State Implementation Plan for Ozone for the Pittsburgh-Beaver Valley Nonattainment Area

ATTAINMENT PLAN

December 29, 1997

COMMONWEALTH OF PENNSYLVANIA
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TABLE OF CONTENTS

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Summary

This document establishes the Commonwealth's plan to provide for attainment of the one-hour health-based National Ambient Air Quality Standard (NAAQS) for ozone in the Pittsburgh-Beaver Valley area (shown in Figure 1). This finalized plan, is being submitted to the Environmental Protection Agency (EPA) for inclusion in the State Implementation Plan (SIP).

I. Background

A. Air Quality. Ground-level ozone can pose a significant health threat. Ozone is an odorless gas which reacts with lung tissue. It can harm breathing passages and cause respiratory effects, such as coughing and pain upon inhalation. Eye irritation and headaches have also been associated with ozone and related ozone components. These symptoms are experienced at all age levels in both healthy and sick individuals. Some studies suggest that decreases in lung function in children, asthma attacks and increases in hospital admissions for respiratory ailments are also linked to ozone exposure. EPA has established a National Ambient Air Quality Standard (NAAQS) for ozone at 0.12 parts per million (ppm). Recently a more protective air quality standard was adopted by EPA . This plan, however, addresses only the one-hour (0.12 ppm) standard which remains in effect until it is attained, according to recent EPA guidance.

Ozone is not emitted directly into the air. It is formed under certain meteorological conditions by a photochemical reaction that involves volatile organic compounds (VOCs) and nitrogen oxides (NOx). The sources of VOCs include biogenic (natural) sources, such as trees and crops and human activities, such as industries, automobiles and lawn mowers. NOx is produced from the burning of fossil fuels in motor vehicles, power plants and other industrial sources.

The Department and the Allegheny County Health Department monitor ozone in the Pittsburgh-Beaver Valley nonattainment area. While air quality has been improving, the monitors continue to measure exceedances of the ozone standard. When exceedances of the standard occur, monitors at the Pennsylvania-Ohio-West Virginia border typically show ozone concentrations entering Pennsylvania equal to 0.10-0.11 ppm or 83-92 percent of the standard. Thus, ozone from outside of Pennsylvania significantly contributes to nonattainment in the Pittsburgh-Beaver Valley Area.

Both Pennsylvania and EPA are taking action to address the transport of pollutants into Pennsylvania. On August 14, 1997, Pennsylvania filed a petition with EPA under Section 126 of the Clean Air Act (a copy of that petition is found in Appendix 6). The Petition requests that EPA establish emission limitations for certain large sources of NOx to reduce transported air pollution. In addition, on October 10, 1997, EPA announced a proposal to require 22 states and the District of Columbia to submit SIPs that address the regional transport of ozone and ozone precursors. In that rule, EPA made a proposed finding that "22 States and the District of Columbia significantly contribute to nonattainment in, or interfere with maintenance by, a downwind State."

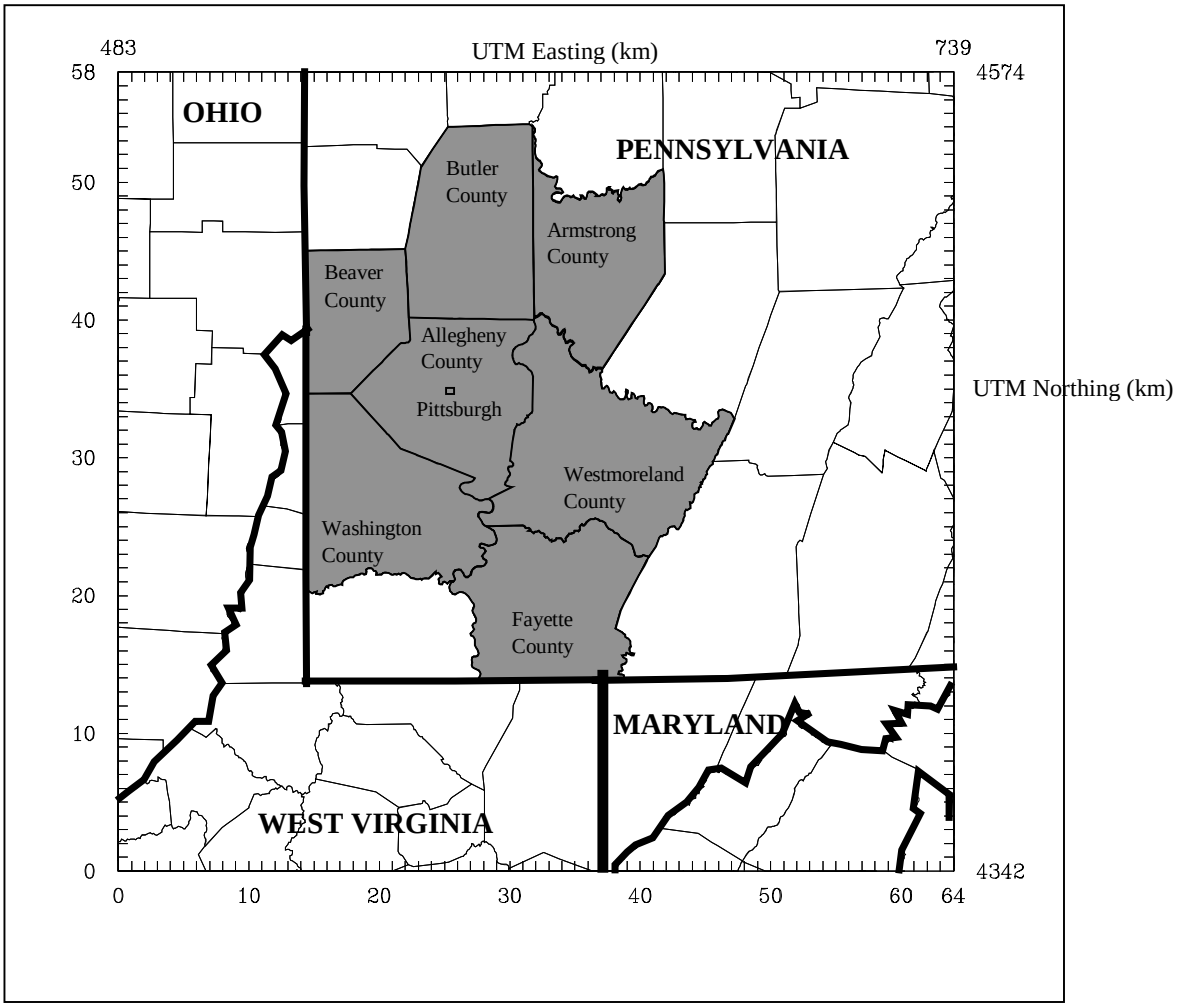

Figure 1. Pittsburgh-Beaver Valley Ozone Modeling Region.
(Nonattainment Counties Are Shaded. Each grid mark represents 4 kilometers and divides the region into 4 km by 4 km grid squares.)

B. State Implementation Plan Obligations. Based on 1991 through 1994 monitoring data, the Environmental Protection Agency on July 19, 1995, determined that measured air quality in the area met the ozone NAAQS and that the statutory requirement for an attainment demonstration (and other related requirements) was no longer applicable. However, there were a number of ozone exceedances in 1995 that resulted in a violation of the ozone NAAQS. During these exceedances monitoring stations at the Ohio-West Virginia border, measured one-hour ozone levels of 0.10 to 0.11 ppm. These data conclusively demonstrate that ozone from other states significantly contributes to the failure of the Pittsburgh-Beaver Valley Area to achieve the one-hour standard.

In response to violation of the health-based standard, the Commonwealth formed a stakeholder group in Southwestern Pennsylvania to review the ozone problem and recommend additional emission control programs.

On June 4, 1996, EPA published a finding that the area was no longer attaining the ozone standard and reinstated the applicability of the attainment demonstration and related requirements. These requirements are those required by Part D of Title 1 of the Clean Air Act, section 182(b) and 172(c)(9). EPA recognized the work of the stakeholders when it published a schedule for the completion of the attainment demonstration for the Pittsburgh-Beaver Valley ozone nonattainment area. In the June 4, 1996 *Federal Register* (61 FR 28061), the EPA stated:

> Taking the individual circumstances the Commonwealth faces in addressing its outstanding SIP requirements, including the Commonwealth's rule adoption process and the Southwestern Pennsylvania Ozone Stakeholders process, EPA has determined that it is reasonable to allow more time than proposed for the submission of a full attainment demonstration SIP.

EPA was also a member of the stakeholders group.

The schedule in the June 4 *Federal Register* notice was the result of a letter submitted by the Commonwealth. The notice formally established a series of milestones for the development of an attainment demonstration for the Pittsburgh-Beaver Valley ozone nonattainment area. These are:

> (A) By August 15, 1996, the Commonwealth was required to submit to EPA, and make available for public comment as a proposed SIP submission, complete photochemical oxidant modeling for the Pittsburgh area which identified the VOC and NOx reductions levels necessary for attainment, and a list of available control strategies.
>
> (B) By October 1, 1996, the Commonwealth was required to submit to EPA a SIP revision containing a photochemical oxidant modeling demonstration and a list of available control strategies.
>
> (C) By April 1, 1997, the Commonwealth was required to submit to EPA a SIP revision for those emission reduction strategies selected by the Commonwealth for the Pittsburgh area for which new regulations were not required.

(D) By April 1, 1997, the Commonwealth was required to submit to EPA a committal SIP revision for those emission reduction strategies selected by the Commonwealth for the Pittsburgh area that required new regulations.

(E) By December 31, 1997, the Commonwealth must submit to EPA as a SIP revision adopted, final, fully enforceable regulations encompassing the emission reduction strategies contained in the committal SIP.

The first four milestones have been met, as shown in the chart below. Pennsylvania has also finalized the regulations necessary to meet the last milestone. These regulations will be submitted to EPA prior to December 31, 1997. The proposed SIP revision contained in this document will be finalized after public comment and will also be submitted to EPA by December 31, 1997. It references and takes credit for the fully enforceable regulations for the control strategies identified in the March 14, 1997 submission. In addition, it contains additional discussion of the impact of transported pollutants and air quality modeling results and predicts attainment based on a weight-of-evidence analysis.

MILESTONE	DUE DATE	PA ACTION	EPA ACTION
A	8/15/96	Submitted 8/14/97	Accepted as complete 8/22/97
B	10/1/96	Submitted 9/30/96	Accepted as complete 10/10/97
C	4/1/97	Submitted 3/14/97	Accepted as complete 4/14/97
D	4/1/97	Submitted 3/13/97	Accepted as complete 4/14/97
E	12/31/97	This document	

II. Southwestern Pennsylvania Ozone Stakeholder Group Process

Gov. Tom Ridge formed the Southwestern Pennsylvania Ozone Stakeholder Working Group to evaluate the nature of the ozone problem in the Pittsburgh area and come to consensus on actions needed to meet and maintain the one-hour standard. The Stakeholders were asked to make recommendations on emission reduction strategies beyond the proposed low enhanced auto emissions inspection and maintenance program and the second phase of NOx control (a 55% emission reduction) contained in the Ozone Transport Commission's Memorandum of Understanding (OTC MOU).

In order to better understand the complex interaction of out-of-state transported air pollution and locally generated volatile organic compounds and nitrogen oxides, the Stakeholders, with Commonwealth assistance, commissioned a contractor to model air quality concentrations for the Pittsburgh area including the impact of potential emission reduction strategies. The Stakeholders reached a consensus recommendation on a number of issues.

Due to the complexity and uncertainty of ozone modeling and the multi-faceted nature of the ozone problem, a specific prescription for Southwestern Pennsylvania's ozone problem was not possible. Therefore, taking the model results and other information into account, the Working Group developed a three-tiered approach to use when addressing the ozone problem in Southwestern Pennsylvania. The three-tier approach recognizes the limitations of photochemical modeling, the role of transport and the local ozone producing emissions generated in Southwestern Pennsylvania when selecting control options.

The components are as follows:

Tier I: Recommendations to reduce local ozone precursors emitted in the seven-county nonattainment area.

Tier II: Recommendations to reduce upwind ozone precursors emitted outside the seven-county nonattainment area.

Tier III: Supplemental technical analyses which demonstrate that, within the uncertainties and limitations of the model, the Working Group's recommendations reduce the magnitude, frequency and geographic extent of the ozone problem sufficiently to enable DEP to prepare an attainment demonstration for submission to EPA.

This Section covers the Tier I and Tier II issues, while the Tier III issues are presented in Section III. A copy of the final Stakeholders report is available from the Department.

A. Ozone Air Quality Modeling. The Pittsburgh-Beaver Valley Ozone Modeling Study was aimed at characterizing the processes whereby ozone is formed and/or transported into the seven-county nonattainment region during high ozone episodes and to identify strategies for its control. Two major activities were carried out in the study: application of EPA's Urban Airshed Model version IV (UAM-IV) to three multiple-day ozone episodes in the Pittsburgh region and evaluation of alternative control strategies devised by the Southwestern Pennsylvania Ozone

Stakeholders Group for bringing the region into attainment with the one-hour NAAQS for ozone.

The Pittsburgh Ozone Modeling Study consisted of the following elements:

1. Develop a final work plan and ozone modeling protocol that describes the background, objectives and procedures to be followed in the modeling analysis;

2. Select three multi-day ozone episodes for UAM-IV modeling of the region using historical air quality and meteorological data;

3. Develop 1995 base-case, 1996 future year and control scenario emissions inventories for the Pittsburgh modeling domain;

4. Prepare meteorological and air quality inputs for each modeling episode;

5. Develop 1995 base-case and 1996 future year UAM-IV boundary conditions of ozone and ozone precursors;

6. Apply and evaluate full set of the meteorological and photochemical models used for each of the three episodes. Assess the suitability of each modeling episode for use in modeling future-year ozone impacts;

7. Apply the UAM-IV model to each episode to establish future-year 1996 baseline conditions;

8. Develop interim "across-the-board" emissions reduction strategies to estimate the level of controls needed for ozone attainment;

9. Apply the UAM-IV model for a variety of emissions sensitivity simulations to explore the effects on ozone concentrations due to various emissions reduction scenarios including tradeoffs between ground-level versus elevated sources, point versus mobile sources, local versus more distant sources and so on;

10. Apply the UAM-IV model for alternative control scenarios to assess whether the chosen strategies are effective in bringing the Pittsburgh-Beaver Valley region into attainment of the current one-hour NAAQS for ozone; and

11. Document UAM-IV modeling analysis and results in a series of reports and transmit the modeling files to the study sponsors.

The technical approach followed in this study was consistent with current EPA guidance regarding the regulatory application of photochemical models for SIP attainment demonstrations. However, in several instances, notably in the preparation of the meteorological fields, emissions inputs and boundary conditions to UAM-IV, more refined modeling methods were used instead of the default EPA methods. The models used in this study included UAM-IV, the Emissions Modeling System (EMS-95) and the PSU/NCAR Mesoscale Meteorological Model (MM5). In

addition, UAM-V and SAQM regional photochemical models were used to develop estimates of ozone and ozone precursor boundary conditions to the UAM-IV model for base case and future year simulations.

The episodes selected for the Pittsburgh-Beaver Valley ozone SIP modeling were drawn from the most recent five year historical record (i.e., 1991 through 1995) with primary emphasis given to significant ozone exceedances at numerous monitoring stations during the episode. Based on analysis of EPA AIRS ozone data, the most significant episodes occurring during 1991-1995 were:

Episode 1: July 31- August 2, 1995;
Episode 2: July 13-15, 1995; and
Episode 3: June 17-19, 1995.

The various meteorological and photochemical models were set up and evaluated for the three multiple-day modeling episodes following the procedure described in the ozone modeling protocol. A detailed evaluation of MM5 meteorological modeling for these episodes has also been completed. Emissions inputs were developed using the EMS-95 model.

The term "boundary condition" is used to represent air quality concentrations on the edges of the modeling region or domain as shown previously in Figure 1. The modeling domain is essentially a large box where the model transports pollutants from cell to cell at the same time chemically reacting the pollutants and calculating the ground level ozone concentrations. Boundary conditions are developed for five planes. Four are the vertical planes that make up the sides of the modeling region to the north, south, east and west. The fifth plane is the horizontal plane representing the top of the modeling region. While UAM-IV predicts local region concentrations, it is not capable of predicting concentrations for much larger scales.

Three approaches were evaluated for developing boundary conditions (BCs) to UAM-IV: (a) use of measurement data, (b) use of SAQM-derived BCs, and (c) use of UAM-V derived BCs. The preferred estimation methodology (UAM-V derived) was selected based on the belief that this latter approach offered the most realistic procedure for prescribing inflow, surface and aloft ozone and precursor species for the base year and future year modeling scenarios. Thus, UAM-V is used to calculate the boundary conditions for use in UAM-IV.

1. Evaluation of the Models

a. MM5 Meteorological Model: The MM5 meteorological model was used to prepare meteorological inputs to UAM-IV, UAM-V and SAQM urban- and regional-scale photochemical models for the three modeling episodes. Based on an operational evaluation for surface wind speed and direction and a scientific evaluation of surface and aloft temperatures and mixing ratios, the modeled meteorological fields were judged to be very good. The evaluation was consistent with results achieved in other recent studies in the U.S. with the same or similar state-of-science models. The MM5 model was judged to be adequate for providing urban- and regional-scale input to the photochemical models used subsequently in this study.

b. EPA UAM-IV Photochemical Model: The UAM-IV model evaluation revealed that

Episodes 1 and 2 may be relied upon at the present time for detailed control strategy assessment. The July 31- August 2, 1995 and July 13-15, 1995 modeling data sets can be used in assessing the suitability of alternative VOC and/or NOx control targets for attainment of the ozone NAAQS in the Pittsburgh-Beaver Valley nonattainment region. Based on review studies of photochemical grid model performance, the following conclusions were drawn for Episodes 1 and 2:

- UAM-IV simulations produce daytime peak prediction accuracy and gross error estimates for ozone that are consistent with previous urban-scale model simulations.

- For the design days of Episodes 1 and 2, the model does a good job of locating the domain-wide peak ozone levels.

In developing the UAM-IV modeling data base for the third Pittsburgh-Beaver Valley episode it was determined that the model could not be reliably used. Despite considerable diagnostic analyses with this June 17-19, 1995, episode, UAM-IV performance remained insufficient for control strategy testing and attainment demonstration modeling. Therefore, Episode 3 was determined, with EPA's concurrence, to be inadequate for use in ozone attainment planning. Episode 3 was the least severe of the three episodes modeled. Due to the extreme severity of Episodes 1 and 2, it is highly unlikely that the proposed emission controls would be deemed insufficient even if a new episode were to be evaluated. A detailed discussion of the difficulties with model performance for Episode 3 is contained in Appendix 4, Section 6 and also in Appendix 5, Section 4.

2. Measured Ozone Concentrations for Modeled Episodes

Up to the summer of 1995, the Pittsburgh-Beaver Valley area was measuring attainment with the one-hour ozone standard. During the summer of 1995, however, a number of exceedances of the standard occurred. As noted above, the three worst episodes for 1995 were selected for modeling. The actual measured maximum hourly ozone concentrations in ppm are shown in Figures 2, 3 and 4. This measured data demonstrates the extent of ozone entering Pennsylvania and the ozone gradient across western Pennsylvania during the modeled episodes. It is important to point out that the monitoring data clearly show that a significant contribution to ozone nonattainment in the Pittsburgh-Beaver Valley Area results from ozone transported into Pennsylvania from other states. The monitors on the Pennsylvania/Ohio/West Virginia border upwind of the Pittsburgh-Beaver Valley Area show ozone concentrations of 0.10-0.11 ppm or 83 to 92 percent of the standard. No Pennsylvania sources contribute to these significant border measurements.

3. Baseline Modeling Results

The model was used to predict baseline concentrations assuming growth through 1996 as required by EPA. The results are summarized in Table 1. Plots of the peak concentrations are shown in Figure 5 for Episode 1 (August 2nd meteorology) and in Figure 6 for Episode 2 (July 15th meteorology). (NOTE: The NAAQS of 0.12 ppm becomes a standard of 124 parts per

billion (ppb) due to rounding. For example, 125 ppb equals 0.125 ppm and rounds off to 0.13 ppm for comparison to the standard of 0.12 ppm following EPA guidance. Thus, 124 ppb equals 0.124 ppm and rounds down to 0.12 ppm).

While a large number of exceedances occurred with the July 13th meteorology, these exceedances are generally upwind in the Ohio-West Virginia portions of the modeling region. They are not the direct subject of this report but they do demonstrate the significance of transported air pollution for Southwestern Pennsylvania.

In Table 1, three different ozone measures (or metrics) are listed. The daily maximum ozone concentration (in ppb) is the maximum predicted ozone concentration anywhere within the UAM-IV modeling domain on each episode day. The grid total ozone is the sum, over all grid cells, of the daily maximum ozone concentration in each grid cell in the full UAM-IV domain. This is a measure of the maximum hourly, ground-level ozone mass throughout the domain during the day. The number of grid cells each day for which the daily maximum concentration exceeded the 124 ppb concentration level is also shown. All three of these metrics are valuable in assessing the air quality improvement from implementing potential control measures.

For Episode 1 on August 2nd , there are 17 grid cells that exceed 124 ppm with a peak concentration of 155 ppm in Allegheny County just downwind of Pittsburgh. For Episode 2 on July 15th, there are 21 grid cells with peak concentrations greater than 124 ppm. The maximum peak value is 131 ppm occurring near the Allegheny County-Washington County border. Another area of high ozone concentration is predicted just south of the city of Washington.

Table 1. Future-Year Baseline Ozone Concentrations for Episodes 1 and 2.

Episode Day	Daily Maximum Ozone Conc. (ppb)	Grid Total Ozone (ppb)	Number of Grid Cells > 124 ppb
Episode 1			
- 212 (31 July)	143	268,500	19
- 213 (1 Aug)	122	252,800	0
- 214 (2 Aug)	155	253,900	17
Episode 2			
- 194 (13 July)	154	301,600	239
- 195 (14 July)	124	302,000	1
- 196 (15 July)	131	294,600	21

B. Transported Ozone. The information available to the Stakeholders Working Group indicated that a substantial portion of the ozone in Southwestern Pennsylvania is caused by ozone and its precursors from upwind sources. These upwind emissions cause or contribute to exceedances on some days.

While the Working Group recognized that the Commonwealth had other options, the Working Group endorsed the OTAG process and expected its recommendations to address transport issues. The Working Group hoped that OTAG's recommendations would result in actions by the states and upwind sources, either voluntarily or through SIP calls by EPA, that would adequately meet the health, economic and other interests of Pennsylvania. In the event that upwind sources, upwind states or EPA did not implement measures to adequately address transport issues within a reasonable period of time via the OTAG process, the Working Group recommended that the Commonwealth explore its other options to effectively address the transport problem.

The Working Group also urged that EPA evaluate the impact of transport from upwind areas when considering what measures are appropriate when exceedances occur in Southwestern Pennsylvania.

Since the Stakeholders Final Report in January 1997, two important follow-up actions have occurred to deal with transported ozone and ozone precursors:

First, Gov. Tom Ridge filed a petition on August 14, 1997 with EPA asking it to take action to reduce air pollution coming into the Commonwealth from other states. Section 126 of the federal Clean Air Act gives states the ability to require EPA to address the issue of transport of pollution. Pennsylvania is using Section 126 to petition EPA in an effort to reduce emissions from a category of air pollution sources – large fossil-fuel fired combustion units and electric generating facilities – in most of the OTAG region. The petition requests moderate levels of reductions at these sources now, with an assessment to follow to determine if additional reductions are necessary. Pennsylvania has agreed to do the same with its sources. The petition requests that EPA establish specific emission limitations and reductions on the affected units in the 19 named states, as well as a schedule for compliance, if necessary. Documentation of transport of air pollution is presented in the petition, its appendices, similar petitions by other states and information available from the OTAG process. Appendix 6 contains a copy of the Petition filed by Pennsylvania.

Second**,** on October 10, 1997, EPA proposed a "Finding of Significant Contribution and Rulemaking for Certain States in the OTAG Region for Purposes of Reducing Regional Transport of Ozone." This action, under Section 110 of the federal Clean Air Act, proposes SIP calls for 22 states and the District of Columbia.

These SIP calls would require affected states to reduce NOx emissions to levels specified in the proposal. Individual states could choose how to achieve those reductions. The proposal calls for final requirements to be set in September 1998 and for states to submit required regulations and plans by September 1999. The reductions are to be achieved by September 2002. EPA has indicated that these reductions are necessary for meeting the current health standard for ozone and are a central component for meeting EPA's new ozone standard that was made final in July 1997. The proposed strategy was developed by EPA to implement the cooperatively- developed

recommendations of the 37 OTAG states.

The state by state NOx reduction targets are as follows:

State	% Reduction
Alabama	36
Connecticut	21
Delaware	28
District of Columbia	9
Georgia	35
Illinois	38
Indiana	42
Kentucky	40
Maryland	36
Massachusetts	32
Michigan	32
Missouri	43
New Jersey	25
New York	19
North Carolina	34
Ohio	43
Pennsylvania	32
Rhode Island	19
South Carolina	31
Tennessee	35
Virginia	21
West Virginia	44
Wisconsin	35

C. Local Emission Reduction Strategies. There are four local emission reduction strategies which the Commonwealth has adopted for the demonstration of attainment of the ozone standard. The four strategies are:

1. Enhancements to the motor vehicle emission inspection and maintenance program,
2. The second phase (55%) of the OTC NOx Memorandum of Understanding,
3. Clean gasoline regulations, and
4. Stage II vapor control requirements.

A SIP revision for the **motor vehicle emission inspection and maintenance program (IM)** was submitted to the Environmental Protection Agency on March 22, 1996. The Environmental Protection Agency granted conditional interim approval for this program on January 28, 1997. Regulations for the program were published September 29, 1997 and contain changes recommended by the Stakeholders Group; adding a gas cap pressure test, additional anti-

tampering provisions and increased emphasis on repair technician training. The regulations implementing this program are contained in Appendix 1. They are being submitted to EPA under separate cover as a formal SIP revision.

The **NOx Memorandum of Understanding** is an agreement among the states in the Ozone Transport Region to reduce NOx emissions from major combustion sources. The program is designed to reduce emissions from combustion units rated at greater than 250 mmBtu/hr by 55 percent from 1990 baseline levels or to 0.2 pounds NOx/mmBtu. This regulation was adopted, after appropriate public notice, comment and public hearings, by the Environmental Quality Board on September 16, 1997 and approved by the Independent Regulatory Review Commission on October 9, 1997. The regulation is scheduled for publication in the *Pennsylvania Bulletin* on November 1, 1997. The regulations implementing this program are contained in Appendix 2. They are being submitted to EPA as a SIP revision under separate cover.

The Stakeholders recommended a **cleaner gasoline** be sold in the Pittsburgh-Beaver Valley ozone nonattainment area during the ozone season. The Stakeholders recommended that all gasoline sold for dispensing in the seven county nonattainment area during the ozone season should be either federal Reformulated Gasoline (RFG) or 7.8 RVP (Reid vapor pressure) gasoline. Individual refiners and distributors will be authorized to select which fuel they wish to market during the ozone season. The low RVP gasoline reduces the evaporative losses from the storage tanks in vehicles. The RFG fuel reduces exhaust emissions and evaporative losses. This regulation was adopted, after appropriate public notice, comment and public hearing, by the Environmental Quality Board on September 16, 1997. It is scheduled to be published in the *Pennsylvania Bulletin* on November 1, 1997. The regulations implementing this program are contained in Appendix 3. They are being submitted to EPA as a SIP revision under separate cover.

The **Stage II vapor control requirements** are controls on the refueling of vehicles at gasoline dispensing facilities. Gasoline vapors are collected from the vehicle by a specially designed nozzle and returned to the facility's gasoline storage tank. The Stakeholders recommended the following schedule and throughput cutoff sizes for the implementation of these requirements.

1. By the end of the year 1998, Stage II should be put in place by all stations pumping an average of 120,000 gallons of gasoline per month based on 1995/1996 sales.
2. By the end of the year 2000, Stage II should be put in place by all stations pumping an average of 90,000 gallons of gasoline per month based upon 1995/1996 sales.
3. As of April 1, 1997, Stage II should be required to be installed and operational by all newly constructed gasoline dispensing facilities.
4. As of April 1, 1997, Stage II should be required to be installed and operational at the reopening of any gasoline dispensing facility which has been rebuilt or renovated, where tanks and associated piping have been substantially disturbed in the rebuilding or renovation process.
5. Stage II will no longer be required as of the year 2010 provided the federal program to have vapor collection canisters on-board each new vehicle is implemented.

In addition to the above limitations, the Department believes that very small gasoline marketers should be exempted from this rule. 25 PA Code Section 129.82(a)(1) provides an exemption for these small marketers. This exemption is based on the provisions of Section 325 of the Clean Air Act.

The Stakeholders recommended that Stage II implementation be contingent on the resolution of safety concerns. The Department will continue to investigate the safety concerns during the coming year. To date, no significant safety concerns have been documented. In addition, the Stakeholders recommended that the Department enhance the enforcement of the Stage I regulations. The Department and the Allegheny County Department of Health currently enforce the Stage I regulations and are exploring ways to enhance compliance with these requirements including an educational outreach program in cooperation with the service station associations.

The Department's authority to revise the existing SIP approved Stage II program to expressly implement these recommendations depends upon repeal of Section 6.7 of the APCA (35 P.S. 4006.7). Paragraphs (a) through (g) of Section 6.7 of the Air Pollution Control Act (35 P.S. 4006.7(a)-(g)) have been repealed. The Department will be modifying its regulations at 25 PA Code Section 129.82 to implement the stakeholder recommendations. Until the regulatory modification is complete, for newly constructed or substantially modified gasoline dispensing facilities, the Department will implement the existing regulations at 25 Pa. Code Section 129.82 on the following schedule:

1. As of April 1, 1997, Stage II is required to be installed and operational by all newly constructed gasoline dispensing facilities pumping an average of 10,000 gallons or more per month.
2. As of April 1, 1997, Stage II is required to be installed and operational at the reopening of any gasoline dispensing facility pumping an average of 10,000 gallons or more per month which has been rebuilt or renovated, where tanks and associated piping have been substantially disturbed in the rebuilding or renovation process.
3. By the end of the year 1998, Stage II will be required to be installed and operational by all stations pumping an average of 120,000 gallons of gasoline per month (based on 1995/1996 sales).
4. By the end of the year 2000, Stage II will be required to be installed and operational by all stations pumping an average of 90,000 gallons of gasoline per month based upon 1995/1996 sales.
5. After the year 2000, Stage II will be required to be installed and operational by all gasoline dispensing facilities regulated under Section 6.7 of the APCA and 25 Pa. Code Section 129.82. Prior to beginning to enforce this provision, the Department will determine whether these additional reductions are necessary to achieve or maintain the National Ambient Air Quality Standard for ozone. No emission reduction credits are included in this SIP for this portion of the current regulation.

This enforcement schedule implements the recommendation of the Southwest Ozone Stakeholders and is necessary for the Commonwealth to achieve attainment of the national ambient air quality standard for ozone. The regulations for Stage II were previously submitted to EPA and approved by EPA as a SIP revision effective on January 22, 1995.

The Stakeholders made recommendations for future additional programs. A number of these are under development. For example the Stakeholders supported voluntary, episodic, public measures such as the Ozone Action Partnership to reduce emissions on days with high ozone potential. While these and other programs are under development no credit has been assumed in this plan for those measures.

D. Predicted Concentrations with the Four Identified Local Emission Reduction Strategies. Predicted peak concentrations after application of the local emission reduction strategies show significant improvement in air quality. Frequently, peak concentrations occur in areas west of, and largely unaffected by, Pennsylvania emissions. Remaining peak values are virtually at the ambient standard. Below the future-year ozone estimates for both episodes are presented. Also included are additional ozone measures (or "metrics") based on the spatial extent of peak ozone concentrations $\geq$ 124 ppb.

Table 2 and Figures 7-12 present the attainment-year UAM-IV modeling results for the six days of the two primary episodes. The table and figures list ozone statistics for each day based on the highest ozone concentration modeled in each grid cell irrespective of hour. In Figure 9, for example, there are a total of 5 grid cells in the domain for which the daily maximum predicted ozone concentration exceeded 124 ppb.

Table 2. Maximum Predicted Ozone Concentrations Throughout the Entire Pittsburgh-Beaver Valley UAM-IV Modeling Domain for Episodes 1 and 2.

Episode Day	Domain Maximum Ozone Conc. (ppb)	Domain Total Ozone (ppb)	Number of Grid Cells > 124 ppb
Episode 1			
- 212 (31 July)	137	253,500	3
- 213 (1 Aug)	109	248,600	0
- 214 (2 Aug)	140	258,700	5
Episode 2			
- 194 (13 July)	114	230,800	0
- 195 (14 July)	105	246,900	0
- 196 (15 July)	126	224,300	2

Beginning with the statistical results in Table 2, three different ozone measures (or metrics) are listed. The daily maximum ozone concentration (in ppb) is the maximum predicted ozone concentration anywhere within the UAM-IV modeling domain on each episode day. For Episode 2, these peak grid predictions occur within the seven-county nonattainment area. However, for

Episode 1, the grid maximum ozone predictions on July 31st and August 2nd (the days with concentrations exceeding 124 ppb) are predicted to occur *upwind* of the seven-county nonattainment area and in fact are located on the OH-WV border. The grid total ozone shown in Table 2 is the sum, over all grid cells, of the daily maximum ozone concentration in each grid cell in the full UAM-IV domain. This is a measure of the maximum hourly, ground-level ozone mass throughout the domain during the day. The number of grid cells each day for which the daily maximum concentration exceeded the 124 ppb concentration level is also shown. All three of these metrics are valuable in assessing the air quality improvement from implementing potential control measures. From Table 2, the maximum future year one-hour ozone peaks on each of the Episode 1 days are respectively 137 ppb, 109 ppb, and 140 ppb. For Episode 2, they are 114 ppb, 105 ppb, and 126 ppb.

As noted, for all days in Episode 2 and the middle day of Episode 1 (August 1), the peak ozone impacts occur within the seven-county nonattainment region. However, on the two highest-impact days, the peaks occur immediately downwind of NOx point source complexes along the Ohio River in eastern Ohio. For the weather conditions of this episode, these locations in Ohio are upwind and outside of the nonattainment region*;* thus, as discussed in Appendix 5 Section 6, these peak predictions are disregarded. Within the nonattainment area itself, the maximum predicted ozone concentrations on July 31st and August 2nd are 125 ppb and 135 ppb, respectively.

Table 2 shows that there are a total of 8 grid cells for which daily maximum ozone concentrations were greater than 124 ppb for Episode 1. Considering only the nonattainment area, this number of exceedance cells is reduced to five. For Episode 2, only two grid cells exceed the 124 ppb threshold.

In summary, the maximum ozone impacts within the Pittsburgh-Beaver Valley nonattainment area and downwind impact regions for the six subject modeled days are below the 124 ppb threshold with the following exceptions:

Episode Day	**Maximum Ozone**	**Cells > 124 ppb**
July 31	125 ppb	1
August 2	135 ppb	4
July 15	126 ppb	2

Appendix 5 provides a more in-depth discussion of these results.

The federal standard is attained when monitoring data show no more than three days on which an exceedance occurs over a three year period evaluated at each monitor. The method for evaluating attainment, based on air quality modeling predictions for future conditions, is set forth by EPA in "Guidance for Regulatory Application of the Urban Airshed Model," 1991. In general for severe ozone episodes such as those used for this evaluation, predicted concentrations should not exceed 130 ppb. Since one grid cell for the six days evaluated by the attainment study does exceed this value, further analysis is required and is presented in the following section.

III. Attainment Plan Modeling Weight-of-Evidence Demonstration

The EPA has issued revised guidance on the use of photochemical grid models for demonstrating attainment of the federal one-hour ambient ozone standard as the result of broadening experience in using UAM-IV and other models in support of regulatory decision making. EPA identifies two alternative approaches for using models to demonstrate attainment. Referred to as the "statistical" and "deterministic" approaches, each consists of various tests that must be passed in order for attainment to be demonstrated.

Should one or more of the tests narrowly fail, weight-of-evidence analyses are then recommended to determine if there is compelling evidence to suggest that attainment is indeed likely notwithstanding the failure of passing the relevant test. A determination makes it possible to demonstrate attainment even if a test is not quite passed. Mid-course review of the success of the attainment plan is also required to provide a safeguard to ensure that the standard is successfully attained.

Following EPA criterion the use of the statistical approach was permitted. For this analysis, EPA criteria call for the region to be subdivided into an array of four cell by four cell sub-regions. Each sub-region thus contains 16 cells that are 4 km by 4 km. This approach establishes three benchmarks to be met as follows:

(1) allows **up to** three exceedances in every sub-region depending on the severity of the modeled days,
(2) limits the magnitude of each allowed exceedance depending upon the severity of the modeled days and observations at current attainment sites throughout the U.S. and
(3) requires that if the UAM-IV model under-predicts the peak observed ozone by more than 5 percent, at least an 80 percent reduction in the incidence of predicted daytime ozone concentrations greater than 124 ppb be demonstrated.

Associated with the statistical approach are a set of weight-of-evidence analyses wherein:

(a) weight is assigned to model predictions considering performance, data quality, length of projection period and closeness of model results to test's criteria;
(b) results of other analyses are reviewed and weighed. "Other analyses" include consideration of trends, severity of modeled days, other grid model results, observational models, responsiveness of model predictions and associated costs; and
(c) balance is reached subjectively based on how close model results come to passing the test, the credibility of each analysis and the decisiveness of results.

The conclusions reached in carrying out the statistical approach and the weight-of-evidence analyses for the Pittsburgh-Beaver Valley region are presented below and in greater depth in Appendix 5.

A. Statistical Approach

Benchmark 1: Because no individual sub-region has more than two modeled exceedances over the six design days Benchmark 1 is easily passed.

Benchmark 2: For this benchmark to be passed, according to EPA criteria, concentrations cannot exceed 130 ppm in any sub-region.

On August 2nd, two sub-regions have predicted maxima exceeding the 130 ppb EPA statistical limits. However, since these locations are upwind of the Pittsburgh-Beaver Valley nonattainment region on the modeling episodes, emissions from the nonattainment area have no plausible connection with the ozone predicted in these upwind subregions. Thus, the exceedances in the Ohio-West Virginia area can be disregarded since they are unaffected by emissions controls in the seven-county Pittsburgh-Beaver Valley nonattainment area. Wind directions supporting this conclusion were presented in "Evaluation of the MM5 Model for Three 1995 Regional Ozone Episodes Over the Northeastern United States," October 1,1996 on page 8-41.

Excluding these two sub-regions the maximum prediction on August 2nd was 135 ppb. Since UAM-IV over-predicted monitored ozone peaks in this local sub-region by 14 ppb (10%), the 135 ppb prediction is quite likely overestimated as well.

Since the 135 ppb value is less than four percent higher than EPA's 130 ppb allowable statistical threshold, it seems likely that if UAM-IV had demonstrated zero bias in peak prediction on this day in Allegheny county, there would have been no predicted value exceeding the 130 ppb allowable statistical level.

Nevertheless, because the predicted exceedance of 135 ppb is greater than 130 ppb, Benchmark 2 is not passed, but only by a very narrow margin. Therefore, the weight-of-evidence analyses is required. The weight of analysis indicating that Benchmark 2 is actually passed easily is described below.

Benchmark 3: Benchmark 3 is passed on the two days where it applies, August 1 and July 15. In fact, the percent reduction in daytime ozone exceedances is greater than 80 percent on <u>all</u> modeling days.

B. Weight-of-Evidence Analyses:

A number of analyses were conducted. Eleven technical analyses are covered in detail in Appendix 5. These analyses are divided into two categories: 1) a series of analyses which review the basic data used in the modeling and 2) a series of analyses which review the modeling methodologies and procedures.

The first category contains the following seven analyses which support the weight of evidence analysis by showing that the basic data were consistent with EPA guidelines and

produced good quality results:

1. Selected episodes cover days with high ozone potential.
2. Selected episodes are severe ozone events.
3. Ozone modeling explains much of the variance in concentrations.
4. UAM-IV model performance is good.
5. The data used is extensive.
6. The projection time period is short.
7. There is a high degree of confidence in the inventories.

The second category contains the following four additional analyses which can be considered focused ones since they focus on particular aspects of the modeling:

1. UAM-IV over-predicts daily peak ozone concentrations for Episode 1.
2. Model results come very close to meeting the benchmarks.
3. Outdated numerical methods may explain over-prediction.
4. The two delta-x method for comparing grid model predictions with the standard shows attainment.

Additional weight-of-evidence analyses are included in the Pennsylvania Section 126 petition and the proposed EPA Section 110 SIP call which demonstrate the expected air quality improvements from these emission reduction programs. Section IV demonstrates that the Pittsburgh Area is significantly impacted by overwhelming transport originating in states upwind of Pennsylvania. This demonstration supports and corroborates the technical weight-of-evidence discussion.

Pennsylvania's weight-of-evidence analysis and Sec. 126 petition or EPA's proposed Sec. 110 SIP call when combined with the adopted local emissions reduction regulations present sufficient evidence that this plan will provide for attainment of the one-hour ozone NAAQS.

IV. Reductions in Interstate Air Pollution

Pennsylvania and EPA recognize, and the technical analysis demonstrates, that reductions in the transport of ozone and NOx are necessary to achieve the ozone standard. As discussed below, OTAG has provided the most complete technical analysis of ozone transport ever completed. Pennsylvania along with seven additional northeastern states has filed a Petition for Abatement of Excess Emissions with EPA seeking reductions in NOx emissions from states in the midwest and south. EPA has also proposed both a determination that these reductions are necessary for Pennsylvania to achieve the one-hour standard and a SIP call to 22 states to address the transport problem.

Reductions in transported ozone and NOx from states in the midwest and south, along with the local emission reduction requirements discussed previously will assure that Pennsylvania is able to attain the one hour ozone standard in the Pittsburgh-Beaver Valley Area. When combined with the weight of evidence analysis described in the previous section, reductions in transport provide additional support for a finding that the Pittsburgh-Beaver Valley Area attains the one-hour ozone standard.

A. Measured Data. Measured data from the summer of 1995 included previously as Figures 2,3 and 4 shows peak one-hour concentrations on the western Pennsylvania boundary regularly in excess of 100 ppb on ozone exceedance days.

During the summer of 1997, additional ozone exceedances were measured in the seven county nonattainment area. This measured air quality data continues to show elevated ozone concentrations entering Pennsylvania, as high as 113 ppb. Figure 13 shows this measured data for June 24, July 12 and July 13, 1997. This graphically demonstrates that emissions from outside of Pennsylvania continue to significantly contribute to nonattainment in the Pittsburgh-Beaver Valley Area.

B. Ozone Transport Assessment Group (OTAG). OTAG was formed by the Environmental Council of the Sates to assist states east of the Mississippi River in attaining the federal clean air standards for ozone and to develop regional strategies to address the regional ozone problem. This national workgroup was composed of representatives from the 37 easternmost states, the District of Columbia, and other interested stakeholders from industry and environmental groups. The workgroup's goal was "to identify and recommend a strategy to reduce transported ozone and its precursors, which, in combination with other measures, will enable attainment and maintenance of the ozone standard in the OTAG region."

One of the primary conclusions reached by OTAG was that "regional NOx reductions are effective in producing ozone benefits; the more NOx reduced, the greater the benefit." As a result, OTAG recommended ranges of utility and non-utility NOx control levels for much of the OTAG region. The benefits from such regional reductions are shown in Figure 14, which shows the OTAG modeling results for 60% reduction in elevated NOx emissions for the July 15 day of Episode 2 for the southwestern Pennsylvania area. This indicates a benefit of 12 to 20 ppb in the southwest Pennsylvania area.

Figure 15 shows the potential benefits for OTAG sensitivity run 5g. This modeling run reduced elevated NOx by 80 percent and low-level NOx by 60 percent. This strategy is predicted to achieve reductions for the July 15 day of Episode 2 for the southwestern Pennsylvania area of up to 20-28 ppb. In the near-by portions of OH and WV up to a 28-36 ppb air quality improvement is expected. Further information is available on the OTAG web site (http://www.epa.gov/ttn/OTAG).

C. Pennsylvania Sec. 126 Petition. The need for upwind emission reductions is also documented in the PA Section 126 Petition included as Appendix 6. This petition supports the OTAG process by requesting EPA to ensure reduction of ozone and ozone precursor transport through specific NOx reductions from large fossil fuel-fired combustion units within much the OTAG area. As shown previously and in more detail in Appendix 6, air quality improvements of 12-20 ppb are predicted depending on final emission reductions. Additional information in Appendix 6 reviews aircraft measurements at the western PA border, back trajectory analysis of the path of high ozone air masses arriving in western Pennsylvania on exceedance days and monitored ozone data for western Pennsylvania border sites. Expeditious action on the Pennsylvania Sec. 126 Petition is necessary to achieve the reductions in transported ozone in a timely fashion.

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D. EPA Sec. 110 SIP Call. During the OTAG process EPA committed to issue requirements for states where transport interfered with ozone attainment under Sec. 110 of the federal Clean Air Act. In October, EPA proposed this Sec. 110 SIP call, setting forth emissions budgets for 22 of the 37 OTAG states. EPA finds that these 22 states "significantly contribute to nonattainment in, or interfere with maintenance by, a downwind state." States, including Pennsylvania, would be required to adopt and submit, within 12 months after publication of the notice of final rulemaking, SIPs containing control measures that will mitigate the ozone transport problem by meeting the assigned statewide emissions budget. State by state reductions were presented previously in Section II, B of this plan. EPA believes that OTAG strategy run 5, which is shown in Figure 16, is closest to the emissions reductions and air quality improvement expected from the EPA proposed SIP call. This strategy would require significant NOx and VOC reductions from a variety of sources as outlined in EPA's proposal.

V. Conclusion

Emission reductions from previous air pollution control efforts have significantly improved air quality in Southwestern Pennsylvania, lowering ground-level ozone in the area to concentrations approaching the one-hour health-related NAAQS. However, the area has still experienced unhealthful air quality during summer episode conditions, as indicated by measured data in 1995 and 1997.

To address this problem, Pennsylvania brought together local representatives to develop an approach for meeting the one-hour ozone standard. Studies commissioned by the Stakeholders and measured air quality demonstrate that Southwestern Pennsylvania is substantially affected by transported ozone from other states in addition to local emissions from highway vehicles, industrial sources and other general activities.

The Stakeholders recommended a three tiered approach: reduce local emissions, reduce transported ozone and ozone precursors and use a weight-of-evidence analysis to develop an attainment plan.

Local emissions are reduced by the four major programs developed by the Stakeholders which are incorporated in this document. Reductions are achieved from Pennsylvania's motor vehicles, large utilities and industries as well as smaller general sources. Those local reduction strategies, included in the Stakeholders final report, are aggressive and cost-effective, and their effect is significant.

Reductions in transported ozone and ozone precursors are expected as a result of either Pennsylvania's Sec. 126 petition or EPA's Sec. 110 SIP call. Air quality modeling using a statistical analysis is presented in this document which shows that only one day out of six severe days modeled for attainment does not meet EPA criteria for demonstrating attainment.

Pennsylvania's weight-of-evidence analysis and Sec. 126 petition or EPA's proposed Sec. 110 SIP call when combined with the adopted local emissions reduction regulations present sufficient evidence that this plan will provide for attainment of the one-hour ozone NAAQS.

APPENDIX 1

Motor Vehicle Emission Inspection and Maintenance Program Regulations

APPENDIX 2

NOx Memorandum of Understanding Regulations

APPENDIX 3

Clean Gasoline Regulations

APPENDIX 4

Photochemical Modeling Analysis of the Pittsburgh-Beaver Valley Ozone Nonattainment Area: Volume VII - Final Report

Appendix 5

Photochemical Modeling Analysis of the Pittsburgh-Beaver Valley Ozone Nonattainment Area: Volume VI - Attainment Demonstration

Appendix 6

Petition of the Commonwealth of Pennsylvania for Abatement of Excess Emissions