ROANOKE CLEAN AIR PLAN

Ozone Early Action Plan

For

The Roanoke Ozone Early Action Compact Area

March 31, 2004

ROANOKE CLEAN AIR PLAN

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1. BACKGROUND

A. Introduction & Project Background

In 1997 the United States Environmental Protection Agency (EPA) established a new 8-hour ozone National Ambient Air Quality Standard (NAAQS). This standard was the result of a review of ground level ozone and related health impacts, and was set to replace the older 1-hour standard. The purpose of this new standard was to address the longer-term impact of ozone exposure at lower levels. As such, the new standard is set at a lower level (0.08 parts per million) than the previous standard (0.120 parts per million) and is more protective of human health.

As part of the implementation of the new standard, states submitted area designation recommendations to the EPA in June of 2000 that identified potential ozone nonattainment areas based on air quality data from 1997 to 1999. The Roanoke Metropolitan Statistical Area (MSA) was identified at that time as one of the potential nonattainment areas in Virginia, mainly based on the fact that ozone concentrations exceeding the standard had been recorded at the monitor located in the Town of Vinton. The State and EPA have reaffirmed this designation in subsequent nonattainment recommendations and proposals.

During the development of these state recommendations, a number of concerns were raised by the potential nonattainment areas about the adverse impacts of a possible nonattainment designation on these areas. In response, the Virginia Department of Environmental Quality (DEQ) began to investigate voluntary actions that could be implemented proactively to improve air quality and lessen the possible impact of a formal nonattainment designation in areas that marginally exceed the new standard.

The most promising of all the options explored is the EPA's ozone Early Action Compact (EAC) program. The EAC concept was originally developed by several areas in Texas in early 2002 and subsequently endorsed and expanded by the EPA as national voluntary program.

EACs are voluntary agreements by the localities, states, and the EPA to develop Early Action Plans (EAPs) to reduce ozone precursor pollutants and improve local air quality in a proactive manner, and in a shorter time than what would occur through the traditional nonattainment area designation and planning process. These plans must include the same components that make up traditional State Implementation Plans (SIPs). This includes emissions inventories, control strategies, schedules and commitments, and a demonstration of attainment based on photochemical modeling.

The goal of an EAP is to develop a comprehensive strategy that will bring an area into attainment of the 8-hour ozone standard by 2007. This goal is will be achieved by selecting and

implementing local ozone precursor pollutant control measures that when combined with other measures on the state and national level, are sufficient to bring the area into compliance with the standard. If the area is successful in developing a plan that demonstrates attainment of the 8-hour ozone standard by 2007, the EPA will defer the effective date of the nonattainment designation for the area. This deferral will remain in place as long as certain milestones are met, such as implementation of local controls by 2005. If all interim milestones are met and the area demonstrates attainment of the standard during the period from 2005 to 2007 through air quality data, then the nonattainment designations will be withdrawn by EPA, without further regulatory requirements. If an area fails at any point in the process, it will revert back to traditional nonattainment status, with all the associated requirements of such a designation.

The Roanoke MSA area entered into an Early Action Compact with both the Commonwealth and EPA for the area including Botetourt and Roanoke Counties, the Cities of Roanoke and Salem, and the Town of Vinton. This Compact was signed by all the parties involved and then submitted to the EPA by the required date (December 31, 2002). The area has subsequently established and commissioned the Roanoke Early Action Plan Task Force to serve as the major stakeholder group to coordinate the development of an early action plan for the area. This Task Force has a diverse and knowledgeable membership, which greatly aided the development of a comprehensive plan.

Both this area, and the other Early Action Compact area in Virginia (Northern Shenandoah Valley), are well suited for this project due to their geographic location and extent, marginal nonattainment air quality levels, and common influences of ozone transport and other external factors. Both areas are located in the western part of Virginia and would be separate and relatively small nonattainment areas, if formally designated.

The remainder of this final plan and report describes the project area, the significant events and progress made thus far, efforts to encourage public participation in the process, and the technical support activities completed support the overall planning effort.

B. The 8-Hour Standard in the Roanoke Metropolitan Statistical Area (MSA)

During the past several years air quality planning in the Roanoke MSA has intensified as ozone concentrations in the Roanoke MSA have exceeded the value permitted by the 8-hour ozone NAAQS. Due to legal challenges to the NAAQS and ensuing litigation, EPA has not formally designated areas of the United States in violation of the 8-hour ozone NAAQS. The 8-hour NAAQS has been upheld and EPA anticipates nationwide designation of nonattainment areas by 2004. Based on recent monitoring data, it is probable that the Roanoke MSA will be designated a nonattainment area when formal designations occur.

The 8-hour ozone standard is determined by averaging three years of the fourth highest 8-hour ozone levels in an area. This number, called the design value, must be lower than 85 parts per billion (ppb) to meet the standard. Currently, the Roanoke MSA design value (averaging 2001, 2002 and 2003) is 85 ppb. Each year this design value may vary. Data is available for the Roanoke MSA for the 8-hour ozone standard beginning in 1990. Ozone concentrations have exceeded the standard a total of 30 times during the period from 1990 to 2003. The number of exceedences recorded in Roanoke from 1991 to 2003 are shown below. Data from the

monitors in Wythe and Rockbridge Counties are also shown for comparison purposes:

Roanoke, VA (Vinton Monitor)

91	92	93	94	95	96	97	98	99	00	01	02	03
2	0	2	2	2	0	2	13	6	2	5	5	1

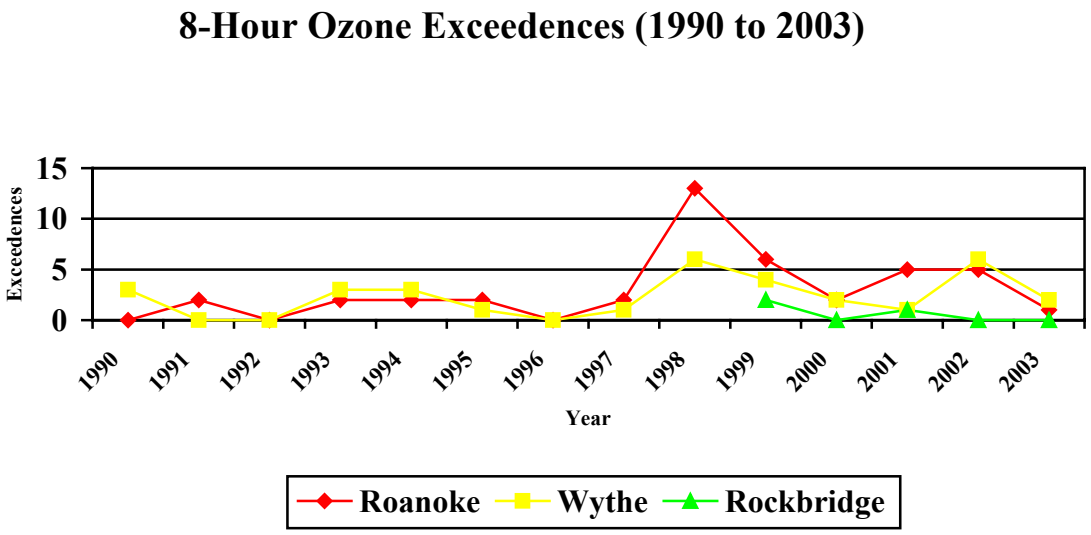
Wythe County, VA

91	92	93	94	95	96	97	98	99	00	01	02	03
0	0	3	3	1	0	1	6	4	2	1	6	2

Rockbridge County, VA

91	92	93	94	95	96	97	98	99	00	01	02	03
(New Monitor beginning operation in 1999)								2	0	1	0	0

Figure 1 – Roanoke 8-hour Ozone Standard Monitor Data



In 2002 and 2003, the Roanoke monitor recorded 8-hour exceedences on the following days:

2002		**2003**	
June 11	91 ppb	June 25	91 ppb
July 17	94 ppb		
August 10	85 ppb		
August 11	92 ppb		

August 13 99 ppb

C. OZONE EARLY ACTION PROGRAM (OEAP)

The region agreed and committed itself to the OEAP process to expedite air cleanup for future public health and welfare. The OEAP was developed according to protocol endorsed by EPA Region 6 on June 19, 2002. The Protocol offers a more expeditious time line for achieving clean air than expected under EPA's 8-hour implementation rulemaking.

The principles of the OEAP to be executed by Local, State and EPA officials are:

- Early planning, implementation, and emission reductions leading to expeditious attainment and maintenance of the 8-hour ozone standard;
- Local control of the measures to be employed, with broad-based public input;
- State support to ensure technical integrity of the OEAP;
- Formal incorporation of the OEAP into the SIP;
- Deferral of the effective date of nonattainment designation and related requirements so long as all OEAP terms and milestones are met; and
- Safeguards to return areas to traditional SIP requirements should OEAP terms and/or milestones be unfulfilled, with appropriate credit given for emission reduction measures implemented.

The Roanoke MSA OEAP has two principal components:

1. The Early Action Compact (EAC) — EAC was the Memorandum of Agreement to prepare and implement an Early Action Plan (EAP). More specifically, the EAC established measurable milestones for developing and implementing the EAP.

2. The Early Action Plan (EAP) — This EAP serves as Roanoke MSA's official air quality improvement plan, with quantified emission-reduction measures. The EAP will include all necessary elements of a comprehensive air quality plan, (like the plans in Richmond, VA), but will be tailored to local needs and driven by local decisions. Moreover, the EAP will be incorporated into the formal SIP and the region will be legally required to carry out this plan just as in nonattainment areas. For example, development of EAP will require the same scientific diligence and undergo the same scrutiny as the nonattainment areas' SIPs, so that the emission reduction strategies selected will be adequate to ensure the region stays in attainment of the 8-hour standard.

OEAP Versus Traditional Nonattainment

A major advantage of the region's participation in an OEAP is the flexibility afforded to the signatories in selecting emission reduction measures and programs that are best suited to local needs and circumstances. Recognizing the varied social and economic characteristics of the region, not all measures can or should be implemented by every entity.

- The OEAP allows for more local control in selecting emission-reduction measures.
- The OEAP provides deferral of nonattainment designation and related requirements, as long

as Plan requirements and milestones are met. This would prevent any related stigma associated with a nonattainment designation.

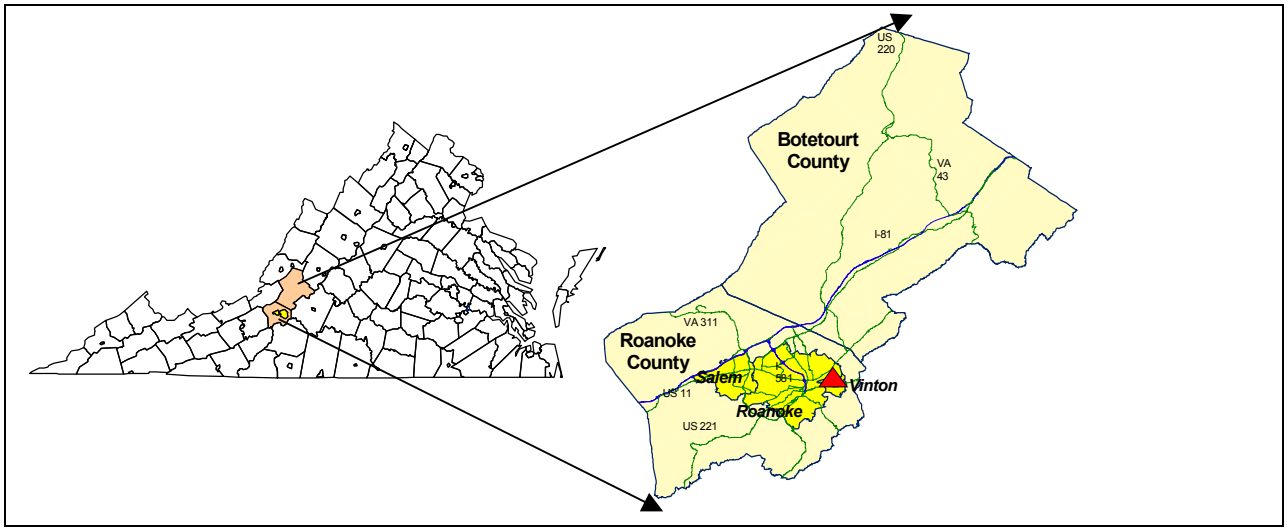
- The OEAP is designed to achieve clean air faster than under the traditional SIP process.
- Should any milestones be missed in designing or implementing the Plan, the area would automatically revert to the traditional SIP requirements, with appropriate credit given for emission reduction measures already implemented.

The Roanoke MSA's OEAP is designed to enable a local, proactive approach to ensuring attainment of the 8-hour ozone NAAQS, and so protect human health. Using the OEAP approach, the region could begin implementing by 2005 emission-reduction measures directed at attaining the 8-hour standard. This allows for a significantly earlier start than waiting for formal EPA nonattainment designation and it gives more flexibility in choosing which emission reduction strategies to implement. The area is then required to demonstrate compliance with the ozone standard by 2007 through ozone monitoring data.

D. Description of the Early Action Compact Area

The Roanoke Metropolitan Statistical Area (MSA) is located within the Blue Ridge Mountains area of Virginia, and has typical topographic characteristics of such a mountain & valley area. The major urbanized center area is located in a valley and made up of the Cities of Roanoke and Salem, along with the Town of Vinton where the ozone monitor for the area is located. The more suburban and rural Roanoke County with Botetourt surrounds this core urban area to the North. The major commercial transportation corridor of Interstate 81 runs through the entire MSA from north to south, which is just to the west of the urban core. A significant portion of Northwestern Botetourt County is rural and part of the Jefferson National Forest.

Figure 2 – Roanoke Early Action Area



The vital statistics of the area in terms of ozone related criteria are as follows:

- Land Area – 851 square miles

- Population (2000) – 235,932

- Population density (2000) – 277 per square mile
- Projected Population (2010) – 244,499
- Volatile Organic Compound Emissions (2002) – 45 tons per day
- Oxides of Nitrogen Emissions (2002) – 50 tons per day
- Prevailing Ozone Season Wind Direction – From the Southwest
- 8-hour Ozone Design Value (2001 – 2003) – 0.085 parts per million

2. PROJECT ORGANIZATION & PROGRESS SUMMARY

The Ozone Early Action Plan development process is a joint effort of the Roanoke Valley Area Metropolitan Planning Organization and the Virginia Department of Environmental Quality. The Roanoke Valley-Alleghany Regional Commission (RVARC) is the administrative agency for the Roanoke Valley Area Metropolitan Planning Organization. Staff with the Commission have been

detailed to work on the Ozone Early Action Plan and to manage the involvement of a consultant, E.H. Pechan & Associates, which assisted with development of the plan.

A. Project Organization

The Ozone Early Action Plan Task Force was established to guide the consultant and Roanoke Valley-Alleghany Regional Commission staff in the development of the Ozone Early Action Plan when it is not practical to engage the public at large on every minor detail. The Task Force is staffed by the RVARC, making Wayne Strickland the Task Force's ex-officio director.

B. Progress Summary

On June 30, 2003, the 1st Semi-Annual Status Report was submitted to EPA. That report fulfilled the first reporting milestone required by the EAC.

The 2nd Semi-Annual Status Report in December 2003 provided a list of the control measures under consideration for adoption by the Roanoke areas. This report listed and described each measure and provided the likely implementation dates, a current assessment of the amount of emission reductions expected to be achieved through implementation of the measure, and the geographical area in which each control measure is anticipated to apply.

The specific process used to select and evaluate local control measures is presented below:

- During the August taskforce meeting, all participating members cast initial votes for potential control measures to be carried forward in process from the original June 16th potential local control measure list that was submitted to EPA. The top measures from this voting were those the group generally believed were most likely to be effective and acceptable if included in the final local control plan.

- Three subcommittees made up of taskforce members were established during the September meeting to individually evaluate each potential local control measure that was

previously voted forward in the process. These subcommittees covered the following categories of potential local controls:

1. Heavy Duty Diesel and Diesel equipment strategies
2. Air-quality action day, public education, and stationary sources strategies
3. Lawn and garden equipment strategies

The individual committees met continuously during October to define, evaluate, and quantify the measures in each category. Once this process was completed, a draft local control plan was developed and presented to the whole task force in November and accepted for inclusion in the status report during the December taskforce.

The subsequent draft final Early Action Plan (EAP) was then developed and presented for formal adoption to each the governing body of each jurisdiction involved. In turn, each jurisdiction has formally adopted the plan and committed to its subsequent implementation. The formal resolutions of adoption are present in Appendix B.

C. Stakeholder Involvement and Meetings

The "Task Force" is staffed by the RVARC, making Wayne Strickland the ex-officio director of the "Task Force." Thus far, we have not turned away any stakeholder interested in serving on the Ozone EAP Task Force. Thus, the complete make-up of the Task Force is not static; however, its approximate current makeup includes representation from the following organizations at a minimum ***(Blue Ridge Bicycle Club, Roanoke Regional Chamber of Commerce, Blue Ridge Environmental Network, US Forest Service, Piedmont Environmental Council, RIDE Solutions, Salem – Roanoke County Chamber of Commerce, Virginia Tech, Norfolk Southern Corp., Southern Environmental Law Center, Clean Valley Council, Roanoke Valley Greenways Commission, Roanoke Valley Asthma and Air Quality Coalition, Sierra Club – Virginia Chapter, Roanoke Valley Economic Development Partnership, Roanoke Valley Resource Authority, Virginia Health Department, City of Roanoke, City of Salem, County of Roanoke, County of Botetourt, Town of Vinton, Virginia DEQ, Virginia DOT (VDOT), Federal Highway Administration)*** Many other organizations have participated on an ad hoc basis. There is room for new organizations to participate as the planning process continues.

- ***Monday December 16, 2002*** Early Action Compact (EAC) Signing Ceremony, Public and Press Invited, Press Releases preceded the event, a media pack was developed in conjunction with RVARC's on call PR Consultant.
- ***January 14, 2003*** Ozone EAP Task Force Kickoff meeting (*see Task Force Makeup Above)
- ***Wednesday February 19, 2003*** – EAP was featured in Leadership Roanoke Valley Air Quality Program at Roanoke County Fire and Rescue Training

Center (LRV Quality of Life Program – All Day)

- ***February 28, 2003*** – EAP Task Force Meeting – Consultant Presentations and Selection of finalist for contract.
- ***March 28,2003*** – **EAP Task Force Meeting** – Air Quality Modeling Presentation and Discussion – Virginia DEQ
- ***March 10, 2003*** – Oral Presentation to Cosmopolitan Club (Mark McCaskill, Lunch Meeting, Q&A included)
- ***April 10, 2003*** – Oral Presentation to Roanoke Regional Chamber of Commerce Transportation Committee concerning the EAP. (Mark McCaskill, 12:00 pm, Q&A included)
- ***April 23, 2003*** – Oral Presentation to Roanoke Valley Greenways Commission concerning the EAP. (Mark McCaskill, 5:00 pm, Q&A included)
- ***May 1, 2003*** – Media Interview Channel 10 6:00 O'clock News
- ***May 2, 2003*** – **EAP Task Force Meeting** – E.H. Pechan Associates – Draft Strategies Menu Discussion
- **May 15, 2003** Advertisement sent to ***Roanoke Times*** and ***Roanoke Tribune*** for May 29, 2003 public input meeting. Advertisement will run in the Sunday May 18, 2003 Edition (Roanoke Times) and Thursday May 22, 2003 edition (Roanoke Tribune).
- ***May 16, 2003*** – Distribution of Draft Strategies List to "Regional Mayor's and Chairs" meeting (Local Elected and Chief Administrative Officers for the Region)
- ***May 16, 2003*** – Notice of May 29th public meeting in Roanoke Regional Chamber's Monthly Electronic Newsletter "Member Connections"
- ***May 19, 2003*** – **EAP Task Force** teleconference meeting with E.H. Pechan concerning draft strategies.
- ***May 19, 2003*** – May 29th meeting **press release** to following recipients (Joe McKean, WDBJ-TV; Melissa Preas, WSLS-TV; Ray Reed, The Roanoke Times; Chris Kahn, Associated Press; William Little, Fincastle Herald; Claudia Whitworth, The Roanoke Tribune; Jeff Walker, The Vinton Messenger; Meg Hibbert, Salem Times Register; Rick Mattioni, WVTF-FM (Public Radio); Kevin LaRue, WFIR-FM (Roanoke's News Radio)
- ***May 27, 2003*** – Retransmission of above press release
- ***May 29, 2003*** – Interview with Dan Heyman WVTF News concerning public meeting
- ***May 29, 2003*** – Article published in Roanoke Times concerning public meeting (see file)

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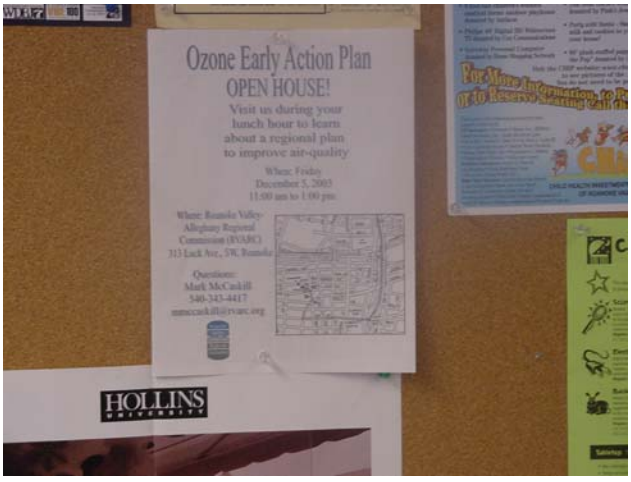
- ***May 29, 2003*** – Public Meeting Roanoke County Headquarters Library (28 Attendees) – Public comments cataloged and transmitted to consultant (E.H. Pechan) for revision of draft strategies list.
- ***June 25, 2003*** – Isak Howell (The Roanoke Times) requests the list of potential strategies to do an Ozone related story.
- ***June 26, 2003*** – Isak Howell story appears in The Roanoke Times and mentions the Ozone EAP and public participation.
- ***July 30, 2003*** – Ozone EAP featured in July 29, 2003 edition of "Legislative Connection" email distributed by Roanoke Regional Chamber of Commerce.
- ***August 8, 2003*** – Ozone EAP Task Force meeting. Initial "Voting" on strategies.
- **SEPTEMBER** – Article featuring Ozone EAP process and the Roanoke Valley's participation featured in the National Association of Development Organizations' (NADO) "Economic Development Digest" September Edition – Kelly Novak Author

- ***September 4, 2003*** – Ozone EAP Task Force meeting and establishment of "subcommittees" to evaluate strategies.
- ***September – November,*** 2003 subcommittee meetings.
- ***November 14, 2003*** – Ozone EAP Task Force Meeting.
- ***November 26, 2003*** – Press Release to announce December 5, 2003 EAP Open House
- ***November 30, 2003*** – Advertisement of December 5, 2003 in *Roanoke Times*
- ***December 1, 2003*** – Notices placed at City of Roanoke Main, Gainsboro, Jackson, Melrose and Williamson Road Library Branches.
- ***December 2, 2003*** – City of Roanoke Environmental Information Officer placed November 26 Press Release in the City's "My Roanoke" email newsletter.
- ***December 2, 2003 –*** Notices announcing Open House placed at Harrison Museum of African American Culture as



well as Refugee & Immigration Services.

- ***December 5, 2003 –*** Ozone Open House 11:00 am to 1:00 pm.
- ***December 5, 2003 –*** Ozone Task force meeting.
- ***January 11, 2004 –*** Legal advertisement in "Roanoke Times" announcing January 20, 2004 Public Hearing"
- ***January 18, 2004 –*** Follow-up legal advertisement in "Roanoke Times" announcing January 20, 2004 Public Hearing"
- ***January 19, 2004 –*** Presentation to Regional Chamber of Commerce concerning Ozone EAP.
- ***January 20, 2004 –*** Ozone EAP Draft Public Hearing.
- ***January 21, 2004 –*** Interview with WVTF Public Radio for broadcast.
- ***January 22, 2004 –*** Interview with News 7 (CBS) for 5:00 p.m. and 6:00 p.m. news.

- ***January 20, 2004*** – EAP formally adopted by resolution by the Town of Vinton.
- ***January 27, 2004*** – EAP formally adopted by resolution by Roanoke County.
- ***January 29, 2004*** – EAP formally adopted by resolution by the City of Salem
- ***January 20, 2004*** – EAP formally adopted by resolution by the Town of Vinton.
- ***February 17, 2004*** – EAP formally adopted by resolution by the City of Roanoke.
- ***February 24, 2004*** – EAP formally adopted by resolution by the Botetourt County.
- ***February 27, 2004*** - Ozone Task force meeting to discuss modeling progress and results.

3. EMISSION REDUCTION STRATEGIES

This section describes the local control measures that have been adopted and included in the final local Early Action Plan. These measures, when combined with control strategies at the state and federal levels are meant to significantly reduce ozone precursor emissions and bring the Roanoke Valley area into compliance with the 8-hour ozone standard.

A. Local Control Measures

Described below is a summary of the local control strategies in the final Early Action Plan. These control measures are grouped according to the categories and subcommittees established by the Taskforce to evaluate these measures. **A detailed description all these**

potential control measures and projected implementation dates is presented in the local Early Action Plan document.

Heavy Duty Diesel and Diesel Equipment Strategies

#1 – Reduction of locomotive idling and resulting emissions. Through a local voluntary agreement, the Norfolk Southern Railroad Company will implement an internal policy to limit locomotive idling at its facilities/yards in the City of Roanoke. This measure will reduce emissions of both NO_X and fine particulate matter (PM) and will be in addition to emission reductions from federal locomotive controls. A detailed estimate of these reductions is currently under development. This measure was not included in the estimate of EAP emissions reductions or in the air quality modeling exercise.

#2 – Limitation of idling times for local school bus fleets. This measure will involve the expansion of existing school bus idling restrictions to the entire EAP area. An initial estimate of reductions expected from this measure is 0.7 tons/year of NO_X and an undetermined amount of PM.

#3 – Retrofit control technology for 100 Roanoke County school buses. This measure will involve the installation of oxidation catalysts on 100 school buses. An initial estimate of the reductions expected from this measure is 0.3 tons/year of VOCs, 0.07 tons/year of PM, and 1.2 tons/year of Carbon Monoxide (CO). It is likely that the City of Roanoke will also participate in this program which will increase the reduction estimate.

#4 – Purchase and use of bio-diesel compatible solid waste trucks by the City of Roanoke. This measure will involve the conversion of five new garbage trucks to use bio-diesel fuels. An initial estimate of the reductions expected from this measure is approximately 250 kilograms/year of NO_X and 8 kilograms/year of PM.

#5 – Purchase and use of ethanol compatible alternative fuel vehicles by the City of Roanoke. This measure will involve the purchase and use of up to 26 alternatively fueled vehicles. The estimate of reduction from this measure will be developed once the details are determined.

#6 – Purchase of bio-diesel ready trucks by the City of Roanoke. This measure involves the prior and future purchase and use of waste trucks utilizing bio-diesel fuels. The estimate of reduction from this measure will developed once the details are determined.

#7 – Purchase of hybrid vehicles by the City of Roanoke. This measure will involve the purchase and use of up to four hybrid vehicles. The estimate of reduction will depend on the number of vehicles purchased and will be developed once this is determined.

#8 – Purchase of more efficient, low-emission, or alternative fuel vehicles by Roanoke County. A plan is currently being developed by the County for these purchases, and the reductions anticipated will be calculated once this plan is completed and approved.

#10 – Educational and training program of vehicle use by Roanoke County. The County has implemented an educational program on “effective environmental driving”. Reductions will be estimated based on observed fuel use reductions achieved after the completion of the training.

Air Quality Action Day, Public Education, and Stationary Source Strategies

The center piece of the proposed local control plan will be a comprehensive air quality (ozone) action day program which will require restrictions on ozone precursor pollutant producing activities by state/local governments and encourage voluntary restrictions of similar activities on local businesses and the public. The DEQ already issues local forecast of ozone levels for the Roanoke area during the typical ozone season. An enhanced forecasting tool for the Roanoke area is currently under development and will be used as part of this action day program. Another key component of this program will be an ongoing public awareness and education program to notify and inform the public on action they can take to reduce their individual impact on the area's air quality. To facilitate this program, regional and local air quality coordinators will be assigned to implement and coordinate the efforts involved. The main components of the air quality action day program, along with several longer-term support activities are as follows:

#11 – Air quality action day program (hybrid approach). This program will consist of two main efforts. First, local governments have made commitments to limit or ban certain ozone precursor forming activities during predicted high ozone days. These activities will include landscaping, pesticide application, refueling vehicles, and use of other solvent based products. The State Department of Transportation, which performs many of the same activities in the local area, has also made this commitment. Secondly, voluntary restrictions on these same activities will be requested of local business and the general public during potential high ozone days. At the same time businesses and the public would be encouraged to make alternative commuter choices such as car or vanpools, public transit, telecommuting, and trip-chaining. As a contingency measure, if ozone exceedances continue or a shortfall in emission reductions is identified after plan implementation, the area will reevaluate and determine if additional mandatory restrictions are warranted.

#12 – Early morning or late evening refueling of vehicles. This measure will also have a mandatory and voluntary component. Local governments and state agencies will restrict vehicle refueling during high ozone days to the evening. At the same time, local gasoline distributors will be encouraged to provide incentives to the public to refuel early or late in the day during high ozone days.

#13 – Promotion of alternative fuel vehicles. As part of the public awareness and education program, the environmental and economic benefits of alternative fuel vehicles will be identified as encouragement to purchase these vehicles.

#14 – Media and public relations concerning air quality action days. A comprehensive and year-round media and public relations program will be implemented and coordinated by a regional air quality and ride-sharing coordinator and assisted by local coordinators.

#15 – Public transit incentives (transit passes) for college students and local employers. This will involve the purchase of at least 300 transit passes to be distributed to students and employers for use during high ozone days or year-round.

#16 – Bicycle infrastructure and amenities. This program will encourage bicycle use during high ozone days and encourage the expansion of bicycle related infrastructure.

#17 – School (K-12 and adult education) based public education. This will involve expansion of an ongoing educational program to identify air quality issues and individual action that can be taken to reduce ozone precursor emissions at area primary and secondary schools.

#18 – Tree canopy/ urban forestry. This will involve an area-wide comprehensive tree- planting program with the goal of reducing concentrations of certain pollutants including ozone and NO_X .

#19 – Roanoke to Blacksburg public transit. Establishment of a bus route from Roanoke to Blacksburg (where Virginia Tech is located), and point in between. This will reduce vehicle trips within the compact area and produce a 0.9 ton/year reduction of NO_X and 2 ton/year reduction of VOC.

Although it is very difficult to estimate ozone precursor emission reduction that will be achieved from these individual actions, it is not unreasonable to assume that all these actions combined will have the desired impact of reducing emissions to some extent. Through the evaluation of these types of programs in other areas, a general range of emission reductions that can be expected from the combination of these types of voluntary measures of 3% from affected activities and emissions. Therefore, an initial estimate of a 3% reduction in ozone precursor emissions from these activities in the Roanoke area has been used to estimate the reductions from the combination of these measures during predicted high ozone days. For those activities that have a state/local mandatory component, a 5% reduction estimate has been used for the purpose of determining emissions reductions. In total, this equates to a daily reduction of 1 ton/day of VOC and 1.5 tons/day of NO_X.

Lawn and Garden Equipment Strategies

#20 – Replacement of gasoline golf carts with electric carts. This measure will involve obtaining commitments from up to four local golf courses to replace some or all of their golf carts with electric carts. Replacement of 100 gas carts with electric carts would produce a VOC reduction of 25 tons over three years.

#21 – Gasoline powered lawnmower buyback program. This will involve providing incentives for the public to trade in gasoline powered lawnmowers for zero emissions equipment (electric or manual).

#22 & #23 – Restrictions on the use of lawn and garden equipment. This would be another two-part control measure with mandatory restrictions the use of gasoline powered lawn and garden equipment for state/local governments and voluntary restrictions on local businesses and the public, during predicted high ozone days. Assuming a 5% percent reduction in lawn & garden emissions from this measure, VOC emissions would be reduced by 0.2 tons/day.

#24 – Open burning bans/restrictions. Several jurisdictions have adopted local rules restricting or prohibiting open burning. The other EAP jurisdictions will ban or restrict open burning during

predicted high ozone days. This will reduce area emissions by 0.56 tons/day of VOC, and 0.24 tons/day of NO_X.

B. State & Federal Control Measures

In addition to the local control measures identified in the preceding discussion, there are several state and federal actions that have or will produce substantial ozone precursor emission reductions both inside and outside of the Roanoke Valley area. These reductions are aimed at reducing local emissions and the movement (transport) of pollution into the area. These measures, when combined with the local control program, are expected to lower area ozone concentrations to the level at or below the ozone standard.

At the state level, several significant actions have been taken. First, in response to EPA's call for the reduction of NO_X emissions from large combustion sources (i.e., the NO_X SIP Call), the state has adopted and will implement a program to significantly reduce emissions of NO_X as part of a regional program to reduce ozone transport. This program alone is predicted to reduce ozone forming NO_X emissions by up to 30,000 tons per ozone season in Virginia. Secondly, the state opted into the National Low Emission Vehicle program that began to require less polluting vehicles in the state, beginning in 1999. Also in 1999, Stage I vapor recovery systems were required at gasoline stations in the Roanoke area which has reduced gas station VOC emissions by 1.7 tons/day. To further address local emissions, the state has recently adopted Reasonably Available Control Technology (RACT) controls for industries in the area, to further reduce the local contribution to ozone formation. The emission reduction expected from RACT in the area is 1.1 tons of VOC and 1.5 tons/day of NO_X. Compliance with the RACT rule will be required by the end of 2005.

On the federal level, numerous EPA programs have been or will be implemented to reduce ozone pollution. These programs cover all the major categories of ozone generating pollutants and are designed to assist many areas to come into compliance with the federal ozone standard. A brief description of these measures is provided below:

Stationary & Area Source Controls: In addition NO_X SIP Call program, the EPA has developed a number of control programs to address smaller "area" sources of emissions that are significant contributors to ozone formation. These programs reduce emissions from such sources as industrial/architectural paints, vehicle paints, metal cleaning products, and selected consumer products.

Motor Vehicle Controls: The EPA continues to make significant progress in reducing motor vehicle emissions. Several federal programs have established more stringent engine and associated vehicle standards on cars, sport utility vehicles, and large trucks. These programs combined are expected to produce progressively larger emission reductions over the next twenty years as new vehicles replace older ones.

Non-Road Vehicle & Equipment Standards: The category of "non-road" sources that covers everything from lawn & garden equipment to aircraft, has become a significant source of air pollutant emissions. In response, EPA has adopted a series of control measures to address these sources. These programs include engine emission standards for lawn & garden equipment, construction equipment, boat engines, and locomotives.

All these measure have been developed to address both the creation of ozone producing emissions in the local area, as well as reducing the movement of ozone into the area as a comprehensive approach to reducing ozone levels.

4. AIR QUALITY TECHNICAL SUPPORT ACTIVITIES

A. Background

Air Quality analyses are used to simulate the combination of meteorology, emissions, and atmospheric chemistry that promote ozone formation and higher ambient concentrations in a given area. Once a representative scenario, or episode conducive to ozone formation, based on an actual observed ozone event is selected and validated, various emission reduction strategies can be tested to predict whether they would succeed in reducing ozone and attaining the ozone standard. The major steps involved in photochemical modeling is as follows:

- Selection of type and geographic scale of photochemical model
- Selection of representative ozone episode(s)
- Base case episode modeling and validation
- Future year projection and attainment demonstration modeling

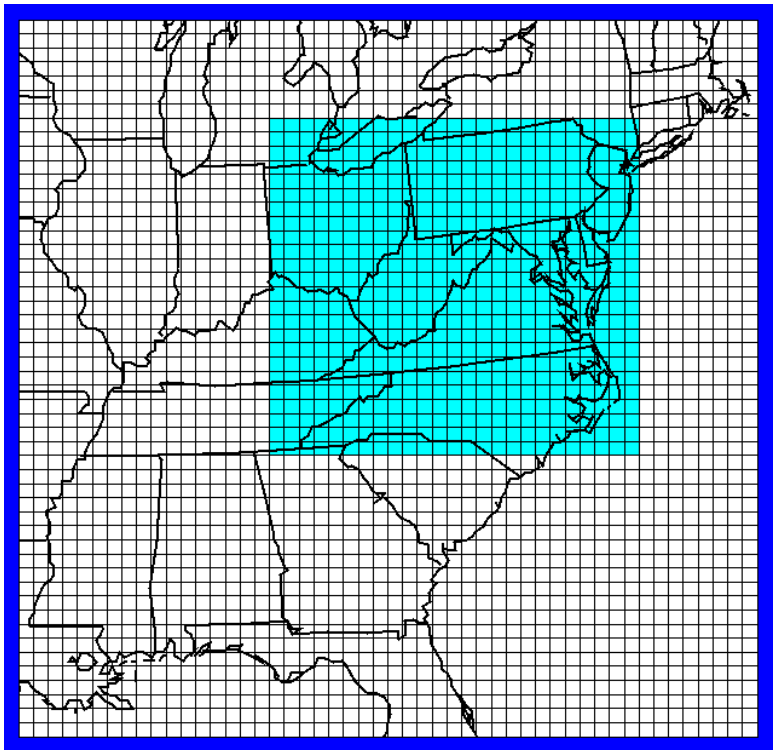
B. Model and Domain Selection

Due to the regional nature of ground level formation and transport that is prevalent in the Eastern United States, combined with the reasonable assumption the early action area is impacted by ozone transport, a regional photochemical modeling exercise has been selected for this project. This selection will allow for the evaluation of the impact of transport on the study area, as well as the impact of regional and national control strategies in reducing ozone transport into these areas.

The initial photochemical model selected for this purpose in EPA's MODELS3/CMAQ model that is EPA's latest modeling platform for such analyses. The meteorological inputs required to run the model will be developed using the MM5 meteorology model, and the emissions inputs will be developed using the SMOKE emissions preprocessor model. The purpose of these model data input preprocessors is to temporally and spatially allocate these inputs to a grid system used by the photochemical model to recreate the atmospheric interaction of all these factors in promoting ozone formation.

Due the need to model a larger region for ozone transport assessment, a regional domain that covers a large portion of the Mid-Atlantic States has been chosen to support the early action modeling. This domain has been used in previous analyses by the State to assess transport and the regional effect of emission reductions. The domain will consist of a series of descending grid cells from 36 kilometers (km) at the edges of the domain, to 12 km in the Mid-Atlantic area. A local 4 km exercise for the project area may be added later to provide further resolution. In this way the resolution of the model and modeling results will be the highest in and around the early action planning areas. This modeling domain is shown in Figure 3.

Figure 3: Early Action Modeling Domain of 36 km & 12 km Resolution



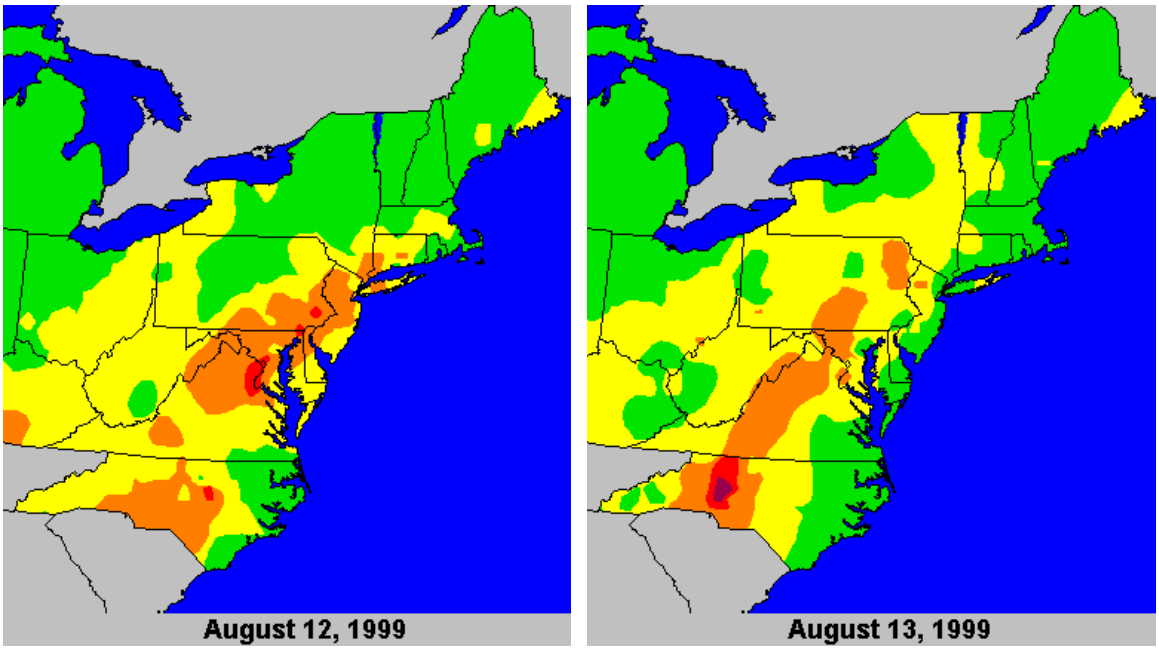
C. Episode Selection

One of the key aspects of a modeling analysis of a particular area and air pollution problem is to select one or more representative episodes to model. The selection process should reflect one or more of the prevailing meteorological and emissions conditions that produce higher levels of ozone in the subject area. An additional consideration for this project is that EPA guidance requires that the baseline emission inventory and subsequent episode(s) selected for an EAP are no older than 1999. Finally, since three states are developing plans in the same general area, an episode common to all three was selected.

The result of this process produced an ozone episode that occurred on August 12th and 13th in 1999. This episode was selected mainly because exceedences of the ozone standard were observed at all the area monitors involved in this effort (including Roanoke), during this period. This episode also involved the transport of ozone into Virginia from both the West and Southwest. To adequately simulate the events leading up and following this episode, a 10 day period from August 8th to the 18th will be modeled. After the completion of this modeling exercise, an additional episode, probably in 2002, will be selected and modeled to retest and confirm the results of the initial modeling and to begin the analysis of other nonattainment areas

in Virginia. The EPA ozone maps of the August 12th & 13th, 1999 episode are shown in Figure 4.

Figure 4: The Ozone Episode of August 12th & 13th, 1999



The episode meteorological conditions of August 12th and 13th in 1999 are listed below.

August 12th

The surface weather map on the morning of August 12th indicated a trough of low pressure extending from coastal New England, through the Delmarva region into central Virginia. South and east of the trough, surface winds were generally from the southeast and higher dew point temperatures, indicative of maritime air. West of the trough, surface winds were calm and variable with lower dew point temperatures, indicative of ozone–conducive continental air. Haze was reported over a large area from Maine into Tennessee and Georgia. Surface winds remained light into the afternoon. Surface and 1500 meter 48-hour back trajectories for Roanoke ending that afternoon indicated that air passed over the Ohio River Valley and West Virginia. The evening surface weather map indicated the trough of low pressure separating maritime from continental air persisted from New England southwestward through Maryland and Richmond, extending into central North Carolina. Maximum temperatures east of the trough were around 90 degrees. West of the trough, high temperatures reached into the low to mid 90s.

August 13th

The surface weather map on the morning of August 13th indicated the trough extended from Washington, D.C. through central Virginia into central North and South Carolina. Again, higher dew point temperatures and southerly winds east of the trough indicated maritime air. Lower dew points and calm winds west of the trough indicated the presence of a continental air mass. Forty- eight hour surface and 1500 back trajectories for Roanoke ending that afternoon originated from the Great Smokey Mountains region of northeastern Tennessee and north central Tennessee, respectively. The surface

trough separating the maritime air from the continental air persisted into the evening. High temperatures reached the mid-to-upper 90s in the region.

D. Emissions Inventory and Control Measures Summary

This section presents the various air pollutant emissions inventories developed to support the Roanoke Valley Ozone Early Action Plan. Typical daily inventories during the ozone season, expressed in tons per day, have been developed for this purpose. These inventories include baseline, interim, and future projection years to determine historic, current, and future emissions levels as part of the air quality plan development process. The major source categories used to present this inventory data are:

- **Stationary Point Sources -** Large utility and industrial facilities with significant individual emissions.
- **Mobile Sources -** Motor vehicles operated on public roads such as interstates, freeways, and local roads.
- **Area Sources -** Small individual sources of emissions such as gasoline distribution and marketing, solvent usage, and others.
- **Non-road Mobile Sources -** Motor vehicles and equipment such as lawn and garden tools, construction equipment, locomotives, and aircraft.

The first inventory developed for this process was the baseline emissions inventory. 1999 was selected for this purpose, since the ozone episode being modeled to support the EAP process occurred during the summer of 1999. This inventory serves as a baseline estimate of area emissions during the time when the modeled episode occurred. This inventory reflects actual emissions in the area during this year.

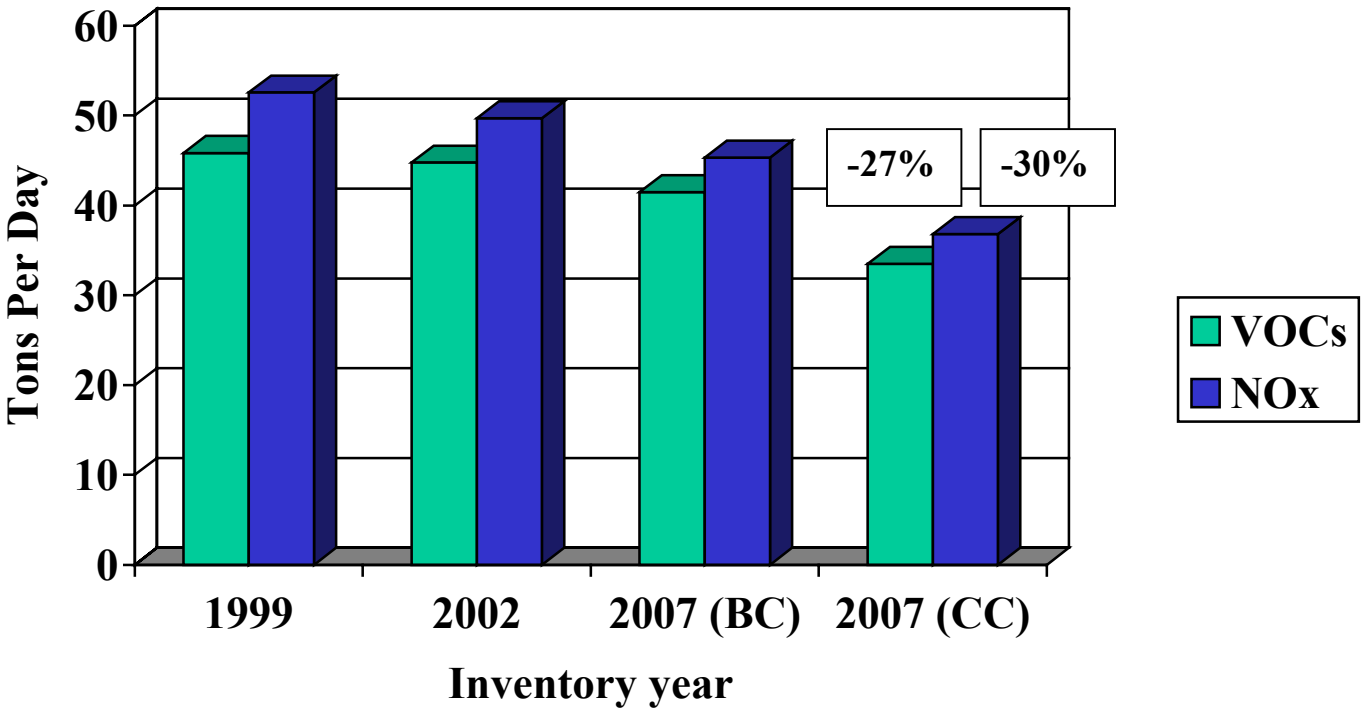
The second inventory to be developed was the interim (current) year emissions inventory. 2002 was selected for this purpose because this is the latest year for which a comprehensive inventory for all sources has been developed. This inventory serves to represent existing emissions levels in the local area and can also be compared to the baseline inventory to determine emissions trends. This inventory also reflects actual emissions in the area during this year.

The last two inventories developed for this process are predicted future year emissions inventories that represent base case (uncontrolled) and control case (controlled) emissions scenarios. The year selected for this purpose was 2007, which is the year by which the area must come into compliance with the ozone standard. The future base case inventory represents uncontrolled emissions projected with appropriate growth factors. The exception to this is the mobile source inventory that contains some reductions associated with previous federal/state motor vehicle controls. The future control case inventory represents the application of all control expected to be implemented in the local area by the attainment year. This includes the local impact of additional federal/state control measures, and the local control measures selected as part of the EAP process. A summary table and bar graph of these emissions inventories is presented in Figure 5. The various emissions inventories developed as part of EAP process are presented on Pages 21 to 29. A table summarizing all emissions

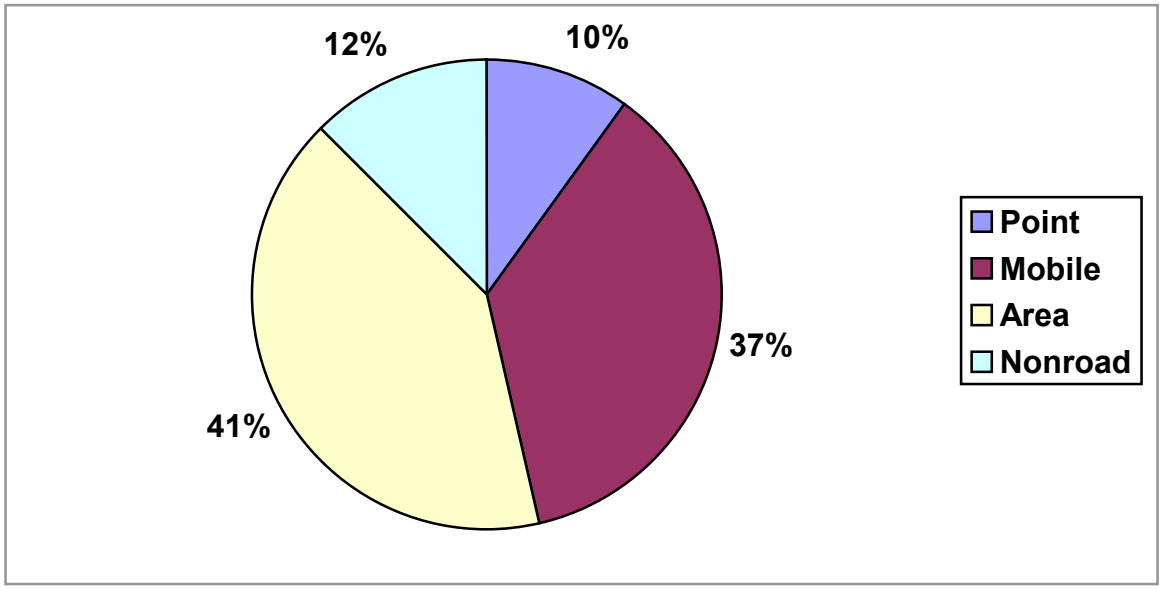
control measures and predicted reductions from 2007 uncontrolled levels is presented on Page 30.

Figure 5: Roanoke Valley EAP Emissions Inventory Summary

Source Category	1999 (Baseline)	2002 (Interim)	2007 (Base Case)	2007 (Control Case)
Volatile Organic Compound (VOC) Emissions in tons/day				
Point Sources	4.551	3.518	3.927	3.927
Area Sources	18.845	19.360	20.044	15.300
Non-road Sources	5.683	5.726	5.803	3.804
Mobile Sources	16.770	16.188	11.732	10.489
Totals:	**45.849**	**44.792**	**41.506**	**33.520**
Oxides of Nitrogen (NO_X) Emissions in tons/day				
Point Sources	9.312	7.231	7.876	6.343
Area Sources	5.091	5.254	5.531	5.293
Non-road Sources	7.807	8.049	8.480	6.285
Mobile Sources	30.358	29.166	23.436	18.897
Totals:	**52.568**	**49.700**	**45.323**	**36.818**

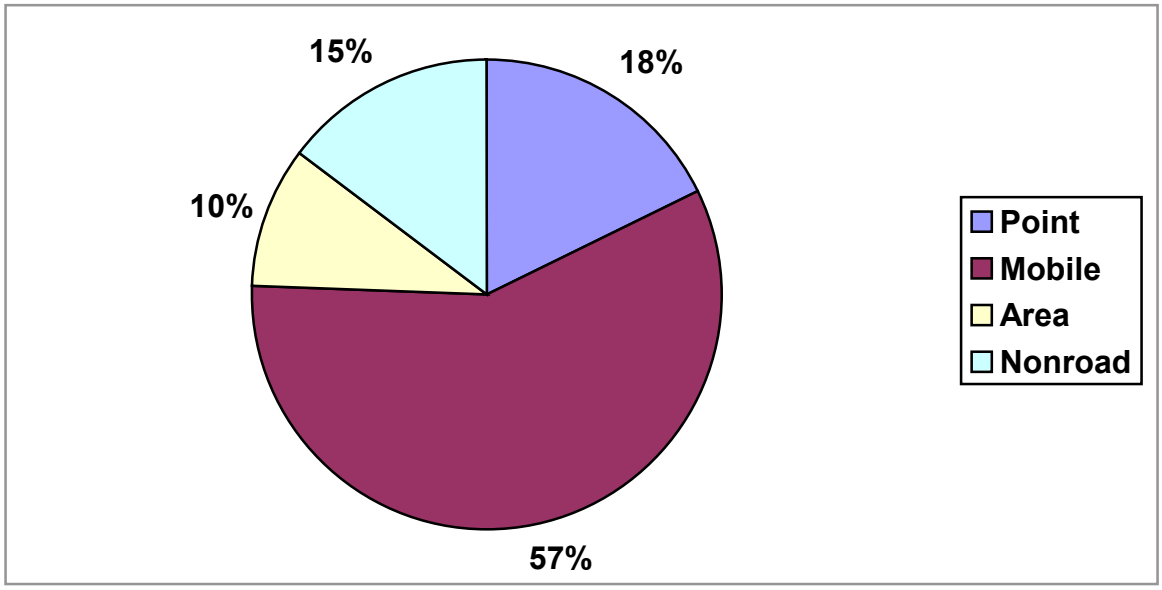


1999 Baseline Ozone Season Daily Emissions of Volatile Organic Compounds (VOC)



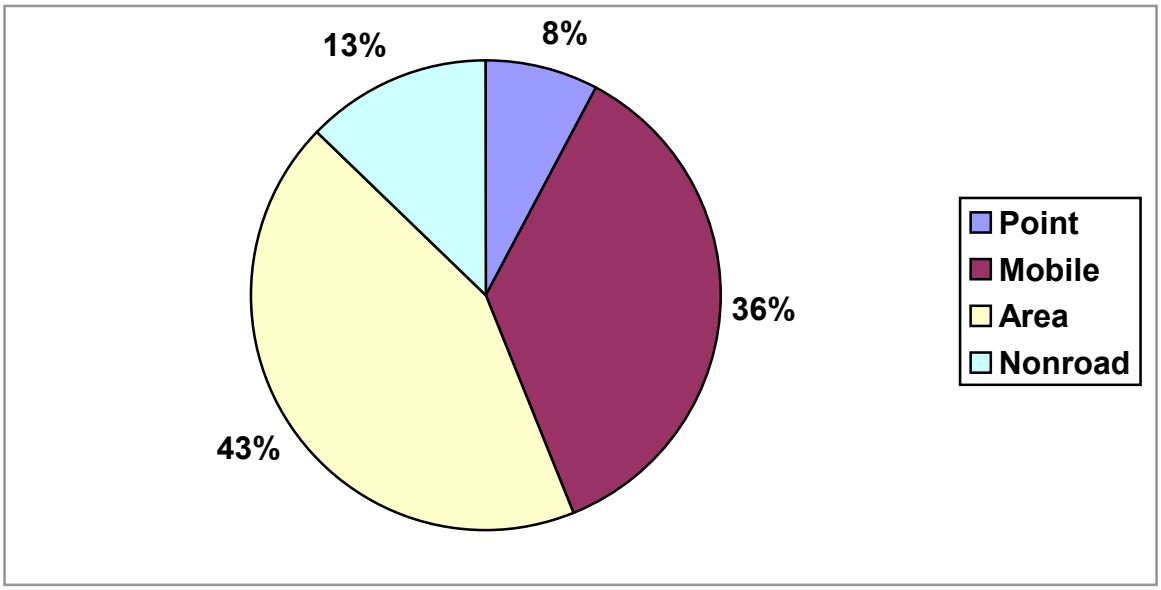
Summary of the Roanoke Valley Baseline VOC Emissions Inventory for Calendar Year 1999	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
28 individual facilities (Botetourt: 7, Roanoke Co.: 12, Roanoke City: 5, Salem City: 4) - Description: Includes cement production, metal works, minerals production, gas terminals.	4.551 tpd
On-Road Mobile Sources	
Motor Vehicles on Public Roads – **Description**: local and through traffic on the I-81 corridor. Large percentage of heavy-duty diesel trucks. Also, vehicle traffic on all other public roads from major arterials to local roads.	16.770 tpd
Area Sources	
Use of Solvent-based Products – Description: paints, cleaners, consumer products, & others.	11.229 tpd
Gasoline Distribution & Marketing – Description: Gasoline storage & transfer operation at terminals and service stations	5.579 tpd
All Others – description: Open burning, landfills, & others	2.037 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	5.490 tpd
All Others – Description: Locomotives, aircraft, boats	0.193 tpd
Total	**45.849 tpd**

1999 Baseline Ozone Season Daily Emissions of Oxides of Nitrogen (NO_X)



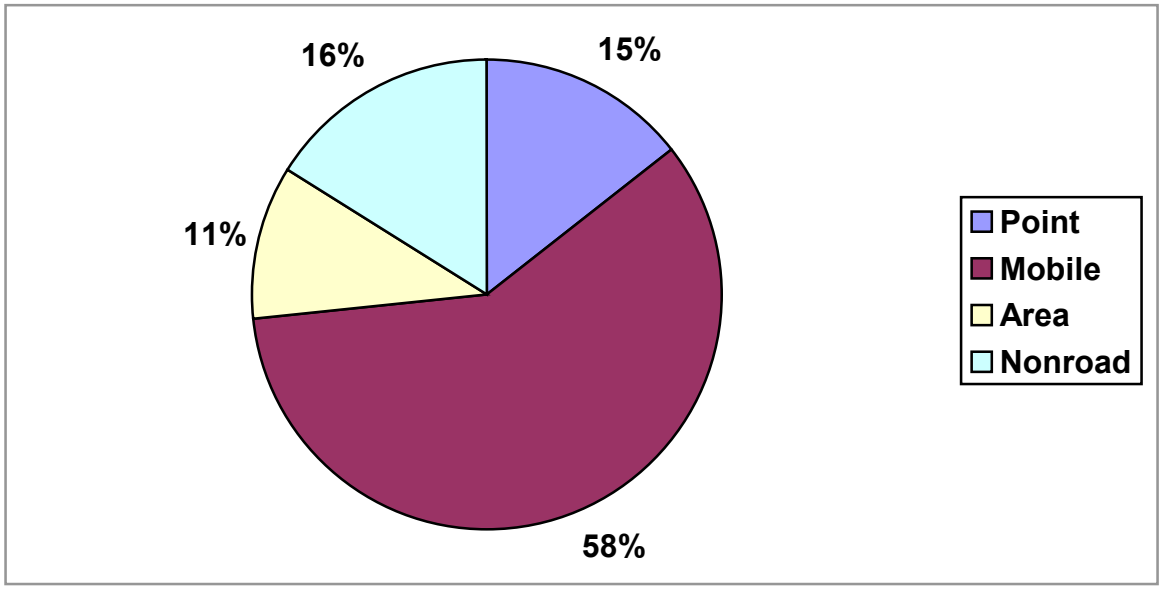
Summary of the Roanoke Valley Baseline NO_X Emissions Inventory for Calendar Year 1999	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
28 individual facilities (Botetourt: 7, Roanoke Co.: 12, Roanoke City: 5, Salem City: 4) - Description: Includes cement production, metal works, minerals production, gas terminals.	9.312 tpd
On-Road Mobile Sources	
Motor Vehicles on Public Roads - **Description**: local and through traffic on the I-81 corridor. Large percentage of heavy-duty diesel trucks. Also, vehicle traffic on all other public roads from major arterials to local roads.	30.358 tpd
Area Sources	
Fuel Consumption – Description: Fuel consumption for heating, cooling, and other purposes in all sectors.	4.585 tpd
All Others – description: Open burning, landfills, & others	0.506 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	5.450 tpd
All Others – Description: Locomotives, aircraft, boats.	2.357 tpd
Total	**52.568 tpd**

2002 Interim Ozone Season Daily Emissions of Volatile Organic Compounds (VOC)



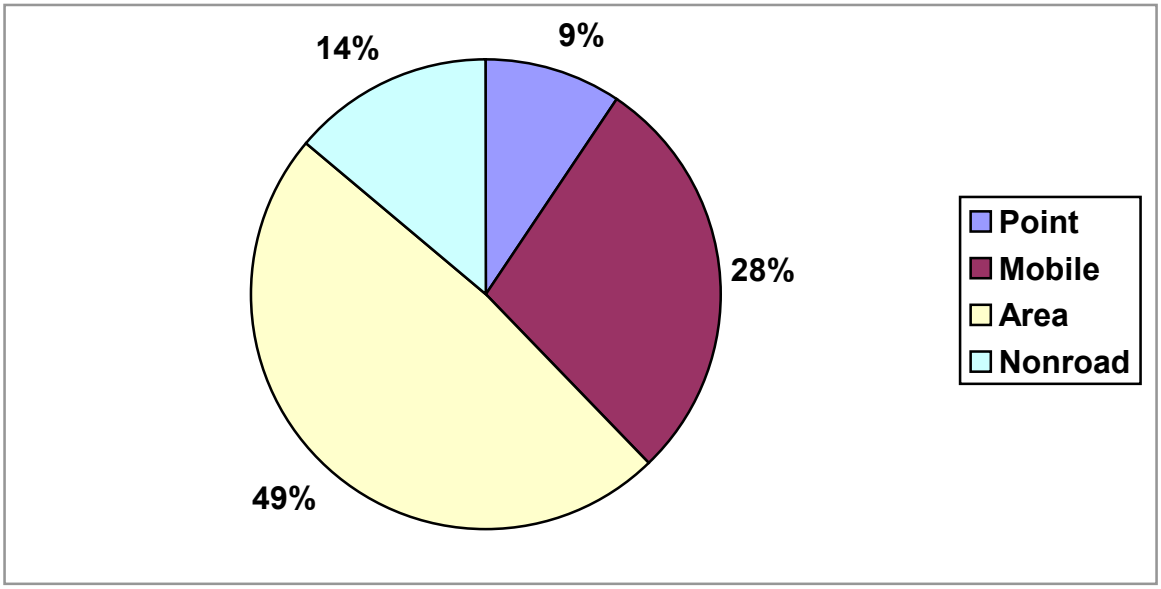
Summary of the Roanoke Valley Interim VOC Emissions Inventory for Calendar Year 2002	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
28 individual facilities (Botetourt: 7, Roanoke Co.: 12, Roanoke City: 5, Salem City: 4) - Description: Includes cement production, metal works, minerals production, gas terminals.	3.518 tpd
On-Road Mobile Sources	
Motor Vehicles on Public Roads – **Description**: local and through traffic on the I-81 corridor. Large percentage of heavy-duty diesel trucks. Also, vehicle traffic on all other public roads from major arterials to local roads.	16.188 tpd
Area Sources	
Use of Solvent-based Products – Description: paints, cleaners, consumer products, & others.	11.426 tpd
Gasoline Distribution & Marketing – Description: Gasoline storage & transfer operation at terminals and service stations	5.808 tpd
All Others – description: Open burning, landfills, & others	2.126 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	5.524 tpd
All Others – Description: Locomotives, aircraft, boats	0.202 tpd
Total	**44.792 tpd**

2002 Baseline Ozone Season Daily Emissions of Oxides of Nitrogen (NO_X)



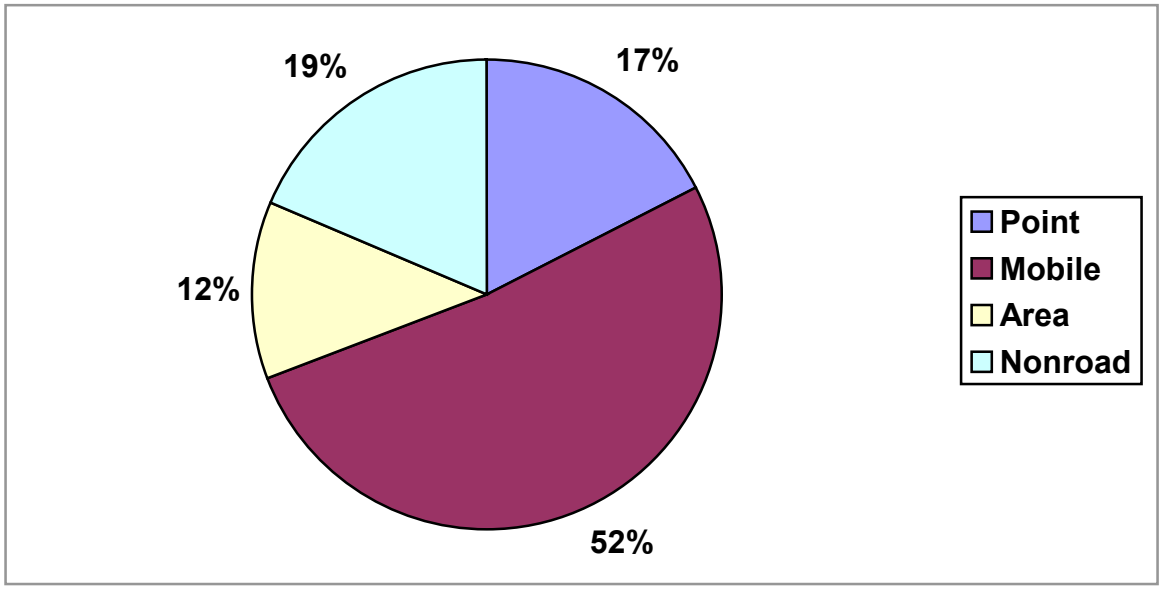
Summary of the Roanoke Valley Interim NO_X Emissions Inventory for Calendar Year 2002	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
28 individual facilities (Botetourt: 7, Roanoke Co.: 12, Roanoke City: 5, Salem City: 4) - Description: Includes cement production, metal works, minerals production, gas terminals.	7.231 tpd
On-Road Mobile Sources	
Motor Vehicles on Public Roads - **Description**: local and through traffic on the I-81 corridor. Large percentage of heavy-duty diesel trucks. Also, vehicle traffic on all other public roads from major arterials to local roads.	29.166 tpd
Area Sources	
Fuel Consumption – Description: Fuel consumption for heating, cooling, and other purposes in all sectors.	4.724 tpd
All Others – description: Open burning, landfills, & others	0.530 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	5.553 tpd
All Others – Description: Locomotives, aircraft, boats.	2.496 tpd
Total	**49.700 tpd**

2007 Base Case Ozone Season Daily Emissions of Volatile Organic Compounds (VOC)



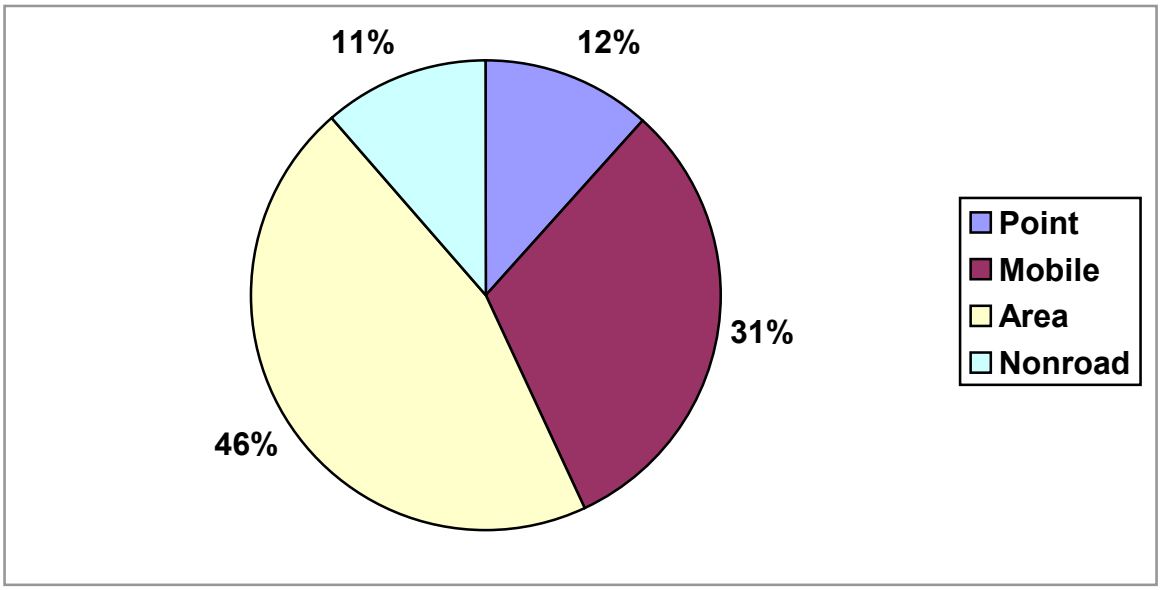
Summary of the Roanoke Valley Base Case VOC Emissions Inventory for Calendar Year 2007	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
28 individual facilities (Botetourt: 7, Roanoke Co.: 12, Roanoke City: 5, Salem City: 4) - Description: Includes cement production, metal works, minerals production, gas terminals.	3.927 tpd
On-Road Mobile Sources	
Motor Vehicles on Public Roads – **Description**: local and through traffic on the I-81 corridor. Large percentage of heavy-duty diesel trucks. Also, vehicle traffic on all other public roads from major arterials to local roads.	11.732 tpd
Area Sources	
Use of Solvent-based Products – Description: paints, cleaners, consumer products, & others.	11.569 tpd
Gasoline Distribution & Marketing – Description: Gasoline storage & transfer operation at terminals and service stations	6.211 tpd
All Others – description: Open burning, landfills, & others	2.264 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	5.586 tpd
All Others – Description: Locomotives, aircraft, boats	0.217 tpd
Total	**41.506 tpd**

2007 Base Case Ozone Season Daily Emissions of Oxides of Nitrogen (NO_X)



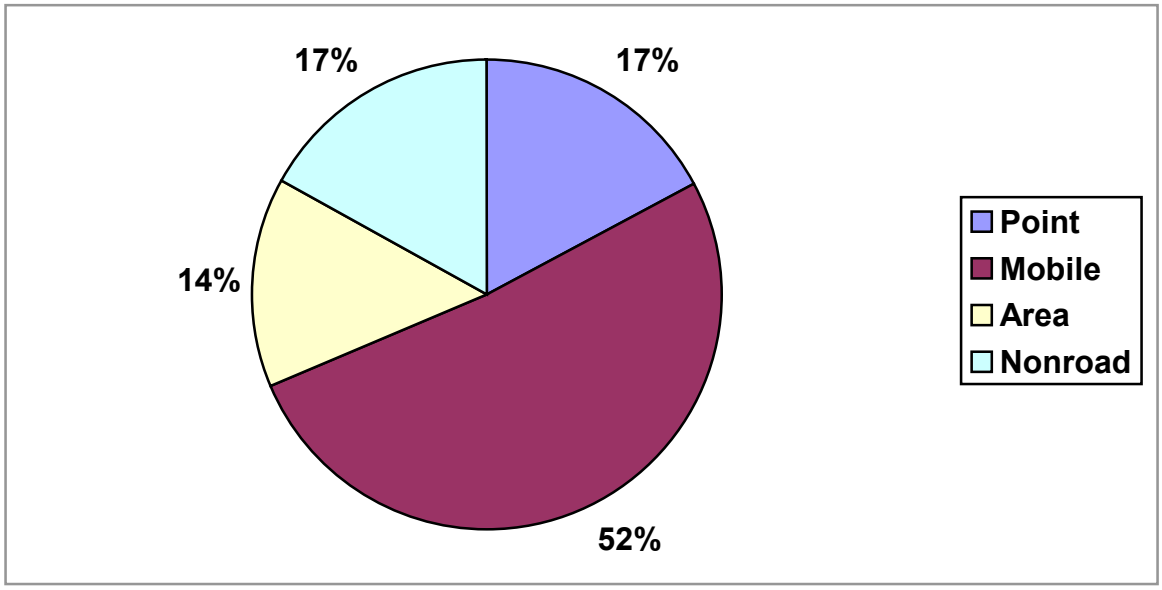
Summary of the Northern Shenandoah Valley Base Case NO_X Emissions Inventory for Calendar Year 2007	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
28 individual facilities (Botetourt: 7, Roanoke Co.: 12, Roanoke City: 5, Salem City: 4) - Description: Includes cement production, metal works, minerals production, gas terminals.	7.876 tpd
On-Road Mobile Sources	
Motor Vehicles on Public Roads - **Description**: local and through traffic on the I-81 corridor. Large percentage of heavy-duty diesel trucks. Also, vehicle traffic on all other public roads from major arterials to local roads.	23.436 tpd
Area Sources	
Fuel Consumption – Description: Fuel consumption for heating, cooling, and other purposes in all sectors.	4.966 tpd
All Others – description: Open burning, landfills, & others	0.565 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	5.733 tpd
All Others – Description: Locomotives, aircraft, boats	2.746 tpd
Total	**45.323 tpd**

2007 Control Case Ozone Season Daily Emissions of Volatile Organic Compounds (VOC)



Summary of the Roanoke Valley Control Case VOC Emissions Inventory for Calendar Year 2007	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
28 individual facilities (Botetourt: 7, Roanoke Co.: 12, Roanoke City: 5, Salem City: 4) - Description: Includes cement production, metal works, minerals production, gas terminals.	3.927 tpd
On-Road Mobile Sources	
Motor Vehicles on Public Roads – **Description**: local and through traffic on the I-81 corridor. Large percentage of heavy-duty diesel trucks. Also, vehicle traffic on all other public roads from major arterials to local roads.	10.489 tpd
Area Sources	
Use of Solvent-based Products – Description: paints, cleaners, consumer products, & others.	9.317 tpd
Gasoline Distribution & Marketing – Description: Gasoline storage & transfer operation at terminals and service stations	4.283 tpd
All Others – description: Open burning, landfills, & others	1.700 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	3.602 tpd
All Others – Description: Locomotives, aircraft, boats	0.202 tpd
Total	**33.520 tpd**

2007 Baseline Ozone Season Daily Emissions of Oxides of Nitrogen (NO_X)



Summary of the Roanoke Valley Control Case NO_X Emissions Inventory for Calendar Year 2007	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
28 individual facilities (Botetourt: 7, Roanoke Co.: 12, Roanoke City: 5, Salem City: 4) - Description: Includes cement production, metal works, minerals production, gas terminals.	6.343 tpd
On-Road Mobile Sources	
Motor Vehicles on Public Roads - **Description**: local and through traffic on the I-81 corridor. Large percentage of heavy-duty diesel trucks. Also, vehicle traffic on all other public roads from major arterials to local roads.	18.897 tpd
Area Sources	
Fuel Consumption – Description: Fuel consumption for heating, cooling, and other purposes in all sectors.	4.966 tpd
All Others – description: Open burning, landfills, & others	0.327 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	4.650 tpd
All Others – Description: Locomotives, aircraft, boats	1.634 tpd
Total	**36.818 tpd**

Control Measures & Estimated Emissions Reductions (From Uncontrolled Levels in 2007)

Emissions Control Measures	VOC (tpd)	NO_X (tpd)
State/Federal Area Source Controls		
Stage I Vapor Recovery	1.756	0.000
Architectural & Industrial Paints	0.372	0.000
Consumer Products	0.178	0.000
Metal Cleaning Solvents	0.163	0.000
Motor Vehicle Refinishing	0.158	0.000
Cutback Asphalt	0.005	0.000
Subtotals:	**2.632**	**0.000**
Federal Non-road Source Controls		
Small Gasoline Engine Standards	1.851	0.112
Diesel Engine Standards	0.000	0.951
Locomotive Engine Standards	0.000	1.112
Large Gasoline Engine Standards	0.015	0.004
Recreational Engine Standards	0.015	0.000
Subtotals:	**1.881**	**2.179**
Federal Mobile Source Controls		
Previous Motor Vehicle Standards (from 1999 levels)	5.038	6.922
Tier 2 Vehicle Standards	0.917	3.799
Heavy Duty Diesel Standards	0.001	0.156
Subtotals:	**5.956**	**10.877**
Local Area Early Action Plan Controls		
Existing Source CTG RACT Controls *	1.098	1.533
Ozone Action Days Program **	0.918	0.611
Open Burning Restrictions (Area)	0.564	0.238
All Other Local Programs (All Sources)	0.001	0.001
Subtotals:	**2.581**	**2.383**
TOTALS:	**13.050**	**17.618**

* **Implemented by State Regulation**
** **To be supported by State Ozone Forecasts**

E. Base Case Modeling

A 1997 episode was originally selected to support the development of the early action plan since emissions and meteorological data were readily available and quality assured. However, subsequent to this decision, EPA EAP guidance required that inventories and episodes no older than 1999 had to be used in this effort. As a result, the episode described above as been selected to support the air quality planning effort. However, this change in the modeling plan and episode has resulted in a change to the modeling project schedule as well.

DEQ has obtained the necessary meteorological data for the 1999 episode and has successfully completed the processing of the data through the MM5 meteorological model. Several MM5 runs were required to adequately simulate the relatively complex meteorological conditions that existed during the selected ozone episode as previously described. Figures 6 and 7 provide selected results of the meteorological modeling used as input into the regional air quality model.

Figure 6: Meteorological Modeling – Selected Results for Temperature and Winds

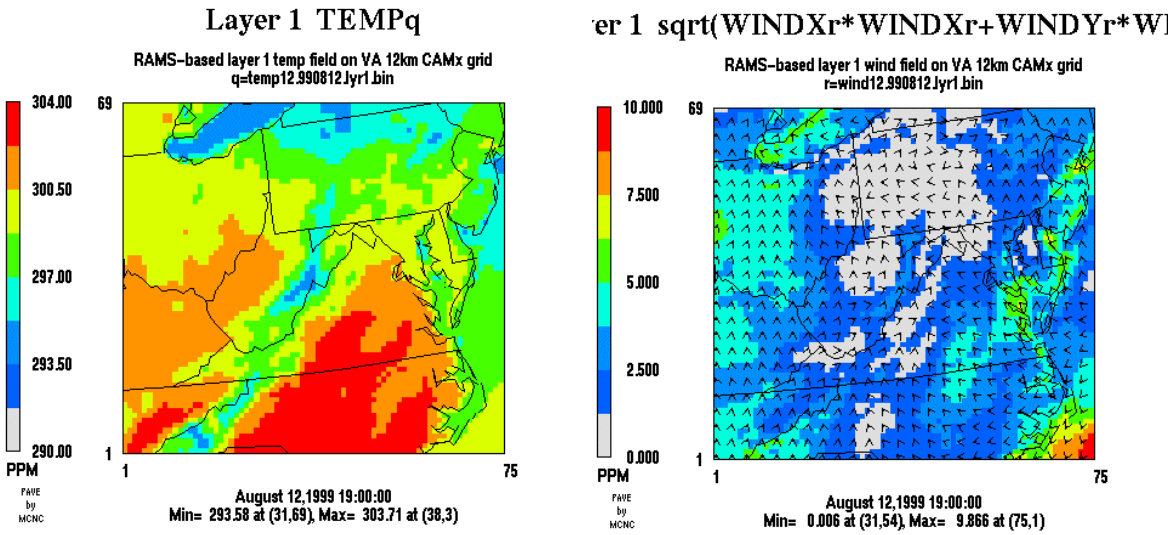
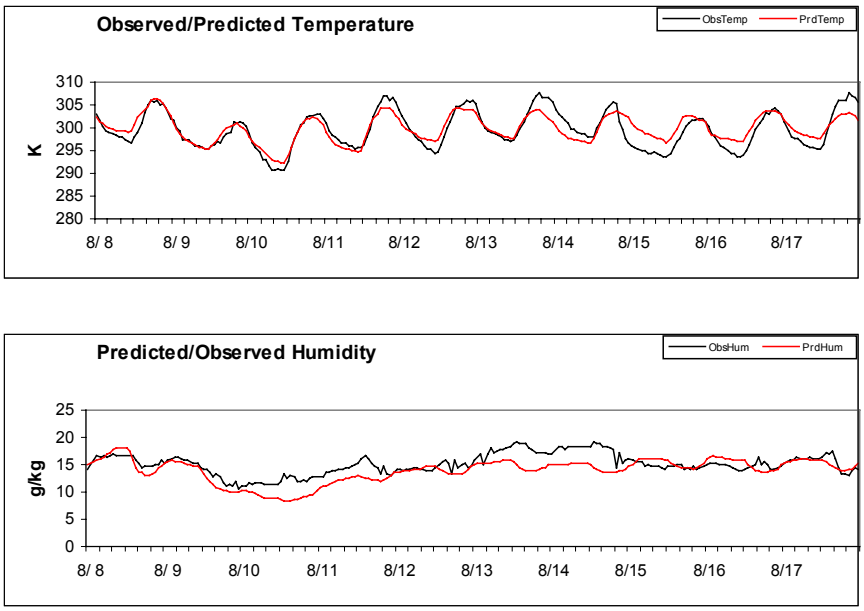


Figure 7: Meteorological Modeling – Observed and Predicted Temperatures and Winds



Emissions data for 1999 from all state in the modeling domain has also been obtained from the NEI. This emissions data has been supplemented with state specific data from Virginia and West Virginia. The conversion of this data to SMOKE input files and the preprocessing of this data through the SMOKE emission model has also been completed. Several problems were encountered during the processing of the emissions data that delayed the commencement of base case modeling efforts. The most difficult problem dealt with the EPA requirement that all EAC modeling efforts used MOBILE6-based emissions for mobile sources. To do this we had to use the latest draft version of the SMOKE emissions preprocessor (Version 1.5). Numerous problems were encountered in attempting to install and run the mobile emissions through this version of the emissions model. Ultimately, the DEQ contracted the developers of SMOKE (Carolina Environmental Program to solve these problems and process the emissions data through this latest version of the emissions preprocessor. With this external assistance, the emissions preprocessing step has also been completed.

Once all the preprocessing steps were completed, the regional photochemical modeling exercise was begun. After several runs using the CMAQ model were completed, it became obvious that the performance of the model was not up to EPA standards using the selected episode. After internal consultations, it was decided to change photochemical models from CMAQ to the Comprehensive Air Quality Model with Extensions (CAMx). The modeling platform was thus changed to use this alternative air quality model. After several runs using CAMx, base case modeling results were produced that meet or exceed EPA's acceptance criteria for model performance. The base case results of the validated CAMx model are presented below in graphic form (Figure 8) showing the simulation of the ozone episode days of August 12th and 13th, 1999. Also presented below are selected comparisons of observed and model predicted ozone concentrations at several area monitors (Figure 9).

Figure 8: CAMx Photochemical Model Results – Base Case Modeling

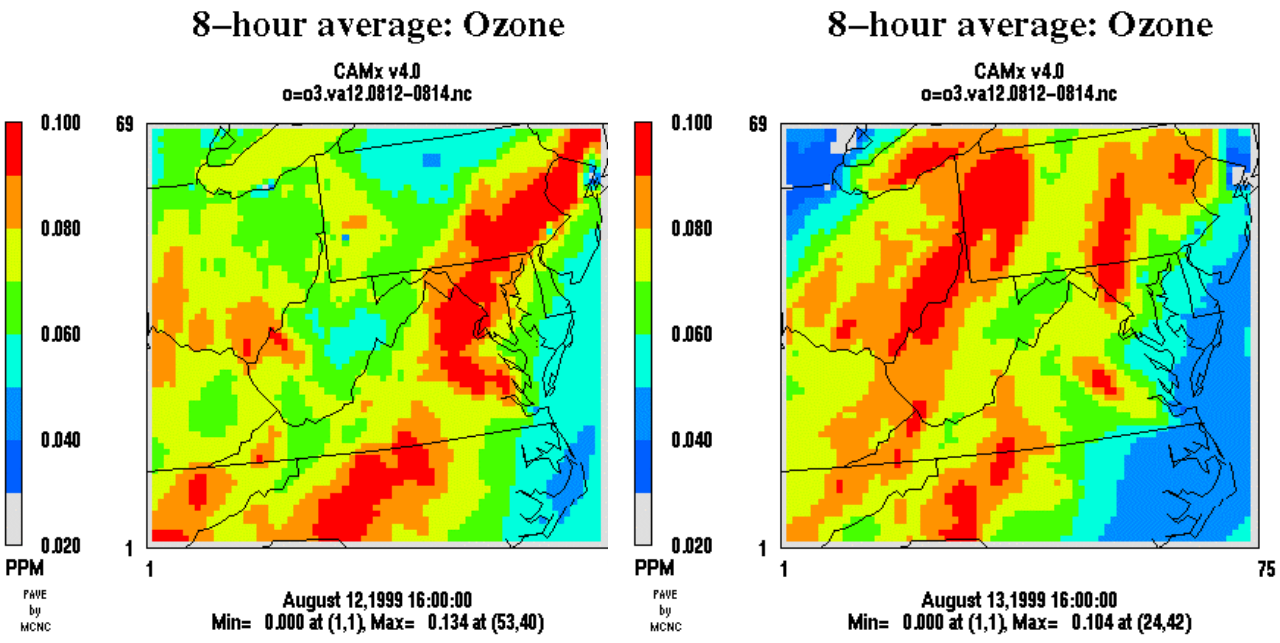
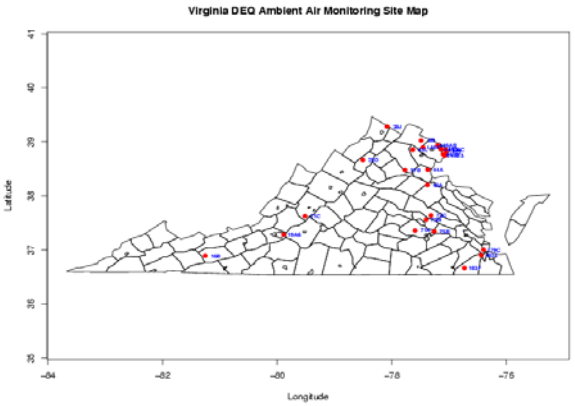
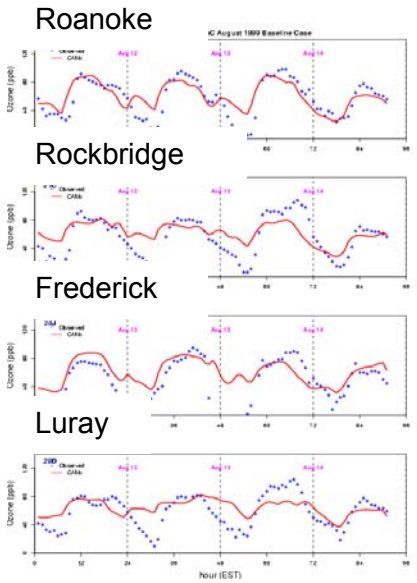


Figure 9: Air Quality Model Validation – Observed & Predicted Ozone Concentrations

Monitoring Stations for Model Validation





In summary, the base case modeling has been completed for the selected ozone episode and the performance evaluation of the model indicates that:

- The EPA performance goals established for air quality models have been met for both episode days.
- The model performance is acceptable for use in future and control case modeling.

F. Future Case Modeling

Once the base case modeling and associated performance evaluation and validation was completed, work began on the future base and control case modeling scenarios. In order to do this, a future year modeling emissions inventory had to be developed to predict future ozone precursor emissions levels in the EAC areas and the overall modeling domain to account for both anticipated growth in unregulated emissions sources and reduction in emissions from sources subject to local, state, and federal control strategies. In developing these future year inventories, the DEQ worked with neighboring EAC states to ensure the consistency of these future estimates. Standard emissions projection and control techniques were used to develop the projected emissions inventories for this purpose.

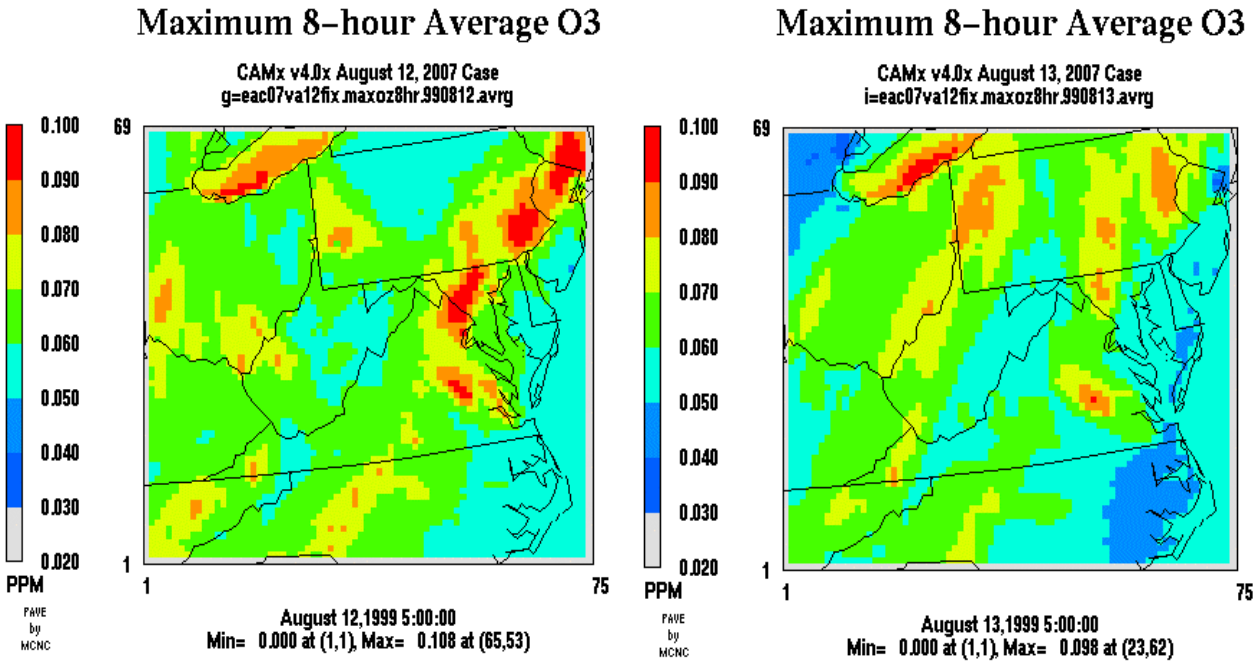
First, the base case inventory was developed based on the assumption of emissions growth coming from unregulated or uncontrolled source categories, along with controlled estimates for source categories subject to State/Regional/National control strategies already promulgated for the control of ozone precursor emissions that were not directly relating to the controls to be implemented through the local EAP. The controls included in this base case inventory include

most of those identified in Section 3 (C) of this document. The subsequent modeling conducted with this inventory produced substantial reductions in predicted ozone concentrations in the

EAC areas and throughout the entire modeling domain. **In fact, the base case controls are predicted to be sufficient to bring both the Virginia EAC areas as well as the panhandle EAC areas in West Virginia and Maryland into compliance with the ozone standard**.

The second future case inventory involved the addition of the local control strategies contained in the EAP to serve as the control case inventory for this project, as identified in Section 3 (A) of this document. The combination of all the controls at all applicable levels (local, state, federal) produced the results shown in Figure 10 below.

Figure 10: CAMx Photochemical Model Results – Control Case Modeling



The results of this modeling shows that most areas within the modeling domain would be at or below the 8-hour ozone standard in 2007 under this **episode scenario as a result of the control strategies to be implemented during this time period. Future ozone levels in the Virginia EAC areas are predicted to be in the 62 to 65 ppb range under these same conditions. Specifically, the Roanoke Valley area is predicted to experience a 22% relative reduction in local ozone concentrations. It is also predicted that the base case design value for the area of 90 parts per billion will be reduced to 70 parts per billion in 2007**. Therefore, the modeling exercise indicates that the desired result of reducing ozone concentrations to levels below the 8-hour ozone standard will be achieved by the implementation of the controls included in this EAP, and combined with the control strategies being implemented on the state and federal levels. A full description of the EAC modeling project is contained in the "Virginia, West Virginia, and Maryland Early Action Compact

Modeling Report and Ozone Attainment Demonstration" which has been submitted with this plan.

5. MAINTENANCE FOR GROWTH

A. Background

Beyond the attainment demonstration provided above, the Early Action Compact also calls for a mechanism and demonstration that the area remains in attainment of the ozone standard after 2007. Although this demonstration of maintenance is not yet completed, the following supporting information is provided to support the assumption that the area will remain in attainment for a substantial time after the predicted attainment date of 2007.

B. Contingency Measures

As part of the local EAP, a mechanism is in place to monitor the progress towards implementing the local controls and assessing their effectiveness. If it is found that progress is not being made or the level of emissions reductions expected is not achieved, the Task Force will reevaluate the existing strategies to enhance their effectiveness, or recommend the adoption of additional control measures. This mechanism represents the contingency measure portion of the local EAP. One or more enhanced or new strategies could be implemented after 2005, in response to continuing exceedances of the ozone standard or a shortfall in anticipated emission reductions from the initial EAP. These additional strategies could also be implemented at any time after 2007 if the situations warranted or called for additional local emission reductions in response to worsening air quality or unexpected increases in local emissions. These measures would require more lead-time for implementation as well as additional work with an expanded group of stakeholders.

C. Other Air Quality Modeling Exercises

Although specific modeling of an additional future maintenance year has not been performed as part of this project, other recent modeling exercises performed by the EPA to support regional or national program provide some indication that many areas of the Country will attain the ozone standard in the near term. These same modeling exercises also indicate that most of these areas will remain in attainment for at least ten years after their projected attainment date. The latest of these EPA modeling projects, used to support the national "Clear Skies" legislation, indicates that most areas in Virginia will attain the ozone standard by 2010 and will remain in attainment at least out to 2020, even without the implementation of the Clear Skies program.

In addition, this modeling shows that predicted ozone concentrations will be trending downward during this period. The specific prediction of this modeling for the Roanoke area is that concentrations in 2010 will be at 67 parts per billion, and then will reduce down to 59 parts per billion in 2020.