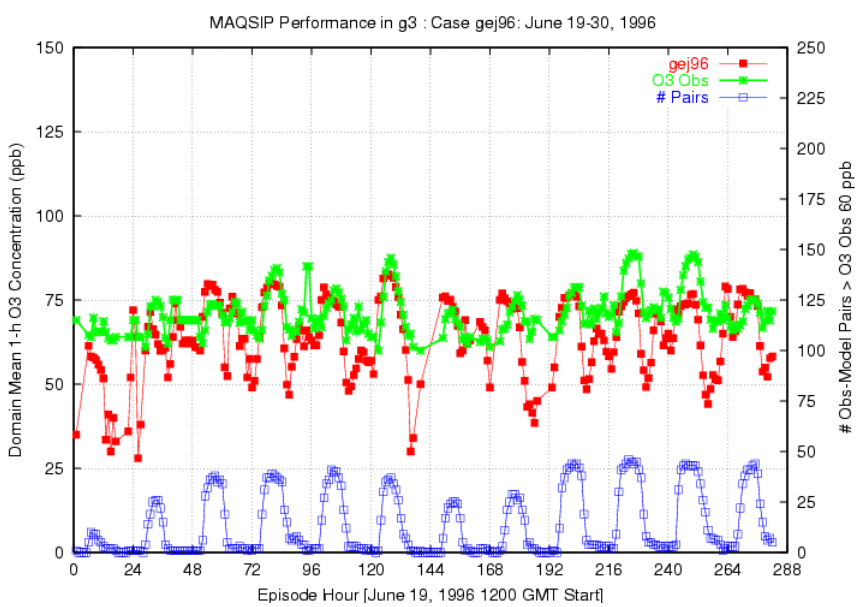

Figure 3.3-6. Time series plot of model predicted versus observed mean 1-hr observed ozone concentrations for observed concentrations greater than 60 ppb for June 19-30, 1996.

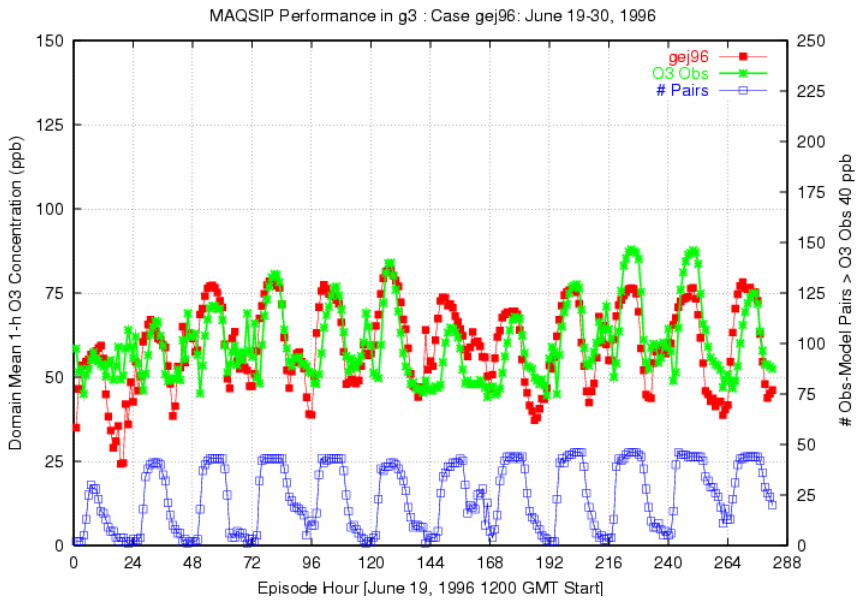

Figure 3.3-7. Time series plot of model predicted versus observed mean 1-hr observed ozone concentrations for observed concentrations greater than 40 ppb for June 19-30, 1996.

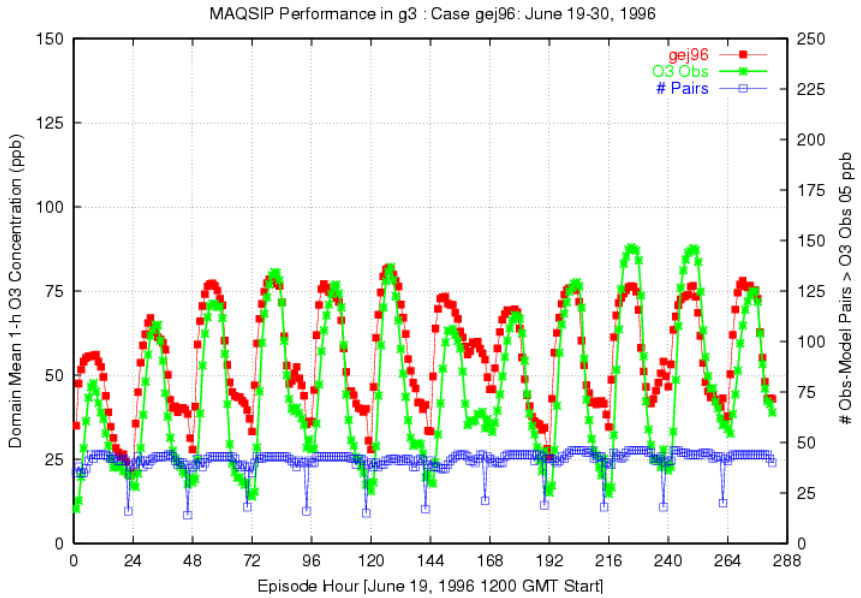

Figure 3.3-8. Time series plot of model predicted versus observed mean 1-hr observed ozone concentrations for observed concentrations greater than 5 ppb for June 19-30, 1996.

3.4 1997 Episode

Spatial Plots

Spatial model performance at 4 km was good for the 1997 episode, with most of the areas of higher ozone concentrations captured well by the model (Figures 3.4-1 and 3.4-2). There were very few significant over predictions.

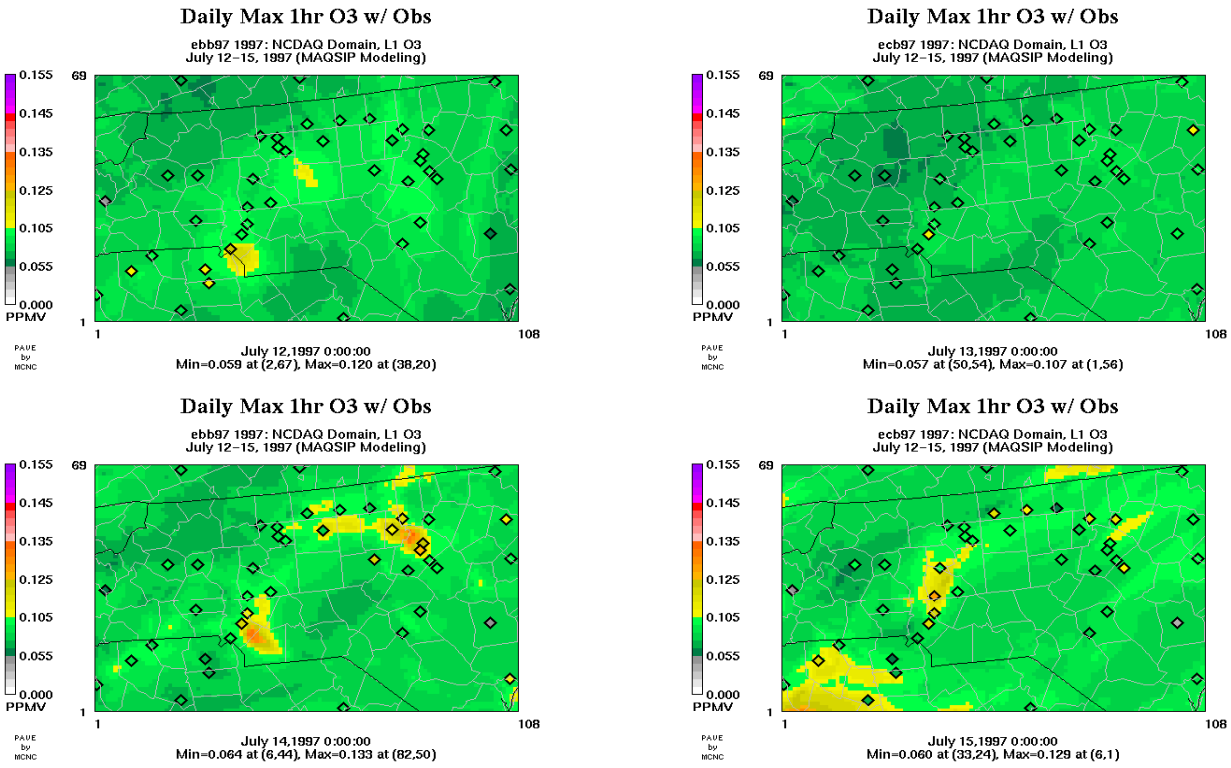

Figure 3.4-1. Spatial plots for model predicted and observed peak 1-hr ozone concentrations for July 12-15, 1997.

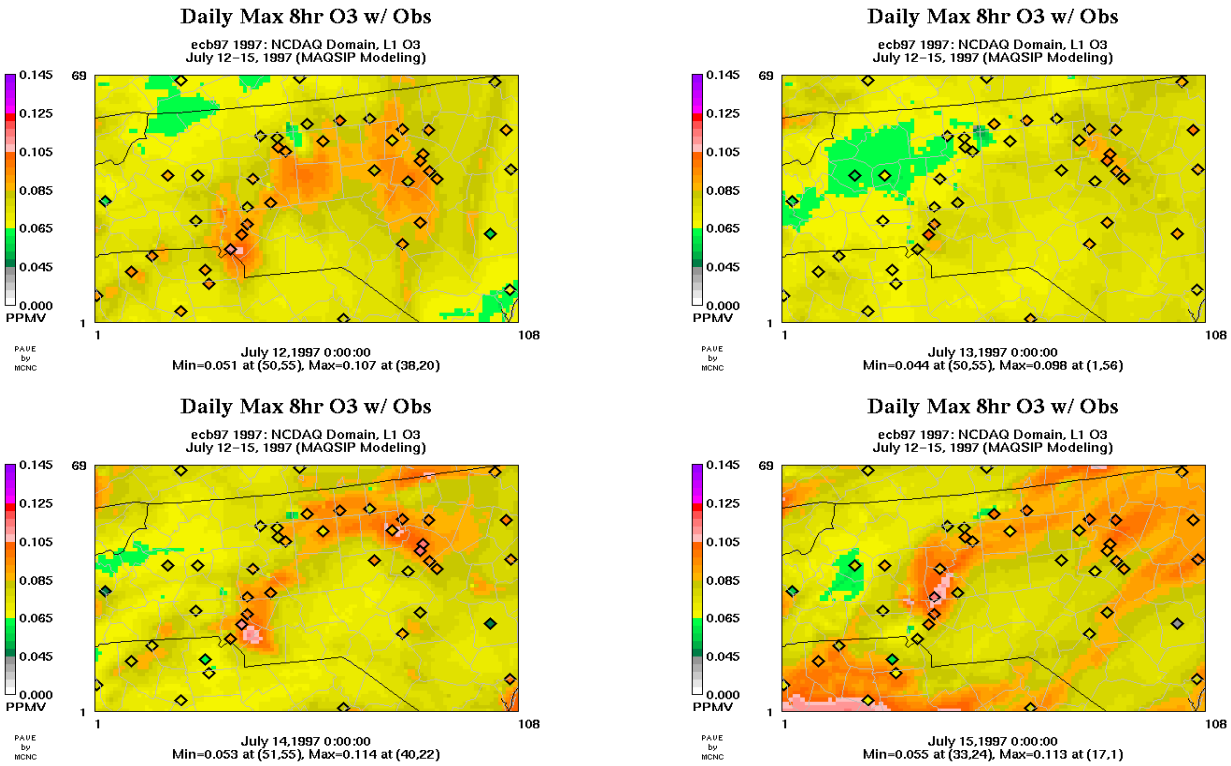

Figure 3.4-2. Spatial plots for model predicted and observed peak 8-hr ozone concentrations for July 12-15, 1997.

Scatter Plots

As with the 1996, there were several model over predictions, as well as some less significant under predictions. Overall, the majority of the model forecasts fall within the thresholds for acceptable performance (Figure 3.4-3).

4 km Domain Time Series

As with the previous domain wide time series plots, the model did well capturing the peak ozone, with mostly a slight under prediction on some days (Figures 3.4-4 through 3.4-6). Overall, the model did well capturing the ozone cycle for the 40 and 5 ppb thresholds, while the model tended to under predict ozone during the overnight periods for the 60 ppb threshold.

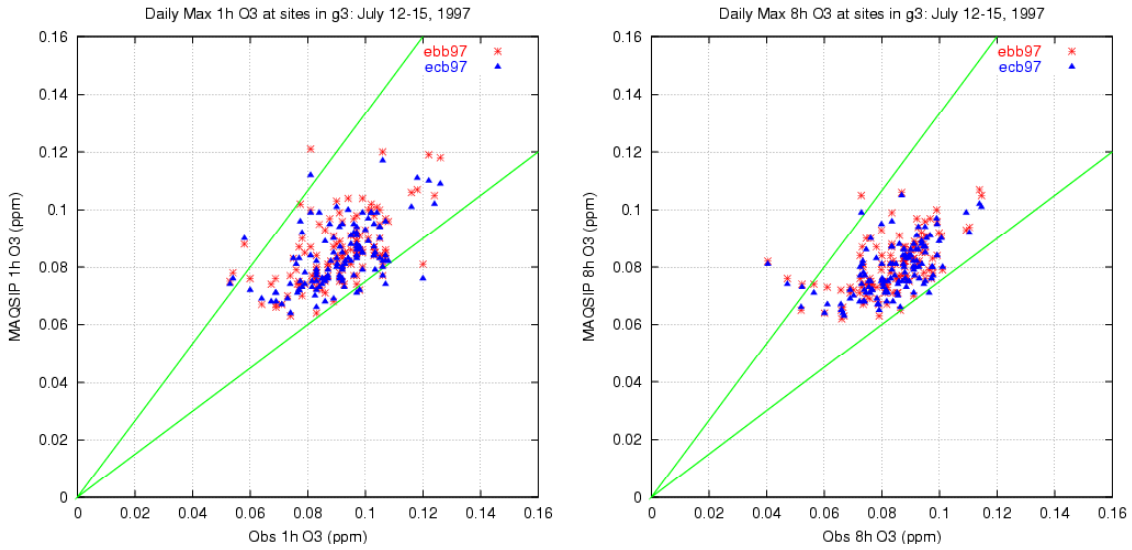

Figure 3.4-3. Scatter plot of model predicted versus observed 1-hr and 8-hr max ozone for July 12-15, 1997.

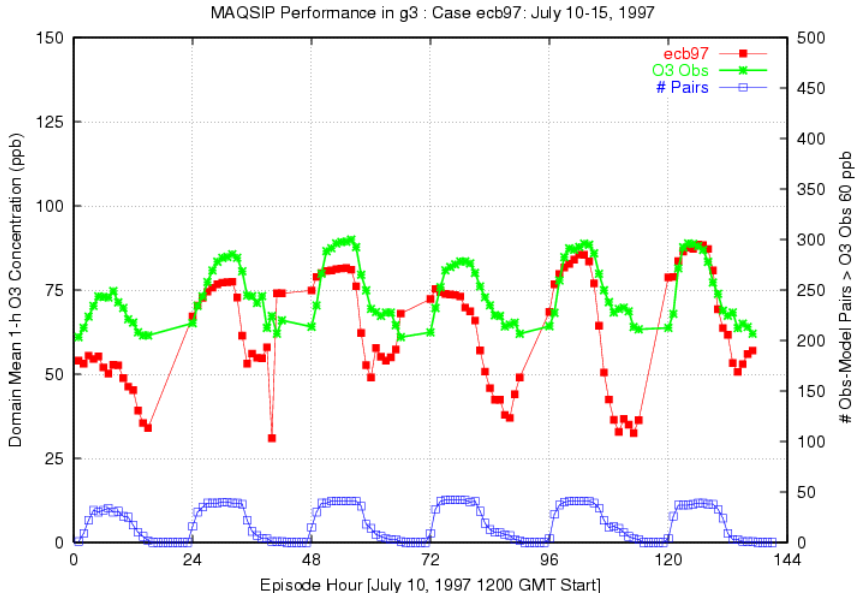

Figure 3.4-4. Time series plot of model predicted versus observed mean 1-hr observed ozone concentrations for observed concentrations greater than 60 ppb for July 10-15, 1997.

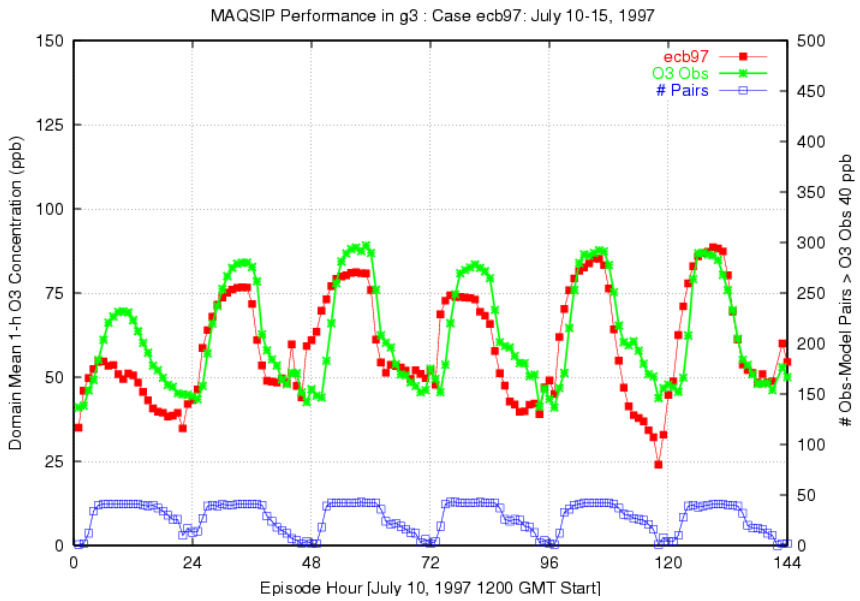

Figure 3.4-5. Time series plot of model predicted versus observed mean 1-hr observed ozone concentrations for observed concentrations greater than 40 ppb for July 10-15, 1997.

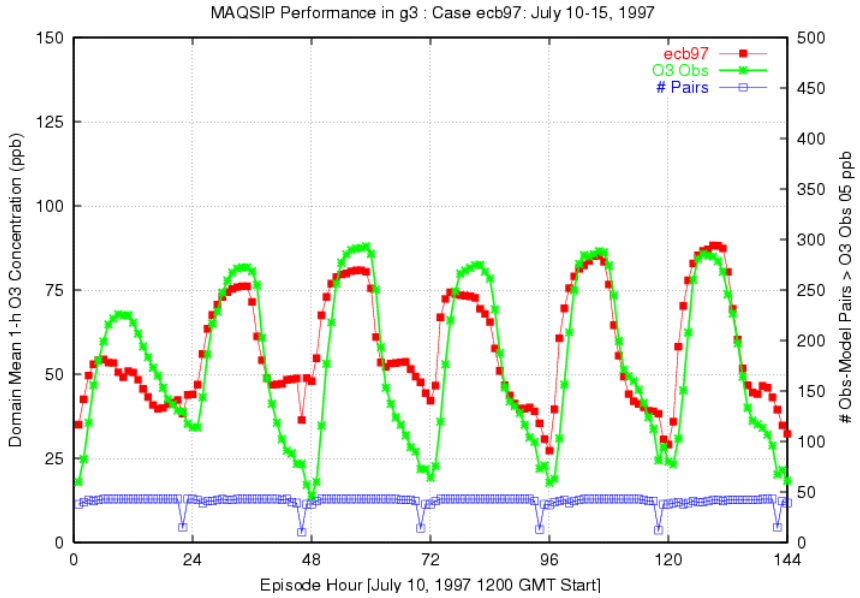

Figure 3.4-6. Time series plot of model predicted versus observed mean 1-hr observed ozone concentrations for observed concentrations greater than 5 ppb for July 10-15, 1997.

3.5 Domain-Wide Summary

Overall, the model performance for the entire domain throughout all three episodes is good. For the most part, normalized bias and gross error are within the recommended limits for good model performance, especially above 40 ppb. The model seems to do a good job capturing the ozone cycle for all three episodes. There are some instances of under and over predictions, but for the majority of the time the model does well simulating the afternoon ozone peak throughout the whole domain. The scatter plots show that the model did well for the 1995 and 1997 episodes, while having a slight over prediction tendency for the 1996 episode. We feel that the model performance is well within the limits of acceptable performance established in the draft guidance.

3.6 EAC Model Performance Evaluation

Below is the model performance evaluation for each EAC area (Triad, Unifour, Mountain, and Fayetteville). Included are visual (e.g. time series) and statistical measures for each region. These evaluation products include:

1. Time series plots showing how the model's predicted ozone compares to the observed ozone at the monitor within the same grid cell. This is considered the most stringent of the model performance evaluation procedures since it requires the evaluation of the model's ability to predict the observed ozone in the location where it was observed over all hours of the episode.

2. Statistical measures by EAC region and by monitors in those regions. Statistical measures include bias, normalized bias, and gross error. Like the time series, the statistics compare the observed ozone at the monitor to the grid cell where the monitor is located. The tables in each subsection below contain the statistical information. Values in red are calculated from the 12km modeling domain where the 4km domain did not cover the monitor's location. All other values are from the 4km modeling domain. Blank cells indicate days where no monitored data were available.

3.6.1 Triad EAC Model Performance Evaluation

<u>Time Series Plots</u>

Following are time series plots at 4 km for the Hattie Avenue and Pollirosa monitors located in Forsyth County for the three modeled episodes (Figures 3.6.1-1 through 3.6.1-2). The time series presents the observed values (green x's) and the predicted values (red diamonds). Overall, model performance at the Hattie Avenue monitor is good, although the model tends to under predict the max 8-hr ozone late in the 1995 and 1996 episodes. The model does a fairly good job capturing the diurnal cycle of ozone at Hattie Avenue throughout the three episodes. Model performance is particularly good through the majority of the 1996 episode at Hattie Avenue.

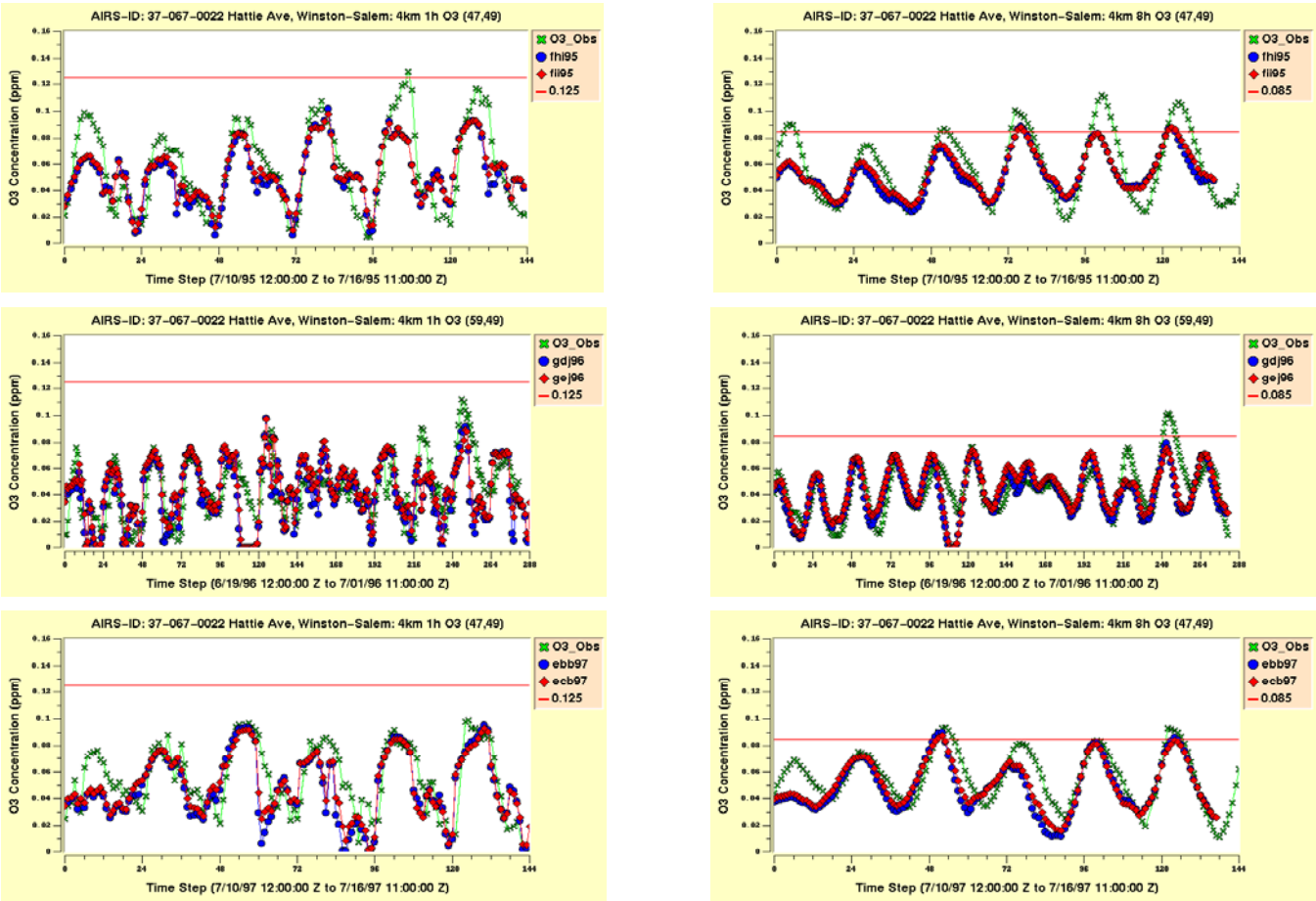

Figure 3.6.1-1. Time series plot of model predicted versus observed 1-hr and 8-hr ozone concentrations for the Hattie Avenue monitor in Forsyth County in the Triad EAC area for the three episodes.

While model performance at the Pollirosa monitor is not as good as for the Hattie Avenue monitor, the model does do a good job capturing the peak ozone at both 1-hr and 8hr. The model does appear to have difficulty capturing the diurnal cycle for ozone, however.

All of the time series plots for the monitors located in the 4 km domain in the Triad EAC region are included in Appendix L, so the model performance for the entire domain can be evaluated.

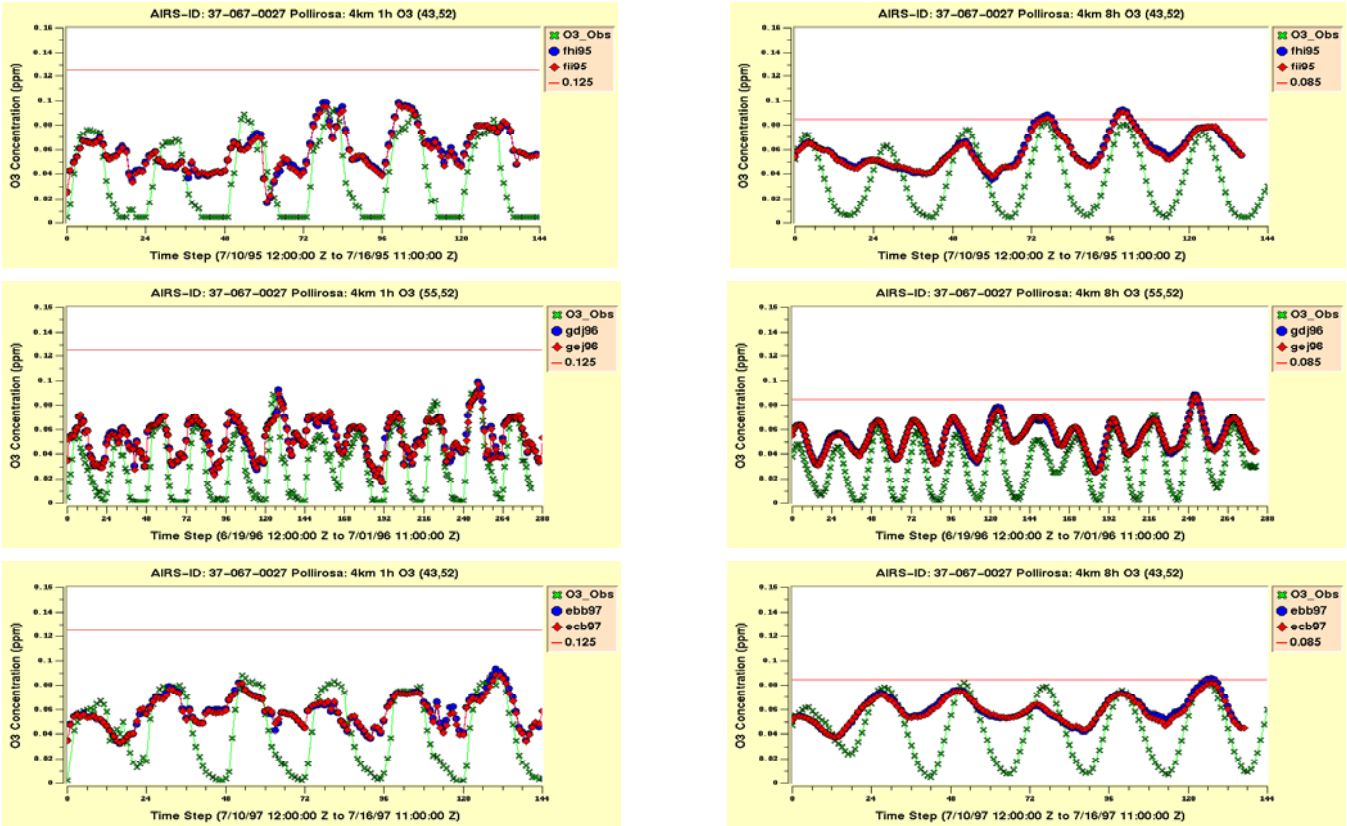

Figure 3.6.1-2. Time series plot of model predicted versus observed 1-hr and 8-hr ozone concentrations for the Pollirosa monitor in Forsyth County in the Triad EAC area for the three episodes.

Area and Monitor Statistics

The following are model performance statistics tables comparing the modeled 8-hour ozone mean and the observed 8-hour ozone mean at each monitor in the Triad EAC area, as well as the combined statistics for all of the monitors in the EAC area. Each of the episodes modeled are included.

It is recommended that the combined normalized bias fall within ± 5-15 percent and the combined gross error not exceed the 30-35 percent range. Table 3.6.1-1 shows that the Triad is well within these ranges for the EAC wide statistics in the 1995 episode. For a specific monitor, it is recommended that the normalized bias fall within ± 20 percent. Table 3.6.1-1 does show some performance outside the ranges for specific monitors. In the case of Hattie Avenue, the large negative bias can be attributed to high observed ozone on one of the episode days. It should be noted that performance statistics were not calculated for the Cooleemee, Shiloh and Sophia monitors because they were not in operation during 1995.

Table 3.6.1-2 presents both the 1996 episodes where, again, the EAC wide statistics are with accepted thresholds. Statistics were not calculated for the Sophia monitor because it was not in operation in 1996. Table 3.6.1-3 shows perhaps the best overall performance of the three

episodes with a bias of only –4.0 ppb. Again, the Sophia monitor was not in operation in 1997, so no statistics are calculated for this monitor.

Table 3.6.1-1. Triad Area/Monitor Statistics for the 1995 Episode

Monitor	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Triad EAC	86.0	85.0	1.00	2.52	13.76
Bethany	93.0	73.0	20.00	26.37	26.37
Cherry Grove	85.0	85.0	0.00	0.29	8.45
Hattie Avenue	82.0	101.0	-19.00	-16.92	16.92
Mcleansville	80.0	85.0	-5.00	3.62	12.85
Pollirosa	80.0	78.0	2.00	2.40	10.29
Union	86.0	87.0	-1.00	-0.64	7.66

Table 3.6.1-2. Triad Area/Monitor Statistics for the 1996 Episodes

Monitor	1996 Episode 1				
	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Triad EAC	75.0	69.0	6.00	9.73	12.07
Bethany	72.0	74.0	-2.00	-2.44	6.53
Cherry Grove	79.0	68.0	11.00	22.76	23.46
Cooleemee	77.0	74.0	3.00	4.05	6.58
Hattie Avenue	70.0	67.0	3.00	5.20	6.51
Mcleansville	81.0	72.0	9.00	14.02	14.02
Pollirosa	69.0	61.0	8.00	13.86	13.86
Shiloh	73.0	67.0	6.00	11.76	16.97
Union	78.0	72.0	6.00	8.62	8.62
	1996 Episode 2				
Triad EAC	72.0	79.0	-7.00	0.77	13.64
Bethany	73.0	87.0	-14.00	-14.79	14.79
Cherry Grove	74.0	78.0	-4.00	-3.89	13.67
Cooleemee	77.0	82.0	-5.00	-5.27	11.33
Hattie Avenue	67.0	77.0	-10.00	16.47	20.08
Mcleansville	76.0	80.0	-4.00	7.49	20.21
Pollirosa	73.0	72.0	1.00	-1.24	5.47
Shiloh	64.0	75.0	-11.00	15.96	13.04
Union	77.0	85.0	-8.00	-8.55	10.52

Table 3.6.1-3. Triad Area/Monitor Statistics for the 1997 Episode

Monitor	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Triad EAC	80.0	84.0	-4.00	-4.03	11.71
Bethany	77.0	88.0	-11.00	-11.78	12.94
Cherry Grove	82.0	95.0	-13.00	-14.00	14.00
Cooleemee	80.0	85.0	-5.00	-5.25	13.29
Hattie Avenue	79.0	87.0	-8.00	-9.22	9.22
Mcleansville	87.0	74.0	13.00	18.99	22.84
Pollirosa	73.0	79.0	-6.00	-8.45	8.45
Shiloh	78.0	77.0	1.00	0.82	7.29
Union	84.0	86.0	-2.00	-3.33	5.61

3.6.2 Unifour EAC Model Performance Evaluation

Time Series Plots

Figure 3.6.2-1 is the time series plot at the Lenoir monitor in Caldwell County in the Unifour EAC area. Note that for the 1996 episode no 4 km time series was available, so the 12 km time series was used instead (without observations). The model has some difficulty simulating the full extent of the ozone cycle throughout the period. The model tends to under predict the peak ozone early in the 1995 period, but does a better job capturing the peaks later in the episode. For the 1997 episode, the model also does not capture the full extent of the peak ozone on several days, but overall performance was good.

All of the time series plots for the monitors located in the 4 km domain in the Unifour EAC region are included in Appendix L, so the model performance for the entire domain can be evaluated.

Area and Monitor Statistics

The following are model performance statistics tables comparing the modeled 8-hour ozone mean and the observed 8-hour ozone mean at each monitor in the Unifour EAC area, as well as the combined statistics for all of the monitors in the EAC area. Each of the episodes modeled are included.

Tables 3.6.2-1 through 3.6.2-3 present the area statistics for the Unifour EAC. In Table 3.6.2-1, there are no data for the Taylorsville monitor because there were no observations made during the period. Similarly, there were no observations for the Lenoir monitor during the 1996 episode (Table 3.6.2-2). Overall, there were no major discrepancies between the modeled and observed data.

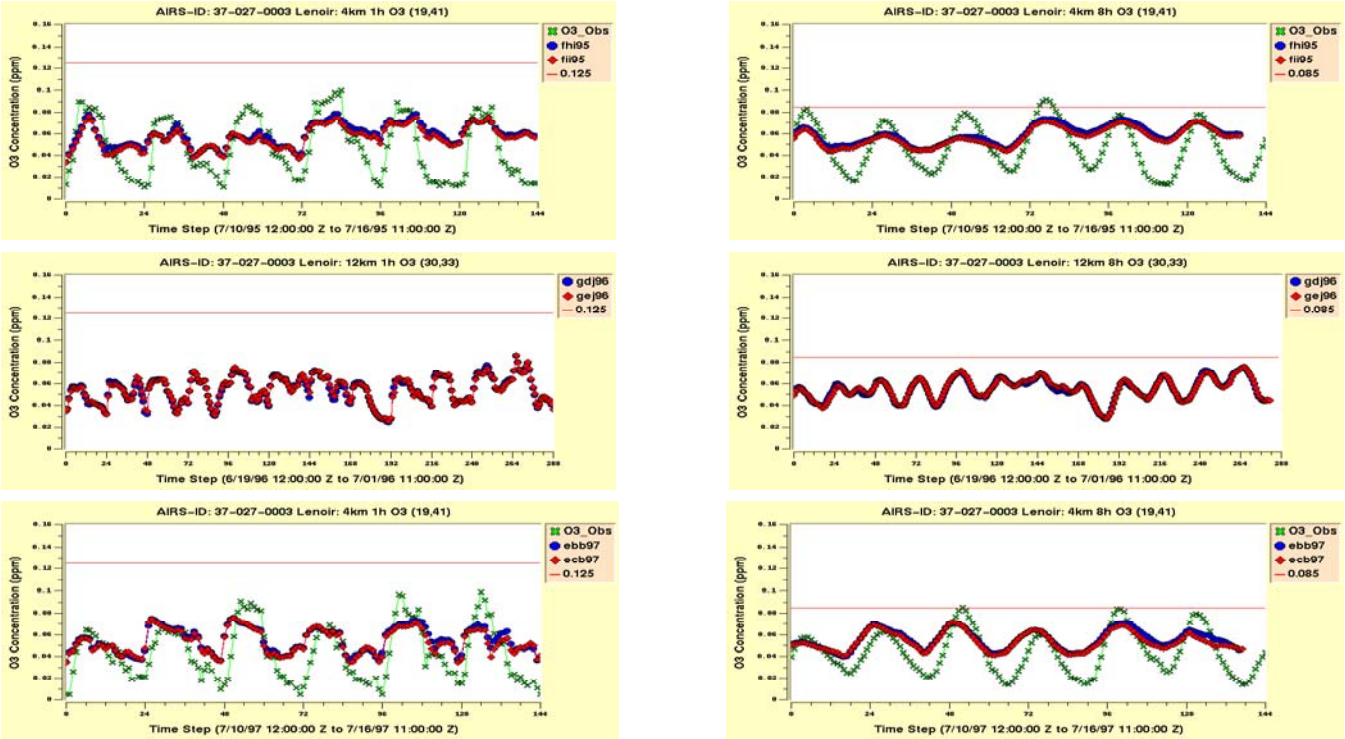

Figure 3.6.2-1. Time series plot of model predicted versus observed 1-hr and 8-hr ozone concentrations for the Lenoir monitor in Caldwell County in the Unifour EAC area for the three episodes.

Table 3.6.2-1. Unifour Area/Monitor Statistics for the 1995 Episode

Monitor	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Unifour EAC	66.0	81.0	-15.00	-18.74	18.74
Lenoir	66.0	81.0	-15.00	-18.74	18.74
Taylorsville					

Table 3.6.2-2. Unifour Area/Monitor Statistics for the 1996 Episodes

Monitor	1996 Episode 1				
	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Unifour EAC	67.0	56.0	11.00	20.12	20.12
Lenoir					
Taylorsville	67.0	56.0	11.00	20.12	20.12
	1996 Episode 2				
Unifour EAC	69.0	74.0	-5.00	7.17	7.11
Lenoir					
Taylorsville	69.0	74.0	-5.00	7.17	7.11

Table 3.6.2-3. Unifour Area/Monitor Statistics for the 1997 Episode

Monitor	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Unifour EAC	68.0	76.0	-8.00	-9.78	11.45
Lenoir	66.0	77.0	-11.00	12.28	15.61
Taylorsville	70.0	76.0	-6.00	-7.29	7.29

3.6.3 Mountain EAC Model Performance Evaluation

Time Series Plots

Figure 3.6.3-1 shows the time series plot for the Bent Creek monitor in Buncombe County in the Mountain EAC area for all three episodes, and represents a valley location. Note that the Bent Creek monitor was not in the 4 km domain for the 1995 episode, so the 12 km data is used instead. The model has considerable difficulty simulating the diurnal ozone cycle in the mountains and valleys. However, the model still does a fair job capturing the peak ozone concentrations at Bent Creek. The model does perform fairly well late in the 1996 episode.

Figure 3.6.3-2 shows the time series plot for the Frying Pan monitor in Haywood County in the Mountain EAC area for all three episodes, and represents a high elevation (peak) location in the mountains. The diurnal behavior of ozone in high elevation locations is much different from other locations. While the model has some difficulty trying to capture the ozone cycle at Frying Pan, the overall performance of the model at the location is acceptable.

All of the time series plots for the monitors located in the 4 km domain in the Mountain EAC region are included in Appendix L, so the model performance for the entire domain can be evaluated.

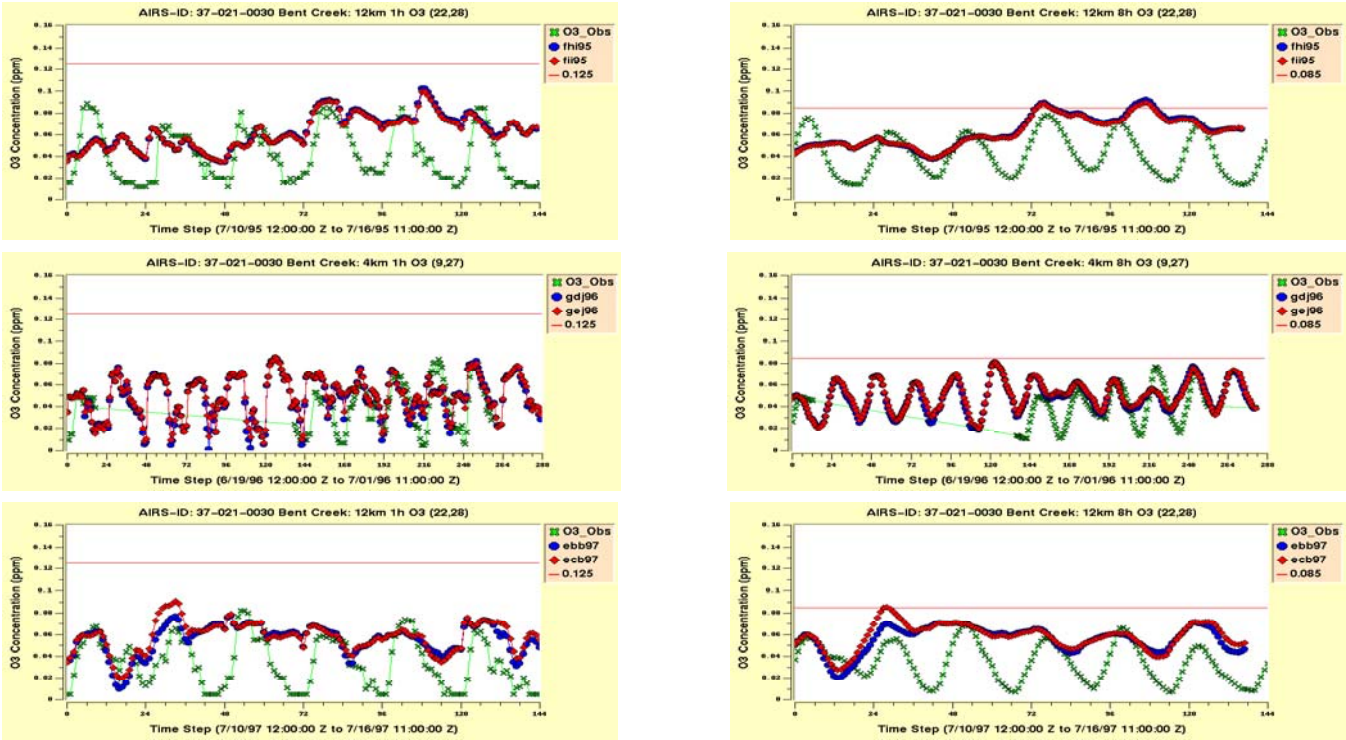

Figure 3.6.3-1. Time series plot of model predicted versus observed 1-hr and 8-hr ozone concentrations for the Bent Creek monitor in Caldwell County in the Mountain EAC area for the three episodes.

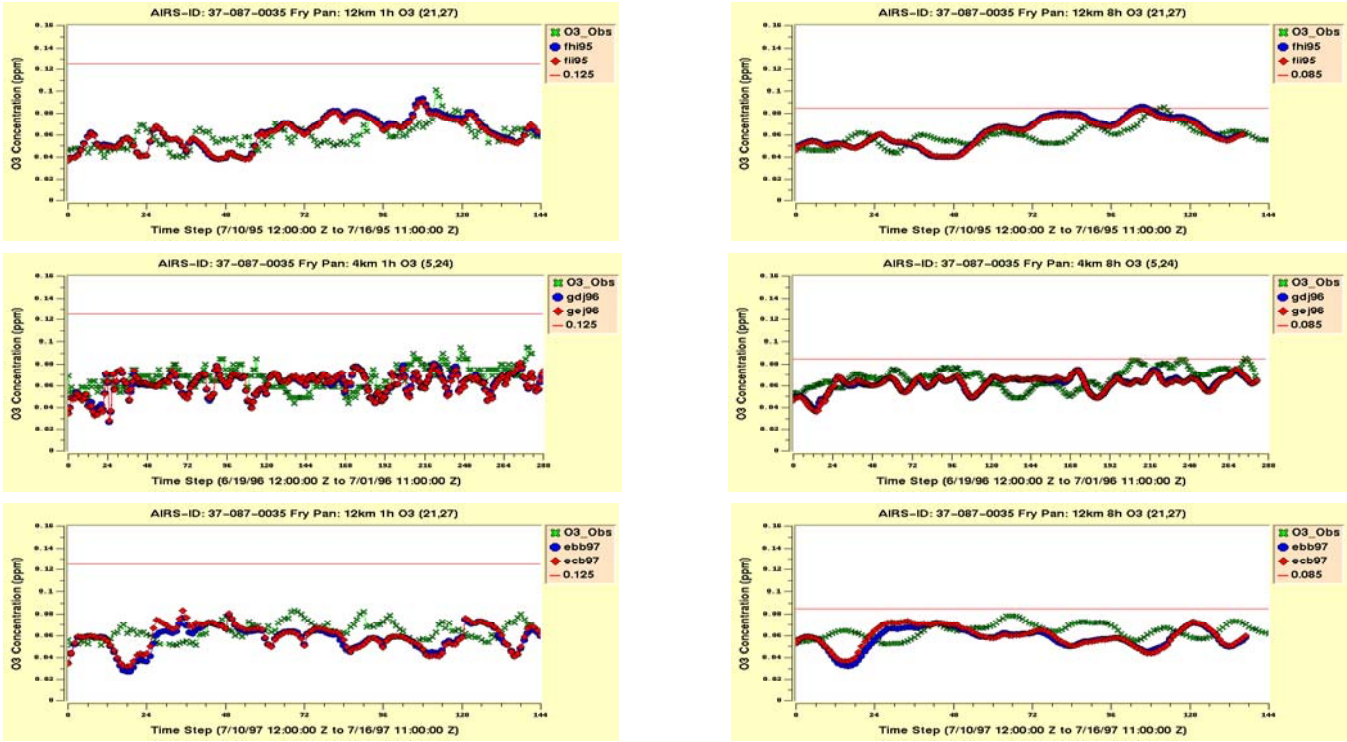

Figure 3.6.3-2. Time series plot of model predicted versus observed 1-hr and 8-hr ozone concentrations for the Frying Pan monitor in Haywood County in the Mountain EAC area for the three episodes.

Area and Monitor Statistics

The following are model performance statistics tables comparing the modeled 8-hour ozone mean and the observed 8-hour ozone mean at each monitor in the Mountain area EAC area, as well as the combined statistics for all of the monitors in the EAC area. Each of the episodes modeled are included.

Somewhat surprisingly, despite the complex terrain, the statistics performed on the Mountain EAC were mostly within the accepted ranges. The main outlier is in Table 3.6.3-3 where under-prediction plagued the model at the Purchase Knob monitor. The statistics were not calculated for the Waynesville monitoring site for any of the episodes since it was not in operation during this period.

Table 3.6.3-1. Mountain Area/Monitor Statistics for the 1995 Episode

Monitor	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Mountain EAC	73.0	71.0	2.00	2.59	9.07
Bent Creek	77.0	70.0	7.00	8.99	12.96
Frying Pan	75.0	73.0	2.00	2.70	7.04
Purchase Knob	66.0	69.0	-3.0	-3.92	7.19

Table 3.6.3-2. Mountain Area/Monitor Statistics for the 1996 Episodes

Monitor	1996 Episode 1				
	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Mountain EAC	67.0	69.0	-2.00	-1.41	10.03
Bent Creek*					
Frying Pan	67.0	73.0	-6.00	-7.63	7.63
Purchase Knob	67.0	65.0	2.00	4.81	12.44
	1996 Episode 2				
Mountain EAC	69.0	78.0	-9.00	2.25	14.57
Bent Creek	64.0	70.0	-6.00	-7.82	10.60
Frying Pan	84.0	70.0	-14.00	16.34	16.34
Purchase Knob	71.0	79.0	-8.00	-7.81	15.78

* Statistics were not calculated for the Bent Creek monitor during the 1996 Episode 1 since there was no observation data available at that monitor during this episode.

Table 3.6.3-3. Mountain Area/Monitor Statistics for the 1997 Episode

Monitor	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Mountain EAC	65.0	75.0	-10.00	-8.69	19.03
Bent Creek	66.0	60.0	6.00	13.63	17.41
Frying Pan	66.0	75.0	-9.00	-11.64	11.64
Purchase Knob	64.0	89.0	-25.00	-28.05	28.05

3.6.4 Cumberland County EAC Model Performance Evaluation

Time Series Plots

Figure 3.6.4-1 shows the time series plot for the Wade monitor in Cumberland County in the Fayetteville EAC area for all three episodes. While the model has some difficulty capturing the ozone cycle early in the 1995 episode, overall model performance for the three episodes is good. The model does very well simulating the peak ozone during the majority of the days in each episode.

All of the time series plots for the monitors located in the 4 km domain in the Fayetteville EAC region are included in Appendix L, so the model performance for the entire domain can be evaluated.

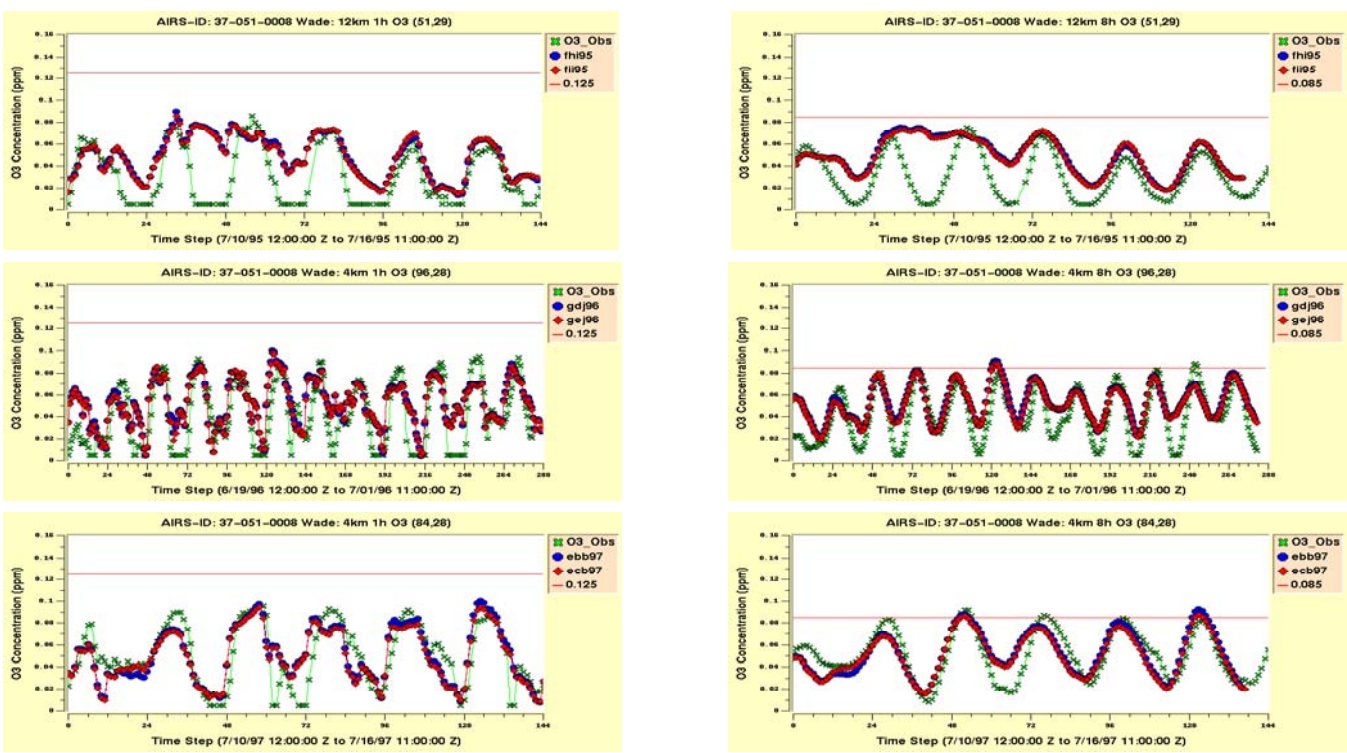

Figure 3.6.4-1. Time series plot of model predicted versus observed 1-hr and 8-hr ozone concentrations for the Wade monitor in Cumberland County in the Fayetteville EAC area for the three episodes.

Area and Monitor Statistics

The following are model performance statistics tables comparing the modeled 8-hour ozone mean and the observed 8-hour ozone mean at each monitor in the Cumberland County EAC area, as well as the combined statistics for all of the monitors in the EAC area. Each of the episodes modeled are included.

Tables 3.6.4-1 through 3.6.4-3 again display the statistics for each monitor in the Fayetteville EAC. All the statistics fall within acceptable ranges with the exception of the Golfview monitor in the second episode in 1996. This large positive bias can be attributed to an abnormally low reading at the monitor on June 29, 1996 of the episode.

Table 3.6.4-1. Cumberland County Area/Monitor Statistics for the 1995 Episode

Monitor	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Fayetteville EAC	64.0	56.0	8.00	17.23	18.24
Wade	66.0	60.0	6.00	12.57	14.60
Golfview	62.0	52.0	10.00	21.89	21.89

Table 3.6.4-2. Cumberland County Area/Monitor Statistics for the 1996 Episodes

Monitor	1996 Episode 1				
	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Fayetteville EAC	79.0	80.0	-1.00	-0.31	6.14
Wade	81.0	78.0	3.00	3.65	5.48
Golfview	78.0	81.0	-3.00	-4.27	6.80
	1996 Episode 2				
Fayetteville EAC	73.0	78.0	-5.00	-0.31	22.90
Wade	72.0	81.0	-9.00	-11.64	9.05
Golfview	75.0	74.0	1.00	14.79	37.92

Table 3.6.4-3. Cumberland County Area/Monitor Statistics for the 1997 Episode

Monitor	Modeled Mean (ppb)	Observed Mean (ppb)	Bias (ppb)	Norm. Bias (%)	Norm. Gross Error (%)
Fayetteville EAC	79.0	85.0	-6.00	-6.75	9.59
Wade	81.0	85.0	-4.00	-5.35	9.05
Golfview	78.0	85.0	-7.00	-8.15	10.12

4.0 CONTROLS APPLIED

Several control measures already in place or being implemented over the next few years will reduce point, highway mobile, and nonroad mobile sources emissions. The Federal and State control measures were modeled for all of the future years and are discussed in the sections below. The EAC control measures are also summarized below. The only EAC measure that was modeled was the fuel switching at one of the RJ Reynolds facilities in the Triad EAC area. Details of the EAC control measures can be found in Appendix C.

4.1 Federal Control Measures

4.1.1 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.

4.1.2 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.

4.1.3 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.

4.1.4 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, in 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 emission standard 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 model year 2006 off-highway motorcycles and all-terrain-vehicles, the new exhaust emissions standard will be phased-in by 50%, and for model years 2007 and later 100% of the engines must meet the new standards. 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.

4.2 State Control Measures

North Carolina has adopted a number of regulations and legislation to address pollution issues across the State. These include the Clean Air Bill, the NOx SIP Call Rule, the Clean Smokestacks Act and Open Burning Rule. All of these regulations were modeled in the attainment demonstration. These regulations are summarized below and the actual regulations and legislation can be viewed in Appendix O.

4.2.1 Clean Air Bill

The 1999 Clean Air Bill will expand the vehicle emissions inspection and maintenance program in North Carolina from 9 counties to 48 counties between July 1, 2002 and January 1, 2006. Vehicles will be tested using the onboard diagnostic system (OBDII), an improved method of testing, which will indicate NOx emissions, among other pollutants. The previously used tailpipe test (i.e., idle test) did not measure NOx. For most of the counties in EACs, the inspection and maintenance program is above and beyond what is required federally for these areas. The exception is Forsyth and Guilford Counties, which were required to have the idle test inspection and maintenance program due to the 1-hour ozone nonattainment/maintenance status of those counties. The idle test only tested VOC and CO emissions, therefore, the NOx benefits from having the OBDII inspection and maintenance program in Forsyth and Guilford Counties is above and beyond what is Federally mandated. Table 4.2.1-1 below lists the phase-in schedule

for the expanded inspection and maintenance program. The bolded counties are EAC counties and counties with asterisks (*) are located adjacent to an EAC area, which will contribute to additional NOx reductions in the EAC areas.

Table 4.2.1-1 Phase-In Dates for the Expanded Inspection & Maintenance Program

Phase-In Date: July 1, 2002		
Cabarrus Durham **Forsyth**	Gaston **Guilford** Mecklenburg	Orange* Union Wake
Phase-In Date: July 1, 2003		
Catawba **Cumberland**	**Davidson** Iredell*	Johnston Rowan*
Phase-In Date: January 1, 2004		
Alamance Chatham* Franklin	Lee Lincoln* Moore*	**Randolph** Stanly
Phase-In Date: July 1, 2004		
Buncombe Cleveland*	Granville Harnett*	**Rockingham**
Phase-In Date: January 1, 2005		
Edgecombe Lenoir Nash	Pitt Robeson* Wayne	Wilson
Phase-In Date: July 1, 2005		
Burke **Caldwell** **Haywood**	Henderson* Rutherford* **Stokes**	**Surry** Wilkes*
Phase-In Date: January 1, 2006		
Brunswick Carteret	Craven New Hanover	Onslow

The amount of emission reductions associated with the expanded inspection and maintenance program were estimated in a series of MOBILE 6.2.03 model runs. The MOBILE runs were processed for only those Early Action Compact (EAC) counties in North Carolina that will have OBDII testing in 2007.

The study was designed to compare 2007 mobile emissions from 2 model runs. The intention of the first run was to simulate what 2007 mobile emissions would be without the expanded

inspection and maintenance program. The second run simulated the 2007 mobile emissions with the expanded inspection and maintenance program in place. The table below provides the specifics of the simulations. Please note that Guilford and Forsyth Counties' estimates included the idle test that was already in place prior to implementation of the expanded program.

Table 4.2.1-2 MOBILE Model Parameters

County	RVP	I/M program modeled (w/o expansion)	I/M program modeled (with expansion)	Maximum Temp	Minimum Temp	Met Station
Cumberland County EAC Area						
Cumberland	9.0	none	OBDII	88.9	70.4	FAY
Hickory EAC Area						
Burke	9.0	none	OBDII	84.8	67.7	HKY
Caldwell						
Catawba						
Alexander	No runs were done for this county since it will not have an I/M program.					
Mountain Area EAC Area						
Buncombe	9.0	none	ODBII	82.5	63.5	AVL
Haywood						
Madison	No runs were done for this county since it will not have an I/M program.					
Triad EAC Area						
Forsyth	7.8	Idle test	OBDII	85.4	67.7	GSO
Guilford						
Davidson	7.8	none	OBDII	85.4	67.7	GSO
Alamance	9.0	none	OBDII	85.4	67.7	GSO
Randolph						
Rockingham						
Stokes						
Surry						
Davie	No runs were done for these counties since they will not have an I/M program.					
Caswell						
Yadkin						

The resulting emission factors for the "with" and "without" expanded inspection and maintenance program were multiplied by the vehicle miles traveled (VMT) estimates for 2007. The Table 4.2.1-3 below shows the volatile organic compounds (VOCs) and nitrogen oxides (NOx) reductions resulting from the expanded inspection and maintenance program in each of the EAC counties.

Table 4.2.1-3 Expected Emission Reductions from Expanded I/M Program

County	VOC (tons/day)	NOx (tons/day)
Cumberland County EAC Area		
Cumberland	0.6	0.7
Hickory EAC Area		
Alexander*	N/A	N/A
Burke	0.2	0.3
Caldwell	0.2	0.2
Catawba	0.4	0.3
Hickory Area	***0.8***	***0.8***
Mountain Area EAC Area		
Buncombe	0.4	0.5
Haywood	0.2	0.2
Madison*	N/A	N/A
Mountain Area	***0.6***	***0.7***
Triad EAC Area		
Alamance	0.3	0.3
Caswell*	N/A	N/A
Davidson	0.4	0.5
Davie*	N/A	N/A
Forsyth†	0.0	0.9
Guildford†	0.0	1.3
Randolph	0.3	0.4
Rockingham	0.2	0.3
Stokes	0.1	0.1
Surry	0.4	0.2
Yadkin	N/A	N/A
Triad Area	***1.7***	***4.0***

* Alexander, Caswell, Davie and Madison Counties are not part of the expanded I/M program due the rural nature of these counties.

† Forsyth and Guilford Counties are already had the tailpipe I/M program and therefore there were no VOC benefits as a result of the expanded I/M program only NOx benefits.

4.2.2 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 (from a 1996 baseline). The North Carolina Environmental Management Commission adopted rules in October 2000 requiring the reductions. In order to estimate the emission reductions in 2007, the projected energy demand for the utilities was multiplied by the emission rates before the NOx SIP Call Rule and the emission rates used in the

modeling. These emission estimates were then subtracted to determine the net reduction as a result of the rule. Table 4.2.2-1 shows the NOx emissions and reductions, in tons/day, from this rule by county. The bolded counties are EAC counties, however, it should be noted that emission reductions from the utility sector that occur outside of an EAC area may still help reduce the ozone levels in the EAC area, especially if the facility is located in an adjacent county.

Table 4.2.2-1 Emission Reductions From NOx SIP Call Rule

County	Facility	2007 NOx Emissions		
		without Rule	with Rule	Reductions
Buncombe	Progress Energy - Asheville	14.05	7.05	7.00
Catawba	Duke Energy - Marshall Steam	90.92	44.30	46.62
Chatham*	Progress Energy - Cape Fear	13.47	3.91	9.56
Gaston	Duke Energy - Allen Steam	53.09	24.41	28.68
	Duke Energy - Riverbend	23.05	15.01	8.04
New Hanover	Progress Energy - Sutton	36.78	23.51	13.27
Person*	Progress Energy - Mayo	27.60	5.97	21.63
	Progress Energy - Roxboro	90.87	20.32	70.55
Robeson*	Progress Energy - Weatherspoon	3.34	3.20	0.14
Rockingham	Duke Energy - Dan River	14.17	9.35	4.82
Rowan*	Duke Energy - Buck Steam	18.90	10.82	8.08
Rutherford*	Duke Energy - Cliffside	36.31	13.46	22.85
Stokes	Duke Energy - Belews Creek	172.20	25.32	146.88
Total Emission		***607.29***	***219.19***	***388.10***

*Facilities located in a county adjacent to an EAC area.

4.2.3 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 (from a 1998 baseline). These power plants must also reduce annual sulfur dioxide emissions by 49% by 2009 and by 74% in 2013. The Clean Smokestacks Act will 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.

During the public hearing process, Duke Energy announced that they would move up the installation schedule for the controls on unit 4 at the Marshall Steam facility to aid in the EAC process. This unit was scheduled to have controls in place by 2008 and Duke Energy has committed to have the controls in place prior to the 2007 ozone season. NCDAQ modeled a sensitivity run with the controls in place for attainment year 2007, and additional reductions in the future year design values in the Triad EAC area were observed.

The additional reductions in NOx emissions are expected to be 4.95 tons/day. This was estimated by taking the emissions for that unit used in the modeling and adjusting them to reflect the lower emission rate. The projected emissions for Marshall unit 4 were 16.98 tons/day NOx with an emission rate of 0.23 lb. NOx/MMBTU. The new rate will be 0.17 lb. NOx/MMBTU, resulting in 12.03 tons/day.

4.2.4 Open Burning Bans

The Environmental Management Commission approved a new rule that would ban open burning during the ozone season on code orange and code red ozone action days for those counties that NCDAQ forecasts next day ozone levels. This is a mandatory no burn rule and became effective on June 1, 2004.

The emissions are calculated for open burning by multiplying the rural population by an emission factor provided by the U. S. Environmental Protection Agency. To model the open burning rule, a conservative 50% compliance/penetration/effective combined rate was assumed for only those counties in our ozone forecast areas. The 2007 Statewide emission reductions were 84.61 tons/day CO, 5.97 tons/day NOx and 8.52 tons/day VOC. For the purpose of modeling, the emissions for 2007 were all reduced by 50% since there was no way in the emission model to turn this control on or off for any given day. For the 2012 and 2017 modeling runs, it was assumed that all of the days would be below a code orange day, so no reductions were taken. The EAC counties' emission reductions are listed in the table below. These emissions are in tons/day since it would be difficult to adjust these numbers to an annual number due to the ban only occurring on ozone action days. The annual emission reductions would then be dependent on the number of predicted code orange and red days, which would vary from ozone season to ozone season.

Table 4.2.4-1 Open Burning Rule Emission Reductions

County	2007 Emissions Before Reduction			2007 Emission Reductions		
	VOC	NOx	CO	VOC	NOx	CO
Cumberland County EAC Area						
Cumberland	0.4	0.3	3.7	0.2	0.1	1.9
Hickory EAC Area						
Alexander	0.3	0.2	2.7	0.1	0.1	1.3
Burke	0.4	0.3	3.9	0.2	0.1	2.0
Caldwell	0.3	0.2	2.9	0.1	0.1	1.4
Catawba	0.5	0.3	4.8	0.2	0.2	2.4
Hickory Area	***1.4***	***1.0***	***14.3***	***0.7***	***0.5***	***7.1***
Mountain Area EAC Area						
Buncombe	0.6	0.4	5.8	0.3	0.2	2.9
Haywood	0.3	0.2	2.5	0.1	0.1	1.2
Madison	0.2	0.1	1.9	0.1	0.1	1.0
Mountain Area	***1.0***	***0.7***	***10.2***	***0.5***	***0.4***	***5.1***

Table 4.2.4-1 Open Burning Rule Emission Reductions (continued)

County	2007 Emissions Before Reduction			2007 Emission Reductions		
	VOC	NOx	CO	VOC	NOx	CO
Triad EAC Area						
Alamance	0.4	0.3	3.9	0.2	0.1	1.9
Caswell	0.2	0.2	2.3	0.1	0.1	1.1
Davidson	0.8	0.6	8.1	0.4	0.3	4.1
Davie	0.3	0.2	2.6	0.1	0.1	1.3
Forsyth	0.3	0.2	2.7	0.1	0.1	1.3
Guilford	0.7	0.5	6.6	0.3	0.2	3.3
Randolph	0.8	0.5	7.6	0.4	0.3	3.8
Rockingham	0.5	0.4	5.3	0.3	0.2	2.6
Stokes	0.3	0.2	3.5	0.2	0.1	1.7
Triad Area	***4.3***	***3.0***	***42.5***	***2.1***	***1.5***	***21.3***

4.3 EAC Control Measures

The local EAC control measures are designed to reduce point, highway mobile and nonroad mobile source emissions. Many of the measures have already been implemented since the EAC were signed in December 2002, while others will be implemented within the next year.

The original list of local control measures submitted to the USEPA by each EAC area on March 31, 2004, can be found in Appendix C. Three of the EAC areas, based on comments received by the USEPA and the Southern Environmental Law Center, have refined the control measures in their Early Action Plans. The refined local control measures can be found in Appendix Q and are summarized below.

4.3.1 Cumberland County Area EAC Control Measures

Through the Stakeholders' and Public involvement process, the Fayetteville Metropolitan Statistical Area (MSA) submitted to all of the County's jurisdictions and Fort Bragg a list of proposed strategies to be implemented in the efforts to decrease NOx and VOC emissions.

While reviewing the strategies to be implemented, the Early Action Compact (EAC) and Milestones were carefully reviewed. This area is very supportive of this process and wishes for a healthful environment for its citizens and a high quality of life. Logistically, many of the strategies that could be selected and implemented require more time to develop and enforce than the two years outlined in the Milestones of the EAC. For this reason some of the following strategies have a deadline of December 2005, whereas efforts to develop new or amended ordinances and documents are already on-going. It is the hope of all of the jurisdictions within the Fayetteville MSA that several strategies will be implemented and enforced during this year, however, knowing that ordinances and new program implementations take time, the December

2005 deadline will be maintained to assure that all of the efforts will be fully completed by the deadline.

Upon implementation of the strategies, the EAC binds local areas to submit semi-annual reports to the EPA until 2007 and to perform modeling for the year 2012. The EAC signed by this area includes modeling for the year 2017, ten years after designation. The Fayetteville MSA will continue to monitor and report on accomplishments beyond 2007 and will compile and submit such report during the review and update of the Metropolitan Planning Organization's (MPO's) Long Range Transportation Plan, whether required every five years, as currently set, or every three years, if modified in the Reauthorization of TEA-21, the current Transportation Bill, to the year 2019. All of the described proposed strategies were formulated during or after December 2002, the timeframe in which the Compact was developed and signed.

Quantifiable Strategies

MOBILE SOURCES

Inspection and Maintenance Program

The 1999 Clean Air Bill expanded the vehicle emissions inspection and maintenance program from 9 counties to 48, and improved the testing method. Vehicles are being tested using the onboard diagnostic system, which indicates NOx emissions, among other pollutants. The previously used tailpipe test did not measure NOx.

- The North Carolina Department of Environment and Natural Resources Division of Air Quality modeled these emission reductions for Cumberland County:
  - VOC: 0.6 Tons Per Day
  - NOx: 0.7 Tons Per Day

- This strategy was implemented on July 1, 2003.

- The adopting jurisdiction is all of Cumberland County.

- State enforceable; modeled in attainment demonstration.

Retrofitting Diesel School Buses

A $50,000 grant has been received to fund retrofitting of 50 school buses serving the Fort Bragg Schools. It is expected that this project will decrease VOC emissions as well as other pollutants. The plan is to put Diesel Oxidation Catalysts on 50 school buses and crankcase spiracles on 13 of the 50 buses.

- The grant was officially signed and processed on September 20, 2004. The units are expected to be installed by Summer 2005 and at the latest will be installed before December 2005.

- The Environmental Protection Agency shows these approximate decreases for Diesel Oxidation Catalysts under their *Verified Retrofit Technologies*:
  - PM: At least 20%
  - CO: At least 13%
  - VOC: At least 42%

- The adopting jurisdiction is Fort Bragg.

- Voluntary measure with funds committed via grant; not modeled in attainment demonstration.

CONSERVATION

Outdoor Burning Ban

The North Carolina Environmental Management Commission approved a new rule that bans open burning on forecasted "air quality action days", Code Orange or above days. The ban applies to 39 counties in or around metropolitan areas of the state, including Cumberland County. The Division of Air Quality (DAQ) formed an Open Burning Outreach Team (OBOT). The team is responsible for helping to disseminate information to the public regarding open burning.

- The Division of Air Quality modeled these reductions for Cumberland County prohibiting open burning on code orange days (assuming a 50% compliance rate).
  - VOC: 0.2 Tons Per Day
  - NOx: 0.2 Tons Per Day
  - CO: 1.8 Tons Per Day

- This strategy was implemented on June 1, 2004.

- The adopting jurisdiction is all of Cumberland County

- State enforceable; modeled in attainment demonstration

Use renewable energy sources when available (i.e. solar and methane)

Landfill gas-to-energy projects provide environmental value by capturing methane emissions from landfills and displacing fossil fuel. Landfill gas is an attractive renewable energy alternative for many applications because of its 24 X 7 availability and high capacity factor (between 95 and 98%). Burning landfill gas converts methane into carbon dioxide, and therefore dramatically reduces the impact on climate change by reducing greenhouse gas (GHG) emissions. Landfill gas (LFG) procurement is both an opportunity for corporations to reduce their GHG emissions footprint and to create a more diversified energy portfolio. *The*

World Resources Institute published a report, Corporate Guide to Green Power Market, "Opportunities with Landfill Gas" is Installment 2 of this report. The Group has found that the most environmentally and economically attractive use of landfill gas, particularly in the absence of policy incentives such as production tax credits, is a medium-Btu "direct use" application, which Cargill, Inc. is currently using.

Cumberland County Landfill harvests methane and through a contract with Biomass Energy, sells the energy to Cargill Inc., a local industry. Cargill Inc. was using 1000 cubic feet/minute of landfill gas. As of June 2004, usage has been increasing steadily and forecasted to reach 1600 cubic feet/minute by 2009. The first year Cargill reported use of landfill gas was in 1999 in the amount of 369,110,000 cubic feet.

- Estimated NOx reduction from this strategy is 5 tons per year. AP42, Table 2.4-5 was used to obtain emission reduction estimates. NOx savings were approximated using the flare NOx emission rate of 40 lb/million cubic feet, 252 million cubic feet/min of landfill gas usage (which is the increase of 600 cubic feet/minute multiplied by 7000 operating hours per year).

- In 2003 Cargill burned 67,983,000,000 cubic feet of landfill gas. Cargill is in the process of installing a larger gas boiler to burn additional landfill gas and hope to have it operational between May and August of 2005.

- The adopting jurisdiction is Cumberland County.

- Voluntary measure; not modeled in attainment demonstration.

Non-Quantifiable Strategies

LAND USE

The following is from the EPA Air and Radiation Office of Transportation and Air Quality Improving Air Quality Through Land Use Activities, EPA420-R-01-001, January 2001.

The physical characteristics and patterns of land development in a region can affect air quality by influencing the travel mode choices citizens have available to them. Development patterns that locate jobs, housing and recreation in closer proximity to each other, can mean shorter and fewer car and truck trips, thus reducing vehicle miles traveled (VMT) and likely reducing motor vehicle emissions. Other development patterns have the potential to improve or mitigate air quality problems by providing and promoting alternatives to vehicular travel, such as mass transit, walking, or biking. The most significant urban form features that can affect travel activity are:

- *Density = infill*
- *Land Use Mix – incorporating different land uses (e.g. recreation, housing, employment, shopping) with a development, a neighborhood, or a region.*
- *Transit Accessibility – locating high-density commercial and residential development*

around transit stations, also known as "transit oriented development," or TOD.

- *Pedestrian-Environment/ Urban Design Factors – features that improve the pedestrian environment such as sidewalks, clearly marked crosswalks, shade trees, benches, and landscaping; also refers to features that improve the bicycling environment such as bike paths and dedicated bike lanes, bike parking and clear signs.*
- *Regional Patterns of Development – patterns of dispersion, centralization, or clustering of activities within a metropolitan area, as well as the relationship of development to highway and transit systems; involves the interrelationships between employment and residential development and the transportation connection between sets of origin and destination points*

The air quality impacts of land use activities on transportation depend on numerous factors, including density and location of development, amount of development, mix of uses, and access to transportation alternatives. The interaction of these factors is complex, and due to the variations from one development project to another, each development needs to be analyzed individually. Studies have been conducted in Portland, Oregon; Sacramento and Los Angeles, California; Baltimore, Maryland; and Washington, DC that support VMT reduction associated with land use strategies over a 20 year time horizon.

Landscape Ordinance

Require landscaping of major nonresidential developments within the MSA. It is believed that this strategy will lower NOx emissions. The emission reductions are not currently quantifiable, but this strategy is directionally correct.

- Fort Bragg implemented the Sustainable Installation Design Guide setting landscape requirements for all new development in December 2003.

- The City of Fayetteville adopted a buffer/landscape ordinance effective as of June 30, 2004 for all new development or redevelopment.

- Hope Mills has a landscape and tree preservation ordinance, however they are expected to revise their ordinance to include residential home sites in early 2005.

- Cumberland County and the smaller jurisdictions are reviewing ordinance amendments to require landscape on new developments.

- The strategy will be implemented by December 2005 countywide.

- The adopting jurisdictions are Cumberland County, City of Fayetteville, Falcon, Godwin, Hope Mills, Stedman, Wade, and Fort Bragg.

- Locally enforceable; not modeled in attainment demonstration.

Transit/Pedestrian/Mixed Use Oriented Development

Add a mixed-use alternative to zoning ordinance along transit lines and include sidewalks, shade trees, benches, and landscaping as well as bike paths/lanes, which will increase the desirability of walking and biking and promote the use of transit. Work with schools and parks to facilitate pedestrian crossing from subdivisions to schools. Fort Bragg is building upon existing mixed-use development by adding pedestrian trails and sidewalks. There is no way to quantify these emission reductions without an extensive base-line study and follow-up studies. However, NOx reductions are supported by the Portland, Oregon study cited on Page 26 of "Improving Air Quality Through Land Use Activities". The Portland, Oregon study supports 8% decrease in VMT and NOx emissions decrease of 6%.

- Cumberland County is revising its ordinances to include mixed-use development and released a draft in June 2004. Ordinance amendments will be adopted by December 2005.

- Fort Bragg requires all projects to include sidewalks and bicycle racks. Some of the major projects also include bus stops.

- The Town of Wade requires sidewalks as part of its Subdivision Ordinance.

- The Fayetteville Area Metropolitan Planning Organization will host 8 Walkable Communities workshops across the local area. This is a $20,000 investment designed to make the community more walkable and pedestrian friendly. The workshops are scheduled to take place in late April or early May 2005.

- The adopting jurisdiction is Cumberland County for all participating agencies.

- Locally enforceable; not modeled in attainment demonstration.

Infill Development

Promote infill and brownfield development in urban areas, to utilize existing infrastructure and to decrease and/or maintain VMTs. Strengthening the downtown area through economic incentives, available for businesses in the downtown area through the Downtown Loan Program and Historic Properties, a public/private partnership. It is believed that this strategy will lower NOx emissions by decreasing VMT (promotes Pedestrian Transit and Mass Transit Use). The emission reductions are not currently quantifiable, but this strategy is directionally correct. Currently, the City of Fayetteville, Cumberland County and the Town of Stedman have ordinances that govern Zero Lot Line Developments, which foster land preservation and infill, while increasing density.

- Fort Bragg will continue to redevelop existing urban land use. The majority of projects are built on the currently developed sites instead of new, undisturbed sites as part of their

Sustainable Installation Design Guide, which was implemented beginning in December 2003.

- The Town of Wade is developing a Zero Lot Line Ordinance encouraging infill development and it will be implemented by December 2005.

- The adopting jurisdictions are Fort Bragg and the Town of Wade.

- Locally enforceable; not modeled in attainment demonstration.

Shared Parking Facilities and Connectivity

This will reduce the amount of impervious surface, which contributes to the heat island effect and reduces the amount of stop and go traffic. It is believed that this strategy will lower NOx emissions by decreasing VMT. Although the emission reductions are not currently quantifiable, this strategy is directionally correct. The City of Fayetteville and the Town of Hope Mills have ordinances to allow shared parking. They include provisions for lateral access and connectivity.

- Cumberland County is revising the Zoning Ordinance and will include lateral access and connectivity as a part of it. Ordinance amendments will be adopted by December 2005.

- The Town of Linden is in the process of developing a zoning ordinance that will allow for shared parking facilities and connectivity. The strategy will be implemented by December 2005.

- The adopting jurisdictions are Cumberland County, Falcon, Godwin, Linden, and Wade.

- Locally enforceable; not modeled in attainment demonstration.

Urban Reforestation/ Green Space

The Public Works Commission has policies to maintain tree coverage in watershed areas and seek to expand land acquisition for preservation of the watershed. NC Forest Services is seeking grant funding to plant at least 100 trees. Cumberland County completed a public green space inventory of the entire county in March 2004 and a conservation subdivision option will be investigated. It is believed that this strategy will lower NOx emissions by reducing the heat island affect. Although, the emission reductions are not currently quantifiable, this strategy is directionally correct.

- Since 2003, the Watershed Resource Team with PWC have added about 60 acres to the watershed buffers and have planted about $2000 worth of plant species.

- The NC Forest Service on March 31, 2004 planted 250 trees throughout Pope Air Force Base, Fayetteville, and other parts of Cumberland County, exceeding their goal of 100 trees. They plan to make this an annual event as part of Arbor Day.

- Fort Bragg has planted 836 trees on post since January 1, 2004 and continues to plant with all new developments and buildings.

- The adopting jurisdictions are the City of Fayetteville and Fort Bragg.

- Voluntary measure; not modeled in attainment demonstration.

MOBILE SOURCES

The Fayetteville MSA reviewed many Alternative Fuels (AF) and Alternative Fueled Vehicles (AFV) possibilities, but, because the infrastructure is not in place at this time and developing it would be cost prohibitive and it could not be implemented by December 2005, no other governments agreed to participate. Mobile source strategies will be reviewed and evaluated for long range planning in this area.

Alternative Fuels and AF Vehicles

Fort Bragg has developed a plant to convert its fleet to Bio-Diesel 20 and Ethanol E85. This project includes an AF fueling station. 185 vehicles will be converted to B20 (100,000 gallons of diesel fuel). 158 Flexible Fuel vehicles will use approximately 55,000 gallons of E85 per year. This strategy is expected to reduce VOC and in turn hazardous air pollutants (HAPs), NOX and particulate matter. The bio-diesel strategy shows a slight increase in NOx emissions, however with the other pollutant reductions, this strategy is believed to be of value.

- To date, 25 off-road vehicles have been converted to B20. In Fiscal Year ’03 Fort Bragg used 7,755 gallons of B20. In Fiscal Year ’04 that number increased to 10,000 gallons.

- Fort Bragg expects to have an alternative fueling facility completed and their gasoline-powered vehicles converted to E85 in Fiscal Year ’05.

- The adopting jurisdiction is Fort Bragg.

- Voluntary measure with funds committed; not modeled in attainment demonstration

Idling Restrictions

Festival Park will include electrical outlets to be used by vendors/exhibitors to reduce truck idling during festivals and events. It is expected that this strategy will decrease NOx emissions. Festival Park construction is scheduled to begin on March 1, 2005 and to be completed by September 20, 2005.

- The adopting jurisdiction is the City of Fayetteville.

- Voluntary measure; not modeled in attainment demonstration.

TRANSPORTATION

Using Intelligent Transportation Systems (ITS) and Dynamic Message Signs (DMS) for Congestion Management and Ozone Alerts

Project U-3635, Closed Loop Signal System, will provide a new area-wide closed loop signal system. Dynamic Message Signs will be installed at congested intersections/corridors. Expansion of existing continuous flow right turn lanes in the urbanized area. It is expected that this project will decrease NOx emissions by decreasing traffic congestion. It is currently difficult to quantify this effort, however other examples of this system have shown anywhere from 0-20% reductions in traffic congestion resulting in less idling, travel time, and, as a result, NOx emission reductions.

- The summer of 2005 is the expected completion time for the closed loop signal system.

- Two dynamic message signs along I-95 have been installed, but are not yet operational.

- The adopting jurisdictions are Cumberland County, City of Fayetteville, and Hope Mills.

- Voluntary measure with committed funds; not modeling in attainment demonstration

Enhance Mass Transit System

The Fayetteville Area System of Transit is redesigning routes to be more convenient to riders and plans to increase frequency of transit services to 15 minutes. The plan is a hybrid deviated fixed route demand response system. It allows for riders to be picked up from their home by a van and transported anywhere in that zone by the van. Riders also can be picked up and taken to a large super stop, where they can catch the bus and be transported all across the service area. Increase transit service is expected to reduce VOC and NOx emissions by reducing VMT.

- The enhanced transit service is expected to be in place by December 2005. The plan has been presented to all of the local municipalities involved and is currently in the funding planning phase. Dates of presentations:
    - Fayetteville City Council: January 12, 2004
    - Spring Lake Commissioners: March 22, 2004
    - Hope Mills Commissioners: April 19, 2004
    - Cumberland County Commissioners: May 3, 2004

Fort Bragg initiated a shuttle service providing transportation around the post and connecting with municipal transit. They have also implemented a Saturday Express Shuttle that transports Fort Bragg residents to Cross Creek Mall.

- The Fort Bragg shuttle service began on June 1, 2003 and is ongoing. Average weekly ridership for the shuttle is between 650-750 riders.

- The Fort Bragg Saturday Express Shuttle started with two Saturdays during the Christmas Holidays of 2003. However, it became permanent in the summer of 2004. The average ridership is approximately 50 passengers per week.

- The adopting jurisdictions are City of Fayetteville and Fort Bragg.

- Voluntary measure with funding committed; not modeled in attainment demonstration

Formulate Car and Van Pooling

The Fayetteville Area System of Transit changed a staff position from Special Projects Coordinator to Ridesharing and Community Outreach Coordinator. This is an effort to expand public outreach for FAST and encourage more ridesharing and vanpooling. Work is being done to develop a database to connect riders. The transit provider is advertising vanpooling and carpooling programs. FAST has received a license from DOT for database matching software. The software is regionally based to where coordination can be made across county lines. This strategy is believed to decrease NOx emissions based upon an increase in public transit usage and car and vanpooling, and a decrease in VMT.

- This strategy was implemented in June of 2004 and is ongoing.

- The adopting jurisdiction is the City of Fayetteville.

- Voluntary measure; not modeled in attainment demonstration

Increase Rural Transportation Paratransit

Rural transportation is currently being expanded to connect outlying areas of the county and smaller municipalities. Quantification will be provided when implemented.

- The strategy will be implemented by December 2005.

- The adopting jurisdiction is the City of Fayetteville.

- Voluntary measure; not modeled in attainment demonstration

Encourage Park and Ride for Large Events

FAST and Private Transportation providers are providing shuttle services at nominal cost to public. Fort Bragg provides internal transportation services for large on-post events at no cost to the rider. Updates will be given for the events and included in semi-annual updates.

- The implementation of this strategy is ongoing as special events come up (i.e. Festival of Flight, May 16-26, 2003).
- The adopting jurisdictions are City of Fayetteville and Fort Bragg.
- Voluntary measure; not modeled in attainment demonstration

CONSERVATION

Use renewable energy sources when available (i.e. solar and methane)

Encourage residents and businesses to support NC Green Power, a nonprofit program working to encourage development of renewable energy sources. A $4.00 contribution purchases one block of green power (equivalent to 100 kilowatt-hours). We are working with NC Green Power to obtain the number of blocks of green power purchased by Cumberland County Residents.

- Implementation started in Spring 2004 and will continue to promote during AQ outreach, and include link on County website.
- The adopting jurisdiction is Countywide.
- Voluntary measure; not modeled in attainment demonstration

Retrofitting of public buildings. Encourage construction of energy efficient buildings.

Through the "Guaranteed Energy Savings Contract", the County will engage a company to evaluate and upgrade buildings equipment and material to increase energy efficiency. PWC is a member of the "Good Cents" Housing Program. Participating builders receive heat pump rebates and free listing of energy efficient homes for sale in the local newspaper and on the PWC website. Smaller municipalities are also promoting the "Good Cents" Housing Program. Fort Bragg is currently implementing energy reduction per Executive Order 13123 and as part of its Sustainability Plan by partnering with Honeywell Corporation to retrofit buildings on Fort Bragg (replacing inefficient interior/ exterior lighting, installing new HVAC systems with energy controls for optimum building performance. Fort Bragg also constructs new homes and retrofits older homes to meet "ENERGY STAR" standards. It is believed that this strategy will lower NOx emissions by reducing the output needed from fossil fuel plants to heat and cool homes and public building. The local EAC is still trying to quantify emission reductions, but feel this strategy is directionally correct.

- Cumberland County has selected a company to retrofit 12 public buildings to comply with the "Guaranteed Energy Savings Contract". Construction is projected to begin in January of 2005.

- Cumberland County completed a contract on September 9, 2004 to replace 144,000 square feet of black roofing with light colored roofing.

- The promotion of "Good Cents" Housing Program and Fort Bragg's energy reduction program are ongoing.

- Fort Bragg continues to encourage the use of light colored, high reflective materials for pavement and roofs with new and retrofitted buildings. They also encourage the use of pervious pavement where applicable.

- The adopting jurisdiction is Cumberland County for all participating agencies.

- Voluntary measure with funds committed; not modeled in attainment demonstration.

Encourage Construction and Use of Energy Efficient Equipment and Promote Purchase of "Green"/less polluting products.

Fort Bragg is implementing energy reduction strategies including low NOx burners in new major emission sources, is increasing the use of water-based paints to reduce VOC emissions and has installed a paint booth which uses only water-based paint, and is researching alternatives to replace two incinerators. These strategies will lower NOx and VOC emissions. Research efforts will include emission reductions.

- During the Summer 2004, Fort Bragg did research on alternatives for the incinerators. However, the alternatives did not yield good enough results to make a change.

- On May 5, 2004, Fort Bragg shipped 8,915 pounds of Class I Ozone Depleting Substances (ODS) off the installation to the Defense Depot in Richmond, Virginia. The substances are replaced with much more environmentally safe alternatives.

- Fort Bragg continues to encourage the use of energy-efficient appliances in all renovations and new construction projects as well as low-flow appliances (showers, toilets, etc.) and limited or no irrigation. They also encourage the use of no VOC containing paints, sealants, or adhesives.

- The adopting jurisdiction is Fort Bragg.

- Voluntary measure; not modeled in attainment demonstration

AWARENESS

FAMPO Air Quality Staff Position

The Fayetteville Area Metropolitan Planning Organization created a fully funded Air Quality Coordinator staff position. The staff person is responsible for coordinating air quality outreach efforts in Cumberland County as well as preparing and maintaining Early Action Compact information. It is believed that this strategy will reduce NOx and VOC emissions based upon this person working with different organizations to get the word out and get the community working on improving the Air Quality.

- This strategy was implemented in March of 2003 and is ongoing.
- The adopting jurisdiction is Cumberland County for all participating agencies.
- Voluntary measure with funds committed; not modeled in attainment demonstration

Student Outreach through Education Systems

Ongoing effort using the "GLOBE" program, a worldwide hands-on, primary and secondary school-based educational science program. This is a cooperative effort, led in the US by a federal interagency program supported by NASA (National Aeronautics & Space Administration), NSF (National Science Foundation), EPA (Environmental Protection Agency) and the U.S. State Department. There are currently 65 teachers in Cumberland County who are trained and present the program that promotes environmental stewardship and research. Staff, Air Quality Stakeholders, and Technical Committee members are also providing classroom presentations upon request. It is believed that this strategy will lower NOx emissions. Although the emission reductions are not currently quantifiable, this strategy is directionally correct.

- Two Cumberland County schools, Warrenwood Elementary and Ponderosa Elementary, have implemented the atmospheric portion of the GLOBE program for the 2004-2005 school year. More schools are expected to get involved as funding becomes available.
- A total of 35 teachers and community volunteers took part in ozone training on September 10 and 11.
- The adopting jurisdiction is Cumberland County.
- Voluntary measure; not modeled in attainment demonstration

Public Education/Outreach at Community Events & Churches

This is an ongoing effort through the Speakers Bureau. Staff and volunteers participate in festivals, fairs, community meetings, etc to provide information on air quality and the

individual measures that can be taken to improve the air we breathe. It is believed that this strategy will lower NOx emissions. Although the emission reductions are not currently quantifiable, this strategy is directionally correct.

- The implementation of this strategy began with the first outreach event, the Spring Nature Fair, at Clark Park on April 5, 2003 and is ongoing.

- The adopting jurisdictions are Cumberland County, City of Fayetteville, Falcon, Godwin, Linden, Spring Lake, Stedman, and Wade.

- Voluntary measure; not modeled in attainment demonstration

Speakers Bureau

Participation in radio/television programs to reach the general public with air quality information and tips, advertise meetings and involve the local newspapers and churches in disseminating information to increase public awareness and participation in implementing voluntary reduction strategies. It is believed that this strategy will lower NOx emissions. Although the emission reductions are not currently quantifiable, this strategy is directionally correct.

- This strategy was implemented with the first regular Cumberland County Air Quality Stakeholders meeting on May 15, 2003 and is ongoing.

- The adopting jurisdictions are Cumberland County, City of Fayetteville, Falcon, Godwin, Linden, Spring Lake, Stedman, and Wade.

- Voluntary measure; not modeled in attainment demonstration

Air Quality Web Page

Maintained and updated by FAMPO (Fayetteville Area Metropolitan Planning Organization). Provides information on upcoming meetings, seasonal air quality tips, the Early Action Compact program and other relevant topics. It is believed that this strategy will lower NOx emissions. Although the emission reductions are not currently quantifiable, this strategy is directionally correct.

- This strategy was implemented in March of 2003 and is ongoing.

- The adopting jurisdiction is Cumberland County for all participating agencies.

- Voluntary measure; not modeled in attainment demonstration

Promote Bus Ridership for Youth

Fayetteville Area System of Transit (FAST) is promoting bus tours for children of all ages, educating them on how to use the transit system and the benefits of using transit (including air quality and health issues). Various organizations have tours for groups (i.e. Boys and Girls Club) that include giving them free bus passes. It is believed that this strategy will lower NOx emissions by increasing future mass transit use and decreasing VMT. Although the emission reductions are not currently quantifiable, this strategy is directionally correct.

- The implementation of this strategy is ongoing.
- The adopting jurisdiction is the City of Fayetteville.
- Voluntary measure; not modeled in attainment demonstration

Air Quality Educational System at the local libraries.

Air Quality handouts and flyers are made available at all branches. Make available for children's summer program. It is believed that this strategy will lower NOx emissions by raising awareness. Although, the emission reductions are not likely quantifiable, this strategy is directionally correct.

- The implementation of this strategy for the local libraries began in May of 2003 and is ongoing. Inclusion in the children's summer reading program will start in the summer of 2005.
- An Air Quality display was set up at the Main Branch of the Library for the months of June, July, and August 2004.
- The adopting jurisdiction is Cumberland County for all participating agencies.
- Voluntary measure with funds committed; not modeled in attainment demonstration

Air Quality poster/essay contest for schools.

Air Quality related contest to raise air awareness. It is believed that this strategy will lower NOx emissions. Although the emission reductions are not likely quantifiable, this strategy is directionally correct.

- The implementation of this strategy began in 2003 with the 2003-2004 school year for public schools and will begin in November 2004 for public and private schools for the 2004-2005 school year.
- The adopting jurisdiction is Cumberland County for all participating agencies.

- Voluntary measure; not modeled in attainment demonstration

4.3.2 Mountain Area EAC Control Measures

Quantifiable Strategies

STATE ENFORCEBLE MEASURES

Inspection and Maintenance Program

The 1999 Clean Air Bill expanded the vehicle emissions inspection and maintenance program from 9 counties to 48, and improved the testing method. Vehicles are being tested using the onboard diagnostic system, which indicates NOx emissions, among other pollutants.

- The North Carolina Department of Environment and Natural Resources Division of Air Quality modeled these emission reductions for the Mountain Area EAC:
  - VOC: 0.6 Tons Per Day
  - NOx: 0.7 Tons Per Day

- This strategy was implemented on July 1, 2004 for Buncombe County and will be implemented on July 1, 2005 for Haywood County.

- The adopting jurisdiction is all of Buncombe and Haywood Counties.

- State enforceable; modeled in attainment demonstration.

Outdoor Burning Ban

The North Carolina Environmental Management Commission approved a new rule that bans open burning on forecasted "air quality action days", Code Orange or above days. The ban applies to 39 counties in or around metropolitan areas of the state, including all of the counties in the Mountain Area EAC. The Division of Air Quality (DAQ) formed an Open Burning Outreach Team (OBOT). The team is responsible for helping to disseminate information to the public regarding open burning.

- The Division of Air Quality modeled these reductions for the Mountain Area prohibiting open burning on code orange days (assuming a 50% compliance rate).
  - VOC: 0.5 Tons Per Day
  - NOx: 0.4 Tons Per Day
  - CO: 5.1 Tons Per Day

- This strategy was implemented on June 1, 2004.

- The adopting jurisdiction is all of Buncombe, Haywood and Madison Counties.

- State enforceable; modeled in attainment demonstration.

Non-Quantifiable Strategies

ASHEVILLE – BUNCOMBE COUNTY

These are recommended actions for Buncombe County and the City of Asheville and are based on work of the Asheville-Buncombe Council of the Mountain Area Early Action Compact. Our goal was to develop proposed strategies to be included in a required report to the Environmental Protection Agency and due on March 31, 2004.

Since beginning the planning, it has become apparent that our area will achieve the standards for the year 2003. This is due in large part to a cool and wet summer, which inhibits the formation of ozone. Since we are in compliance, our participation in the Compact is voluntary, however; we recommend continued participation in the program to improve air quality and to guard against future non-attainment of standards.

Actions the public can take on an ongoing basis to reduce ozone

Keep your car tuned up. A car does not always have visible smoke from its tailpipe when it is producing excessive NOx. An auto shop can often make minor repairs resulting in better gas mileage and less pollution from your tailpipe.

Keep tires properly inflated. Proper tire inflation increases gas mileage and lowers the contribution to pollution.

Carpool or vanpool. Join a carpool or vanpool for the trip to and from work. Local businesses, non-profit agencies and government agencies should seek sources of transportation for carpoolers in case of an emergency.

Ride your bike. Bike on at least one errand a week. It's great exercise and a stress reliever.

Take a walk. Walk to lunch with a friend instead of starting up the car. Walk to the next meeting or on an errand near home.

Take the bus. Ride the bus to work or on an errand.

Use an electric powered mower or a push mower. A two-stroke gas-powered lawnmower pollutes the equivalent of 40 late-model cars in just an hour. Use a rake on your leaves instead of a leaf blower. Reduce the need to mow by installing water-wise landscaping.

Conserve energy and reduce pollution at home. Much of the region's electricity still comes from coal-fired generators. Turn off lights when not in use and reduce the use of the air conditioning with ceiling fans, good insulation, and a programmable thermostat. Replace

paints and cleaning products with more environmentally friendly alternatives. Choose a gas fireplace and barbeque grill over wood or charcoal.

Practice appropriate vehicle operating tips, such as shutting off the engine when parked. Avoid excessive idling at drive-throughs by parking and walking in. Operate the vehicle only on an as-needed basis to reduce emissions. Avoid travel through known congested areas whenever possible.

Purchase products that meet the EPA Energy Star Program. Learn how much energy is used by the products you purchase.

Ozone Action Days for the public and businesses

Tell your friends! Spread the word about Ozone Action Days and air quality issues. There are about eight to ten Ozone Action Days each year in our area. They can occur from late spring to early fall. These are days when our individual actions can make the most difference in comfort and health for everyone, especially those with asthma and chronic respiratory disorders.

The NC Division of Air Quality issues ozone forecasts during ozone season at 3pm each day for the following day. Forecasts for Buncombe and surrounding counties are available from WLOS TV and The Asheville Citizen-Times. Ozone forecasts are also available at 1-888-RU4NCAIR. The Division of Air Quality will e-mail or fax the forecast to you. Those features can be accessed at http://daq.state.nc.us/airaware/ozone.

Delay errands until late in the day. Cars driven in the morning hours produce NOx and VOCs that become ground-level ozone in the heat of the afternoon. The more one can avoid driving, the better for air quality.

Don't mow your lawn until late in the day. Small engines like lawnmowers, weed whackers and leaf blowers lack pollution controls. The average lawnmower produces as much pollution in one hour as 40 late-model cars!

Bring your lunch or walk to lunch. Reduce your contribution to air pollution by not starting up your car at lunchtime.

Bus, Bike or Walk. If you find you're not affected by ozone on Ozone Action Days, take the bus, walk, or bike to work, to lunch, or on an errand.

Practice appropriate vehicle operating tips. Shut off the engine when parked. Operate the vehicle only on an as-needed basis to reduce emissions. Idling for 30 seconds to 1 minute emits more pollution than restarting your vehicle.

Do not use drive-through services. Avoid excessive idling at bank or fast food drive-throughs. Instead, park your vehicle and walk into the business. Businesses could voluntarily close their drive-through services until 11:00 a.m.

Telecommute. Businesses could allow employees with appropriate jobs to work at home when it is possible. Telecommunication from the home will reduce the number of vehicles emitting nitrogen oxides.

Participate in OAD program. Large and medium sized businesses are encouraged to participate in the NC Division of Air Quality Ozone Action Day (OAD) program.

Ozone Action Days for local, state and federal government

Local government will seek participation of state and federal agencies in the following measures:

Limit morning meetings. Minimize scheduling of morning meetings involving auto travel between the hours of 8:00AM and 9:00AM when possible. Because OADs are declared with only one-day notice, the practice of delaying all meetings requiring auto travel should be encouraged during ozone season.

Practice appropriate vehicle operating tips. Shut off the engine when parked. Avoid excessive idling such as sitting at drive-throughs instead of walking in. Operate the vehicle only on an as-needed basis to reduce emissions. Avoid travel through known congested areas whenever possible.

Work schedules. Limit vehicle/equipment use. Encourage multiple crew transports using higher occupancy vehicles.

Nonessential operations. Reschedule operations under direct control of the city such as driving, lawn maintenance, tree trimming, and use of power saws, generators and similar gasoline or diesel-powered equipment. Bid similar contracted work with an alternate to halt operations on ozone action days.

Paving. Reschedule nonessential paving activities, including pothole repairs. Bid similar contracted work with an alternate to halt operations on ozone action days.

Alternative Transportation/ Alternative Fuels. Explore the use of alternative fuels, including diesel and off-road diesel fuels, to reduce NOx emissions, subject to availability of reliable sources of supply. Consider purchase of commercially available hybrid vehicles for use in non-emergency fleet.

Cleaner Burning Gasoline, Diesel Fuel and off-road Diesel Fuel. Track statewide initiatives to bring cleaner burning fuels to area retailers during ozone season or year round.

Smoking Vehicles. Smoking vehicles are heavy polluters. Local law enforcement agencies will be educated on the state statute concerning smoking vehicles and encouraged to increase enforcement. Local government will publicize programs for citizen reporting of smoking vehicles.

Tree Planting Program. Ozone formation is exacerbated by high temperatures. Because of the urban heat-island effect, temperatures in cities can average up to 15 degrees higher than nearby rural areas. Trees clean and cool the air. They shield from the sun hard surfaces that would otherwise store and radiate heat, and they release cooling moisture. Mature trees increase property values. The City of Asheville, through its proposed 2025 plan, will continue to require tree planting.

Hybrid-Electric Technology. The City of Asheville will explore the possibility of using hybrid-electric technology whenever possible.

Retrofit Technology. Purchase of applicable fuel line and electric spark controller retrofit technologies are being explored. Successful devices have proven to reduce Hydrocarbon, Carbon Monoxide, and Nitrogen Oxides, while improving engine performance and fuel consumption. Some retrofits have already occurred to Asheville Transit Services vehicles.

Service Contracts. Departmental requirements specific to OADs will be incorporated into service contracts. Purchase and service contracts will specify energy-efficient equipment and maintenance practices.

Annual In-House Training. An annual training program to increase awareness of OAD responsibilities of Departments and employees will be developed. OAD orientation packets for new employees will be developed.

OAD Coordinators. The City will appoint one or more Ozone Action Day Coordinators to manage OAD initiatives. The Coordinator will participate in the state OAD program.

Telecommute. Local government could allow employees with appropriate jobs to work at home when it is possible. Telecommuting from the home will reduce the number of vehicles emitting nitrogen oxides.

Ongoing Actions to Reduce Ozone

Clean burning fuels. Local government will collaborate with area fuel suppliers to accelerate availability of clean gasoline/diesel fuels.

Western North Carolina Regional Air Quality Agency. The City has supported this agency and its programs for more than thirty years and will continue to do so.

Public Education Campaigns. Develop educational brochures and related materials for children about air quality. Provide for a public relations component within the WNCRAQA to assist in media relations and public education efforts.

Outreach. Work with area governmental entities and local media to develop educational outreach programs.

Themes. Develop air quality themes for use in advertising on busses and other public venues. Tie themes to air quality summits to provide businesses, institutions and government with information on what each sector can do to improve air quality.

Cultural Outreach. A bilingual and multicultural educational outreach program for air quality will be developed that expands current public outreach efforts to all citizens.

Community Outreach. Provide air quality tips to neighborhood associations who can pass out the information to individual households.

Business Involvement. Local governments will encourage involvement of area businesses in OAD programs.

Conserve energy and reduce pollution at work. Much of the region's electricity still comes from coal. Turn off lights when not in use. Reduce the use of air conditioning with good insulation and window blinds. Use programmable thermostats to reduce energy use for heating and cooling. Replace paints and cleaning products with more environmentally friendly alternatives.

Land Use. Mixed-use neighborhoods in which residents can access both commercial and residential destinations using a variety of transportation modes are conducive to less driving by residents. In accordance with the proposed 2025 Plan, the City is working to adopt measures to encourage construction on vacant or underused land in the City and to increase density along designated transit corridors. City officials will continue to support such planning.

Conversion to Alternative Fuels. The City, through Land-of-Sky Regional Council, will seek DOE Clean Cities designation in order to promote greater availability of clean gasoline, diesel and alternative fuels. Clean Cities designation will also facilitate the creation of infrastructure necessary for the utilization of these fuels.

Low sulfur fuels. Develop community support in order to encourage the petroleum industries to make low sulfur gas and diesel fuels available in the Compact area by April 2005.

Ride the bus. In order to encourage bus ridership, the Asheville Transit System will explore options such as business sponsorships to provide free bus service and promote bus ridership on OADs.

Energy Star. Purchase products that meet the EPA Energy Star Program. Government agencies should consider the energy efficiency of the products they buy.

AQ Group. The City of Asheville should collaborate to form a permanent advisory group to address air quality and other environmental issues.

HAYWOOD COUNTY

Local Government will encourage the following public actions for normal days:

Keep your car tuned up. A car does not always have visible smoke from its tailpipe when it is producing excessive NOx. An auto shop can often make minor repairs resulting in better gas mileage and less pollution from your tailpipe. Keep tires properly inflated and maintain regular tune-ups to lower the contribution to pollution.

Carpool or vanpool. Join a carpool or vanpool for the trip to and from work.

Ride your bike. Bike on at least one errand a week. It's great exercise and a stress reliever.

Take a walk. Walk to lunch with a friend instead of starting up the car. Walk to the next meeting or on an errand near home.

Take the shuttle when possible.

Purchase energy efficient appliances.

Build energy efficient houses or improve energy efficiency in existing houses.

Use an electric powered mower or a push mower. A two-stroke gas-powered lawnmower pollutes the equivalent of 40 late-model cars. Use a rake on your leaves instead of a leaf blower. Reduce your need for mowing by installing water-wise landscaping.

Conserve energy and reduce pollution at home. Much of the region's electricity still comes from coal. Turn off lights when not in use and reduce the use of the air conditioner with ceiling fans, good insulation, and a programmable thermostat. Replace paints and cleaning products with more environmentally-friendly alternatives. Choose a gas fireplace and barbeque grill over wood or charcoal.

Ozone Action Days for Public.

The County Government Access Channel may be used to deliver information on Ozone Action Days.

Delay errands until late in the day. Cars driven in the morning hours produce NOx and VOCs that become ground-level ozone in the heat of the afternoon. The more one can avoid driving, the better for air quality.

Don't mow your lawn until late in the day. Small engines like lawnmowers, weed whackers and leaf blowers lack pollution controls.

Bring your lunch or walk to lunch. Reduce your contribution to air pollution by not starting up your car at lunchtime.

Take the shuttle. Take the shuttle to work, to lunch, or on an errand.

Take a walk. If you have an errand to run that's a short distance away, try walking instead of driving.

Ride your bike. Ride your bike on morning errands. If you find that you're not affected by ozone on Ozone Action Days, try biking to work or school.

Tell your friends! Spread the word about Ozone Action Days and air quality issues.

Ozone Action Days for Local Government

Minimize movement in vehicles. Use of fleet vehicles will be used for essential use only. Meetings requiring traveling by fleet vehicles are to be canceled when possible, or implement the use of e-mail and conference calls.

Minimize scheduling of morning meetings between the hours of 8:00AM and 9:00AM when possible or teleconference. Because OADs are declared with only one-day notice, the practice of delaying meetings should be encouraged year-round.

Practice appropriate vehicle operating tips, such as shutting off the engine when parked, avoiding excessive idling such as sitting at drive-thru's, and leaving the vehicle running while parked. Operate the vehicle only on an as-needed basis to reduce emissions. Avoid travel through known congested areas whenever possible.

Work schedules should reflect limited vehicle/equipment use and should encourage multiple crew transports using higher occupancy rate vehicles.

Reschedule nonessential operations such as lawn maintenance, tree trimming, and use of power saws, generators, etc., which include other gasoline-powered equipment.

Long-term Local Government actions to reduce ozone

Investigate the supply of alternative fuels to the County.

Develop network of coordinators throughout the County for ozone notifications and other information.

Commute Solutions: Encourage ride sharing for regional trips.

Land Use: Encourage the continued development of greenways, and mixed-use neighborhoods in which residents can access both commercial and residential destinations using a variety of transportation modes. Encourage smart growth by utilizing vacant or underused land. Town officials are actively supporting increased housing in the downtown area.

Downtown Guide: The towns are encouraging walkable communities. Some have developed a walking guide to the Town.

Smoking Vehicles: It is estimated that 10% of vehicles produce 90% of vehicular pollution. Encourage citizens to report smoking vehicles on form to the State of North Carolina. (Form available on web site daq.state.nc.us/smoking.shtml.

Tree Planting Program: Ozone formation is exacerbated by high temperatures. Because of the urban heat-island effect, temperatures in cities can average up to 15 degrees higher than nearby rural areas. Trees clean and cool the air. They shield from the sun hard surfaces that would otherwise store and radiate heat, and they release cooling moisture. Mature trees increase property values. Encourage tree-planting programs with agencies.

Hybrid-Electric Car Pilot Program: Local Governments will evaluate the cost effectiveness and performance of hybrid-electric technology.

Retrofit Technology: Purchasing of applicable fuel line and electric spark controllers retrofit technologies are being explored. Successful devices have proven to reduce Hydrocarbon, Carbon Monoxide, and Nitrogen Oxides, while improving engine performance and fuel consumption. Seek grants for retrofitting diesel engines.

Service Contracts: Department specific OAD requirements will be incorporated into purchase and service contracts.

In-House Training: Development of an annual training program to increase awareness of OAD responsibilities of Departments and employees. Placement of the OAD into orientation packets for new employees.

Department Specific Plans for Ozone Action Days.

On OADs, the following practices will be implemented:

Reschedule nonessential operations using gasoline-powered equipment, such as lawnmowers, edgers, blowers, power saws, tree trimmers, and generators.

Reschedule nonessential construction, when possible.

Operation of construction and heavy equipment will be restricted to essential use, when possible.

Personnel shall be encouraged to limit travel on ozone action days.

Reschedule controlled burning permits.

Reschedule nonessential inspections on commercial establishments.

Public Education

Obtain and distribute flyers and information on air quality.

Use the County Government Access Channel to show video and other information on air quality.

Provide a speakers bureau on air quality for civic club meetings and other resources.

Use the County Information line and County Web site to disseminate information.

Participate in training programs and invite business and industry to participate.

MADISON COUNTY

The Council offered a list of proposed emissions reduction strategies to the County Manager in June 2003. Those proposals were reviewed locally and a list of proposed strategies was forwarded to the US Environmental Protection Agency and the NC Division of Air Quality on June 16, 2003.

During the fall of 2003, it was found that air quality in the region had improved to the point that member counties of the EAC were no longer at risk of the non-attainment designation. This news mitigated the immediate need to continue participation in the EAC for economic stability and development; however, concerns for public health and long-term economic development remain.

Public Education Campaign

The Madison County Board of Commissioners should initiate an ongoing public education campaign to inform residents specifically about non-attainment of Federal Clean Air Act Ozone Standards and generally about the risks of air pollution. Educational programs should enable citizens to understand the negative effects of air pollution on public health and economic progress. Education should also equip the public with tools to make informed decisions regarding behaviors and choices that are consistent with improving air quality.

The county should explore opportunities to collaborate with state and local governments in educating the public. This will assure regional uniformity of message and may result in a better product at less expense than a singular effort.

The County should seek cooperation of local schools, businesses, news media and non-profit organizations to deliver educational messages to the citizens of Madison County.

Madison County should continue to participate in ongoing EAC wide plans for a joint educational effort to inform citizens of the problems associated with ozone and other air pollutants. Such education should target two goals: first to inform citizen discourse on matters of public policy related to air quality and second to equip citizens to make personal choices that will have a positive impact on air quality.

At a minimum, the county should develop and distribute printed informational materials through the Health Department, Building Permits office and other appropriate agencies. French Broad Electric Membership Corporation has agreed to make space available periodically in its monthly newsletter for air quality education. The Board of Commissioners should appoint an appropriate staff member to coordinate educational activities.

Encourage Carpooling

The Madison County Board of Commissioners should encourage carpooling by working to establish the infrastructure necessary to facilitate communication among potential car-poolers. This should be done as a cooperative effort including nearby businesses and institutions, especially those that employ large workforces. Principles to guide the recommendation include:

- The purchase of property for parking is, in our judgment, not feasible given current budget restraints.

- A considerable amount of informal carpooling already exists among residents who work out-of-county. These individuals should be encouraged to participate in planning.

- County evaluation of transportation projects should include advocacy of public parking facilities similar to the existing facility at the Mars Hill exit on Interstate 26.

- The primary county responsibility should be to facilitate communication. The Council believes this can be accomplished substantially by use of existing resources. For example, the Mountain Area Information Network may be able to host a website to disseminate information on carpooling and facilitate user communication.

- As carpooling grows, a secondary county responsibility should be to negotiate the use of private parking properties for daytime commuters. Liability will be an important issue in those negotiations.

- As resources permit, the county should explore guaranteed-ride-home programs and emergency transportation for carpoolers.

The Board of Commissioners should appoint and provide staff to a citizen task force to implement the strategies discussed above. The task force should have broad citizen representation and should target members that have familiarity with work place and employment issues.

Ozone Action Day Coordinator

Madison County should appoint an Ozone Action Day Coordinator by adding that duty to a current staff member's responsibility. The main duties would include:

- Informing citizens by web, recording or otherwise of Ozone Action Days. The state issues each day at 3PM during ozone season a forecast for the next day's ozone status. When ozone reaches elevated levels, an Ozone Action Day is declared to advise citizens of increased risk. There are about eight to ten Ozone Action Days annually.

- The OAD Coordinator should serve as a point of contact for citizens requesting information regarding ozone and other air pollution concerns.

- The OAD Coordinator should participate in state sponsored activities to learn about ozone and to coordinate local programs with statewide activities.

It is suggested that the Board of Commissioners appoint a staff member, possibly within the Emergency Services Department or Health Department, to implement the above strategies. This position would become a major component of ongoing education and would alert residents to episodes of poor air quality. The OAD would be primarily responsible for the second educational goal mentioned above, namely, to help citizens understand the personal choices they can make to reduce pollution and cope with health problems associated with occurrences of poor air quality.

Ozone Action Day for Government Offices

Madison County should seek cooperation in emissions reduction and air pollution education from state and federal offices located in the county. Local business should also be encouraged to join.

Assign this task to OAD Coordinator.

Banning Open Burning On Ozone Action Days

Madison County should enact an ordinance banning open burning on Ozone Action Days. The Council realizes that burning bans can be controversial; however, this proposal would only apply for about eight to ten days each year. The days on which burning would be

banned are those on which sensitive persons are most at risk. We believe that citizens will cooperate with a burning ban on days when it can have such a great effect on their neighbors.

Assign study of an ordinance to the task force proposed above or to an already existing planning body.

4.3.3 Triad Area EAC Control Measures

Quantifiable Strategies

STATE ENFORCEABLE MEASURES

Inspection and Maintenance Program

The 1999 Clean Air Bill expanded the vehicle emissions inspection and maintenance program from 9 counties to 48. Vehicles are being tested using the onboard diagnostic system, which indicates NOx emissions, among other pollutants.

- The North Carolina Department of Environment and Natural Resources Division of Air Quality estimated the emission reductions for Triad Area EAC:
  - VOC: 1.7 Tons Per Day
  - NOx: 4.0 Tons Per Day

- This strategy was implemented on:
  - July 1, 2002 Forsyth and Guilford Counties
  - July 1, 2003 Davidson County
  - January 1, 2004 Alamance and Randolph Counties
  - July 1, 2004 Rockingham County
  - July 1, 2005 Stokes and Surry Counties

- Strategy modeled in attainment demonstration

Open Burning Ban

The North Carolina Environmental Management Commission approved a new rule that bans open burning on forecasted “air quality action days”, Code Orange or above days. The ban applies to 39 counties in or around metropolitan areas of the state, including the Triad Area. The Division of Air Quality (DAQ) formed an Open Burning Outreach Team (OBOT). The team is responsible for helping to disseminate information to the public regarding open burning.

- The Division of Air Quality estimated these reductions for Triad Area, prohibiting open burning on code orange days (assuming a 50% compliance rate).
  - VOC: 2.1 Tons Per Day
  - NOx: 1.5 Tons Per Day

- CO: 21.3 Tons Per Day

- This strategy was implemented on June 1, 2004.

- The affected jurisdictions are all of Alamance, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Rockingham and Stokes Counties.

- Strategy modeled in attainment demonstration

LOCAL ENFORCEABLE MEASURES

Eliminate Coal Fired Boilers at R. J. Reynolds Tobaccoville facility

Located in Forsyth County - RJR has eliminated use of coal-fired boilers identified in Title 15A, North Carolina Administrative Code Chapter 2D, Section 1416 during ozone season. This measure will reduce NOx emissions. The attached letter from RJR, dated November 24, 2004, addresses emissions trading and net emissions as a result of retiring the Tobaccoville coal-fired units. (See Attachment A to Triad EAC submission in Appendix Q.)

- The expected emission reductions for this strategy are higher for 2004 and 2005 than for 2006 and beyond because the NOx budget allocated to this facility in the NC Administrative Code is different in 2004-2005 than 2006 and beyond. The table below shows the NOx budget allocated to this facility in the NOx SIP Call Rule, the amount modeled and the resulting reductions.

Year	NOx Rule Allocation (tons/day)	NOx Modeled (tons/day)	Reduction (tons/day)
2004/2005	6.39	0.97	5.4
2006 +	1.67	0.97	0.7

- This strategy was implemented before the 2004 ozone season.

- The affected jurisdiction is Forsyth County.

- Strategy modeled in attainment demonstration.

Build A Network of Regional Park and Ride Lots

Between January 2005 and June 2007, PART and local governments within the EAC will create an average of four additional park and ride lots per year. This is a conservative estimate. Four are currently completed, and design has been completed for a fifth lot. PART was awarded $3.5 million in Federal Transit Administration grants which cover site location and design, conducting environmental and other required approvals, construction and maintenance of lots, signage and marketing of the Park and Ride program. Commitments for the new lots do not exist at this time, but sites in Alamance, Rockingham, Davidson,

Randolph and Surry counties are under active consideration. Like any kind of property development, commitments to locate, acquire, and maintain each location is negotiable. Based on experience and interest in the program, all parties believe the goal of an average of four new lots a year is reasonable.

- The emission reductions for this strategy were estimated by Forsyth County Environmental Affairs Department using a NCDOT spreadsheet provided by PART and NCDOT. This is based on 15 VMT/trip and a 10% increase per 5 years. If the projected number of lots are built, the estimated reductions in 2007 will be:
  - NOx 3.2 tons/year
  - VOC 1.8 tons/year

- Implementation of this strategy began in 2003 and will continue through June 2007, the end of the grant period (assuming an extension.)

- Geographic Area - This strategy will be implemented in the urban core first in Guilford, Forsyth and Alamance Counties, moving then to the adjacent counties of Davidson, Rockingham and Randolph.

- Responsible Party - Piedmont Authority for Regional Transportation is responsible for expenditures as required by the grant. Local governments are responsible for matching funds.

- Locally enforceable with funds committed; not modeled in attainment demonstration.

Retrofit and/or Replace Diesel School Busses

School systems within the EAC will initiate programs to retrofit or replace at least 165 school busses with lower emissions equipment between March 31, 2004 and December 31 2005.

- These reductions can be quantified once information is obtained on how many of the 165 or more will be retrofits or new lower emissions buses. The emission reductions will be reported as the necessary information is obtained via the semi-annual progress reports. Figures from Guilford County schools show that:

  (a) Funds were awarded, contract let and approximately 123 diesel oxidation catalysts are now being installed on Guilford County school buses model years 2000-2003.

  (b) August 2004 – 48 new lower emissions buses delivered. Similar information will be gathered from the region's other school systems

- Implementation has begun in many school systems, and results will be assessed annually.

- Geographic Area - 11 county EAC region.

- Responsible Party - The 14 school systems within the EAC are primarily responsible. EAC also has responsibility to provide grant information and provide progress and comparative information to all school systems.

- Locally enforceable with funds committed; not modeled in attainment demonstration.

LOCAL VOLUNTARY MEASURES

Truck Stop Electrification

The first truck stop electrification site opened in the Triad in July 2004 in the city of Mebane at Exit 157 off Interstate 85/40. Phase I of this project has 52 electrified spaces. The in-cab service offers electrical outlets and attachments for internet, telephone and satellite TV. Funding to purchase and install the equipment was provided by a grant from the National Association of State Energy Offices to the NC Division of Air Quality. Remaining costs for installing the electrified parking spaces was provided by Idle Aire Technologies Corp., which has installed and will operate the Advanced Travel Center Electrification system. The service costs $1.25 per hour compared to $1.68 or more per gallon of diesel fuel. The IdleAire system costs about $8000 per parking space but is financially self-supporting once operational.

- Reductions occur from not idling the diesel engines. By not idling diesel engines 8-10 hours at a time, each electrified truck stop is projected to save 263,000 gallons of fuel annually. Additionally, Idle Aire estimates that the average electrified truck stop will result in the following reductions:
  - CO2 2,732 tons/year
  - NOx 35 tons/year
  - VOC 1.8 tons/year
  - CO 15 tons/year
  - PM 1 ton/year

- Implementation Date was July 2004. Installation date for Phase II additional units not known at this time.

- Geographic Area - Mebane, eastern portion of Triad, I-85/40 corridor

- Responsible Party - IdleAire Technologies

- Voluntary with funds committed and facility in operation; not modeled in attainment demonstration.

Increase ridership on regional (PART Express) bus services

The regional bus service travels from downtown transit centers in Greensboro, Winston-Salem and High Point to the PART regional transfer facility. There, shuttles travel to

businesses and hotels in the airport area and to the airport itself. During the one year this strategy has been in effect PART has had a 52% increase in ridership over 2003. The goal was a 50% increase. Monthly ridership (on average) is 800 boardings a day for an average 20 operating days per month, this equals 16,000 boardings a month and a significant monthly reduction in miles traveled on the region's road network. Ridership goals for 2005 and 2006 have not yet been adopted; the PART staff will establish these goals in January.

- Emission reductions for 2004 were estimated by Forsyth County Environmental Affairs Department using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software (CACPS) developed by Tonie Smith Associates Inc. The assumptions in estimating the reductions were 15 VMT/trip with 16,000 trip/month = 2,880,000 VMT/yr; PART vehicles operate 205 Trips/day @ 15 VMT/trip = 738 VMT/yr; Assume NO INCREASE in ridership The estimated reductions are:
  - NOx 7060 pounds/year
  - VOC 9929 pounds/year
  - CO 102,053 pounds/year
  - SOx 303 pounds/year
  - PM10 -95 pounds/year

- Implementation for 50% ridership increase in 2004 began January 2004 and has been exceeded.

- Geographic Area - Primarily Guilford and Forsyth counties

- Responsible Party – PART

- Voluntary measure with funds committed; not modeled in attainment demonstration

Expand PART Ride Sharing and Vanpooling of the Piedmont (RSVP)

RSVP provides vanpool and ride-match services to employers and employees. Less than a year ago when this strategy was first developed, the program had 20 vans. Now it has 27. RSVP now principally serves Guilford and Forsyth Counties, but it is ready to expand and will do so depending upon employee recruitment in outlying counties. Projections are that 5 new vans will be added per year in 2005 and 2006. This estimate is based on population projections, new business openings such as Dell Computer, which will hire 1300 workers, and the need for increased employee recruitment in outlying counties. In addition, PART has worked in concert with other regional organizations to create of a statewide commuter information network that connects riders with transportation options. The web site is www.sharetheridenc.com

- The emission reductions were estimated by Forsyth County Environmental Affairs Department using CACPS. The following assumptions were used to estimate the reductions: currently, 27 vans at 14 persons per van, two trips a day, 21 days a month =

15,876 passenger trips per month. Assuming 5 new vans per year transporting 12 persons/van and 30 VMT per person per day. The estimated 2007 reductions are:

- NOx 0.7 tons/year
- VOC 0.7 tons/year

- Implementation Dates - Beginning 2004 through 2007

- Geographic Area - Principally Guilford and Forsyth counties with expansion on demand into Rockingham, Surry, and Davidson counties

- Responsible Party – PART

- Voluntary measure; not modeled in attainment demonstration

Increased Carpooling

Expand carpooling through PART website sign-ups, promotions, and advertisements. This strategy also benefits from PART's participation with other regional organizations in the statewide commuter information network that connects riders with transportation options (see above). PART will work to a 1% increase per year beginning January 2004 in Guilford and Forsyth counties.

- The emission reductions were estimated by Forsyth County Environmental Affairs Department using CACPS and the 2000 census. The following assumptions were used to estimate the reductions: a conservative assumption based on 5.73% carpool population, approximately 30 VMT/person/day and 1% annual increase. The estimated 2007 emission reductions are:
  - NOx 19 tons/year
  - VOC 23.2 tons/year

- Implementation Dates - Beginning January 2004 through December 2007

- Geographic Area - Triad urban core - Guilford and Forsyth counties

- Responsible Party – PART

- Voluntary measure; not modeled in attainment demonstration

Duke Energy Anti-idling Policy

The first phase is to eliminate idling from the mobile meter reading program and 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. The second phase is to instituted company-wide idling reduction guidelines for fleet vehicles in addition to the mobile meter reading program.

- This strategy is considered voluntary since it is not associated with an enforcement mechanism or permit status. The reductions have been quantified but are not considered to add new emissions reductions benefits. Reductions from this strategy are:
  - Mobile Meter Reading – Assumes 56 routes @ 90 miles per day. NOx emissions per vehicle = 1.1 grams per mile. Equals 12 pounds/day. Ozone Season = 153 days. Week days = 153 x 5/7 = 109 days.
    - NOx 1308 pounds/ozone season

  - Company-wide program - 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 information available at this time.

- Implementation Dates – Mobile meter reading program implemented 2003; Idling reduction guidelines implemented summer 2004

- Geographic Area - 11 EAC counties

- Responsible Party -Duke Energy

- Voluntary measure; not modeled in attainment demonstration

Increase Use of Biodiesel Fuel in the Region

The City of Greensboro's use of up to 1.5 million gallons of B20 has been noted in previous submissions. As of November 2004, two local universities (UNCG and NC A&T University) have agreed to start using biodiesel in their refuse trucks. UNCG has designed a logo to be applied to city and university vehicles. Local media will be contacted once the logo is finalized. In addition, both universities are working on educational materials. These efforts will provide another avenue for advertising the benefits of biodiesel.

One of North Carolina's major distributors of biodiesel will secure property in the Triad by the Spring of 2005 as a wholesale distribution facility. Assuming this wholesale outlet for biodiesel is established, it is likely that a major corporation with an extensive fleet in the region will work with the EAC to purchase biodiesel for its Triad based fleet, as it has done elsewhere in the state. Demand numbers have already been developed. The EAC acknowledges that use of biodiesel by this corporate fleet depends on financial and other considerations and is only a potential strategy.

- Actual emission reductions cannot be quantified until the actual number of gallons of fuel sold is know. Although there is a slight increase in NOx emissions with the use of biodiesel, the reductions in the other pollutants make this a very worthwhile strategy. In general the following reductions result from use of biodiesel:
  - Hydrocarbons 30% reduction
  - CO 20% reduction

- PM 22% reduction
- Sulfates 20% reduction
- PAH 13% reduction
- NPAH 50% reduction
- NOx 2% increase

- Implementation Dates - Greensboro biodiesel, November 2002. Universities and biodiesel, November 2004

- Geographic Area - Guilford County, to date

- Responsible Party - City of Greensboro, UNCG and NC A&T Universities

- Voluntary measure; not modeled in attainment demonstration

Non-Quantifiable Strategies

LOCAL ENFORCEABLE MEASURES

Continue support for PART (Piedmont Authority for Regional Transportation) the regional transportation service and planning entity

In 2003 Guilford and Forsyth counties granted PART ongoing legal authority to impose an automobile rental tax to support PART's regional work program. Newly authorized funding provided about $2.5 million in 2003. In addition, PART secured nearly $7 million in state and federal funds. Begun as an urban core MPO-based organization, PART's membership has now expanded to 7 Triad counties.

- The emission reductions for this measure are not quantifiable. However, PART is the central connecting transportation element in linking the counties and cities in the Triad's urban core as well as planning and financing regional mass transit. In addition, PART's transportation strategies are based on land use principles in the Triad Coordinated Land Use and Transportation Policies adopted by PART and endorsed by the governing boards of 27 jurisdictions. Support for PART is further evidenced by increasing ridership on PART's transportation options, thereby reducing commuter miles and VMTs.

- Implementation Dates – Began in 2003 and will continue

- Geographic Area - 7 counties: Alamance, Davidson, Forsyth, Guilford, Randolph, Rockingham and Surry counties

- Responsible Party - PART and Guilford, Forsyth, Alamance, Davidson, Randolph, Rockingham and Surry counties

- Locally enforceable with funds committed; not modeled in attainment demonstration

Build and Use Sidewalks, Greenways and Bicycle Routes

This strategy is partially enforceable because local government funds for many of these projects are already budgeted. Other sidewalk, greenway and bicycle routes are in capital improvements plans but not yet budgeted. Between March 31 2004 and December 31, 2007 local governments within the EAC will have constructed an additional 98 miles of public sidewalks, constructed an additional 14.25 miles of public linear greenways suitable for pedestrian and bicycle transportation, and established or improved an additional 190 miles of signed bicycle routes.

Greenway development will focus on segments which will extend connectivity of pedestrian and bicycle transportation routes to additional neighborhoods, institutions and activity centers (e.g. in Winston-Salem extending the Salem Creek Trail to the N.C. School of the Arts, Forsyth Technical College and the Winston Lake area.). The above figures are derived primarily from transportation plans in Greensboro, Winston-Salem and High Point.

- Reductions are not quantifiable but definitely decrease VMTs, promote a healthy lifestyle and contribute toward more pedestrian friendly communities. (The Triad EAC's December 2004 report to EPA will include information on the Triad's pedestrian friendly ranking in a Surface Transportation Policy Project, along with news articles and editorials in response.)

- Implementation Dates – Began March 31, 2004 and will continue through December 31, 2007.

- Geographic Area – 11-county EAC area, most mileage concentrated in urban core.

- Responsible Party - Each jurisdiction. These figures are derived primarily from transportation plans from Greensboro, Winston-Salem and High Point for which funding is already allocated or anticipated. (Greensboro: 2030 Greensboro Urban Area Long Range Transportation Plan. Actual amount to be built by 2007 is available from Greensboro Engineering & Inspection ProTrack Project Status Tracking System. Winston-Salem, page 26 2015 Greenway Plan for Winston-Salem and Forsyth County; document available on the City County Planning Board's webpage. The bicycle route estimate, from consultant recommendation for comprehensive bicycle plan, completion date Spring 2005. The sidewalk estimate, from the City's Sidewalk Bond Projects listed to be built by 2007, the Rural Hall Bicycle and Ped Plan sidewalk projects to be built by 2007, and the capital improvement funds of the other municipalities within the MPO.)

- Locally enforceable with funds committed; not modeled in attainment demonstration

LOCAL VOLUNTARY MEASURES

Develop and Maintain a Regional Emissions Reduction Clearinghouse

The EAC will develop and implement a central strategic monitoring and reporting clearinghouse function by April 2005. This function will be housed within the Piedmont Triad COG, with additional staff support provided by the Northwest Piedmont COG, Forsyth Environmental Affairs Department, and PART. The clearinghouse function will include, at a minimum, the following elements:

(a) Receive and compile implementation reports from local governments participating in the EAC, on the following matters:
  (i) Public fleet vehicle purchases, with alternate/clean fuel vehicles noted.
  (ii) Program developments intended to boost availability or utilization of public transit, including public and private employer transit pass programs, transit route extensions, transit use promotional activities, incorporation of transit stop requirements into development/zoning ordinances, and other transit promotional incentives for employers and developers.
  (iii) Development/zoning ordinance modifications to increase sidewalk, bike path, bike route, and greenway requirements or incentives.
  (iv) Construction and funding commitments for additional public sidewalks, bike paths, bike route improvements, and greenways, by estimated length and population served.

(b) Publish cumulative results for the region on at least a semi-annual basis to local media, participating governments, EPA and monitoring agencies.

(c) Compile and circulate model and innovative strategies and programs in the above areas to participating local governments on at least an annual basis. The initial distribution of these materials will be made by July 2005.

- Reductions are not quantifiable but are directionally strong. The purpose of this strategy is to create an information system that, although not enforceable, builds in local government accountability for emission reduction commitments made by their governing boards.

- Implementation Dates - The implementation date for this strategy began in October 2004 and will be completed by December 31, 2005.

- Geographic Area - Strategy will be implemented in the 11 county region

- Responsible Party - The Triad EAC and participating local governments are responsible for implementation and will be accountable if not implemented by 12/31/2005.

  Evidence of local government commitment is demonstrated by a specific provision in each endorsement resolution approved by local governments in 11 counties in December 2002:

"[The Triad] Early Action Plan will include a process to monitor and maintain long-term compliance with the standards [established by EPA]"

Then in May 2003 each local government approved a resolution adopting our strategies which committed each city and county to:

> *"Use applicable strategies as policy guidelines in decisions affecting purchasing, workplace practices, evaluation and implementation of capital projects, transportation and land use planning, and communications with its citizens."*

In order to follow through on these commitments, the councils of governments, Piedmont Triad COG and Northwest Piedmont COG, incorporated this strategy into their programs of work. In the Triad region, there are no grants, MPO or other outside funds for this initiative. Thus, it is entirely supported by *significant* expenditures of local government dues to their COGs. Well over $100,000 in unreimbursed staff time has been devoted to the EAC. This strategy falls into the "voluntary" rather than the "enforceable" category. However, as long as the incentive remains to pursue this and other strategies, local government and COG commitment can be counted on.

- Voluntary measure; not modeled in attainment demonstration

Reduce Fleet Emissions

Reduce aggregate fleet emissions in Triad EAC cities and counties as quickly as possible, considering public budget constraints.

a. EAC staff will meet with fleet managers at least 3 times between October 2004 and August 2005 to develop a process and assign responsibilities for:
    - Collecting scientific data on emissions reductions approaches and products including: (1) replacing vehicles with new lower emission models, (2) retrofits, (3) alternative fuels, and (4) retiring old high emission vehicles
    - Collecting cost information
    - Comparing costs and benefits of the various approaches and products
b. EAC will use this data to develop an analytical tool by March 2005 for local government use in purchasing and decision-making to achieve maximum feasible emissions reductions by considering fleet emissions in the decision making process.
c. Tool will be made available to local governments before December 31, 2005.
d. Feed results from local purchasing into the central strategic monitoring and reporting clearinghouse described above.
e. Results will be reported to EPA annually as a part of the Clearinghouse.

Evidence of local government commitment is demonstrated by endorsement resolutions approved by local governments in 11 counties. The reporting mechanism described in this strategy, and the specified time and number of deadlines demonstrate local buy-in.

- Reductions are not quantifiable but are directionally strong for the following reasons: they verify and assimilate accurate information on emissions reductions methods and products; they provide information to local governments; they motivate action by giving

local governments a basis for decision-making and a benchmark to compare their own with the progress of other governments in the region.

- Implementation Dates - The implementation date for this strategy began in October 2004 and will be completed by December 31, 2005.

- Geographic Area - Strategy will be implemented in the 11 county area.

- Responsible Party - Triad EAC

- Voluntary measure; not modeled in attainment demonstration

Initiate and Grow a Hospital Transportation Shuttle That Connects Hospitals in the Triad and Triangle Regions

This new strategy, PART Connections Express, began operation in April 2004. The express shuttle service provides trips twice a day on a fixed schedule taking residents of any Triad county to hospitals in Durham and Chapel Hill (university and veterans hospitals). Trips originate in Winston-Salem (Forsyth County) and make three stops in Guilford and Alamance counties. Families and human services transportation agencies from other counties bring riders to the collection points. Formerly, county human services transportation agencies were making multiple trips to Durham and Chapel Hill per week. Since April, passenger trips have increased from 300 to 450 a month.

- Reductions are non-quantified at this point. However, this strategy yields a savings of numerous trips per week (VMTs) by county agency vans to Durham and Chapel Hill. Now they need only link with PART Connections Express at convenient collection points, and they can remain in their counties to serve residents needing local transportation. A study, to be completed December 31, 2004, by the Transportation Institute of North Carolina A&T University will quantify the financial and miles saved value of this new regional transportation service. The study will develop a method for analyzing out-of-county transportation and its benefits. The information derived will help PART and county human services agencies attract more riders to PART Connections Express.

  Implementation Dates - Beginning 2004 and continuing through 2007
  Geographic Area - 11 county region
- Responsible Party – PART

- Voluntary measure; not modeled in attainment demonstration

Enhance Municipal Mass Transit Facilities, Bus Stops and Accessibility

Improve existing transit systems with bus shelters, web based schedules, etc. Add bus stops for municipal bus systems at employers. Greensboro Transit Authority (GTA), Winston-

Salem Transit Authority (WSTA), and High Point Transit Authority (HiTran) purchase and erect shelters and add bus stops by request - either of riders or employers. They will continue to budget funds for this purpose annually. Greensboro has a Riders' Advisory Panel that meets monthly to identify customer service needs. Greensboro and Winston-Salem have web based scheduling.

Reductions are non-quantifiable. These are all efforts to increase the comfort and convenience of mass transit riders thereby increasing ridership and decrease VMTs in the three municipalities.
Implementation Dates – Already begun and will continue
Geographic Area - Greensboro, Winston-Salem, High Point in Guilford and Forsyth counties.
Responsible Party - Three individual transit systems

- Voluntary measure; not modeled in attainment demonstration

Provide Mass Transit Incentives and Passes

By December 31, 2005, at least two of the EAC's four transit systems (Winston-Salem Transit, Greensboro Transit, High Point Transit and PART) will have initiated incentives such as employer based transit passes, passes for special populations, or other successful outreach programs with the goal of increasing transit ridership in the region by 11% between December 31, 2003 and December 31, 2005. Following are examples of current pass and incentive programs:

- Winston-Salem does have a marketing and outreach program targeting employers. The notable success is one offered by the Veterans' Hospital which has resulted in a 2% increase in employee ridership since 2003
- Greensboro Transit has a variety of passes:
  - a 31 day rolling pass for unlimited rides at $35 for adult fare.
  - a summer ozone season "buses to books" pass for students who can ride free on any route by showing their local library card.
  - GTA's Corporate Connection program provides tax deductions, up to $65 per employee, for passes employers purchase for their employees. (No data on participation.)
  - a 180-day rolling pass, the equivalent of a semester, at a nominal fee of $75 for college students.
  - Plans are in the works for dedicated service routes at a nominal fee for students at Greensboro's 5 colleges and universities that will provide expanded options for getting to and from classes, shopping, off campus housing, and employment.

- Reductions - Increasing bus ridership provides many community benefits including a decrease in VMTs, promoting a healthy lifestyle and access to employment and medical services. Expanding bus ridership also goes hand-in-hand with smart growth development patterns which call for transportation services to town centers, employment centers and other densely populated areas.

- Implementation Dates - This strategy has already begun through marketing and outreach programs at Winston-Salem Transit Authority, PART and Greensboro Transit Authority. By December 31, 2005 the EAC will verify that the overall regional goal of an 11% increase in ridership has been accomplished.

- Geographic Area - Greensboro, Winston-Salem, High Point, Guilford and Forsyth counties.

- Responsible Party - Each transit authority is responsible for its own outreach efforts. Through the Regional Clearinghouse, the Triad EAC will obtain reports and verification of each system's progress.

- Voluntary measure; not modeled in attainment demonstration

Build and Use Sidewalks, Greenways and Bicycle Routes

Between March 31 2004 and December 31, 2007 local governments within the EAC will have constructed an additional 98 miles of public sidewalks, constructed an additional 14.25 miles of public linear greenways suitable for pedestrian and bicycle transportation, and established or improved an additional 190 miles of signed bicycle routes. The new or improved bicycle routes will include repair of roadway hazards specific to nonmotorized transport. Greenway and bicycle route improvements will also address security concerns of pedestrians and cyclists. Greenway development will focus on segments which will extend connectivity of pedestrian and bicycle transportation routes to additional neighborhoods, institutions and activity centers (e.g. in Winston-Salem extending the Salem Creek Trail to the N.C. School of the Arts, Forsyth Technical College and the Winston Lake area.). The above figures are derived primarily from transportation plans in Greensboro, Winston-Salem and High Point. However, projects outside the urban core have already been identified by rural transportation planners and the goal will likely be exceeded.

- Reductions are not quantifiable but the measure will definitely decrease VMTs, promote a healthy lifestyle and contribute toward more pedestrian friendly communities. (The Triad EAC's December 2004 report to EPA will include information on the Triad's pedestrian friendly ranking in a Surface Transportation Policy Project, along with news articles and editorials in response.)

- Implementation Dates - Ongoing between March 31, 2004 and December 31, 2007.

- Geographic Area – 11-county EAC area, most mileage concentrated in urban core.

- Responsible Party - Each jurisdiction. These figures are derived primarily from transportation plans from Greensboro, Winston-Salem and High Point for which funding is already allocated or anticipated. (Greensboro: 2030 Greensboro Urban Area Long Range Transportation Plan. Actual amount to be built by 2007 is available from Greensboro Engineering & Inspection ProTrack Project Status Tracking System.

Winston-Salem, page 26 2015 Greenway Plan for Winston-Salem and Forsyth County; document available on the City County Planning Board's webpage. The bicycle route estimate, from consultant recommendation for comprehensive bicycle plan, completion date Spring 2005. The sidewalk estimate, from the City's Sidewalk Bond Projects listed to be built by 2007, the Rural Hall Bicycle and Ped Plan sidewalk projects to be built by 2007, and the capital improvement funds of the other municipalities within the MPO.)

- Voluntary measure; not modeled in attainment demonstration

Syngenta Crop Protection

The following have been committed to by Syngenta Crop Protection company; 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.

- Reductions have not been quantified. They are ongoing and do not add a new emissions reduction benefit. However, the EAC believes these actions should be acknowledged. They represent long-range corporate policy and in some cases financial investment. A return to pre-implementation status is highly improbable.

- Implementation Dates - Already implemented in 2002 and 2003.

- Geographic Area - Guilford County

- Responsible Party -Syngenta Crop Protection

- Strategy is considered voluntary since it is not associated with an enforcement mechanism or permit status; not modeled in attainment demonstration

Energizer Battery Company, Inc.

The following have been committed to by Energizer Battery Company; 1) Reduced fleet of vehicles by 57%; 2) 90% of fork lift trucks are now battery powered; 3) 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.

- Reductions have not been quantified. They are ongoing and do not add a new emissions reduction benefit. However, the EAC believes these actions should be acknowledged.

They represent long-range corporate policy and in some cases financial investment. A return to pre-implementation status is highly improbable.

- Implementation Dates - Implemented in 2003 and summer of 2004.

- Geographic Area - Randolph County

- Responsible Party -Energizer Battery

- Strategy is considered voluntary since it is not associated with an enforcement mechanism or permit status; not modeled in attainment demonstration

Idling Reduction Efforts

By December 31, 2005 three additional school systems will adopt anti-idling policies for school buses in their fleet. School systems are leaders in the Triad with anti-idling policies. Examples of newly adopted school system anti-idling policies:

- Guilford County Schools - "When the temperature is 50 degrees or higher, upon arrival at school sites while awaiting afternoon boarding, school bus engines will be turned off and not restarted until loading is completed and buses are ready to begin the routes." As of November 2004 Guilford County Schools transportation department has downloaded software that allows tracking of each bus to determine over use of fuel and identify violators.
- Davidson County Schools and Alamance-Burlington School System - similar policies "Five minute maximum on idling; no idling while loading or unloading on school grounds; buses should not park "nose to tail" when avoidable; buses should not park on school grounds near building air-intake systems; no bus to run without the driver being within three feet of the bus."

- This is a potentially quantifiable reduction but no calculations have been run to date. Reduced idling results directly in reduced diesel emissions.

- Implementation Dates - 2004. At least three additional school systems by December 2005.

- Geographic Area - County by county in Triad region. Three counties to date; Alamance, Davidson and Guilford Counties.

- Responsible Party - Triad EAC to monitor and promote. Individual county school systems to adopt and monitor.

- Voluntary measure; not modeled in attainment demonstration

Implement energy efficiency in operation and design of facilities, purchase and use of equipment

Principles include: a) use of design and construction standards for energy efficient buildings, b) retrofitting public buildings and schools for energy efficiency, c) seeking out and purchasing energy efficient products, d) using programmable thermostats and lighting to lessen use when the office is closed, e) rescheduling nonessential operations (lawn maintenance, outdoor painting, paving) to non-peak ozone times.

- Reductions in fuel, electricity and other energy costs have been identified by local governments and their vendors, such as Johnson Controls, and their architects and engineers. This has not been quantified as emissions reductions. This strategy is directionally strong because of the linkage between reduced energy use and emissions. There is no vehicle to make this an enforceable or mandatory strategy for local governments. However, the EAC, through the COGs, will continue to advocate this strategy with local government managers

- Implementation Dates - Implemented 2003 - 2004 in High Point municipal buildings, Davidson County office buildings, Guilford County schools, Rockingham County schools and City of Asheboro (Randolph County) municipal buildings.

- Geographic Area - Selectively in Guilford, Davidson, Rockingham and Randolph counties

- Responsible Party - Individual jurisdictions

- Voluntary measure; not modeled in attainment demonstration

E-government / increase available locations.

Provide telephone and web-based services, both for information and transactions and/or multiple locations for payments, etc. Implemented in City of Thomasville in Davidson County. Others with telephone and electronic e-bill pay will be identified.

- This strategy is non-quantifiable, however, it is a directionally strong strategy because it saves VMTs for those who often pay in person at the municipal or county building.

- Implementation Dates - 2003 in City of Thomasville, Davidson County

- Geographic Area - Thomasville, Davidson County

- Responsible Party - EAC and COGs will advocate

- Voluntary measure; not modeled in attainment demonstration

Use Intelligent Transportation Systems (ITS)

Local transportation departments to use detection loops and other systems that 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.

- Reductions are non-quantified but these measures reduce congestion and vehicle idling, leading to lower emissions.

- Implementation Dates - Already implemented in Greensboro, Winston-Salem and High Point; incorporated into their long-range transportation updates. Funding to expand these systems will be forthcoming and is based on each MPOs Long-Range Transportation Plan.

- Geographic Area - MPO area for Greensboro, Winston-Salem, and High Point.

- Responsible Party - Each MPO

- Voluntary measure; not modeled in attainment demonstration

Direct Deposit

Offer employees direct deposit of pay checks. A sampling of local governments in the region shows 3 of 4 counties contacted and 3 of 5 larger cities have mandatory direct deposit. The remaining 3 governments in the contact group have voluntary direct deposit; 2 have 90% participation and 1 has 60% participation.

- Reductions are non-quantifiable but this saves each employee at least one vehicle errand per pay period.

- Implementation Dates - Implemented in various jurisdictions in 2002, 2003 and 2004

- Geographic Area - Various jurisdictions in Guilford, Forsyth, Randolph, and Davidson counties

- Responsible Party - Each jurisdiction. EAC and COGs will advocate for increased implementation.

- Voluntary measure; not modeled in attainment demonstration

Adopt Planned Growth Measures Including Pedestrian Friendly Communities and Transportation Strategies that Promote Connectivity and Less Reliance on Automobiles

Throughout the region Triad local governments have adopted and are formulating new comprehensive development plans and unified development ordinances that incorporate smart growth principles. The development ordinances, typically zoning and subdivision ordinances, implement principles in their communities' comprehensive plans. The ordinances provide for street connectivity, more sidewalks, traditional neighborhood developments (TNDs), mixed use and infill development, and landscaping. Some of these provisions are required (enforceable), and others are optional (voluntary). The same smart growth principles found in the comprehensive plans and zoning and subdivision provision are integrated into the region's four MPO multi modal transportation plan updates. In addition, 27 local governments have adopted PART's Land Use and Transportation Principles. These principles serve as a regional guide to link land use and transportation planning. Details of this can be found in the Triad EAC submittal in Appendix Q.

NOTE: On November 17, Greensboro's Southside neighborhood was announced as one of EPA's five winners of the 2004 National Awards for Smart Growth Achievement. Greensboro's Department of Housing and Community Development developed a Traditional Neighborhood District Ordinance to assist redevelopment of this 10 acre project. Southside is a five- to ten-minute walk from the central business district and includes single-family homes, two-family homes, townhouses, restored historic homes, and live/work units.

- Reductions - As recommended in the EPA guidance, these measures reduce reliance on automobiles, make walking to destination points more convenient, promote infill and mixed uses and reduce sprawl, and require tree planting and preservation. These are long-term strategies to reduce emissions and provide a greener environment.

- Implementation Dates - Ordinances cited in Triad's EAC Plan (Appendix Q) have been adopted in 2003 and 2004 by the jurisdictions identified.

- Geographic Area - Ordinances with provisions similar to those cited are found in 8 of the 11 Triad counties.

- Responsible Party - Individual jurisdictions

- Voluntary measure; not modeled in attainment demonstration

Determine Potential and Value of Open Burning and Lawnmower Buy-Back Policies

The Forsyth County Environmental Affairs Department will study the potential and value of additional open burning restrictions and a lawn mower buy-back program for one or more jurisdictions and make recommendations on both of these issues to the EAC by December 31, 2005.

- This strategy is directionally strong because it will identify the most feasible policies to restrict open burning beyond the statewide ban on code orange and red days. It will also provide a lead agency, Forsyth County Environmental Affairs, to assemble key elements of a lawn mower buy-back program. The EAC will identify jurisdictions for potential implementation

- Implementation Dates - The implementation date for this strategy will begin January 2005 and will be completed on or before December 5, 2005, the date of the December meeting of the Triad EAC.

- Geographic Area - The entire 11 county region will be studied; however the likelihood of implementing one or both programs is stronger in the urban core counties of Guilford and Forsyth.

- Responsible Party - The Triad EAC and the Forsyth County Environmental Affairs Department are responsible for implementation and will be accountable if not implemented by 12/31/2005.

- Voluntary measure; not modeled in attainment demonstration

Support Our Regional Consortium

Continue the Triad EAC as a regional air quality consortium involving county and municipal governments, environmental interests, business and industry to develop and carry out initiatives to reduce ozone emissions in the region.

- This is not an emissions reduction measure. However, if it were not for the Triad EAC, many of these strategies would not be adopted or implemented, and emissions reduction would not be receiving its current level of support in the region.

- Implementation Dates - December 2002 and continuing

- Geographic Area - 11 counties

- Responsible Party - local governments, Piedmont Triad COG and Northwest Piedmont COG

- Voluntary measure; not modeled in attainment demonstration

Continue Existing Air Awareness Programs

Continue regional education and outreach services provided through the N.C. Division of Air Quality and the Triad Air Awareness Program. Implement outreach programs with added

emphasis on ozone season (May – September) and ozone episodes. Activities of the Triad Air Awareness program include:

- Ads and Special Events - Placing radio and TV ads, which can be used free of charge by organizations and local government/business. The "Breathing" TV spot just won an international award. Cost of airtime is a barrier to more frequent airing of these spots. Running the radio spots as public service announcements is an option but not widely accepted by radio stations. To view the TV spots and listen to some of the radio spots go to the triad air web site. www.co.forsyth.nc.us/envaffairs/triadair

  The two major special events consist of a big family Air Awareness day at SciWorks in Winston-Salem and an event in collaboration with the Greensboro Children's Museum.

- Targeted Outreach - The Triad Air Awareness Program uses communications designed for special populations developed by various national organizations. This information is distributed in a variety of settings such as special events at public libraries and school visits.

- Go into the Schools – Develop school-based outreach to educate children, who, in turn can inform their families. This strategy is similar to the approach that worked when children educated their families about recycling. The NC Air Awareness program has been successful in getting the topic of air quality included in the 7th grade science curriculum. Seventh graders in North Carolina study atmosphere, and air quality fits in nicely. For younger grades there are coloring books called "Air Pollution From A To Z."

- Media Reports - Support Air Quality reports on TV, radio, newspaper, and web sites with advocacy and information**.** A few TV stations in the Triad and one or two newspapers provide strong coverage of air quality episodes, but it tends to be sporadic. Coverage is, however, much improved from 2002 and previous years. This is in large part a result of personal appeals and information from the Triad Air Awareness Program.

- Reductions are non-quantifiable. Public education and exposure are critical to making air quality an issue of public concern, as water quality has become. Also, as children are educated, they can impact the habits of their families for healthier living, walking, mowing lawns after 6:00 p.m. etc.

- Implementation Dates - Beginning in 2001. New techniques implemented frequently. Note, funding of the Triad and other regional Air Awareness program through NC Division of Air Quality will be under discussion at NCDAQ this month.

- Geographic Area - 11 counties

- Responsible Party - Triad Air Awareness Program, N.C. Division of Air Quality

- Voluntary measure; not modeled in attainment demonstration

Partner with Triangle area in a two-region Clean Cities program

First joint venture was an AFV road show conducted in Greensboro and Winston-Salem on April 21, 2004. Programming and outreach provided by Triangle Clean Cities program, City of Greensboro and City of Winston-Salem. Subsequent joint ventures include publicizing grant opportunities and eliciting applications for Mobile Source Emissions Reduction Grants, and creating a user group of local governments for Clean Cities Webcasts.

- No emissions reductions. Provides opportunity for information sharing and air quality program development.
- Implementation Dates - February 2004 and ongoing.
- Geographic Area - 11 county Triad region and eastward to Raleigh-Durham-Chapel Hill area of N.C.
- Responsible Party - Triad EAC, Piedmont Triad COG, Northwest Piedmont COG, NC Solar Center, Triangle Clean Cities program
- Voluntary measure; not modeled in attainment demonstration

Proceed with Plans for Commuter and Intercity Rail

In the fall of 2004 PART signed a contract for phase II of the Major Investment Study a regional mass transit system. Under this phase, costs and benefits will be calculated for multiple approaches to providing mass transit within the Triad. Options include monorail, commuter rail, and bus rapid transit. The study will recommend the option that will work best. This phase II study will include a public travel demand model being developed by PART. It will help consultants forecast demand and use of the mass transit options. Phase I of the study identified the mass transit corridor from western Winston-Salem to eastern Greensboro. The corridor will later be lengthened to go into western Forsyth County and Alamance County. This Study incorporates land use policies of activity centers, village centers and infill in designated centers along the corridor.

- Since this measure is still in the planning phase no emission reduction are estimated. Furthermore, this strategy does not affect near-term air quality improvement, but it demonstrates progress in a positive direction.
- Implementation Date - Phase II of the study began in the fall of 2004 and will be complete by the summer of 2005.
- Geographic Area - Initially Guilford and Forsyth counties
- Responsible Party – PART

- Voluntary measure; not modeled in attainment demonstration

Determine feasibility of developing HOV / HOT lanes

Determine feasibility of developing HOV/HOT lanes along I-40 (main east-west corridor through the Triad.) - PART is partnering with NC A&T University and UNC Chapel Hill on this study which began in February 2004 and will be completed by the summer of 2005. This is a value pricing study and only one component of the process to determine the feasibility a value pricing line along this major east-west artery. Even if it is determined that the Triad is not ready for a value travel lane, study results may be useful. As traffic increases, there could be a need for this information in the future.

- Reductions - To be determined. Long-term
- Implementation Dates - Study began in 2004; to be completed by summer 2005
- Geographic Area - Forsyth, Guilford and Alamance counties
- Responsible Party – PART
- Voluntary measure; not modeled in attainment demonstration

4.3.4 Unifour Area EAC Control Measures

In March 2004, the Unifour Air Quality Committee (UAQC) adopted fourteen Emission Reduction Strategies. These measures have been revised based on comments received by the U.S. Environmental Protection Agency (USEPA), Southern Environmental Law Center (SELC), and the North Carolina Division of Air Quality (NCDAQ). The measures are in accordance with requirements that the local control measures be specific, quantified and permanent. These revised measures have been reviewed by each local member of the Unifour Early Action Compact (EAC) to demonstrate their commitment to address ozone pollution in the Unifour area.

Quantifiable Strategies

MOBILE SOURCES

Inspection and Maintenance Program

The 1999 Clean Air Bill expanded the vehicle emissions inspection and maintenance program from 9 counties to 48, and improved the testing method. Vehicles are being tested using the onboard diagnostic system, which indicates NOx emissions, among other pollutants.

- The North Carolina Department of Environment and Natural Resources Division of Air Quality modeled these emission reductions for the Unifour EAC Area:

- VOC: 0.8 tons/day
- NOx: 0.8 tons/day

- This strategy was implemented on:
  - July 1, 2003 Catawba County
  - July 1, 2005 Burke and Caldwell County

- The affected jurisdiction is all of Burke, Caldwell and Catawba Counties.

- State enforceable; modeled in attainment demonstration

Expand Public Transportation and Ridesharing Programs

The Piedmont Wagon Transit System (PWTS) and the Piedmont Wagon Manager's Consortium are committed to air quality improvements by continually expanding transit service and the number of users. The system will adopt policies that limit bus idling and incorporate AFVs into the system. The Piedmont Wagon Transit System will seek to play a useful role in not only providing an efficient public transit service but also in fostering the implementation of ridesharing programs by area businesses. When approved by the Piedmont Wagon Manager's Consortium, a significant fixed route service modification will be implemented in April 2005. New transit service will be provided to areas that are currently outside the existing bus routes. The expansions include the Tate Boulevard corridor for employment and medical destinations, the North Carolina Employment Security Commission office and connections to the intercity bus stop on U.S. Highway 70. Those who now rely on single occupancy vehicles (SOVs) will now have an alternative mode of transportation to make their trips to these destinations.

The NC Department of Transportation has a web-based ride matching program, based on the RidePro software, which serves the Unifour area (www.sharetheridenc.org). A computerized database is being developed that will be useful to potential SOV drivers who want an alternative mode of transportation to commute to work. This will be done by making area employers and their employees aware of the ride matching program. These programs will be monitored for usage and relevant statistics will be gathered to demonstrate the system's effectiveness and impact on air quality. Verification and monitoring of this control measure will be part of the Unifour's EAC biannual report to the NC Division of Air Quality and the United States Environmental Protection Agency.

- Emission reduction estimates for increased use of public transportation in the Hickory area has been quantified using the CACPS program.
  - NOx 0.4 tons/year
  - VOC 0.5 tons/year

- When approved by the Piedmont Wagon Manager's Consortium, a significant fixed route service modification will be implemented in April 2005.

- Jurisdiction affected is Hickory, NC.

- Voluntary measure with funding committed; not modeled in attainment demonstration.

Compressed Work Weeks or Flexible Schedules

Encourage the use of compressed work weeks or flexible hours. Currently, several of the stakeholders, including Caldwell County, Catawba County, and the City of Hickory use this technique. As awareness increases we believe this will be used more. By December 31, 2005, all EAC members will adopt a resolution allowing flexible work schedules, telecommuting, and compressed work week wherever appropriate. This support will be beneficial in providing an example for the private sector and reducing the number of vehicles on the road during peak hours. Business associations and Chambers of Commerce will provide program leadership in the private sector. All participation in the program will be monitored as part of the ongoing activities of the UAQC in order to gauge efficacy and emission reductions. The City of Hickory remains committed to the encouragement of compressed workweeks and flexible work schedules. The City of Hickory Public Services (Public Works) Department currently operates from 7:00 AM until 3:30 PM Monday through Friday. For example the Finance Department has utilized flex hours. The City of Newton practices flexible work schedules for public works/utility personnel in summer months. One caveat to this measure is the fact that there are several instances in local government that necessitates the establishment of a set regular work schedule. For example, Caldwell County allows flex hours in departments where it would benefit both the department and the employee.

- Emission reduction estimates for the Hickory area have been calculated using the CACPS program.
  - NOx 1.3 tons/year
  - VOC 1.5 tons/year

- Resolutions allowing flexible work schedules will be adopted by December 31, 2005.

- Jurisdiction affected is the Unifour area.

- Voluntary measure; not modeled in attainment demonstration.

Develop Regional Bicycle and Pedestrian Plan

By December 2005, each member will have contributed to and adopted a regional bicycle and pedestrian plan that includes provisions for identifying funding sources and necessary land acquisitions for the establishment of a network of greenways, paths, trails, and bike facilities. The WPCOG is currently initiating such a system and will continue to pursue further options for non-motorized travel throughout the Unifour. The progress on the bicycle and pedestrian plan will be tracked and verified as part of the EAC biannual reporting process. Hickory adopted a bicycle and pedestrian plan in September 2000: “Sidewalk,

Bikeway, Greenway, and Trail Master Plan." This Master Plan establishes a specific set of strategies the City of Hickory is currently undertaking in an effort to expand and develop non-vehicular transportation corridors within the City of Hickory. The Master Plan identifies all existing pedestrian oriented facilities, and establishes goals and implementation strategies associated with the expansion of the network. In total, the Master Plan identifies a network consisting of two hundred seventy eight (278) miles of pedestrian specific transportation corridors. Development proposals are reviewed and compared to the Master Plan. If the Master Plan depicts a planned pedestrian facility, the development is required to install the facility during construction.

- Emission reduction estimates for increased biking and walking in the Hickory area have been quantified using the CACPS program.
  - NOx 1.6 tons/year
  - VOC 2.0 tons/year

- This strategy will be implemented in all areas by December 31, 2005. The city of Hickory has already adopted its plan.

- Jurisdiction affected is the Unifour area.

- Voluntary measure; not modeled in attainment demonstration.

CONSERVATION

Outdoor Burning Ban

The North Carolina Environmental Management Commission approved a new rule that bans open burning on forecasted "air quality action days", Code Orange or above days. The ban applies to 39 counties in or around metropolitan areas of the state, including the Hickory area. The Division of Air Quality (DAQ) formed an Open Burning Outreach Team (OBOT). The team is responsible for helping to disseminate information to the public regarding open burning.

- The Division of Air Quality modeled these reductions for Unifour EAC area prohibiting open burning on code orange days (assuming a 50% compliance rate).
  - VOC: 0.7 Tons Per Day
  - NOx: 0.5 Tons Per Day
  - CO: 7.1 Tons Per Day

- This strategy was implemented on June 1, 2004.

- The affected jurisdiction is all of Alexander, Burke, Caldwell and Catawba County

- State enforceable; modeled in attainment demonstration

City and County Energy Plan

An energy conservation plan will be developed that directs city & county departments to reduce energy consumption and conserve resources. The North Carolina State Energy Office provides many resources to help local government agencies develop an energy conservation plan. By December 31, 2005, all members of the EAC will, by local resolution, develop, adopt and implement energy plans which include significant conservation measures similar to those identified in NC General Statutes Chapter 143 Article 3B. These plans will include provisions that help assure compliance by designating adequate staff and financial resources sufficient to carry out the plan's objectives. Facilities will be monitored to determine reductions in energy usage and consumption of raw materials used to generate electricity. Upon internal review, any member found to be out of compliance with their plan's stated objectives will commit additional resources towards the implementation of the plan the following year. Verification and monitoring of the energy conservation plans effectiveness will be provided through biannual reports to the NCDAQ.

- Emissions reductions for the Hickory area have been estimated using CACPS program.
  - NOx 0.4 tons/year
  - VOC 0.5 tons/year

- Implementation will be completed by December 2005.

- Jurisdiction affected will be the Unifour area.

- Voluntary measure; not modeled in attainment demonstration.

Non-Quantifiable Strategies

MOBILE MEASURES

Alternative Fuel Vehicles and The Clean Cities Program

The Centralina Clean Fuels Coalition (CCFC) was recently added to the U.S. Department of Energy's Clean Cities program (October 15, 2004). The UAQC will continue its participation as a stakeholder in the Carolina Clean Fuels Coalition and utilize the concepts and methods of the Clean Cities program in order to bring more alternative fuels and alternative fuel vehicles (AFVs) to the Unifour. Members of the EAC will commit to replacing conventional vehicles with AFVs and towards the creation or expansion of alternative fuel delivery systems within the region. Dependent on volume, funding opportunities, and existing infrastructure, each member will demonstrate, by local resolution, a commitment to alternative fuel technology by committing to the ongoing pursuit of AFVs and alternative fuels on a permanent basis. The specific commitment of each member will be determined internally based on the replacement needs of each local member, while at the minimum resolving to increase their local AFV program each year. The effectiveness of this measure will be verified and tracked as part of the biannual reporting requirements of the EAC program.

- Emission reduction for this strategy have not been estimates.

- The Unifour area is already participating as a stakeholder to the CCFC.

- Jurisdiction affected will be the Unifour area.

- Voluntary measure; not modeled in attainment demonstration.

Support Efforts and Coordination of Metropolitan Planning Organization and Rural Planning Organization

The MPO and RPO does long range transportation planning on a five year cycle to ensure that highway and transit projects conform to the air quality goals established by the EAC's air quality State Implementation Plan (SIP). Although Transportation Conformity is not required for EAC areas, the Greater Hickory MPO and RPO will coordinate transportation activities in the Unifour Area in such a way that does not cause new air quality violations, worsen existing violations, or delay attainment of the national ambient air quality standards. The MPO and RPO will use the directionally appropriate concepts of Transportation Conformity to do transportation planning and coordinate these activities based on the mobile source emissions modeling done by the NCDAQ as part of this SIP. All ten members of the EAC participate and make significant contributions to the MPO planning process and all four counties in the region participate and contribute to the RPO.

- It is not possible to quantify the exact reductions from this measure but it is directionally appropriate and commonly acknowledged as a tool to help reduce ozone pollution.

- Has been implemented.

- Jurisdiction affected will be the Unifour area.

- Voluntary measure; not modeled in attainment demonstration.

Improve Traffic Operational Planning, Engineering and Maintenance

In addition to being the lead planning agency for the EAC, the WPCOG is the lead planning agency for the Greater Hickory Metropolitan Planning Organization and Unifour Rural Planning Organization as well. A Transportation Demand Management (TDM) plan will be developed by the WPCOG by December 31, 2005. This plan will complement the ongoing transportation planning activities in the region and help alleviate air quality problems. Each member of the EAC contributes financially to these programs. The City of Hickory currently uses signaling efforts to avoid idling problems and to help decrease traffic congestion. The Piedmont Wagon Transit System supports an institutional arrangement for delivery of TDM programs by for-profit organizations, such as VPSI or 2Plus. We expect Piedmont Wagon Transit System to provide logistical support to ensure effective cooperation and coordination of services between the TDM program and the PWTS. This type of coordination will result

in an enhanced public transportation system for the area. Verification and tracking of this measure will be provided as part of the DAQ and EPA biannual reporting requirements for the Unifour EAC.

- It is not possible to quantify the exact reductions from this measure but it is directionally appropriate.
- Will be implemented by December 31, 2005.
- The affected jurisdiction is the Unifour area.
- Voluntary measure; not modeled in attainment demonstration.

Implement Smart Growth, Mixed Use, and Infill Development Policies

Each local EAC member will actively advance compact development that is consistent with the document, "Improving Air Quality through Land Use," an EPA guidance paper that provides options for accounting for air quality benefits and describes land use activities that encourage travel patterns and choices that reduce vehicle miles traveled. Several of the EAC members have these measures integrated into their land use and development documents. The City of Hickory has adopted a comprehensive land use and transportation plan (Hickory by Choice) which is an excellent example of a Smart Growth plan. Catawba County has approved several Small Area Plans that also represent Smart Growth activities in the area. The City of Newton is currently preparing Area Specific Plans for six areas of the City and ETJ that include policies that are based upon Smart Growth principles. Other member counties and cities are reviewing the possibilities of these types of plans. As part of the EAC biannual reporting process, updates will be provided for other locally adopted plans and land use activities that help improve air quality in the area. In an effort to cope with issues associated with air quality standards the City of Hickory has implemented a number of strategies/policies designed to improve and/or mitigate such issues.

The following bulleted list describes each of these strategies/policies and offers an explanation of the mechanics of each.

- <u>Hickory By Choice, Comprehensive Land Use and Transportation Plan</u>, *Adopted August 1999*.

  Hickory By Choice (HBC) is the City of Hickory's Comprehensive Land Use and Transportation Plan and is designed to guide development activities within the City for the next twenty-five (25) years. HBC outlines specific goals involving the development of its transportation network, the preservation of natural resources, the expansion of transit opportunities, and development of land-uses.

  HBC identifies an "Overriding Planning Principal" as being the foundation to which the bulk of the document revolves around. This principal indicates the importance of

pedestrian oriented interconnectivity and the realization of traditional patterns of development. This verbatim text of this strategy is located below.

> *The overriding planning principle is simply to create a network of neighborhoods of housing, parks, and schools placed within walking distance of shops, civic services, and employment. Hickory has grown as a regional provider of medical services, retail shopping, cultural activities, and employment. And this planning principle builds upon the traditional development patterns in Hickory with the intent of Reestablishing a community less reliant on automobiles and promotes a sustainable economy. New development patterns in the city should reinforce the connection between new mixed use/multiple use and traditional residential neighborhoods and the elements of a sustainable community such as neighborhood shopping, open space and parks, employment, and services. These connections should be more pedestrian scale and safe while providing more options to reach one's desired destination. The new network of neighborhoods would be centered on commercial core districts that provide shopping, offices, civic spaces, and services located along major thoroughfares to further enhance economic sustainability and provide opportunities for use of transit to travel from one neighborhood to another. Transit opportunities would also improve access to larger industrial, office, and commercial employment centers. Beyond the establishment of neighborhood focused commercial districts and mixed-use neighborhoods will be a more traditional pattern of single-family residential development.*

The goals and objectives identified within HBC are achieved through the adoption and implementation of the City of Hickory's Land Development Code, which is outlined below.

- City of Hickory Land Development Code, *Adopted April 3, 2001*.

The City of Hickory's Land Development Code (LDC) contains specific development and design standards that are intended to implement the goals and strategies indicated within Hickory By Choice. In particular the LDC establishes standards that facilitate the preservation and/or installation of landscaping features, provide adequate locations for transit facilities, establish mixed-use land-use classifications, promotes traditional/historic development patterns, and establish higher density residential development. Each of these established standards are outlined below.

- *Provisions for Transit Accessibility, Article 3*

  The City of Hickory's Land Development Code places specific requirements for development activities within its non-residential zones

that stipulate requirements associated with the provision of adequate facilities designed to accommodate public transit vehicles.

- *Mixed-Use Development, Section 5.1*

  The LDC provides for the implementation of a Neighborhood Mixed-Use Overlay District, which allows for the establishment of retail and office type uses intermingled within residential areas. The overlay's primary intent is to implement the neighborhood-based planning polices outlined within Hickory By Choice.

- *City Center Pedestrian Overlay District, Section 5.4*

  This overlay district promotes easy pedestrian access to buildings by prohibiting parking in front of buildings and allowing zero-lot line setbacks to further facilitate a pedestrian friendly atmosphere.

- *Traditional Development Patterns, Section 6.1*

  The promotion of traditional development patterns are highlighted within the LDC's Traditional Neighborhood Development (TND) section. This concept employs the rational of master planned communities. The provisions allow for the development of higher density mixed-use development that relies on the fundamentals of pre-suburban development patterns.

- *Higher Density Residential Development, Section 8.1*

  The LDC establishes minimum required lot sizes for each of its zoning districts. Within residential zoning districts provisions have been made for the creation of smaller lots, which in turn provide opportunity for higher density residential development patterns.

- *Conservation Subdivisions, Section 8.5*

  Conservation subdivisions provide for the development of property into smaller more dense lots while preserving open space. Typically, the normal density of the tract being developed is still permitted, however the lots are compacted and the remainder of the tract is preserved as open space.

- *Enforcement of Violations, Article 16*

Article 16 of the LDC outlines the steps and procedures for the resolution of any and all violations of the provisions contained within the LDC. Such measures include mechanisms to stop work of constructions projects, the revocation of permits, injunction procedures, court ordered abatements, and civil penalties.

***City of Conover**:*

a. 2003 Land Development Plan
b. Traditional Neighborhood Development Ordinance
c. October 2003
d. May 3, 1999 by Ordinance 16-99
e. A 10 year growth and development strategy policy document
f. Division 12, Section 312.1
g. Guides growth and development encouraging smart growth practices, infill development, mixed use and cluster developments, bikeways and pedestrian linkages, set policy for a growth area limited to public infrastructure placement.
h. Development plans are not approved unless they follow the LDP.
i. Development plans are not approved unless in compliance with development regulations.

- Catawba County has adopted Small Area Plans that cover the majority of the county. Small area plans are designed to assess specific neighborhood area's current quality of life and sustainability on issues such as traffic congestion, residential development patterns, water quality, library service levels, utility capacities and school facilities. Upon reviewing these issues, committees will then recommend measures for improvement. Specifically, Small Area Planning Committees will discuss and develop goals and action statements for the following issues: 1) economic development; 2) natural resources; 3) cultural resources; 4) public services and community facilities; 5) housing; 6) land use and development; and 7) transportation. Plans will also include how the goals and action statements will be implemented, whether it is through ordinance or policy amendments, modified capital improvement plans, or coordination with other agencies to complete specific tasks. Small Area plans are Smart Growth that address current land uses & residential density recommendations, future transportation recommendations, proposed Zoning Map amendments and natural and cultural resources.

- It is not possible to quantify the exact reductions from this measure but it is directionally appropriate.

- Will be implemented by December 31, 2005.

- The affected jurisdiction is the Unifour area.

- Voluntary measure; not modeled in attainment demonstration.

AWARENESS

Air Awareness Program

Local Governments join and participate with the private sector in the NC Air Awareness Program. As awareness increases we anticipate this program being very beneficial in reducing ozone pollution in the region. All ten local members of the EAC have joined and are participants in the NC Air Awareness program. This measure also calls for the development, adoption, and implementation of an "Action Plan for Ozone Alert Days." Each EAC member will officially adopt their plan by local resolution before the beginning of the 2005 ozone season.

Such plans will include provisions to help reduce ozone pollution through actions such as:
1) timely notification of relevant staff of ozone status,
2) discontinuing the use by government employees of gas-powered landscaping and maintenance equipment such as lawnmowers and blowers,
3) discontinuing nonessential travel and trips in government fleet vehicles, and
4) using "best practices" for refueling and idling of fleet vehicles.

For example, superiors in relevant government departments will be responsible for ensuring that the provisions are followed by delegating certain responsibilities, such as notification, and having a system in place that incorporates alternate workloads and assignments much like what is required on "rainy days in many departments. EAC members in the Unifour will lead by example and help the private sector to participate in the Air Awareness Program and to develop their own ozone action plans. .

- It is not possible to quantify the exact reductions from this measure but it is directionally appropriate and commonly acknowledged as a tool to help reduce ozone pollution.

- The City of Hickory's plan was adopted in June 2004. As of December 2004, Alexander County, Catawba County, Caldwell County, Newton, and Taylorsville have adopted an Action Plan for high ozone days.

- Voluntary measure; not modeled in attainment demonstration.

A*dopt a Local Clean Air Policy*

Adopt a local clean air policy and appoint stakeholder group to identify and recommend locally feasible air quality improvement actions. Each member of the EAC will, by local resolution, develop and adopt a clean air policy that takes into consideration the unique conditions that exist in each county and municipality. For example, a mass transit policy will be more suited to the more densely populated and urbanized areas than the rural areas of the region. Each local member will identify and establish a stakeholder group, independent of the UAQC, by June 30, 2005. This group will fill the role of developing and implementing an aggressive program to educate and motivate their local community to take action and

minimize air pollution. Technical support for the development of the local clean air policies will be provided to the groups by the WPCOG and NCDAQ.

- It is not possible to quantify the exact reductions from this measure but it is directionally appropriate.

- Each local member will identify and establish a stakeholder group, independent of the UAQC, by June 30, 2005.

- Jurisdiction affected will be the Unifour area.

- Voluntary measure; not modeled in attainment demonstration.

Air Quality Contact

Designation of air quality contacts throughout the EAC will help guarantee each organization's adherence to all the other control measures. These contacts will be responsible for the dissemination of air quality information throughout their organization and for the oversight of air quality programs. Every EAC member organization will assign at least one staff person as their official air quality contact by December 31, 2004. There will be at least one contact designated per member organization and may include more as necessitated by the absolute size of the organization, or as each contact finds necessary. These contacts will play a crucial role in the overall emission reduction strategy and help form an essential knowledgebase for air quality issues in the area. The EAC will depend on these contacts to make certain the control measures and air quality policies are carried out locally while documenting and reporting their efforts, achievements, and progress in a detailed and regular manner to the UAQC. Each EAC member devotes quantifiable staff resources to air quality issues. For example, from the WPCOG, one staff member allocates twenty percent of a fulltime work schedule to air quality activities. Air Quality Contacts will track and document personnel hours spent on air quality issues and this information will be compiled and included as part of the EAC biannual reporting process.

- It is not possible to quantify the exact reductions from this measure but it is directionally appropriate.

- Implemented by December 31, 2004.

- Jurisdiction affected will be the Unifour area.

- Voluntary measure; not modeled in attainment demonstration.

LANDUSE

Landscaping Standards and Urban Forestry

Planted trees and vegetative landscaping reduce the need for air conditioning, reduce the heat island effect in urban areas, and help reduce energy usage. Landscaping and tree ordinances will be drafted to establish minimum tree planting standards for new development and to promote strategic tree planting, street trees, and parking lot trees as advocated through "Urban Forestry." By December 31, 2005, members of the EAC will adopt a landscape ordinance, or incorporate policies into their existing land use regulation ordinances, which establish guidelines that take into consideration the methods and concepts of Urban Forestry (http://www.urbanforestrysouth.org/ordinances/index.htm). Oversight and technical assistance will be provided to EAC members by the WPCOG as needed. Many of the local governments have adopted landscaping standards or are currently reviewing the benefits of adoption.

- It is not possible to quantify the exact reductions from this measure but it is directionally appropriate.

- Catawba County has adopted landscaping standards for new developments. On March 15, 2004, Caldwell County adopted a revised Zoning Ordinance which includes buffer requirements for planting of vegetation or utilizing existing vegetation. It also includes landscaping which requires the breaking of parking lot expanses with vegetation. Newton currently has ordinances in place that require landscaping of parking areas and the installation of street trees in new developments.

  Some local examples from the Unifour include:

  City of Conover:

  a. Landscape Parking Ordinance
  b. Adopted on Dec. 4, 1995 by Ordinance 22-95
  c. Section 23.5 of the Zoning Ordinance
  d. Requires trees and shrubbery within the parking lots and in a 10' minimum-planting strip between any road and parking lot. This reduces the impact of a heat envelope created by large expanses of unbroken asphalt.
  e. Zoning Permit not approved unless part of plans. Any vegetation that dies is required to be replanted within the planting season.
  f. Zoning Ordinance Violations are enforceable.

  City of Hickory:

  - Landscaping and Screening, Section 10.11 of the Land Development Code (LDC). The Landscaping and Screening section of the LDC places specific requirements upon new development activities and any alterations and/or expansions of existing land-uses. Specifically the section promotes the preservation of existing vegetation and in instances where such preservation is not possible the LDC stipulates that required activities provide substantial plantings to

provide aesthetically pleasing features that also work along with natural biological systems to promote a beautified and cleaner community.

- Jurisdiction affected will be the Unifour area.

- Voluntary measure; not modeled in attainment demonstration.

5.0 ATTAINMENT DEMONSTRATION

5.1 Changes to Emission Inventories Since March 31, 2004 Submittals

The modeling emission inventories changed since the March 31, 2004 submittals for both the current year and the 2007 attainment year. These revisions were made to address errors that were found and the use of better available data. The emission inventory changes resulted in changes in the attainment test results that were presented in the March 31, 2004 submittals. The inventory changes are listed below and the resulting attainment test results are listed in Section 5.3.

5.1.1 Current Year (2000) Inventory Changes

The changes in the current year point source emission inventories included:

- using actual 2000 emissions data for sources in North Carolina when available,
- corrections to Alabama and Illinois emissions modeling files to remove duplicate sources, and
- inclusion of dropped Continuous Emission Monitoring (CEM) emissions data.

The current year mobile source emission inventory was changed to correct:

- the vehicle miles traveled data in South Carolina,
- the vehicle age distribution that was used in North Carolina,
- the mobile input files for North Carolina so that the modeled temperatures were used to calculate the emission factors.

The current year nonroad mobile source emission inventory was changed to reflect changes in EPA's NONROAD mobile model. The NONROAD mobile model was re-run for all counties within the 36-km modeling domain. The changes to the inventory were minor, but NCDAQ wanted to use the most recent data available for this modeling project. There were no changes made to the current year area source or biogenic source emission inventories.

5.1.2 Attainment Year (2007) Inventory Changes

The changes in the 2007 attainment year point source emission inventories included:

- growing the North Carolina 2000 emissions data to 2007,
- correction of stack temperatures in the North Carolina emission files,
- using the latest North Carolina utility emissions according to the Clean Smokestacks Act compliance plan update,
- corrections to Alabama and Illinois emissions modeling files to remove duplicate sources,
- growing the other States non-utility current year emissions to 2007 via EGAS growth factors, and
- using the Clear Skies modeling emission files for the other States' utilities.

The 2007 attainment year mobile source emission inventory was changed to correct:

- the vehicle age distribution that was used in North Carolina,
- the mobile input files for North Carolina so that the modeled temperatures were used to calculate the emission factors.

The 2007 attainment year nonroad mobile source emission inventory was changed to reflect updates in EPA's NONROAD mobile model. The NONROAD mobile model was re-run for all counties within the 36-km modeling domain. Again, the changes to the inventory were minor, but NCDAQ wanted to use the most recent data available for this modeling project. Also, the airport projection factors were updated for the three major airports in North Carolina (Charlotte/Douglas, Raleigh/Durham, and Piedmont Triad International Airports) as well as the airport in Forsyth County. The updated projection information was obtained from the Federal Aviation Administration (FAA).

For area sources, the 2007 attainment year inventory was changed to apply North Carolina's open burning rule, and apply federal control strategies expected to be in place by 2007. There were no changes made to the biogenic source emission inventory.

5.2 Attainment Test Introduction

The modeled attainment test is the practice of using air quality modeling results for current and future years to determine if an area is expected to attain the NAAQS. For the 8-hour ozone NAAQS, the current and future model estimates are used in a "relative" rather than "absolute" sense. Specifically, the ratio of the air quality model's future to current predictions is calculated at each ozone monitoring site. These monitoring site-specific ratios are called relative reduction factors (RRFs). Future ozone design values (DVFs) are then estimated at each monitor by multiplying the monitor-specific current ozone design value (DVC) by the modeled relative reduction factor for each monitor. If all of the predicted monitor-specific DVFs in a given area are less than or equal to 0.084 ppm, the attainment test is passed and the area is said to demonstrate attainment. Equation 5.2-1 presents the modeled attainment test, applied at monitoring site "x" as described in Section 3.0 of the USEPA's Draft 8-hour Ozone Guidance.

$$(DVF) = (RRF) \times (DVC) \qquad \text{Equation 5.2-1}$$

Where (DVC) = the current design value monitored at site "x", ppm
= the higher of: (a) the 3-yr period straddling the year represented by the most recent available emission inventory (99-01), or (b) the 3-year period used to designate an area "nonattainment" (01-03).

(RRF) = the ratio of the future 8-hr daily maximum concentration predicted "nearby" a monitor (averaged over each day of the episode) to the current 8-hr daily maximum concentration predicted "nearby" the monitor (averaged over each day of the episode).

(DVF) = the estimated future design value, ppm.

It is important to consider an array of cells "nearby" a monitor rather than focusing on the individual cell containing the monitor. This allows for variations in the model performance where the peak ozone may not occur in the grid cell that contains the monitor but rather nearby the monitor.

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 5.2-2).

$$\text{RRF} = \frac{\text{mean future yr. 8-hr daily max "near" monitor "x"}}{\text{mean current yr. 8-hr daily max "near" monitor "x"}} \qquad \text{Equation 5.2-2}$$

The DVC, for purposes of the modeled attainment test, is defined in the USEPA's Draft 8-hour Ozone Guidance as the higher of the average 4th highest value for the 3-yr period used to designate an area "nonattainment" or the average 4th highest value for the 3-yr period straddling the year represented by the most recent available emissions inventory. In this modeling demonstration, the DVC used to designate an area nonattainment was based on data for 2001-2003 and since the current year (2000) inventory is the most recent emission inventory, the DVC straddling this was based on data for 1999-2001. Both DVCs are listed in Table 5.3-1 for each ozone monitoring site in each of the respective EAC regions, however, only the higher of these two values is the DVC used in the attainment test.

5.3 Attainment Test Results

As stated above, the attainment test is not based on absolute modeling results but rather relative reductions of ozone and is only applied at the monitors. However, reviewing the modeling results of how the predicted ozone decreases in the future years and how wide spread the reductions are plays an import role for the State in determining if additional controls should be considered. The modeling results for each day used in the relative reduction factor calculations are available in Appendix M. Additionally, discussions about how this modeling demonstration meets the screening test for areas away from the monitoring sites and additional matrices performed to support the attainment test results are in Appendix N.

For one of the monitors in the Mountain Area, Purchase Knob, the monitor does not fall within the 4-km modeling domain. Therefore, it was necessary to use a relative reduction factor (RRF) calculated from the 12-km modeling results. NCDAQ compared the differences between the RRF calculated using 4-km modeling data versus 12-km modeling data for the monitors within the 4-km domain to assess the impact of horizontal grid resolution. The results showed no significant impacts on the RRF. Appendix P contains the full discussion of the analysis of grid resolution on relative reduction factors for 8-hour ozone.

Table 5.3-1 lists the attainment test results by EAC area. The first column is the monitoring site, followed by the two current design values discussed in Section 5.2. The bolded DVC is the value used for the test. The next series of columns are the calculated relative reduction factor and the resulting future design value (DVF) for each of the future years, i.e., the attainment year

2007 and the two maintenance years 2012 and 2017. The orange colored design values are values above the 8-hour ozone NAAQS. As you can see, all of the monitors in the EAC areas attain the NAAQS by 2007 and continue to maintain the standard 5 and 10 years beyond the attainment year.

Table 5.3-1 Attainment Test Results

Monitoring Site	DVC (ppm)		2007		2012		2017	
	1999-2001	2001-2003	RRF	DVF (ppm)	RRF	DVF (ppm)	RRF	DVF (ppm)
Fayetteville EAC Area								
Wade	**0.088**	0.086	0.890	0.078	0.830	0.073	0.790	0.069
Golfview	0.086	**0.087**	0.890	0.077	0.830	0.072	0.790	0.068
Mountain EAC Area								
Fry Pan	**0.087**	0.082	0.890	0.077	0.850	0.073	0.840	0.073
Purchase Knob	**0.087**	0.085	0.870	0.075	0.810	0.070	0.780	0.067
Bent Creek	**0.083**	0.078	0.900	0.074	0.840	0.069	0.820	0.068
Waynesville	**0.080**	0.079	0.890	0.071	0.840	0.067	0.820	0.065
Triad EAC Area								
Cooleemee	**0.096**	0.093	0.870	0.083	0.830	0.079	0.790	0.075
Hattie Ave.	**0.094**	0.093	0.860	0.080	0.800	0.075	0.760	0.071
Union Cross	**0.093**	0.089	0.850	0.079	0.790	0.073	0.760	0.070
Bethany	0.085	**0.091**	0.840	0.076	0.790	0.071	0.780	0.070
Cherry Grove	**0.090**	0.088	0.850	0.076	0.800	0.072	0.770	0.069
McLeansville	**0.090**	0.089	0.850	0.076	0.790	0.071	0.760	0.068
Shiloh Church	**0.089**	0.088	0.860	0.076	0.810	0.072	0.770	0.068
Sophia	-----	**0.085**	0.850	0.072	0.790	0.067	0.760	0.064
Pollirosa	0.082	**0.082**	0.850	0.069	0.800	0.065	0.770	0.063
Unifour EAC Area								
Taylorsville	0.087	**0.088**	0.860	0.075	0.790	0.069	0.770	0.067
Lenoir/Caldwell Co	**0.087**	0.084	0.850	0.073	0.790	0.068	0.770	0.066

Shaded area represents data from the 12-km grid modeling domain since the monitor is not within the 4-km grid modeling domain.

5.4 Supporting Evidence

The modeling results clearly show reductions in expected future year ozone levels, although one monitor is close to the standard. However, the majority local EAC control measures were not included in the modeling. These expected emission reductions further support the conclusion

that the EAC areas will attain and maintain the 8-hour ozone standard in the future. A few examples of these expected emission reductions not modeled are summarized in Table 5.4-1.

Table 5.4-1 Estimated Emission Reductions from EAC Strategies.

Strategy	Estimated Reduction	
	NOx (tons/year)	VOC (tons/year)
Triad EAC		
Increase ridership on municipal and regional bus service	3.5	5.0
Create new Park and Ride lots	3.2	1.6
Expand PART ride sharing & vanpooling	0.7	0.7
Expand carpooling	19.0	23.2
Diesel retrofits on school buses	23.0	17.0
Diesel retrofits on other vehicles	10.0	7.0
Truck Stop Electrification	35.0	1.8
Duke Energy Anti-Idling Policy	0.7	-----
Increase use of Biodiesel	2% increase	30% reduction
Cumberland County EAC		
Landfill harvesting methane and selling energy	5.0	
Retrofitting Diesel School Buses		~42% reduction
Unifour EAC		
Expanded Public Transportation	0.4	0.5
Compressed Work Weeks	1.3	1.5
Regional Bicycle & Pedestrian Plan	1.6	2.0
Cith & County Energy Plan	0.4	0.5

5.5 Data Access

The modeling input and output files are very large and it would not be reasonable to submit all of these files with the SIP attainment demonstration. These include all files used to process the emissions, meteorology and air quality models and any other files used to develop the modeling. To request access to these files please contact the Division of Air Quality, Attainment Planning Branch Chief at 919.733.3340.

6.0 MAINTENANCE PLAN

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

The following section describes the commitments by North Carolina for the EAC maintenance plan, it update in 2015, annual tracking of both stationary and mobile sources and a continuing planning process under the Early Action Compact. These commitments are in force unless the 8-hour ozone standard is revoked in the future. North Carolina believes that would happen only in the event that the USEPA revises or revokes the current 8-hour ozone standard of 0.08 parts per million.

6.1 Section 175A Maintenance Plan Requirement

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

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

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

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

Section 175A also requires contingency provisions:

> *Each plan revision submitted under this section shall contain such contingency provisions as the Administrator deems necessary to assure that the State will promptly correct any violation of the Standard which occurs after the redesignation of the area as an attainment area. Such provisions shall include a requirement that the State will implement all measures with respect to the control of the air pollutant concerned which were contained in the State implementation plan for the area before redesignation of the area as an attainment area.*

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

NCDAQ believes this process and schedule are consistent with the requirements and intent of Section 175A of the Clean Air Act.

6.2 Annual Tracking for Growth

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

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

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

6.2.1 Stationary Point Sources

Annual Analysis

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

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

Action Trigger:

If the actual stationary source NOx **emissions** are greater than 10 percent higher than those emissions used in the modeling analysis either for an individual county or for the entire area and

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

6.2.2 Highway Mobile Sources

Annual Analysis

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

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

Action Trigger:

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

effective as soon as practicable, but no later than one year of the finding that emissions growth or growth rates were exceeding those used in the air quality modeling analyses.

6.3 Air Quality Analysis

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

- Design Value Trends – Most recent design values (3 year average of the 4th highest 8-hour ozone average), compared to the trend in design values from the 1994-1996 timeframe to present.

- 8-Hour Ozone Exceedances – Number of exceedances of the 8-hour ozone standard at each monitor in the EAC areas for the most recent ozone season, compared to the number of exceedances at each monitor from 1994 to present.

- 1-Hour Ozone Design Value Trends – Most recent 1-hour ozone design values compared to the trend in 1-hour ozone design values from the 1994-1996 timeframe to present.

- 4th Highest Value Trends – 4th Highest 1-hour ozone value compared to the 4th highest 1-hour ozone value from 1994 to present.

- 1-Hour Ozone Exceedances – Number of exceedances of the 1-hour ozone standard at each monitor in the EAC areas for the most recent ozone season, compared to the number of exceedances at each monitor from 1994 to present.

- Weather Patterns – Discussion of weather patterns and climatology in most recent ozone season.

6.4 Continuing Planning Process

In addition, the EAC protocol also requires a continuing planning process, including modeling updates and modeling assumption verification. Since the larger source sectors for NOx emissions will be covered in the annual stationary point source and highway mobile source evaluation discussed above, NCDAQ proposes to evaluate in 2008 whether a full modeling update is needed for the EAC areas. At this point, DAQ will use the full emission inventories submitted as part of the CERR process. All emissions will have been inventoried in 2007 for calendar year 2005. These emissions will be used to evaluate whether a full modeling update is needed. These emissions can also be used to determine if a particular source sector is growing a higher growth rate than previously forecast, and if so, whether contingency measures should be adopted to be implemented in the event the sector began causing 8-hour ozone standard violations. The State may conduct any of the above analyses and reviews on a combined area basis as appropriate to utilize resources more effectively.

6.5 General Timeline

- December 2004 – DAQ submits EAC SIP, covering both attainment date of 2007 and first 10-year maintenance period through 2017
- December 2005 – DAQ and EAC areas implement EAC measures
- December 2005 – First annual tracking report is submitted for each EAC area
- December 2006 – Second annual tracking report is submitted for each EAC area
- December 2007 – Attainment date
- December 2007 – Third annual tracking report is submitted for each EAC area
- April 2008 – EPA designates area for the 8-hour ozone standard
- December 2008 – DAQ completes evaluation of new emissions data and determines whether revised modeling analysis is required
- December 2008 – Fourth annual tracking report is submitted for each EAC area and continues for each year thereafter through the end of the maintenance period.
- January 2013 – DAQ begins work on 10-year maintenance plan update
- December 2015 – DAQ submits 10-year maintenance plan update
- December 2027 – 20 year maintenance plan and annual tracking for growth concludes

7.0 STATE IMPLEMENTATION PLAN APPROVAL

7.1 Introduction

For an area to have an approved maintenance plan, the State must submit a revision to the maintenance plan within 8 years of the original redesignation to attainment. The SIP revision must include evidence of compliance with the rules relied on to show maintenance of the standard. This section provides the evidence of compliance with such rules for the North Carolina 1-hour ozone maintenance areas.

7.2 Evidence Of Compliance

The EAC areas have not been required to make SIP revisions, since they have not been designated nonattainment for ozone prior to the 1990 CAA. Therefore, North Carolina has fully approved SIPs for these areas. However, the following rules regulating emissions of volatile organic compounds and emissions of nitrogen oxides in North Carolina have been approved, or have been submitted with a request to be approved, as part of the SIP:

15A NCAC 2D .0958, Work Practices For Sources of Volatile Organic Compounds,
15A NCAC 2D .0530, Prevention of Significant Deterioration,
15A NCAC 2D .0925, Petroleum Liquid Storage in Fixed Roof Tanks,
15A NCAC 2D .0926, Bulk Gasoline Plants,
15A NCAC 2D .0927, Bulk Gasoline Terminals,
15A NCAC 2D .0928, Gasoline Service Stations Stage I,
15A NCAC 2D .0932, Gasoline Truck Tanks and Vapor Collection Systems,
15A NCAC 2D .0933 Petroleum Liquid Storage in External Floating Roof Tanks
15A NCAC 2D .1000, Motor Vehicle Emission Control Standards.
15A NCAC 2D .1409(b), Stationary Internal Combustion Engines
15A NCAC 2D .1416 - .1423, NOx SIP rules, and
15A NCAC 2D .1700, Municipal Solid Waste Landfills
15A NCAC 2D .1900, Open Burning

Although 15A NCAC 2D .0925, .0926, .0927, .0928, .0932, and .0933, have been approved as part of the state implementation plan, their applicability to these counties has not been submitted to USEPA for approval as part of the federally-approved state implementation plan. These rules are, however, state enforceable in these counties. The extension of these rules to these counties was part of the State's air toxic program and not part of any federally mandated program.

Another important set of rules that control volatile organic compound emissions in these counties is Section 15A NCAC 2D .1100, Control of Toxic Air Pollutants. These rules, however, have not been submitted to USEPA to be approved as part of the state implementation plan.

There are two other rules that control emissions of volatile organic compounds in these areas. They are 15A NCAC 2D .0524, New Source Performance Standards, and .2D.1110, National Emission Standards for Hazardous Air Pollutants. Also, rule 2D.1111, Maximum Achievable

Control Technology applies to control of emissions of volatile organic compounds. They are not part of the SIP, but the USEPA has delegated the State enforcement authority for standards that have been adopted by the State. (The standards adopted by the State are state-enforceable regardless of the USEPA delegation.)