Georgia's State Implementation Plan for the Atlanta Ozone Non-attainment Area

July 17, 2001

Incorporates original SIP Submittal of October 28, 1999 and all Subsequent Revisions

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State Implementation Plan For The Atlanta Ozone Non-attainment Area

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PUBLIC HEARING DATES

On October 28, 1999, the State Implementation Plan (SIP) for the Atlanta 1-Hour Ozone Nonattainment Area was submitted to the U.S. EPA. Since then, several revisions have also been submitted to the U.S. EPA. The subsequent SIP submittals included either new or revisions to existing Sections/Tables/Figures/Appendices of the Atlanta Ozone Attainment SIP. While each SIP revision has been subject to public participation (a thirty-day public comment period culminating in a public hearing), it has become increasingly difficult to correlate the updated Sections/Tables/Figures/Appendices of the SIP to specific public hearings. Below is an outline of all the Sections, Tables, Figures and Appendices and the corresponding public hearing dates for the current versions.

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III	Protocol For A Comparison Of The UAM-IV And UAM-V Models	09-08-1999

Appendix Number	Appendix Heading	Date of Public Hearing
IV	September 15, 1994 EPA Letter	09-08-1999
V	Overview Of Updated Isoprene Chemistry Mechanism In UAM-V Model	09-08-1999
VI	Comparison Of The UAM-IV And UAM-V Photochemical Models For Three Atlanta Area Ozone Episodes	09-08-1999
VII	1987, 1988 And 2003 Vehicle Miles Traveled, And MOBILE 5 Input	09-08-1999
VIII	Collection Of Research Papers Related To Modeling Of Biogenic Isoprene	09-08-1999
IX	Memorandum Describing Revision Of Meteorological Input Files For 1987 And 1988 Modeled Episodes	09-08-1999
X	Application Of SAI Mesoscale Model To Atlanta Modeling Domain	09-08-1999
XI	Sub-Regional Photochemical Modeling Analysis For Atlanta, Birmingham, And Eastern Gulf Coast Area	09-08-1999
XII	Guidance On Use Of Modeled Results To Demonstrate Attainment Of The Ozone NAAQS	09-08-1999
XIII	December 23, 1997 EPA Letter	09-08-1999
XIV	Improved Air Quality In Atlanta During The 1996 Olympic Summer Games	09-08-1999
XV	15% Plan Controls	09-08-1999
XVI	9% Plan Controls	09-08-1999
XVII*	Revised Air Quality Rules	
XVIII	Utility Rule	09-08-1999
XIX	Permit Conditions For Austell Box Board, Blue Circle Cement, and Transcontinental Pipeline	09-08-1999
XX	RACT Determination Methods	09-08-1999
XXI*	Revised I/M Rules	
XXII	PSG Options List	09-08-1999
XXIII	PSG Operating Plan	09-08-1999
XXIV	PSG Governor Actions	09-08-1999
XXV	Description Of PSG	06-28-2001
XXVI	PSG Program Effectiveness Report	06-28-2001
XXVII	OTAG Executive Report, 1997	09-08-1999
XXVIII	2001 SCAT Proposed Measurement Scope	06-28-2001
XXIX	2004 Hartsfield International Airport Emissions Inventory	06-28-2001
XXX	Fuel Rule Commitment Letter	07-12-2000
XXXI	2004 MVEB	06-28-2001
XXXII	1999 Ozone Season PSG Program Effectiveness Report	06-28-2001
XXXIII	FY2000 CMAQ Annual Report	06-28-2001

*The Air Quality Rules and Enhanced Inspection and Maintenance Rules were subject to several different public hearing dates, as follows:

Air Quality Rules: July 7, 1999, September 8, 1999, January 20, 2000, May 18, 2000, July 12, 2000, November 29, 2000, and June 6, 2001.

Enhanced I/M Rules: July 7, 1999, September 8, 1999, November 17, 1999, November 29, 2000, February 21, 2001, and June 6, 2001.

1. INTRODUCTION

1.1 Ozone and the National Ambient Air Quality Standard

Ozone is a highly reactive pollutant formed in the air by a series of complex reactions involving precursor compounds, mainly nitrogen oxides (NO_x) and volatile organic compounds (VOC). These reactions require the presence of intense sunlight. Therefore, the hot, stagnant weather conditions of summer are when ozone is a problem. For the Atlanta area this period is usually June, July and August.

The precursor chemicals- NO_x and VOC - are both produced by human activity, but natural processes account for a large portion of the VOC. Based on the 1990 emissions inventory, vegetation (biogenic emissions) accounts for at least 60% of all VOC emissions in the 13 county non-attainment area. Human activities that contribute heavily to both VOC and NO_x emissions include many industrial and manufacturing operations, combustion processes, off-road activities including boating and lawn care, and vehicle usage.

The national ambient air quality standard (NAAQS) for ozone is based on the expected number of days per year with a one hour concentration of 0.12 ppm (parts per million) or greater. For an area to achieve attainment the average number of days above the standard within that area must be equal to or less than one (1), for three (3) consecutive years. This means that if an ozone monitoring site measures four (4) days above standard in a year, that site will be in violation even if no readings above standard are measured during the next two (2) years. The area in which that monitor is located is considered to be non-attainment. The severity or magnitude of the exceedance is determined by the amount that the measurement is above 0.12 ppm.

The area in which the measurement is made is classified by the magnitude of the ozone. Five (5) classifications of non- attainment for the one-hour ozone standard are specified in the 1990 Clean Air Act Amendments (CAAA) - Marginal, Moderate, Serious, Severe, and Extreme. Historical metro Atlanta monitoring data is shown in Figure 1-1.

1.2 Atlanta Non-attainment Status

The non-attainment classification status of Atlanta and other areas of the country was based on ozone air sampling measurements made during 1987-1989. The CAAA contained a requirement that the most recent three years of data be used in deciding the attainment status of an area. EPA determined that at the time of Act adoption this three-year period was the most current data available. The ozone air sampling network from which these measurements were gathered consisted of five (5) sites and is shown on the attached map (Figure 1-2). This map also shows the outline of the 13 county Atlanta ozone non-attainment area.

Since then the monitoring network has been modified, as shown on the attached map (Figure 1-3) and detailed in Table 1-1. Meteorological sites are detailed in Table 1-2.

From these three years of data it was determined that Atlanta should be classified as a Serious non-attainment area.

1.3 Non-attainment Boundaries

Draft guidance issued by EPA in October, 1990 specified that ozone e non-attainment areas classified as Serious or above would be automatically revised to be the entire MSA (Metropolitan Statistical Area, which for Atlanta at that time included a total of 18 counties) unless the state could demonstrate that such action would not be appropriate.

In establishing the 13 county non-attainment area (Figure 1-2), three main criteria were used to determine if certain counties should be included or excluded for non-attainment purposes. These criteria included: 1) population density, urbanization, commuting patterns, population increases, etc, 2) the emission density of stationary sources and the density of mobile sources expressed as VMT (vehicle miles traveled), and 3) meteorological factors, biogenic (natural) vs. anthropogenic (man-made) emissions and physical boundaries that may influence movement of precursor pollutants. EPA guidance was used in making these evaluations and after careful consideration five of these counties were removed from non-attainment designation. The five removed were Barrow, Walton, Newton, Butts, and Spalding.

The Atlanta ozone non-attainment area consists of the following counties: Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale.

The Atlanta metropolitan statistical area currently consists of the counties listed above, as well as the following seven counties: Barrow, Bartow, Carroll, Newton, Pickens, Spalding, and Walton.

1.4 Ozone Attainment State Implementation Plan

Atlanta's designation as a serious ozone non-attainment area requires EPD to demonstrate attainment of the ozone NAAQS through photochemical grid modeling or some other equivalent. Through this modeling effort, control strategies are to be adopted that would be adequate to meet the federal ozone standard by no later than November 1999.

In accordance with the CAAA, serious ozone non-attainment areas like the metro-Atlanta area were required to submit a revised State Implementation Plan (SIP) for ozone by November 15, 1994 that demonstrated attainment by 1999. Georgia EPD attempted to develop such an attainment plan, but was unable to do so by that date.

At that time, the following conclusions and observations regarding this inability to show attainment were made:

a. The required use of worst-case weather conditions experienced in 1987 and 1988 to show future-year attainment probably was inappropriate using the Urban Airshed Model (UAM), the selected photochemical grid model. These weather conditions were highly unusual in

degree and temporal extent and occur very infrequently (the worst ozone levels since 1974). Using such non-representative and worst-case conditions to develop control strategies could result in unnecessarily harsh regulatory requirements without the ability to evaluate other factors in the modeling analysis.

b. All modeling scenarios run to this point showed the UAM ozone concentrations were unexpectedly high even with significant emission reductions. This was noticed initially when it was shown that even reductions in all ozone precursor emissions of up to 66% beyond planned controls had little positive effect on ozone concentrations, and in some cases 33% reduction in NO_x theoretically resulted in ozone increases.

c. Ozone formation appeared to be primarily weather driven. Obviously, precursors have to be present to produce ozone, but modeled projections were relatively insensitive to reductions compared to meteorological factors, as discussed in b. above.

d. Based upon ozone measurements upwind of Atlanta during certain days of violation of the standard, and the best information available for UAM computer modeling, it appeared that ozone and reactive precursors coming into the Atlanta 13-county area were often significant - sometimes over half of the current allowable ozone standard concentration. Therefore, transport from upwind emission sources appeared to be significant under certain relatively stagnant weather conditions. These are the conditions that normally produce the highest ozone.

It was uncertain as to the degree of contribution of upwind sources and where they may be located. This more broad or regional type of analysis was actively considered and discussed between EPA and various States with ozone problems.

In 1995, other states in the eastern U.S. also failed to submit necessary attainment plans by November 1994. Georgia began work with EPA, 36 other states, and stakeholders in a consortium known as the Ozone Transport Assessment Group (OTAG) to study the issue of transported ozone and ozone precursors. For about two years, OTAG evaluated air monitoring data, performed extensive photochemical grid modeling, and developed possible VOC and NO_x control strategies which could be recommended to EPA as ways to address the common problem of transported air pollution.

OTAG completed its work in June 1997, from which the following conclusions were made:

- The southeast appears to be meteorologically decoupled from the midwest and northeast, indicating little transport either way to and from the southeast.

- There does appear to be significant interstate transport, including within the southeast.

- Reductions of VOC and NO_x in urban areas has an impact on ozone reduction within those areas.

- Reductions in NO_x emissions in rural areas can have a significant impact on urban areas longer distances away.

Given the need to allow the OTAG process to advance the quality and reliability of the science of predicting ozone, and to evaluate interstate transport of ozone and ozone precursors, EPA moved the required submittal date for revised Attainment SIPs until April 1998. The State of Georgia submitted the revised Attainment SIP at that time. EPD's analysis indicated that Atlanta would not attain the ozone standard by 1999. However, the model did predict that emission reductions due to the proposed NOx SIP call coupled with other measures would result in attainment of the ozone standard. This modeling analysis was submitted in the SIP along with the three emission reduction measures that could be implemented immediately. These new emission reduction measures were:

- New rules regulating the type of gasoline sold in 43 counties in and around metro-Atlanta during the ozone season. This measure would have reduced NO_x emissions by 16.7 tons per day. (The area was eventually reduced to 25 counties due to distribution issues).

- Modifications at Georgia Power Plants Yates and McDonough (both located within the 13-county non-attainment areas), for seasonal application of natural gas technologies, reducing NO_x emissions by an average of 25.90 tons per day; and

- A Voluntary Ozone Action Program (VOAP) to be put in place to obtain voluntary actions from local businesses, governments, schools, universities and the general public which will reduce VOC and NO_x emissions during episodes of expected high ozone concentrations.

Building on the recommendations of OTAG, EPA issued the final NO_x SIP call in September of 1998. The NO_x SIP call requires Georgia, 21 other States, and the District of Columbia to submit SIPs that reduce emissions of NOx to address the transport of ozone. The NO_x SIP call will reduce total summertime emissions of NO_x by about 28% (1.2 million tons) beginning in the year 2003 in the aforementioned area.

The SIP submitted today replaces the April 1998 submittal of a plan to attain the 1-hour standard. It incorporates the measures outlined in the final NO_x SIP call with all other measures required to attain the standard. Because of the impact of NO_x from upwind states, this SIP also contains a request to revise the attainment date for Atlanta to 2003 [See Appendix I], while demonstrating the "but for ozone transport" case for this 2003 attainment date. This request fully complies with EPA guidance regarding the extension of the attainment date.

1.5 Additional 1990 CAAA Requirements

The CAAA required serious ozone non-attainment areas such as Atlanta to develop and submit 15% Rate of Progress Plans (15% Plan) which would provide for at least 15% reductions of VOC from 1990 to 1996, and Post-1996 Rate of Progress Plans, which would provide for at least 3% per year reductions of either VOC or NO_x annually for 1997, 1998 and 1999 (9% Plan). Georgia submitted its 15% Plan and its 9% Plan to EPA for approval on November 15, 1993 and November 15, 1994, respectively. Revisions to both were last submitted to EPA on June 17, 1996. All of the regulatory activities in these plans have been implemented.

1.6 Metropolitan Atlanta

Atlanta is one of the fastest growing regions in the United States, if not the world, in terms of economic expansion, population increase, residential construction, and almost every other kind of growth. This expansion, which has been going on for more than a decade, shows no signs of abatement. Any plan designed to address air pollution in the Atlanta area, in order to be taken seriously, must consider Atlanta's continued growth beyond the present 13-county 1-hour non-attainment area, and therefore, emission sources inside *and* outside the non-attainment area.

1.6.1 Population Growth

Atlanta has attracted more people since 1990 than any other metropolitan area except Los Angeles. Three of the ten fasting growing counties in the United States (Forsyth, Henry, Paulding) are found in the Atlanta metropolitan area. The Bank of America reported in 1997 that "strong in-migration has pushed population growth to about three times the national average in the 1990s." See Table 1-3, "Atlanta MSA Population and Growth Rates.

A number of factors, including job opportunity, an excellent climate, high wages, and relatively low-cost suburbs have contributed to this steadily increasing population. The growth is expected to continue. *Money* magazine's 1998 ranking of best cities in which to live ranked Atlanta 6th; *Fortune* magazine's 1998 ranking of best places in which to do business ranked Atlanta 7th. In fact, "with a diverse economy, affordable housing, and above average per capita income, Atlanta is well-positioned to remain one of the nation's fastest growing metro areas well into the next century."

1.6.2 Housing Growth

Housing is another hot area of growth for Atlanta. The Atlanta region issued 326,159 permits for new homes in 1998, more than any other census region in the nation, except for Los Angeles and the Washington-Baltimore area. According to the Atlanta Journal: "Metro Atlanta has the hottest housing market in the region, which happens to be the fastest-growing region in the country, which happens to have the strongest economy in the world. In terms of growth, it really doesn't get any better than this."

Housing growth is good for the economy, but it obviously reflects population growth as well. With a population increase has come development, housing, and economic success, but also traffic congestion and air pollution. These problems range, however, over a very wide geographical area.

1.6.3 Vehicular Mileage Growth

Atlanta has always had a love affair with transportation. It began its existence as a rail hub (and was probably named for the Atlantic Railroad). The rail industry is not quite as prominent as it was one hundred years ago, but Atlanta's airport, Hartsfield International, is now the busiest in the world. Atlanta grew up with the advent of the automobile and the two-car garage. Consequently, Atlanta has far less in-town residents compared with older cities. See Table 1-4 for a comparison of Atlanta with older/other U.S. cities based on city population vs. MSA population. The resulting Atlantan culture includes a people that are accustomed to living in the suburbs and driving relatively long distances to work.

Atlanta is also a service-oriented city. In the 13-county non-attainment area, 35% of the employee population is devoted to the service industry. This figure is above both the state and national level. Travel and the subsequent NO_x emissions precipitate from a need to deliver those services. Only 12% of the employee population is devoted to manufacturing, which is below both the state and national levels. See Table 1-5 for a breakdown of the non-attainment area, regional, state and national employee populations. Note that a substantial percentage of the Atlanta employee population is devoted to transportation, which obviously results in mobile emissions, but also the wholesale/retail trade, employments that rely to a large degree on the automobile.

Atlanta's mobile culture and service-oriented nature underlies the fact that Atlantans now travel more miles per day per capita than their counterparts in any other major metropolitan area in the U.S. - 33.96 miles per person per day (1997 data). The 13-county Atlanta area residents drive an estimated 110.4 million miles per day - a distance equal to a trip from the earth to the sun and part way back. This is an increase of 35.5% over 1990 total vehicular miles traveled. It's estimated that metro-Atlantans will be driving 171 million miles a day by 2020. The average commute time is 50.8 minutes (round-trip) , and that has grown by six minutes over the last 14 years. See Table 1-6 for Vehicular Miles Traveled (VMT) growth rates in the Atlanta MSA.

In fact, the same level of mobile NO_x emission densities (tons per year per square mile) found 20 years ago in the Atlanta area and contributing to its non-attainment status are now found in the counties surrounding it as well as the metropolitan statistical areas of Athens, Augusta, Chattanooga, Columbus, and Macon. This NO_x emission density sprawl is reflective of population and vehicular mileage increases in the area and indicates that the problem is spreading outward in the shape of a giant doughnut. See Figures 1-4 and 1-5 for a comparison of VMT densities.

It is not surprising that, compared to other non-attainment cities, Atlanta has relatively more emissions from mobile emissions and relatively less from stationary sources.

1.6.4 Urban Sprawl

The sheer size of the Atlanta area contributes to the amount of vehicular miles traveled, and therefore mobile NO_x emissions. Compared with other non-attainment areas of serious and above the Atlanta metropolitan area (currently 6,126 square miles) ranks 8th out of 22 in terms of square miles. See Table 1-7. Of the metropolitan areas outranking Atlanta - Dallas/Fort Worth, Phoenix, Philadelphia, Los Angeles, Chicago, Houston and New York - three of them have in-town resident percentage far higher than Atlanta, which again demonstrates that, given the land size of the Atlanta area and the great percentage of suburban dwellers, Atlantans travel tremendous distances each day to work.

The affordability of the suburbs and Atlanta's love affair with the car has resulted in a very decentralized population. Forty-five percent of Atlanta's population lives farther than 17 miles from the downtown area. In 1998, the Sierra Club's list of "most sprawl-threatened" places ranked Atlanta at the top. (Los Angeles was considered to be in a class of its own). Atlanta - bounded by neither mountains nor ocean on any side - is sprawling outward toward every point on the compass, unabated by any natural geographic boundary. The metropolitan area is 6,126 square miles.

1.6.5 Change in Population and Emission Densities

It is clear that any solution to Atlanta's smog problem must include controls within the area of this urban sprawl. A review of population growth information indicates that, just as with mobile NO_x emission densities, population and total VOC and NO_x emission densities found in the Atlanta Metropolitan Statistical Area (MSA) core are now of the same level in the counties surrounding the core and even the MSA itself. It can be concluded, therefore, that population and emission levels that previously led to violations of the ozone standard twenty years ago in the MSA core, will continue to contribute to that problem and eventually result in violations in those non-MSA counties if present development and growth patterns continue unchanged. See Figures 1-6 and 1-7 for a comparison of population densities. For sheer population growth from 1990 to 1998, see Figure 1-8. See Table 1-8 for County Comparison Factors.

1.6.6 Area of Significant Impact

The preceding discussion has shown that the Atlanta area is experiencing tremendous growth and urban sprawl; the conditions that are conducive to high ozone concentrations in the original Atlanta non-attainment area are now found in counties surrounding that area, and even further outward. The emissions from these counties could affect ozone formation in the non-attainment area. The reduction of these emissions necessarily must be part of any strategy that has attainment of the ozone standard as its goal. However, before determining the extent of the area where reductions will be targeted, the following questions must be answered: 1) From how far away can pollutant emissions reach the Atlanta area?; 2) Of those emissions that reach the Atlanta area, which have a "significant impact" on the non-attainment area?; and 3) How is "significant impact" defined?

1.6.6.1 OTAG Findings

As previously stated, OTAG was established in early 1995 by EPA and the Environmental Council

of the States (ECOS), to assess transport, the process of ozone and its precursors traveling to areas downwind of their original sources. OTAG found that transport is especially significant in certain areas, including the "Northeast Corridor" (the area stretching from Washington, D.C. to Boston) and in portions of the Midwest. Transport distance appears to be somewhat less in the Southeast, although transport does occur.

Major findings of the OTAG's Air Quality Analyses Workgroup include the following:

A. Spatial and temporal scales of ozone transport, derived from various air quality analyses, range up to about 2 days and 500 miles and are typically longer than those derived from OTAG model results.

B. Ozone transport occurs in the OTAG domain on local, subregional, and regional scales. Local transport in the 30-150 mile range likely contributes most to ozone non-attainment. Subregional transport occurs over the 100-300 mile range, and regional transport can occur over the 300-500 mile range

C. High ozone levels in the southern portion of the OTAG domain are typically associated with stagnant transport conditions resulting in shorter transport scales than on average.

The key findings of the OTAG's Modeling and Assessment Subgroup are as follows:

A. Ozone reductions in a given region are most influenced by emissions reductions in the same region but are also influenced by emissions reductions in upwind regions.

B. There are several different scales of transport: inter-city, inter-state, and inter-regional Spatial scales are farther in the North than in the South.

See Appendix XXVII for a copy of OTAG's Executive Report, 1997.

OTAG has shown that ozone does indeed drift across state lines. While the OTAG modeling does not indicate that metro Atlanta's ozone problem is influenced by faraway states such as New York, Michigan and Ohio, it does show that, under certain conditions, ozone blows to and from Alabama, Tennessee, South Carolina and North Carolina.

Ozone (and its precursors) that drifts across state lines surely drifts across county lines. Add this fact to that of urban sprawl and it is obvious that the sources of ozone pre-cursors that impact the Atlanta area are not contained solely in the thirteen county non-attainment area or even the 20-county Metropolitan Statistical Area. It is reasonable to conclude that local transport occurs on some scale, if only on the low end of the 30-150 mile range determined by the OTAG Air Quality Analyses Workgroup.

1.6.6.2 Definition of Significant Impact

EPA has already established some levels of significant impact for pollutants other than ozone that

may serve as guideposts for our establishment of "significant impact" of ozone and ozone precursors. Under federal regulations regarding Prevention of Significant Deterioration, construction of a major source or major modification requires determination of the impact of the source's emissions on the surrounding area and whether the impact is significant. Significance levels are defined as follows:

Pollutant	Standard	Averaging Basis	Significant Level
NO_x	100 μg/m^3	Annual	1 μg/m^3
SO_2	80 μg/m^3 365 μg/m^3 1300 μg/m^3	Annual 24-hr 3-hr	1 μg/m^3 5 μg/m^3 25 μg/m^3
PM_{10}	50 μg/m^3 150 μg/m^3	Annual 24-hr	1 μg/m^3 5 μg/m^3

Therefore, a contribution of 5 μg/m^3 or greater of either NO_x or VOC to the Atlanta non-attainment area on a 1-hr averaging basis conservatively constitutes "significant impact".

1.6.6.3 Determination of Significant Impact Area

There are several types of models by which pollutant concentrations downwind from an emission source may be predicted. In general, EPD assesses the atmospheric impact of a source through the use of mathematical dispersion models. The models are based upon the assumption that the dispersion of pollutants is primarily a function of: wind speed and direction; atmospheric stability conditions; and the effective point of discharge of the exhaust plume (the plume height). To predict ambient air concentrations, the models simulate the plume exhausting from the stack, rising a certain distance in the atmosphere, leveling off and continuing downwind over relatively flat terrain. The concentrations of pollutants are assumed to have a Gaussian distribution about the longitudinal centerline of the plume. This type of model does not assume any photochemical reaction of NO_x or VOC to form ozone.

EPD used dispersion modeling to determine the maximum distance at which a generic source would have a significant impact on the Atlanta non-attainment area. EPD modeled three generic cases using the U.S. EPA screening guideline model SCREEN3. Case 1 is based on a typical 75 million Btu/hour boiler with assumed NO_x emissions of 100 ton/year. Case 2 addresses the downwind impacts from a large power plant. Case 3 is an area source of 1 km by 1 km with NO_x emissions of 50 ton/year (representing, for example, vehicle emissions over a congested area). A hypothetical range of meteorological conditions was modeled to produce conservative worst-case one-hour downwind concentration from a continuous release. Release heights varied from near ground level for the area source, to 100 feet for the small boiler, and 1000 feet for the large power plant.

See Figures 1- 9, 1-10, and 1-11 for concentration profiles for these three generic cases. These plots

suggests that maximum concentrations are reached in a short distance downwind, and then the concentrations decrease -- rapidly at first, then more slowly until at a distance downwind the decrease in concentrations is very gradual as indicated by a flat curve. The distance at which concentrations fall under the significance level of 5.0 $\mu g/m^3$ for the 100 tpy NO_x source is 20 miles. The concentrations for the power plant and the area source are determined to be 29.1 and 6.25 $\mu g/m^3$, respectively, even at distances of 30 miles. A major source that emits NO_x or VOC within 20 miles of the non-attainment area is considered to have a significant impact in the Atlanta non-attainment area.

The counties that have at least a portion of their area within the 20-mile range of the non-attainment area are as follows:

Banks, Barrow, Bartow, Butts, Carroll, Clarke, Dawson, Floyd, Gilmer, Gordon, Hall, Haralson, Heard, Jackson, Jasper, Lamar, Lumpkin, Meriwether, Monroe, Morgan, Murray, Newton, Oconee, Pickens, Pike, Polk, Spalding, Troup, Upson, and Walton. See Figure 1-12 for a map of this area with prevailing wind directions.

Additional consideration was given to meteorological conditions and prevailing wind patterns. In the summer, winds in the Atlanta area can prevail from any direction, but they most frequently prevail from the Northwest, East, and Southeast. Conversely, winds seldom come from the North, Northeast, or Southwest. Therefore, the EPD has added counties to the area of significant impact that lie in the direction of the most frequent prevailing wind directions: Chattooga, Jones, Madison, and Putnum. These counties are extremely close to the 20-mile border and are oriented in a prevailing wind corridor. Oglethorpe and Greene counties are in the same prevailing wind corridor but are farther away from the 20-mile border. Of the counties outside the 20-mile range considered for inclusion, these counties had the lowest population densities. The EPD removed Fannin, Murray, Gilmer, and White counties from the area of influence because they are not in a prevailing wind corridor and much of the county lies outside the 20-mile range.

2. ATTAINMENT DEMONSTRATION METHODS AND INPUTS

2.1 Analysis Method

The Urban Airshed Model (UAM) is ideally suited for the evaluation of the effects of emission control scenarios on urban air quality because the UAM accounts for spatial and temporal variations as well as differences in reactivity (speciation) of emissions. This is accomplished by first replicating a historical ozone episode to establish a base case simulation. Model inputs are prepared from observed meteorological, emission, and air quality data for a particular day or days. The model is then run with these inputs and the results are evaluated to determine its performance. Once the model results have been evaluated and determined to perform within prescribed levels, the same meteorological inputs and a projected emission inventory can be used to simulate possible future emission scenarios. Therefore the model will calculate hourly ozone patterns likely to occur under the same meteorological conditions as the base case.

Using the UAM model, possible combinations of VOC and NO_x emission control measures with corresponding emission reductions can be modeled to project the probable impact on ozone formation. Different combinations are modeled to develop the optimum set of control measures for ozone reduction.

2.2 Modeling Protocol

The UAM Modeling Protocol was written by EPD to formally establish the methodology to be used in applying photochemical grid models to support the attainment demonstration described in the **Guideline for Regulatory Application of the Urban Airshed Model**. This protocol was submitted to EPA Region IV on February 3, 1994 and approved for use on February 23, 1994. A copy of this protocol is included in this document as Appendix II

A second Protocol was written to allow the EPD to consider the merits of using a newer version of the Urban Airshed Model than the regulatory version currently approved by EPA. This model is known as UAM-V and has scientific improvements such as variable two-way nesting grids; three-dimensional inputs for temperature, water vapor, pressure, photolysis rates, horizontal diffusivities and vertical turbulent exchange coefficients; updated dry deposition; and a plume-in-grid (P-i-G) algorithm. A model comparison procedure was developed and sent to the EPA on February 11, 1994. The specific techniques and steps being used in the comparison of the two versions of the UAM were set forth in a separate document entitled, "Protocol for a Comparison of the UAM-IV and UAM-V Models." This Protocol was approved for use on April 11, 1994. A copy of this Protocol is included in Appendix III. Since that time much work has gone on utilizing a certain version of UAM-V, specifically Version 1.24 which includes both an update to photochemical chemistry and a streamlining of the program to speed execution. This version was used extensively in the Ozone Transport Assessment Group's (OTAG) study of regional ozone transport.

2.2.1 UAM-IV Used in Past Modeling

The current regulatory version of the UAM is UAM-IV, Version 6.2, which incorporates an earlier version of the Carbon-Bond Mechanism and modifications that have been made to the model since its release in 1990. This model or series of programs was used prior to the fall of 1995 for analysis of the Atlanta Ozone SIP and was run on a Hewlett Packard Model 735 Unix Workstation. Both UAM-IV and UAM-V are three-dimensional photochemical grid models programmed to calculate the concentrations of both inert and chemically reactive pollutants by simulating the physical and chemical processes in the atmosphere that affect pollutant concentrations. The atmospheric diffusion or species continuity equation is the basis for UAM-IV and UAM-V. This equation represents a mass balance in which all of the relevant emissions, transport, diffusion, chemical reactions, and removal processes are expressed in mathematical terms.

The major factors that affect photochemical air quality include factors related to emissions, meteorology, chemistry, and background conditions. The spatial and temporal distribution of all emissions of NO_x and VOC, along with the species composition of the emitted VOC and NO_x are major factors in ozone formation and control requirements. Meteorological factors important in these models are the spatial and temporal variations in the wind fields, the dynamics of the stability and mixing heights of the boundary layer, and the diurnal variations of solar insulation and temperature. The chemical reactions involving VOC, NO_x, and other precursor species and the loss of ozone and ozone precursors by dry deposition are important chemical factors. The ambient background of VOC, NO_x, and other precursors in the upwind region of the domain are other major factors.

The UAM-IV and UAM-V simulate these processes in calculating summertime ozone concentrations. In these models, the species continuity equation is solved in four steps: (1) advection/diffusion is solved in the x-direction, (2) advection/diffusion is solved in the y-direction, (3) emissions are injected and vertical advection/diffusion is solved, and (4) chemical transformations are performed for reactive pollutants. The models perform this four-step procedure during each time step.

2.2.2 Use of UAM-V in this SIP

In the previous 1994 SIP submittal, EPD performed a model comparison of UAM-IV and UAM-V using EPA's 1988 Biogenic Emissions Inventory System (BEIS) as input and found that UAM-V simulates the ozone in the Atlanta area as well as or better than UAM-IV. EPA has conditionally approved the use of UAM-V in the Atlanta area in a letter to EPD dated 09/15/94. This letter is included in this document as Appendix IV.

Using the latest scientific studies, the updated 1995 Biogenic Emissions Inventory System (BEIS2) represents the biogenic emissions better than BEIS, especially considering specific studies in the Atlanta area. EPA has recommended that BEIS should be used with UAM-IV and BEIS2 with UAM-V (ISO). An explanation of the selection of episodes follows this section, but in short we have included episodes from 1987 and 1988 in this SIP. Atlanta's 1988 episode is imbedded in the OTAG

episode of July 1-15, 1988. EPA recommends that for this combination "justification and evaluation per section 3.2 of the Guideline on Air Quality Models is not required since considerable evaluation for this model and episodes were performed during the OTAG demonstration".

As for the 1987 episode, the combination of UAM-IV, BEIS, and updated meteorology data do not meet the EPA recommended accuracy for one primary episode day of the unpaired peak concentration. The results using UAM-IV and BEIS predict a peak concentration of 158 ppb ozone for July 31, 1987, while the observed peak was 201 ppb. This 21% under-prediction is outside EPA recommended parameters. Comparing the statistical results from a UAM-IV/BEIS2 combination (a combination which is not recommended by EPA), with the results from the UAM-V (ISO)/BEIS2 combination show comparable values and a "too close to call" decision. Since UAM-IV is not recommended for combination with BEIS2, and UAM-V (ISO) is more scientifically defensible, EPD has used UAM-V(ISO) in combination with BEIS2 for the 1987 episode of this SIP. Complete statistics for all combinations of the two models and two biogenics emissions can be found in section 2.5 of this SIP entitled Model Validation.

The latest version of the UAM-V (ISO) incorporates many features including variable nested grids, a user-defined fixed vertical grid structure; the use of three-dimensional inputs for temperature, water vapor, pressure, photolysis rates, horizontal diffusivities and vertical turbulent exchange coefficients; updated dry deposition; and a plume-in-grid (P-i-G) algorithm. Because of these features, UAM-V (ISO) represents a significant technical advance beyond the UAM-IV. A summary of these features follows.

1. Structured modular computer code: The UAM computer code has been rewritten so that new modules can be easily included and the code can be vectorized to take advantage of modern computer architecture.

2. Vertical Grid Structure: The vertical layer structure in UAM-V (ISO) is defined by the user and is no longer based on the diffusion break (mixing height). This allows for higher resolution vertical layers near the surface and better matching with output from prognostic meteorological models, which typically use a terrain-following coordinate system with fixed levels above ground. The variable vertical structure of UAM-V (ISO) permits more realistic treatment of nighttime vertical structures and entrainment of elevated plumes into the grid calculations.

3. Three-dimensional Inputs: Several meteorological variables that were considered spatially constant in the UAM (METSCALARS) now vary temporally and spatially (e.g., temperature, water vapor, pressure, and photolysis rates). Furthermore, the horizontal diffusivities and vertical turbulent exchange coefficients are now required as input and are usually obtained from a prognostic meteorological model. This feature provides for the use of more realistic meteorological fields that may vary spatially over the region being simulated.

4. Two-way nested grid capability: A fine grid can be imbedded in a coarser grid for more detailed representation of advection/diffusion, chemistry, and emissions. Several levels of

both horizontal and vertical nesting can be accommodated. UAM-V's nested grid structure also allows high grid resolution where it is needed without the computational cost of carrying this high grid resolution over much larger areas where it is not needed.

5. New Dry Deposition Algorithm: An updated dry deposition algorithm formulated by Wesley (1989) has been implemented in the UAM-V. This algorithm is similar to that used by the Regional Acid Deposition Model (RADM).

6. Plume-in-Grid (P-i-G) Capability: The updated model is capable of treating the subgrid-scale chemistry and plume dynamics of user-selected point-source plumes. A Lagrangian photochemical model will simulate emissions from a point source until the plume size is commensurate with the size of a grid cell of the UAM-V. In particular, the reactive-plume P-i-G algorithm treats emissions as a series of multi-layered ellipsoidal puffs in which ambient air is entrained, chemistry takes place, and concentrations are "shed" from the outer shells into the grid as the puff size grows to match the limiting cross sectional area (X-Y or X-Z) of the grid cell. This reactive-plume P-i-G treatment avoids the premature- and over-dilution problems that previous urban- and regional-scale photochemical grid models (such as ROM and UAM-IV) suffer with large point sources.

7. Emission Injections Aloft: Improved treatment of emission injections aloft (elevated sources) is also a feature of UAM-V. This feature includes penetration of multiple layers of varying stabilities in the plume-rise calculations.

8. Chemistry Mechanism: UAM-V (ISO) was further updated by SAI in July of 1996 during the OTAG study and detailed changes to the model and demonstrations of the affects are documented in Appendix V.

2.2.3 Episodes Selected

The methodology specified in Appendix B of EPA's **Guideline for Regulatory Application of the Urban Airshed Model**, was used to select the episodes to be modeled using UAM. This amounted to finding meteorological regimes when, historically, most ozone violations occurred and selecting violation days during 1987 - 1991 that represent those meteorological regimes.

The first step was to gather meteorological data from Atlanta Hartsfield International airport and the South DeKalb College ozone monitoring site for the years 1980 - 1991. During this 12-year period the Atlanta area experienced 140 days of ozone exceedances. Resultant wind velocities were calculated for each of these days using observations from 7 a.m. through 10 a.m. Local Civil Time. Since wind observations from the early years were not available at the South DeKalb site, winds from the Atlanta Airport were used for the years 1980 through 1987 and South DeKalb winds for the remaining period. The resultant wind velocities were separated into 9 categories. The calm group consisted of days with resultant wind speeds less than 1.5 m/s. The other categories were determined using the resultant wind directions and separating those winds into 45 degree categories centered on 8 directions, north through northwest. The calm and the northwest meteorological

regimes occurred more frequently during ozone violations than the other categories. Thus the days to be modeled included days with resultant wind velocities in the calm, northwest, and "other" category.

Next, for the period 1987 through 1991, the days of ozone violation were sorted by maximum hourly ozone concentration and the wind regime included. The day of each wind regime's maximum ozone concentration was selected for modeling. Therefore, July 31, 1987 with an ozone maximum of 201 ppb under a calm wind regime was selected. Also, July 8, 1988 with a 186 ppb reading under the "other" regime and August 1, 1987 with 169 ppb concentration during northwest wind conditions were selected. Since 2 of these days occur back-to-back, it was decided that only 2 episodes would need to be modeled in order to cover all 3 wind regimes. One episode was long, with a gradual build-up and the other short, with a quick peak. In order that these episodes start early enough to minimize the importance of initial condition values, the following dates were selected for UAM modeling: July 29, 1987 through August 1, 1987 and July 7, 1988 thorough July 8, 1988.

The selection of these episodes seems to be conservative in terms of concentration and aerial extent. Of the 5 ozone sampling sites in the Atlanta area, all 5 experienced ozone violations during the longer episode and 4 of the 5 sites had violations during the shorter episode. Even the site not recording a violation, Dallas, was extremely close to the standard on July 8, 1988, recording an ozone maximum concentration of 123 ppb. Also, these episodes contain maximum ozone concentrations that are either the all time maximum or within 95% of the maximum for the 1987 - 1991 period for all 5 sites.

2.2.4 Domain Definition

The modeling domain for the Atlanta study using UAM-IV is identical with the domain used in the 5-City Study performed by SAI ("Final Report: Urban Airshed Model Study of Five Cities; Low-Cost Application of the Model to Atlanta and Evaluation of the Effects of Biogenic Emissions on Emission Control Strategies", Morris et. al, 15 September, 1989). The domain is a 40 by 40 grid with each grid being 4 x 4 km. and the southwest corner of the grid starting at UTM 660 km. east and 3665 km. north in zone 16. The location of the 40 by 40 UAM-IV domain is presented in Figure 2-1. The vertical structure of this domain consists of 5 layers, 2 below the mixing height and 3 layers above the mixing height. (The mixing height is the top of a layer of air extending from the surface upwards in which air is vertically mixed. This height varies during a 24-hour period.) The first layer extends from the surface to 1/2 the mixing height. The top of the modeling domain is 2200 m agl (above ground level).

As stated earlier, UAM-V (ISO) has demonstrated that it better simulates the base case ozone episodes and was used in this SIP Revision. The UAM-V (ISO) domain is much larger and extends into Alabama, Tennessee, and North and South Carolina and is described in more detail in the "Protocol for a Comparison of the UAM-IV and UAM-V Models"(in Appendix III). The location of the UAM-V (ISO) domain is presented in Figure 2-2.

The UAM-V (ISO) modeling domain is comprised of an outer, coarse-resolution grid that extends

approximately 80 km in all directions beyond the current UAM-IV domain and a nested, higher-resolution grid that is identical to the UAM-IV domain. The coarse-grid cell size is 8km by 8km. The overall domain size is approximately 320 x 320 km. By including these additional grid cells, boundary condition information for the nested, urban grid will be simulated in the coarse grid rather than estimated by the user.

The vertical structure for the UAM-V (ISO) grid is consistent with that of the prognostic meteorological model and includes 6 vertical layers: 0-50 m, 50-150 m, 150-450 m, 450-900 m, 900-1500 m, and 1500-2200 m agl. The same vertical structure will be used for all episodes. The top of the UAM-V (ISO) modeling domain is the same as the top of the UAM-IV modeling domain (2200 m agl).

2.2.5 Participating Groups

Since the completion of the OTAG work and the resumption of work on this SIP, the Georgia Environmental Protection Division has had meetings with representatives from the EPA Region IV Office and the regulated community to keep them informed of progress made on the Atlanta Ozone SIP.

2.3 Preparation of the Basecase (1987 and 1988) and Baseline (2003) Emissions for the UAM-V Model

2.3.1 Emissions Overview

The emissions in the UAM-IV domain are based on the EPD's **1990 Base Year Ozone Emission Inventory for Atlanta, Georgia, Non-attainment Area**. This emission inventory was submitted in final form to the EPA in November 1993. EPA guidance was used to develop this inventory for the 13 counties in the Atlanta ozone non-attainment area. Emissions for the additional 30 counties in the UAM-IV domain were developed using a similar approach. Emissions for the remaining areas in the UAM-V domain are based on the **Regional Interim Emission Inventory** (EPA, 1993).

The modeling emission inventory is the sum of five emission source classes: 1) Point, 2) Area, 3) On-Road Mobile, 4) Non-Road Mobile, and 5) Biogenic. The first four source classes are anthropogenic (man-made) sources. The biogenic class consists of emissions from trees, crops, vegetation, and other natural sources. For a detailed description of each emission source class refer to the **1990 Base Year Ozone Emission Inventory for Atlanta, Georgia, Non-attainment Area** (EPD, 1993). Day specific, hourly and gridded emissions for each of the five classes were developed for the July 29 - August 1, 1987 and July 7 - 8, 1988 basecase modeling episodes. These emissions were used in validating the Atlanta UAM-V model application. Baseline emissions were also estimated for 2003 for use in the attainment modeling demonstration. All emissions were processed using the US EPA's Emissions Preprocessor System (EPS2), Version 2 (EPA, 1992).

A summary of all the emissions used in the 1987 and 1988 basecase, and 2003 baseline UAM-V modeling is shown in Tables 2-1 through 2-6. The remainder of this section describes the

development of each of the five emissions source classes, and the quality assurance measures taken to ensure the accuracy of the inventory.

2.3.2 Point Source Emission Inventory

Except in the 13 county non-attainment area, point sources are defined as all stationary sources that emit more than 100 tons per year of either volatile organic compounds (VOCs) or oxides of nitrogen (NO_x). In the 13 county non-attainment area, a point source is defined as a stationary source with annual emissions in excess of 10 tons of VOCs or 100 tons of NO_x.

2.3.2.1 Electric Power Generation Point Source Emission Inventory

Electric power generation is responsible for a sizable fraction of the oxides of nitrogen (NO_x) emissions from all sources. On July 31, 1987 for example, electric power generation produced 47% of all the anthropogenic NO_x emissions in the UAM-IV domain. Clearly, these particular sources are important to ozone formation in Atlanta. To insure accurate accounting of the emissions due to electric power generation, the Georgia Power Company and the Southern Company, their parent company, worked closely with the EPD to develop a detailed, hour-by-hour, episode specific emission inventory for most of the electric power generation point sources in the UAM-IV and UAM-V domains. There was one electric power generating source (Widows Creek Steam Plant) in the UAM-V domain that is not owned by the Southern Company. Emissions for this source were obtained from EPA's **Regional Interim Emission Inventory** (EPA, 1993). All electric power generation sources were tagged for plume-in-grid treatment by the UAM-V.

Except for the Widows Creek Steam Plant, emissions for the 1987 and 1988 historical modeling performance episodes were based on the actual electrical power demand for the episodes. Calculation of these emissions was previously described in **The 1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area**, Appendix C, Methodology to Estimate NO_x, VOCs, and CO Emissions from Southern Company Power Plants, November 15, 1994. Emissions from the Widows Creek Steam Plant were backcast from 1990 levels (from the **Regional Interim Emission Inventory**) to 1987 and 1988 using EPS2 and projection factors provided by the Bureau of Economic Analysis (BEA).

For those sources operated by the Southern Company, electric utility emissions for 2003 were based on the July 29 - August 1, 1987 and July 7 - 8, 1988 meteorological conditions and the 2003 forecasted demand for electrical power based on those conditions. There are three steps involved in estimating future year electric utility emissions:

1. Two models are used to predict the response of load to abnormal weather conditions. Historical load and weather patterns are evaluated in this process. From this evaluation, a relationship between normal weather and abnormal weather for system peak and energy requirements is determined and quantified. This is done for each of the ozone episodes. These two models were developed for and used in the system target reliability study. A detailed description of each model and the process can be found in the paper "Quantifying Uncertainty in the Load Forecast -- A User's Perspective," by Vance Mullis, Southern Company Services, 1991.

2. The relationship between normal and abnormal weather that are determined in Step 1 are applied to the weather normalized 2003 peak demand and energy requirement forecast. This results in a 2003 peak and energy forecast that is representative of the weather conditions that occurred during the historical ozone episodes for the Atlanta non-attainment area. The "adjusted" 2003 peak and energy forecast is then applied to a load pattern for each of the episodes. In doing this, the monthly peak demand is preserved and the monthly energy requirement is distributed to each hour of the month while maintaining the load pattern. This process is the same used in developing loads for use in production costing studies as well as determining the integrated resource plan for the Southern Electric System.

3. The final step involves the dispatch of the system units to meet the peak and energy requirements developed in Step 2. The hourly dispatch model used in determining the actual dispatch of the Southern Electric System units is used in this step. The hourly energy forecast is input to this model. The model then dispatches the system generating units to meet the energy requirements. The units available include existing units as well as units forecasted to be installed by July 2003. Also, units that are expected to retire by this time are removed from the dispatch. The available units are based on the 2003 forecast from the 93A1 Integrated Resource Plan for the Southern Electric System.

A more detailed explanation of the methodology for estimating electric utility emissions in 1999 was provided in **The 1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area**, Appendix C, Methodology to Estimate NO_x, VOCs, and CO Emissions from Southern Company Power Plants, November 15, 1994. The same methodology was used for estimating electric utility emissions in 2003.

For the Widows Creek Steam Plant, BEA factors and EPS2 were used to project the emissions from 1990 to 2003. Finally, all future year electric utility emissions include adjustments to those units affected by the Reasonably Available Control Technology (RACT) requirements.

2.3.2.2 Non-Electric Power Generation Point Source Emission Inventory

Creating a 1990 base year inventory for the UAM-IV domain was the first step in estimating the non-utility point source emissions. Details regarding the 1990 point source emissions for the 13 county non-attainment area are available in the **1990 Base Year Ozone Emission Inventory for Atlanta,**

Georgia, Non-attainment Area (1993). Similar procedures were used to develop the emissions in the remaining 30 counties of the UAM-IV domain. Emissions in the UAM-V domain were extracted from EPA's **Regional Interim Emission Inventory** (1993).

In developing day specific emissions for the UAM-IV domain, not every point source in the 1990 inventory was operating during the 1987 and 1988 ozone episodes. Therefore, the operating status of each point source in the UAM-IV domain of the 1990 inventory was checked in the EPA Aerometric Information Retrieval System, AIRS Facility Subsystem (AIRS/AFS), to determine if the plant was in operation during each of the historical ozone episodes. If the plant was not in operation during the historical episodes, then its emissions were removed from the emission inventory prior to backcasting the emissions. In a similar manner, any point sources that ceased to operate after 1990 (as of May 1999) were removed from the inventory prior to forecasting the inventory to 2003. Emissions in the UAM-V domain were not screened for operational status. With minor modification, the 1990 non-utility point source emissions in the UAM-IV domain are identical to those described in **The 1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area**, Appendix D, Development of the UAM-IV Emission Inventories for the 29 July - 1 August 1987, 7-8 July 1988, and 9-10 August 1992 Atlanta Ozone Episodes, November 15, 1994. Deviations from this description in this submittal include corrections to the 1990 NO_x emissions for Delta Air Lines, Ford Motor Company, General Motors, and Lockheed. These emissions were inadvertently omitted from the previously submitted inventory. Also in this submittal, errant SIC codes for Atlanta Gas Light, Star Packaging, All-Pak, Container Corporation, and Atlanta Film were corrected. The remaining 1990 non-utility point source emissions in the UAM-V domain are identical to those used in **Comparison of the UAM-IV and UAM-V Photochemical Models for Three Atlanta-Area Ozone Episodes** (Systems Applications International, SYSAPP-94/106, November 1994) and described therein Chapter 3: Emission Inventory Preparation. This report is included here as Appendix VI.

In both the UAM-IV and UAM-V domains, BEA factors were used to project all emissions back to 1987 and 1988, and forward to 2003. Default temporal factors supplied with EPS2 were used to temporally allocate the emissions from each source. Finally, all EPD regulations that came into effect after 1990 were applied to the appropriate sources in the 2003 forecast inventory. This includes all controls relevant to the 15 % Rate of Progress Plan that were put in place in 1996, and the Post-1996, (9%) Rate of Progress Plan NO_x and VOC reductions. Details regarding the 15 % Plan and the 9% Plan were submitted to EPA previously in the **15% Georgia State Implementation Plan** (November 15, 1993; revised September 1994, November 1994, and June 17, 1996), and the **1994 Ozone State Implementation Plan for the Atlanta Area**, Section 3: The Post-1996 Rate-of-Progress Plan (November 15, 1994; revised June 17, 1996).

The 2003 UAM-IV domain, non-utility point source emission inventory is similar to the inventory submitted previously in the **1994 Ozone State Implementation Plan for the Atlanta Area**, Appendix E, Development of the UAM-IV Future-Year (1999) Emission Inventories for Atlanta, November 15, 1994. The corrections applied here to the 1987 and 1988 non-utility point source inventories also apply to the 2003 inventory. For plants under special consideration, non-utility point

source emissions were updated using a more recent inventory, the **Development of 1996 Periodic Emissions Inventory For Atlanta, Georgia Ozone Non-attainment Area** (Pechan-Avanti Group, Pechan-98.11.002/564, November 1998): For the UAM-IV domain, these were Austell Box Board, Blue Circle, Inland-Rome, and Transcontinental Gas Pipeline. For the UAM-IV domain, only the Medusa plant was updated. Further, the 2003 inventory was updated to include all known plant shutdowns that have occurred between 1990 and May 1999. These include:

FIPS County Code	Plant Name
Bartow	Cosco, Inc.
Clarke	Certainteed Corp.
Clayton	Rex Furniture Company, Inc.
DeKalb	Colonial Baking Co. of Atlanta
	Northern Telecom Inc., Atlanta
	Reckitt & Coleman Household Products
	Scientific-Atlanta Instrument
	Dietzgen Corp.
Floyd	Huntsman Chemical Corp.
	General Electric
Fulton	Cadillac Products, Inc.
	Crown Beverage
	General Motors - Lakewood
	Glidden Co. Coatings & Resins
	Webworks, Inc.
	Atlantic Steel -Atlanta
	Communications Technology Corp.
	Raylock Corp.
	Dynatron/Bondo Corp.
Gwinnett	AKZO Coatings
	Owen of Georgia, Inc.
	Gwinnett Daily News
Henry	Hoyne Industries
Houston	Crown Beverage Packaging - Perry
Rockdale	Leer Southeast
	Farmer Waste Oil
Twiggs	Huber J. M. Corp. - Macon
Walker	Rossville Development - Rossville
Washington	ECC International - Sandersville
Whitfield	Galaxy Dyeing & Finishing

2.3.3 Area Source Emission Inventory

Area sources are stationary sources. Their VOC and NO_x emissions are less than the cutoff criteria used to define point sources (see section 2.3.2). Creating a 1990 base year inventory for the UAM-IV domain was the first step in estimating the episode specific area source emissions. Details regarding the 1990 area source emissions for the 13 county non-attainment area are available in the **1990 Base Year Ozone Emission Inventory for Atlanta, Georgia, Non-attainment Area** (1993). Similar procedures were used to develop the area source emissions in the remaining 30 counties of the UAM-IV domain. 1990 emissions in the UAM-V domain were obtained from the EPA's **Regional Interim Emission Inventory** (1993).

Emissions in the UAM-IV domain specific to 1987 and 1988 were estimated by backcasting the 1990 area source inventory using historical Bureau of Economic Analysis (BEA) scaling factors supplied by EPA with EPS2. Similarly, 2003 uncontrolled area source emissions were estimated by scaling the 1990 inventory by forecasted BEA projection factors. Finally, all EPD regulations that came into effect after 1990 were applied to the appropriate sources in the 2003 forecast inventory. This includes all controls relevant to the 15 % Plan, regulations that were put in place in 1996, and the 9% Plan. These controls primarily affect VOC emissions in the 13 non-attainment counties from architectural coatings, traffic markings, automobile refinishing coatings, all other surface coatings, miscellaneous non-industrial solvent use, underground storage tank filling and breathing at gasoline service stations, and underground storage tank filling at diesel service stations. In addition, all emissions due to open burning were eliminated by a seasonal ban on open burning in the 13 non-attainment counties. Details regarding the 15 % Plan and the 9% Plan were submitted to EPA previously in the **15% Georgia State Implementation Plan** (November 15, 1993; revised September 1994, November 1994, and June 17, 1996), and the **1994 Ozone State Implementation Plan for the Atlanta Area**, Section 3: The Post-1996 Rate-of-Progress Plan (November 15, 1994; revised June 17, 1996). Emissions in the UAM-V domain were projected back to 1987 and 1988 and forward to 2003 using only BEA factors. No additional controls were applied to area sources in the UAM-V domain.

In general, the methods used to estimate the historical and future year area source emissions in the UAM-IV domain were similar to those used in **The 1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area**, Appendix D, Development of the UAM-IV Emission Inventories for the 29 July - 1 August 1987, 7-8 July 1988, and 9-10 August 1992 Atlanta Ozone Episodes; and Appendix E, Development of the UAM-IV Future-Year (1999) Emission Inventories for Atlanta, November 15, 1994. Area source emissions in the UAM-V domain for 1987 and 1988 are identical to those used in **Comparison of the UAM-IV and UAM-V Photochemical Models for Three Atlanta-Area Ozone Episodes** (Systems Applications International, SYSAPP-94/106, November 1994) and described therein Chapter 3: Emission Inventory Preparation. This report is included as Appendix VI.

2.3.4 On-Road Mobile Source Emission Inventory

The on-road mobile source emission inventory consists of the running and evaporative emissions of volatile organic compounds (VOCs), oxides of nitrogen (NO_x), and carbon monoxide (CO) from eight different vehicle types traversing 12 different road types. The eight vehicle types are:

1) light duty gas vehicles (LDGV)
2) light duty gas trucks up to 6000 lbs. gross weight (LDGT1)
3) light duty gas trucks between 6000 lbs. and 8500 lbs. gross weight (LDGT2)
4) heavy duty gas vehicles (HDGV)
5) light duty diesel vehicles (LDDV)
6) light duty diesel trucks (LDDT)
7) heavy duty diesel vehicles (HDDV)
8) motorcycles (MC)

The twelve road types are:

1) rural interstates
2) rural principal arterials
3) rural minor arterials
4) rural major collectors
5) rural minor collectors
6) rural local
7) urban interstates
8) urban other freeways
9) urban principal arterials
10) urban minor arterials
11) urban collectors
12) urban local

2.3.4.1 1987 and 1988 Historical Episode Mobile Source Emissions

1987 and 1988 summer-adjusted vehicle miles traveled (VMT) for each of the 43 counties and twelve road types in the UAM-IV domain were provided by the Georgia Department of Transportation (GDOT). The MOBILE5 model was used to estimate the emissions per mile generated by the eight different vehicle types for each of the twelve road types. Multiplied together, the VMT and the MOBILE5 derived emission factors produce the mobile emissions. In 1987 and 1988, four counties were subject to a vehicle inspection and maintenance (I/M) program. This I/M program was accounted for in the MOBILE5 model. MOBILE5 can also be used to calculate the change in evaporative emissions from mobile sources due to diurnal changes in the ambient temperature. These temperature effects were applied using the MVADJ program in the Emissions Processing System (EPS2), Version 2. Temporal adjustments were made using the TEMPRL program and an EPA default temporal distribution profile. Spatially, a portion of the emissions in each county was applied to specific links. Links consist of a digitized subset of all the urban and

rural interstates and principal arterials in each county. The total number of miles of links in each county was compared with the actual total number of miles of interstates and principal arterials in each county, as supplied by GDOT, to determine the fraction of the actual road network included in the link subset. This fraction was then used to determine how much emissions should be applied to the links. The remaining interstate and principal arterial emissions, as well as all other on-road mobile emissions, were distributed throughout the county by population surrogate using the GRDEM program from EPS2.

The 1987 and 1988 VMT supplied by GDOT, and the MOBILE5 input files used in estimating the on-road mobile emissions in the UAM-IV domain are included in

Appendix VII: 1987, 1988, and 2003 Vehicle Miles Traveled, and MOBILE5 input

1990 mobile emissions for the UAM-V domain were extracted from EPA's **Regional Interim Emission Inventory** (1993) and projected back to 1987 and 1988 using EPS2 and Bureau of Economic Analysis (BEA) projection factors. These are further described in

Appendix VI: Comparison of the UAM-IV and UAM-V Photochemical Models for Three Atlanta-area Ozone Episodes, Chapter 3: Emission Inventory Preparation (November 1994)

2.3.4.2 2003 Base Year Mobile Source Emissions

The procedures used to calculate the 1987 and 1988 mobile source emission inventory were also used to estimate the 2003 mobile source emissions. For the UAM-IV domain, the differences are in the VMT used and the parameter settings that control the emissions factors calculated by MOBILE5. These parameters include fleet age and mix, vehicle speeds, and the application of State and Federal controls. The controls that were modeled for 2003 include lowered Reid Vapor Pressure (RVP), Stage II vapor recovery, enhanced I/M in all 13 Atlanta ozone non-attainment area counties, Tier 1 tailpipe standards, the National Low Emission Vehicle (NLEV) program, and low-sulfur gasoline. Each of these factors is discussed below.

A. 2003 VMT for the 13 non-attainment counties was provided by the Atlanta Regional Commission (ARC). In accordance with EPA guidance ("Section 187 VMT Forecasting and Tracking Guidance," U.S. EPA, 1992, equation (1), paragraphs 4.2 and 5.1), growth factors from ARC's travel demand model were applied to summer-adjusted 1997 daily VMT provided by GDOT. Documentation of the procedures used is in "Methodology for VMT Projections and Speed Estimates," in Appendix VII.

   For all the other counties, estimates of 2003 VMT were prepared by GDOT based on 1992 through 1997 HPMS (Highway Performance Monitoring System) VMT estimates. The approved linear regression equation per paragraph 4.3 of EPA's "Section 187 VMT Forecasting and Tracking Guidance" was used. Note that, due to the regression generating negative VMT in some functional classifications, a value of zero was assigned to all negative numbers in the various functional classifications. The 2003 VMT used for all counties in the

UAM-IV domain are included in Appendix VII.

B. A single average overall travel speed for each of the HPMS roadway functional classifications was supplied by GDOT; GDOT calculated these Georgia-specific speeds using the HPMS Impact Analysis software with 1992 HPMS VMT data during their most recent statewide plan update in 1994. Because speeds for local streets are not included in the HPMS Impact Analysis output, speeds for rural local streets were assumed to be the same as speeds for rural minor collectors. Speeds for urbanized local streets were assumed to be the same as those for urbanized collectors. The following speeds were used for the 30 counties in the UAM-IV domain outside the 13 non-attainment counties.

Functional Classification	HPMS Speed
Rural Interstate	52.8
Rural Principal Arterial	44.0
Rural Minor Arterial	43.3
Rural Major Collector	32.0
Rural Minor Collector	29.0
Rural Local	29.0
Urbanized Interstate	50.0
Urbanized Other Freeway	47.4
Urbanized Principal Arterial	19.4
Urbanized Minor Arterial	20.8
Urbanized Collector	22.0
Urbanized Local	22.0

For the 13 non-attainment area counties, ARC provided the following speeds, based on their travel demand model (see "Methodology for VMT Projections and Speed Estimates," in Appendix VII), for each of the HPMS roadway functional classifications.

Functional Classification	ARC Speed
Rural Interstate	56.9
Rural Principal Arterial	46.8
Rural Minor Arterial	34.8
Rural Major Collector	29.6
Rural Minor Collector	31.4
Rural Local	14.0
Urbanized Interstate	44.2
Urbanized Other Freeway	47.6
Urbanized Principal Arterial	28.2

Urbanized Minor Arterial	23.4
Urbanized Collector	22.8
Urbanized Local	12.1

C. Rather than a national default distribution, a more representative local vehicle registration distribution based on 1990 data for the 13-county Atlanta ozone non-attainment area was used in calculating 2003 emission factors for all 43 counties. The 1990 distribution is used for future year emissions because "...EPA will not accept modeling for SIPs that includes assumptions that the vehicle fleet will be newer in the future than is reflected in the registration distributions used for the base year emission factors and inventory development" (User's Guide to MOBILE5, May 1994, Section 2.2.3, p. 2-24).

D. Only gasoline with a Reid Vapor Pressure (RVP) of 7.0 pounds per square inch (psi) will be sold in the 13-county Atlanta ozone non-attainment area during the 2003 ozone season. The region outside of the 13-county non-attainment area is designated as a volatility attainment area (as defined in 40 CFR 80.27 (a) (2)) and is subject to gasoline with an RVP of 9.0 psi. See I. below for additional RVP requirements outside the 13 counties.

E. Stage II gasoline vapor recovery is a system found at gasoline dispensing facilities that controls VOCs that are emitted from the vehicle tank upon filling. The fumes are returned, either by vacuum or pressure gradient, to the gasoline storage tank where they are subsequently delivered to the gasoline delivery truck and returned to the bulk gasoline terminal for incineration or condensation. Properly installed systems are certified as having a control efficiency of 95%. Gasoline dispensing facilities in the Atlanta ozone non-attainment area must have systems with a control efficiency of at least 95% and are subject to the 50,000/10,000 gallon rule exemptions. EPD conducts periodic inspections, functional checks, and other compliance activities leading to a 95+% rule effectiveness.

F. A biennial enhanced I/M program for all 13 counties of the Atlanta non-attainment area covers 1975 and newer model years of lightweight gasoline powered vehicles. This is a hybrid test-and-repair program with 100% emission reduction credit modeled and consisting of a 2500/idle test for the six newest model years and an ASM 2525 test for vehicles seven years old and older. There is a stringency of 20% for 1975 through 1980 model year vehicles. An anti-tampering program (ATP) checks for catalyst tampering on all vehicles covered by the program, and all receive gas cap checks (modeled as 40% as effective as a full pressure test).

G. Tier 1 Tailpipe Standards are mandated by the 1990 Clean Air Act Amendments for all light duty cars and trucks. The standards were be phased in over a three year period, with 40% of covered vehicles complying in the 1994 model year, 80% in the 1995 model year, and 100% in the 1996 model year.

H. The NLEV program was modeled, per EPA guidance, with the assumption that new cars and light-duty trucks up to 6,000 pounds gross vehicle weight rating will meet stricter tailpipe emission standards beginning with the 2001 model year. The standard schedule of 100% LEVs beginning in

the 2001 model year, per EPA guidance ("MOBILE5 Information Sheet #6, Effect of New National Low Emission Vehicle Standard for Light-Duty Gasoline Fueled Vehicles") was used. See "NLEVSTD.D" in Appendix VII.

I. In the 13-county Atlanta non-attainment area and in 12 additional counties (Barrow, Bartow, Butts, Carroll, Dawson, Hall, Haralson, Jackson, Newton, Pickens, Spalding, and Walton), all gasoline sold during the ozone season will meet the following limits on RVP and sulfur:

RVP	7.0 psi
sulfur	150 ppm

Emission reductions from LDGVs, LDGT1s, and LDGT2s resulting from these limits are expected to produce the following overall highway mobile source emissions reductions in these counties:

	13 counties	12 counties
VOC	3.24%	11.63%
NO_x	7.61%	2.93%

Note that in the 13-county non-attainment area RVP is already limited to 7.0 psi and there is a Stage II vapor recovery program in place.

The MOBILE5 input files used to model highway mobile source emissions for the Atlanta ozone non-attainment area for the 2003 Ozone Attainment Demonstration Emission Inventory are included in Appendix VII: 1987, 1988, and 2003 Vehicle Miles Traveled, and MOBILE5 input.

In the UAM-V domain, 1990 mobile emissions were extracted from EPA's **Regional Interim Emission Inventory** (1993) and projected forward to 1999 using EPS2 and factors provided by the Bureau of Economic Analysis (BEA).

2.3.5 Non-Road Mobile Source Emission Inventory

Non-road mobile sources consist of portable or mobile equipment that is not used expressly for the purposes of transportation. Examples of non-road mobile sources are gasoline powered lawn and garden equipment, farm and construction equipment, aircraft, locomotives, recreational vehicles such as boats and ATVs. The EPD developed a 1990 non-road mobile source emission inventory that covered all 43 counties in the Atlanta UAM-IV domain, except for two emission source classes. Those two source classes were aircraft and locomotives. 1990 emissions for these two classes were estimated from actual aircraft and locomotive activity data.

Emissions specific to 1987 and 1988 were estimated by backcasting the 1990 non-road mobile source inventory using historical Bureau of Economic Analysis (BEA) scaling factors supplied by EPA with EPS2. 2003 non-road mobile source emissions were also estimated by scaling the 1990 inventory by forecasted BEA projection factors.

Finally for the 2003 non-road mobile sources, all regulations that came into effect after 1990 were applied to the appropriate sources in the 2003 forecast inventory. These include all controls relevant to the 15 % Plan regulations that were put in place in 1996, and the 9% Plan reductions. For non-road mobile sources, decreases in NO_x and VOC emissions in 2003 occur as a result of several Federal rules: the gasoline detergents additives program, regulation of small non-road gasoline engines, and the regulation of large non-road diesel engines. Details regarding these controls are contained in the **15% Georgia State Implementation Plan** (November 15, 1993; revised September 1994, November 1994, and June 17, 1996), and the **1994 Ozone State Implementation Plan for the Atlanta Area**, Section 3: The Post-1996 Rate-of-Progress Plan (November 15, 1994; revised June 17, 1996).

Non-road mobile emissions in the UAM-V domain were extracted from EPA's **Regional Interim Emission Inventory** (1993) and projected back to 1987 and 1988 and forward to 2003 using BEA factors.

In general, the methods used to estimate the historical and future year non-road mobile source emissions were similar to those used in **The 1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area**, Appendix D, Development of the UAM-IV Emission Inventories for the 29 July - 1 August 1987, 7-8 July 1988, and 9-10 August 1992 Atlanta Ozone Episodes; and Appendix E, Development of the UAM-IV Future-Year (1999) Emission Inventories for Atlanta, November 15, 1994. Non-road mobile source emissions in the UAM-V domain for 1987 and 1988 are identical to those used in **Comparison of the UAM-IV and UAM-V Photochemical Models for Three Atlanta-Area Ozone Episodes** (Systems Applications International, SYSAPP-94/106, November 1994) and described therein Chapter 3: Emission Inventory Preparation. This report is included here as Appendix VI.

2.3.6 Biogenic Emission Inventory

The EPA's Biogenic Emissions Inventory System (BEIS2), Version 2 (1995) was used to generate the biogenic emissions inventory for both the UAM-IV and UAM-V domains. During the ozone season, natural sources can emit significant quantities of both oxides of nitrogen (NO_x) and volatile organic compounds (VOCs). Natural sources of NO_x include lightning and soil based microbial activity. In urban areas, NO_x from the soil is only a minor source relative to the anthropogenic sources. Lightning however, could be a potentially large source of NO_x. BEIS2 estimates soil NO_x, but not lightning NO_x. However, since high ozone concentrations are generally associated with high pressure, subsidence, and ample sunshine (meteorological conditions not often related with lightning), the omission of lightning NO_x from the biogenic inventory is justified for this analysis. VOCs on the other hand, are emitted from trees, crops, and other vegetative sources. For sylvan cities such as Atlanta, these emissions can dominate the total VOC emission inventory in terms of both total mass and incremental reactivity. BEIS2 estimates VOC emissions from 127 different vegetative classes.

An earlier version of the Biogenic Emissions Inventory System commonly referred to as BEIS was used in the **1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area** (November 15, 1994). The most significant difference between BEIS and BEIS2 is in the estimated emissions of isoprene. Isoprene is extremely reactive in the atmosphere. On a per molecule basis, it can generate more ozone molecules than almost any other hydrocarbon. Thus since isoprene is so reactive, and since it constitutes such a large fraction of the total hydrocarbon inventory, it is important to accurately estimate its emissions. As will be shown in section 2.5 of this document, EPD exercised both the UAM-IV and UAM-V with both BEIS and BEIS2 emissions for the historical episodes in an attempt to determine which configuration most accurately simulates ozone formation in Atlanta. Comparing the simulations with observations, the UAM-V with BEIS2 emissions proved to be the most accurate. Further, independent research conducted since 1994 shows that BEIS grossly under predicts isoprene emissions in the Atlanta area, and that BEIS2 produces more representative isoprene emissions. Papers published from these studies are included here for reference in

- Appendix VIII: Chang et al., "Inverse modeling of biogenic isoprene emissions," *Geophys. Res. Letts.*, V23, p. 3007, 1996.

- Geron et al., "Reassessment of biogenic volatile organic compound emissions in the Atlanta area," *Atmos. Env.*, V29, p. 1559, 1995.

- Guenther et al., "Isoprene fluxes measured by enclosure, relaxed eddy accumulation, surface layer gradient, mixed layer gradient, and mixed layer mass balance techniques," *J. Geophys. Res.*, V101, p. 18555, 1996.

- Pier, P.A., "Isoprene emission rates from northern red oak using a whole-tree chamber," *Atmos. Env.*, V29, p. 1347, 1995.

Based on these independent studies and its own evaluation, EPD chose to use BEIS2 exclusively in the attainment demonstration.

BEIS2 was exercised for each day of the modeling episodes, July 29 - August 1, 1987 and July 7 - 8, 1988 and for each modeling domain, UAM-IV and UAM-V. These same emissions were also used for the 2003 inventories. In running BEIS2 to generate the emissions, county level land use supplied by the US EPA was used. Emission factors for each land use category were supplied with the BEIS2 source code. WBAN cloud data for all reporting meteorological stations within the UAM-V domain were obtained from the National Weather Service for the six episode days and reformatted for use by BEIS2.

2.3.7 Modifications from the 1994 Ozone SIP and Other Quality Assurance Measures

Except where noted, the emissions inventories for the UAM-IV domain submitted in this State Implementation Plan are not significantly different from the emissions inventories submitted in the **1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area** (November 15,

1994). The inventories submitted in 1994 were subjected to a rigorous review process, which included review and acceptance of the 1990 Base Year Emission Inventory by the EPA, and a peer review process consisting of graphical and tabular inspection techniques. This review process was described in detail in the **1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area**, Section 4.2.2 Quality Assurance Measures, and the referenced appendices therein (November 15, 1994). A comparison between the current base year (1987 and 1988) UAM-IV domain emission inventories and those submitted in 1994 is presented in Tables 2-7 through 2-9.

The difference in biogenic emissions is due to differences between the BEIS2 and BEIS models. Over the whole UAM-IV domain, estimates of biogenic VOC emissions using BEIS2 are about twice as great as those estimated in the **1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area** in which BEIS was used.

For the 1987 and 1988 anthropogenic base year inventories, the mobile source emissions are significantly different from the inventories that were submitted in 1994. These differences are primarily due to the method by which the mobile source emissions were estimated. In the **1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area**, the 1987 and 1988 mobile emissions were estimated by backcasting the 1990 mobile inventory using scaling factors developed from 1987, 1988, and 1990 seasonally adjusted, county estimates of vehicle miles traveled (VMT) per roadway type and vehicle classification. MOBILE5 *was not* rerun for the years 1987 and 1988. Thus, the 1987 and 1988 mobile source emissions inventory submitted in 1994 does not accurately represent the age of the fleet or the implementation status of the inspection and maintenance (I&M) program in place at the time. These shortcomings were corrected in this SIP and are reflected in the mobile emission estimates for the 1987 and 1988 episodes.

The only other significant differences are in area sources. The inventory submitted here has been corrected for an error involving double counting of some industrial fuel combustion sources (the subject sources were included in both the point and area source inventories in the inventory submitted in 1994.)

2.4 UAM Preprocessor Data Preparations

The use of UAM to adequately replicate the full three-dimensional structure of the atmosphere during an ozone episode requires a day-specific database for input preparation. Therefore, wherever possible, day specific values for each preprocessor were used. This includes emissions, boundary conditions, and meteorological parameters. What follows is a summary of the data bases used and the assumptions and procedures followed to prepare the input data into the UAM through its preprocessors.

AIR QUALITY

This file contains the initial concentrations of each of the CB-IV species for each grid cell at the start of the simulation. This data was interpolated from observed air quality data for the UAM-V grid. However, the simulation was started at least one day before the day of interest so that the peak model concentrations were not driven by the estimated initial

concentration field. The air quality database consists of all NAMS, SLAMS, and SPMS monitoring sites in the Atlanta area and surrounding states. Those sites monitoring ozone, NO_x, and CO have been described in the introduction.

BOUNDARY

This file contains the location of the modeling domain boundaries and the concentration of each species for each hour and is used as the boundary condition along each lateral boundary for each level. For each boundary cell in the base case simulations, hourly data from surrounding ozone monitors was averaged and the result entered for the ozone concentration for that cell. Ozone levels for future cases and all other CB-IV species for the base case and future case simulations were produced using EPA-recommended background concentrations (EPA, 1991).

WIND

This file contains the x and y direction wind velocity components for every grid cell for each hour of the simulation. Also contained in this file are the surface wind speeds for the entire domain. The meteorological data for this study was gathered from several sites in the area. Hourly resultant wind direction and speed from the South DeKalb and Monastery ozone Monitoring Sites and the Georgia Power Company Plant Yates Site were available for 1987 only. Spot reading winds were used from the National Weather Service (NWS) Station at Atlanta International Airport, FAA Stations at Peachtree-DeKalb and Fulton County Airports, and the military station at Dobbins Air Force Base. All other meteorological parameters were taken from the NWS, FAA, and Air Force stations. The upper air data was taken from NWS stations at Athens and Waycross, Georgia; Centreville, Alabama; Nashville, Tennessee; Greensboro, North Carolina; and Charleston, South Carolina.

In order to provide a dynamically consistent, physically realistic representation of the meteorological fields and, thus, to utilize the enhanced capabilities of the UAM-V (e.g., three-dimensional temperature and moisture fields, direct specification of the vertical exchange coefficients), the meteorological input preparation procedures deviated from those outlined in the EPA UAM guidance document (EPA, 1991). The meteorological inputs were prepared using the SAI Mesoscale Model (SAIMM), a prognostic, data-assimilating mesoscale meteorological model for the UAM-V. To ensure agreement between the simulated fields and the observed meteorological data, observations were incorporated into the prognostic model using a four-dimensional data assimilation (FDDA) procedure. The SAIMM and FDDA procedure are described in detail in Appendix IX.

Meteorological Conditions and Comparison to SAIMM Results

A discussion of meteorological conditions and the predicted values using SAIMM follows and more details can be found in Appendix X. On 29 July 1987, the surface winds over the Atlanta area back from northerly to westerly throughout the day and the winds aloft indicate considerable vertical shear within the modeling domain. Since the model was initialized on the morning of 29 July, this discussion of the wind fields begins at 0900 EST. At this time, the surface winds were primarily northerly over the Atlanta area. Wind speeds were variable, and the observations were well

represented. Aloft, winds were generally easterly at 675 m agl(above ground level) and west to northwesterly at 1850 m agl. By 1500 EST, the surface winds were northwesterly over the Atlanta area but the simulated wind speeds were generally lower than observed. Upslope flow was apparent along the terrain features. Winds aloft were weak and generally southerly at 675 m agl and west to northwesterly at 1850 m agl. The 2100 EST surface wind field showed light and variable winds over Atlanta in good agreement with the observations. Winds aloft veered from southerly at 675 m agl to northwesterly at 1850 m agl.

Surface winds continued to veer, and by 0300 EST on 30 July were from the northeast. Downslope flow was apparent. At this time winds aloft were weaker than on the previous day and were southeasterly at 675 m agl and southwesterly at 1850 m agl. The 0900 EST surface wind field was characterized by primarily easterly flow while southerly flow was indicated aloft (1850 m agl). By 1500 EST, a southerly flow component emerged at all levels. Winds aloft (1850 m agl) were very weak. Southerly flow continued at 2100 EST at the surface and 675 m agl; above this northerly flow developed.

On 31 July, the early morning surface winds were weak and generally southeasterly. The 0300 EST winds veered with height and were southwesterly at 675 m agl and westerly at 1850 m agl. Light and variable winds at the surface and westerly flow aloft continued through 0900 EST. By 1500 EST, the surface winds indicated northwesterly flow. The simulated wind speeds were generally slower than the observed wind speeds, possibly due to a high degree of variability in the observations for this hour. Winds aloft were weak and southwesterly at 675 m agl and stronger and northwesterly at 1850 m agl. This surface airflow pattern was replaced at 2100 EST by southerly winds. Wind speeds increased aloft but wind directions were unchanged.

The final day of the simulation period, 1 August, was characterized by weak surface winds and westerly to northwesterly flow aloft. Surface wind directions were variable but generally veered from southwesterly to northwesterly throughout the day.

1988 Episode Conditions

On 7 July, wind directions generally veered from easterly to southeasterly throughout the day. At 0900 EST, the simulated surface winds were easterly over the Atlanta area; the observed northerly components were not well represented in the simulated fields. Surface wind speeds throughout the domain were typically less than 2 ms^{-1}. Winds aloft were considerably stronger and were easterly over the eastern half of the domain and southeasterly over the western half of the domain at both 675 and 1850 m agl. Surface wind speeds increased during the day, and by 1500 EST surface winds were southeasterly with speeds on the order of 5 ms^{-1}. Winds aloft retained an easterly component. The 2100 EST wind field was characterized by weak southerly flow at 25 and 675 m agl. At 1850 m agl, winds were northeasterly to southeasterly.

At 0300 EST on 8 July, the surface wind field was characterized by primarily southwesterly flow; winds over the Atlanta area were weak. Winds aloft were variable at 675 m agl (a weak anticyclonic eddy appeared to the southeast of Atlanta) and northeasterly to southeasterly at 1850 m agl. By 0900

EST, moderate westerly flow developed over the Atlanta area; good agreement between the simulated and observed winds was apparent. An anticyclonic circulation was still apparent in the simulated fields for 675 m agl. In fact, this circulation was more well-defined than in the early morning wind field, and at 0900 EST was located to the southwest of the Atlanta area. The persistence of this feature suggested the possibility of pollutant recirculation over the Atlanta area during this episode. Above this, northeasterly to southeasterly flow prevailed. By 1500 EST, the surface winds veered to northerly. Winds aloft were weak and generally northerly at 675 m agl; wind speeds increased at 1850 m agl but the easterly flow component was maintained.

HEIGHT

This file contains the height for the top of each layer and the atmospheric pressure at the midpoint of each layer in the modeled region. This input file was produced from output from the SAIMM prognostic model.

TEMPERATURE

This file contains hourly, gridded temperatures. Three-dimensional temperature profiles were obtained from the SAIMM output.

CHEMPARAM

This file contains information regarding the chemical species to be simulated including reaction rate constants, upper and lower bounds, activation energy, reference temperature, and resistance to surface sinks. For photochemical applications, the file is supplied with the model. The existing default guideline file was used in all the analysis. The isoprene oxidation reaction was adjusted from previous versions to represent new information on a lower reaction rate.

SURFACE

This file contains the distribution of land-use types for each grid cell in the region. Land-use type determines the UV albedo, roughness height, and surface resistance to deposition of gaseous species. It varies spatially, but not temporally. This file was derived from USGS data.

TERRAIN

This file contains the ground level altitude above sea level of each horizontal coarse grid location. It is only used to calculate altitudes for certain radiative calculations. All other terrain influence is input into UAM-V through meteorological inputs. It varies spatially, but not temporally. This file was also obtained from USGS data.

TOPCONC

This file contains the concentration of each CB-IV species for the area above the modeling region. For each cell in the base case simulations, hourly data from surrounding ozone monitors was averaged and the result entered for the ozone concentration above that cell. Ozone levels for future cases and all other CB-IV species for the base case and future case simulations were produced using EPA-recommended background concentrations.

H2O

This file contains the concentration of water vapor for each grid cell in the region. This input file was produced from output from the SAIMM prognostic model's hourly specific humidity values.

VDIFFUSION

This file contains the vertical diffusion coefficients for each grid cell in the region. This input file was produced from output from the SAIMM prognostic model.

2.5 Model Validation

2.5.1 Observation Data Available for Comparison

Model performance was evaluated using those measures specified in the UAM protocol. The same set of hourly ozone data from monitors located in the Atlanta non-attainment area was used to evaluate the performance of the two models. In calculating the statistical measures, weighted interpolation of the simulated values in the four grid cells surrounding a monitoring site was performed to provide collocated pairs of simulated and observed values.

2.5.2 Results from Required Statistical Tests

The three primary measures calculated, for which EPA has provided "acceptability" goals in the UAM guidance document (EPA, 1991), are the following:

1) Unpaired accuracy of the peak ($A\mu$) - (EPA goal: within $\pm$ 20 percent) - unpaired in space or time - peak simulated versus peak observed

2) Mean relative error (MRE) (normalized bias) - (EPA goal: within $\pm$ 15 percent) - paired in space and time using pairs for which observation is above cutoff

3) Mean unsigned relative error (MURE) (gross error) - (EPA goal: less than 35 percent) - paired in space and time using pairs for which observation is above a cutoff

A cutoff concentration of 60 ppb was used to calculate the statistics for ozone (observation/simulation pairs were not included in the calculation of statistics for observations less than 60 ppb).

2.5.3 Statistical Assessment of Performance

Quantitative measures of performance and resulting statistics for the 29 July - 1 August 1987 episode and for the 7-8 July 1988 episode are given in Table 2-10 through Table 2-12. Calculation of all statistical measures yield values acceptable per EPA guidance for the UAM-IV/BEIS-2 and UAM-V/BEIS-2 modeling runs. The under prediction of ozone levels as determined by the unpaired

accuracy of the peak results are generally smaller for the UAM-V/BEIS-2 modeling runs. Therefore, these runs are considered to be the most statistically valid. Also, qualitatively the predicted ozone concentrations appear to correspond to the observed values in space and time. See Appendix XI for "Subregional Photochemical Modeling Analysis for Atlanta, Birmingham, and the Eastern Gulf Coast Area: Input Preparation and Model Performance Evaluation."

2.5.4 Graphical Assessment of Performance

The results of the simulations are illustrated using two primary graphical analysis techniques: ozone isopleth plots and time-series plots. These plots allow examination of the model's ability to replicate the observed spatial and temporal ozone patterns for each episode.

Figures 2-3 and 2-4 present the daily maximum simulated ozone concentrations for 31 July and 1 August 1987, respectively, for the final UAM-V/BEIS-2 base-case simulation. Time-series plots comparing observed ozone concentrations with UAM-V simulated concentrations for each of the monitoring sites for the 1987 episode are provided in Figure 2-5. Figure 2-6 presents the UAM-V maximum simulated ozone concentrations for 8 July 1988. Time-series plots comparing observed ozone concentrations with UAM-V simulated concentrations for each of the monitoring sites for the 1988 episode are shown in Figure 2-7.

2.5.5 Summary of Model Performance Evaluation

In summary, the results of model performance evaluations, presented graphically and quantified statistically, show that model performance is very good using the UAM-V and BEIS-2 for all episodes and resulting performance statistics fall well within the EPA-specified goals for UAM SIP applications. It also shows that results are not consistently biased low compared to the observations.

3. ATTAINMENT DEMONSTRATION

Section 3.1 describes the UAM modeling analysis done for various controls scenarios. Several different possible control measures were modeled and analyzed. Recommendations are made on the optimum control strategy.

Section 3.2 then describes which of the modeling control measures will be implemented as part of this attainment plan.

Section 3.3 then discusses final conclusions and describes the measures to be implemented and the milestones for achieving them.

3.1 Modeling Demonstration

3.1.1 Benchmarks for Attainment

In Guidance On Use of Modeled Results to Demonstrate Attainment of the Ozone NAAQS (EPA-454/B-95-007, June 1996), EPA describes two acceptable approaches for demonstrating attainment of the National Ambient Air Quality Standard (NAAQS) for ozone: a statistical approach and a deterministic approach. The former approach is used here.

The statistical approach consists of a set of tests (benchmarks) plus an optional "weight of evidence determination." Depending on the severity of episodes modeled, the statistical approach allows up to three exceedances per subregion with a subregion defined by the guidance as an area that approximates a 15 by 15 km region. In this case 16 of the 4 by 4 km grids in the UAM-IV domain and 4 of the 8 by 8 km grids in the UAM-V domain were combined to form 16 by 16 km subregions The total UAM-V modeling domain consisted of a 20 by 20 grid of subregions.

Although predicted exceedances of the 1-hour, 0.12 ppm ozone standard are allowed under the guidance, the statistical approach limits the magnitude of each allowed exceedance so as to be consistent with observed ozone patterns at sites currently attaining the NAAQS. Further, if the model under predicts observed ozone, the statistical approach requires at least an 80% reduction in the predicted incidence of ozone greater than 124 ppb. If the model fails the benchmarks, a supplemental weight of evidence determination may be employed to describe whether attainment is still likely despite model results that do not strictly satisfy the statistical test. A copy of the guidance document is included here as Appendix XII.

As more fully described in the guidance, the statistical test is passed for the Atlanta episodes modeled here if these three benchmarks are passed:

(1) Limits on Number of Modeled Exceedances. No subregion in the UAM-V fine grid domain may contain modeled exceedances on more than (N-1) of the modeled days, where N is the number of episode days classified as "severe" (expected to occur less than 2 times per year).

(2) Limits on Modeled Concentrations for Allowed Exceedances. For the July 31, August 1, and July 8, primary modeling days, predicted daily maximum ozone concentrations may not exceed 130, 124, and 130 ppbv respectively. These maximum allowable concentrations are based on the EPA guidance and the severity of the episode days.

(3) Required Minimum Level of Improvement. For the August 1 and July 8, primary modeling days, the number of surface grid cell-hours exceeding 124 ppbv during 8 AM to 8 PM LST must be reduced by 80% from the base case August 1, 1987 and July 8, 1988 scenarios. Since the model under-predicted the peak observed ozone concentration by 5% on July 31, 1987 (see Section 3.5), this benchmark is waived for the July 31 episode day. The guidance requires this benchmark for all episode days on which the model under predicted the peak observed ozone concentration by more than 5%.

The first and second benchmark depend critically on the rank of severity of the days selected for modeling. The episodes modeled in this SIP are the same as those selected for the **1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area** using the EPA guidance: Guideline for Regulatory Application of the Urban Airshed Model, EPA-450/4-91-013, 1991. Through this process, July 31, 1987, August 1, 1987, and July 8 1988 were selected as three of the most severe ozone days ever to occur in Atlanta. Table 3-1 demonstrates the severity, based on the observed peak ozone, of the days selected for modeling. The table lists all days in Atlanta between 1974 and 1998 that exceeded the 0.12 ppmv, 1-hour ozone NAAQS and it is ordered by maximum observed, 1-hour averaged ozone concentration. The highest ozone concentrations ever measured in Atlanta occurred on July 31, 1987. The table also shows that the fourth highest and twelfth highest concentrations ever measured in Atlanta occurred on July 8, 1988 and August 1, 1987 respectively.

Another measure of severity is the expected yearly frequency of exceedance or ExEx. It is defined as:

$$\text{ExEx} = (\text{Rank} - 1) / (\text{\# of years used for ranking})$$

If we used monitoring data as the basis of the definition of severity and 25 years of data (1974 through 1998), the three primary modeling days - July 31, 1987; August 1, 1987; and July 8, 1988 - would have an ExEx of 0.00, 0.44, and 0.12 respectively. These would satisfy the first benchmarks requirements for ExEx. 2.00. It is important to note that the 1-hour ozone NAAQS allows, on average, one exceedance per year. For Atlanta, this would occur when ExEx = 1.00 or from Table 3-1, 159 ppbv. This is higher than the Atlanta design value of 149 ppbv for the more recent years and shows the improvement in Atlanta's ozone problem.

However, the Guidance On Use of Modeled Results to Demonstrate Attainment of the Ozone NAAQS (EPA, 1996) specifically states that monitor values alone can not be used to determine the severity of a model episode day. It describes a different method to determine severity of modeled episodes using a statistical model developed by Cox and Chu (1996). This method uses a regression equation and meteorological data as the independent variables and ozone observations as the

dependent variables to rank the ozone forming potential for every day. According to the Cox and Chu approach, July 31, 1987 ranks as only the 50th worst day, August 1, 1987 ranks 126th and July 8, 1988 ranks 26th.

Although EPD analysis indicates that the Cox and Chu approach does not accurately describe the ozone forming potential in Atlanta in demonstrating an $R^2 = 0.69$, we have found no statistical model that better predicts Atlanta ozone concentrations. We have used other regression equations, some of which use previous day parameters, and none of these are accurate predictors of ozone concentration. Part of the reason for the relatively low R^2 value of all of these regression equations is that they can account for the effect of stagnation during a single day by considering wind speed and direction, but they do not properly account for the buildup of precursors and pollutants over several days. Nor do they account for possible localized recirculation events, in which ozone and its precursors generated on previous days are first transported out of the region, and then returned at a later time. It is these multiple day, stagnation and recirculation events that have historically been linked to Atlanta's worst ozone episodes. Table 3-2 shows a comparison of the resultant values from these two methods, Cox & Chu and Monitored Rank. We think Cox & Chu method is extremely conservative in the ranking of these days, which may adversely affect the benchmark analysis. We plan to develop a statistical model that better represents the ozone forming potential of the Atlanta non-attainment area in the near future.

The acceptable upper limits for the second benchmark are derived from the ozone severity rankings from Table 3-2 presented here, and Table 4.2 of Guidance On Use of Modeled Results to Demonstrate Attainment of the Ozone NAAQS (EPA, 1996). The table below is a subset of Table 4.2 from the guidance showing the acceptable upper limits for daily ozone maximum given a historical ozone database spanning 41 years of Cox & Chu's meteorological database.

Acceptable* Upper Limits for Daily Maximum Ozone on Very Severe Days with Allowed Modeled Exceedances Given Cox & Chu 41 Years of Record

Day Rank	Maximum Acceptable Ozone (ppbv)*
1	161
2	152
3	151
4	148
5	145
6	142
7	140
8	140
9	139
10	138
11	137
12	137
13	137
14	136

15	134
16	133
17	132
18	131
19	131
20	131
21	130
.	
.	
.	
81	130

*Acceptable for modeling analysis, in accordance with U.S. EPA guidance.

From Table 3-2, July 31, 1987 is ranked 50th. According to the table above, the acceptable upper limit for daily maximum ozone for this day is 130 ppbv. August 1, 1987 is ranked 126th and not considered severe. The acceptable upper limit for this day is the standard of 124 ppbv. July 8, 1988 is ranked 26th. The acceptable upper limit for this day is 130 ppbv. According to the guidance, an attainment demonstration must show peak concentrations equal to or less than these upper limits in order to satisfy the second benchmark.

The third benchmark applies only to those episode days on which the UAM-V under predicted the peak observed ozone concentration by more than 5%. As was shown in section 3.5, the model's unpaired accuracy of the peak was 4.5% for July 31, 1987. Therefore, this benchmark does not apply to this day. However, for the August 1 and July 8 modeling days, the number of layer 1 grid cell hours exceeding 124 ppbv during 8 am to 8pm LST were determined and compared to the 80% reduction threshold.

3.1.2 Modeled Control Packages

Various emissions control packages were simulated using the UAM-V to determine the effect of the controls on ozone air quality in Atlanta. Results of the simulations were also compared with the benchmarks described in section 3.1.1 to determine if the controls were sufficient to demonstrate attainment of the 1-hour, 0.12 ppmv ozone NAAQS. The two control packages are called 2003 Base and 2003 Attain. The 2003 Base package consists of the 2003 emissions described in section 3.3. These emissions include all growth assumptions, Georgia mandated controls in place by 1999, and Federal Clean Air Act mandated controls that will occur by 2003. The 2003 Attain package consists of the emissions from the 2003 Base package with additional Georgia mandated controls that could be in place by 2003. Figure 3-1 summarizes the differences in these emissions control packages for the UAM-IV modeling domain.

3.1.2.1 2003 Base

The purpose of simulating the 2003 Base package is twofold. First, it demonstrates the effectiveness

of all mandated controls net of growth that have been or will be implemented by 2003. Second, it establishes a baseline by which the effectiveness of any additional controls implemented by 2003 or beyond can be measured.

3.1.2.1.1 Emissions

The emissions used in this simulation are the same as those 2003 emissions described in section 2.3. These emissions have been grown (projected) to 2003 and then reduced by all relevant Federal and State mandated controls. The controls that apply to the 2003 Base package are those included in the **15% Georgia State Implementation Plan** (November 15, 1993; revised September 1994, November 1994, and June 17, 1996), the **1994 State Implementation Plan for the Atlanta Ozone Non-attainment Area**, Section 3: The Post-1996 Rate-of-Progress Plan (November 15, 1994; revised June 17, 1996), Phase I gasoline, and natural gas technologies on Georgia Power Plants McDonough and Yates. A detailed description of controls can be found in Section 3.2. Tables 2-4 through 2-6 summarize the emissions used in this emissions control package.

3.1.2.1.2 Boundary Conditions

As with Georgia, other States have also experienced substantial changes since 1987 and 1988 such that the quality of air exported from these areas is likely to be significantly different in 2003 than the air exported over a decade previous. It is this exported air which may be imported into Atlanta through the airshed's lateral and top boundaries. For the model validation runs of July 29 - August 1, 1987 and July 7 - 8, 1988, the boundary conditions were estimated from observations taken near the location of the UAM-V domain boundaries (see section 2.4). Although based on the same meteorology, these boundary conditions are probably not an accurate representation of what may occur in 2003 because of changes in the emissions of ozone precursors in Georgia and throughout the Southeast. Therefore, the boundary conditions were determined through guidance provided by EPA Region IV in a letter to EPD dated December 23, 1997. A copy of this letter is included in this document as Appendix XIII. In this letter EPA suggests that boundary conditions could be taken from round 2 modeling performed for OTAG. Specifically, it was suggested that Run 5 be used for the 1988 OTAG episode and that hourly values be obtained from this run for each boundary grid at each level of the model. Run 5 represents the controls that are expected from each State's proposed regional NO_x emission budget. A contractor, Systems Applications International, extracted the boundary values for July 7 and 8, 2007 from this run.

For the 1987 episode the boundary conditions were estimated to be close to EPA default values of 40 ppb ozone for all boundary grids. This was determined in our April 28, 1998 SIP for the Atlanta Ozone Non-attainment area and the same reasoning carries over to this SIP. EPD made this estimation for the following reasons. The peak ozone concentration on July 8, 1999 using the Controls after 1999 package and boundary conditions from OTAG Run 5 was 153 ppbv. For the same day using the same emissions but EPA default boundary conditions, the peak ozone concentration was 154 ppbv. Thus, the OTAG Run 5 boundary conditions yield about the same effect as EPA default boundary conditions. Also, since the 1987 episode is a stagnant episode the differences in boundary conditions are considered less critical than for the 1988 episode. Therefore

EPA default boundary conditions were used in modeling the 2003 Base and 2003 Controls package for the 1987 episode.

3.1.2.1.3 Results

Compared with the 1987 validation simulation that contained much higher boundary conditions, the peak simulated ozone concentration for the 2003 Base Case decreased from 192 ppbv to 174 ppbv on July 31, and from 156 ppbv to 136 ppbv on August 1. Compared to the 1988 validation simulation, peak simulated ozone concentrations decreased from 176 to 155 on July 8. The first benchmark requires that the number of modeled exceedances in the modeling domain be ≤ 3 or ≤ (N-1), whichever is less, where N is the number of severe primary episode days. As shown in section 3.1.1, two days are classified as severe (ExEx ≤ 2.00) and thus no more than (2 - 1) = 1 exceedances are allowed in each subregion. On the left of Figure 3-2, the peak hourly ozone concentration in each of the 20 by 20 subregions for each episode day is shown. On the right of Figure 3-2, all the subregions over 124 ppb are designated by a "1" in it's location. Finally at the bottom is the total number of exceedances of 124 ppb in each subregion for all 3 days. As illustrated by Figure 3-2, there are 14 subregions that have more than 1 exceedance for all 3 primary episode days and thus benchmark 1 is failed.

The second benchmark states that for episode days for which modeled exceedances are permitted, the predicted daily maxima cannot exceed the prescribed maximum ozone allowed value (130 ppbv for July 31, 124 ppbv for August 1, and 130 ppbv for July 8). Figure 3-3 shows that there are 13 subregions that exceed the maximum ozone allowed on two of the episode days, and 23 subregions in which the maximum allowable is exceeded on at least one day. Thus, benchmark 2 is failed.

Finally, Benchmark 3 requires an 80% reduction of grid-hours exceeding 124 ppb for the August 1 and July 8 primary episode days that under predict observed concentrations by more than 5%. The results below show that Benchmark 3 is passed for day 8/1/87 and failed for 7/8/88.

Grid-hours > 124 ppb	**8/1/87**	**7/8/88**
1987/1988 Base	613	340
2003 Base	99	102
Per Cent Reduction	84.0%	70.0%

3.1.2.2 2003 Attain

In the Regional NO_x SIP Call, EPA has found that the transport of ozone from certain States (including Georgia) and the District of Columbia in the Ozone Transport Assessment Group region (or OTAG, the 37 eastern most States and the District of Columbia) significantly contributes to non-attainment of the ozone National Ambient Air Quality Standards (NAAQS), or interferes with maintenance of the NAAQS, in certain downwind States. EPA found that local controls alone were not sufficient to reduce ozone during region-wide episodes since a substantial amount of ozone may be transported into areas from upwind sources. The amount of ozone transported into the Atlanta airshed was suggested to be one of the factors contributing to Georgia's inability to demonstrate attainment in this area. As a result of this finding, EPA has required statewide NO_x reductions for those States contributing to the non-attainment status of other downwind States. These reductions are to be achieved by 2007, though control measures are required to be implemented by 2003. The control measures EPA used to develop the proposed budgets are generally consistent with the OTAG recommendations. However, States have the flexibility to adopt a different set of control strategies as long as they achieve the 2007 reductions. Georgia's 2007 NO_x budget requires a 25% decrease in emissions off the 2007 baseline inventory (projected emissions less controls mandated by the Clean Air Act and other controls already implemented).

The States affected by EPA's proposed Regional NO_x SIP Call are Alabama, Connecticut, District of Columbia, Delaware, Georgia, Illinois, Indiana, Kentucky, Massachusetts, Maryland, Michigan, Missouri, North Carolina, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, Wisconsin and West Virginia.

The 2003 Attain package includes all emissions controls inherent to the federally mandated controls package plus an estimate of the additional reductions that could occur by 2003 due to the aforementioned Regional NO_x control requirements. This simulation also investigates the effect of clean boundary conditions on ozone non-attainment in Atlanta.

3.1.2.2.1 Emissions

In addition to the controls described in the 2003 Base Case package, additional reductions are applied by estimating the effect of the control measures EPA used to establish Georgia's 2007 Statewide NO_x budget. These include controls from electric power generating devices and non-utility point sources. In the Regional NO_x SIP Call, EPA estimates that the following reductions could be achieved by 2007 in Georgia during the ozone season:

Category	2007 CAA Base (tons)	Proposed Budget (tons)	Percent Reduction
Electric Utilities	86,455	30,402	65%
Non-utility Point	36,827	29,024	21%
Area Sources	13,212	13,212	0%
On-Road Mobile	90,499	90,499	0%
Non-Road Mobile	26,497	26,497	0%
Total	253,490	189,634	25%

The reductions stated above plus reductions described in Section 3.2 were modeled together and these reductions constitute the 2003 Attain package. The net effect of these controls is shown in the emissions summaries of Tables 3-3 through 3-5.

3.1.2.2.2 Boundary Conditions

As was the 2003 Base Case, the boundary conditions were determined through guidance provided by EPA Region IV in a letter to EPD dated December 23, 1997. A copy of this letter is included in this document as Appendix XIII. In this letter EPA suggests that boundary conditions could be taken from round 2 modeling performed for OTAG. Specifically, it was suggested that Run 5 be used for the 1988 OTAG episode and that hourly values be obtained from this run for each boundary grid at each level of the model. Run 5 represents the controls that are expected from each State's proposed regional NO_x emission budget. A contractor, Systems Applications International, extracted the boundary values for July 7 and 8, 2007 from this run.

For the 1987 episode the boundary conditions were estimated to be close to EPA default values of 40 ppb ozone for all boundary grids. The justification for using EPA default values for the future case boundary conditions for the 1987 episode in this SIP is the same as that used in our 4/28/98 Ozone SIP. EPD made this estimation for the following reasons. The peak ozone concentration on July 8, 1999 using a controls package and boundary conditions from OTAG Run 5 was 153 ppbv. For the same day using the same emissions but EPA default boundary conditions, the peak ozone concentration was 154 ppbv. Thus, the OTAG Run 5 boundary conditions yield about the same effect as EPA default boundary conditions. Also, since the 1987 episode is a stagnant episode the differences in boundary conditions are considered less critical than for the 1988 episode. Therefore EPA default boundary conditions were used in modeling the 2003 Attain package for the 1987 episode.

3.1.2.2.3 Results

The peak simulated concentrations for the 2003 Attain package with boundary conditions representative of OTAG Run 5 were 164 ppbv for July 31, 133 ppbv for August 1, and 154 ppbv for July 8. Again, the first benchmark requires that no more than one exceedance of 124 ppbv are allowed in any subregion in the modeling domain. Figure 3-4 shows that seven of the subregions in the Atlanta non-attainment area have at least two exceedances of 124 ppb. Thus, ***Benchmark 1 is failed.***

The second benchmark states that for episode days for which modeled exceedances are permitted, the predicted daily maxima cannot exceed the prescribed maximum ozone allowed value. Figure 3-5 shows that there are 17 subregions that exceed the maximum ozone allowed of 130 ppbv on July 31. For the next day, August 1, 1987, 6 subregions exceeded the maximum allowed of 124 ppbv. There are 4 subregions that exceed the maximum ozone allowed of 130 ppbv on July 8. Thus, ***Benchmark 2 is failed.***

Finally, Benchmark 3 requires an 80% reduction of grid-hours exceeding 124 ppb for the August 1 and July 8 primary episode days that under predict observed concentrations by more than 5%. According to the table below, we can expect 95.6%, and 75.9% reductions in exposure, respectively, for August 1 and July 8 are predicted, with a combined reduction in grid-cell hours of 88.6%. Thus, ***Benchmark 3 is passed***.

Grid-hours > 124 ppb	**8/1/87**	**7/8/88**	**Combined**
1987 (1988) Base	613	340	953
2003 Attain	27	82	109
Per Cent Reduction	95.6%	75.9%	88.6%

3.1.3 Supporting Evidence (Weight of Evidence)

The 2003 Attain simulations suggest that Atlanta will approach attainment of the 1-hour, 0.12 ppmv ozone NAAQS if all currently proposed controls are implemented. The challenge remains for Georgia to control growth in emissions in the Atlanta area or compensate for it to ensure that the region will also maintain the standard. Even though the bright line tests of the statistical determination were not completely satisfied, there are several reasons to believe that Atlanta will attain the standard in 2003 - a) Relative Reduction Factor Analysis; b) EPA's modeling of the NO_x SIP Call Reductions; c) Atlanta's Partnership for a Smog-Free Georgia program; and d) Georgia's regulation of peaking generators. Each of these reasons is discussed in more detail below.

3.1.3.1 Relative Reduction Factor Analysis

Although EPA guidance is still in draft form and intended for analysis of the 8-Hour Ozone NAAQS, we used this methodology to assess the attainment of the 1-Hour Ozone Standard in the Atlanta area in a qualitative or Weight-of-Evidence manner.

Our analysis used monitored design values in concert with model-generated data; it uses model results in a "relative" rather than "absolute" sense, and is applied near ozone monitoring sites. One (1)-hour daily maximum ozone is predicted near a monitor for each day in the test. Each day's prediction is then summed and averaged, first with current emissions and then with future emissions. The ratio of future to current predicted mean 1-hour daily maxima is then computed. This ratio is called the "relative reduction factor", or RRF. The analysis consisted of the following steps:

1. Compute a current site-specific design value from *monitored* data.

The average of three design values using 1996 (computed from the period 1994-1996, 1995-1997, and 1996 to 1998) for each Atlanta ozone monitoring site are as follows:

Confederate Ave	0.1440 ppm
South DeKalb	0.1330 ppm
Dawsonville	0.0993 ppm
Conyers	0.1400 ppm
Tucker	0.1367 ppm
Gwinnett Tech	0.1260 ppm
Douglas Co.	0.1353 ppm
Yorkville	0.1200 ppm
Peak area	0.1460 ppm (average of max design value for each of 3 years)

2. Use air quality modeling results to estimate a site-specific relative reduction factor.

First, one-hour maximums were predicted for each episode day in the base scenario, 1996. Using the draft guidance received from EPA Region IV, the year of 1996 was selected as the most recent year that provides accurate representative ambient monitoring and emission inventories. 1996 is the latest year to have 3 associated design values that includes all quality assured ozone readings. Also the 1996 emission inventory includes all corrections and updates incorporated in the 2003 inventories. Improvements include the use of measured vehicle miles traveled (VMT) in 1996, the latest yearly data received from ARC and Georgia DOT. The use of Mobile 5b and the latest changes of the inputs for the I/M program were incorporated only for 1996 and 2003. For the area source portion of the 1996 inventory, the peaking generators were added, while past inventories failed to account for these sources. Because of the above improvements, the 1996 emission inventory was used to calculate the emission shortfall to attainment according to method 1 of the draft guidance.

Second, one-hour maximums were predicted for each episode day in the control scenario, 2003.

These concentrations were then summed and averaged.

The ratio of future to current predicted mean 1-hour daily maxima was then computed.

The results are as follows:

Confederate Ave	Max 1-hr 1996	Max 1-hr 2003	Relative Reduction Factor
7/31/87	0.1839	0.1643	--
8/1/87	0.1455	0.1276	--
7/8/88	0.1657	0.1428	--
Average	0.1650	0.1449	0.8782

South DeKalb	Max 1-hr 1996	Max 1-hr 2003	Relative Reduction Factor
7/31/87	0.1839	0.1643	--
8/1/87	0.1521	0.1295	--
7/8/88	0.1474	0.1246	--
Average	0.1611	0.1395	0.8659

Dawsonville	Max 1-hr 1996	Max 1-hr 2003	Relative Reduction Factor
7/31/87	0.1078	0.0950	--
8/1/87	0.0980	0.0843	--
7/8/88	0.0819	0.0609	--
Average	0.0959	0.0801	0.8352

Conyers	Max 1-hr 1996	Max 1-hr 2003	Relative Reduction Factor
7/31/87	0.1821	0.1643	--
8/1/87	0.1587	0.1329	--
7/8/88	0.1260	0.1029	--
Average	0.1556	0.1334	0.8573
Tucker	**Max 1-hr 1996**	**Max 1-hr 2003**	**Relative Reduction Factor**
7/31/87	0.1821	0.1606	--
8/1/87	0.1520	0.1295	--
7/8/88	0.1322	0.1115	--
Average	0.1554	0.1339	0.8616

Gwinnett Tech	Max 1-hr 1996	Max 1-hr 2003	Relative Reduction Factor
7/31/87	0.1683	0.1465	--
8/1/87	0.1374	0.1237	--
7/8/88	0.1077	0.0938	--
Average	0.1378	0.1213	0.8803

Douglasville	Max 1-hr 1996	Max 1-hr 2003	Relative Reduction Factor
7/31/87	0.1286	0.1139	--
8/1/87	0.1120	0.0848	--
7/8/88	0.1747	0.1506	--
Average	0.1384	0.1164	0.8410

Yorkville	Max 1-hr 1996	Max 1-hr 2003	Relative Reduction Factor
7/31/87	0.1379	0.1011	--
8/1/87	0.1080	0.0787	--
7/8/88	0.1119	0.0870	--
Average	0.1193	0.0889	0.7452

Peak Area	Max 1-hr 1996	Max 1-hr 2003	Relative Reduction Factor
7/31/87	0.1839	0.1643	--
8/1/87	0.1587	0.1329	--
7/8/88	0.1775	0.1542	--
Average	0.1734	0.1505	0.8679

3. Multiply the relative reduction factor obtained in step 2 times the site-specific design value in step 1. The result is a predicted site-specific future design value.

Confederate Ave	0.1440 x 0.8782	=	0.1265 ppm
South DeKalb	0.1330 x 0.8659	=	0.1152 ppm
Dawsonville	0.0993 x 0.8352	=	0.0829 ppm
Conyers	0.1400 x 0.8573	=	0.1200 ppm
Tucker	0.1367 x 0.8616	=	0.1178 ppm
Gwinnett Tech	0.1260 x 0.8803	=	0.1109 ppm
Douglasville	0.1353 x 0.8410	=	0.1138 ppm
Yorkville	0.1200 x 0.7452	=	0.0894 ppm
Peak Area	0.1460 x 0.8679	=	0.1267 ppm

The preceding analysis indicates that observed values at Atlanta ozone monitoring sites, except for the Confederate Ave monitoring site and peak area site, can be expected to be below the standards after the controls described within this plan are implemented and that the Atlanta ozone non-attainment area can achieve compliance with the ozone standard by 2003. Even the excessions at Confederate Ave. and the peak area are extremely close to attainment and well within the noise of the model.

3.1.3.2 EPA's Modeling of the NO_x SIP Call Reductions for Ozone Sites in Georgia

To further support the relative reduction results stated above, EPA, in a July 10, 1998 memo from Bill Hunt to the Regions, described a relative reduction method coupled with NO_x SIP Call Reduction Emission Inventory modeling that results in attainment for all counties in the Atlanta non-attainment area. Although this analysis uses a dated emission inventory, a regional modeling grid size of 12 km. squares, and a countywide approach, the results show attainment by 2007. In this analysis, EPA determined the 1994-1996 ozone design value for a county to be the highest design value of all the sites in that county. If there were less than 3 years of ozone monitoring data at any one site, they used the 3rd highest 1-hour ozone reading over 2 years or the 2nd highest value for 1 year. They then modeled the 1995 episode as the base case and that same meteorological episode for 2007 emissions reduced by the NO_x SIP Call implemented in all applicable states. The relative reduction results show that the design values are all reduced to less than 124 ppb, with the highest being 119 ppb in the DeKalb County area. What follow is the results from this analysis for each county in the 13-County Non-attainment Area that has ozone monitoring sites.

Note that the Confederate Avenue site is located in Fulton County, which indicates a value of 118 ppb, attaining the standard.

County	Ozone Design Value 1994-1996 (ppb)	After SPR. Budget Run (ppb)
DeKalb	147	119
Douglas	140	116
Fulton	143	118
Gwinnett	123	100
Paulding	114	95
Rockdale	141	116

The preceding analysis indicates that the Atlanta area can achieve the 1-hour ozone standard with the implementation of controls similar to those found in the Regional NO_x SIP call.

3.1.3.3 The Partnership for a Smog-Free Georgia, Empirical Evidence from the 1996 Centennial Olympic Games, and Additionally Proposed Controls

The Partnership for a Smog-Free Georgia (PSG) represents a proactive and innovative approach to reducing ozone in the Metro Atlanta area. It is aimed specifically at reducing the number of days when ozone levels are high, thus reducing the health and environmental risks associated with such high levels. PSG focuses on collective and individual actions to change or reduce emissions from the mobile and area source categories. These include changes in vehicle volumes and traffic patterns by promoting alternative commuting options, and other actions that involve operational and maintenance activities. The PSG program is fully described later in section 3.2.1.3.

A credit amounting to 3.0% of the emission reductions needed to demonstrate attainment was assumed to account for PSG measures and the Governor's Executive Order that all State departments and agencies and units of the University System of Georgia located in the 13 non-attainment counties must strive to reduce the number of single occupancy vehicle trips its employees make driving to and from work by a goal of no less than 20%. However, larger ozone reductions are expected. EPD estimates that an aggressive 20% VMT reduction program would result in a 35 tons/day decrease in mobile source NO_x in the 13 county non-attainment area. Using the results from sensitivity runs on mobile sources in these same 13 counties, a NO_x reduction of 11.6 tons/day showed a 4 ppb decrease in ozone at the peak for the July 31, 1987 episode. Assuming a linear relationship, the 29.75 tons/day (85% of the 35 tpd, since 3% of the reduction in VMT has already been modeled) mobile source decrease from the PSG program would result in a 10.3 ppm decrease in ozone. Assuming that this reduction would affect both the Confederate Avenue Site and the Peak Area this would bring all sites at or below the ozone standard with the highest being the Confederate Avenue

Site with a design value of 124 ppb ozone. Empirical evidence from the 1996 Centennial Olympic Games may support this value or an even higher response.

More people visited the 1996 Summer Games in Atlanta than attended the Summer Games in Barcelona and Seoul combined. In order to accommodate and serve the increased population, the Atlanta Committee for the Olympic Games (ACOG) developed a traffic management plan which relied heavily on restricting access to many streets within downtown Atlanta, and an increased dependence on mass transit. Further, anecdotal evidence suggests that many of the natives modified their typical patterns of commuting and business transactions to avoid either real or perceived personal transportation difficulties associated with the Games. One study suggests that the resultant improved air quality is directly related to these actions. This study is included here as Appendix XIV. The effect of these transportation alternatives, used by the permanent and temporary population, on air quality is uncertain. However, it is clear that the ozone air quality in Atlanta during the 1996 Summer Games was improved. See Figure 3-6 for a comparison of monitored data at the Confederate Avenue site. The ozone standard was exceeded on June 30, 1996, prior to the Games. On July 20, 1996 during the Games, an analysis of the meteorological conditions indicated similar ozone-forming potential as June 30. However, monitored ozone was significantly less.

PSG is inducing some of the same type of worksite and transportation changes which occurred during the Olympics. While the Olympics were a unique experience, it is expected that PSG will make a significant and positive impact on ozone air quality in Atlanta.

Finally, only the reductions to be obtained in the 13-county non-attainment area from the PSG program were utilized in the modeling runs. In fact, however, the benefits won't stop at the non-attainment boundaries. The program will have an effect on motorists outside the area, through its public outreach and car pooling efforts. The reductions obtained through these efforts will aid in a further reduction of ozone concentrations.

3.1.3.4 Peaking Generation Regulation

NO_x reductions due to the regulation of stationary gas turbines and stationary engines used for electricity generation are expected to reach as high as 30 tpd. Since these are low-level sources, sensitivity analysis indicates reductions from these sources will reduce ozone concentrations by approximately 10 ppb.

3.1.4 Recommendations

EPD has modeled a 2003 Base control strategy as well as a 2003 Attain control strategy. A description of each of these two control strategies are found in sections 2.3 and 3.1.2

Even with all the emissions controls that are proposed to be implemented by 2003, the UAM-V Attainment section predicts that Atlanta cannot attain the 1-hour, 0.12 ppmv ozone NAAQS using the bright line test. The model does show that with these same controls however, plus weight of evidence considerations that Atlanta can experience attainment in 2003. It also shows that Atlanta will be able to meet the standard on some days when previously it could not.

However, there are compelling reasons to believe that a) the emissions controls that already have been implemented or will be implemented in the future are much more effective than the model indicates; and b) there will be more emissions reductions by 2003 and beyond than what was included in any of the modeled control packages.

The model provides direction in the sense that reductions in ozone concentration are demonstrated with the 2003 Attain controls. It is these controls that EPD will implement to produce the reductions of NO_x and VOC emissions necessary to bring the Atlanta ozone non-attainment area into compliance with the National Ambient Air Quality Standard. These controls are described in detail in section 3.2.

Analysis of relative reduction factors, EPA's NO_x SIP Call modeling, Georgia's PSG program, analysis of the 1996 Summer Olympics conditions and Georgia's regulation of peaking generators point to an eventual peak ozone concentration in the Atlanta area somewhere in the range of 110-120 ppb in 2003.

3.1.5 Data Access Procedures

3.1.5.1 Assurance Files Archived and Maintained

All of the UAM-V modeling evaluations were performed by personnel at EPD and those files are archived and maintained on the same machine. All input files for all UAM-V runs generated by EPD have been archived and maintained either on 4 mm tape or hard disk. A log containing a listing of each file used for each UAM-V run is being updated. This history of UAM-V runs, when completed, will show the file naming convention and comments about each run. It can be used to determine which files to request to perform a model evaluation.

3.1.5.2 Computer on Which Files Generated and Can Be Read

All UAM run executions performed by EPD have been conducted on a Hewlett Packard Model 735/125 UNIX workstation and the files stored either on one of six 4 gigabyte hard disks or on 4 mm DAT tape.

3.1.5.3 Identification of Contact Person

The following Georgia Air Protection Branch personnel should be the first contact depending on the type of information desired.

Engineering and control requirements	- Jeff Carter	(404) 363-7014
General details on UAM modeling	- Dale Kemmerick	(404) 363-7092
Mobile Source Emissions	- Marlin Gottschalk	(404) 363-7024

3.1.5.4 Administrative Procedures Needed to Access Files

All requests for access to UAM files must be submitted in writing to Dale Kemmerick at Georgia Air Protection Branch, 4244 International Parkway, Suite 120, Atlanta, Georgia 30354. Depending on the nature of the request, the data will be furnished in the medium requested.

3.2 Control Strategies

Building on the technical conclusions from the OTAG work, continued VOC and NO_x reductions in the metro-Atlanta urban area, along with NO_x reductions outside the area, were determined to be effective in reducing ozone concentrations. Possible control strategies to achieve these types of reductions were studied for the various sectors of the emission inventory.

Following a process of evaluating all possible control measures with various levels of emission reduction, and the time necessary to implement them, the elements of an overall control strategy were developed. The implementation of these control measures will enable the Atlanta area to attain the 1-hour ozone standard by 2003 and will also ensure continuing progress towards meeting the 8-hour standard.

This control strategy targets the largest contributors to the ozone problem, continues VOC controls in the urban area, and adds NO_x controls inside and outside the 13-county Atlanta non-attainment counties.

Controls that were in place by May 1, 1999:

- All elements of the 15% Rate of Progress Plan, which included 117.06 tons per day of VOC reduction from 1990 to 1996. This includes, among other things, the enhanced vehicle inspection and maintenance program, low RVP gasoline, Stage II gasoline vapor recovery, a ban on open/slash/prescribed burning, and a reliance on federal rules on architectural and industrial maintenance coatings, auto body repair shops and new vehicle emissions. (See Appendix XV for a full list of controls.)

- All elements of the Post-1996 (9%) Rate of Progress Plan, which included 50.10 tons per day of NO_x reductions from 1990 to 1999. This includes, among other things, NO_x RACT on certain stationary sources, and the enhanced vehicle inspection and maintenance program. (See Appendix XVI for a full list of controls.)

- A rule lowering the sulfur content of gasoline sold in a 25-county area in and around metro-Atlanta during the ozone season. This will reduce NO_x and VOC emissions by 11.7 and 17.8 tons per day, respectively, in 1999.

- Modifications at Georgia Power's Plants Yates and McDonough (both located within the 13-county non-attainment area), for seasonal application of natural gas technologies, reducing NO_x emissions by an average of 25.90 tons per day in 1999.

- A Partnership For A Smog-Free Georgia (PSG) Program has been put in place to obtain voluntary actions from local businesses, governments, schools, universities and the general public which will reduce VOC and NO_x emissions by 6.51 and 4.28 tons per day, respectively, during the summer season when ozone concentrations are the highest.

Controls that are to be implemented by May 1, 2003:

- A rule further lowering the sulfur content of gasoline sold in a 45-county area in and around metro-Atlanta during the ozone season. This will reduce NO_x and VOC emissions by 23.54 and 30.50 tons per day, respectively, in 2003.

- Modifications at point sources with large electric utility steam generating units, located throughout the non-attainment area and the area of significant impact, reducing NO_x emissions by about 290 tons per episode day in 2003.

- Modifications at three point sources with large NO_x emitting units other than electric utility steam generating units, located in the 13 county area, reducing NO_x emissions by 18.83 tons per day in 2003.

- Additional enhanced I/M requirements for the 13 county non-attainment area providing NO_x and VOC emissions reductions of 11.34 and 13.17 tons per day, respectively, in 2003.

- New Source Review (NSR) requirements expanded to applicable point sources located in the area of significant impact, providing NO_x and VOC emissions reductions of 21 and 0.2 tons per day, respectively, in 2003.

- Reasonably Available Control Technology (RACT) requirements expanded to applicable point sources located in a 32 county area outside the non-attainment area for NO_x and VOC reductions of 100.1 and 14.3 tons per day, respectively, in 2003.

- A new rule to regulate NO_x emissions from medium-sized new boilers and other fuel-burning equipment in the area of significant impact in and around the Atlanta ozone non-attainment area, providing NO_x emissions reductions of 0.7 tons per day in 2003.

- A new rule to regulate NO_x emissions from new and existing stationary engines and new stationary gas turbines located in the area of significant impact in and around the Atlanta ozone non-attainment area and used to generate electricity (including peaking power) for a NO_x reduction of at least 30 tons per day, within the 45-county area, in 2003.

- Regional NO_x reductions, as specified by EPA on October 27, 1998, which reduce transported ozone and ozone precursors entering the metro-Atlanta area, totaling greater than 95 tons per day in 2003.

- National VOC and NO_x control measures from on-road mobile, off-road mobile, and area sources, such as the national low emission vehicle (NLEV) program, locomotive engine standards, phase 2 requirements for VOC consumer and commercial products, marine engine standards, and phase 2 and 3 non-road diesel engine standards.

The reductions from these control measures were modeled using the modeling process described above. The results indicate that this set of control measures, when put into place and implemented by May 1, 2003, will reduce ozone concentrations in the area sufficient to attain the ozone air quality standard by 2003 using weight of evidence arguments allowed under EPA guidance.

3.2.1 Additional Reductions Achievable by 2003

There are thirteen main NO_x and VOC control groupings, in addition to the existing controls included in the 15% Rate of Progress Plan and the Post-1996 (9%) Rate of Progress Plan, that are being proposed to be achieved by 2003. Total NO_x and VOC reductions modeled for these controls were 637.71 and 107.92 tons per average episode day, respectively, in 2003.

3.2.1.1 Point Source Control Measures

3.2.1.1.1 New Or Modified Major Stationary Sources

A revision to the existing air quality control rule relating to "Permit Requirements" will expand the existing New Source Review (NSR) requirements for VOC and NO_x sources with VOC or NO_x emissions greater than 100 tons per year to the following counties: Banks, Barrow, Bartow, Butts, Carroll, Chattooga, Clarke, Dawson, Floyd, Gordon, Hall, Haralson, Heard, Jackson, Jasper, Jones, Lamar, Lumpkin, Madison, Meriwether, Monroe, Morgan, Newton, Oconee, Pickens, Pike, Polk, Putnam, Spalding, Troup, Upson, and Walton.

These NSR requirements will reduce or limit emissions from new growth by an estimated 22.67 and 0.2 tons per day for NO_x and VOC, respectively, in 2003. BACT (Best Available Control Technology) and offsets at a ratio of 1.1 to 1 will be required. LAER (Lowest Achievable Emission

Reductions) is normally required for non-attainment NSR; however, BACT is being substituted in these 32 counties.

See Appendix XVII for a copy of the amended rules for the expansion.

3.2.1.1.2 Large Electric Utility Steam Generating Units

Effective May 1, 1999, existing air quality control rule, Rule (jjj), relating to "NO_x Emissions From Electric Utility Steam Generating Units" limits NO_x from coal-fired units with maximum heat inputs greater than 250 MMBtu/hr located in the 13 county Atlanta ozone non-attainment area to alternative emission limits to be established for the units by EPD's Director and/or 0.34 lb/MMBtu heat input averaged over all affected units. Effective May 1, 2000, Rule (jjj) limits NO_x from the same affected units to new alternative limits and/or 0.30 lb/MMBtu heat input averaged over all affected units. A revision to this rule will add additional NO_x emissions limits effective May 1, 2003 for such units located in a 16 county area in and around the Atlanta ozone non-attainment area. The additional limits consist of new alternative emission limits and/or 0.15 lb/MMBtu heat input averaged over all affected units. The proposed 3 additional counties include Bartow, Floyd, and Heard. The limits will apply during the period from May 1 through September 30 of each year on a 30-day rolling average basis.

Compliance with Rule (jjj) will be determined, potentially, in two steps. First, each source will be assigned (in an air quality permit) a specific alternative emission limit that will be a 30-day rolling average limit. The source-specific alternative emission limits will be established such that the weighted average of all of the source-specific emission limits, using the maximum heat input capacity for each source, will equal the 30-day rolling average lb/MMBtu limit in the Rule (i.e., 0.34 or 0.30 or 0.15 lb/MMBtu). If each source is complying with its specific alternative emission limit, compliance with Rule (jjj) will be satisfied. If the actual emission rate from any source is greater than its alternative emission limit, then compliance shall be achieved by demonstrating that the actual Btu-weighted average emissions rate for all affected sources is less than the 30-day rolling average limit in the Rule.

Compliance with a 30-day rolling average alternative emission limit is determined by performing a weighted average, using the actual hourly source heat inputs (MMBtu/hr), of all of the hourly NO_x emission rates (lb/MMBtu) for the periods of operation of the source during a 30 consecutive day source operational period. To determine compliance with a 30-day rolling average emission limit specified in the Rule (i.e., 0.34 or 0.30 or 0.15 lb/MMBtu), you would perform a weighted average, using the actual source heat inputs (MMBtu/hr), of all of the hourly NO_x emission rates for all of the affected sources during a 30 consecutive day period.

Georgia Power operates two coal-fired electric generation power plants in the ozone non-attainment area (Plants Yates and McDonough) that have access to a natural gas supply. These have been required by Rule (jjj) to utilize natural gas technologies (co-firing, re-burn) during the ozone season beginning in 1999 to achieve approximately a 25% reduction in NO_x emissions.

Re-burn technology uses a second, fuel-rich combustion zone above the top row of burners to reduce NO_x formation from primary combustion. Boiler heat input from 15 to 30 percent is introduced into this re-burn zone. Over-fire air is injected in a burnout zone at the top of the furnace to complete the combustion of this re-burn fuel.

Initial calculations indicate that these control measures will result in an average of about 25.90 tons per episode day of NO_x reductions in 1999.

Georgia Power will be required under Rule (jjj) to install additional controls by May 2003 on coal-fired boilers at five of its plants that impact the Atlanta ozone non-attainment area. The controls will affect an average emissions rate of 0.15 lb/MMBtu heat input for the coal-fired boilers at Plants Bowen, Hammond, McDonough, Wansley, and Yates. The following table contains a list of possible NO_x control methods that may be employed to meet the 0.15 lb/MMBtu limit. It should be noted that the actual control method that will be installed on a particular coal-fired boiler will be determined based on boiler and site-specific factors and the actual control method that will be utilized may be different from that method in the following table.

Additional Georgia Power Controls By May 2003

Plant/Unit	NO_x Base (lb/MMBtu)	Possible Control Method	NO_x Target (lb/MMBtu)
Bowen 1	0.43	85% SCR	0.07
Bowen 2	0.44	85% SCR	0.07
Bowen 3	0.44	ALNB	0.23
Bowen 4	0.44	ALNB	0.23
Hammond 1	0.86	LNBOFA	0.25
Hammond 2	0.86	LNBOFA	0.25
Hammond 3	0.86	LNBOFA	0.25
Hammond 4	0.43	85% SCR	0.07
McDonough 1	0.30	SNCR	0.21
McDonough 2	0.30	SNCR	0.21
Wansley 1	0.40	85% SCR	0.07
Wansley 2	0.43	85% SCR	0.07
Yates 1	0.30	LNB+SNCR	0.20
Yates 2	0.30	LNB+SNCR	0.20

Plant/Unit	NO_x Base (lb/MMBtu)	Possible Control Method	NO_x Target (lb/MMBtu)
Yates 3	0.30	OFA	0.29
Yates 4	0.30	OFA	0.29
Yates 5	0.30	OFA	0.29
Yates 6	0.30	GNOCIS	0.27
Yates 7	0.30	ALNB	0.17

SCR = Selective Catalytic Reduction
ALNB = Advanced Low NO_x Burner
LNBOFA = Low NO_x Burners with Over-Fire Air
SNCR = Selective Non-Catalytic Reduction
OFA = Over-Fire Air
GNOCIS is a software-based operational parameter monitoring and control system

Initial calculations indicate that the above controls would result in 2003 NO_x reductions of about 201.48 tons per day. A copy of the proposed rule requiring these changes is presented in Appendix XVII.

3.2.1.1.3 Other Large Point Sources

EPD has determined that the following large point sources are significant contributors and that additional controls and NO_x reductions are deemed available for Blue Circle Cement in Fulton county, Transcontinental Gas Pipeline in Henry county, and Austell Box Board in Cobb county. The negotiated controls and associated NO_x reductions are as indicated in the following sections.

Blue Circle Cement

Blue Circle Cement will be required under this SIP to implement additional controls to reduce NO_x emissions from the two cement kilns located at its Atlanta plant. The control method proposed by Blue Circle to meet this requirement is mid-kiln firing of tires. This alternate fuel lowers kiln combustion temperatures, which produces less NO_x. Tires will be fired in the kilns except during periods when certain specialty products are being produced. However, such periods will be limited to no more than 10 days during any 30-day period. The resulting NO_x reduction is estimated to be 30% of the kilns emissions or 2.67 tons per day in 2003.

These additional controls and associated NO_x reductions are made binding and will be consistently assured by way of the permit conditions included in Appendix XIX.

Transcontinental Gas Pipeline

Transcontinental Gas Pipeline will be required under this SIP to implement additional controls for all fifteen of its mainline internal combustion engines (ICEs) located at its Stockbridge plant (Station 120). The control level is a 6.0 grams per horsepower hour NO_x limit to be achieved through use of low emissions combustion (LEC) techniques on each of the fifteen engines and which translates to a 45-78% reduction for each engine. The resulting overall plant NO_x reduction is estimated to be 15.83 tons per day in 2003.

These additional controls and associated NO_x reductions are made binding and will be consistently assured by way of the permit conditions included in Appendix XIX.

Austell Box Board

Austell Box Board will be required under this SIP to evaluate and implement additional NO_x control strategies for the coal-fired boiler at its plant. The control strategies to be evaluated include, but would not be limited to, the installation of low NO_x burners and/or burner modifications. It is anticipated that these additional control strategies will reduce the NO_x emissions to approximately 0.38 lb/MMBtu or lower; however, a site specific boiler study will be conducted this summer to determine whether a lower limit is achievable and appropriate. Once the results of the boiler study are evaluated by EPD, the 0.38 lb/MMBtu limit may be adjusted downward. At a 0.38 lb/MMBtu emission rate, the resulting NO_x reduction is estimated to be about 25% of the boiler's emissions or 0.30 tons per day in 2003. These additional controls and associated NO_x reductions are made binding and will be consistently assured by way of the permit conditions included in Appendix XIX.

3.2.1.1.4 Other Point Sources

Georgia has existing rules requiring Reasonably Available Control Technology (RACT) for certain NO_x and VOC sources located in the 13 county ozone Non-attainment area not subject to one of the existing source category specific Control Technology Guideline (CTG) rules for VOC sources. In accordance with the need to obtain reductions for ozone attainment from as many sources as controls are reasonably available, EPD has expanded the existing requirements for VOC sources with VOC emissions greater than 100 tons per year and NO_x sources with NO_x emissions greater than 100 tons per year to the following counties:

Banks, Barrow, Bartow, Butts, Carroll, Chattooga, Clarke, Dawson, Floyd, Gordon, Hall, Haralson, Heard, Jackson, Jasper, Jones, Lamar, Lumpkin, Madison, Meriwether, Monroe, Morgan, Newton, Oconee, Pickens, Pike, Polk, Putnam, Spalding, Troup, Upson, and Walton.

The majority of these reductions will be obtained by the use of case-by-case RACT at existing sources of VOC and NO_x. RACT for these sources will be determined using methods outlined in Appendix XX. These case-by-case RACT determinations will be incorporated into state permits that will be submitted to EPA for SIP revision within one year of conditional approval of the modified case-by-case RACT rules. A letter of commitment to submit the permits for SIP revision is found in Appendix XXVIII.

The expansion of RACT to the above counties will result in NO_x and VOC reductions of about 100.13 and 14.3 tons per day, respectively, in 2003. See Appendix XVII for a copy of the amended rules for the proposed expansion.

3.2.1.1.5 Other Stationary Sources

Two new rules will regulate NO_x emissions from certain types of new and existing stationary fuel combustion equipment. In addition, several additional phases of the federal consumer and commercial products requirements scheduled to be in place by 2003 will control VOC emissions from the use of such products.

a. New Fuel Burning Equipment. The first stationary fuel combustion equipment rule pertains to new boilers and other equipment meeting the definition of fuel burning equipment in the Rules. (Fuel burning equipment is equipment for which the primary purpose is the production of thermal energy from the combustion of fuel and which furnishes heat indirectly through transfer by fluids, such as stream or thermal oil, or transmission through process vessel walls.) A new air quality control rule, "NO_x Emissions From Fuel-burning Equipment", will regulate NO_x emissions from new boilers and other fuel-burning equipment whose heat input capacity is equal to or greater than 10 million Btu/hr and less than or equal to 250 million Btu/hr in the 45-county area in and around the Atlanta ozone non-attainment area. The rule will limit NO_x emissions from affected fuel-burning equipment installed or modified on and after May 1, 1999 to no more than 30 ppm at 3% oxygen. The limit will apply during the period from May 1 through September 30 of each year, providing a NO_x reduction of 0.7 tons per day in 2003.

b. Stationary Gas Turbines and Engines For Electricity Generation. A second new air quality control rule, "NO_x Emissions From Stationary Gas Turbines and Stationary Engines Used To Generate Electricity" will regulate NO_x emissions from new and existing stationary engines and new stationary gas turbines located in the 45-county area in and around the Atlanta ozone non-attainment area and used to generate electricity. The primary focus of this rule is on stationary engines and turbines with capacities between 100 kilowatts and 25 megawatts that are being operated during peak electrical demand periods. EPD calculates that there is at least 320 megawatts of installed capacity of peaking engines in the 45- county area and expects continued growth of this type of equipment. Peaking engines are located at commercial facilities, industrial facilities, governmental facilities, and utilities. A high percentage of these engines are installed primarily for use in case of emergency power outages. Engines that are used solely for emergency power outages are not subject to this rule.

Information gathered by EPD indicates that existing peaking engines are primarily diesel fuel-fired and emit 10 to 60 times more NO_x per unit of heat input than other available low NO_x emitting equipment (such as combustion turbines). In addition, available information indicates that periods when peaking engines are being operated often coincide with periods

when the ground level ozone concentrations are approaching or exceeding the standard. Therefore, it follows that subjecting these peaking engines to a restrictive NO_x limit will result in significant reductions in emissions during periods when the ozone concentrations are more likely to be elevated. It is estimated that the rule will result in daily NO_x reductions in excess of 25 tons per day within the non-attainment area and 5 tons per day outside the non-attainment area on peak ozone days. This reduction estimate is based on operating information from 154 Megawatts of capacity that is operated as part of Georgia Power's Standby Generator Service program and several electric membership corporations within the 45 county area. There are also additional units operated by the municipalities for which capacity or operating time is currently unavailable and 166 Megawatts of capacity located at industrial and commercial sites which are used for peak shaving (operated by the owner for the purpose of reducing their electrical demand) for which operating data is unavailable. These additional units would increase the amount of NO_x emitted on peak ozone days.

The rule will limit NO_x emissions from affected turbines installed or modified on and after January 1, 1999 and before October 1, 1999, to 42 ppm at 15% oxygen and will limit NO_x emissions from affected turbines installed on or after October 1, 1999, to 30 ppm at 15% oxygen. Compliance with these limits will be required beginning May 1, 2000, and upon startup, respectively. The rule will limit NO_x emissions from affected engines installed or modified on and after April 1, 2000, to no more than 80 ppm at 15% oxygen. Compliance with this limit will be required upon startup. These limits will require the installation of low NO_x combustion technology and/or add-on controls on new engines and turbines. Affected engines that are in operation before April 1, 2000 will be limited to 160 ppm NO_x at 15% oxygen beginning May 1, 2003. This limit will result in the installation of add-on controls or the dedication of the engines to emergency use only. The May 1, 2003 compliance deadline will provide sufficient time for the installation of any new low emitting electrical generation facilities that may be needed to replace any lost capacity as a result of the rule limits. The limits will apply during the period from May 1 through September 30 of each year.

A revision to the existing air quality control rule relating to "Exemptions" will require permitting of stationary engines located in the 45-county area in and around the Atlanta ozone non-attainment area with rated capacities equal to or greater than 300 kilowatts burning natural gas, LPG, and/or diesel fuel and used for emergency and/or peaking power. This will allow EPD the opportunity to evaluate the vast majority of the engines and turbines that are being installed to insure compliance with the rule. [Note: Air quality permit applications do not need to be submitted for existing unpermitted engines that will be used solely for emergency use or shut down by May 1, 2003.]

A copy of the proposed rules requiring these changes is presented in Appendix XVII**.**

c. Additional Federal Consumer And Commercial Products Requirements. As indicated earlier, several additional phases of federal consumer and commercial products requirements scheduled to be in place by 2003 will further control VOC emissions from the use of such

products. Requirements took effect in 1998 for 24 categories of consumer products (aerosol cooking sprays, air fresheners, auto windshield wiper fluids, and 21 others) and 2 categories of coatings (architectural and autobody refinishing) that were projected to result in a 20% VOC reduction from the pre-regulated level.

Additional requirements are to be in place to regulate VOC emissions from aerosol spray paints, lithographic printing materials, industrial cleaning solvents, and flat wood paneling coatings nationwide by 2001. By 2003, requirements are to be in effect to reduce VOC emissions nationwide from 6 additional categories of coatings (miscellaneous metal products; large appliances; paper, film, and foil; plastic parts, metal furniture, and auto and light duty truck assembly), fiberglass boat manufacturing materials, miscellaneous industrial adhesives, letterpress printing materials, and petroleum dry cleaning solvents. Based on control information from the OTAG work, these additional requirements are assumed to result in at least a 30% overall VOC reduction compared to the pre-regulated level. They are estimated to provide a 13.82 ton per day additional VOC reduction by 2003.

3.2.1.2 Mobile Source Control Measures

3.2.1.2.1 Georgia Gasoline

Gasoline sold in a 25-county area will be regulated by phase 1 sulfur requirements beginning in 1999 such that gasoline-powered vehicle NO_x exhaust emissions will be reduced by 6.6%. To achieve this, the volume-weighted average sulfur content of this gasoline will be limited to 150 ppm during the ozone season.

The area subject to this Georgia gasoline regulation in 1999 consists of the following 25 counties: Barrow, Bartow, Butts, Carroll, Cobb, Coweta, Clayton, Cherokee, Dawson, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Hall, Haralson, Henry, Jackson, Newton, Paulding, Pickens, Rockdale, Spalding and Walton. A map of this area is shown in Figure 3-7.

Initial calculations indicate that the NO_x and VOC reductions resulting from phase 1 of the gasoline rule will be about 11.7 and 17.8 tons per day, respectively, in this 25-county area, in 1999.

Note that the VOC reductions result primarily from a 7.0 psi Reid vapor pressure (RVP) limit implemented in the Atlanta area in 1995 and described in the 15% Georgia State Implementation Plan (November 15, 1993; revised September 1994, November 1994, and June 17, 1996). This RVP limit was maintained in the phase 1 sulfur requirements and expanded from the original 13-county coverage area to the 25-county area.

U.S. EPA has proposed national fuel measures that will limit the sulfur content in gasoline to a 30 ppm average with an initial 300 ppm cap. However, these measures will not be implemented until 2004, to be phased in over several years. The national fuel program is scheduled too late to be utilized in Georgia's control strategy for a 2003 attainment date.

Additional regulation of Georgia gasoline to produce even greater NO_x reductions will require refinery modifications which can not be completed to produce delivery of such gasoline by 1999. Therefore, phase 2 sulfur requirements set to achieve additional reductions in gasoline-powered vehicle exhaust will go into effect on April 1, 2003. To achieve this, the volume-weighted average sulfur content of this gasoline will be limited to 30 ppm by weight and a 150 ppm per gallon cap. This fuel will be required year-round and is consistent with the recent EPA proposal for a national sulfur control program. The aforementioned 7.0 psi RVP limit will be maintained for the summer ozone season.

The area subject to this Georgia gasoline regulation in 2003 will consist of the 25 counties listed above and the following additional 20 counties: Banks, Chattooga, Clarke, Floyd, Gordon, Heard, Jasper, Jones, Lamar, Lumpkin, Madison, Meriwether, Monroe, Morgan, Oconee, Pike, Polk, Putnam, Troup, and Upson. A map of this expanded area is shown in Figure 1-12.

Initial calculations indicate that the NO_x and VOC reductions from Phase 2 of the gasoline rule will be about 23.54 and 30.50 tons per day, respectively, in this 45-county area in 2003.

See Appendix XVII for a copy of the rule for gasoline marketing.

To assure compliance with this rule, EPD has designed a program of downstream product sampling and testing. All field sampling by EPD and its agent(s) will be performed in accordance with the EPA guidance document "Methodology for Randomized Sampling to Estimate Mean Sulfur in Gasoline During a Specified Ozone Season", dated April 1, 2000. See Appendix XXX for a copy of this guidance document.

Section 211 of the Clean Air Act (CAA) pre-empts states from implementing fuel regulations that are not identical to those prescribed by the EPA. Section 211(c)(4)(C) of the CAA, however, provides for a pre-emption waiver dependent upon the state's demonstration that no other measures that would bring about timely attainment exist, or that other measures are unreasonable or impracticable. An application for a pre-emption waiver for the RVP and sulfur specifications has been submitted to EPA.

3.2.1.2.2 Additional Enhanced I&M Measures

In October 1996, EPD upgraded its Basic I/M program to an Enhanced I/M program and expanded it from the core counties of Cobb, DeKalb, Fulton and Gwinnett to nine new counties, Cherokee, Clayton, Coweta, Douglas, Fayette, Forsyth, Henry, Paulding and Rockdale, to cover the 13-county non-attainment area. It was also expanded to cover more vehicles: all gasoline-powered, light-duty vehicles from model year 1975 to the present. The upgrade of the program to "enhanced" has served to better identify high-emitting vehicles, especially those with excess NO_x emissions. The expansion in area and model coverage has more than doubled the number of vehicles required to be tested and repaired, if identified as high-emitters.

The current Enhanced I/M inspection consists of a biennial, 2-speed idle exhaust test for newer

vehicles (6 model years old and newer) and a loaded-mode Acceleration Simulation Mode (ASM 2525) test for older vehicles (7 model years and older). Each vehicle is also subject to a visual check for the catalytic converter and a pressure test of the gas cap.

Calculations indicate that, in 1999, the current Enhanced I/M program will reduce NO_x emissions by 57.95 tons per day and VOC emissions by 67.07 tons per day from a 1999 baseline without an I/M program.

To further reduce mobile source emissions to attain and maintain the ozone standard, EPD is proposing the following for the Enhanced I/M program: a change to annual testing for covered vehicles; conversion of the ASM test to a more stringent 2-mode ASM 2525/5015, for older vehicles; and the addition of an OBD test for newer vehicles. In addition, older vehicles are re-defined as model years 1975 through 1995; newer vehicles are re-defined as model years 1996 and newer. Also, new vehicles up to three years old are exempted from testing.

These changes are expected to further reduce VOC emissions by 13.17 tons per day and NO_x emissions by 11.34 tons per day in 2003.

The changes to the program will be rolled out in three steps:

1) Effective January 1, 2000, the test frequency for the inspection program will be changed to annual. However, a vehicle inspected in the 1999 test year and issued a 2-year Certificate of Emission Inspection will not be required to be tested again until its registration date in 2001.

2) Effective January 1, 2001, the new definitions for "newer" and older vehicles will be implemented, as well as adding a third year to the exemption for newer vehicles. Also, OBD testing of newer vehicles will be started.

3) Effective January 1, 2002, older vehicles will be tested using the 2-mode ASM 2525/5015 exhaust test. The 2-speed idle exhaust test will be used for those vehicles that cannot be tested by ASM for technical reasons.

See Appendix XXI for a copy of the revised Rules for Enhanced I/M.

3.2.1.2.3 Establishment of 13-County Atlanta Non-attainment Area Mobile Source Budget

A motor vehicle emissions budget is defined in EPA's transportation conformity rule (40 CFR Part 93, Section 93.124) as "...the implementation plan's estimate of future [motor vehicle] emissions." In accordance with U.S. EPA guidance, the motor vehicle emissions budgets for the 13 county Atlanta ozone Non-attainment area were calculated as "typical summer day" inventories rather than by using reaggregated hour-by-hour emissions from modeling inventories used as input to UAM. Modeling inventories differ from typical summer day inventories primarily in that they are episode-day specific, using a separate temperature for each of the 24 hours in each day of each episode being modeled. These episode-specific temperatures are used to explicitly model diurnal evaporative (hydrocarbon) emissions. That is, motor vehicle emissions are adjusted hourly for temperature effects.

Also, apart from the effects of temperature, the temporal profile applied to the motor vehicle inventories used for ozone concentration modeling results in lower emissions on some episode days (e.g., weekends) than on others.

The minimum and maximum temperatures used for the typical summer day inventories were taken from Georgia's final 1990 Base Year Ozone Emissions Inventory (November 1993). The temperatures used were:

Minimum Daily Temperature = 71 F
Maximum Daily Temperature = 95 F

These same minimum and maximum temperatures, derived from the minimum and maximum daily temperatures associated with the 10 days having the highest ozone concentration during the years 1988 through 1990, were used in the MOBILE inputs for the 15% Plan and the 9% Plan.

Identical VMT and speed data were used to calculate both the typical summer day inventories and the modeling inventories. See "Methodology for VMT Projections and Speed Estimates" in Appendix VII for an explanation of these data.

The EPA motor vehicle emission factor model MOBILE5b was used to calculate 2003 emission factors with the proposed 2003 controls in place. These controls include: annual enhanced I/M with 2500/idle tests and onboard diagnostics system checks on 1996 and newer model year vehicles, 2-mode ASM tests on 1975 through 1995 vehicles; 7.0 psi Reid Vapor Pressure gasoline; Stage II gasoline vapor recovery; the Federal Motor Vehicle Control Program, including Tier 1 tailpipe standards; and national LEV.

The emission factors resulting from the MOBILE5b runs were used in spreadsheets with the summer 2003 VMT to calculate tons per day emissions in the following manner:

Projected summer 2003 VMT for each roadway functional classification were multiplied by the

MOBILE5b VMT Mix fractions for each vehicle type and by the MOBILE5b emission factors for the speed associated with each functional classification. Other spreadsheets added emissions from each of the eight vehicle types, totaled the emissions, and, by dividing them by 907,180, converted the emissions from grams per day to tons per day. The MOBILE input files and the spreadsheet files used in these calculations are included in Appendix VII. Because the 418-column-wide comma-separated variables MOBILE5b output format was used, the output files were not printed, but they were imported into spreadsheets where their emission factors, calculated to three decimal places, were rounded to two decimal places and displayed for each vehicle type and speed.

Several adjustments had to be made to the tons per day emissions calculated by the spreadsheets to arrive at the final motor vehicle emissions budgets.

To calculate the additional reductions from the proposed 30 ppm sulfur fuel, EPA's Final Complex Model spreadsheet was used to calculate the percent difference between Atlanta-area baseline fuel (including RVP already lowered from 7.8 to 7.0 psi) and the proposed fuel. The Complex Model indicated additional VOC reductions of 4.408% and NO_x reductions of 11.730%. These reductions were applied to 13-county inventories of light-duty gasoline powered vehicles only (LDGV, LDGT1, and LDGT2). The VOC and NO_x light-duty gasoline inventories were 113.04 and 117.94 tons per day, respectively, and the predicted reductions were 4.98 VOC tons per day and 13.83 NO_x tons per day.

Calculation of the reductions associated with PSG, 6.51 VOC tons per day and 4.28 NO_x tons per day, is described in Section 3.2.1.4.

The final adjustment accounts for the loss of credit from exempting from vehicle inspection and maintenance cars 10 years old or older driven fewer than 5,000 miles per year and owned by persons 65 years old or older. It was estimated that this exemption increases VOC emissions by 0.83 tons per day and NO_x emissions by 0.64 tons per day. See "Effect of Senior Exemption on Highway Mobile Source Emissions" in Appendix VII for a description of the calculations.

The table below summarizes all these calculations.

2003 Motor Vehicle Emissions (tons per day)			
	CO	**VOC**	**NO_x**
1) Cherokee	35.73	5.29	8.72
2) Clayton	59.83	8.90	13.97
3) Cobb	175.03	25.52	38.34
4) Coweta	18.30	2.83	5.74
5) DeKalb	153.39	23.17	37.89

2003 Motor Vehicle Emissions (tons per day)			
	CO	**VOC**	**NO_x**
6) Douglas	33.85	5.03	8.26
7) Fayette	20.48	3.16	5.36
8) Forsyth	18.53	2.94	5.18
9) Fulton	256.88	39.34	66.39
10) Gwinnett	149.20	22.33	37.21
11) Henry	36.07	5.42	10.45
12) Paulding	11.79	1.81	3.03
13) Rockdale	25.16	3.64	5.34
Subtotal (MOBILE5b results)	994.24	149.38	245.88
Off-model calculations:			
Georgia gasoline reductions	--	4.98	13.83
PSG reductions	--	13.02	8.56
I/M - senior exemption increases	--	0.83	0.64
TOTAL	**994.24**	**132.21**	**224.13**

Based on projected VMT growth and additional control measures identified for the 13-county Atlanta non-attainment area used in the attainment demonstration, the motor vehicle emissions budgets for 2003 are 224.13 and 132.21 tons per typical summer day, NO_x and VOC, respectively.

These mobile budgets of 224.13 tons per day NO_x and 132.12 tons per day VOC were derived from the most accurate model available for predicting 2003 motor vehicle emissions. They represent 2003 VMT growth data projected from a state-of-the-art travel demand model for the 13 counties and emission factors from EPA's MOBILE5b emission factor model. The control measures identified and modeled for mobile emissions used to establish these budgets, along with all other control measures in this plan, will result in attainment of the 1-hour ozone air quality standard by 2003.

3.2.1.3 Off-road Mobile Source Control Measures

a. Federal Non-road Diesel Engine Phases 2 and 3 Requirements

Under current phase 1 requirements, diesel engines greater than 50 horsepower (hp) other than those used in underground mining equipment, locomotives, and marine vessels must meet Tier 1 emissions standards being phased in between 1996 and 2000, depending on engine size. At least a 30% reduction in NO_x emissions is projected to result from these requirements compared to uncontrolled levels.

In August 1998, more stringent standards were adopted for new non-road diesel engines other than those used in underground mining equipment, locomotives, and marine vessels over 50 hp to be phased in as 3 sets of standards between 1999 and 2008. The first set will be for engines less than 50 hp and phased in from 1999 to 2000. The second set will be phased in from 2001 to 2006 and cover all engines sizes. And the third set will be for engines greater than 50 hp phased in from 2006 to 2008. EPA projects that NO_x emissions from new non-road diesel equipment will be further reduced by 60% compared to the Tier 1 level as a result of these standards. In terms of all non-road sources, overall NO_x and VOC reductions of 6 and 9%, respectively, are projected in 2003 as a result of these standards.

b. Federal Marine Engine Requirements

EPA is setting new emission control requirements for all marine engines under control programs for gasoline outboards and personal watercraft marine engines, commercial diesel marine engines, and recreational stern drive and inboard engines. The program for the first type of engines went into effect in July 1996 and involves increasingly stringent standards for new engines over the course of a nine-year phase-in period beginning in model year 1998. A 75% reduction in HC compared to unregulated levels is projected. A program for the second type was proposed in November 1998 and involves emission limits that vary depending on engine size. Emission limits for the third type of engines are currently under consideration by EPA.

c. Federal Locomotive Requirements

EPA finalized emission standards for NO_x, HC, and other pollutants from locomotives in April 1998. The three sets of standards are expected to reduce NO_x emissions by 67% and HC emissions by 50% overall. The first set (Tier 0) applies to locomotives and locomotive engines originally manufactured from 1973 through 2001 at any time they are manufactured or remanufactured. The second set (Tier 1) covers those originally manufactured from 2002 through 2004 at the time of manufacture and each subsequent remanufacture. The final set (Tier 2) applies to locomotives and locomotive engines manufactured in 2005 and later at the time of manufacture and each subsequent manufacture. Those that were manufactured before 1973 or are electric or historic steam-powered do not contribute significantly to the

emissions and are not covered by the requirements. The requirements are estimated to result in about 17% less NO_x and 2% less HC from such sources in 2003.

3.2.1.4 Partnership for a Smog-Free Georgia

The Partnership for a Smog-Free Georgia (PSG) is a Voluntary Mobile Source Emission Program (VMEP) created and operated by Georgia EPD. Georgia EPD is committed to attaining 4.28 tpd of NOx reductions and 6.51 tpd of VOC reductions by the year 2003, through the successful implementation of the PSG program. This section presents a brief history on the formation of the PSG program, and provides references to the goals, objectives, and a commitment to a plan of action to achieve the NOx and VOC reductions.

Difficulty in regulating the emissions of small or unconventional sources, the increasing cost of technology needed to produce incrementally smaller reductions, and the time needed for improvements to penetrate existing fleets suggests that Voluntary Mobile Source Emission Reduction Programs (VMEPs) are worthy of consideration. VMEPs have the potential to contribute, in a cost-effective manner, reductions beyond mandatory Clean Air Act programs by engaging the public to make voluntary changes in their activities that will result in those reductions.

The Atlanta area has already experienced the effect that voluntary changes in driving habits can bring. Air quality during the 1996 Summer Olympic Games [held in Atlanta from July 19 through August 3, 1996], was significantly better than on days before or after with similar meteorological conditions. During the period, local businesses and residents worked and lived differently. For example, residents came into work at an earlier or later time than normal, or utilized MARTA instead of their personal vehicle, in order to facilitate and attend events and to accommodate the more than one million visitors that came to Atlanta for the Games. These actions affected traffic and other emission producing activities. On comparable days during the Olympic period, actual measured peak ozone concentrations were 25 to 27 ppb lower than forecasted. See Figures 3-6 and 3-8 for comparisons of monitored ozone and traffic counts.

In recognition of the value of voluntary measures, EPA has provided an incentive for states and the public to voluntarily reduce air pollution through its "Guidance on Incorporating Voluntary Mobile Source Emission Reduction Programs in State Implementation Plans," October 24, 1997. The stated goal of the guidance is to promote the creation of viable voluntary mobile source air quality programs and increase the number of areas implementing voluntary mobile source emission programs.

The guidance lays out the framework for ensuring that VMEPs become eligible for SIP Credits. Basically, the required documentation includes:

1. Identification and description of the VMEP;
2. Projections of emission reductions attributable to the program, along with relevant technical support documentation;
3. A commitment to monitor, evaluate, and report the resulting emissions effect of the voluntary measure;
4. A commitment to remedy in a timely manner any SIP credit shortfall if the VMEP program does not achieve projected emission reductions.

The following narrative references documentation which describes how Georgia's VMEP, the Partnership for a Smog-free Georgia (PSG), meets these criteria.

Appendix XXII is a list of options, used in marketing PSG to employers and employees, for changes in commuting and operational/maintenance activities, and therefore is a list of predicted program activities. Note that a majority of commuter actions are ones that EPA has already defined as being representative of VMEPs that could be implemented as credited with emission reductions for SIP purposes. Note also that the PSG Operations & Maintenance Activities include activities from sources other than mobile, and therefore go beyond the scope of the VMEP guidance and the allowed 3 percent credit.

Appendix XXIII is a copy of the original PSG operating plan, which includes a chart outlining roles and responsibilities of the program organizers and a time line of the work tasks. While the PSG has grown and evolved over the past three years, the operating principles, work tasks and participants remain largely unchanged.

Appendix XXIV provides copies of the Georgia Governor's Executive Order directing all state departments and agencies to become PSG1 partners, as well as a) the Governor's letters to federal regional administrators, local governments and the top 100 employers in the non-attainment area, challenging them to become PSG1 partners, and b) the Governor's letter to President Clinton outlining the importance of the initiative and requesting his support.

Appendix XXV provides the following information:

1. A description of program participants and identification of sponsors.
2. A description of how the program works.
3. Predicted effects of PSG activities.
4. Predicted PSG Emission Benefits in 2003.
5. A description of program evaluation methods and data collection methodology.
6. A description of program resources in terms of personnel and funding.
7. Commitments to evaluate the program and remedy any shortfall.

Appendices XXVI and XXXII contain reports on quantification of program effectiveness in the

1 At the time of the Order and the letters, PSG was known as the Voluntary Ozone Action Program, or VOAP.

program's inaugural year of 1998 and in 1999, respectively, plus supporting documents. A description of the assumptions used in tracking emissions is included.

Appendix XXVIII is the 2001 SCAT Proposed Measurement Scope, which describes the regional transportation surveys and business leader tracking surveys that will supplement SCAT's current contract work. These surveys are being developed after models prepared for use the California Air Resources Board.

Appendix XXXIII is the FY2000 CMAQ Annual Report. This report presents the findings of the ongoing measurement and evaluation of emissions reductions from PSG and other TDM projects.

3.2.1.5 RACM Analysis

Section 172(c)(1) of the Clean Air Act requires State Implementation Plans (SIPs) to provide for the implementation of all reasonably available control measures (RACM). The EPA memo dated November 30, 1999, and entitled, "Guidance on the Reasonably Available Control Measures (RACM) Requirement and Attainment Demonstration Submissions for Ozone Nonattainment Areas" indicates that States need to provide justification as to why potential "reasonably available" measures have not been adopted. Evaluations of control measures may be based on technological or economic grounds. RACM may include measures from any anthropogenic source of emissions - point, area, on-road mobile or non-road mobile.

Georgia EPD has performed an analysis to determine if any additional RACM measures are available for the Atlanta 1-hour ozone non-attainment area. Table 3-6 contains a list of technologically feasible NOx emission control measures and Table 3-7 contains a list of technologically feasible VOC emission control measures. The control options were categorized primarily by the emission source.

Each control option was evaluated as to: 1) Authority to implement; 2) Amount of NOx reductions; 3) Amount of VOC reductions; 4) Whether a similar measure is already being implemented; 5) Cost effectiveness; 6) Whether SIP credit has already been taken for the measure and 7) Whether the measure can be implemented by May 1, 2003 (measures implemented after this date cannot advance the 2004 attainment date).

Most of the control measure data in the RACM analysis came from a study completed by Georgia State University ("The Direct Costs of Controlling NOx and VOC emissions in Atlanta." Georgia State University. Atlanta, GA: November 1, 1997, pp. 43-65). For the Georgia State Report, the 1990 NOx and VOC emissions inventory data were updated using growth factors to reflect emissions in 1999. Georgia EPD multiplied the percent reduction expected from a particular control measure (from GSU study) by a 2003 base number in order to calculate 2003 reductions for VOC and NOx. The 2003 base number was acquired from the 2003 Base Modeling run for the day of July 31. This method was applied to most of the calculations in the RACM analysis.

For many of the remaining calculations, EPD applied reduction factors (from sources such as STAPPA/ALAPCO and EPA) to emissions data derived from modeling runs for the Atlanta non-attainment area in order to get 2003 VOC and NOx reductions from a particular control measure. Other reductions were based on similar control measures enacted in other areas and the reduction results seen there.

The following types of options were eliminated from consideration as a RACM and have been grouped accordingly within the primary control option category: 1) Options for which the State had no authority to implement; 2) Options that have been superceded by similar measures already implemented; 3) Options which have been implemented but for which no SIP credit has been taken and/or measures that have been implemented through the Transportation Improvement Plan (TIP); 4) Options with a cost effectiveness of greater than $5,000/ton; and 5) Options that cannot be implemented by May 1, 2003.

The remaining measures were grouped, by primary category, under the heading "remaining measures." Summation of these control options indicates that, should all these remaining measures be implemented, NOx reductions achieved will be no greater than 18.66 tpd as indicated in Table 3-6 and VOC reductions achieved will be no greater than 51.76 tpd as indicated in Table 3-7. Note that many of these remaining measures, though technically feasible, are impracticable or burdensome for the purposes of fuel waiver analysis. See Georgia's Fuel Waiver Request for further explanations.

Calculation of the Effect of the NOx SIP Call

The State Implementation Plan for bringing the Atlanta area into compliance with the ozone standard relies upon reductions from the NOx SIP Call. The NOx SIP Call was issued to alleviate ozone transport – that is, upwind contributions of ozone or ozone precursors. In order to advance the attainment date from November 15, 2004, and thereby be classified as RACM, a control measure or set of control measures would need to provide a greater effect, by May 1, 2003, on ozone reduction than the NOx SIP Call measures.

Appendix C, "1-Hour Upwind/Downwind Linkages" of The Air Quality Modeling Technical Support Document for the NOx SIP Call, September 23, 1998, lists Alabama, Kentucky, North Carolina, South Carolina, and Tennessee as significant contributors to Atlanta's ozone exceedances. Table 6 of EPA's Final 2007 Base NOx emission rates published in the Federal Register on March 2, 2000, gives totals for these five states equal to 1,109,255 tons per season or about 10,177 tons per day. Proposed budget NOx emission rates for the five states equal 821,063 tons per season or about 7,533 tons per day. The NOx reduction achieved by the NOx SIP Call in 2007 for these five states is the difference between the 2007 Base and the budget rates, which is 288,192 tons per season or 2,644 tons of NOx per day. Backcasting this number to 2004 using BEA factors yields 2,553 tons of NOx per day, the amount of NOx reductions achieved by the NOx SIP Call in the five states for 2004. The average percent emission reduction is 26%.

Of course, not all of these emissions are transported into Georgia or the Atlanta area. Therefore, any meaningful comparison must be based on the NOx SIP Call's effect on ozone concentrations

in Atlanta. Appendix G of the technical support document referenced above, "Evaluation of Contributions – Tables of Metrics, 1-Hour CAMX: Upwind States to Downwind States", page G-6, gives average contributions to an Atlanta area exceedance as follows:

Alabama	8%
Kentucky	1%
North Carolina	1%
South Carolina	1%
Tennessee	4%

Assuming a minimum exceedance of 125 ppb, an average out-of-state contribution would be 125 ppb x 15% = 18.6 ppb. This figure is conservative since other less significant contributors such as Louisiana, Mississippi, and Texas, are not included, and the exceedance could be greater than 125 ppb. Assuming a reduction in NOx emissions will yield a proportional reduction in ozone contribution, the NOx SIP call will reduce the average out-of-state contribution by 26%, or about 4.8 ppb, at a minimum.

Calculation of the Effect of the Remaining Measures

The effect of the "remaining measures" is calculated by dividing the reduction amount times the change in pollutant per change in ozone:

For NOx, :

[18.66 tpd] / [41.45 tpd NOx /ppb ozone*] = 0.45 ppb of ozone

For VOC, :

[51.71] / [164.9tpd VOC/ppb ozone*] = 0.31 ppb of ozone

Total ozone reduction due to "remaining measures" = 0.75 ppb of ozone

* These sensitivity ratios represent the average of the effects of NOx and VOC. For a description of how these factors were developed, see Section 5.6.

Comparison of the Two Effects

Comparison of the effect of the NOx SIP Call with the effect of the remaining measures shows that the remaining measures do not come close to replicating the effect of the NOx SIP Call in terms of ozone reduction. Therefore, the remaining measures cannot advance the attainment date.

This analysis is based on a cost-effectiveness threshold of $5000 per ton reduced. If the figure of $2000 per ton were used in accordance with the NOx SIP Call and the 126 Petition Rulemakings, even less "remaining measures" and therefore, emission reductions and ozone reduction, would be available.

Georgia EPD is hereby committing to proceed with the development and submittal of a SIP

revision for implementing the Regional NOx SIP Call as expeditiously as possible after EPA finalizes a NOx SIP Call budget for us.

This analysis therefore demonstrates that no additional RACM measures are available for the Atlanta 1-hour ozone non-attainment area.

3.2.1.6 Additional Measures to be Studied

To ensure that the 1-hour ozone standard will be met, and to make progress towards attaining the 8-hour standard, the following additional control measures will be studied. Not enough time has been available to study control options and work with potentially regulated sources to include these in this SIP or for proposed rules. They are all candidates for rules in the year 2000 or beyond.

- On-road heavy duty diesel engines (trucks and buses) emit large amounts of NO_x. An I/M program should be considered. Possible NO_x reductions are estimated to be 12 tpd, in 2003.

- A cleaner diesel fuel, which would reduce NO_x from heavy duty diesel engines, should be studied. Possible NO_x reductions are estimated to be 4.4 tpd, in 2003.

- Metro-Atlanta is a major railroad freight transfer center. Diesel fueled engines in use at large rail yards may be able to change operations or fuels to reduce NO_x emissions. Possible NO_x reductions are estimated to be 2.0 tpd, in 2003.

- Hartsfield Airport is a major NO_x and VOC source and operations will continue to grow. The bulk of the emissions are from aircraft landings and takeoffs. Incentives to encourage the cleanest possible aircraft to be used at Hartsfield should be considered. Ground support and related transportation processes in and around the airport could be re-designed to result in lower NO_x and VOC emissions. Possible NO_x and VOC reductions are estimated to be 3.94 and 0.39 tpd, respectively, in 2003.

- Off-road diesel engines such as used in construction equipment emit large amounts of NO_x and VOC. A combination of a low sulfur diesel fuel and use restrictions could reduce emissions. Possible NO_x and VOC reductions are estimated to be 23.9 and 2.52 tpd, respectively, in 2003.

- Off-road 2-cycle and 4-cycle engines, such as those used in lawn and garden equipment, emit large amounts of VOC within the 13 counties. New federal standards regulate these engines, but this equipment has a long useful life. Incentives should be studied to encourage turnover of this old equipment to new, cleaner versions. Possible NO_x and VOC reductions are estimated to be 1.27 and 23.6 tpd, respectively, in 2003.

Implementation of these measures could result in NO_x and VOC reductions totaling 47.51 and 26.51 tpd, respectively. Sensitivity analysis indicates that these reductions would produce a 16 ppb reduction in ozone concentrations.

EPD will immediately begin considering these additional control measures, in order to maximize emission reductions by 2003 and to assure continued progress towards attaining the 8-hour ozone standard.

3.2.2 Coordination with 15% Plan and 9% Plan

In addition to this attainment SIP, EPD has also submitted SIPs to meet other requirements of the CAAA. In order to make progress towards reducing emissions which contribute to ozone formation, EPD has submitted a 15% Plan and a 9% Plan, as described above.

The control measures in the 15% Plan and 9% Plan, with the exception of transportation control measures (TCMs), were modeled as part of the 2003 Base and the 2003 Controls. (Note that these plans both only deal with the 13 county non-attainment area.)

3.3 Conclusions

The bright line tests of the statistical determination in this Section 3 do not demonstrate attainment of the 1-hour ozone standard in the Atlanta area by 2003. The June 1996 modeling guidance, " Guidance on Use of Modeled Results to Demonstrate Attainment on the Ozone NAAQS" allows a weight of evidence (WOE) approach. WOE considers the results from corroborative information in concert with the outcome of attainment tests to assess whether attainment of the NAAQS is likely. In November of 1999, EPA issued the "Guidance for Improving Weight of Evidence Through Identification of Additional Emission Reductions, Not Modeled" for situations like those described in this section where attainment is close, but additional emission reductions are needed. We have used this guidance to calculate the 'shortfall' in reductions and have listed the proposed additional emission reductions we expect to bring the Atlanta area into attainment with the ozone NAAQS in the next Section 4.

Originally, U.S. EPA required that regional NOx reductions resulting from their proposed NOx SIP Call be implemented by 2003, however the United States Court of Appeals for the D.C. Circuit issued an order extending the compliance date for the NOx SIP Call to May 31, 2004. This SIP proposes all local measures determined to be necessary in Georgia to attain the standard. This SIP also demonstrates that regional NOx reductions outside Georgia prevent metro-Atlanta from attaining the one-hour ozone standard in 1999. Therefore, EPD requests that the attainment date be extended to 2004, when these regional NOx reductions and will be implemented.

The EPD will proceed with implementing all the control measures achievable by 2003. The EPD will work closely with EPA to ensure that all the federal measures projected to be necessary to result in attainment are achieved as effectively as possible. EPD will also be carefully examining both the application and economics of controls to ensure the most effective combination of other control measures.

In order to implement this plan, EPD will follow this schedule:

- All control measures relied on in the 15% Plan and the 9% Plan have been implemented.

- Rules necessary for the Georgia gasoline (Phase 1 and 2) has been adopted. Phase 1 of this rule is being implemented in 1999. Phase 2 of this rule will be implemented in 2003.

- Rules necessary for the utility modifications at Georgia Power Plants Yates and McDonough has been adopted. These rules will be implemented in 1999.

- Rules necessary for the additional point source NOx and VOC control measures and for gasoline and I/M program changes have been adopted (scheduled for September 1999 Board of Natural Resources adoption) and will be immediately implemented.

- The PSG Program has been implemented and continues to this date.

- EPD will develop any contingency measures that may be needed to ensure that the emission reductions relied on in this plan are achieved.

- EPD will work with EPA as needed to ensure full implementation of the national control measures contained in the plan.

4. ADDITIONAL WEIGHT OF EVIDENCE

4.1 Calculation of Required Additional Reductions (Shortfall Calculations)

This analysis includes the following:

A. Controls on Electric Generating Units (EGUs) at Georgia Power Plants

1. 0.13 lbs/MMBTU 5-plant average for plants Bowen, Hammond, McDonough, Wansley, and Yates

2. 0.20 lbs/MMBTU 7-plant average for the same 5 plants along with plants Branch and Scherer

B. Open Burning

1. A ban on open burning (including both prescribed and slash burning) in 6 additional counties (Bartow, Carroll, Hall, Newton, Spalding and Walton)

2. A ban on open burning (including slash burning) in 26 additional counties (Banks, Barrow, Butts, Chattooga, Clarke, Dawson, Floyd, Gordon, Haralson, Heard, Jackson, Jasper, Jones, Lamar, Lumpkin, Madison, Meriwether, Monroe, Morgan, Oconee, Pickens, Pike, Polk, Putnam, Troup and Upson)

C. NOx / VOC RACT and NSR

1. Delayed NOx / VOC RACT in 6 additional counties (listed above)
The rules have been promulgated, but no credit can be taken at this time, as the RACT determinations are not being expected to take place before November 2000. Nevertheless, reductions are expected to take place by May 2003.

2. No NOx / VOC RACT and NSR in 26 additional counties (listed above)
The rules are revised to remove applicability to these counties.

D. Large Combustion Turbines

1. A new rule for Large Combustion Turbines in the existing 13-county Non-attainment Area and the 32 additional counties (listed above)

A county by county description of the changes due to the additional reductions of NOx and VOC can be found in Tables 4-1 and 4-2, respectively.

Note: This version of the "Shortfall Calculations" replaces all previous versions that were submitted as a part of the Atlanta Ozone Non-Attainment Area SIP.

4.2 Determination of Required Additional Reductions "Shortfall Calculations" (Utilizing corrected 2003 controls)

Method 1

1. Calculate the average (over all modeled days) predicted daily maximum 1-hour ozone concentration at the area of the highest modeled concentration first with the current emissions and then with the future emissions.

   Note: The 1996 Controls modeling was used
   The 1996 peak modeled concentrations were 183.9, 158.7, and 177.5 ppb. The 2003 peak concentrations are 164.3, 154.2, and 132.9 ppb. The average modeled concentrations (i.e., AVGP) for these years are:

   $AVGP_{2003}$ = 150.5 ppb $AVGP_{1996}$ = 173.4 ppb

2. Calculate the relative reduction factor (RRF) by taking the ratio of the average daily maximum 1-hour ozone concentration obtained with future emissions to that obtained with the current emissions.

   $(RRF) = (AVGP_{2003})/(AVGP_{1996}) = 150.5/173.4 = 0.8679$

3. Calculate the area-wide design value for 1996 (DV_{96}) using the design values that include the year of current emissions. The design value for 1996 was calculated by averaging the design values for 1994-1996, 1995-1997, and 1996-1998. (Averaging three years of design values is performed to reduce the variability in the design value due to meteorology). The respective value for each of those years was 147, 145, and 146 ppb. Thus, the average 1996 design value is:

   DV_{96} = 146 ppb at the Confederate Avenue monitor site

   Note: The Confederate Ave monitor site was used to obtain a value that was close to the peak area site.

4. Multiply the relative reduction factor by the average design value to compute the future design value (DVF).

   $(DVF) = (RRF)*(DV_{96}) = 0.8679 * 146 = 126.72$ ppb

5. Calculate the change in air quality design value (AQ) by subtracting the estimated future design value (step 4) from the base air quality design value (step 3).

   $AQ = DV_{96} - DVF = 146 - 126.72 = 19.28$ ppb

6. Estimate the percent reduction in NOx emissions and VOC emissions that occurred within the 13-county area before and after controls. Biogenics are NOT included in emissions.

The following emission rates are found in the UAM model:

NOx_{1996} = 563.2 tpd	NOx_{2003} = 419.1 tpd
+ 7.42 from open/slash burning	+ 7.75 from open/slash burning
+ 321.53 from electric generating units	+ 213.61 from electric generating units
+ 15.23 from 32 counties	+ 9.06 from 32 counties
+ 0.00 from combustion turbines	+ 4.55 from combustion turbines
= 907.38 tpd	= 654.07 tpd

Note: The emissions from the Georgia Power plants are based on an average of the three episode days. They include the most likely scenario for emissions from individual emission units. However, this should not be construed as individual emission limits for those units.

VOC_{1996} = 508.6 tpd	VOC_{2003} = 376.83 tpd
+ 36.2 from open/slash burning	+ 37.9 from open/slash burning
+ 3.31 from prescribed burning	+3.50 from prescribed burning
+ 31.50 from 32 counties	+ 13.99 from 32 counties
= 579.61 tpd	= 432.22 tpd

$$\%NOx_{Rd} = [(907.38 - 654.07)/907.38]*100 = 27.92\%$$

$$\%VOC_{Rd} = [(579.61 - 432.22)/579.61]*100 = 25.43\%$$

7. Divide the percent reduction in NOx emissions by the change in the air quality design value and divide the percent reduction in VOC emissions by the change in air quality design value.

$$NOx_{norm} = \%NOx_{Rd} / AQ = 27.92\% / 19.28 \text{ ppb} = 1.45 \text{ \%/ppb}$$
$$VOC_{norm} = \%VOC_{Rd} / AQ = 25.43\% / 19.28 \text{ ppb} = 1.32 \text{ \%/ppb}$$

8. Estimate the amount of additional ozone reduction needed by taking the difference between the future design value and 124 ppb, the maximum ozone design value consistent with meeting the NAAQS.

$$RN = 126.72 - 124 = 2.72 \text{ ppb}$$

9. Calculate additional necessary emission reductions by taking the product of each of the normalized emissions reduction factors and the amount of ozone reduction needed.

$$NOx_{needed} = RN * NOx_{norm} = 2.72 \text{ ppb} * 1.45 \text{ \%/ppb} = 3.94 \text{ \%}$$

$$VOC_{needed} = RN * VOC_{norm} = 2.72 \text{ ppb} * 1.32 \text{ \%/ppb} = 3.59\%$$

Percent amount of reductions needed from 1996 base: NOx = 3.94%
VOC = 3.59%

Amount of reductions needed in tons per day:
NOx = 907.38 tpd * 3.94% = 35.75 tpd
VOC = 579.61 tpd * 3.59% = 20.81 tpd

Required NOx Reductions	**35.75**

Industrial Open Burning Ban	-0.24
Commercial Open Burning Ban	-0.19
Residential Open Burning Ban	-3.66
Slash Burning Ban	-3.66
Additional EGU Controls	-44.06
Relieve NSR in 26 Counties	+1.73
Relieve RACT in 26 Counties	+10.98
Delay RACT in 6 Counties	+0.81
New Combustion Turbine Rule	-3.1

Extra NOx Reductions Beyond Those Required	**5.64**

Required VOC Reductions	**20.81**

Industrial Open Burning Ban	-0.91
Commercial Open Burning Ban	-0.96
Residential Open Burning Ban	-18.48
Slash Burning Ban	-17.55
Prescribed Burning Ban	-3.5
Relieve NSR in 26 Counties	+0.2
Delay RACT in 6 Counties	+3.69
Relieve RACT in 26 Counties	+10.66

Extra VOC Reductions Beyond Those Required	**6.04**

5. 2004 ATTAINMENT DEMONSTRATION

5.1 Summary of Demonstration

The analysis presented in Sections 1 through 4 follows 1999 EPA guidance and demonstrates that the 2003 modeling inventory plus additional reductions will provide the Atlanta area with attainment of the 1-hr ozone NAAQS in the year 2003. An underlying assumption of this analysis is that national NOx measures would be in place by that year.

However, on August 30, 2000, the United States Court of Appeals for the D.C. Circuit issued an order extending the compliance date for the NOx SIP Call from May 1, 2003 to May 31, 2004. Regional NOx emission reductions relied upon for the attainment demonstration cannot be assumed to occur before the Court ordered compliance date. This delay will adversely impact Atlanta's attainment of the 1-hour ozone. For these reasons, we request in a letter found in Appendix 1 that Atlanta's attainment deadline be extended until November 15, 2004.

This section describes the process that demonstrates attainment of the 1-hour ozone standard for 2004. Underlying the process is the assumption that changes in NOx and VOC precipitate a change in ozone concentration and that attainment continues to be demonstrated if the predicted ozone concentration for 2004 is less than or equal to the 2003 predicted ozone concentration.

Since the 2003 attainment demonstration was based on the UAM-IV (fine grid) modeling, EPD developed a 2004 emission inventory for the UAM-IV domain, with additional reductions also projected to 2004. For this step, we used the most accurate methods for determining the mobile and non-road mobile emissions. These additions included a new speed study, a different evaluation of the PSG effect, the new Non-road Model, and a new Hartsfield Airport emission study. A detailed description of the inventory development is presented in sections 5.2 and 5.3.

Comparison of the 2003 and 2004 inventories indicate that NOx emissions increase somewhat over the UAM-IV domain, while VOC emissions decrease significantly. Sensitivity analyses indicate that any incremental ozone increase due to this area-wide increase in NOx emissions is offset by the decrease in ozone due to the VOC emission reductions. Predicted ozone concentrations for 2004 do not exceed the predicted ozone concentrations for 2003. Therefore, attainment is indicated for 2004.

5.2 Projected Emissions in the Non-Attainment Area and UAM-IV Domain for 2004

5.2.1 Point Sources

5.2.1.1 Non-Attainment Area

The emissions from point sources within the Non-attainment Area were assumed to have zero growth from 2003 to 2004 because of the Offset Rule, 391-3-1-.03 section (8) (c) 13 that was adopted by the DNR Board in September of 1999. However, even this assumption is conservative because the regulation requires an offset ratio (1.2 to 1 for external; 1.3 to 1 for internal) in emissions, so point source emissions in this area should decrease if any new sources are permitted for this area. Also, with the new power plant offset rule in 32 counties, there should be no growth of EGU point source NOx (>50 tpd in 13 counties, > 100 tpd in 32 counties) emissions. Finally, the 2003 control emissions used in the modeling of 2003 attainment included growth based on BEA factors from 1999 to 2003 for point sources in the Non-attainment Area that should have been zero growth. Therefore, the modeling inventory contains about 2-3 tpd more NOx in the Non-attainment area than it should and is not accounted for in any table.

5.2.1.2 UAM-IV Domain

The Emission Processing System 2 (EPS2) grew point sources outside the 13-County Non-attainment Area to 2004 by applying Bureau of Economic Analysis (BEA) projection factors to 2003 emission rates. The BEA factors vary by industry type and source type, and SIC code. However, they do not vary by location within Georgia because the factors are applicable to state, not county, levels. Tables 5-1 and 5-2 show the 2004 estimated emissions from all emission types for the non-attainment and UAM-IV areas, respectively.

5.2.2 Area Sources

5.2.2.1 Non-Attainment Area

Area source emissions were grown to 2004 by applying the proper BEA factor by source category to the 2003 emissions for the 13-county non-attainment area. Railroad and airport emissions, other than Hartsfield International Airport, were included in area source emissions and were projected using BEA factors.

5.2.2.2 UAM-IV Domain

Area source emissions for the attainment counties in the UAM-IV domain were grown to 2004 by BEA factors multiplied by their 2003 emissions and added to the 2004 emissions for the 13 county nonattainment area. Again, Tables 5-1 and 5-2 reflect these values. All 2004 cases increased as compared to 2003. This assumption is supported by EPA guidance, such as "Guidance for Improving Weight of Evidence Through Identification of Additional Emission Reductions, Not Modeled", November 1999, in which emissions changes and relative reduction

factors based on modeled ozone concentrations are used to determine future air quality. It also is supported by different sensitivity analysis results performed using UAM-V and described hereafter.

5.2.3 On Road Mobile Sources

5.2.3.1 Background

There is a perception that requirements of the federal transportation conformity regulation at 40 CFR Part 93.122 prohibit the use of standard mobile source inventory SIP methodology[1] in developing regional emissions analyses for transportation conformity determinations. Because of this, 64 average speeds[2] rather than 12 are used to calculate emission factors for regional emissions analyses in Atlanta. This difference in speed averaging results in a 2004 regional emissions analysis with VOC and NO_x emissions approximately eight percent (8.13 tons per day) and two percent (4.28 tons per day) higher, respectively, than SIP inventories/budgets calculated using 12 VMT-weighted average speeds. Due to the relative insensitivity of the Urban Airshed Model (UAM) to emissions changes[3], such differences would have little effect on modeled ozone concentrations, but could prevent a positive conformity determination from being made.[4]

The emissions preprocessor software used to develop the mobile emissions for episode-specific ozone modeling inventories requires the AIRS/AMS (Airometric Information Retrieval System/Area and Mobile Subsystem) data structure: 12 roadway classifications, eight vehicle types. Mobile source emissions inventories used as inputs to the ozone modeling preprocessor must be encoded with AMS source category classification (SCC) codes. There is a separate SCC code for every combination of the 12 HPMS roadway types and the eight MOBILE5 vehicle types. Revising the software that develops the mobile source ozone modeling inventories to use (potentially) 64 speeds for each of 12 VMT bins, rather than one speed per bin, would be a major undertaking. Time did not allow those changes to be made for this SIP revision.

A meeting between EPA, EPD, and the Georgia Regional Transportation Authority (GRTA) was held on Wednesday, March 14, 2001, to establish a methodology, described below, for adjusting 2003 mobile source ozone modeling inventories to 2004, incorporating new speed data (see "Development of Vehicle Speed Parameters For Atlanta Non-Attainment Area Emissions Post-

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[1] *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources,* EPA, 1992, section 3.3.5.1: "[U]se FHWA's Highway Performance Monitoring System (HPMS) roadway classification scheme to group portions of [vehicle miles traveled (VMT)] by the functional classification of the roadways on which they occur. This results in 12 subsets of VMT. Within each subset, speed is weighted by VMT to calculate an average speed...."

[2] The 64 speeds used are 2.5 mph, then 3 mph to 65 mph, inclusive, in one mile per hour increments.

[3] As stated in section 3.2.1.4, "Based on current modeling runs, [outright] attainment of the ozone standard is reached when mobile source emissions are zeroed out throughout the [43-county] UAM-IV modeling domain."

[4] "The transportation plan, TIP, and project not from a conforming transportation plan and TIP must be consistent with the motor vehicle emissions budget(s) in the applicable implementation plan (or implementation plan submission)...This criterion is satisfied if it is demonstrated that emissions of the pollutants or pollutant precursors...are less than or equal to the motor vehicle emissions budget(s) established in the applicable implementation plan or implementation plan submission." 40 CFR Part 93.118(a).

Processor Used in 2004 State Implementation Plan" in Appendix XXXI <http://www.dnr.state.ga.us/dnr/environ/ plans_files/plans/Speed_Study.pdf>) and adjusting emissions to account for the use of 64 speeds instead of 12, without revising the mobile source ozone modeling inventory software.

5.2.3.2 Revised Methodology

5.2.3.2.1 Non-Attainment Area

At the conclusion of consultant contracts to incorporate data from the recent Atlanta Non-Attainment Area Speed Study into the Atlanta Regional Commission's (ARC)[5] speed and emissions post-processor, ARC used the revised post-processor to develop "typical summer day" 2004 mobile source emissions inventories. For each of three times of day (a.m. peak, p.m. peak, and off-peak), the HPMS-adjusted 2004 VMT from each link in ARC's travel demand model were multiplied by the 2004 MOBILE5b emission factor at the average speed closest to the speed on that link. See Section 6 of this SIP revision for details of the mobile source controls modeled. Emissions from all the links and all three time periods were summed together to get daily inventories. These inventories were used to establish the motor vehicle emissions budgets (MVEBs) for transportation conformity purposes - see Section 6. For details of the emissions post-processor, see "Emissions Post-Processor Documentation" in Appendix XXXI (http://www.dnr.state.ga.us/dnr/environ/plans_files/ plans/Emissions_Post-Processor.pdf). The post-processor files themselves are available on EPD's web page. They are four Excel 97 workbooks: one summary workbook and three time-of-day workbooks:

Summary Tables for Mobile Emissions Post-Processor:
(http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/lkemsum04.xls)

A.M. Peak Mobile Emissions Post-Processor:
(http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/lkemam04.zip)

Off-Peak Mobile Emissions Post-Processor:
(http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/lkemop04.zip)

P.M. Peak Mobile Emissions Post-Processor:
(http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/lkempm04.zip)

Note that the time-of-day workbooks are large: 11 megabytes compressed, 45 megabytes expanded.

After the inventories were calculated and off-model adjustments[6] made, factors were developed

[5] ARC is the designated Metropolitan Planning Organization responsible for transportation planning for the Atlanta area.

[6] For low-sulfur/low Reid vapor pressure gasoline (calculated by the emissions post-processor), Partnership for a Smog-free Georgia (see Section 3.2.1.4 and Appendix XXV), and the I/M senior exemption (see "Effect of Senior

by the ratios of the 13-county 2003 mobile source emissions inventories in the October 28, 1999, attainment SIP[7] to the 2004 mobile source emissions inventories produced with the revised emissions post-processor. These factors were then applied to 2003 episode-day-specific mobile source modeling inventories to adjust them to 2004 modeling inventories reflecting all of the mobile modeling changes between 2003 and 2004, including the revised speed data and the more disaggregate speed averaging. See "Changes in Mobile Modeling Assumptions, 2003 to 2004" in Appendix XXXI (http://www.dnr.state.ga.us/dnr/environ/ plans_files/plans/04change.pdf) for details on the changes and the reasons for them.

The 2003-to-2004 adjustments for the ozone episode modeling inventories in the 13-county Atlanta non-attainment area (NAA) can be summarized as follows:

a) 2004 64-speed inventory / 2003 12-speed inventory = adjustment factor

b) 2003 12-speed modeling inventory * adjustment factor = 2004 modeling inventory

2003 Mobile Source Emissions in Non-attainment Area (tons per day)			
	CO	VOC	NO_x
Subtotals (MOBILE5b results)	994.24	149.38	245.88
Off-model calculations:			
Georgia gasoline reductions	--	4.98	13.83
PSG reductions	--	13.02	8.56
I/M - senior exemption increases	--	0.83	0.64
TOTALS	994.24	132.21	224.13

2004 Mobile Source Emissions in Non-attainment Area (tons per day)			
	CO	VOC	NO_x
Subtotals (MOBILE5b results)	779.45	116.25	243.69
Off-model calculations:			
Georgia gasoline reductions	--	4.15	15.15
PSG reductions	--	6.51	4.28
I/M - senior exemption increases	--	0.67	0.86
TOTALS	779.45	106.26	225.12

2003-to-2004 Non-attainment Area Adjustment Factors			
	CO	VOC	NO_x
	0.784	0.804	1.004

Exemption on 2004 Highway Mobile Source Emissions" in Appendix XXXI, <http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/senior04.pdf>).

[7] These inventories were developed with the 12 VMT bins/12 speeds standard SIP inventory methodology. See <http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/03naa.zip>

These adjustment factors were applied to the 13-county grid cells of the ozone episode-day-specific modeling inventories. Step (b) was repeated 3 times, using the same adjustment factor for each of the three SIP episode days, with ramp-up days ignored, and the results were averaged over those three days. See Table 5-1 elsewhere in Section 5 of this SIP revision.

5.2.3.2.2 Attainment Counties in UAM-IV Domain

For the 30 counties within the UAM-IV domain but outside the non-attainment area, an area not covered by ARC's travel demand model, 2004 VMT were forecast using the linear regression methodology described in section 4.3 of EPA's Section 187 guidance[8], with summer-adjusted 1994 through 1999 HPMS VMT substituted for 1985 through 1990 VMT. The resulting 2004 VMT[9] were used with 2004 MOBILE5b emission factors calculated with a new, local VMT mix, based on 1999 Highway Statistics Table VM-4 data weighted with 1999 HPMS VMT from these attainment area counties, and with the MOBILE5b default registration distribution, to produce a 2004 "typical summer day" (TSD) mobile source inventory. See <http://www.dnr.state.ga.us/dnr/environ/plans_files/ plans/uam-iv.zip>. An adjustment factor (the percent difference between the resulting 2004 30-county TSD inventory and a 2003 30-county TSD mobile inventory) was applied to episode-day-specific 2003 mobile modeling inventories in the 30 attainment area counties to produce 2004 mobile modeling inventories. The 2003-to-2004 adjustments for the ozone episode modeling inventories in the 30 attainment area counties in UAM-IV can be summarized as follows:

(a) 2004 TSD 12-speed inventory / 2003 TSD 12-speed inventory = adjustment factor

(b) 2003 12-speed modeling inventory * adjustment factor = 2004 modeling inventory

2003 Mobile Emissions in 30 UAM-IV Counties (tons per day)			
	CO	VOC	NO_x
Subtotals (MOBILE5b results)	578.73	95.37	122.20
Off-model calculations:			
Georgia gasoline reductions	--	21.90	8.99
TOTALS	578.73	73.47	113.21

2004 Mobile Emissions in 30 UAM-IV Counties (tons per day)			
	CO	VOC	NO_x
Subtotals (MOBILE5b results)	577.90	95.55	137.62
Off-model calculations:			

[8] *Section 187 VMT Forecasting and Tracking Guidance*, US EPA, January 1992 (http://www.epa.gov/oms/transp/vmttrack/vmtguide.zip).
[9] See dnrtren3.xls (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/dnrtren3.zip).

Georgia gasoline reductions	--	20.41	8.59
TOTALS	577.90	75.14	129.03

2003-to-2004 Adjustment Factors for 30 UAM-IV Counties			
	CO	VOC	NO_x
	0.999	1.023	1.140

These adjustment factors were applied to the 30-county grid cells of the ozone episode-day-specific modeling inventories. As in the NAA, step (b) was repeated 3 times, using the same adjustment factor for each of the three SIP episode days, with ramp-up days ignored, and the results were averaged over those three days. See Table 5-2 elsewhere in Section 5 of this SIP revision.

5.2.3.3 Future Mobile Source Inventory Methodology Planning

EPD emphasizes that this factoring methodology was used due to the considerable time and resources required to align the methodologies for SIP mobile source emissions inventory development and transportation conformity regional emissions analysis. EPD, ARC, GRTA, and other agencies have begun discussions on how to accomplish this alignment and simultaneously accommodate the new output file structures that the yet-to-be-released MOBILE6 model will have.

5.2.3.4 Additional Supporting Information

The following additional information is available on EPD's web page:

> The MOBILE5b input and output files used to calculate the 2004 mobile source emissions inventories for the MVEBs:
> http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/04mob-io.zip
>
> The MOBILE5b input and output files and the spreadsheet used to calculate, strictly for purposes of comparison, the 2004 12-speed NAA mobile source emissions inventories:
> http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/04naa.zip
>
> The 2003 12-speed NAA mobile source emissions inventories files:
> http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/03naa.zip
>
> The 2003 and 2004 "typical summer day" 12-speed UAM-IV mobile source emissions inventories files:
> http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/uam-iv.zip

5.2.4 Off-Road Mobile Sources

5.2.4.1 Non-Attainment Area

The emissions from off-road mobile sources were calculated using EPA's draft Non-road Model, 2000 version, and the 2003 control emissions. The model was used in a relative sense to find a growth or reduction factor between 2003 and 2004 as we did for shortfall calculations. Even if this draft model is modified before it is final, it is assumed that those changes would affect 2003 and 2004 equally. Once the factors were calculated, we multiplied them by the 2003 controlled emissions for off-road mobile sources to determine the 2004 emissions. We chose this model because it contained the latest activity levels and factors at this time. It also allowed us to input local parameters for gasoline and temperatures. In short, the methodology employed in the model was similar to the steps we took to calculate the 2003 controlled emissions for off-road mobile sources. The non-road model has been specified for use by EPA to estimate non-road emissions for the National Emissions Trends (NET) emissions database.

Emissions were calculated for a typical summer weekday in tons per day. The RVP for our local gas was 7.0 and sulfur content for gasoline was 30 ppm. Stage II was assumed to be 80%. The minimum, maximum and average temperature was 68.2, 86.9 and 77.8 respectively. Emissions were calculated for 13 and 43 counties. Emissions include all VOC emissions, including exhaust and evaporative emissions, as well as NOx and CO exhaust emissions. All non-road emissions other than airport and railroad decreased for NOx and VOC. Railroad and airport, other than Hartsfield, emissions were included in Area Sources and projected using BEA factors.

This model does not estimate emissions for airports, railroads or commercial shipping. Atlanta does not have commercial shipping emissions, but it does have airplane and railroad emissions. Hartsfield International Airport emissions were subtracted from the 2003 off-road mobile source emissions before applying the Non-road Model factor. Airport emissions for 2004, based on a special study, were added to the 2004 inventory after application of the non-road emissions projection factor. The study entitled "Air Emissions Inventory – 2004 Hartsfield Atlanta International Airport", prepared by Environmental Science Associates in April of 2001 is included as Appendix 29. Although the methodology is different from that used to develop the modeled 2003 controlled inventory, it reflects more accurately the airport emissions for 2004. This study included the most current activity levels based on Hartsfield and FAA projections of the number of flights and types of aircraft at the airport. Projecting activity data from 2001 to 2004 is obviously much more representative than activity data from 1990 to 2004. Second, it includes the latest information on fleet mix. The 1990 fleet mix does not account for new engines or the fact that engine manufacturers have tinkered with the engines to reduce CO emissions which actually increases NOx emissions. Finally, Ground Support Equipment emissions factors have been revised, as a result of California Air Resources Board (CARB) studies and used in this report.

Other than the airport emissions, the off-road mobile emissions decreased because of cleaner burning engines found on non-road equipment. 2004 VOC and NOx non-road model emissions decreased 7.62% and 1.91% respectively. Therefore, the EPD has applied a factor of 0.923832 and 0.980889 respectively to the 2003 Attainment SIP. Again, these factors were applied to all

non-road emission except airport emissions.

5.2.4.2 UAM-IV Domain

The same method that was described above for the non-attainment area was used for the area out side the 13-county area**.**

5.2.5 Biogenic Sources

The biogenic emissions were conservatively assumed not to vary from year to year even though urban growth may decrease biogenic emissions.

5.3 Projected Emissions in the UAM-V Domain for 2004

The UAM-V domain extends into 3 other states and therefore much of the area is outside the influence of decision makers of Georgia. Because most of this area was outside the control of Georgia, previous modeling attempts did not change the emissions in this area. It was assumed that growth and controls from the NOx SIP Call would balance each other out. That is why in sections 2.3.3, 2.3.4, and 2.3.5 the emissions for the UAM-V domain outside the UAM-IV domain is described as equivalent to that produced for 1999. For this effort we have updated the area and non-road mobile emissions to 2004 using BEA factors and corrected errors found in the tables for 2003 emissions in the UAM-V domain. The NOx emissions for Table 5-3 show the grown emissions for 2004 in the UAM-V domain. Because the 1999 mobile emissions in UAM-V were based on a 1990 EPA inventory grown to 1999 using BEA factors, they were considered to be conservatively high. To estimate how conservative the mobile emissions in the 47 Georgia counties in UAM-V but outside UAM-IV were, 1990 MOBILE5b emission factors run at the Federal Test Procedure (FTP) average speed of 19.6 mph were multiplied by summer-adjusted 1999 historic VMT. MOBILE5b emission factors for 2004, also run at the FTP average speed, were multiplied by projected summer-adjusted 2004 total VMT (from a linear regression based on 1994 through 1999 historic VMT[10]) for those 47 counties. See dnrtren3.xls (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/dnrtren3.zip). Results are shown in the table below (907,180 grams per ton):

year:	**1999**	**2004**
total VMT:	47,198,084.29	54,000,504.14
	1990 gm/mi	**2004 gm/mi**
VOC:	6.318	2.651
CO:	42.457	20.759
NOx:	2.948	2.287

10 *Section 187 VMT Forecasting and Tracking Guidance*, section 4.3, US EPA, January 1992 (http://www.epa.gov/oms/transp/vmttrack/vmtguide.zip)

	1999 tons/day	2004 tons/day
VOC:	328.71	157.80
CO:	2,208.92	1,235.69
NOx:	153.38	136.14

5.4 2004 Projected Emissions including Additional Emission Reductions Not Modeled

It should be noted that emissions from certain stationary sources were modeled with controls for 2003 but were later removed manually in the shortfall reduction calculations. [See Section 4.1, "Calculation of Required Additional Reductions"]. In fact all the Shortfall reductions need to be added to the 2004 emissions calculated above. The final 2004 emissions, as presented in Tables 5-4 and 5-5, reflect the changes in the shortfall calculations that were added and grown using BEA factors. The point source emissions contain emission changes for Electrical Generating Units (EGU) that in sum decrease and reflect a new Combustion Turbine Rule not included in the modeling inventory. The point sources also contain increased emissions due to relief in certain counties for New Source Review (NSR) and in certain counties the delay or relief of Reasonable Available Control Techniques (RACT) requirements. The area source emissions were decreased to include a new rule banning burning in the industrial, commercial, residential, and slash classifications compared to the 2003 modeled inventory. The 2003 estimates adjusted for growth using BEA factors and adjusted for additional reductions not modeled (i.e., shortfall reductions) by county are presented in Tables 5-4 and 5-5.

In summary the shortfall calculations show an increase of 3.24 tons/day of point source NOx and no change in VOC emissions in the 13-County Non-attainment area. In the UAM-IV domain, area source and point source NOX decrease by 7.68 and 28.42 tons/day respectively. However for the VOC emissions in the UAM-IV domain, the area source emissions decrease by 37.52 tons/day, while the point source emissions increase by 13.09 tons/day. Finally, similar changes occur in the UAM-V domain. For NOx, area and point emissions decrease by 7.8 and 34.08 tons/day respectively. While for VOC, the area emissions decrease by 38.16 tons/day and the point source emissions increase by 14.74 tons/day. These values have been added to tables 5-1 thru 5-3 and result in the final 2004 emissions in tables 5-6 thru 5-8. Please note that we have subtracted the shortfall reductions from 2003 emissions that result in attainment while we have subtracted those grown attainment values plus the excess reductions identified from the 2004 emission totals.

5.5 2004 Ozone Attainment Demonstration SIP Reductions

Control Measure	2004 NOx Reduction (TPD)	2004 VOC Reduction (TPD)

GA gasoline	23.74	24.56
Large electric utility steam generators[1]	289.83	0
Partnership for a Smog Free GA	4.28	6.51
Large NOx units in 13 Co. NAA	18.83	0
Changes in Enhanced I&M in 13 Co. NAA	12.25	11.33
Expanded new source review rule	20.94	0
Expanded RACT rules	0	0
New boilers & fuel burning equip.	0.67	0
Stationary engines & gas turbines	30.00	0
National LEV program	18.19	9.07
Locomotive engine standards	4.88	0.03
Consumer/commercial products II	0	13.82
Marine engine standards	0	1.25
Non-road diesel eng. stand. II & III	7.13	12.97
Total	430.74	79.54

[1]Reduction estimates are in terms of episode day instead of typical ozone season day emissions
[2]An additional 44 tons per day of NOx reductions may result from large electric utility steam generation units located in Georgia due to the EPA NOx SIP Call rule.

Note: Our attainment demonstration modeling relied on the implementation of NOx SIP Call measures on out-of-state sources. However, the effect of these measures is difficult to quantify. It is expected that we would have an ozone reduction of 4-15 ppb in 2004 as an air quality benefit. Although we have relied on these measures, no SIP credit has been taken as we have no control over out-of-state sources.

5.6 2004 Air Quality Assessment

As shown in Table 5-7, the UAM-IV domain will experience an increase in NOx emissions from 2003 to 2004 while the VOC emissions will decrease significantly during that same period. With one precursor increasing while the other decreases, it is necessary to determine the overall impact of those emission changes on the peak ozone concentration. Effects vary depending on the type of pollutant and episode day.

To ascertain the effect on ozone concentrations, and, specifically, to determine whether decreased VOC emissions coupled with slightly-increased NOx emissions will result in increased ozone concentrations, a sensitivity evaluation was conducted using UAM runs for episode days July 31, 1987; August 1, 1987; and July 8, 1988. Runs were selected from existing model scenarios that demonstrated simple controls while holding all other emissions the same. Metrics were calculated for the percent of the total VOC or NOx reduced, the percent needed to result in a 1.0 ppb reduction in ozone, and finally the tons/day reduction needed in that pollutant necessary to affect a 1.0 ppb ozone reduction. The tons/day reduction values were used for comparison. For each pollutant, the average effect per model run was obtained for each episode day. These effects were then averaged over all episode days.

Tables 5-9 and 5-10 summarize the emission data and modeling results for the different UAM runs used in the analysis. Table 5-9 contains information for episode days 7/31/1987 and 8/1/1987 and Table 5-10 has information for 7/8/1988. Table 5-11 shows the effect of NOx reductions in the UAM-IV domain, while Table 5-12 shows the effect of VOC reductions in the same area. The analysis indicates that much more VOC reduction compared to NOx reduction is needed to produce a certain change in ozone.

In general, then, because of the varying effects of pollution reduction on ozone concentrations, we expect the VOC decrease to offset the UAM-IV area-wide NOx increase, resulting in a net ozone concentration change of essentially zero. Table 5-13 is an illustration of this effect.

5.7 Conclusions

The UAM-IV domain will experience increased NOx emissions while the VOC emissions decrease during the same period. However, the large decrease in VOC will offset the increase of NOx within the area resulting in a no change in ozone. Therefore, we expect Atlanta to have the same attainment levels of air quality in 2004 as demonstrated for 2003. The only delay is due to the delay of the implementation of the NOx SIP Call measures.

6. ESTABLISHMENT OF 2004 MOTOR VEHICLE EMISSIONS BUDGETS FOR TRANSPORTATION CONFORMITY PURPOSES IN THE 13-COUNTY ATLANTA NON-ATTAINMENT AREA

A motor vehicle emissions budget (MVEB) is described in EPA's transportation conformity rule (40 CFR Part 93, Section 93.124) as "...the implementation plan's estimate of future [motor vehicle] emissions." For a discussion of the differences between MVEBs, which are based on "typical summer day" inventories, and highway mobile source ozone modeling inventories, which are ozone episode-day-specific, see Section 3.2.1.2.3.

The methodology used to calculate the highway mobile source emissions on which the 2004 MVEBs are based is discussed in Section 5.2.3 and, in greater detail, in the following documents in Appendix XXXI:

> Changes in Mobile Modeling Assumptions, 2003 to 2004
> (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/04change.doc)
>
> Emissions Post-Processor Documentation
> (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/Emissions_Post-Processor.pdf)
>
> Development of Vehicle Speed Parameters For Atlanta Non-Attainment Area Emissions Post-Processor Used in 2004 State Implementation Plan
> (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/Speed_Study.pdf)
>
> Assignment of HPMS Functional Classification and Posted Speed Limit Attributes to the Atlanta Regional Commission Highway Network
> (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/HPMS_and_Posted_Speed_Coding.pdf)

The EPA motor vehicle emission factor model MOBILE5b was used to calculate 2004 emission factors with all proposed controls, except low-sulfur gasoline, which MOBILE5b cannot model, in place. These controls include: annual enhanced I/M with onboard diagnostics system checks on 1996 and newer model year vehicles, 2-mode ASM tests on 1975 through 1995 vehicles; a check for catalytic converter tampering on all subject vehicles; 7.0 psi Reid Vapor Pressure gasoline; Stage II gasoline vapor recovery; the Federal Motor Vehicle Control Program, including Tier 1 tailpipe standards; and national LEV. Note that, although Georgia's enhanced inspection/maintenance rules are being changed to require the catalytic converter check only on older vehicles and to reflect the fact that "an antique or collector car or truck 25 years old and older" is exempt from inspection (Enhanced Inspection and Maintenance Rules, Chapter 391-3-20-.03(9)(b)), these changes have no effect on MOBILE5b emission factors.

The emission factors resulting from the MOBILE5b runs were used in the Atlanta Regional Commission's speeds and emissions post-processor with summer 2004 VMT to calculate tons per typical summer day emissions in the following manner:

For each of three times of day (a.m. peak, p.m. peak, and off-peak), the HPMS-adjusted 2004 VMT from each link in ARC's travel demand model were multiplied by the 2004 MOBILE5b emission factor at the average speed closest to the speed on that link. Emissions from all the links and all three time periods were summed together to get grams per day inventories, which were divided by 907,180 to convert from grams per day to tons per day. Details of the emissions post-processor and the mobile emissions modeling methodology, along with the MOBILE5b input file and other documentation, are in Appendix XXXI (Emissions Post-Processor Documentation).

The emissions post-processor calculated the additional reductions attributable to the proposed 30 ppm sulfur fuel. EPA's Final Complex Model spreadsheet (http://www.epa.gov/otaq/regs/fuels/rfg/epafinal.zip) was used to calculate the percent difference between Atlanta-area baseline fuel (including RVP already lowered from 7.8 to 7.0 psi) and the proposed fuel. The Complex Model indicated additional VOC reductions of 4.408% and NO_x reductions of 11.730%. See Complex Model results in Appendix XXXI (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/Complex_Model.pdf). These reductions were applied to emission factors for light-duty gasoline powered vehicles only (LDGV, LDGT1, and LDGT2). The post-processor calculated link-based regional emissions with and without these adjustments to the emission factors, and the differences in those inventories, 4.15 VOC tons per day and 15.15 NO_x tons per day, are the predicted reductions from Georgia gasoline.

Two adjustments had to be made to the tons per day emissions calculated by the post-processor to arrive at the final motor vehicle emissions budgets.

Calculation of the reductions associated with Partnership for a Smog-free Georgia, 6.51 VOC tons per day and 4.28 NO_x tons per day, is described in Section 3.2.1.4 and in Appendix XXV.

The final adjustment accounts for the loss of credit from exempting from vehicle inspection and maintenance cars 10 years old or older driven fewer than 5,000 miles per year and owned by persons 65 years old or older. It was estimated that this exemption increases VOC emissions by 0.67 tons per day and NO_x emissions by 0.86 tons per day. See "Effect of Senior Exemption on 2004 Highway Mobile Source Emissions" in Appendix XXXI (http://www.dnr.state.ga.us/dnr/environ/plans_files/plans/senior04.pdf) for a description of the calculations.

The table below summarizes all these calculations.

2004 Motor Vehicle Emissions (tons per day)			
	CO	VOC	NO_x
Subtotal (MOBILE5b results)	779.45	116.25	243.69
Off-model calculations:			
Georgia gasoline reductions	--	4.15	15.15
PSG reductions	--	6.51	4.28
I/M - senior exemption increases	--	0.67	0.86
TOTAL	779.45	106.25	225.12

Based on the revised link-by-link calculation methodology, on the revised speeds, registration data, VMT mix, and projected 2004 VMT, and on the control measures identified for this attainment demonstration for the 13-county Atlanta nonattainment area, the motor vehicle emissions budgets for 2004 are 106.25 and 225.12 tons per typical summer day, VOC and NO_x, respectively.

These mobile budgets of 106.25 tons per day VOC and 225.12 tons per day NO_x reflect the most up-to-date mobile modeling assumptions, including 2004 VMT projected from a state-of-the-art travel demand model for the 13 counties and July 2004 emission factors from EPA's MOBILE5b emission factor model. The control measures identified and modeled for mobile emissions used to establish these budgets, along with all other control measures in this plan, will result in attainment of the 1-hour ozone air quality standard by 2004.