Ozone Early Action Plan
Northern Shenandoah Valley

The Northern Shenandoah Valley Ozone Early Action Compact Area

State Implementation Plan

December 31, 2004

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For the
Northern Shenandoah Valley Ozone Early Action Compact Area

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 Winchester/Frederick County area 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 Frederick County. 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 Northern Shenandoah Valley area entered into an Early Action Compact with both the Commonwealth and EPA for the area including the City of Winchester and Frederick County. 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 Northern Shenandoah Valley Air Improvement 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 (Roanoke), 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.

Since the EAC process in Winchester/Frederick area began with the establishment of the Northern Shenandoah Valley Air Improvement Task Force and the formal development and signing of the Early Action Compact, a series of required documents have been produced. These efforts culminated in the submission of the official EAP in March 2004. Provided below is a listing and timeline of the products and documents provided by the Roanoke EAC effort:

- **December 31, 2002 –** Early Action Compact for the Roanoke Area.
- **June 16, 2003 –** Potential local control list submission.
- **June 30, 2003 –** 1st annual status report for January to June 2003.
- **December 31, 2003 –** 2nd annual status report for July to December 2003.
- **March 31, 2004 –** Completed local Early Action Plan submitted to DEQ & EPA.
- **June 30, 2004 –** 3rd annual status report for January to June 2004.

All these documents and enclosures, along with other information concerning the EAC program and other EAC areas, can be viewed and retrieved at from the following EPA web site:

http://www.epa.gov/ttn/naaqs/ozone/eac/index.htm

As a result of the completion of these task and documents, EPA published its formal air quality designations and classifications for the 8-hour ozone standard on April 30, 2004, for all areas of the County. This action included the deferral of the effective date for all nonattainment areas with approved early action plans including the Northern Shenandoah Valley area. Specifically, the Winchester/Frederick area was designated as a “basic” nonattainment area with the effective date of the designation deferred to September 30, 2005. Additional deferrals of the effective date of the nonattainment designation will be granted by EPA as long as the Roanoke continues to meet the schedule and commitments contained in the EAP, including the submission of this State Implementation Plan.

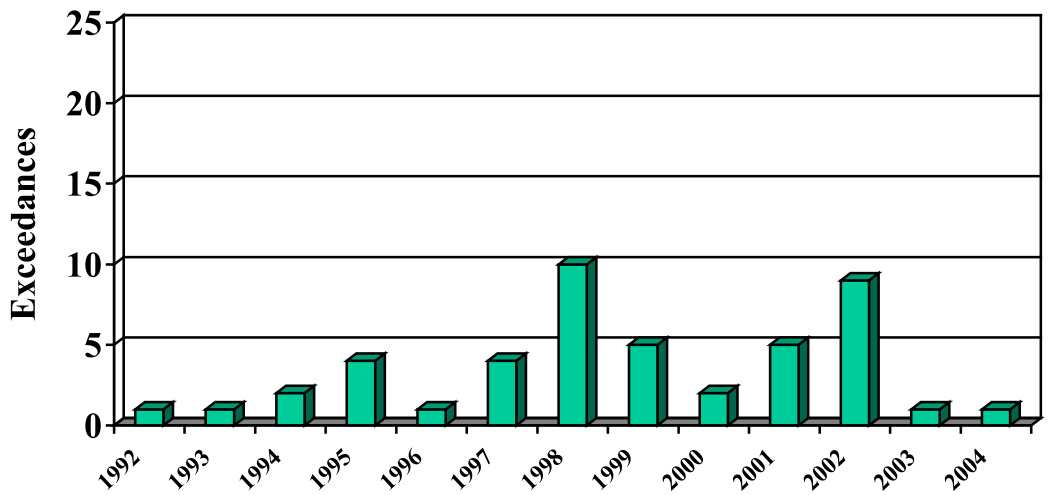
The remainder of this SIP narrative document describes the process and results of the ozone early action plan for the Winchester/Frederick area including significant events/actions, public participation, and technical support activities performed to support the overall planning effort.

B. The 8-Hour Standard in the Northern Shenandoah Valley Area

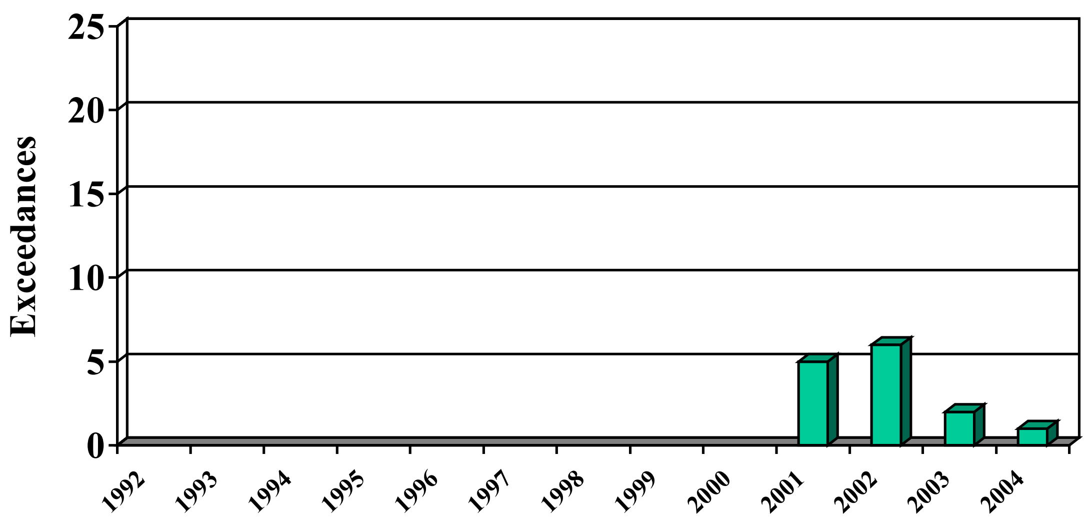
During the past several years air quality planning in the Northern Shenandoah Valley has intensified as ozone concentrations in the area have exceeded the value permitted by the 8-hour ozone NAAQS. Due to legal challenges to the NAAQS and ensuing litigation, EPA has just recently designated areas of the United States in violation of the 8-hour ozone NAAQS. Based on the most current official ozone monitoring data, the Winchester/Frederick area has been designated a nonattainment area with a deferred effective date as described earlier.

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 comply with the standard. Currently, the Northern Shenandoah Valley area’s official design value (averaging 2001, 2002 and 2003) is 85 ppb. Each year this design value may vary. Data is available for the area for the 8-hour ozone standard beginning in 1992. Ozone concentrations have exceeded the standard a total of 46 times during the period from 1990 to 2004. The number of exceedences recorded at the Frederick County monitor from 1991 to 2004 are shown below. Data from the nearby monitors in Fairfax County and Martinsburg, WV are also shown for comparison purposes:

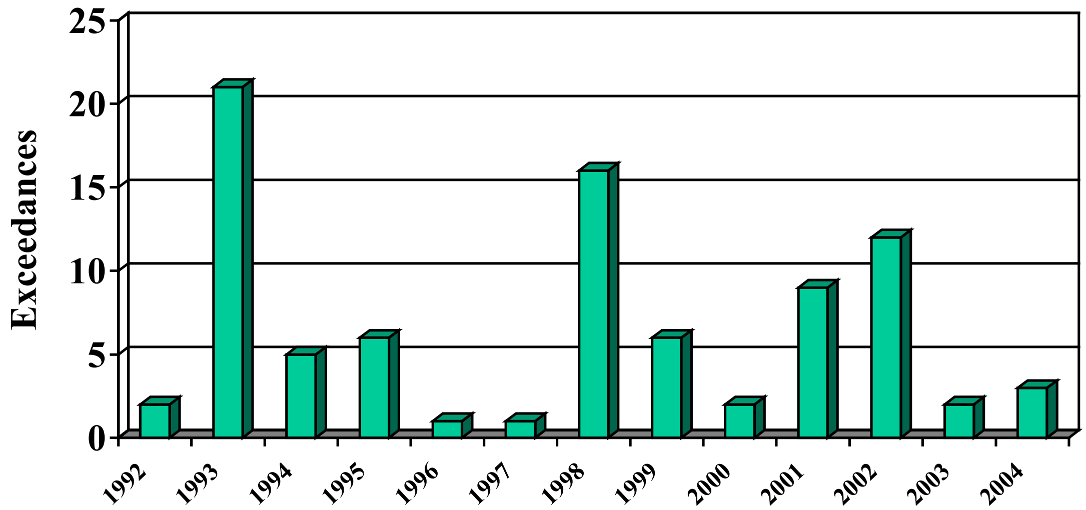
Frederick County 8-hour Ozone Exceedances (1992 to 2004)



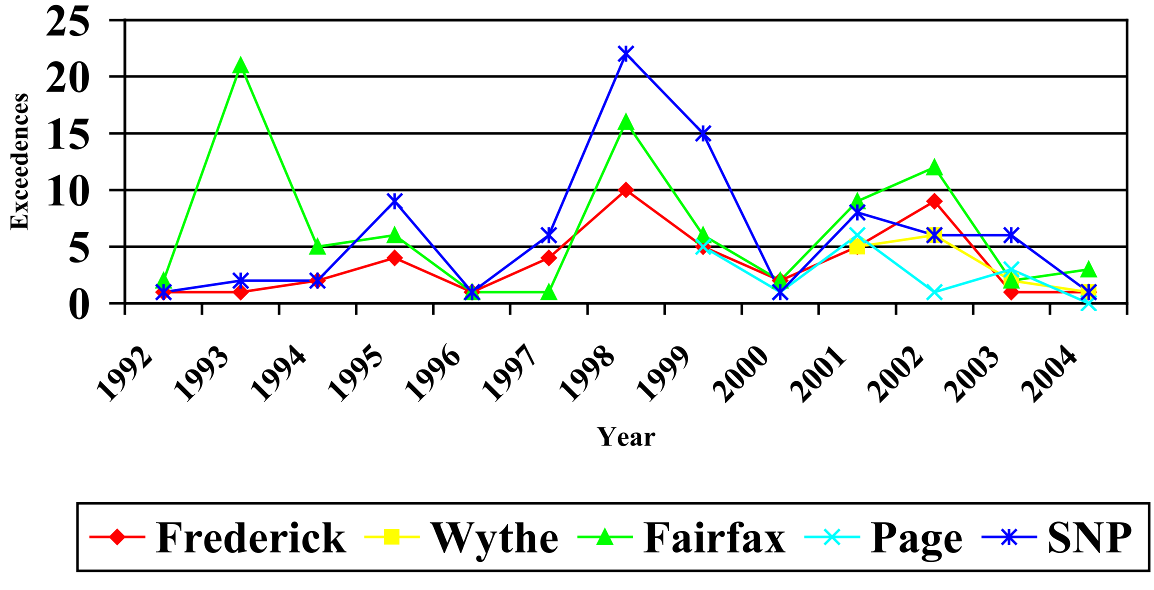
Martinsburg 8-hour Ozone Exceedances (2001 to 2004)



Fairfax (Chantilly) 8-hour Ozone Exceedances (1991 to 2004)



8-Hour Ozone Exceedences (1992 to 2004)



During 2002 to 2004, the Frederick monitor recorded 8-hour exceedences on the following days:

2002		2003		2004	
June 21	87 ppb	June 25	94 ppb	July 3	89 ppb
June 25	87 ppb				
July 2	93 ppb				
August 11	92 ppb				
August 13	91 ppb				
August 21	89 ppb				
Sept 9	87 ppb				
Sept 10	97 ppb				
Sept 13	85 ppb				

Based on unofficial ozone data from the summer of 2004, the Winchester/Frederick area is currently in compliance with the 8-hour standard. The three-year average design value at the Frederick monitor for 2002 to 2004 is 78 ppb.

C. Early Action Program (EAP)

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

The principles of the EAP 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 EAP;
- Formal incorporation of the EAP into the SIP;
- Deferral of the effective date of nonattainment designation and related requirements so long as all EAP terms and milestones are met; and
- Safeguards to return areas to traditional SIP requirements should EAP terms and/or milestones be unfulfilled, with appropriate credit given for emission reduction measures implemented.

The Northern Shenandoah Valley EAP 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 the area's official air quality improvement plan, with quantified emission-reduction measures. The EAP will include all necessary elements of a comprehensive air quality plan, (such as formal State Implementation Plans), 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 the EAP requires 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.

EAP versus Traditional Nonattainment

A major advantage of the region's participation in an EAP 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.

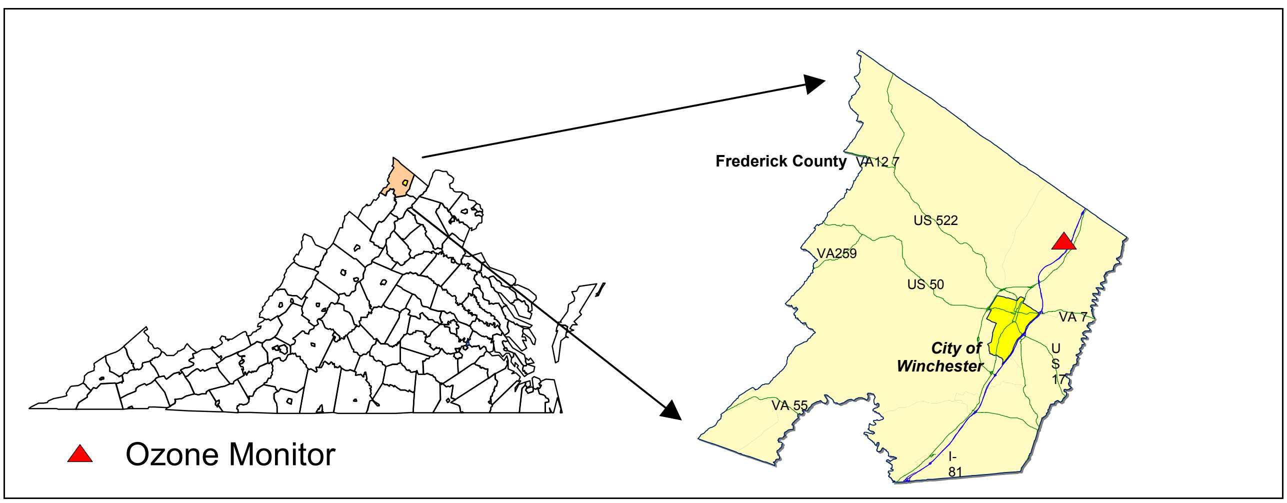
- The EAP allows for more local control in selecting emission-reduction measures.
- The EAP provides deferral of nonattainment designation and related requirements, as long as Plan requirements and milestones are met. This would prevent any related stigma associated with a formal nonattainment designation.
- The EAP 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 Northern Shenandoah Valley EAP is designed to enable a local, proactive approach to ensuring attainment of the 8-hour ozone NAAQS, and so protect human health. Using the EAP 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 Winchester/Frederick area is located in the Valley and Ridge Region of Virginia that includes the Northern Shenandoah Valley and the Appalachian Ridge. The major urban center of the area is the City of Winchester that is in turn surrounded by the suburban/rural Frederick County. This urban center along with the major commercial transportation corridor of Interstate 81 is located in the Valley portion of the project area. Much of the western portion of Frederick County is mountainous and forested rural area associated with the Appalachian Ridge. The majority of the area population and industry is centered in and around Winchester, and along the I-81 corridor. The area's ozone monitor is located in northeastern Frederick County just south of the West Virginia Border.

Winchester/Frederick County Early Action Area



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

- Land Area – 424 square miles
- Population (2000) – 82,794
- Population density (2000) – 195 per square mile
- Projected Population (2010) – 93,095
- Volatile Organic Compound Emissions (2002) – 23 tons per summer day
- Oxides of Nitrogen Emissions (2002) – 19 tons per summer day
- Prevailing Ozone Season Wind Direction – From the West/Southwest
- 8-hour Ozone Design Value (2001 – 2003) – 0.085 parts per million

2. PROJECT ORGANIZATION & PROGRESS SUMMARY

Provided below is a summary of the Early Action process and progress made leading up to the development of this SIP document. A great number of organizations and individuals have contributed to the successful completion of this effort.

A. Organization

The Winchester-Frederick County Economic Development Commission (EDC) initiated the Early Action process with City and County officials to develop an inclusive stakeholder involvement process to assist in producing a realistic and workable EAP. The result of this was the Northern Shenandoah Valley Air Improvement Task Force that was initially established in November 2002 as the group that would develop the EAP for the area. The Task Force includes representatives of local governments, involved state and federal agencies, business and industry, as well as environmental groups. A complete listing of Task Force members included as Appendix A. The Task Force also guided the work of a consultant in the development of the Ozone Early Action Plan.

B. Progress Summary

As stated before the Northern Shenandoah Valley EAC process began back in the fall of 2002 with discussions and final agreement to participate in the EAC program. This resulted in the formal submission of a compact, signed by representatives of the all parties involved, to the EPA on December 23, 2002.

The Air Improvement Task Force met on a nearly monthly basis throughout 2003 and 2004. These meetings were held in accessible locations and open to public and media representatives. These meetings were supplemented by presentations to the Northern Shenandoah Valley Regional Commission, various business and civic groups a special Public Briefing on the EAC, as well as numerous public sessions of the Winchester City Common Council and the Frederick County Board of Supervisors. A complete chronology of EAC/EAP activities is included as Attachment C.

The first deliverable of the taskforce and major milestone in the EAP process was a list of ozone precursor pollutant control measures under consideration for inclusion in the formal local air quality (EAP) plan. This list was developed and submitted to EPA on June 11, 2003.

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. This report described the process achieved thus far by the taskforce in developing control strategies and gaining public input.

The 2nd Semi-Annual Status Report in December 2003 provided a list of the control measures under consideration for adoption by the area. 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.

On March 31, 2004, all the efforts of the parties involved culminated in the development and submission of the final local Early Action Plan and supporting documentation. This submission contained local, state, and federal control measures and estimates, emissions inventories and predictions, and a demonstration that the area would come into compliance with the ozone standard by 2007.

On June 30, 2004, the 3rd Semi-Annual Status Report was submitted to which provided additional detail on the implementation of the Northern Shenandoah EAP.

To develop the final list of local controls, the Task Force reviewed a broad spectrum of potential strategies. Those strategies were narrowed to a manageable level based on their perceived promise for implementation in the local area. In September 2003, the Task Force identified 25 potential strategies for evaluation by EAP contractor. Their evaluation included the following:

- Completing a preliminary screening on all strategies identified by the Task Force and ranking of these strategies based on their approximate contribution levels to the VOC and NO_X emission inventories, as well as past experience in program effectiveness and feasibility;

- Preparing a technical memorandum presenting the ranking of the strategies, as well as documenting the data, methodology and assumptions used in developing the ranking after completing the initial screening of strategies;

- Recommending the top ten strategies (with input from the Task Force);

- Analyzes of the top ten strategies via a cost-effectiveness analysis and feasibility assessment, using in-house data and information, as well as relevant data obtained from technical publications related to those selected strategies.

- Submission of a report presenting the results of the cost effectiveness analysis and feasibility assessment of the selected strategies, as well as documenting the data, methodology, and assumptions used in the cost-effectiveness analysis and feasibility assessment.

Based on this work by Environ, the Task Force recommended both local signatory parties adopt eleven (11) local strategies. These local strategies were divided into two phases due to implementation timing. Strategies listed in the first phase are currently being implemented or will be implemented no later than December 31, 2005. Phase 2 strategies serve as contingency measures. These measures require additional time to develop and implement by state regulation and will be implemented if and when needed as described in Section 5 – Maintenance for Growth. The Frederick County Board of Supervisors adopted these strategies by vote unanimously at the November 12, 2003 Board meeting. The City of Winchester's Common Council in turn adopted the same strategies unanimously by vote on January 27, 2004.

The subsequent final Early Action Plan (EAP) was developed and presented for formal adoption to each governing body of the jurisdictions involved. In turn, both jurisdictions have formally passed resolutions of endorsement and adoption of the plan and have committed to its subsequent implementation.

C. Stakeholder Involvement and Meetings

Throughout the EAP process, extensive efforts were extended to inform and involve the public in the process in order to obtain their input and participation. The main vehicle used to coordinate the overall EAP process was the EAP Task Force as described earlier. The main vehicle for public outreach for this process has been the development of a local website devoted to the EAP and air quality in the Northern Shenandoah Valley (valleyairnow.com). Provided below is a comprehensive list of meetings, actions, and public events involved in the EAP effort in the area:

Date	Activity
June 19, 2002	EPA Protocol for EACs issued June 19, 2002
June 26, 2002	EDC attended workshop on non-attainment issue by DEQ & VDOT *(Staunton, VA)*
August 23, 2002	EDC attended workshop on non-attainment issue by DEQ & VDOT *(Winchester, VA)*
September 6, 2002	EDC Commission briefed on issue and supported staff recommendation to further research issue
September 17, 2002	Non-attainment issue briefing with Rezin Inc.
September 24, 2002	EDC attended briefing on non-attainment issue by DEQ & EPA to Shenandoah Valley Manufacturers Association *(Winchester, VA)*
October 4, 2002	EDC Commission updated on non-attainment & ozone flex plan. Staff created a Task Force to assist in the development of plan.
October 7, 2002	Winchester City, Frederick County, and Clarke County representatives meet with DEQ and EPA officials on Ozone Early Action Plan. *(Woodbridge, VA)*
October 16, 2002	EDC submitted letter on Ozone Early Action Plan to Frederick County and provided of copy of letter to City of Winchester
October 23, 2002	Upon the invitation by Frederick County administration, the EDC briefed the BOS on the Ozone Early Action Plan.
November 8, 2002	Air Quality Improvement Task Force invitation sent out
November 14, 2002	EPA issued guidance memo on EACs
November 15, 2002	Air Quality Improvement Task Force 1st Meeting
November 15, 2002	Follow-up Materials provided to Task Force members unable to attend
November 20, 2002	First draft of Early Action Compact distributed to task force
November 22, 2002	Air Quality Improvement Task Force 2nd Meeting
December 2, 2002	Final draft of Early Action Compact distributed to task force
December 3, 2002	Early Action Compact submitted to City and County for December 10th and December 11th agenda respectively
December 6, 2002	Early Action Compact distributed to EDC Commission
December 9, 2002	Public Briefing on Early Action Compact
December 10, 2002	Early Action Compact discussed by Winchester City Common Council and referred to special work session on December 16th
December 17, 2002	Early Action Compact discussed/approved by Frederick County BOS
December 31, 2002	Early Action Compact signed by City of Winchester and Frederick County
February 4, 2003	Air Quality Improvement Meeting #3
February 11, 2003	Air Quality Improvement Meeting #4

Date	Activity
March 4, 2003	Air Quality Improvement Meeting #5
March 26, 2003	Selection of Wilbur Smith Associates to assist in developing EAP
April 10, 2003	Air Quality Improvement Meeting #6
May 7, 2003	Air Quality Improvement Meeting #7
May 22, 2003	Presentation to Northern Shenandoah Valley Regional Commission
June 4, 2003	Air Quality Improvement Task Force Meeting #8
June 4, 2003	Selection of local control strategies under consideration for 6-16 milestone
June 10, 2003	Winchester Common Council approves June 16th submittal
June 11, 2003	Frederick County Board of Supervisors approves June 16th submittal
June 15, 2003	Submission of 6-16 milestone documents to VDEQ
June 30, 2003	Submission of 2nd semi-annual status report
August 6, 2003	Air Quality Improvement Task Force Meeting #9
September 3, 2003	Air Quality Improvement Task Force Meeting #10
October 30, 2003	Air Quality Improvement Task Force Meeting #11
December 17, 2003	Air Quality Improvement Task Force Meeting #12
December 17, 2003	Local Government Open House to discuss the EAP process
January 7, 2004	Air Quality Improvement Task Force Meeting #13
February 18, 2004	Air Quality Improvement Task Force Meeting #14
March 24 , 2004	Effective date for state RACT regulations for the EAC area
March 31, 2004	Submission of the final Early Action Plan to DEQ and EPA
April 13, 2004	Formal resolution of EAP adoption/support by Winchester City
April 27, 2004	Formal resolution of EAP adoption/support by Frederick County
April 30, 2004	1st Deferral of Winchester/Frederick area nonattainment designation
June 2, 2004	Air Quality Improvement Task Force Meeting #15
June 30, 2004	Submission of 3rd semi-annual status report
August 4, 2004	Air Quality Improvement Task Force Meeting #16
October 26, 2004	Air Quality Improvement Task Force Meeting #17
November 20, 2004	Winchester/Frederick EAP SIP Revision Public Notice
December 20, 2004	Winchester/Frederick EAP SIP Revision Public Hearing
December 31, 2004	EAP SIP Revisions submitted to EPA

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

The Phase I strategies are being implemented as quickly as possible, but no later than the end of 2005. These measures have the greatest public acceptance and provide an important foundation for any future expanded efforts. **A further description of these control measures, local contacts, and actual or predicted implementation dates are presented in Appendix A.**

1. Ozone Action Days/Public Awareness

Implementation of a comprehensive local ozone action days program. This strategy is actually a combination of a number of measures that had been evaluated earlier as individual strategies and are currently being implemented, including:

- General Public Awareness Program
- School-based Public Awareness Program
- Education and Promotion Campaign
- Employer-based Ozone Action Days
- Area Sources Ozone Action Days
- Dynamic Message Signs
- Video Monitor Deployment
- Lawn and Garden Equipment Usage Restrictions for State/Local Governments
- Other State/Local Government Restrictions (Refueling, Pesticides)
- Voluntary restrictions by Public (lawn and garden, refueling, others)

These strategies will be implemented during the ozone season and specifically in a coordinated response to forecasts of predicted high ozone concentrations above the standard from the DEQ. An area specific forecasting tool has been developed for this purpose by a DEQ consultant. The DEQ is also in the process of hiring a second meteorologist to support this forecast and advisory program.

The local governments have budgeted up to $70,000 annually in local public funding assistance to assist in implementation of this strategy through the establishment of a local ozone action day coordinator and public outreach. Participation from business, either in-kind or financially, is being aggressively pursued. This coordinator along with the Task Force will maintain a strong program to raise public understanding and awareness of air quality issues and action that will be a key to successful air quality improvements. The website in support of this EAP is already constructed and online. Valleyairnow.com will act as the centerpiece of this program. This measure is expected to reduce VOC emissions by 0.3 tons/day and NO_X emissions by 0.02 tons/day in the area. This measure is being submitted for SIP credit and was included in the attainment demonstration for the area.

2. VMT Reduction Programs

Implementation of a comprehensive local VMT reduction program. This strategy combines a number of individual programs/activities designed to reduce vehicle miles of travel (VMT). These include:

- Enhanced/expanded Northern Shenandoah Valley Regional Commission Ridesharing Program

- Bicycle and Pedestrian Accommodation
- Green Space Preservation
- Promotion of Mixed Use Development
- Promotion of Telecommuting

The existing ridesharing program operated by the Northern Shenandoah Valley Regional Commission provides an excellent starting point for encouraging and promoting car and van pooling in the region. A combination of the other sub-measures are aimed at improving community pedestrian and bicycle facilities and usage, as well as reducing or eliminating those trips, which are unnecessary. While the projected emissions reductions are relatively small, the long-term benefits for both air and community quality of life is important. This program is being implemented through the regional MPO. This measure is expected to reduce VOC emissions by 0.15 tons/day and NO_X emissions by 0.3 tons/day in the area. This measure is not being submitted for SIP credit and was not included in the attainment demonstration for the area.

3. Open Burning Restrictions

Open burning bans/restrictions during predicted high ozone days and/or the ozone season. The EAP jurisdictions have committed to ban or restrict open burning during predicted high ozone days. This measure is expected to reduce VOC emissions by 0.28 tons/day and NO_X emissions by 0.12 tons/day in the area. This measure is not being submitted for SIP credit and was not included in the attainment demonstration for the area.

4. Engine Idling Restrictions

Restrictions on public and private diesel truck idling. A large amount of idling emissions are generated from heavy-duty diesel vehicles that are parked at truck stops, rest areas and to a lesser extent, distribution centers. The EAC jurisdictions are committed to limit idling of local government vehicles (including school buses) and to promote voluntary restrictions from privately owned vehicles and fleets. This measure is expected to reduce NO_X emissions by 0.1 tons/day in the area. This measure is not being submitted for SIP credit and was not included in the attainment demonstration for the area.

5. School Bus Retrofits

Retrofit control technology for area school bus fleets. This measure involved the installation of oxidation catalysts on 136 school buses. Frederick County will retrofit 126 buses and will soon put out a contract for bid to complete this work. The City of Winchester will retrofit 10 buses and has a contract in place to complete this work. This measure is expected to reduce VOC emissions by 0.002 tons/day and NO_X emissions by 0.001 tons/day in the area. This measure is not being submitted for SIP credit and was not included in the attainment demonstration for the area.

6. Voluntary Industrial Reductions

Voluntary reductions for local industries. The EAC jurisdictions will seek voluntary commitments form local industries to reduce ozone precursor emissions during the ozone season and/or on predicted high ozone days. This strategy will help increase awareness of the pollution problem and establish a relationship between local government and area industry. The emission reductions expected from this measure cannot be calculated at this time. This measure is not being submitted for SIP credit and was not included in the attainment demonstration for the area.

B. Phase II Strategies (Contingency Measures)

Phase II strategies represent the contingency measure section of the Early Action Plan. One or more of the strategies listed below may be implemented in response to continuing exceedances of the ozone standard or a shortfall in anticipated emission reductions from Phase I of the plan. These strategies would require more lead-time for implementation as well as additional work with expanded groups of stakeholders. The contingency plan and measures are described in detail in Section 5 (D) – Maintenance for Growth (Contingency Measures).

7. OTC Portable Container Rule
8. OTC Architectural/Industrial Maintenance Coatings Rule
9. OTC Mobile Equipment Repair and Refinishing Rule
10. Solvent Cleaning Operations Rule
11. Truck Stop Electrification

B. State/Federal Control Measures

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

State Control & Support Measures

At the state level, four significant actions have been taken to support ozone standard attainment in Virginia and specifically in the Northern Shenandoah Valley EAC area.

- Regional ozone transport control program (i.e., the NO_X SIP Call)
- National Low Emission Vehicle Program (VA early opt-in beginning in 1999)
- Reasonably Available Control Technology (RACT) controls for existing industries
- Enhanced ozone forecasting tool for the Northern Shenandoah area

1. Regional Reduction of NO_X Emissions (NO_X SIP Call)

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 implemented a program to significantly reduce emissions of NO_X as part of a regional program to reduce ozone transport.

On May 21, 2002, the Virginia Air Pollution Control Board adopted a final state regulation concerning the NO_X Budget and Emissions Trading Program, 9 VAC 5 Chapter 140, in response to the EPA NO_X SIP Call. The final regulation was published in the Virginia Register on June 17, 2002, and became effective on July 17, 2002. On June 25, 2002, the regulation was submitted to EPA along with the initial allocations for the affected units. On November 12, 2002, EPA issued a notice proposing approval of the state program, with the exception of the NO_X allowance banking provisions dealing with the start date of flow control. This deficiency has subsequently been corrected and submitted to EPA for full final approval of the state program.

This program alone is predicted to reduce ozone forming NO_X emissions by up to 30,000 tons per ozone season in Virginia. Beginning on May 31, 2004, facilities and emission units subject to the state NO_X budget and trading rule must comply with this rule during the control period from May to September of every year hence forth. As part of this program, affected sources must adhere to emission rates and caps unless additional emission allowances are obtained though the EPA administered trading program.

2. National Low Emission Vehicle Program

The National Low Emissions Vehicle (NLEV) program is a voluntary clean vehicle program established by EPA through national regulation on December 16, 1997. Due to the voluntary nature of the program, it was contingent upon agreement by northeastern states (including Virginia) and the major auto manufacturers. Virginia opted into this program for lower vehicle standards, beginning model year 1999 vehicles, as part of the initial startup of this program. Virginia subsequently adopted a state NLEV regulation, 9 VAC 5 Chapter 200, which became effective on April 14, 1999.

This program has and will continue to provide substantial ozone precursor emission reductions in Virginia that will assist regions like the Roanoke area in meeting air quality standards and goals.

3. Reasonably Available Control Technology (RACT) controls for existing industries

To 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. This regulation was adopted by the Air Pollution Control Board in October 2003 and became effective on March 23, 2004. Compliance with this rule will be required by November 15, 2005. Because this measure has specifically been adopted to support the Early Action Plan, this measure has been included and modeled as a local control measure.

4. Enhanced Ozone forecasting tool for the Northern Shenandoah Valley Area

Although not a direct control measure, the DEQ has completed a contract with Sonoma Technology, Inc. to develop an area specific ozone forecast tool to support the local ozone action days program and associated voluntary emission reduction efforts. This tool has been provided and is currently undergoing testing. DEQ is also in the process of filling a second meteorologist/forecaster position to develop and issue area specific ozone forecasts. Steps are also being taken to coordinate ozone forecasts and alerts with the neighboring West Virginia and Maryland EAC areas. Full implementation of this program will begin during the 2005 ozone season.

Federal Control Measures

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 that need to come into compliance with the federal ozone standard. A brief description of these strategies is provided below:

Stationary & Area Source Controls

In addition to the 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 and garden equipment to aircraft, has become a significant source of air pollutant emissions. In response, EPA has adopted a series of strategies to address these sources. These programs include engine emission standards for lawn and garden equipment, construction equipment, boat engines, and locomotives.

All these measure have been developed to address the creation of ozone producing emissions in the local area as well to lessen the transport of ozone into the area as a comprehensive approach to reducing ozone levels. **A detailed summary and description of all the control measures contained in this plan and the emission reductions and estimation methods are presented in Appendix B to this document.**

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 (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

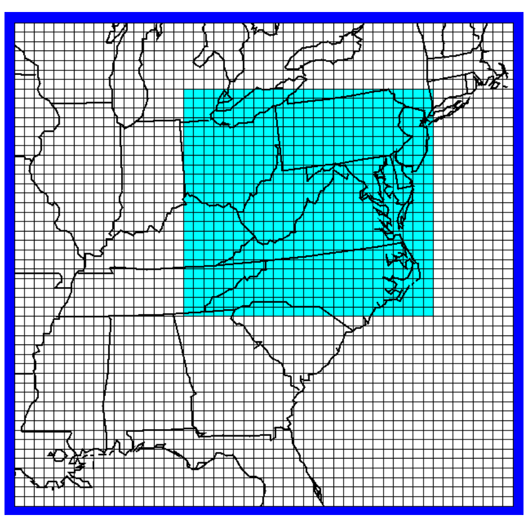
B. Model and Domain Selection

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. 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 below.

Early Action Modeling Domain of 36 km & 12 km Resolution

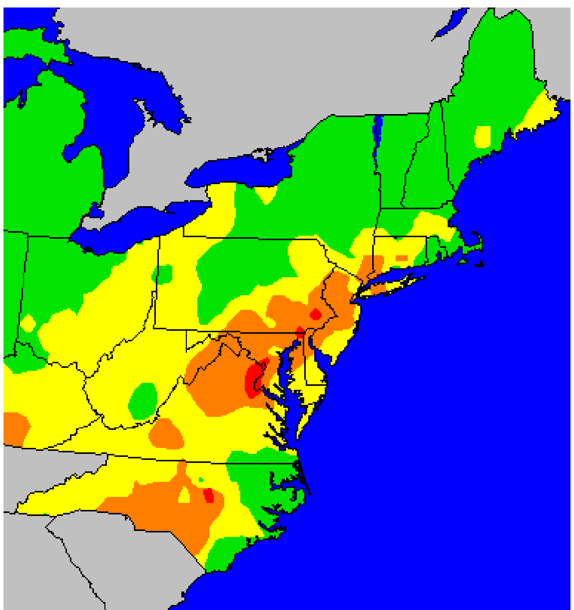


C. Episode Selection

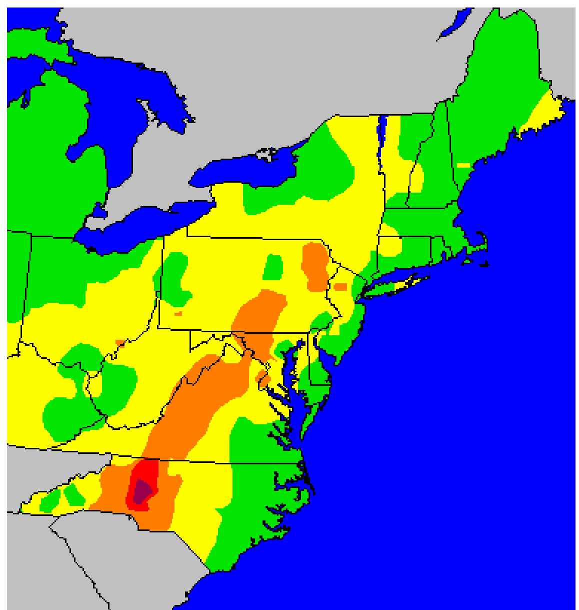
One of the key aspects of a modeling analysis of a particular area and air pollution problem is to select one or more representative episodes to model. The selection process should reflect one or more of the prevailing meteorological and emissions conditions that produce higher levels of ozone in the 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 Frederick Co.), 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 was be modeled. An additional episode, probably in 2002, will be selected and modeled to retest and confirm the results of the EAC 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 below.

The Ozone Episode of August 12th & 13th, 1999



August 12, 1999



August 13, 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 below. The various emissions inventories developed as part of EAP process are also presented. Finally, a table summarizing all emissions control measures and predicted reductions from 2007 uncontrolled levels is presented.

The emissions estimates used in this document were derived using the following method/models:

Point Sources – Actual base and interim estimates obtained for the DEQ Comprehensive Environmental Data System (CEDS). Future point source emissions were estimated using actual historical data and applying appropriate growth factors from the EPA EGAS growth factor model.

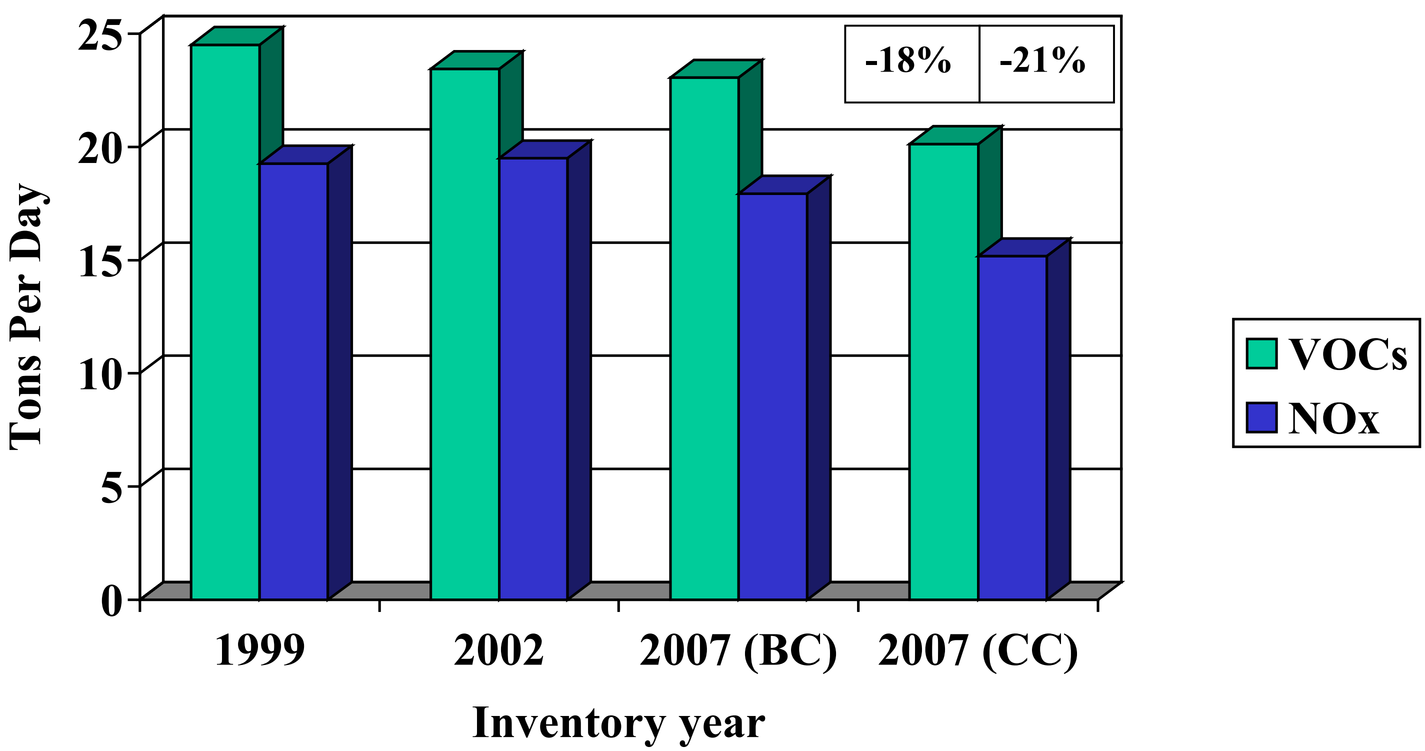
Area Sources – All inventories calculated using established EPA area source emission factors and actual or projected area specific activity data such as population, households, and others.

Mobile Source – All inventories calculated using the EPA MOBILE6 emissions factor model combined with actual or forecasted travel and fuel data.

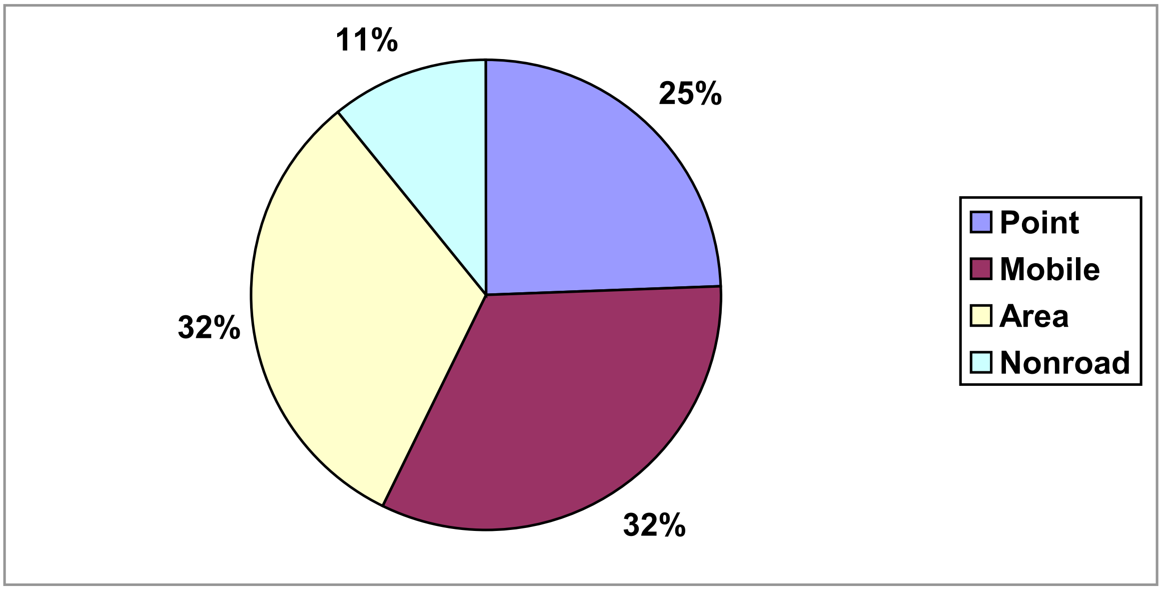
Nonroad Sources – All inventories calculated using the EPA NONROAD model.

Roanoke Valley EAP Emissions Inventory and trends Summaries

Source Category	1999 (Baseline)	2002 (Interim)	2007 (Base Case)	2007 (Control Case)
Volatile Organic Compound (VOC) Emissions in tons/day				
Point Sources	6.019	5.638	6.492	6.068
Area Sources	7.806	7.982	8.221	7.081
Non-road Sources	2.650	2.672	2.986	2.051
Mobile Sources	8.047	7.164	5.372	4.934
Totals:	**24.522**	**23.456**	**23.071**	**20.134**
Oxides of Nitrogen (NO_X) Emissions in tons/day				
Point Sources	0.745	0.934	1.075	1.075
Area Sources	2.526	2.603	2.735	2.612
Non-road Sources	1.910	1.942	3.026	1.647
Mobile Sources	15.090	14.029	11.888	9.952
Totals:	**19.271**	**19.508**	**17.942**	**15.186**



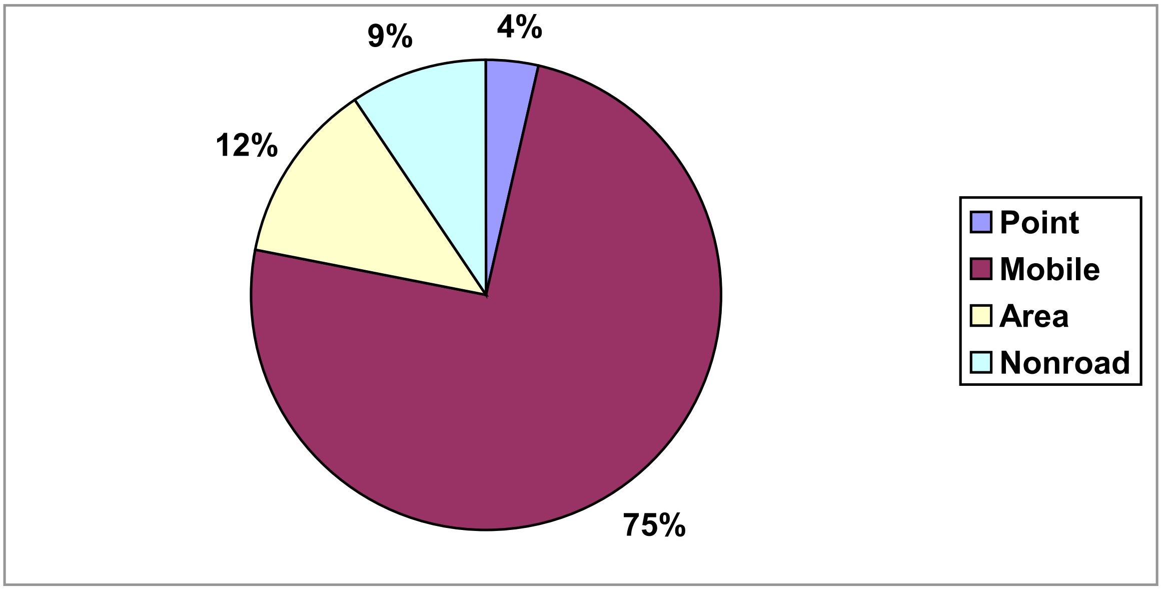
Northern Shenandoah Valley Emissions Inventory – 1999 Baseline Ozone Season Daily Emissions of Volatile Organic Compounds (VOC)



Summary of the Northern Shenandoah Valley Baseline VOC Emissions Inventory for Calendar Year 1999

Summary of the Northern Shenandoah Valley Baseline VOC Emissions Inventory for Calendar Year 1999	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
25 Individual Facilities (7 in Winchester, 18 in Frederick) Description: Includes several printing, plastics, and mineral products industries. No utilities in the project area.	6.019 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.	8.047 tpd
Area Sources	
Use of Solvent-based Products – Description: paints, cleaners, consumer products, & others.	5.321 tpd
Gasoline Distribution & Marketing – Description: Gasoline storage & transfer operation at terminals and service stations	1.851 tpd
All Others – description: Open burning, landfills, & others	0.634 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	2.630 tpd
All Others – Description: Locomotives, aircraft, boats	0.020 tpd
Total	**24.522 tpd**

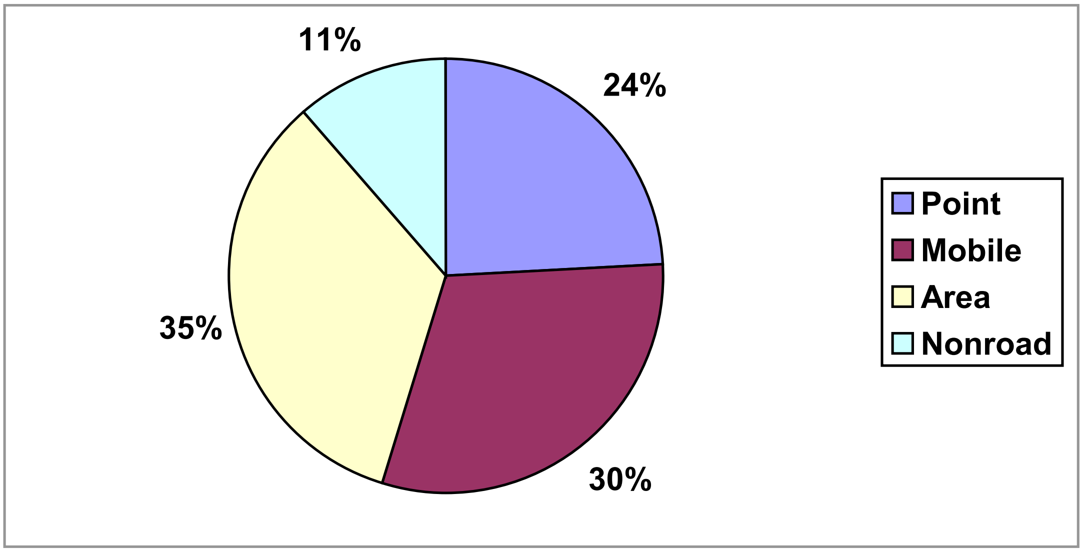
Northern Shenandoah Valley Emissions Inventory – 1999 Baseline Ozone Season Daily Emissions of Oxides of Nitrogen (NOX)



Summary of the Northern Shenandoah Valley Baseline NOx Emissions Inventory for Calendar Year 1999

Summary of the Northern Shenandoah Valley Baseline NO_X Emissions Inventory for Calendar Year 1999	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
25 Individual Facilities (7 in Winchester, 18 in Frederick) Description: Includes several printing, plastics, and mineral products industries. No utilities in the project area.	0.745 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.	15.090 tpd
Area Sources	
Fuel Consumption – Description: Fuel consumption for heating, cooling, and other purposes in all sectors.	2.317 tpd
All Others – description: Open burning, landfills, & others	0.209 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	1.870 tpd
All Others – Description: Locomotives, aircraft, boats.	0.040 tpd
Total	**19.271 tpd**

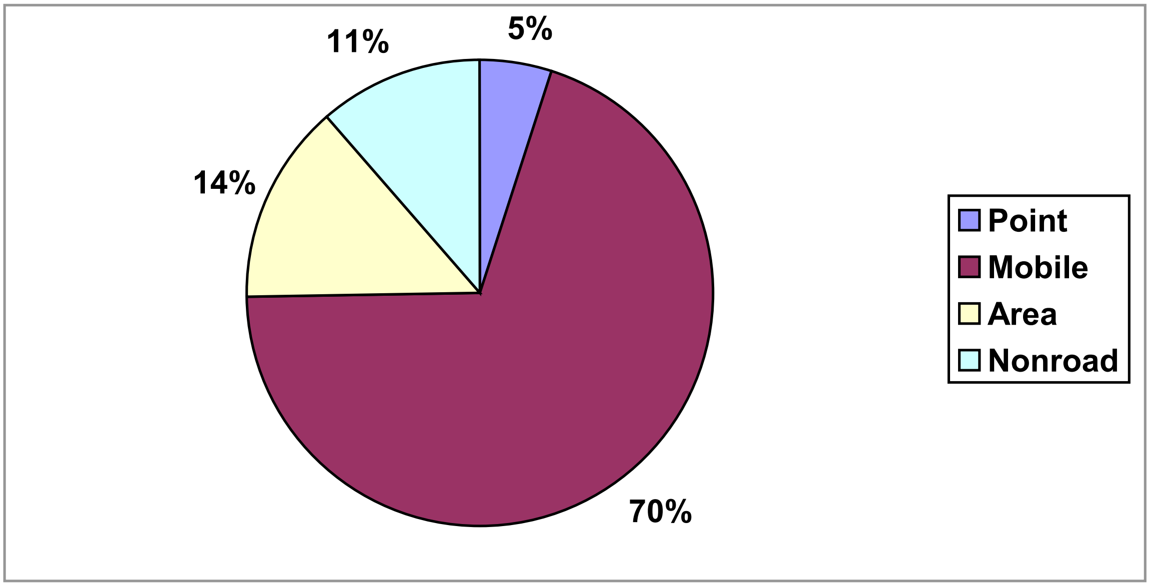
Northern Shenandoah Valley Emissions Inventory – 2002 Ozone Season Daily Emission of Volatile Organic Compounds (VOC)



Summary of the Northern Shenandoah Valley Baseline VOC Emissions Inventory for Calendar Year 2002

Summary of the Northern Shenandoah Valley Interim VOC Emissions Inventory for Calendar Year 2002	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
25 individual facilities (7 in Winchester, 18 in Frederick) - Description: Includes several printing, plastics, and mineral products industries. No utilities in the project area.	5.638 tpd
On-Road Mobile Sources	
Motor Vehicles on all 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.	7.164 tpd
Area Sources	
Use of solvent-based products – Description: paints, cleaners, consumer products, & others.	5.399 tpd
Gasoline distribution & Marketing – Description: Gasoline storage & transfer operation at terminals and service stations	1.927 tpd
All Others – description: Open burning, landfills, & others	0.656 tpd
Non-Road Mobile Sources	
Non-road equipment – Description: lawn & garden, construction, recreational vehicles and boats.	2.650 tpd
All others – Description: Locomotives & aircraft	0.022 tpd
Total	**23.456 tpd**

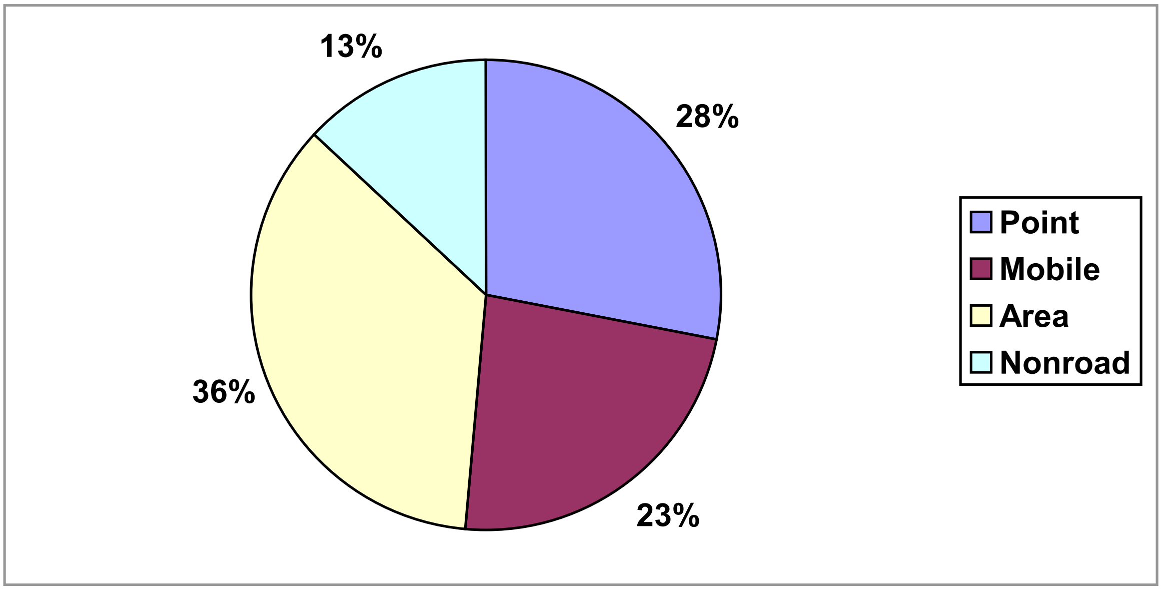
Northern Shenandoah Valley Emissions Inventory – 2002 Ozone Season Daily Emission of Oxides of Nitrogen (NO_X)



Summary of the Northern Shenandoah Valley Baseline NOx Emissions Inventory for Calendar Year 2002

Summary of the Northern Shenandoah Valley Interim NO_X Emissions Inventory for Calendar Year 2002	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
25 individual facilities (7 in Winchester, 18 in Frederick) - Description: Includes several printing, plastics, and mineral products industries. No utilities in the project area.	0.934 tpd
On-Road Mobile Sources	
Motor Vehicles on Interstates - **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.	14.029 tpd
Area Sources	
Fuel Consumption – Description: Fuel consumption for heating, cooling, and other purposes in all sectors.	2.386 tpd
All Others – description: Open burning, landfills, & others	0.217 tpd
Non-Road Mobile Sources	
Non-road equipment – Description: lawn & garden, construction, recreational vehicles and boats.	1.900 tpd
All others – Description: Locomotives & aircraft	0.042 tpd
Total	**19.508 tpd**

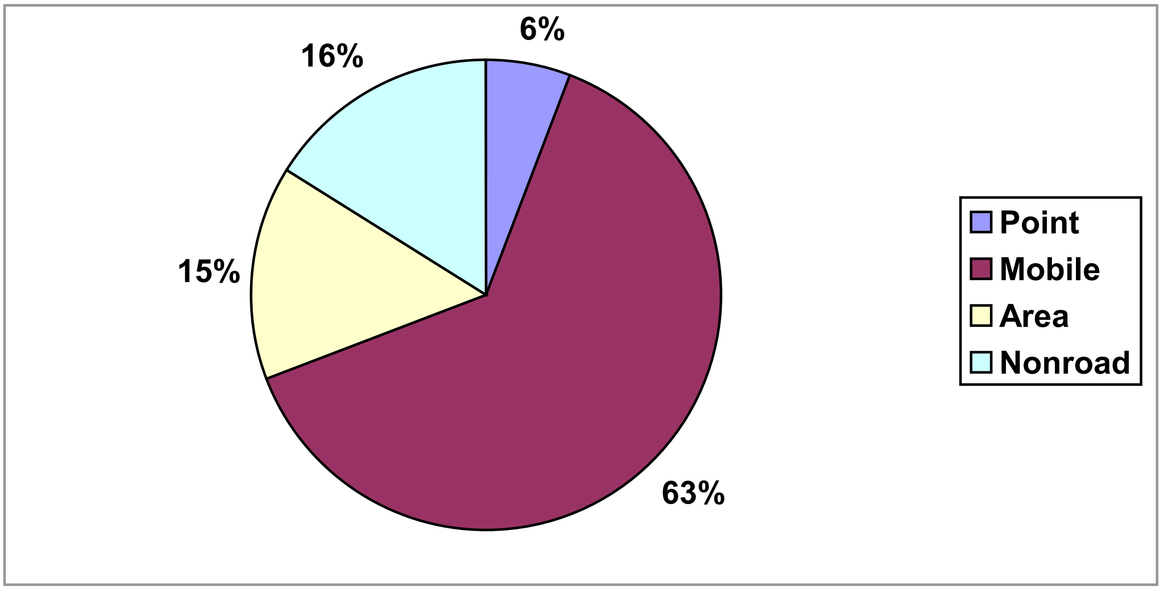
Northern Shenandoah Valley Emissions Inventory – 2007 Base Case Ozone Season Daily Emissions of Volatile Organic Compounds (VOC)



Summary of the Northern Shenandoah Valley Base Case VOC Emissions Inventory for Calendar Year 2007

Summary of the Northern Shenandoah Valley Base Case VOC Emissions Inventory for Calendar Year 2007	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
25 Individual Facilities (7 in Winchester, 18 in Frederick) Description: Includes several printing, plastics, and mineral products industries. No utilities in the project area.	6.492 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.	5.372 tpd
Area Sources	
Use of Solvent-based Products – Description: paints, cleaners, consumer products, & others.	5.470 tpd
Gasoline Distribution & Marketing – Description: Gasoline storage & transfer operation at terminals and service stations	2.061 tpd
All Others – description: Open burning, landfills, & others	0.690 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	2.961 tpd
All Others – Description: Locomotives, aircraft, boats	0.025 tpd
Total	**23.071 tpd**

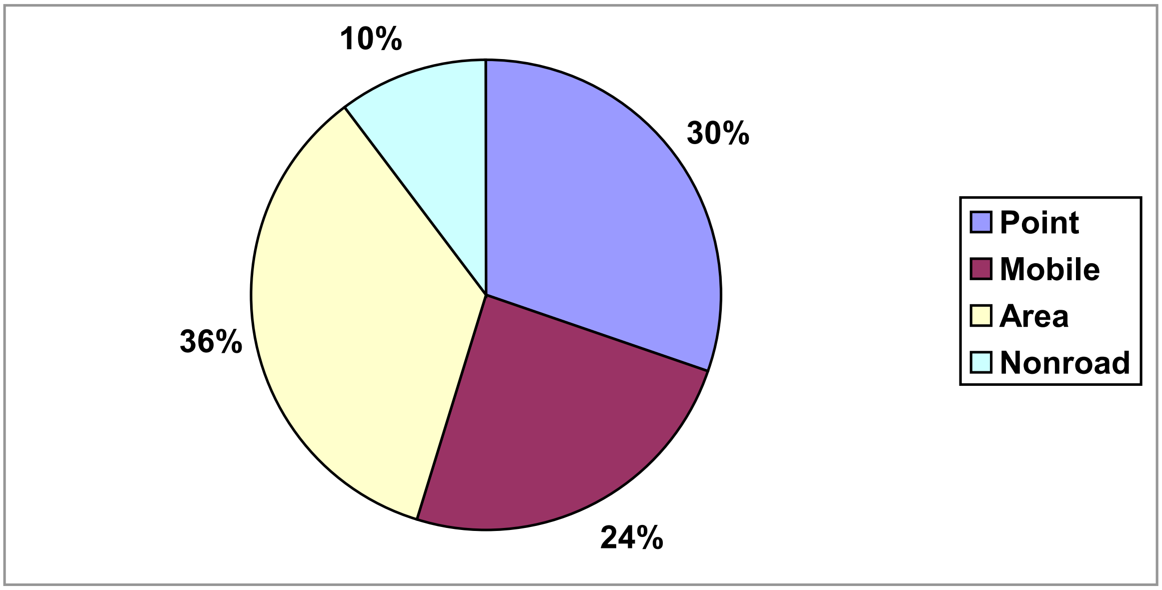
Northern Shenandoah Valley Emissions Inventory – 2007 Base Case Ozone Season Daily Emissions of Oxides of Nitrogen (NOX)



Summary of the Northern Shenandoah Valley Base Case NOX Emissions Inventory for Calendar Year 2007

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	
25 Individual Facilities (7 in Winchester, 18 in Frederick) Description: Includes several printing, plastics, and mineral products industries. No utilities in the project area.	1.075 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.	11.888 tpd
Area Sources	
Fuel Consumption – Description: Fuel consumption for heating, cooling, and other purposes in all sectors.	2.506 tpd
All Others – description: Open burning, landfills, & others	0.229 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	2.198 tpd
All Others – Description: Locomotives, aircraft, boats	0.046 tpd
Total	**17.942 tpd**

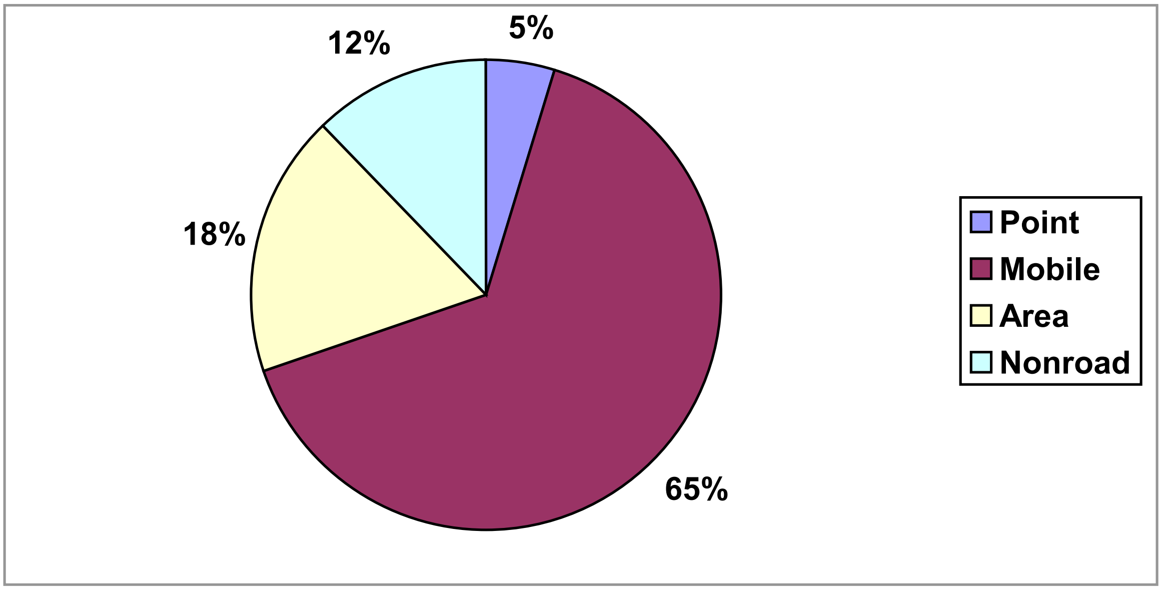
Northern Shenandoah Valley Emissions Inventory – 2007 Control Case Ozone Season Daily Emissions of Volatile Organic Compounds (VOC)



Summary of the Northern Shenandoah Valley Control Case VOC Emissions Inventory for Calendar Year 2007

Summary of the Northern Shenandoah Valley Control Case VOC Emissions Inventory for Calendar Year 2007	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
25 Individual Facilities (7 in Winchester, 18 in Frederick) Description: Includes several printing, plastics, and mineral products industries. No utilities in the project area.	6.068 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.	4.934 tpd
Area Sources	
Use of Solvent-based Products – Description: paints, cleaners, consumer products, & others.	4.693 tpd
Gasoline Distribution & Marketing – Description: Gasoline storage & transfer operation at terminals and service stations	1.978 tpd
All Others – description: Open burning, landfills, & others	0.410 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	2.030 tpd
All Others – Description: Locomotives, aircraft, boats	0.021 tpd
Total	**20.134 tpd**

Northern Shenandoah Valley Emissions Inventory – 2007 Control Ozone Season Daily Emissions of Oxides of Nitrogen (NOX)



Summary of the Northern Shenandoah Valley Base Control Case NOX Emissions Inventory for Calendar Year 2007

Summary of the Northern Shenandoah Valley Control Case NO_X Emissions Inventory for Calendar Year 2007	
Major Source Categories	Emissions (tons/day)
Major Stationary Point Sources	
25 Individual Facilities (7 in Winchester, 18 in Frederick) Description: Includes several printing, plastics, and mineral products industries. No utilities in the project area.	1.075 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.	9.952 tpd
Area Sources	
Fuel Consumption – Description: Fuel consumption for heating, cooling, and other purposes in all sectors.	2.506 tpd
All Others – description: Open burning, landfills, & others	0.106 tpd
Non-Road Mobile Sources	
Non-road Equipment – Description: lawn & garden, construction, recreational vehicles.	1.620 tpd
All Others – Description: Locomotives, aircraft, boats	0.027 tpd
Total	**15.186 tpd**

Provided below is a comprehensive summary of the controls at all levels that apply to the Northern Shenandoah Valley area in the projected 2007 attainment year. The status of each of these measures in terms of federal enforceability and inclusion in the future base case and/or control case modeling is also indicated.

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

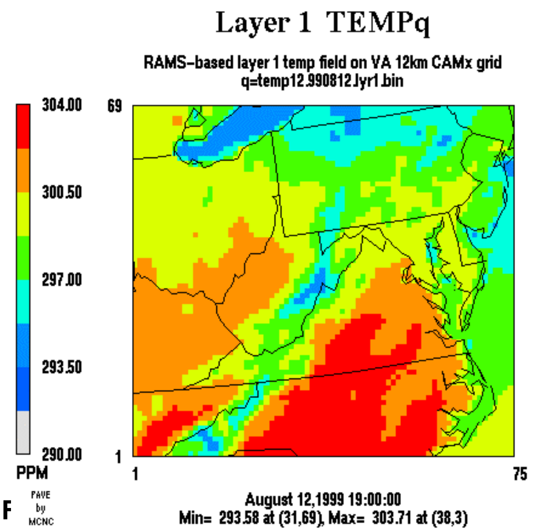
Emissions Control Measures	VOC (tpd)	NO_X (tpd)	Modeled
State/Federal Area Source Controls			
Architectural & Industrial Paints – Federal Rule (Federally Enforceable)	0.134	0.000	YES
Consumer Products – Federal Rule (Federally Enforceable)	0.056	0.000	YES
Metal Cleaning Solvents – Federal Rule (Federally Enforceable)	0.056	0.000	YES
Motor Vehicle Refinishing – Federal Rule (Federally Enforceable)	0.003	0.000	YES
Cutback Asphalt – State Rule (Federally Enforceable)	0.001	0.000	YES
Subtotals:	**0.250**	**0.000**	
Federal Non-Road Source Controls			
Small Gasoline Engine Standards – Federal Rule (Federally Enforceable)	0.812	0.027	YES
Diesel Engine Standards – Federal Rule (Federally Enforceable)	0.047	0.276	YES
Locomotive Engine Standards – Federal Rule (Federally Enforceable)	0.000	0.020	YES
Large Gasoline Engine Standards – Federal Rule (Federally Enforceable)	0.068	0.248	YES
Recreational Engine Standards – Federal Rule (Federally Enforceable)	0.004	0.000	YES
Subtotals:	**0.931**	**0.571**	
Federal Mobile Source Controls			
Previous Motor Vehicle Standards – Federal Rule (Federally Enforceable)	2.675	3.202	YES
Tier 2 Vehicle Standards – Federal Rule (Federally Enforceable)	0.438	1.825	YES
Heavy Duty Diesel Standards – Federal Rule (Federally Enforceable)	0.001	0.111	YES
Subtotals:	**3.114**	**5.138**	
State/Local Early Action Plan Controls			
Existing Source CTG RACT Controls – State Rule (Federally Enforceable)	0.792	0.000	YES
Ozone Action Days Program – State/Local (Mandatory/Voluntary)	0.302	0.015	YES
VMT Reduction – Local (Voluntary)	0.148	0.299	NO
Open Burning Restrictions (Mandatory/Voluntary)	0.122	0.280	NO
School Bus Retrofit Program (Mandatory)	0.002	0.001	NO
Engine Idling Restrictions (Mandatory/Voluntary)	0.000	0.102	NO
Subtotals:	**1.366**	**1.291**	
TOTALS:	**5.661**	**7.000**	

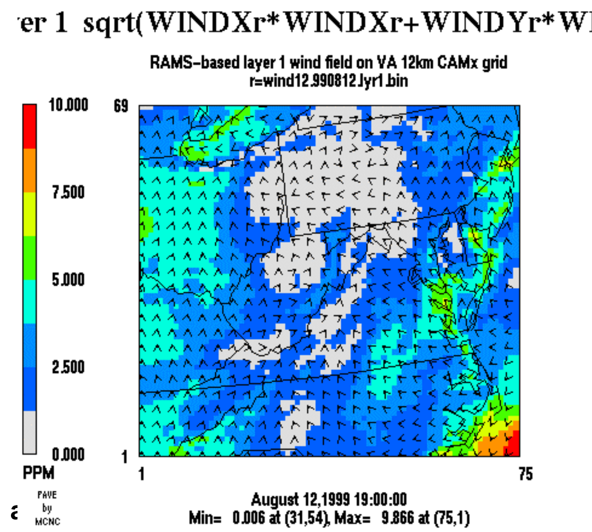
E. Base Case Modeling

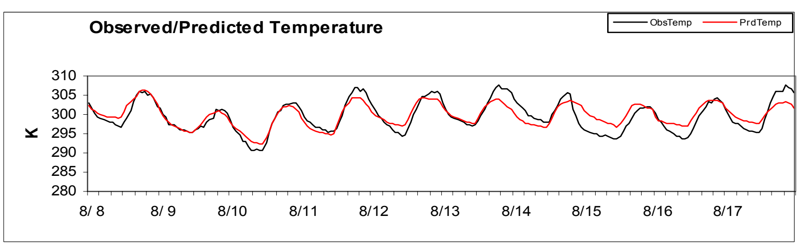
A 1997 episode was originally selected to support the development of the early action plan since emissions and meteorological data were readily available and quality assured. However, subsequent to this decision, EPA EAP guidance required that inventories and episodes no older than 1999 had to be used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

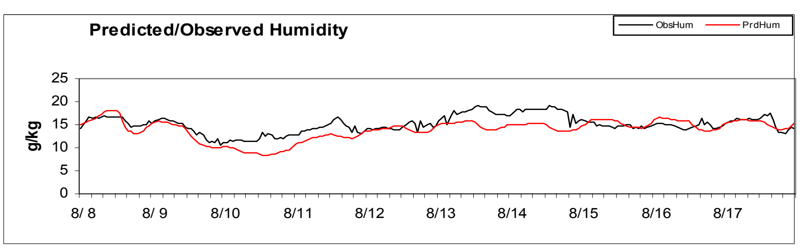
DEQ has obtained the necessary meteorological data for the 1999 episode and successfully completed the processing of the data through the MM5 meteorological model. Several MM5 runs were required to adequately simulate the relatively complex meteorological conditions that existed during the selected ozone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

Meteorological Modeling – Selected Results for Temperature and Winds





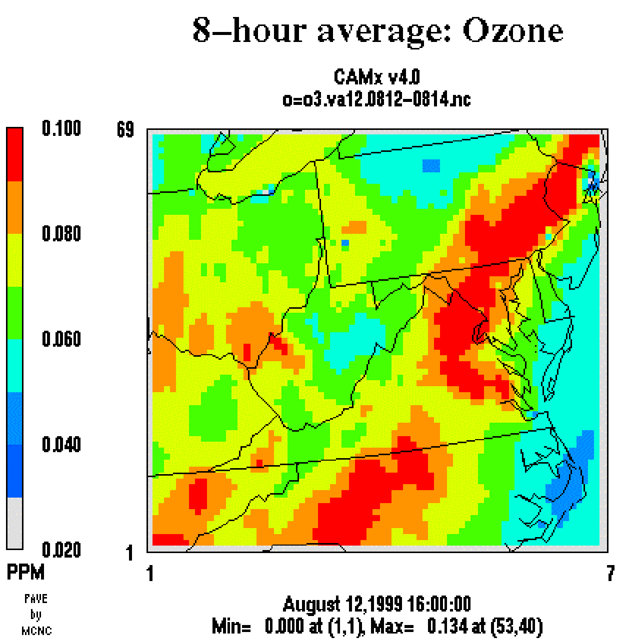


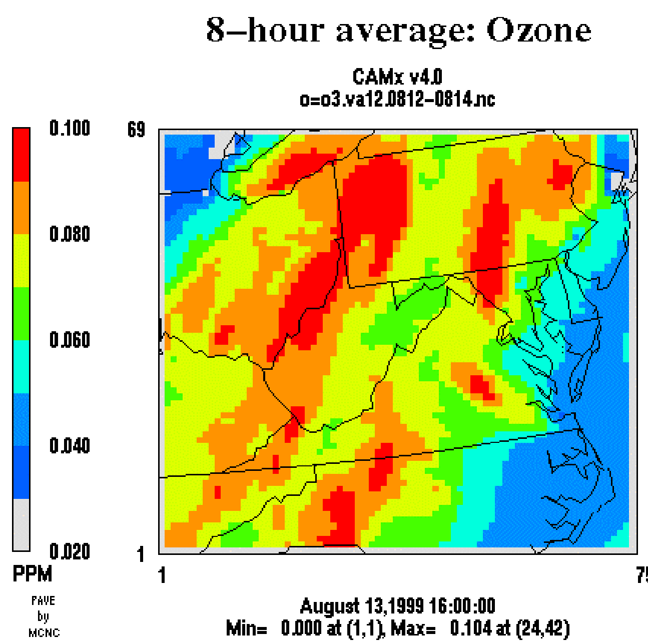


Emissions data for 1999 from all state in the modeling domain has also been obtained from the NEI. This emissions data has been supplemented with state specific data from Virginia and West Virginia. The conversion of this data to SMOKE input files and the preprocessing of this data through the SMOKE 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 was completed.

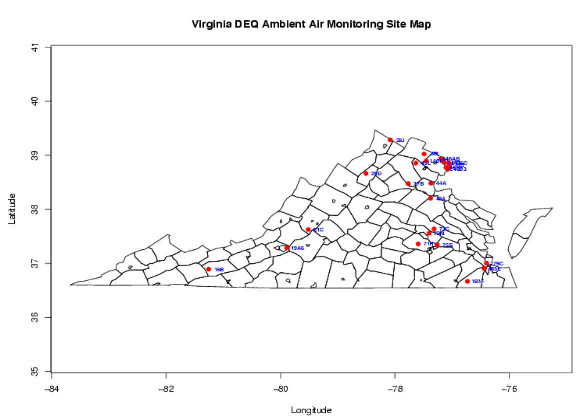
Once all the preprocessing steps were completed, the regional photochemical modeling exercise was begun. After several runs using the CMAQ model were completed, it became obvious that the performance of the model was not up to EPA standards using the selected episode. After internal consultations, it 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 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 .

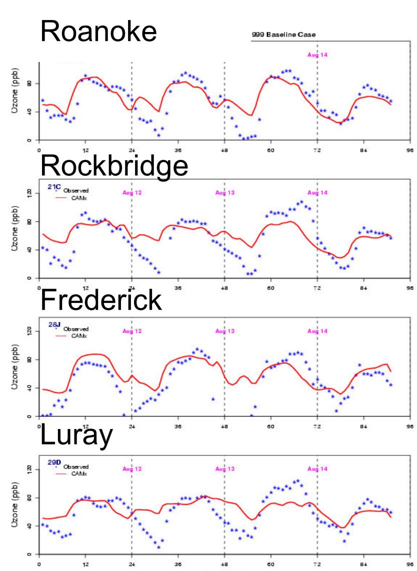
CAMx Photochemical Model Results – Base Case Modeling





Air Quality Model Validation – Observed & Predicted Ozone Concentrations





In summary, the base case modeling was 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.
- The model performance is acceptable for use in future and control case modeling.

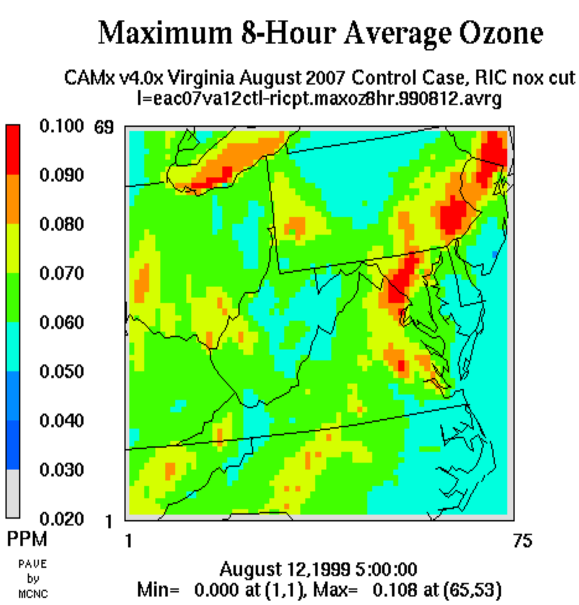
F. Future Case Modeling

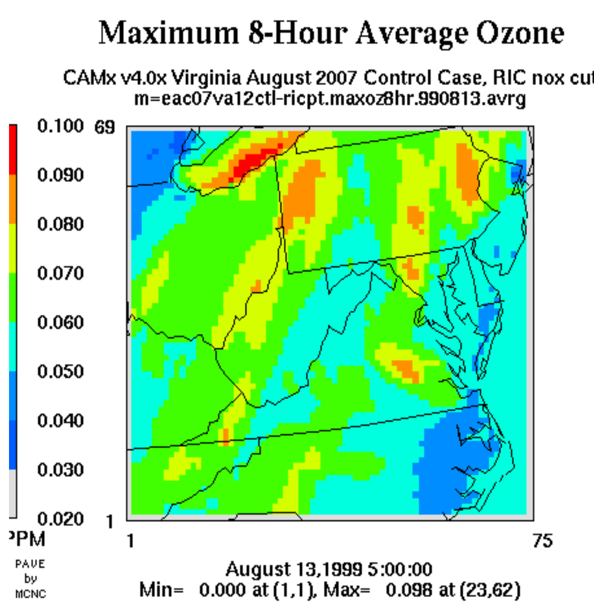
Once the base case modeling and associated performance evaluation and validation was completed, work began on the future base and control case modeling scenarios. In order to do this, a future year modeling emissions inventory had to be developed to predict future ozone precursor emissions levels in 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 future base case scenario was modeled based on the assumption of emissions growth from unregulated or uncontrolled source categories. Also included in this scenario were controlled estimates for source categories subject to State/Regional/National strategies already promulgated for the control of ozone precursor emissions that were not directly relating to the strategies to be implemented through the local control program. This modeling showed substantial reductions in predicted ozone concentrations in the EAC area and throughout the entire modeling domain. **In fact, the base case controls were predicted to be sufficient to bring the Northern Shenandoah Valley EAC area into compliance with the ozone standard.**

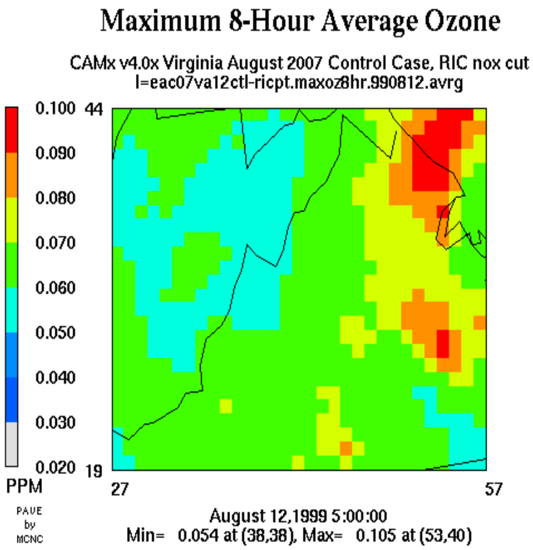
The second future modeling scenario involved the addition of the local control strategies contained in the EAP to serve as the control case inventory for this project. The combination of all the controls at all applicable levels (local, state, federal) produced the results shown below.

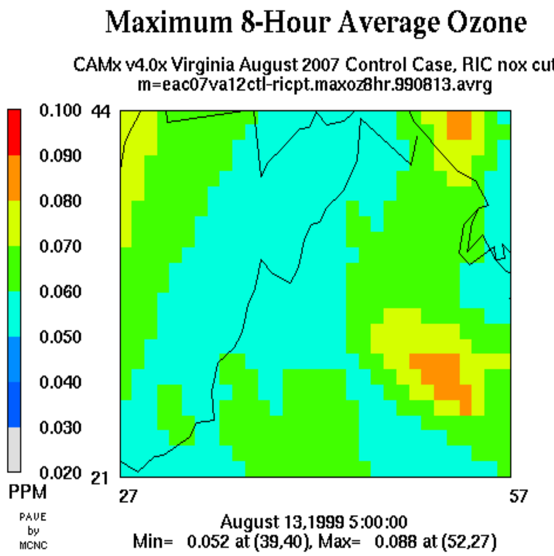
Regional Modeling Results – Future Control Case Predictions (Full Domain)





Regional Modeling Results – Future Control Case Predictions (Central VA)





The results of the control case 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. **Specifically, the Northern Shenandoah Valley area is predicted to experience a 16% reduction in local ozone concentrations. It is also predicted that the base case design value for the area of 87 parts per billion will be reduced to 72 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, when combined with the control strategies being implemented on the state and federal levels. A summary of the attainment demonstration results are presented in the table below:

Determination of Current Design Value for Winchester/Frederick

County/City	AIRS ID	1998-2000 Design Value, ppb	2001-2003 Design Value, ppb	Current Design Value
Frederick Co.	510690001	87	85	87

Attainment Test Results for the Northern Shenandoah Valley EAC Area (Maximum 9 Grid Cells)

County/City	Modeled Average Base-Year (1999) Daily 8-hr Maximum O3 (ppb)	Modeled Average Future-Year (2007) Daily 8-hr Maximum O3 (ppb)	Relative Reduction Factor (RRF)	Current Design Value	2007 Future Design Value	Number of Analysis Days	Pass/Fail Status
Roanoke	77.45	64.85	0.837	87	72.8	4	PASS

Nonattainment

Attainment

5. <u>MAINTENANCE FOR GROWTH</u>

A. Background

Beyond the attainment demonstration provided above, the Early Action Compact also calls for a mechanism and demonstration that the area can continue to attain the ozone standard after 2007. This section addresses this demonstration of maintenance and establishes a contingency plan and associated measures that may be needed to address future unanticipated problems in the implementation of this air quality plan or worsening air quality in the Northern Shenandoah Valley area. The following supporting information is provided to demonstrate that the area will remain in attainment for a substantial time after the predicted attainment date of 2007. It also serves to demonstrate that sufficient contingencies are available to address any potential plan or air quality setbacks or problems.

B. Demonstration of Maintenance

A demonstration of maintenance consists of a finding that a given area in compliance or predicted to be in compliance with a air quality standard will remain in compliance with that standard for a period of time. These demonstrations are generally made using one of two methods:

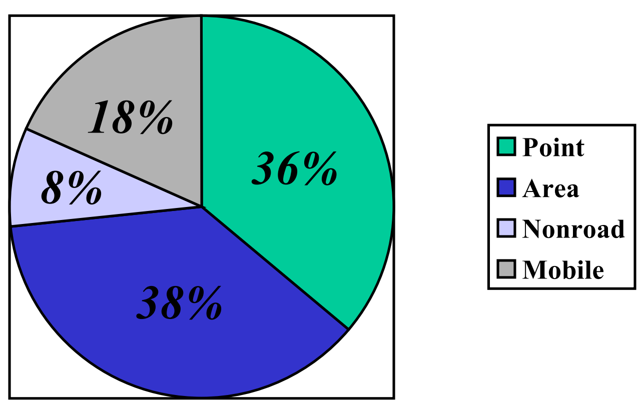
- An air quality modeling analysis that predicts that the area will remain in compliance, or
- An emissions analysis that predicts that emissions will remain below "attainment" levels.

Given the time and data constraints involved in the EAP process, it was not possible to perform an additional modeling analysis for a future year other than 2007. Therefore, an emissions analysis has been developed and is presented below.

A future 2012 ozone precursor emissions inventory has been developed for the Northern Shenandoah Valley area using the same methods as those used to develop the other inventories in this document. A summary of this 2012 inventory is provided below along with a comparison to the base (1999), interim (2002), and attainment (2007) inventories for the area.

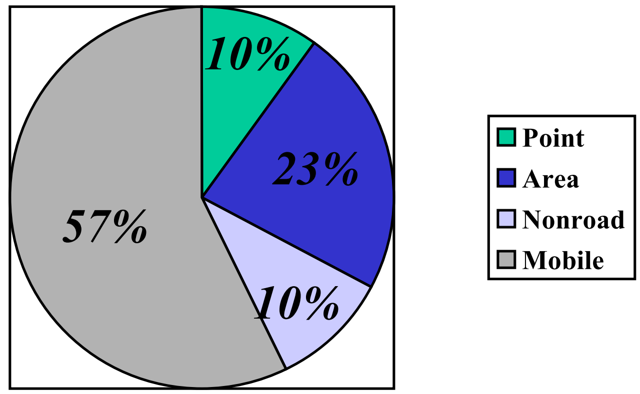
2012 Projected VOC Emissions:

CATEGORY	*DAILY EMISSIONS*
Point	7.207
Area	7.481
Nonroad	1.680
Mobile	3.652
TOTAL:	**20.020**

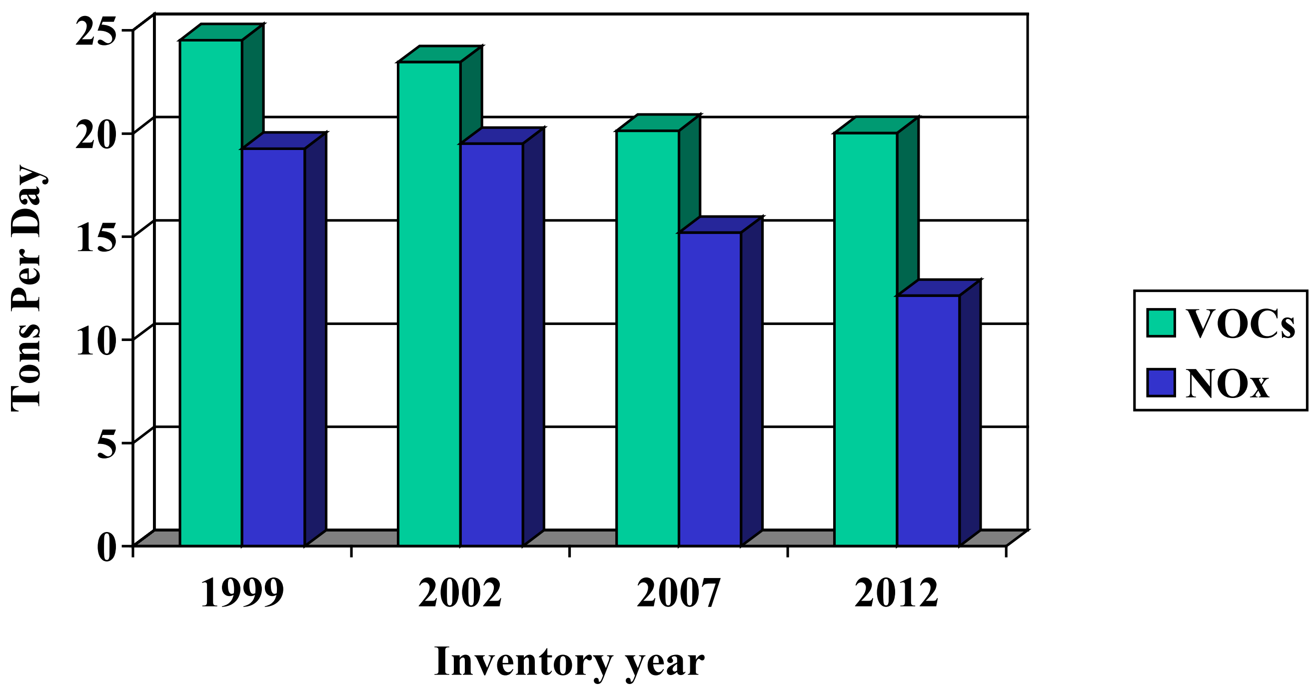


2012 Projected NO_X Emissions:

CATEGORY	*DAILY EMISSIONS*
Point	1.225
Area	2.760
Nonroad	1.210
Mobile	6.951
TOTAL:	**12.146**



Ozone Emissions Inventory Comparisons for NSV (1999 to 2012)



As demonstrated by the charts presented above, it is predicted that ozone precursor emissions in 2012 for the Northern Shenandoah Valley area will remain below attainment year (2007) levels. Therefore, this analysis serves as an indicator that the area is likely to continue to be in compliance with the ozone standard based on local predicted emissions trends.

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 programs 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 Clean Air Interstate Rule (CAIR), 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 this rule.

These regional modeling exercise have been performed by EPA to support various rulemaking actions, most recently in support of the Clear Skies Act (CSA) and Clean Air Interstate Rule (CAIR). Although these modeling exercises were performed for different reasons, they have produced predicted future ozone levels that provide additional information on predicted ozone trends in the future. A summary of these modeling exercises and the resulting ozone predictions for the Northern Shenandoah Valley area is provided in the table below:

MONITOR	2010	2015	2020
Frederick	**71 PPB (CSA)**	**70PPB (CAIR)**	**63 PPB (CSA)**

As can be seen above, all of these EPA modeling exercises predict attainment in the Northern Shenandoah Valley area from 2010 out to 2020. In addition, these results show that predicted ozone design values will continue to decrease during this period. The specific prediction of these results for the area is that the design value in 2015 will be at 70 parts per billion, and decrease to 63 parts per billion in 2020.

D. Contingency Measures

As part of the local EAP, a mechanism and commitment is in place to monitor the progress towards implementing the local controls and assessing their effectiveness. Furthermore, as part of this SIP submittal, the local area commits to continue to submit periodic updates in the form of semi-annual status reports to DEQ and EPA on the implementation status and results of the local control program with sufficient details to make program sufficiency determinations.

If it is found that progress is not being made or the level of emissions reductions expected have not been achieved, the local Task Force will reevaluate the existing strategies to enhance their effectiveness or recommend the adoption of additional control measures. This mechanism represents the local contingency measure portion of the EAP. One or more enhanced or new strategies would be implemented in response to continuing exceedances of the ozone standard or a shortfall in anticipated emission reductions from the initial EAP. These additional strategies would be developed and implemented if the situation warranted or called for additional local emission reductions in response to worsening air quality or an unexpected shortfall in local emission reductions. These measures would require additional lead-time for implementation as well as additional work with an expanded group of stakeholders. Truck stop electrification has specifically identified as a potential measure to be evaluated and implemented, if needed.

Beyond the possible implementation of additional local controls as discussed above, the DEQ will be prepared to implement of the “Ozone Transport Commission” (OTC) rules in the area as contingency and/or maintenance measures. One or more of these rules may be implemented if a substantial failure occurs in the local control plan in terms of failure to implement controls, or in response to worsening air quality. DEQ will begin the regulatory process to enable implementation of the following additional measures as needed:

<u>OTC Portable Container Rule</u>
The portable container rule would reduce emissions that result from either gas container spillage or permeation. Additional benefits include potential reduction of water contamination and reduction of potential fire hazards. The estimated emissions reduction benefits from this measure is < 0.001 tons/day of VOC.

<u>OTC Architectural/Industrial Maintenance Coatings Rule</u>
This rule would require reformulated coatings to meet lower VOC content limits than under the current federal rule. Manufacturers would be required to assume the primary responsibility to produce coatings that meet or exceed VOC content limits for sale and use at the retail and wholesale levels. The estimated emissions benefit from this measure is approximately 0.166 ton/day of VOC.

OTC Mobile Equipment Repair and Refinishing Rule
This rule would require lower VOC content for paints and use of improved transfer efficiency application and cleaning equipment. The rule would apply primarily to small businesses that apply refinishing materials and to a variety of mobile equipment repair and refinishing facilities. The approximate emissions reduction for this strategy is estimated to be 0.002 tons/day VOC.

OTC Solvent Cleaning Operations Rule
This rule would establish additional hardware and operating requirements for vapor cleaning machines used to clean metal parts. It also includes volatility restrictions for cold cleaning solvents. Degreasing and solvent cleaning operations are performed by many commercial and industrial facilities. The estimated emissions benefit for this rule is 0.335 tons/day of VOC.

OTC Consumer Products Rule
This rule would establish additional VOC content restrictions on various consumer products sold in the area. This rule mainly impacts the manufacturers and users of these products. The estimated emissions benefit for this rule is 0,071 tons/day VOC.

A detailed summary and description of all these contingency measures and the emission reductions and estimation methods is presented in Appendix B to this document.

The specific triggers that will prompt the implementation of the contingency measures in this section are as follows:

1. Failure to implement one or more local control measures.

If the area is unable to implement one or more local controls, the area will develop and implement one or more equivalent control measures.

2. Failure to substantially implement or support the local air quality plan.

If the area fails to substantially implement or support the local air quality plan, one or more state "OTC" rules will be adopted and implemented by DEQ as expeditiously as possible.

3. For a new violation of the 8-hour ozone standard.

If a violation of the standard occurs after to the submission and approval of this plan, one or more state "OTC" rules will be adopted and implemented by DEQ as expeditiously as possible.

DEQ reserves the right to substitute equivalent measures for use as contingency measures as part of this plan if and when needed.

APPENDIX A

NORTHERN SHENANDOAH VALLEY EARLY ACTION PLAN

LOCAL CONTROL IMPLEMENTATION STATUS UPDATE

DECEMBER 31, 2004

Summary

Below is a summary of process toward the full reasonable effective implementation of emission control strategies in Phase I of the NSVEAP.

1. Ozone Action Days/Public Awareness

This strategy is actually a combination of several measures that had been evaluated earlier as individual strategies including:

Control Strategies	Status	Full Implementation Schedule	Voluntary Regional Implementation
General Public Awareness Program	Under development	Spring 2005	Spring 2006
School-based Public Awareness Program	Under development	Spring 2005	Spring 2006
Education and Promotion Campaign	Under development	Spring 2005	Spring 2006
Employer-based Ozone Action Days	Under development	Spring 2005	Spring 2006
Area Sources Ozone Action Days	Under development	Spring 2005	Spring 2006
Dynamic Message Signs	Completed	Summer 2004	Summer 2005
Video Monitor Deployment	Completed	Summer 2004	Summer 2005
Lawn & Garden Equipment Usage Restrictions for State/Local Govts	Enforcement options for Winchester and Frederick County forward for review, comment and action	Spring 2005	Spring 2006
Other State/Local Govt Restrictions (Refueling, Pesticides)	Enforcement options for Winchester and Frederick County forward for review, comment and action	Spring 2005	Spring 2006

2. VMT Reduction Programs

This strategy combines a number of individual programs/activities designed to reduce vehicle miles of travel (VMT). These include:

Control Strategies	Status	Full Implementation Schedule	Voluntary Regional Implementation
Enhanced/expanded NSV Regional Commission Ridesharing Program	Under development within Metropolitan Planning Organization	Spring 2005	Spring 2006
Bicycle and Pedestrian Accommodation	Working with the Green Circle Project and City/County Planning Departments	Spring 2005	Spring 2006
Green Space Preservation	Working with City/County Planning Departments to discover feasible options	Spring 2005	Spring 2006
Promotion of Mixed Use Development	Working with City/County Planning Departments to discover feasible options	Spring 2005	Spring 2006

Promotion of Telecommuting	Working with NetTech Center of Winchester and Telework Consortium on applicable opportunities	Spring 2005	Spring 2006

3. Open Burning Restrictions

Establishing open burning restrictions for land clearing activities has the potential to reduce combustion sources in the emissions inventories. While this type of rule is sometimes difficult to enforce, the reduction of related fire hazards along with the reduction of visible smoke and resulting air quality benefits were deemed important by the Task Force. Local policies or ordinances will implement this measure.

Control Strategies	Status	Full Implementation Schedule	Voluntary Regional Implementation
Open Burning Restrictions	Enforcement options for Winchester and Frederick County forward for review, comment and action	Spring 2005	Spring 2006

4. Engine Idling Restrictions

Restrictions for engine idling was another strategy included, due in part to the heavily traveled I-81 corridor in NSV, which has a high percentage of heavy truck travel. A large amount of idling emissions are generated from heavy-duty diesel vehicles that are parked at truck stops, rest areas and to a lesser extent, distribution centers.

Control Strategies	Status	Full Implementation Schedule	Voluntary Regional Implementation
Engine Idling Restrictions	Enforcement options for Winchester and Frederick County forward for review, comment and action	Spring 2005	Spring 2006

5. School Bus/Heavy Duty Fleets Retrofits

Retrofitting heavy duty diesel engines with emissions control technologies, such as EGR systems, or after treatment devices is an emissions control measure that shows promise for the NSV. In fact, the availability of funding to support the retrofit of school buses will give implementation of this measure a positive boost. DEQ has allocated up to $475,000 in funding assistance to assist in implementation of this strategy.

Control Strategies	Status	Full Implementation Schedule	Voluntary Regional Implementation
School Bus Fleets Retrofits	City/County School Systems implementing according to plans with VDEQ	Spring 2005	Spring 2006
Heavy Duty Fleets Retrofits	Researching feasible options and other comparable programs	Spring 2005	Spring 2006

6. Voluntary Industrial Reductions

The emissions reduction benefits are sometimes difficult to quantify for this strategy, however, an initial voluntary approach seeking industrial reductions is a reasonable and practical way for an EAC area to begin. In addition, this strategy would help increase awareness of the pollution problem and establish a relationship between local government and area industry. The estimated emissions reduction potential for these types of strategies for the area will be determined as agreements are reached with local industries.

Control Strategies	Status	Full Implementation Schedule	Voluntary Regional Implementation
Voluntary Industrial Reductions	City/County School Systems implementing according to plans with VDEQ	Spring 2005	Spring 2006

Detail

Below is a detail description of process toward the full reasonable effective implementation of emission control strategies in Phase I of the NSVEAP.

1. Ozone Action Days/Public Awareness

This strategy consists of a number individual programs/activities, which aim to educate the public, government and business regarding the health effects of air pollution and actions they can take to help reduce it would potentially reduce some emissions, mostly mobile and area source emissions. These strategies would be implemented through the year with an emphasis on a coordinated response to a forecast of high ozone concentrations above the standard from the DEQ. A description and update of implementation of each individual program/activity is provided below.

General Public Awareness Program

Strategy Description

- Develop and implement a program to educate the public regarding the health effects of air pollution and actions they can take to help reduce it.

Implementation to Date

- Developed and maintained website for overall program, www.valleyairnow.com. Website contains general information on ozone, suggestions for individuals, employers, educators and government on how to improve air quality and documents related to our community's Ozone Early Action Plan. Website will be updated to reflect current season and current air quality data.
- Developed Ozone Alert system via email and fax individually tailored to four identified audiences, media, employers, educators and government.
- Developed three public service announcements related to strategies
- Developed job description for Ozone Action Coordinator

School-based Public Awareness Program

Strategy Description

  - Develop and implement a program for use in local schools to educate children and their parents regarding air pollution.

  Implementation to Date
  - Inserted information on suggestions actions for educators into program's website, www.valleyairnow.com.
  - Developed Ozone Alert system via email and fax tailored to educators.

- Education and Promotion Campaign

  Strategy Description
  - Develop and implement a program to promote bicycling and walking as alternatives to short single occupant trips.

  Implementation to Date
  - Inserted information on bicycling and walking as alternatives to short single occupant trips into program's website, www.valleyairnow.com.

- Employer-based Ozone Action Days

  Strategy Description
  - Develop and implement an employer-based program of strategies for Ozone Action Days.

  Implementation to Date
  - Inserted information on suggestions actions for employers into program's website, www.valleyairnow.com.
  - Developed Ozone Alert system via email and fax tailored to employers

- Area Sources Ozone Action Days

  Strategy Description
  - Develop and implement a program which seeks to discourage gasoline powered lawn mowing and leaf blowing on Ozone Action Days

  Implementation to Date
  - Local governments have been provided with options on how to implement strategy
  - Anticipated decision by early 2005

- Dynamic Message Signs

  Strategy Description
  - Deploying dynamic message signs in the I-81 corridor and other key locations in the county

  Implementation to Date
  - All current DMS have been configured to goals of EAP
  - A component of the long-range transportation plan by the Metropolitan Planning Organization
  - Anticipated inclusion into long range plan by mid 2005

- Video Monitor Deployment

  Strategy Description
  - Installing video cameras to monitor traffic flow at two locations to reduce incident duration

  Implementation to Date
  - Over a dozen cameras at major congested intersections are already employed

    - A component of the long-range transportation plan by the Metropolitan Planning Organization
    - Anticipated inclusion into long range plan by mid 2005

- Lawn and Garden Equipment Usage Restrictions for State/Local Governments
  Strategy Description
    - Develop and implement a program to restrict the use of lawn and garden equipment on predicted code orange and red ozone days by local and state governments
  Implementation to Date
    - Local governments have been provided with options on how to implement strategy
    - Anticipated inclusion into long range plan by mid 2005

- Other State/Local Government Restrictions (Refueling, Pesticides)
  Strategy Description
    - Develop and implement a program restricting refueling of local and state government vehicles and use of pesticides in local and state government operations
  Implementation to Date
    - Local governments have been provided with options on how to implement strategy
    - Anticipated decision by early 2005

2. VMT Reduction Programs
This strategy combines a number of individual programs/activities designed to reduce vehicle miles of travel (VMT).

<u>Enhanced/expanded NSV Regional Commission Ridesharing Program</u>
Implementation to Date
- Program has been widely advertised through local media
- Additional park-ride locations are a component of the MPO's long range plan

<u>Bicycle and Pedestrian Accommodation</u>
Implementation to Date
- Green Circle plan has successful acquire $117,200.00 to implement the plan which is envisioned as a network of trails, sidewalks, and streets that would allow walkers and bicyclists to travel to cultural, educational, recreational, and commercial sites around the city in a linear park setting

<u>Green Space Preservation</u>
Implementation to Date
- Green Circle plan has successful acquire $117,200.00 to implement the plan which is envisioned as a network of trails, sidewalks, and streets that would allow walkers and bicyclists to travel to cultural, educational, recreational

<u>Promotion of Mixed Use</u>
Implementation to Date
- Frederick County recently approved a developed named Crosspointe. This development calls for a mixture of residential, office, retail and walking trails over 800 acres.

Promotion of Telecommuting

Implementation to Date

- On October 17th, the Net Tech Center of Winchester will hold its first ever Expo. The Net Tech Center is a public/private telework center. This event seeks to gain awareness of the businesses in the Net Tech Center and its services.

4. Engine Idling Restrictions

Strategy Description

- Establishing regulatory/voluntary restrictions of the idling time of heavy-duty diesel vehicles

Implementation to Date

- Enforcement options for Winchester and Frederick County forward for review, comment and action
- Anticipated decision by early 2005

5. School Bus/Heavy Duty Fleets Retrofits

Strategy Description

- Retrofitting heavy duty diesel engines with emissions control technologies, such as EGR systems, or after treatment devices

Implementation to Date

- Enforcement options for Winchester and Frederick County forward for review, comment and action
- Anticipated decision by early 2005

APPENDIX B

Summary of Control Measures for the Winchester/Frederick County Area

Control Measure Category	Control Measure Description	Emission Reductions					
		VOC		NOx		CO	
Local County/City Initiatives	Ozone Action Days/Public Awareness	0.302 tpd	46.2 tpy	0.015 tpd	2.3 tpy		
	VMT Reduction Programs	0.148 tpd	0.74 tpd	0.299 tpd	1.49 tpy		
	Open Burning Restrictions	0.122 tpd	0.612 tpy	0.28 tpd	1.4 tpy		
	Engine Idling Restrictions			0.102 tpd	26.52 tpy		
	Diesel Retrofits: School Buses	0.002 tpd	0.365 tpy	0.001 tpd	0.238 tpy	0.007 tpd	1.19 tpy
	Voluntary Industrial Reductions	NQ	NQ	NQ	NQ	NQ	NQ
State Measures	State Cutback Asphalt Restriction	0.001 tpd	0.292 tpy				
	CTG RACT	0.793 tpd	289.4 tpy	0 tpd	0 tpy		
Federal Measures (Area, Mobile, & Noroad	Federal Small Gasoline Engine Standards	0.812 tpd	296.4 tpy	0.027 tpd	9.86 tpy		
	Federal Nonroad Diesel Engine Standards	0.047 tpd	17.2 tpy	0.276 tpd	100.7 tpy		
	Federal Locomotive Emission Standards			0.02 tpd	7.1 tpy		
	Federal Large Gasoline Engine Standards	0.068 tpd	24.8 tpy	0.248 tpd	90.5 tpy		
	Federal Spark Ignition Marine Engine Standards	0.004 tpd	1.46 tpy				
	Federal Onroad Motor Vehicle Standards	3.114 tpd	1136.6 tpy	5.138 tpd	1875.4 tpy		
	AIM	0.134 tpd	48.8 tpy				
	Consumer/Commercial Products	0.056 tpd	20.4 tpy				
	Metal Cleaning Solvents	0.056 tpd	20.5 tpy				
	Motor Vehicle Refinishing Paint	0.003 tpd	1.05 tpy				
Contingency Measures	OTC AIM	0.166 tpd	60.5 tpy				
	OTC Consumer Products	0.071 tpd	26.0 tpy				
	OTC Metal Cleaning Solvents	0.335 tpd	122.1 tpy				
	OTC Motor Vehicle Refinishing	0.002 tpd	0.69 tpy				
	OTC Portable Gas Containers	<0.001 tpd	0.36 tpy				

NQ=Not Quantifiable

Measure 14: Ozone Action Days/Public Awareness

Measure Number: 14

Measure Name: Ozone Action Days/Public Awareness

NOx

Estimated Reductions (tpd)	0.015
Estimated Reductions (tpy)	2.3

VOC

Estimated Reductions (tpd)	0.302
Estimated Reductions (tpy)	46.2

Description:

This program is a combination of several measures that are directionally sound and designed to raise public awareness and understanding of air quality issues. These include:

· General Public Awareness Program
· School-based public awareness program
· Education and Promotion Campaign
· Employer-based Ozone Action Days
· Area Sources Ozone Action Days.
· Dynamic Message Signs
· Video Monitor Deployment
· Lawn/Garden Equip't Usage Restrictions for Gov'ts
· Other State/Local Gov't Restrictions

Assumptions/Emission Reductions

· These programs will serve to increase public awareness as well as provide reductions during the Ozone Season. Emissions reductions were based on a projected activity and an emissions reduction of 3% from the emission sources impacted.

VOC Calculations

EMISSIONS SCENARIO	VOC EMISSIONS
2007 w/o program	10.067 tpd
2007 w/ program	9.765 tpd

Total daily VOC reductions: *0.302*

Total annual VOC reductions: *Total daily reductions * 153 ozone days/yr=* *46.2 tpy VOC*

NOx Calculations

EMISSIONS SCENARIO	NOx EMISSIONS
2007 w/o program	0.5 tpd
2007 w/ program	0.485

Total daily NOx reductions: *0.015 tpd NOx*

Total annual NOx reductions: *Total daily reductions * 153 days/year =* *2.3 tpy NOx*

Implementation Schedule and Status

Full implementation by 2005 ozone season.

Measure 2: VMT Reduction Programs

Measure Number: 2
Measure Name: VMT Reduction Programs

NOx

Estimated Reductions (tpd)	0.299
Estimated Reductions (tpy)	1.49

VOC

Estimated Reductions (tpd)	0.148
Estimated Reductions (tpy)	0.740

Description:
This strategy combines individual programs/activities designed to reduce vehicle miles of travel (VMT). These include:

· *Enhanced/expanded Ridesharing*
· *Bicycle and Pedestrian Accommondations*
· *Green Space Preservation*
· *Promotion of Mixed Use Development*
· *Promotion of Telecommuting*

Assumptions

· Assume 3% participation and effectiveness.
· Average of 5 high exceedence days for 2002-2003.
· 2007 WFC EAC area inventory shows 4.934 tpd VOC emissions and 9.952 tpd NOx emissions.

Emission Reductions

Uncontrolled VOC Emissions =	4.93	tpd VOC
@ 3% compliance =	4.786	tpd VOC
Total Reductions =	*0.148*	*tpd VOC*
Annual Reductions (VOC) =	0.15 tpd * 5 days per ozone season	
Annual Reductions (VOC) =	*0.740*	*tpy VOC*
Uncontrolled NOx Emissions =	9.952	tpd NOx
@ 3% compliance =	9.653	tpd NOx
Total Reductions =	*0.299*	*tpd NOx*
Annual Reductions (NOx) =	0.3 tpd * 5 days per ozone season	
Annual Reductions (NOx) =	*1.49*	*tpy NOx*

Implementation Schedule and Status

Measure 15: Open Burning Bans/Restrictions

Measure Number: 15
Measure Name: Open Burning Bans/Restrictions

Description:
Establishment of open burning restrictions for land clearing activities during predicted ozone exceedence days.

NOx

Estimated Reductions (tpd)	0.280
Estimated Reductions (tpy)	1.40

Issues

· Measure is enforced by local fire marshals

VOC

Estimated Reductions (tpd)	0.122
Estimated Reductions (tpy)	0.612

Assumptions

· Assume 80% effectiveness of ban.
· Average of 5 high exceedence days for 2002-2003.
· 2007 WFC EAC area inventory shows 0.153 tpd VOC emissions and 0.350 tpd NOx emissions.

Emission Reductions

Uncontrolled VOC Emissions =	0.15	tpd VOC
@ 80% compliance =	0.031	tpd VOC
Total Reductions =	*0.122*	*tpd VOC*
Annual Reductions (VOC) =	0.12 tpd * 5 days per ozone season	
Annual Reductions (VOC) =	*0.612*	*tpy VOC*
Uncontrolled NOx Emissions =	0.350	tpd NOx
@ 80% compliance =	0.070	tpd NOx
Total Reductions =	*0.280*	*tpd NOx*
Annual Reductions (NOx) =	0.28 tpd * 5 days per ozone season	
Annual Reductions (NOx) =	*1.40*	*tpy NOx*

Implementation Schedule and Status

Measure 4: Engine Idling Restrictions

Measure Number: 4
Measure Name: Engine Idling Restrictions

Description:
Adopting truck and school bus engine idling restrictions would reduce some of the emissions contributed by the heavy-duty vehicles and school buses.

NOx

Estimated Reductions (tpd)	0.102
Estimated Reductions (tpy)	26.520

VOC

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

Assumptions

· Assume 2% to 4% reduction in emissions from anti-idling restrictions.
· 2007 emissions inventory for the area shows VOC emissions to be 0.16 tpd from these types of sources.
· 2007 emissions inventory for the area shows NOx emissions to be 5.1 tpd from these types of sources.
· Assume 260 work days/year.

Emission Reductions

Daily Reductions (NOx) = 5.1 tpd * 2% reduction
Daily Reductions (NOx) = 0.102 tpd NOx

Annual Reductions (NOx) = 0.102 tpd * 260 days per year
Annual Reductions (NOx) = 26.5 tpy NOx

Daily Reductions (VOC) = 0.16 tpd * 2% reduction
Daily Reductions (NOx) = 0.003 tpd NOx

Annual Reductions (NOx) = 0.0032 tpd * 260 days per year
Annual Reductions (NOx) = 0.832 tpy NOx

Implementation Schedule and Status

Measure 5: Diesel Retrofits: School Buses

Measure Number: 5
Measure Name: Diesel Retrofits: School Buses

NOx

Estimated Reductions (tpd)	0.001
Estimated Reductions (tpy)	0.24

VOC

Estimated Reductions (tpd)	0.002
Estimated Reductions (tpy)	0.365

CO

Estimated Reductions (tpd)	0.007
Estimated Reductions (tpy)	1.19

Description:
Winchester has agreed to retrofit 10 school buses with oxidation catalysts, and 6 of these buses will also have reflashing for NOx control. Frederick County will retrofit 126 school buses with oxidation catalysts. Some of these buses will also have reflashing for NOx control.

Issues

· Though not calculated here, the catalysts will also result in a PM reduction.

· Immediate benefits will be greatest for oldest buses. However, these buses may be less cost-effective in the long run if they are nearing the end of their useful lives

Assumptions

· Approximately 126 school buses to be retrofitted in Frederic County. 10 school buses to be retrofitted in Winchester. At least 6 will have reflashing.
· For the catalytic oxidizers, assume VOC reduction of 50%; a CO reduction of 40%; and a PM reduction of 20%.
· For the reflashing technology, assume a NOx reduction of 25%.
· The average diesel school bus emission factors are 0.4866 g/mile VOC, 14.3896 g/mile NOx, 1.9771 g/mile CO.
· Average annual mileage is assumed to be 10,000 miles/year/bus.
· School days are assumed to be 180 days/year.
· Assume average fuel economy is 6.5 mpg

Emission Reductions

Annual Reductions (VOC) = (136 buses*10,000 miles/yr/bus)*0.4866 g/mile*1 ton/906000 gr*50% reduction
Annual Reductions (VOC) = 0.365 tpy VOC

Daily Reductions (VOC) = Annual Reductions/180 days/year
Daily Reductions (VOC) = 0.002 tpd VOC

Annual Reductions (NOx) = 6 buses*10000 miles/year*14.3896 g/mile*25% reduction*1ton/906000 gr
Annual Reductions (NOx) = 0.24 tpy NOx

Daily Reductions (NOx) = Annual Reduction/180 days/year
Daily Reductions (NOx) = 0.001 tpd NOx

Annual Reductions (CO) = (136 buses*10000 miles/yr)*1.9771 g/mile*1 ton/906000 gr*40% reduction
Annual Reductions (CO) = 1.19 tpy CO

Daily Reductions (CO) = Annual Reduction/180 days/year
Daily Reductions (CO) = 0.007 tpd CO

Implementation Schedule and Status

Winchester has a contract with Cummins Atlantic to retrofit 10 buses with catalytic oxidizers and retrofit 6 with reflashing. Delivery of the equipment should be in December of 2004. Frederick County is planning to put out for bid a contract for 126 buses, with a portion of them to be equipped with reflashing as well as catalytic oxidizers. The reflashing use is above and beyond what was in the original EAC.

Measure 6: Voluntary Industrial Reductions

Measure Number: 6
Measure Name: Voluntary Industrial Reductions

NOx

Estimated Reductions (tpd)	NA
Estimated Reductions (tpy)	NA

VOC

Estimated Reductions (tpd)	NA
Estimated Reductions (tpy)	NA

Description:

Implementing voluntary industrial reductions through some EPA voluntary programs, such as Pollution Prevention and Environmental Management Systems.

Assumptions/Emission Reductions

· Due to the nature of the program, it is not possible to quantify reductions of emissions for this strategy.

Implementation Schedule and Status

Measure State #6: State Cutback Asphalt Regulation

Measure Number: State #6
Measure Name: State Cutback Asphalt Regulation

Description:
This measure involves the restriction of the use of cutback asphalt in the WFC area.

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.001
Estimated Reductions (tpy)	0.292

Assumptions

· The emission inventory for the WFC area show uncontrolled emissions from this source category in 2007 is 0.001 tons VOC/day.

· Assume a 100% control efficiency, and an 80% rule effectiveness.

Emission Reductions

Daily VOC Reductions = 0.001 tons/day * 100% control efficiency * 80% RE
Daily VOC Reductions = 0.001 tpd VOC
Annual VOC Reductions = 0.001 tons/day * 100% control efficiency * 80% RE * 365 days/year
Annual VOC Reductions = 0.292 tpy VOC

Implementation Schedule and Status

This program will be required by state regulation beginning in 2005.

Measure State #13: CTG RACT

Measure Number: State #13
Measure Name: CTG RACT

Description:
Applies CTG RACT for NOx and VOC to selected point and area sources in the WFC area.

NOx

Estimated Reductions (tpd)	0.000
Estimated Reductions (tpy)	0.0

Issues

· Requirements will be in state regulations by 2005.

VOC

Estimated Reductions (tpd)	0.793
Estimated Reductions (tpy)	289.4

Assumptions

· The emissions inventory for the area show uncontrolled emissions from these facilities to be 6.492 tons/day VOC and 1.075 tons/day NOx.

· The projected area source emissions inventory show uncontrolled emissions from these facilities to be 0.706 tons/day VOC.

· Reductions are based on source specific estimates for selected major sources.

Emission Reductions

VOC Calculations		
EMISSIONS SCENARIO	VOC EMISSIONS FROM POINT SOURCES	
2007 w/o RACT	6.492 tpd	
2007 w/ RACT	6.068 tpd	
Total daily VOC reductions:	*0.424 tpd VOC from Point Sources*	
	VOC EMISSIONS FROM AREA SOURCES	
2007 w/o RACT	0.706 tpd	
2007 w/ RACT	0.337 tpd	
Total daily VOC reductions:	*0.369 tpd VOC from Area Sources*	
Total daily VOC reductions:	*0.793 tpd VOC from Point and Area Sources*	
Total annual VOC reductions:	*Total daily reductions * 365 days/year =*	*289.4 tpy VOC*
NOx Calculations		
EMISSIONS SCENARIO	NOx EMISSIONS	
2007 w/o RACT	1.075	
2007 w/RACT	1.075	
Total daily NOx reductions:	*0.0 tpd NOx*	
Total annual NOx reductions:	*Total daily reductions * 365 days/year =*	*0.0 tpy VOC*

Implementation Schedule and Status

· This program will be required by state regulation beginning in 2005.

Measure Federal #8: Federal Small Gasoline Engine Standards

Measure Number: Federal #8
Measure Name: Federal Small Gasoline Engine Standards

Description:

This measure involves EPA's establishment of engine emission standards for small spark ignition gasoline powered nonroad engines. These engine standards have been implemented in two phases by EPA and covers both handheld and nonhandheld equipment.

NOx

Estimated Reductions (tpd)	0.027
Estimated Reductions (tpy)	9.86

VOC

Estimated Reductions (tpd)	0.812
Estimated Reductions (tpy)	296.4

Assumptions

· Emissions data below originate from the Mobile6 model for the WFC area.

Emission Reductions

VOC Calculations		
EMISSIONS SCENARIO	VOC EMISSIONS	
2002 Base Year	1.745 tpd	
2007 w/o control	1.928 tpd	
2007 w/ control	1.116 tpd	
Total daily VOC reductions:	*0.812 tpd VOC*	
Total annual VOC reductions:	*Total daily reductions * 365 days/year =*	*296.4 tpy VOC*

NOx Calculations		
EMISSIONS SCENARIO	NOx EMISSIONS	
2002 Base Year	0.145 tpd	
2007 w/o control	0.160 tpd	
2007 w/ control	0.133 tpd	
Total daily NOx reductions:	*0.027 tpd NOx*	
Total annual NOx reductions:	*Total daily reductions * 365 days/year =*	*9.86 tpy VOC*

Implementation Schedule and Status

Federal implementation schedule.

Measure Federal #8: Federal Nonroad Diesel Engine Standards

Measure Number: Federal #8
Measure Name: Federal Nonroad Diesel Engine Standards

Description:
This measure involves emission reductions from EPA emission standards for nonroad compression-ignition (diesel powered) utility engines. This measure affects diesel powered construction equipment, industrial equipment and other equipment rated at or above 37 kilowatts (about 50 horsepower).

NOx

Estimated Reductions (tpd)	0.276
Estimated Reductions (tpy)	100.7

VOC

Estimated Reductions (tpd)	0.047
Estimated Reductions (tpy)	17.2

Assumptions

· Emission calculations originate from the Mobile6 model of the WFC area.

Emission Reductions

VOC Calculations		
EMISSIONS SCENARIO	VOC EMISSIONS	
2002 Base Year	0.143 tpd	
2007 w/o control	0.167 tpd	
2007 w/ control	0.120 tpd	
Total daily VOC reductions:	*0.047 tpd VOC*	
Total annual VOC reductions:	*Total daily reductions * 365 days/year =*	*17.2 tpy VOC*

NOx Calculations		
EMISSIONS SCENARIO	NOx EMISSIONS	
2002 Base Year	1.164 tpd	
2007 w/o control	1.361 tpd	
2007 w/ control	1.085 tpd	
Total daily NOx reductions:	*0.276 tpd NOx*	
Total annual NOx reductions:	*Total daily reductions * 365 days/year =*	*100.74 tpy VOC*

Implementation Schedule and Status

Federal implementation schedule.

Measure Federal #9: Federal Locomotive Engine Standards

Measure Number: Federal #9
Measure Name: Federal Locomotive Engine Standards

Description:
This measure involves NOx emission standards for locomotive engines manufactured or remanufactured after 2001. This program includes all locomotives originally manufactured from 2002 to 2004, and it also includes the remanufacture of all engines built since 1973.

NOx

Estimated Reductions (tpd)	0.02
Estimated Reductions (tpy)	7.1

VOC

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

Assumptions

· The emission inventory for the WFC area shows uncontrolled emissions from these sources are 0.046 tons NOx/day uncontrolled in 2007.

· Assume a 42% control efficiency.

Emission Reductions

Daily NOx Reductions = 0.046 tons/day * 42% control efficiency
Daily NOx Reductions = 0.019 tpd NOx
Annual NOx Reductions = 0.046 tons/day * 42% control efficiency*365 days/year
Annual NOx Reductions = 7.1 tpy NOx

Implementation Schedule and Status

Federal implementation schedule.

Measure Federal #11: Federal Spark Ignition Marine Engine Standards

Measure Number: Federal #11

Measure Name: Federal Spark Ignition Marine Engine Standards

Description:
This measure involves VOC emission standards for spark ignition marine engines including outboard engines, personal watercraft engines, and jet boat engines.

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.004
Estimated Reductions (tpy)	1.46

Assumptions

· Emission calculations originate from the Mobile6 model for the WFC area.

Emission Reductions

VOC Calculations

EMISSIONS SCENARIO	VOC EMISSIONS	
2002 Base Year	0.015 tpd	
2007 w/o control	0.016 tpd	
2007 w/ control	0.012 tpd	
Total daily VOC reductions:	*0.004 tpd VOC*	
Total annual VOC reductions:	*Total daily reductions * 365 days/year =*	*1.46 tpy VOC*

Implementation Schedule and Status

Federal implementation schedule.

Measure Federal #10: Federal Large Gasoline Engine Standards

Measure Number: Federal #10

Measure Name: Federal Large Gasoline Engine Standards

Description:

This measure involves emission standards for large industrial spark-ignition engines, recreational vehicles, and diesel marine engines.

NOx

Estimated Reductions (tpd)	0.248
Estimated Reductions (tpy)	90.5

VOC

Estimated Reductions (tpd)	0.068
Estimated Reductions (tpy)	24.8

Assumptions

· Emission calculations originate from the Mobile6 model for the WFC area.

Emission Reductions

VOC Calculations

EMISSIONS SCENARIO	VOC EMISSIONS	
2002 Base Year	0.141 tpd	
2007 w/o control	0.164 tpd	
2007 w/ control	0.096 tpd	
Total daily VOC reductions:	*0.068 tpd VOC*	
Total annual VOC reductions:	*Total daily reductions * 365 days/year =*	*24.8 tpy VOC*

NOx Calculations

EMISSIONS SCENARIO	NOx EMISSIONS	
2002 Base Year	0.503 tpd	
2007 w/o control	0.585 tpd	
2007 w/ control	0.337 tpd	
Total daily NOx reductions:	*0.248 tpd NOx*	
Total annual NOx reductions:	*Total daily reductions * 365 days/year =*	*90.5 tpy VOC*

Implementation Schedule and Status

Federal implementation schedule.

Measure Federal #12: Federal Onroad Motor Vehicle Emissions Standards

Measure Number: Federal #12

Measure Name: Federal Onroad Motor Vehicle Emissions Standards

Description:

The following national motor vehicle emission reduction measures have or will be implemented that will reduce mobile source emissions in the Roanoke area. These measures include:

* Federal Tier 1 Vehicle Standards
* National Low Emissions Vehicle Standards
* Federal Tier 2 Vehicle & Low Sulfur Fuel Standards
* Heavy Duty Diesel Engine Standards

NOx

Estimated Reductions (tpd)	5.14
Estimated Reductions (tpy)	1875.4

VOC

Estimated Reductions (tpd)	3.11
Estimated Reductions (tpy)	1136.6

Assumptions

· The following calculations are based on the EPA Mobile6 emissions model for this area of Virginia.

Emission Reductions

VOC Calculations

EMISSIONS SCENARIO	VOC EMISSIONS	
1999 Base Year	8.047 tpd	
2007 w/ Tier 1 & NLEV	5.373 tpd	
2007 w/ Tier 1&2, NLEV	4.935 tpd	
2007 w/ Tier 1&2, NLEV, & HDDV	4.934 tpd	
Total daily VOC reductions:	*3.114*	
Total annual VOC reductions:	*Total daily reductions * 365 days/year =*	*1136.6 tpy VOC*

NOx Calculations

EMISSIONS SCENARIO	NOx EMISSIONS	
1999 Base Year	15.090 tpd	
2007 w/ Tier 1 & NLEV	11.888 tpd	
2007 w/ Tier 1&2, NLEV	10.063 tpd	
2007 w/ Tier 1&2, NLEV, & HDDV	9.952 tpd	
Total daily NOx reductions:	*5.138 tpd NOx*	
Total annual NOx reductions:	*Total daily reductions * 365 days/year =*	*1875.4 tpy VOC*

Implementation Schedule and Status

Federal implementation schedule.

Federal Area Source Measure #1: Architectural/Maintenance Coatings

Measure Number: Federal Area Source Measure #1

Measure Name: AIM Rule

Description:
This measure involves the federal rule for Architectural and Industrial Maintenance (AIM) coatings, which restricts the VOC content of architectural, industrial maintenance, special industrial, and highway markings surface coatings sold and used in the area

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.134
Estimated Reductions (tpy)	48.8

Assumptions

· The area source emission inventory for the WFC area show uncontrolled emissions from these area sources are 0.669 tons VOC/day.

· Assume a 20% control efficiency (range is 3% to 40%)

Emission Reductions

Daily VOC Reductions = 0.669 tons/day * 20% control efficiency

Daily VOC Reductions = 0.134 tpd VOC

Annual VOC Reductions = 0.669 tons/day * 20% control efficiency*365 days/year

Annual VOC Reductions = 48.8 tpy VOC

Implementation Schedule and Status

· Federal measure - implemented.

Measure Federal Area Source Measure #2: Consumer/Commercial Products

Measure Number: Federal Area Source Measure #2
Measure Name: Consumer/Commercial Products

Description:
This measure involves the federal rule for commercial and consumer products, which restricts the VOC content of these products sold and used in the WFC area.

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.056
Estimated Reductions (tpy)	20.4

Assumptions

· The area source emission inventory for the WFC area show uncontrolled emissions from these area sources are 0.558 tons VOC/day.

· Assume a 10% control efficiency.

Emission Reductions

Daily VOC Reductions = 0.558 tons/day * 10% control efficiency
Daily VOC Reductions = 0.056 tpd VOC
Annual VOC Reductions = 0.558 tons/day * 10% control efficiency*365 days/year
Annual VOC Reductions = 20.4 tpy VOC

Implementation Schedule and Status

· Federal measure - implemented.

Measure Federal Area Source Measure #3: Metal Cleaning Solvent Controls

Measure Number: Federal Area Source Measure #3
Measure Name: Metal Cleaning Solvent Controls

Description:
This measure involves the federal rule for metal cleaning solvents, which restricts the VOC content of these solvents sold and used in the Roanoke area.

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.056
Estimated Reductions (tpy)	20.5

Assumptions

· The area source emission inventory for the WFC area show uncontrolled emissions from these area sources are 0.563 tons VOC/day.

· Assume a 10% control efficiency.

Emission Reductions

Daily VOC Reductions = 0.563 tons/day * 10% control efficiency
Daily VOC Reductions = 0.056 tpd VOC
Annual VOC Reductions = 0.563 tons/day * 10% control efficiency*365 days/year
Annual VOC Reductions = 20.5 tpy VOC

Implementation Schedule and Status

· Federal measure - implemented.

Measure Federal Area Source Measure #5: Motor Vehicle Repair and Refinishing

Measure Number: Federal Area Source Measure #5
Measure Name: Motor Vehicle Repair and Refinishing

Description:
This measure involves the federal rule for motor vehicle refinishing paint, which restricts the VOC content of these paints sold and used in the WFC area.

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.003
Estimated Reductions (tpy)	1.05

Assumptions

· The area source inventory for 2007 for the WFC area shows the uncontrolled emissions from these source categories to be 0.008 tpd VOC.

· Assume a 36% control efficiency.

Emission Reductions

Daily VOC Reductions = 0.008 tons/day * 36% control efficiency
Daily VOC Reductions = 0.003 tpd VOC
Annual VOC Reductions = 0.008 tons/day * 36% control efficiency*365 days/year
Annual VOC Reductions = 1.05 tpy VOC

Implementation Schedule and Status

· Federal measure - implemented.

Measure Contingency #1: OTC AIM Rule

Measure Number: Contingency #1
Measure Name: OTC AIM Rule

Description:
This measure involves the federal rule for Architectural and Industrial Maintenance (AIM) coatings, which further restricts the VOC content of architectural, industrial maintenance, special industrial, and highway markings surface coatings sold and used in the Winchester/Frederick area.

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.166
Estimated Reductions (tpy)	60.5

Assumptions

· The area source emission inventory for the WFC area show uncontrolled emissions from these area sources are 0.535 tons VOC/day.

· Assume a 31% control efficiency

Emission Reductions

Daily VOC Reductions = 0.535 tons/day * 20% control
Daily VOC Reductions = 0.166 tpd VOC
Annual VOC Reductions = 0.535 tons/day * 31% control efficiency*365 days/year
Annual VOC Reductions = 60.5 tpy VOC

Implementation Schedule and Status

· Contingency measure.

Measure Contingency #2: Consumer/Commercial Products

Measure Number: Contingency #2
Measure Name: Consumer/Commercial Products

Description:
This measure involves the federal rule for commercial and consumer products, which further restricts the VOC content of these products sold and used in the WFC area.

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.071
Estimated Reductions (tpy)	26.0

Assumptions

· The area source emission inventory for the WFC area show uncontrolled emissions from these area sources are 0.502 tons VOC/day.

· Assume a 14.2% control efficiency.

Emission Reductions

Daily VOC Reductions = 0.502 tons/day * 10% control efficiency
Daily VOC Reductions = 0.071 tpd VOC
Annual VOC Reductions = 0.502 tons/day * 14.2% control efficiency*365 days/year
Annual VOC Reductions = 26.0 tpy VOC

Implementation Schedule and Status

· Contingency measure.

Measure Contingency #3: Metal Cleaning Solvent Controls

Measure Number: Contingency #3
Measure Name: Metal Cleaning Solvent Controls

Description:
This measure involves the federal rule for metal cleaning solvents, which further restricts the VOC content of these solvents sold and used in the Roanoke area.

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.335
Estimated Reductions (tpy)	122.1

Assumptions

· The area source emission inventory for the WFC area show uncontrolled emissions from these area sources are 0.507 tons VOC/day.

· Assume a 66% control efficiency.

Emission Reductions

Daily VOC Reductions = 0.507 tons/day * 66% control efficiency
Daily VOC Reductions = 0.335 tpd VOC
Annual VOC Reductions = 0.507 tons/day * 66% control efficiency*365 days/year
Annual VOC Reductions = 122.1 tpy VOC

Implementation Schedule and Status

Contingency measure.

Measure Contingency #4: Motor Vehicle Repair and Refinishing

Measure Number: Contingency #4
Measure Name: Motor Vehicle Repair and Refinishing

Description:
This measure involves the federal rule for motor vehicle refinishing paint, which further restricts the VOC content of these paints sold and used in the WFC area.

NOx

Estimated Reductions (tpd)	N/A
Estimated Reductions (tpy)	N/A

VOC

Estimated Reductions (tpd)	0.002
Estimated Reductions (tpy)	0.69

Assumptions

· The area source inventory for 2007 for the WFC area shows the uncontrolled emissions from these source categories to be 0.005 tpd VOC.

· Assume a 38% control efficiency.

Emission Reductions

Daily VOC Reductions = 0.005 tons/day * 38% control efficiency
Daily VOC Reductions = 0.002 tpd VOC
Annual VOC Reductions = 0.005 tons/day * 38% control efficiency*365 days/year
Annual VOC Reductions = 0.69 tpy VOC

Implementation Schedule and Status

Contingency measure.

APPENDIX C

Virginia, West Virginia and Maryland Early Action Compact Modeling Report

Final Report

Virginia Department of Environmental Quality

December 31, 2004

Executive Summary

The purposes of this report are to document the CAMx modeling results for the Early Action Compact (EAC) projects of Virginia, West Virginia and Maryland and to present the calculation of relative reduction factors and future year 8-hour ozone design values associated with monitors in the concerned EAC areas. This modeling project covers five EAC areas in Virginia, West Virginia and Maryland. The Virginia Department of Environmental Quality is the lead agency in conducting this modeling study. The August 8-18, 1999 ozone episode was selected and used for the EAC modeling project. The Comprehensive Air quality Model with extensions version 4.02 (CAMx) model was selected and used for the modeling project. The National Center for Atmospheric Research (NCAR)/ Penn State Mesoscale Model, MM5, was employed to provide spatial and temporal distribution of meteorological fields to the CAMx air quality model. The MM5 simulation was performed with 3 nested domains, with respective grid resolution of 108 km, 36 km, and 12 km. The Sparse Matrix Operator Kernel Emissions (SMOKE) emissions model was used to process emission inventories into the formatted emission files required by the CAMx air quality model.

The CAMx base case model performance has been evaluated using statistical and graphical metrics for both 36 km and 12 km resolution modeling domains. The CAMx photochemical model meets or exceeds established U.S. EPA performance criteria for attainment demonstrations. In some cases such as large urban areas, finer resolution of 4 km grid cells may be required to better account for local emission and ozone variations. However, after further evaluation and discussion, it was decided that 4 km grid resolution for this modeling exercise was not warranted because:

1. This and other regional modeling efforts have shown that there is much less local variation in predicted ozone levels in "rural" areas and that finer resolution is not needed.
2. Local ozone and emissions gradients (variations) in the EAC areas are relatively small.

The 2007 future emission inventories were developed for the modeling domains. The future year CAMx runs were performed with the same model configuration and meteorological fields developed for the base case runs. Relative reduction factors and future year 8-hour ozone design values at four monitors were calculated in accordance with the U.S. EPA's *Draft Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-Hour Ozone NAAQS (1999)* and the U.S. EPA's *Protocol for Early Action Compacts (2003)*. The results indicate that the attainment test is passed at all five monitors representing five EAC areas in three states during this modeling episode.

1. Introduction

In December of 2002, the Commonwealth of Virginia, the State of West Virginia, the State of Maryland, along with the local jurisdictions involved, signed and submitted ozone Early Action Compacts (EACs) to the U.S. EPA. The compacts were in turn signed by the EPA to complete the approval process. The purposes of the EACs are to defer the effective date of nonattainment designations for the involved local areas if violations of the 8-hour ozone NAAQS occur in the future. The EACs cover the following geographic areas:

The Roanoke, Virginia Metropolitan Statistical Area (Botetourt County, Roanoke County, Roanoke City, Salem City, and the Town of Vinton)
The Northern Shenandoah Valley Jurisdictions of Frederick County and Winchester City
Washington County, Maryland
Berkley County, West Virginia
Jefferson County, West Virginia

The EAC processes require photochemical dispersion modeling demonstrations to show attainment of the 8-hour ozone standard by December 2007.

The lead agency in the EAC modeling process for the above mentioned EAC areas is the Virginia Department of Environmental Quality (DEQ). Providing assistance to the DEQ are Roanoke/Alleghany Regional Commission (RVARC), local governments, the Maryland Department of Environment, the West Virginia Division of Air Quality, U.S. EPA and the University of North Carolina. The modeling study follows *Air Quality Modeling Analysis for Virginia, West Virginia and Maryland Early Action Ozone Compacts: Modeling Protocol, Episode Selection, and Domain Definition* prepared by Virginia Department of Environmental Quality.

This report documents photochemical modeling study results for 1999 base case and 2007 future case for the EAC areas and demonstrates attainment of the 8-hour ozone standards by all the above mentioned EAC areas by December 2007.

2. Episode Days for Modeling

DEQ recommended eleven episode days for simulations based on the observations of elevated 8-hour ozone concentrations. The episode days are from August 8 to August 18, 1999 wherein high ozone concentrations were measured in the six EAC areas. August 12 and August 13 are selected as primary episode days for 8-hour ozone attainment demonstration.

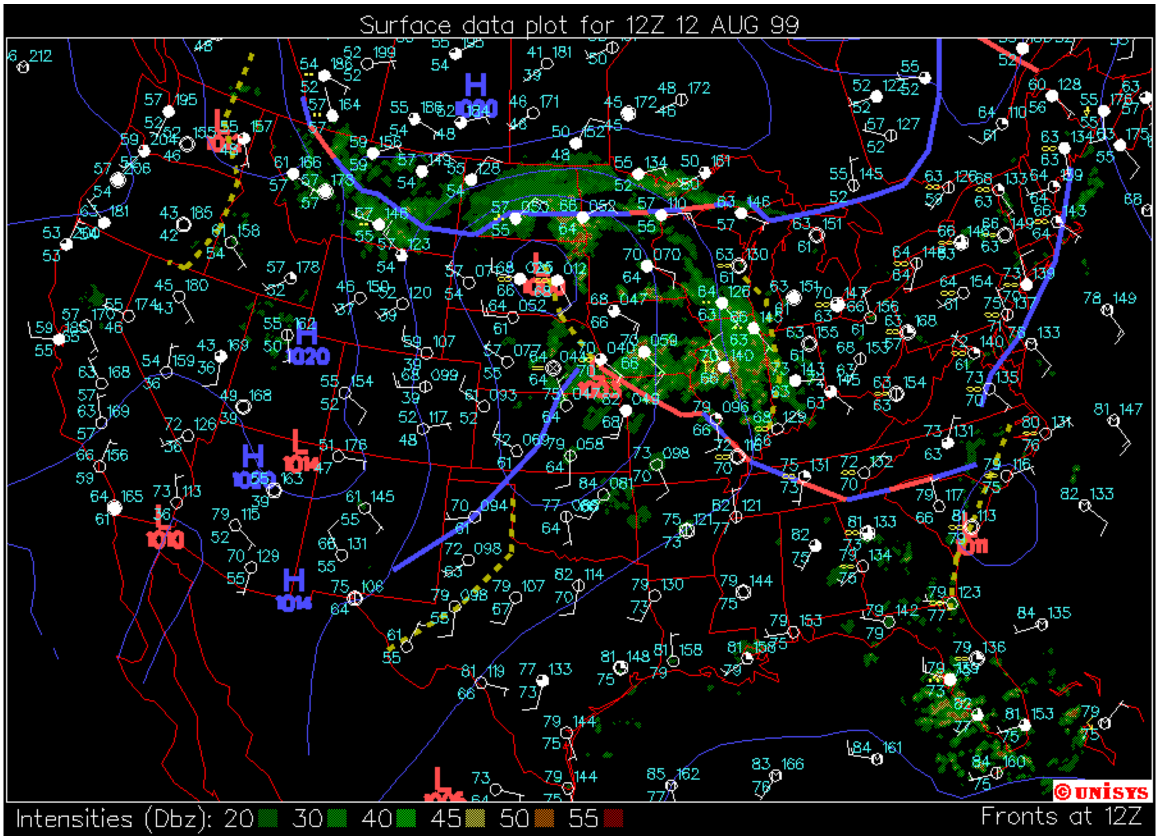
The ozone episode of August 12-13, 1999 was typical of a regional episode in the area. Eight-hour average ozone concentrations peaked at 85 ppb and 87 ppb at Frederick County and Vinton, Virginia, respectively on August 12th. The eight-hour average at

Vinton reached 91 ppb on August 13th. Both concentrations were close to the 2001-2003 eight-hour average design values (85 ppb at both locations). Highest eight-hour averages occurred in Northern Virginia, peaking at 115 ppb on August 12th.
August 12th:

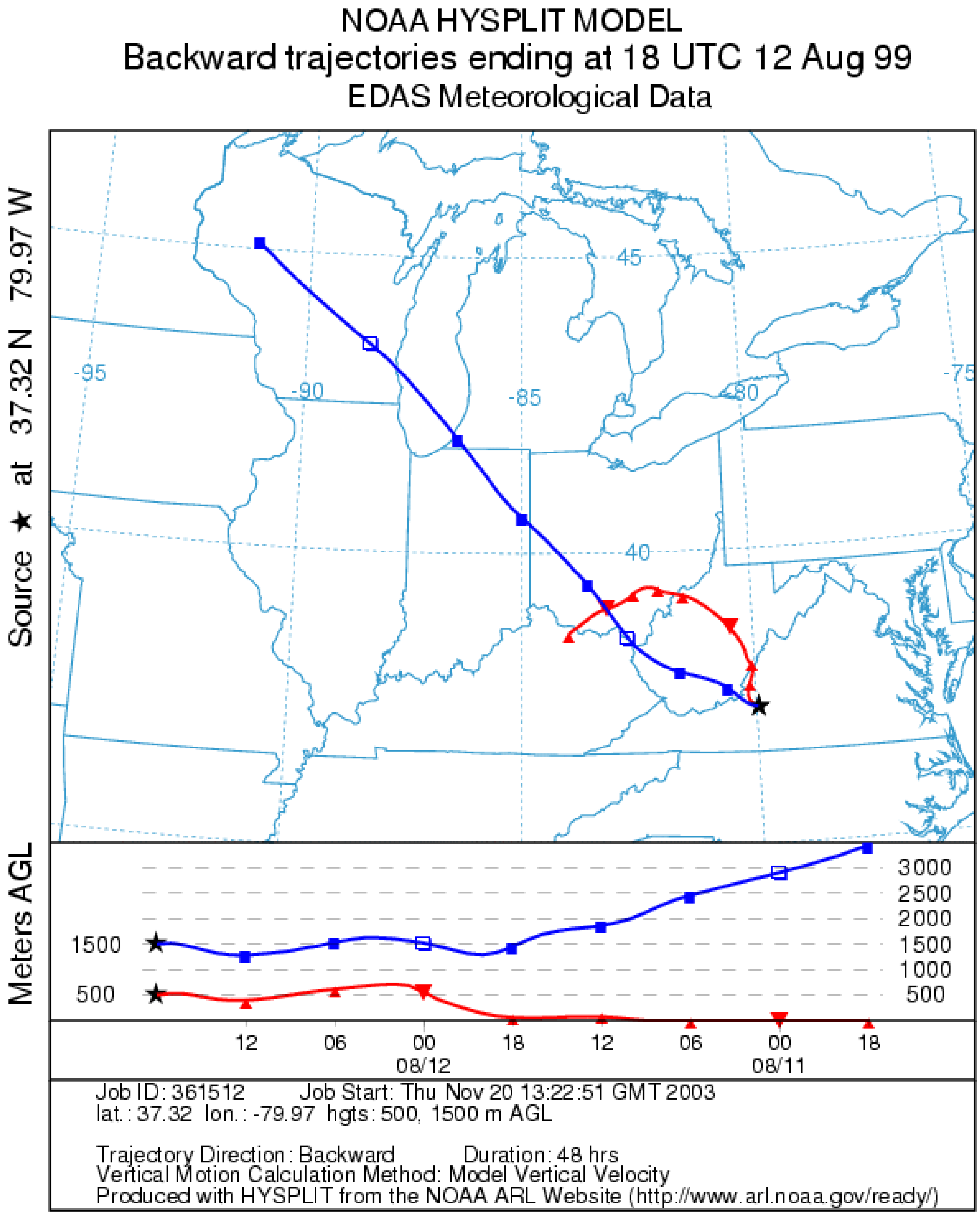
The surface weather map (Figure 2-1) on the morning of August 12th indicated a trough of low pressure extending from coastal New England, through the Delmarva region into central Virginia. South and east of the trough, surface winds were generally from the southeast and higher dew point temperatures, indicative of maritime air. West of the trough, surface winds were calm or light 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. Forty-eight hour 500 and 1500 meter back trajectories for Roanoke and Winchester (18z, 2:00 pm EDT; Figures 2-2 and 2-3) ending that afternoon indicated that air passed over the Ohio River Valley and West Virginia; a typical high ozone, regional air flow pattern. The evening (00z, August 13, 8:00 pm EDT, August 12) surface weather map (Figure 2-4) 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:

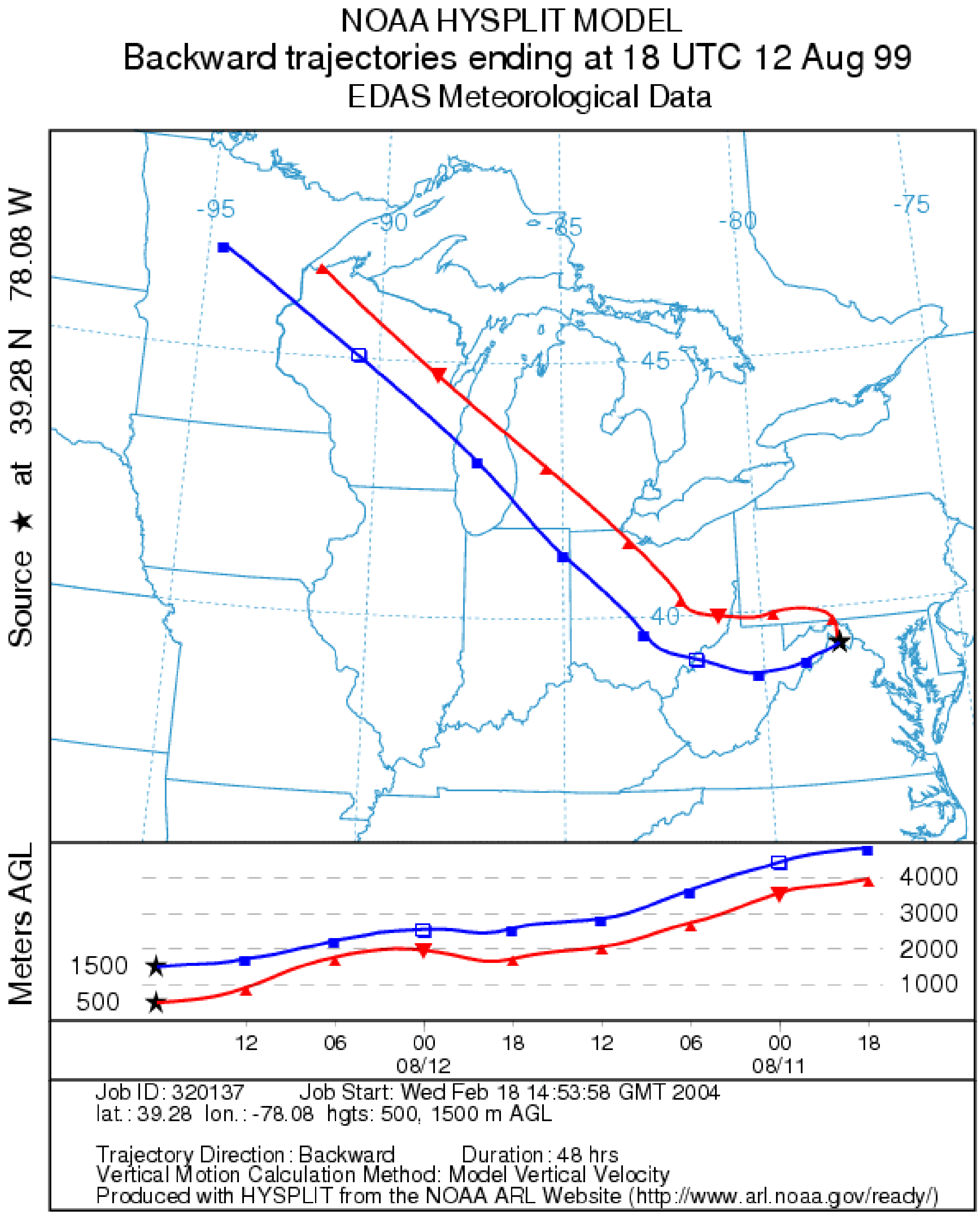
The surface weather map on the morning of August 13th (Figure 2-5) indicated the trough extended from Washington, DC through central Virginia into central North and South Carolina. Again, higher dew point temperatures and southerly winds east of the trough indicated maritime air. Lower dew points and calm winds west of the trough indicated the presence of a continental air mass. Forty-eight hour 500 and 1500 meter back trajectories for Roanoke (Figure 2-6) ending that afternoon originated from the Great Smokey Mountains region of northeastern Tennessee and north central Tennessee, respectively. Forty-eight hour 500 and 1500 meter back trajectories for Winchester ending that afternoon are shown in Figure 2-7. The 500 meter trajectory originated in West Virginia, stagnating and looping over west-central Virginia. The 1500 meter trajectory passed over the Ohio River Valley and West Virginia.. The surface trough separating the maritime air from the continental air persisted into the evening (Figure 2-8). High temperatures reached the mid-to-upper 90s in the region.



Surface data plot for 12z, August 12, 1999.
Figure 2-1.

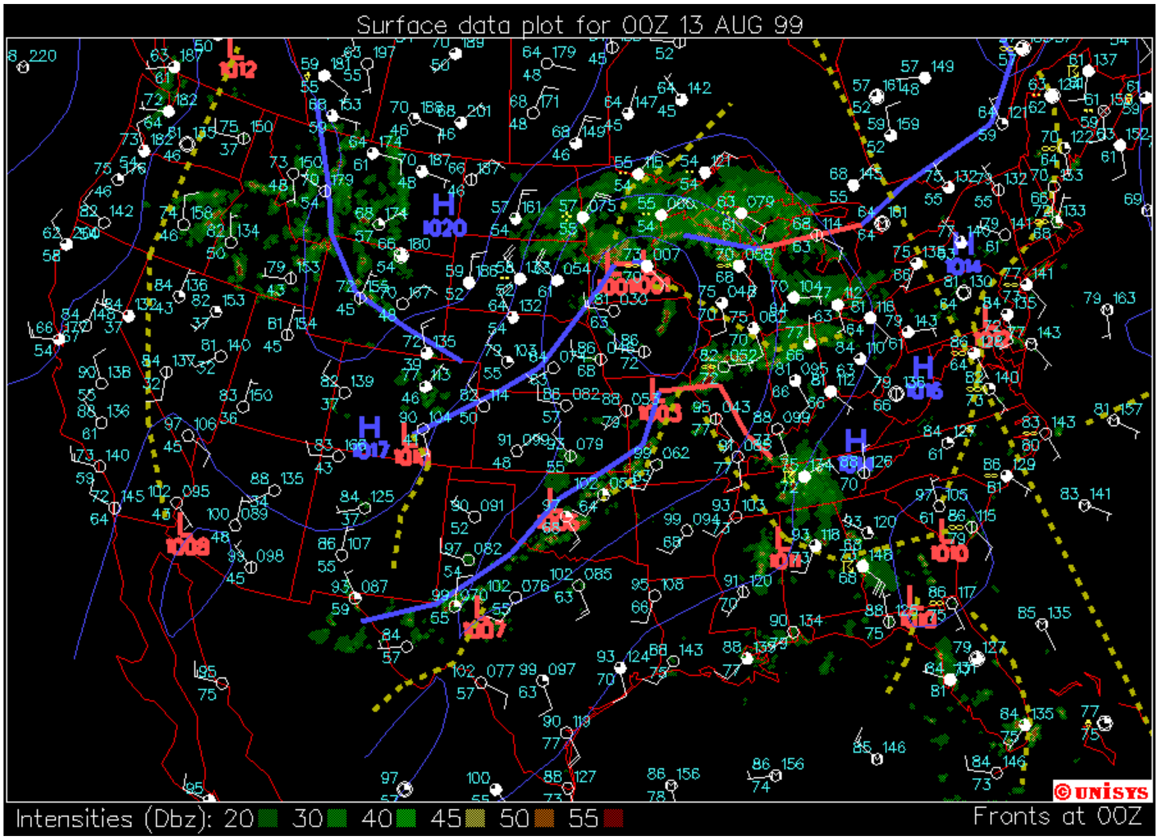


48-hour NOAA HYSPLIT model back trajectory for Roanoke, 18z, August 12, 1999.
Figure 2-2.

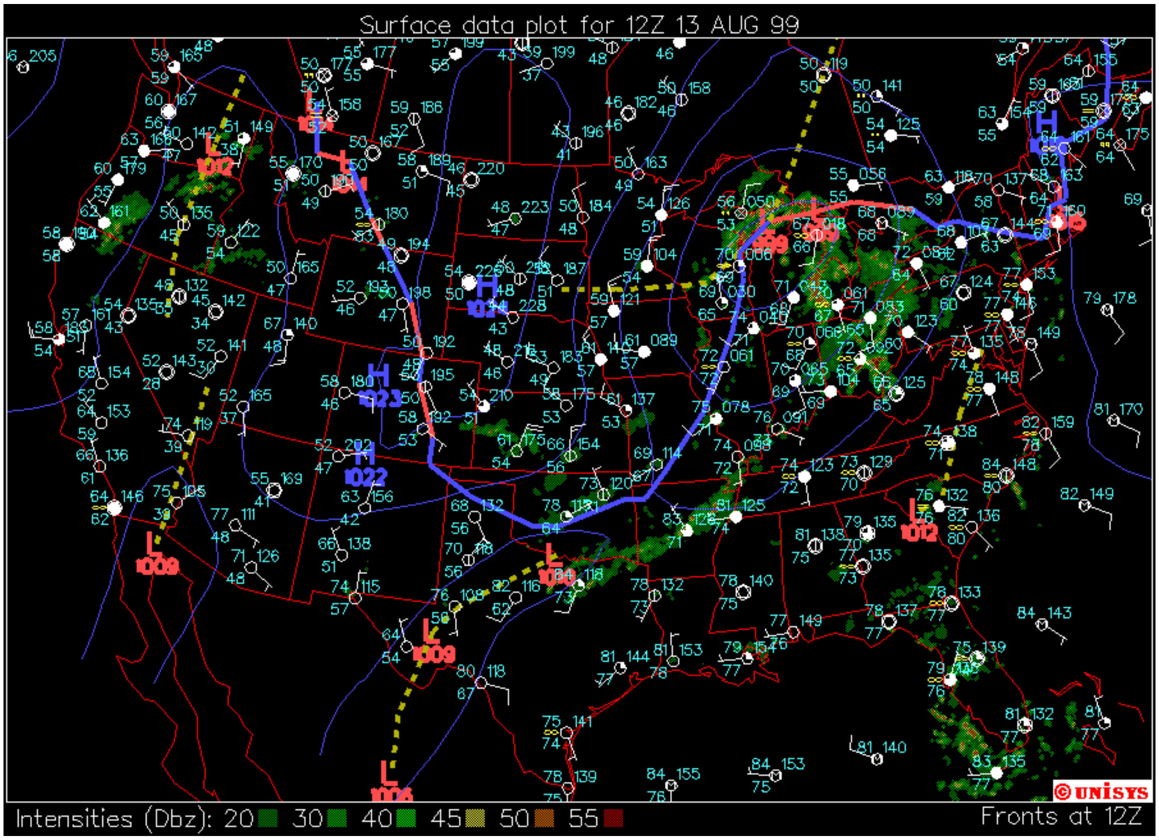


48-hour NOAA HYSPLIT model back trajectory for Winchester, 18z, August 12, 1999.

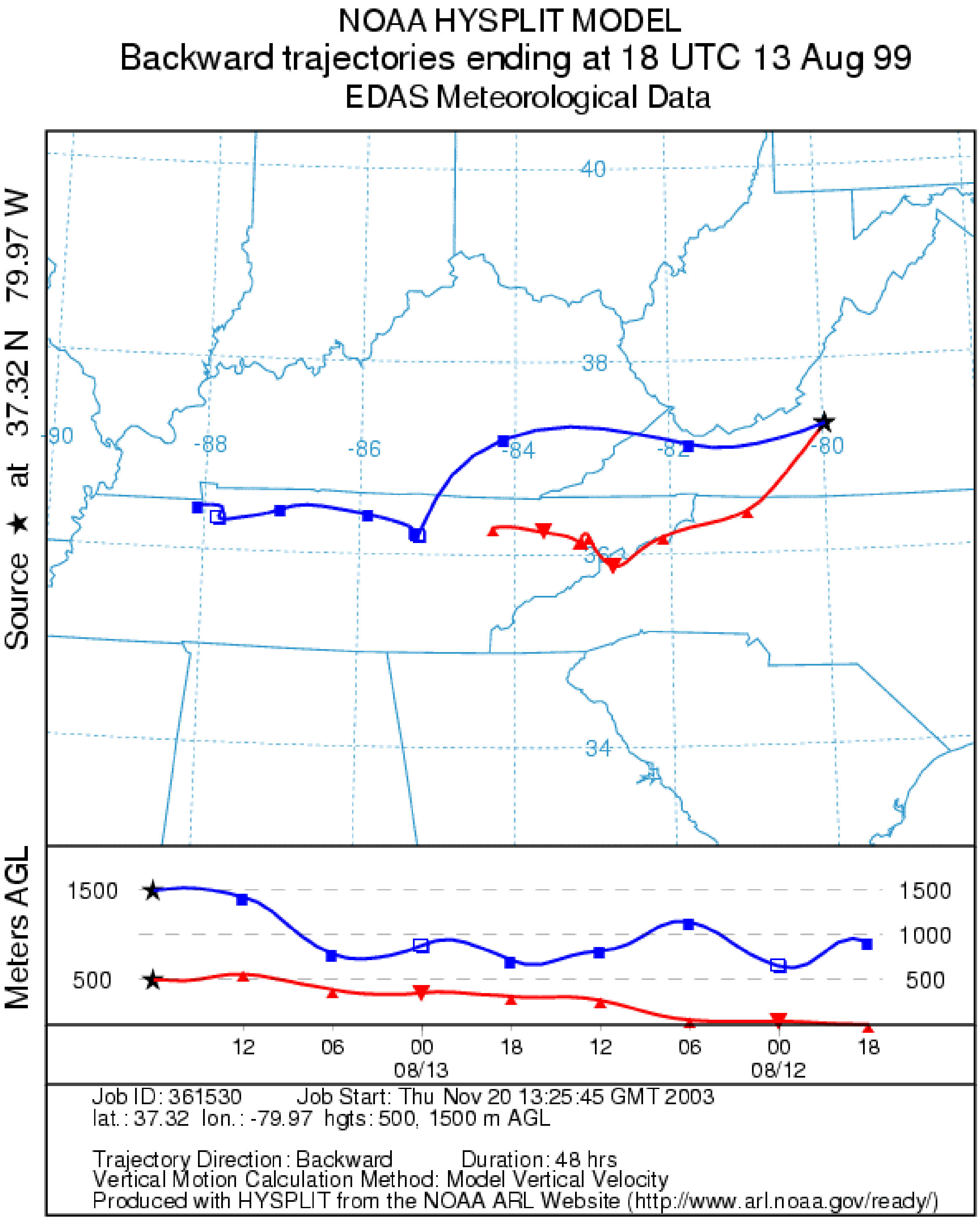
Figure 2-3.



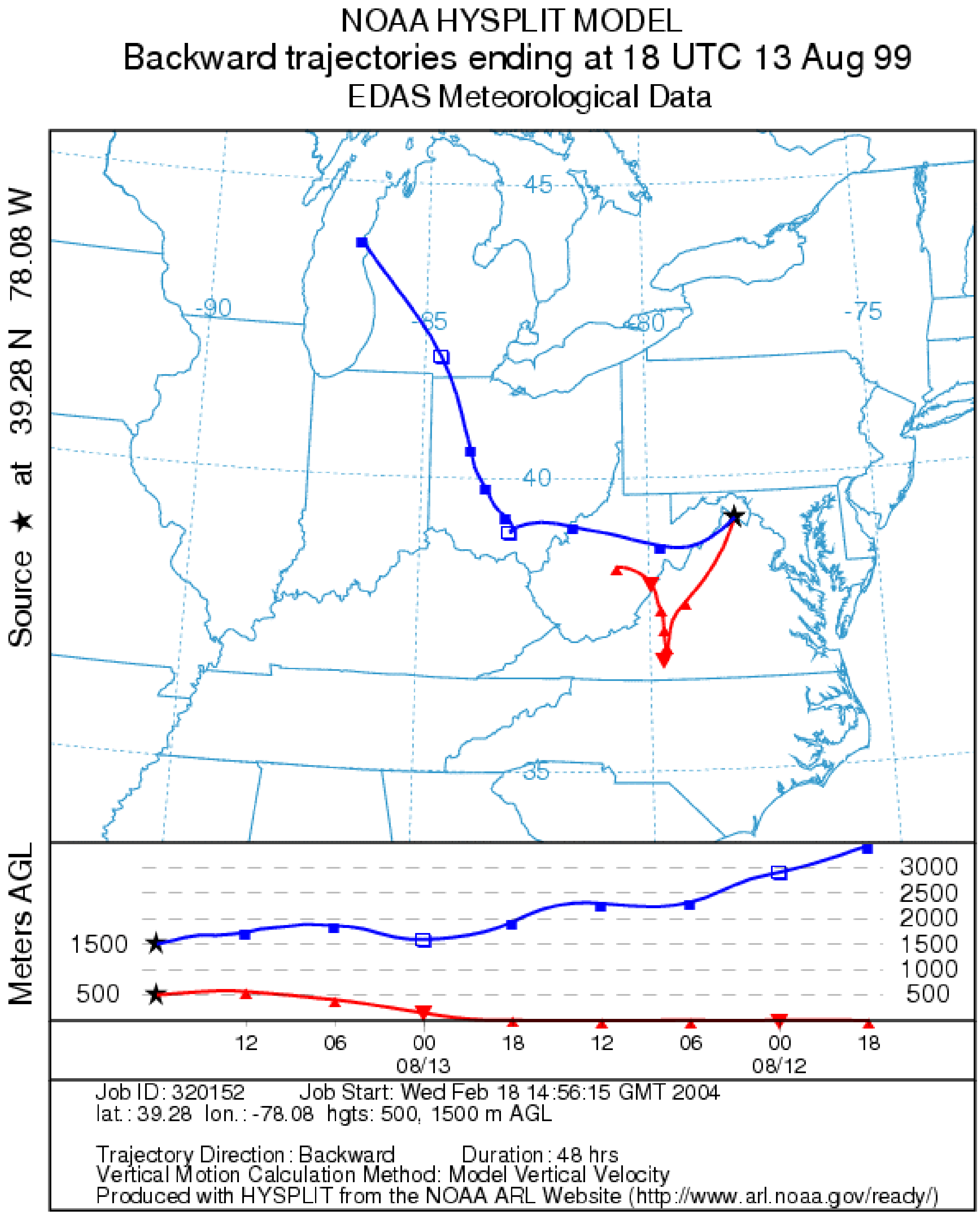
Surface data plot for 00z, August 13, 1999.
Figure 2-4.



Surface data plot for 12z, August 13, 1999.
Figure 2-5.

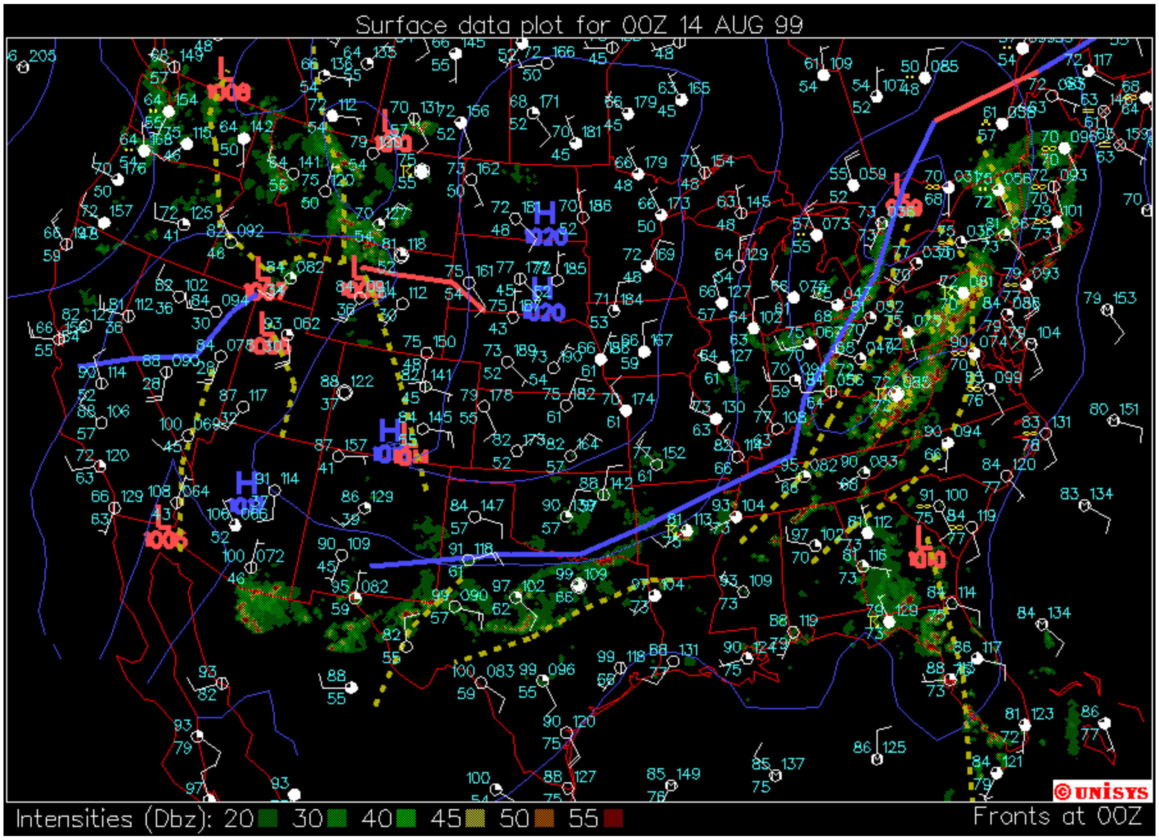


48-hour NOAA HYSPLIT model back trajectory for Roanoke, 18z, August 13, 1999.
Figure 2-6.



48-hour NOAA HYSPLIT model back trajectory for Winchester, 18z, August 13, 1999.

Figure 2-7.



Surface data plot for 00z, August 14, 1999.
Figure 2-8.

3. Emission Inventory and Processing

3.1 Emission Inventories

Emission inventories were required for both of the 36 km and the 12 km resolution modeling domains. Base case point source emissions including appropriate stack parameters (stack height, stack diameter, exit temperature and exit velocity), annual county-level area source emissions data including off-road sources, and on-road mobile sources were obtained from the EPA 1999 NEI Version 2 database. The 1999 NEI Version 2 data are in Microsoft Access database format. DEQ developed a converter and converted 1999 NEI Version 2 data into SMOKE IDA format. Biogenic emissions were prepared using SMOKE version 1.5 that includes a version of the Biogenic Emissions Inventory System. DEQ's MM5 meteorological modeling results and existing land use database from previous modeling studies were used for biogenic emissions calculation. The photochemical model ready emissions files were developed for the modeling domains for both the 1999 base year and the 2007 future year. The State of North Carolina provided 2007 future year 2007 emissions inventories. Updated 2007 future-year emission inventories for the EAC areas in Virginia and Maryland were developed by

DEQ and MDE.

3.2 Emissions Processing

The Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system was used to process the EAC emission inventories into the formatted emission files required by the CAMx air quality model. SMOKE supports area, mobile, and point source emission processing and biogenic emissions modeling. The emissions processing used in this EAC modeling study includes the steps of chemical speciation, temporal allocation and spatial allocation of emissions data. These steps are necessary so pollutant data can be converted to chemical model species needed for the CAMx model. These steps also involves converting the county based emissions information to the grid-cell based emissions information and the conversion of daily temporal emissions data to hourly data required by the CAMx model.

The SMOKE model was run for the episode from August 8 to August 18, 1999 using MM5 meteorological modeling results for the same time period. In addition to the temporal allocation of pollutant data, the hourly plume rise was calculated for the point source emissions for CAMx modeling. After the speciation, temporal allocation and spatial allocation processes were finished, emissions data of point, area, mobile and biogenic sources were merged into gridded hourly emissions. Figure 3-1 shows gridded maximum ground level NOx emissions in the 12 km resolution domain during the episode. Figure 3-2 shows gridded maximum NOx emissions at layer 5, which is roughly

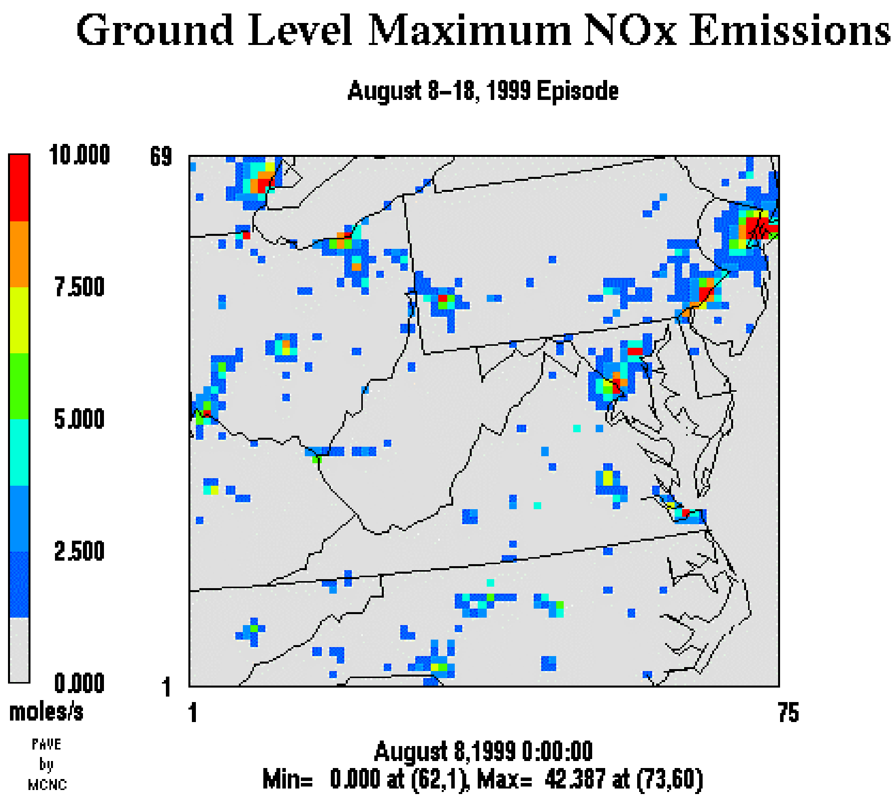


Figure 3-1. Gridded Maximum Ground Level NOx emissions as processed by SMOKE 300 meters above ground level.

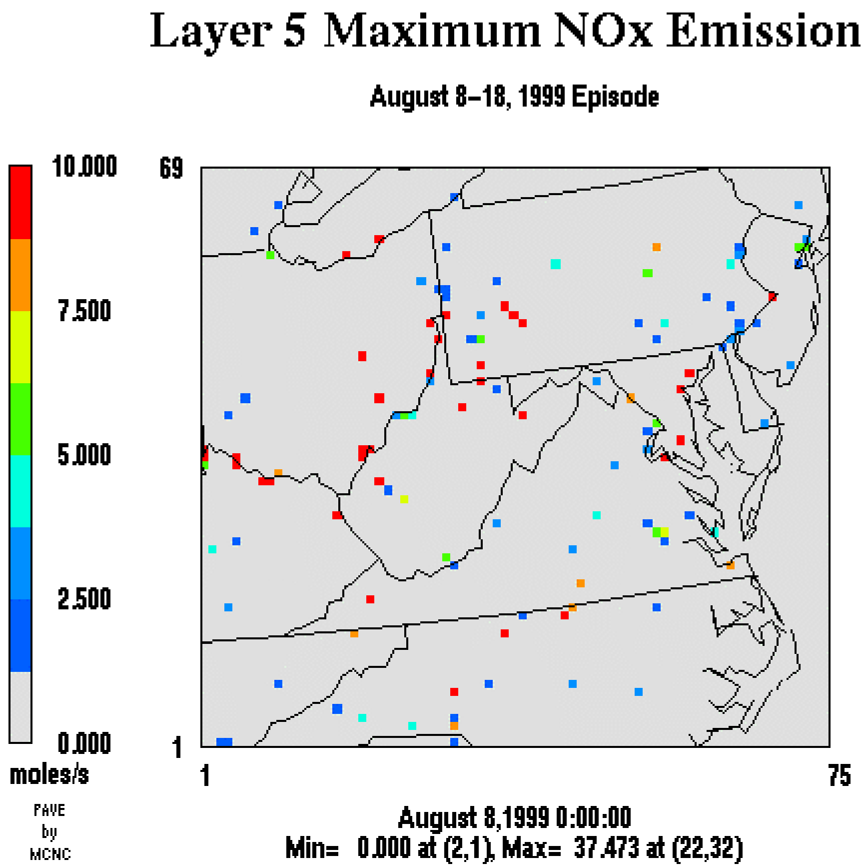


Figure 3-2. Gridded Maximum Layer 5 NOx Emissions

3.3 Biogenic Emissions Modeling

The biogenic emissions were modeled by using SMOKE, which includes a version of the Biogenic Emissions Inventory System 3 (BEIS3) that estimates VOC emissions from vegetation and nitric oxide emissions from soils. Apart from the land use data, the biogenic emissions depend on the meteorological conditions, in particular the air temperature, incoming solar radiation, wind speed and humidity. Those atmospheric variables were provided for each grid cell of the modeling domain by the MM5 simulation results. SMOKE BEIS3 was run for the entire episode from August 8 to August 18, 1999. Figure 3-3 shows gridded maximum biogenic VOC emissions in the 12 km resolution domain. Figure 3-4 shows gridded maximum biogenic NOx in the 12 km resolution domain.

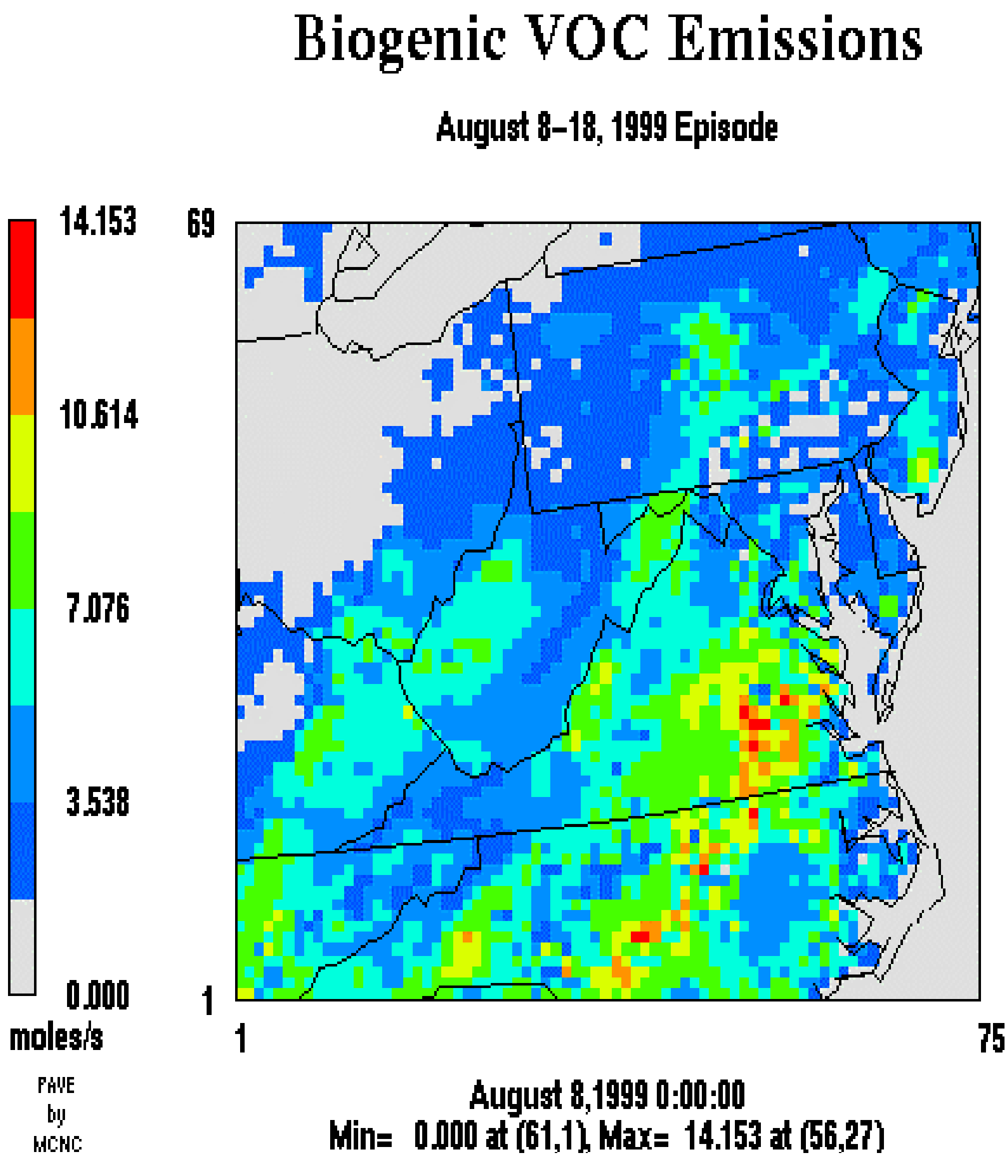


Figure 3-3. Gridded maximum biogenic VOC emissions as modeled by SMOKE

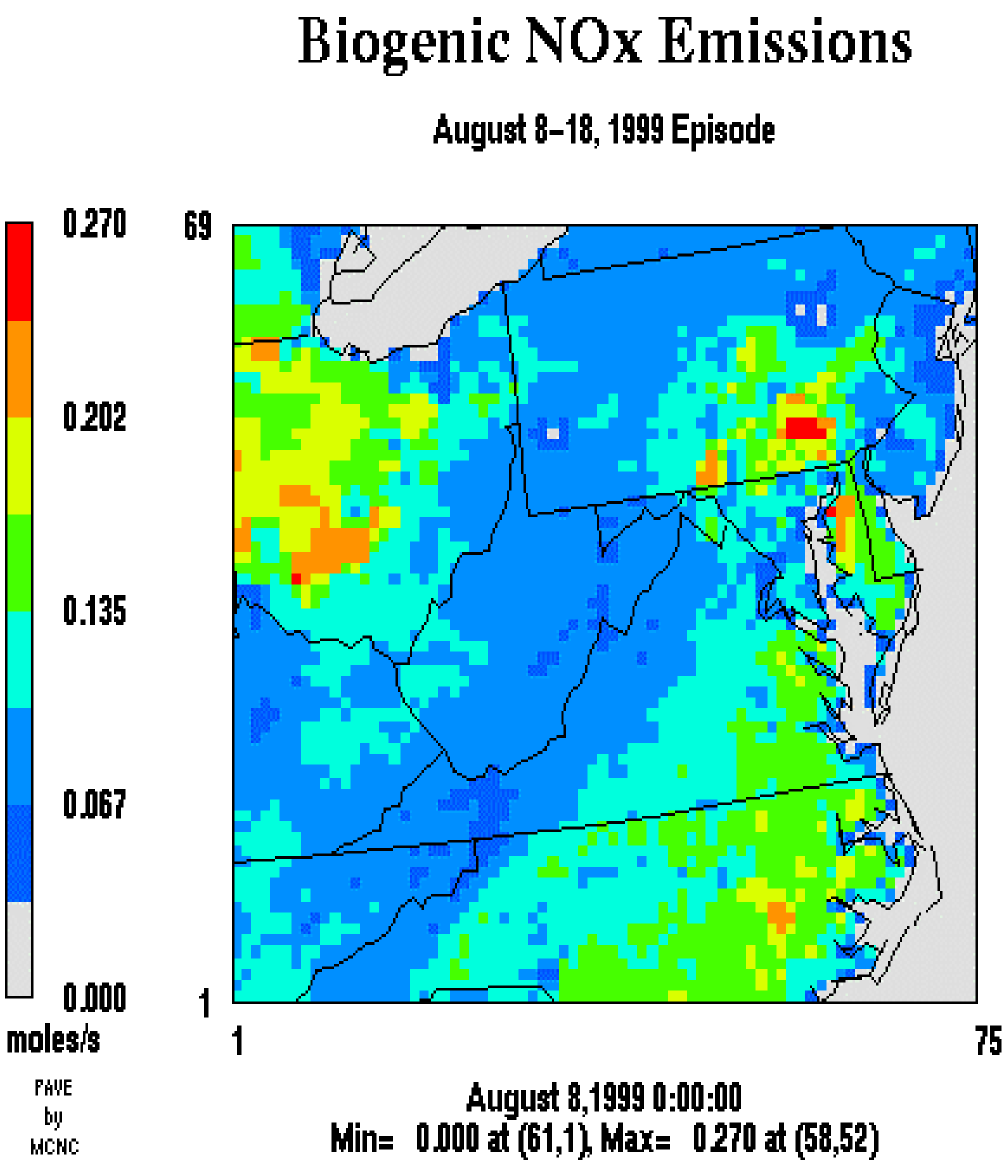


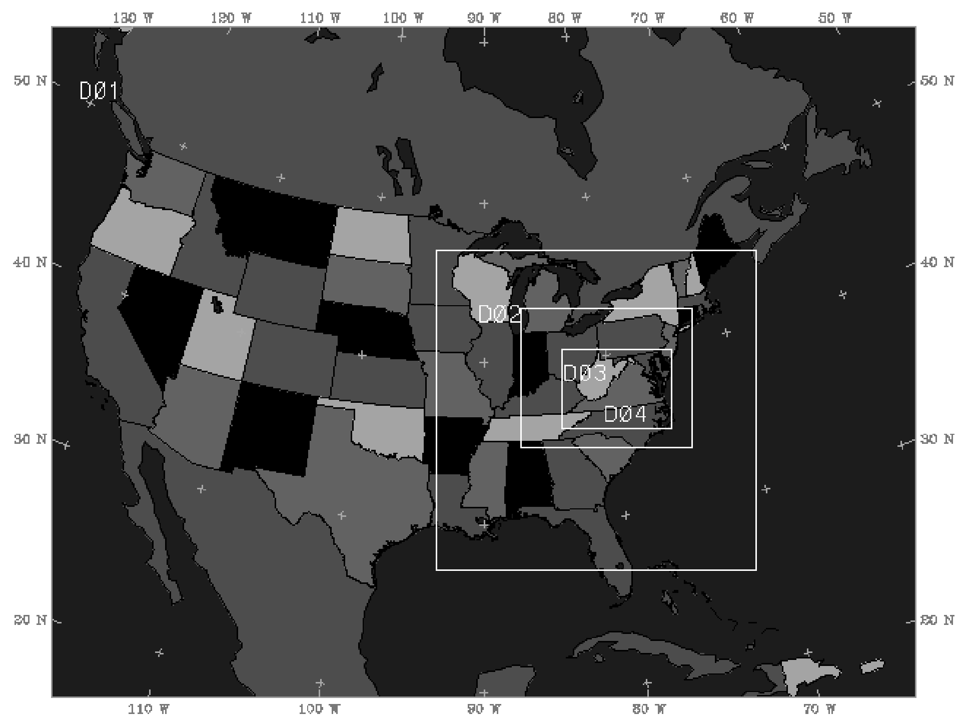
Figure 3-4. Gridded maximum biogenic NOx emissions as modeled by SMOKE

4 Meteorology Modeling

4.1 Numerical Configuration

The Penn State/NCAR Mesoscale Model, MM5, was employed to provide spatial and temporal distribution of meteorological fields to the CAMx air quality model. MM5 has been applied to a broad range of studies, including air quality simulations. The MM5 simulation was performed with 3 nested domains, with respective grid resolutions of 108 km, 36 km, and 12 km. Figure 4-1 shows the MM5 modeling domains for this EAC

Figure 4-1. DEQ MM5 MOdeling Domains



study. It can be seen that the 12 km resolution domain covers the entire state of Virginia and Mid-Atlantic states.   The predominant types of meteorological data used in this study were surface and upper air meteorological measurements reported by the National Weather Service (NWS), and large-scale (i.e., regional/global) analysis databases developed by the National Center for Environmental Prediction (NCEP). Both types of data are archived by, and currently available from, the National Center for Atmospheric Research (NCAR). Measurement data include surface and aloft wind speed, wind direction, temperature, moisture, and pressure. Hourly surface data are usually available from many Class I airports, i.e., larger-volume civil and military airports operating 24-hour per day. The standard set of upper air data is provided by rawinsonde soundings launched every 12 hours from numerous sites across the continent. The typical spacing of rawinsonde site is approximately 300 km. The New York State Department of Environmental Conservation has kindly retrieved all necessary above-mentioned data from NCAR and sent the data to DEQ.

Table 4-1 shows the vertical grid structure of the MM5 model. The EAC MM5 simulations were conducted on DEQ's Linux Cluster system consisting of 6 computing nodes with 12 CPUs. The Distributed Memory Parallel Option was employed using the MPICH message-passing software to provide fast turnaround.   The paralleling processing of MM5 has shortened run time by 10 times over previous MM5 executions on Sun Enterprise systems. A period of 240 hours was simulated for the EAC episode from August 8 to August 18, 1999. The first 12 hours were considered as the warm-up period, followed by 205 hours of prediction, which included the 48-hour ozone episode from August 12 to August 13, 1999.

4.2 MM5 Simulation Results and Statistical Evaluation

This section shows some MM5 predicted meteorological fields and statistical evaluation results. The METSTAT statistical evaluation package, developed by Environ, is used to compare the modeled temperature, humidity and wind fields with observed data.

METSTAT computes a set of statistical quantities, including bias, gross error, and root mean square error (RMSE, total, systematic, and unsystematic). Figure 4-3 shows the meteorological stations used by METSTAT statistical calculation.

4.2.1 Temperature

Figure 4-2 shows MM5 predicted 12 km domain temperature field on August 12, 1999 at 1900 hours GMT. In general, MM5 predicted temperature fields agree well with observed data at most meteorological

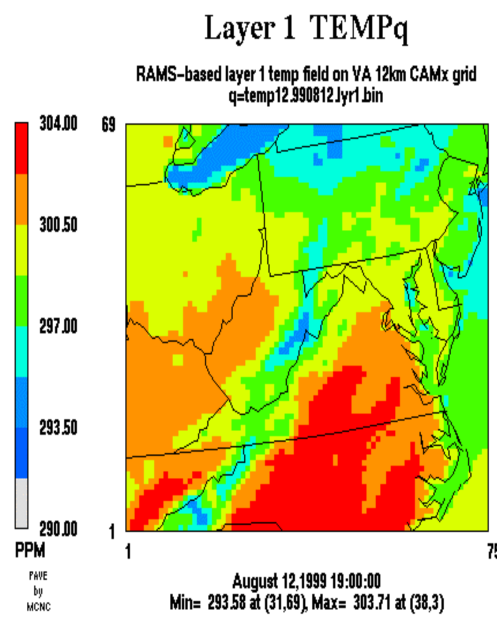


Figure 4-2. MM5 Temperature Field

Table 4-1 Vertical Grid Structures of MM5, CAMx and SMOKE

MM5 Layer K	Sigma	CAMx/SMOKE Layer	Interface Heights (m)
35	0.000	15	12821
34	0.050	15	
33	0.100	15	
32	0.150	15	
31	0.200	15	
30	0.250	15	
29	0.300	15	
28	0.350	15	
27	0.400	14	5812
26	0.440	14	
25	0.480	14	
24	0.520	14	
23	0.560	13	3874
22	0.600	13	
21	0.640	13	
20	0.670	12	2747
19	0.700	12	
18	0.730	11	2185
17	0.760	11	
16	0.785	10	1698
15	0.810	10	
14	0.835	9	1275
13	0.855	9	
12	0.875	8	950
11	0.895	8	
10	0.910	7	675
9	0.925	7	
8	0.940	6	444
7	0.950	6	
6	0.960	5	294
5	0.970	5	
4	0.980	4	146
3	0.086	3	102
2	0.992	2	58
1	0.996	1	29
0	1.000		

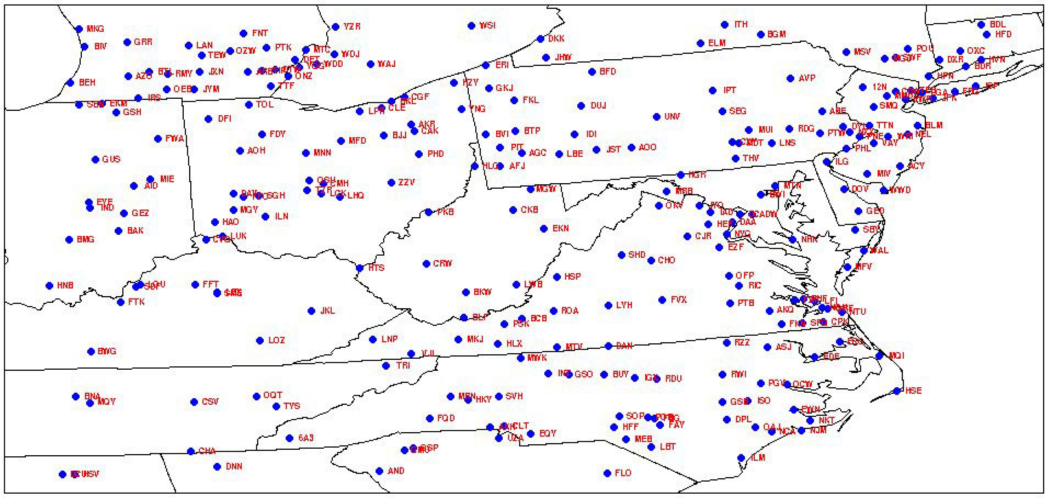


Figure 4-3. Meteorological observation stations

observation sites within the 12 km modeling domain during the episode .

Figure 4-4 shows METSTAT 12 km domain hourly temperature statistics for the August 8 to August 18, 1999 episode. The three RMSE legends in the second graph represent RMSE total, RMSE systematic and RMSE unsystematic.

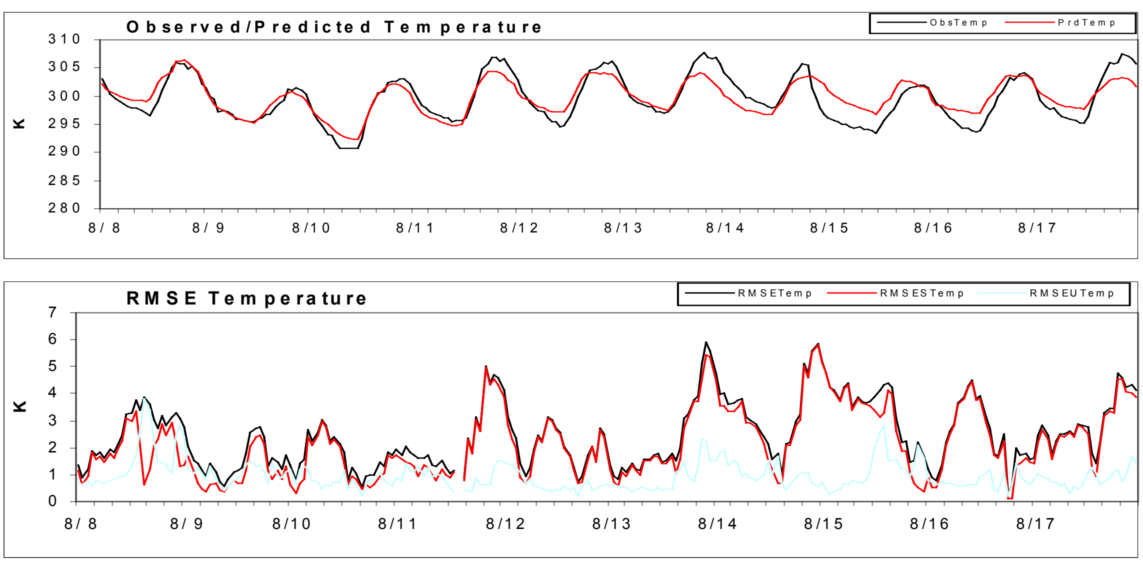
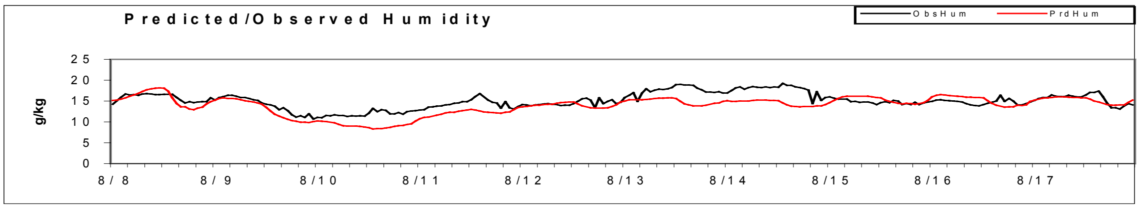


Figure 4-4. METSTAT hourly temperature statistics

4.2.2 Humidity

Figure 4-5 shows METSTAT 12 km domain hourly humidity statistics for the August 8 to August 18, 1999 episode. The predicted humidity fields agree reasonably well with observed humidity fields.



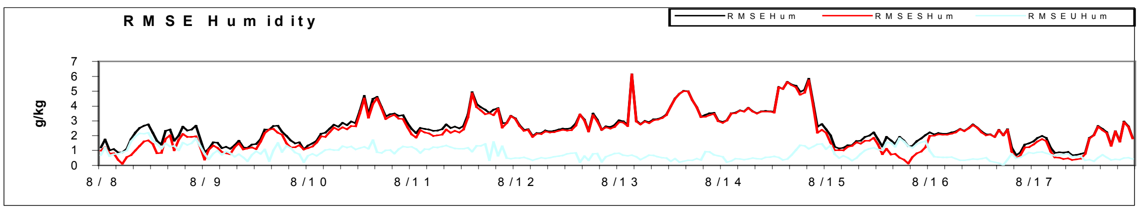


Figure 4-5 METSTAT 12 km domain hourly humidity statistics

4.2.3 Wind Fields

Figure 4-6 shows predicted surface wind on August 12, 1999 at 19:00 GMT. The wind field agrees reasonably well with observed wind field at that hour.

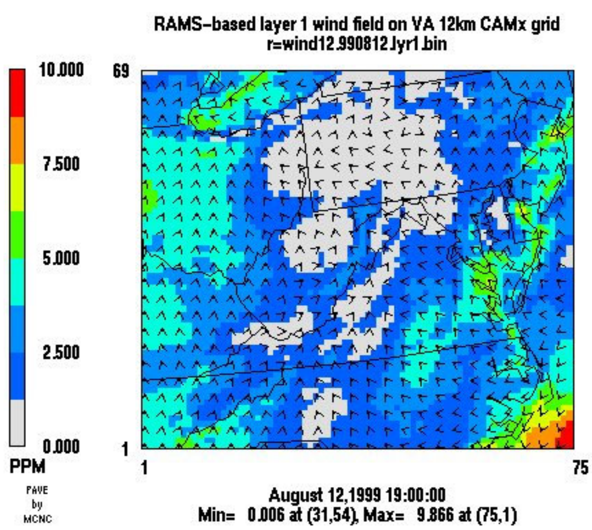


Figure 4-6 MM5 Predicted Surface Wind

Figure 4-7 shows METSTAT 12 km domain hourly wind statistics for the August 8 to August 18, 1999 episode.

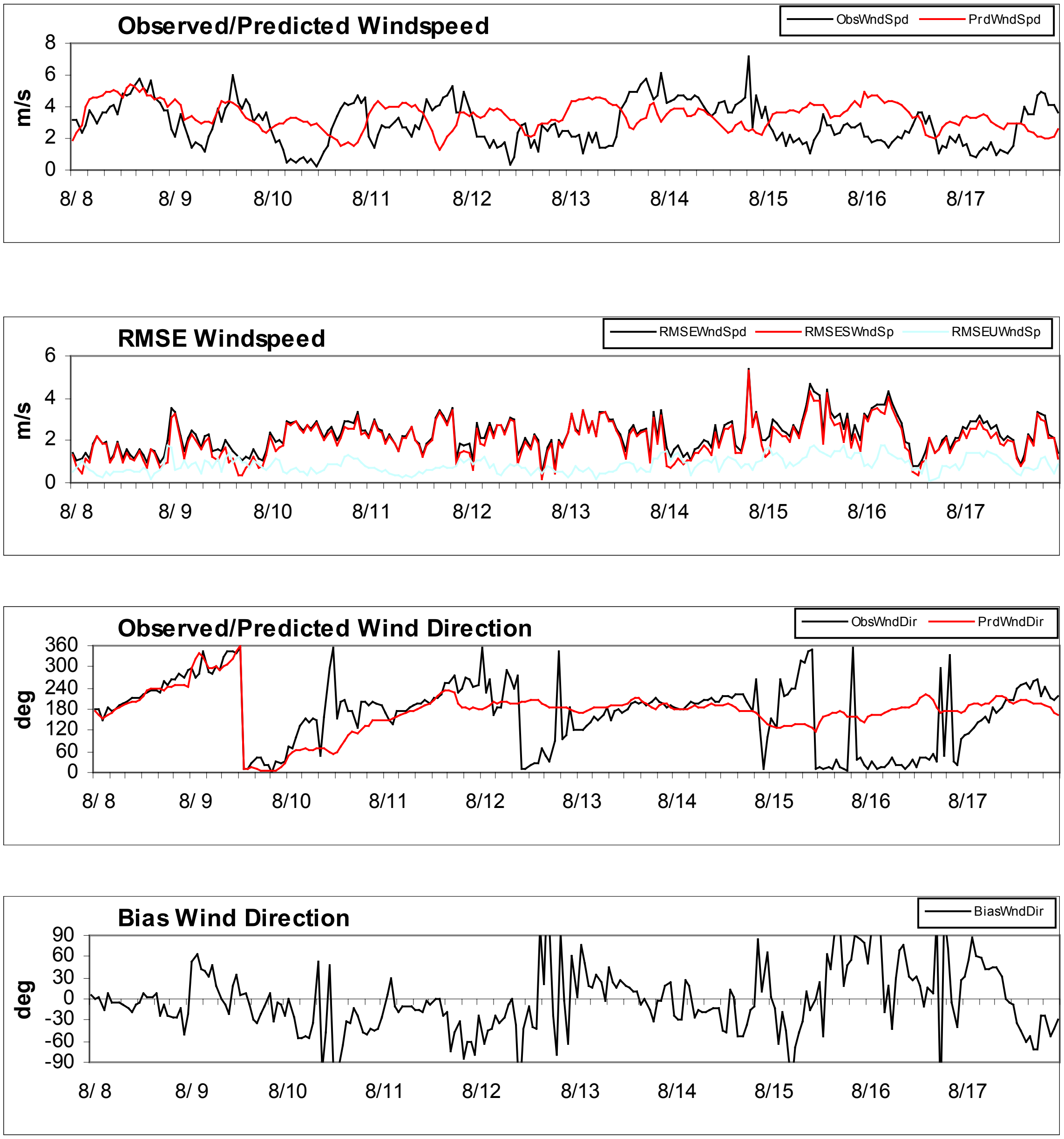


Figure 4-7. METSTAT 12 km domain wind statistics

During the episode, the simulated wind speed is in proper magnitude compare to the observed wind. Wind direction prediction performed fairly well from 8th to 15th even though abrupt wind direction changes were not captured during the 12th and 13th of the episode.

4.2.4 Planetary Boundary Layer Depth

Figure 4-9 through 4-11 shows Planetary Boundary Layer depth for August 12 and August 13, 1999 at 10AM and 2 PM hours. The PBL depth is also called mixing height. The mixing height values during the episode are in reasonable magnitude.

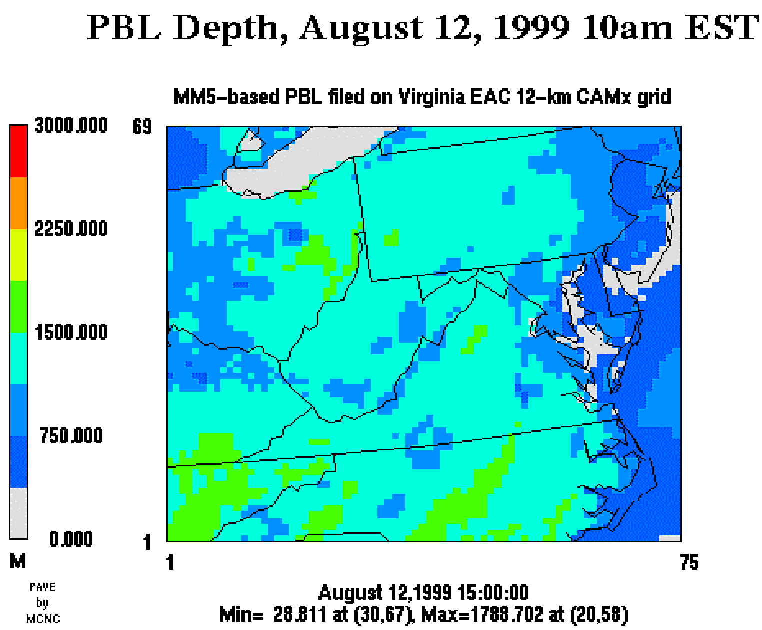


Figure 4-8 PBL Depth, August 12, 1999 10AM EST

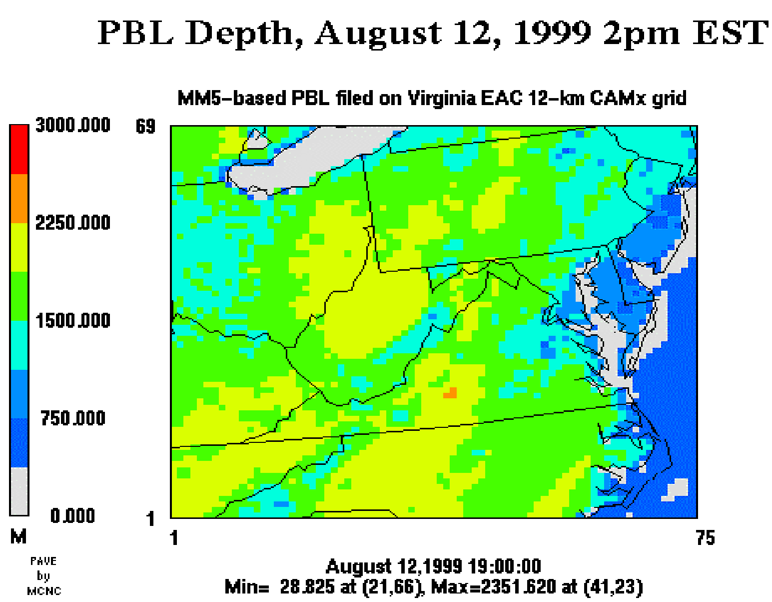


Figure 4-9 PBL Depth, August 12, 1999 2PM EST

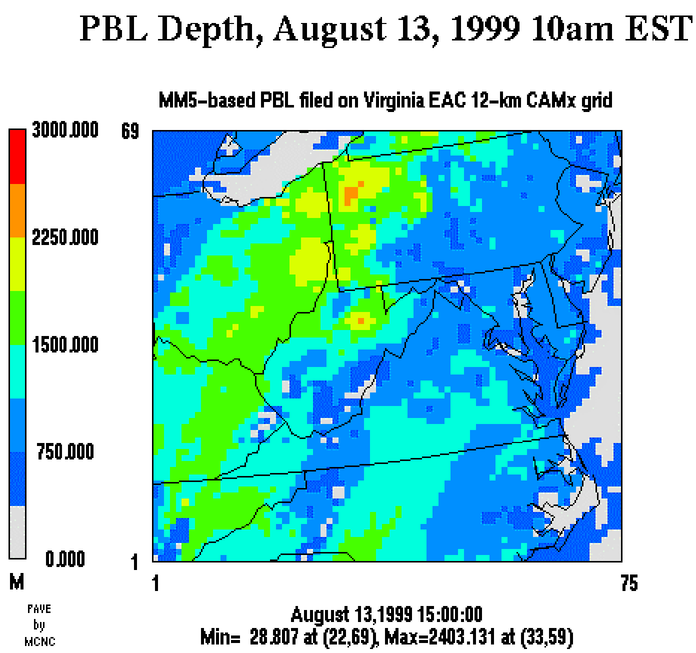


Figure 4-10. PBL Depth, August 13, 1999 10AM EST

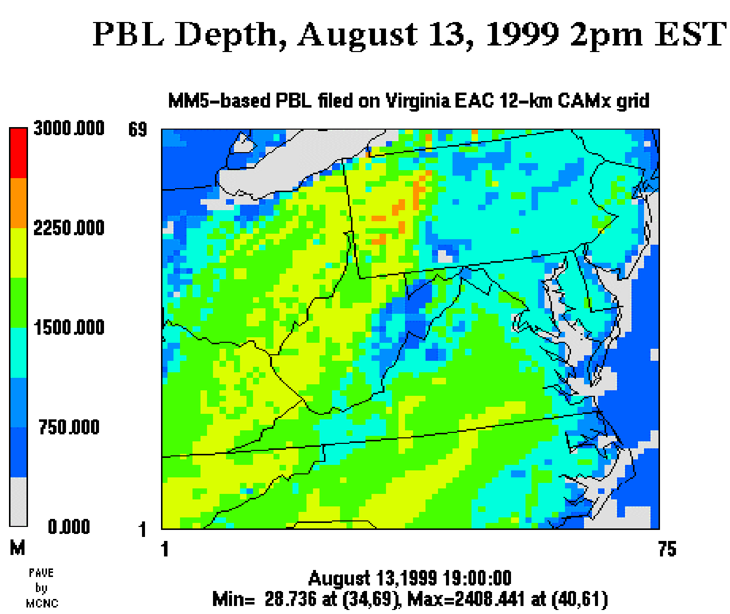


Figure 4-11. PBL Depth, August 13, 1999 2PM EST

5 Ozone Modeling

5.1 CAMx Model Configuration

The Eulerian photochemical model, CAMx modeling system was employed to simulate ozone concentration in the EAC modeling domains. The following is a list of model configuration parameters:

36/12 km grid August 8 – August 18, 1999 period
CB-IV chemistry with CMC fast solver
PPM advection solver
Wet and dry deposition
TUV photolysis rates
TOMS ozone column with default LULC albedo and haze

Figure 5-1 shows the AEC CAMx 36 km and 12 km modeling domains.

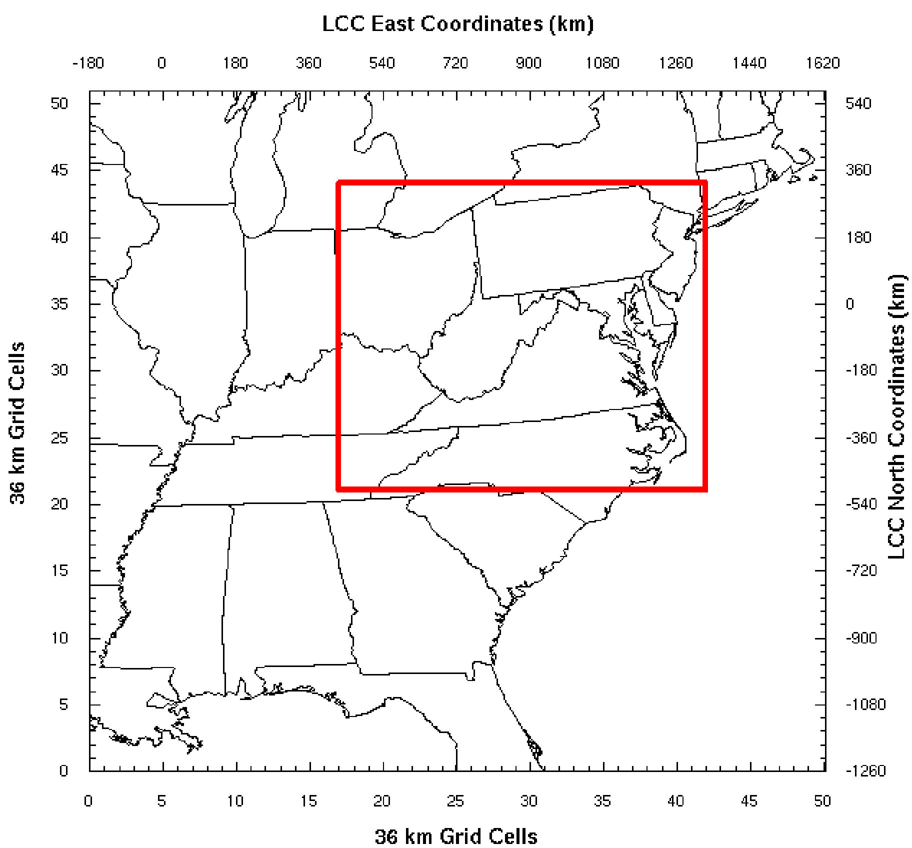


Figure 5-1. EAC CAMx 36 km and 12 km Modeling Domains

5.2 Model Performance Evaluation

Generally, predicted 8-hour ozone concentration agreed very well with observed values at most monitors in the 12 km domain. Figure 5-1 and Figure 5-2 show time series of observed and predicted 8-hour ozone concentrations from August 11 to August 14, 1999 at the Vinton (Roanoke County) and Frederick monitors. Daytime simulations showed good agreement with the observations. Night-time ozone concentrations were systematically over-predicted. However, night-time ozone concentration was not the main focus of this study. Figure 5-3 shows a scatter plot of predicted versus observed ozone concentration for all Virginia sites. Over 90% of predicted values fell within the ±50% bias lines. Most of the predicted values outside the ±50% region were due to night-time over-predictions.

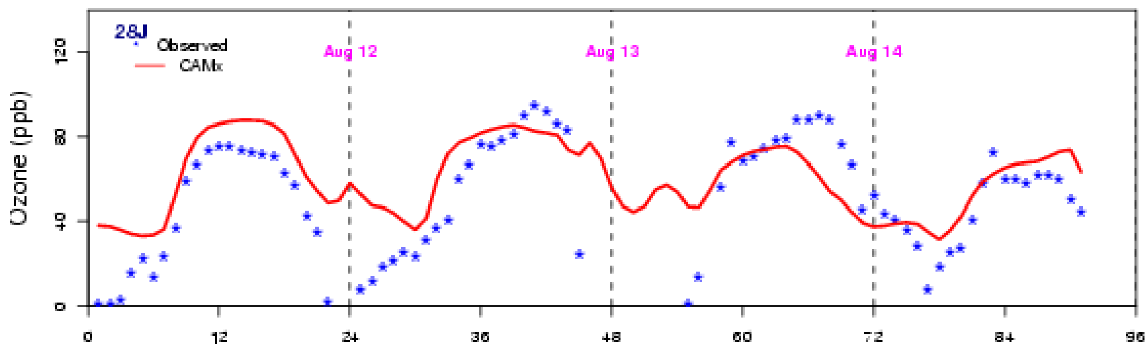


Figure 5-1. Time series of observed and simulated 8-hour ozone concentration at Frederick (Frederick/Winchester City)

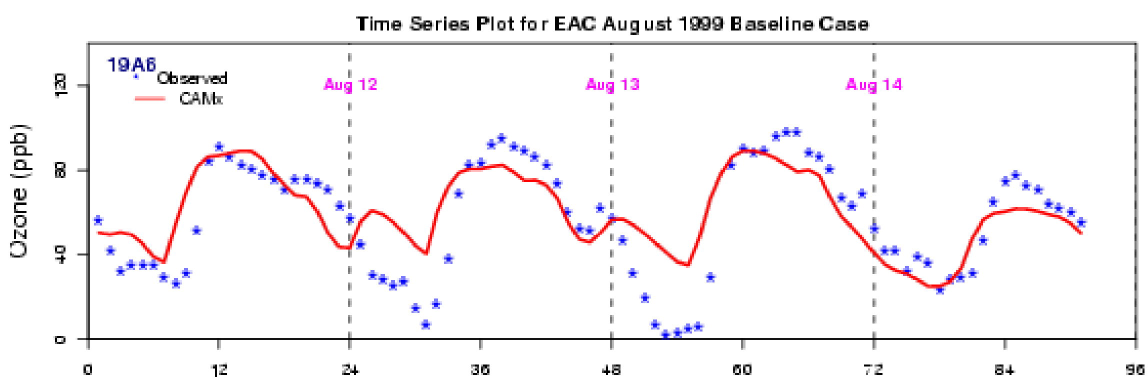


Figure 5-2. Time series of observed and simulated 8-hour ozone concentration at Vinton (Roanoke MSA)

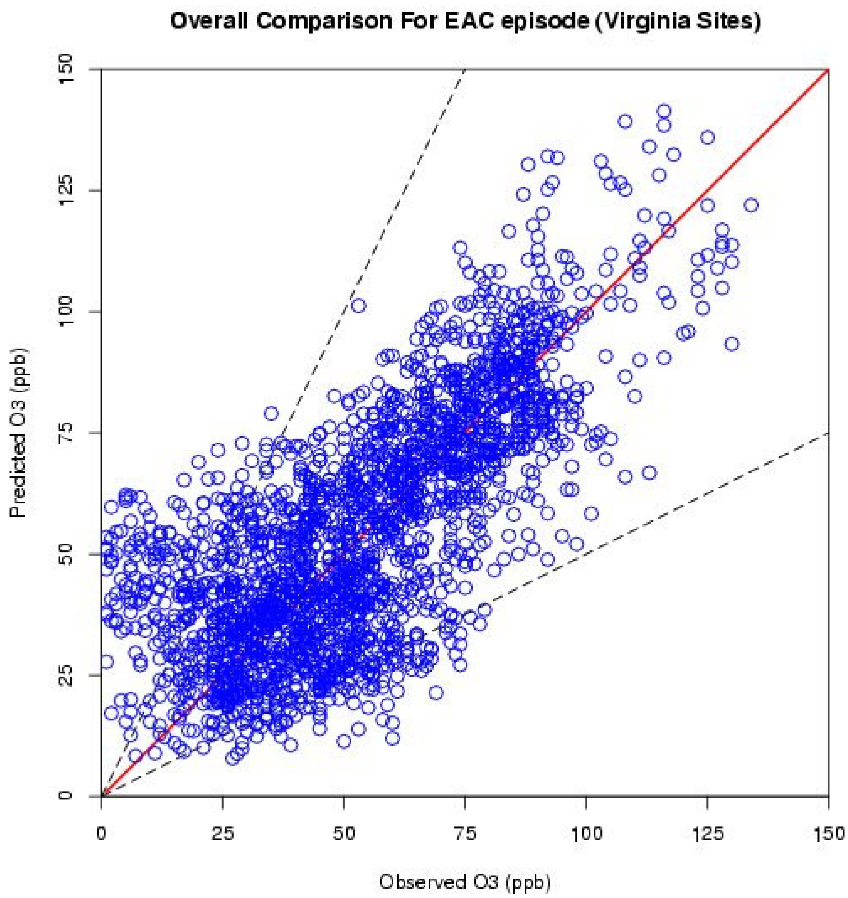


Figure 5-3. Scatter plot of observed and predicted ozone concentration for Virginia sites

Table 5-1 and Table 5-2 provides model performance metrics for August 12 and August 13, 1999 for major performance criteria. For Virginia sites, all performance goals were met for both episode days. For the entire 12 km domain, all performance goals were met for both episode days except the Normalized Bias for the 13th. It was decided based the performance metrics that the model is acceptable for future year modeling for the August 1999 episode.

Figure 5-4 and Figure 5-5 shows 12 km domain predicted base year daily maximum1-hour and 8-hour ozone concentrations, respectively, for the 12th and 13th of the episode.

Table 5-1. **O3 performance statistics for August 12, 1999**

	(a) 12km (VA Sites)	(b) 12km (Whole Domain)	(c) EPA Criteria
Overall Absolute Peak			
Predicted peak	153.9 ppb	153.9 ppb	
Observed peak	134.0 ppb	143.0 ppb	
Unpaired bias	14.9 %	7.7 %	20.0 %
Peak Prediction (Normalized Bias)			
Paired in space	1.7 %	-1.3 %	
Paired space/time	-4.2 %	-8.7 %	
Peak Prediction (Normalized Error)			
Paired in space	12.9 %	13.9 %	
Paired space/time	11.1 %	16.7 %	
Average Concentration Prediction			
Normalized bias	1.3 %	0.6 %	15.0 %
Normalized error	17.4 %	16.6 %	35.0 %
Mean bias	0.9 ppb	-0.6 ppb	
Mean error	14.1 ppb	13.0 ppb	

Table 5-2. **O3 performance statistics for August 13, 1999**

	(a) 12km (VA Sites)	(b) 12km (Whole Domain)	(c) EPA Criteria
Overall Absolute Peak			
predicted peak	116.4 ppb	116.4 ppb	
observed peak	113.0 ppb	164.0 ppb	
unpaired bias	3.0 %	-29.0 %	20.0 %
Peak Prediction (Normalized Bias)			
paired in space	-3.4 %	-0.5 %	
paired space/time	-11.6 %	-9.0 %	
Peak Prediction (Normalized Error)			
paired in space	16.9 %	14.2 %	
paired space/time	22.9 %	17.6 %	
Average Concentration Prediction			
normalized bias	-6.7 %	-2.4 %	15.0 %
normalized error	16.5 %	17.3 %	35.0 %
mean bias	-6.5 ppb	-2.9 ppb	
mean error	13.1 ppb	13.0 ppb	

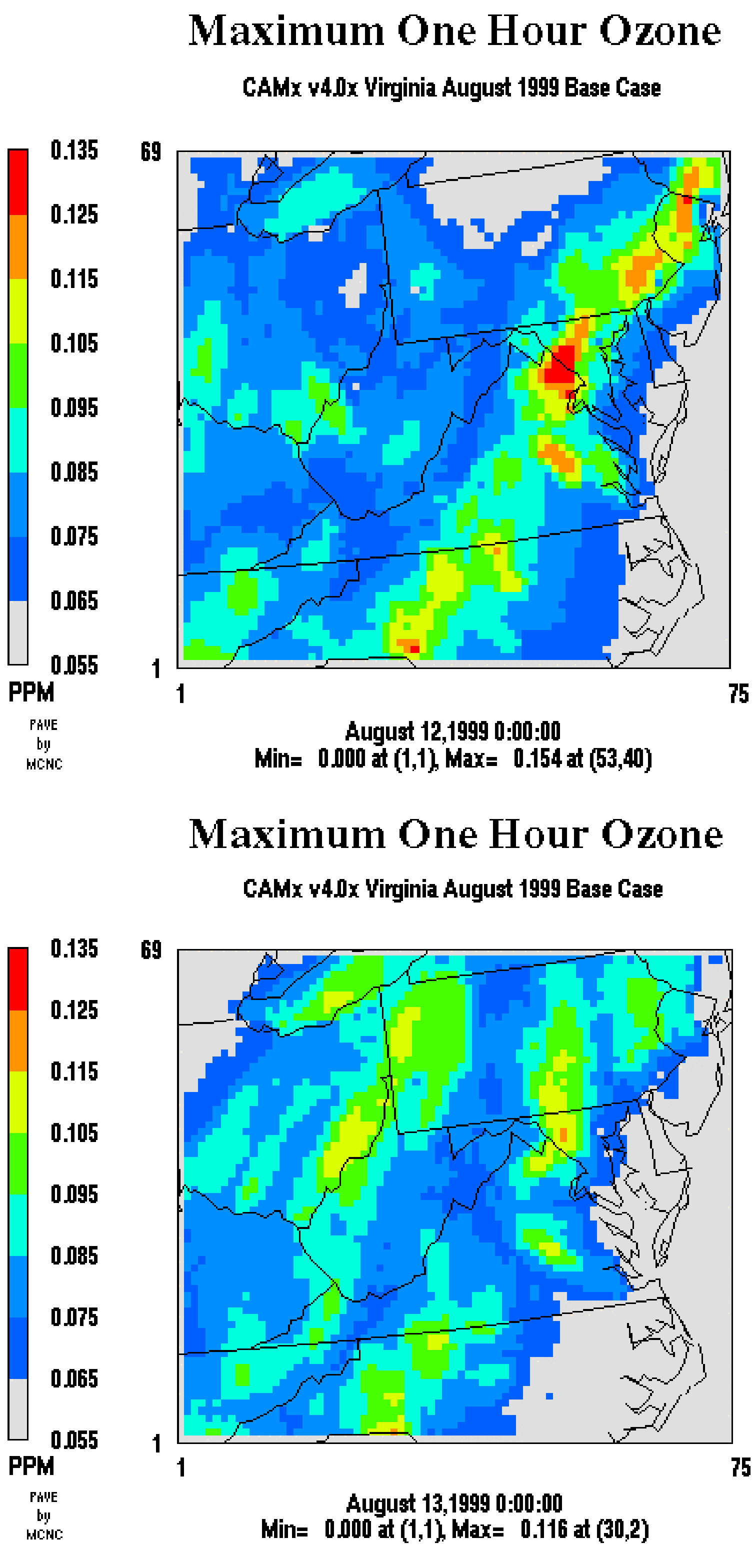
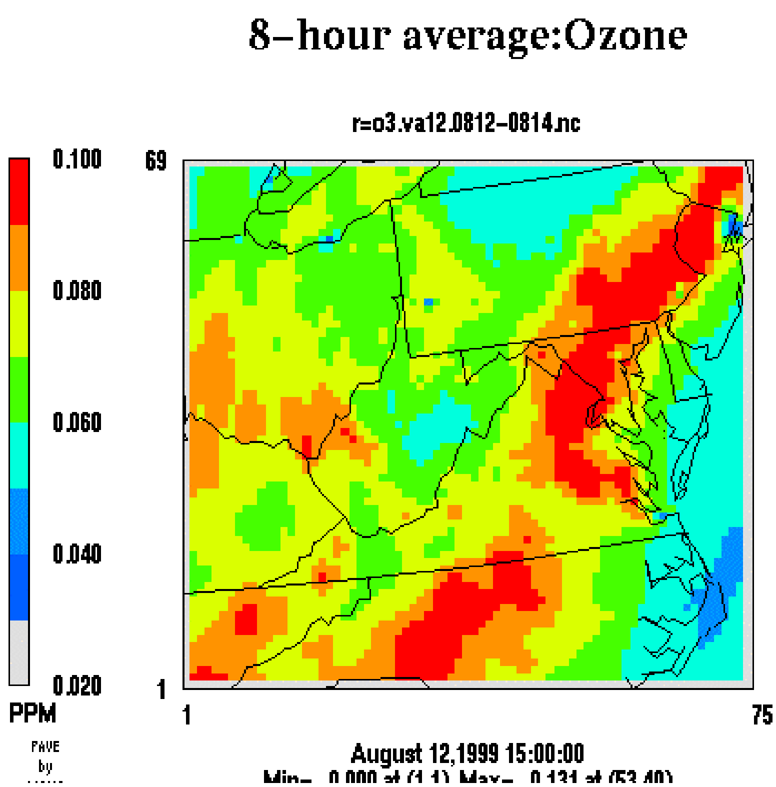


Figure 5-4. CAMx predicted 1-hour daily maximum ozone concentrations



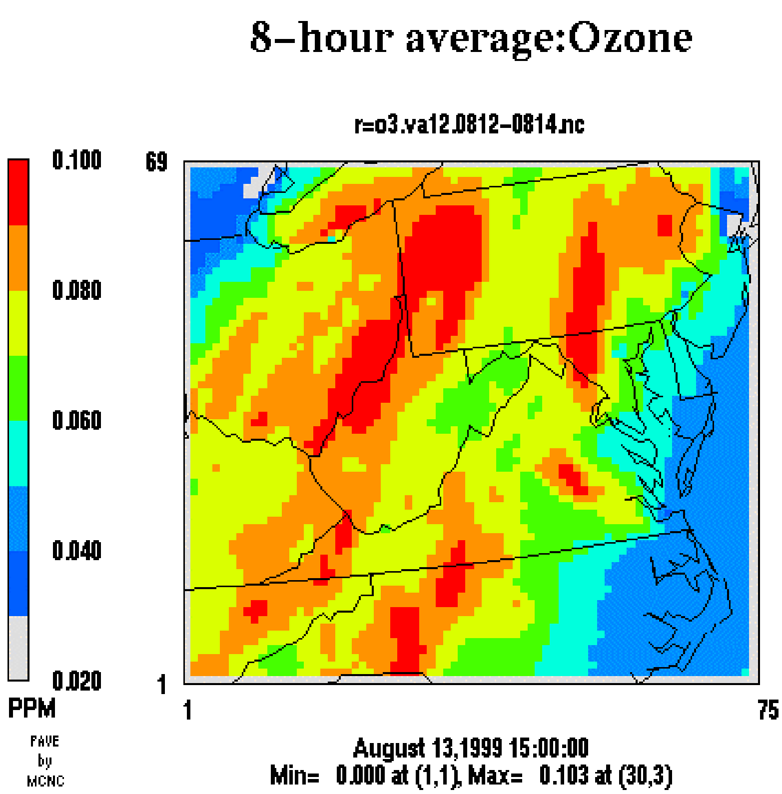
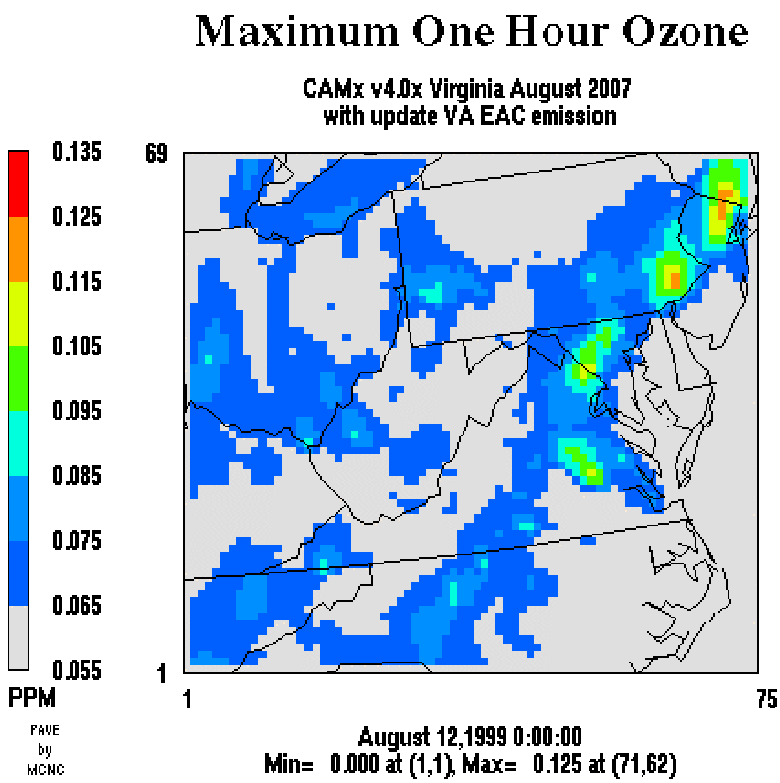


Figure 5-5. CAMx predicted 8-hour daily maximum ozone concentrations

Figure 5-6 and Figure 5-7 shows 12 km domain predicted future year daily maximum1-hour and 8-hour ozone concentrations, respectively, for the 12th and 13th of the episode. All EAC local control measures have been quantified and included in the future year emission inventories.



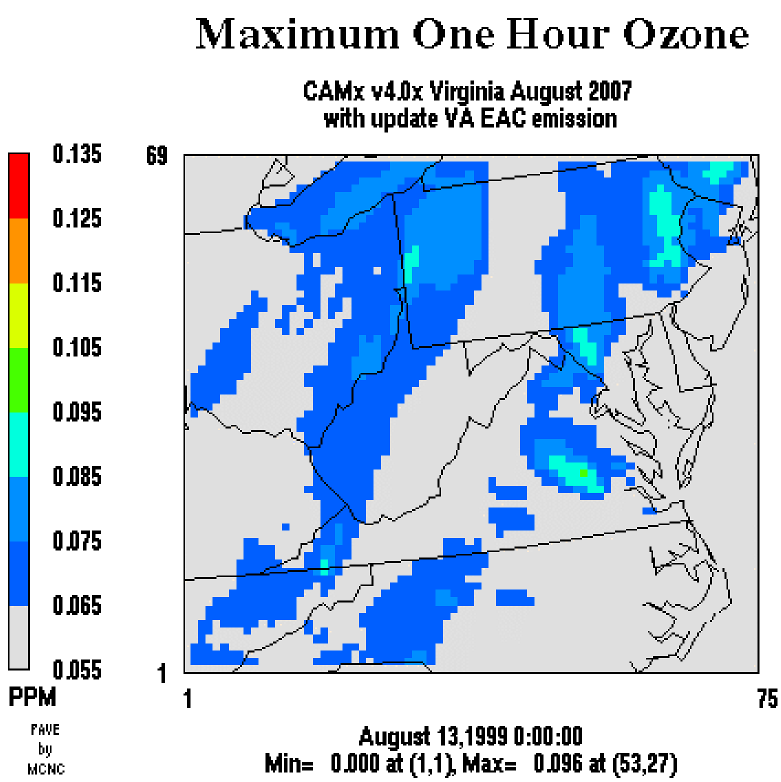
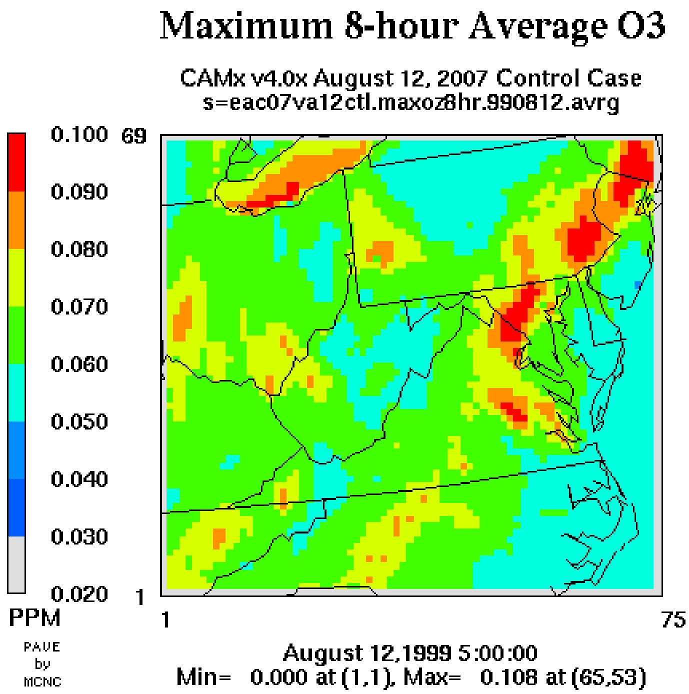


Figure 5-6. CAMx predicted future year 1-hour daily maximum ozone concentrations



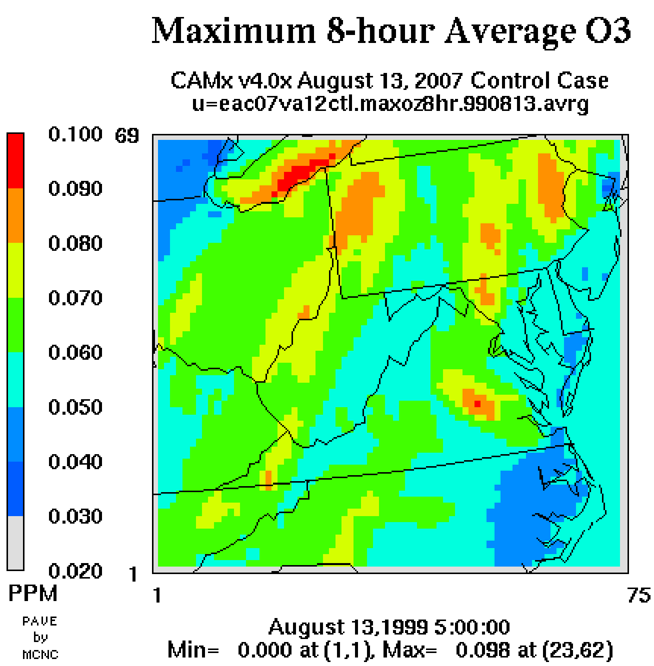


Figure 5-7. CAMx predicted future year 8-hour daily maximum ozone concentrations

6. Attainment Demonstration

Because EPA has not yet designated any region as non-attainment for 8-hour ozone, no formal requirement exists for an 8-hour attainment demonstration. However, EPA has developed draft procedures for using photochemical models to demonstrate attainment of the 8-hour ozone NAAQS. The critical elements in the demonstration of attainment under the 8-hour ozone NAAQS, established by the *Draft Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-Hour Ozone NAAQS, U.S. EPA Office of Air Quality Planning and Standards, EPA-454/R-99-004, May 1999*, are the calculation of relative reduction factors (RRFs) and future design values (DVs). The RRFs and base-year Design Values are the basis for projecting future-year Design Values (DVF).

All episode days with modeled base year daily maximum 8-hour ozone concentration greater than or equal to 70 ppb will be use to calculate the RRF for the all monitors representing the five EAC areas in this study. Table 6-1 lists the monitors and their corresponding EAC areas.

Table 6-1. Monitors for calculating RRFs

Monitors and AIRS ID	EAC Areas
51-161-1004 Roanoke	Roanoke MSA, Virginia
51-069-0010 Frederick	Frederick/Winchester City, Virginia
51-069-0010 Frederick	Berkley County/Martinsburg City, West Virginia
51-069-0010 Frederick	Jefferson County, West Virginia
24-043-0009 Hagerstown	Washington County, Maryland

Figure 6-1 shows the spatial locations of the monitors listed in the above table.

6.1 Calculation Methodology for RRFs and DVs

The methodology calls for scaling base-year design values using RRFs from a photochemical model to future year design values. The calculation is carried out for each monitor. The attainment test is passed if all the future year scaled DVs are 84 ppb or less.

For each monitor (i) and modeling day (j) the maximum 8-hour ozone near the monitor is selected for the current ($O3C_{ij}$) and future-year ($O3F_{ij}$):

$$RRF_i = [\ \Sigma\ O3F_{ij}\ ] / [\Sigma\ O3C_{ij}\ ]$$

Attainment demonstration is done using monitor specific relative reduction factor (RRFi) that is the ration of the future-year to current-year 8-hour ozone estimates near the monitor:

$$DVF_i = RRF_i \times DVC_i$$

These current EPA procedures for using models to demonstrate attainment of the 8-hour ozone NAAQS will be in this study. In this chapter, the relative differences in the modeled 8-hour ozone estimates between 1999 base case simulation and 2007 control case simulation will be developed to scale their measured Design Value for comparison with the 84 ppb 8-hour ozone NAAQS. The attainment demonstration will be done using the above mentioned procedures for two EAC areas in Virginia, two EAC areas in West Virginia and one EAC area in Maryland.

Table 6-2. 8-Hour Ozone Design Values for Virginia and West Virginia EAC Areas

Virginia DEQ 1998-2000 4th Highest 8-hour Ozone Averages					
AIRS ID	County/City	1998	1999	2000	3 yr. Avg.
51-161-1004	Roanoke	99	89	81	**90**
51-069-0010	Frederick	98	85	79	**87**

Table 6-3. 8-Hour Ozone Design Values for Maryland EAC Areas

Virginia DEQ 1997-2000 4th Highest 8-hour Ozone Averages					
AIRS ID	County/City	1998	1999	2000	3 yr. Avg.
24-043-0009	Hagerstown	-	94	94	**94**

The following procedures are carried out in monitor design value scaling:

1. For each monitor, identify the corresponding cell and eight surrounding cells.
2. For each cell, find daily maximum 8-hour ozone values greater or equal to 70 ppb for the entire episode for both the base case and future case.
3.Average the daily maximum 8-hour ozone values across days with daily maximum 8-hour ozone greater or equal to 70 ppb for the base case and future case.
4. Calculate the average Relative Reduction Factors for these cells, and
5. Calculate the average future year Design Values for these cells.

Figure 6-1 shows the geophysical locations of the three monitors participating in RRF calculation and attainment test

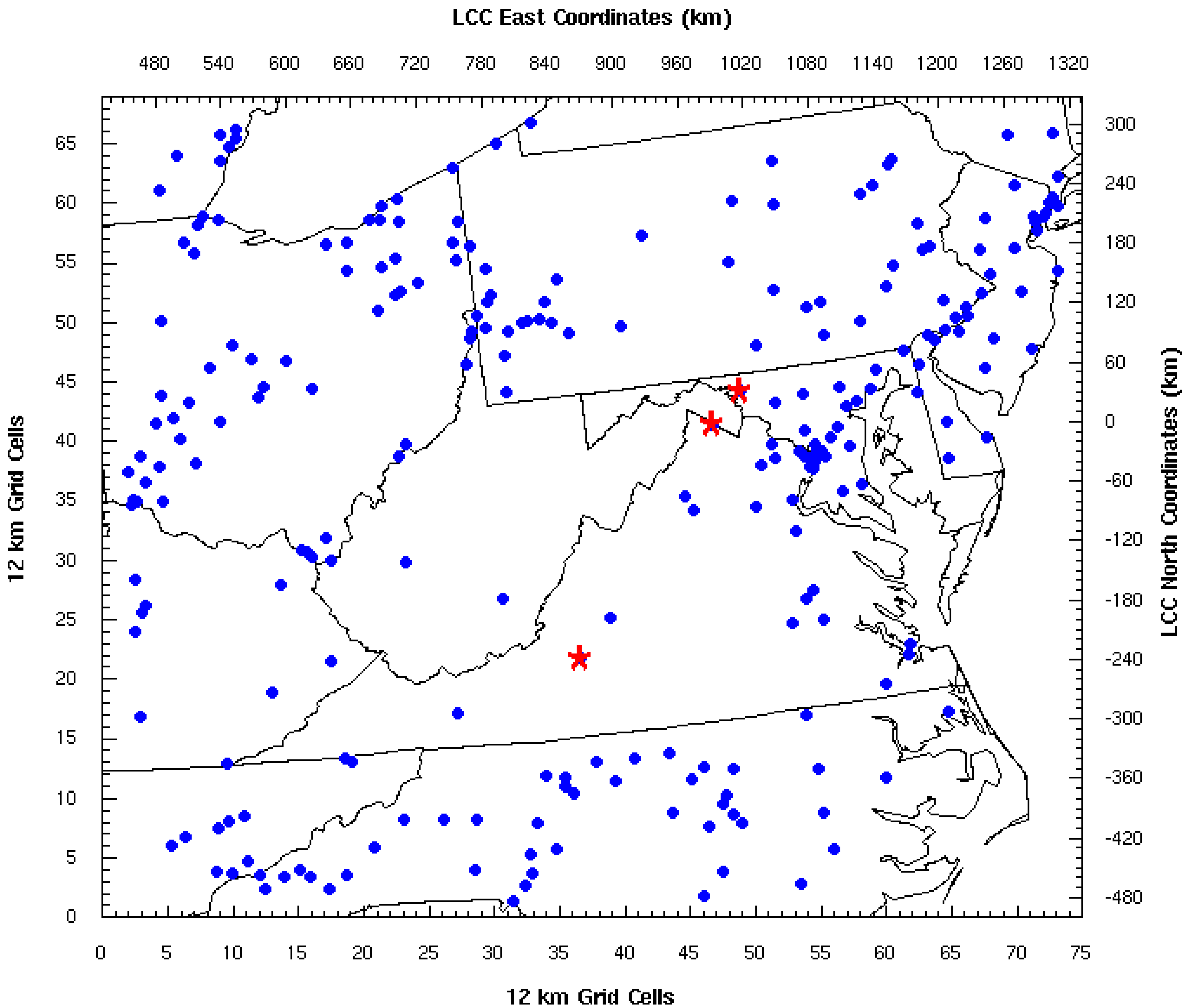


Figure 6-1. Spatial Locations of Monitors for RRFs Calculations and Attainment Demonstration of Virginia, West Virginia and Maryland EAC Areas.

6.1. 8-Hour Ozone Attainment Demonstration of Virginia and West Virginia EAC Areas

County/City	AIRS ID	1998-2000 Design Value, ppb	2001-2003 Design Value, ppb	Current Design Value
Roanoke Co.	510410004	90	85	90
Frederick Co.	510870014	87	85	87

Attainment Test Results for Monitors in the Virginia EAC Areas (Max 9 Grid Cells)

County/City	Modeled Average Base-Year (1999) Daily 8-hr Maximum O3 (ppb)	Modeled Average Future-Year (2007) Daily 8-hr Maximum O3 (ppb)	Relative Reduction Factor (RRF)	Current Design Value	2007 Future Design Value	Number of Analysis Days	Pass/Fail Status
Roanoke	82.93	65.72	0.793	90	71.4	5	PASS
Frederick	77.45	64.85	0.837	87	72.8	4	PASS

Nonattainment **Attainment**

6.2. 8-Hour Ozone Attainment Demonstration of Maryland EAC Area

Attainment Test Results for Monitors in the Maryland EAC Area

County/City	Modeled Average Base-Year (1999) Daily 8-hr Maximum O3 (ppb)	Modeled Average Future-Year (2007) Daily 8-hr Maximum O3 (ppb)	Relative Reduction Factor (RRF)	Current Design Value	2007 Future Design Value	Number of Analysis Days	Pass/Fail Status
Washington	86.88	69.70	0.802	94	75.4	5	PASS

6.3. Summary

Table 6-4 and Table 6-5 has demonstrated that all concerned EAC areas in this study will attain the 8-hour ozone standard by 2007.

COMMONWEALTH OF VIRGINIA
PROPOSED STATE IMPLEMENTATION PLAN REVISION

PUBLIC HEARING ADDITIONAL STATEMENT

December 20, 2004
Winchester, Virginia

In addition to the opening statement, I would like to make the following statement concerning a specific modification to the proposal under consideration today.

As part of the early action process, a regional photochemical modeling analysis must be performed to support the conclusion that the area involved will come into compliance with the ozone standard. A modeling analysis and report is included as part of the early action plan for the Northern Shenandoah Valley area.

As a result of discussions with the U. S. Environmental Protection Agency concerning this modeling analysis, a review of the emissions inventories used in the modeling analysis has been performed. This review has resulted in adjustments to these inventories. In addition, the modeling analysis has been performed again using the adjusted emissions inventory data. This updated modeling analysis shows that the Northern Shenandoah Valley area is predicted to come into compliance with the ozone standard by the year 2007 which is a requirement of the early action compact program. These updated results will be included in the final plan that will be submitted to the U. S. EPA.