

March 28, 2002

SUBJECT: Mid-Course Review Guidance for the 1-Hour Ozone  
Nonattainment Areas that Rely on Weight-of-Evidence  
for Attainment Demonstration

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TO: Air Division Directors, Regions I - X

## SUMMARY

This memorandum—

1. Transmits the technical guidance for performing Mid-Course Reviews (MCR), *Recommended Approach for Performing Mid-course Review of SIP's to Meet the 1-hour NAAQS for Ozone*. (See Attachment.)

The guidance was developed primarily for certain eastern States with serious or severe nonattainment areas that have committed in their 1-hour ozone SIPs to complete and submit a MCR or related analysis (such as an early attainment assessment). This guidance may also prove useful to other areas that may submit new or revised attainment demonstrations relying on weight-of-evidence. In addition, this guidance may have other uses that EPA may reference from time to time.

2. Provides policy guidance for using the MCR technical guidance.

The EPA's modeling and attainment demonstration guidance<sup>1</sup> provides that States using long term projections (which is the case for severe and extreme nonattainment areas, as well as serious areas requesting attainment date extensions) commit in their SIPs to perform a mid-course review. Also, EPA's proposed rulemaking on the 1-hour ozone SIPs for ten nonattainment areas (December 16,

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<sup>1</sup>U.S. EPA, (1996), Guidance on Use of Modeled Results to Demonstrate Attainment of the Ozone NAAQS, EPA-454/B-95-007, (June 1996). Web site: <http://www.epa.gov/ttn/scram/> (file name: "O3TEST").

1999) set forth a framework for reviewing and processing those 1-hour ozone SIPs; one element of that framework was a commitment for a MCR.<sup>2</sup> That proposed rulemaking also noted, “The EPA’s 1996 modeling guidance also recognizes a need to perform a mid-course review as a means for addressing uncertainty in the modeling results. Because of the uncertainty in long term projections, EPA believes a viable attainment demonstration that relies on weight of evidence needs to contain provisions for periodic review of monitoring, emissions, and modeling data to assess the extent to which refinements to emission control measures are needed.”<sup>3</sup>

This memorandum covers several topics:

- The overall MCR process and timing, including the potential consequences of findings that progress toward attainment is or is not being made.
- Guidance for situations where failure to make progress is due to transport.
- Special schedule for other (e.g., moderate or serious) ozone nonattainment areas with attainment dates of 2004 or earlier.

The Regional Offices should provide this guidance to the appropriate State air pollution control agencies.

## BACKGROUND

A mid-course review (MCR) provides for an opportunity to assess if a nonattainment area is or is not making sufficient progress toward attainment of the one-hour ozone standard. The review will utilize the most recent monitoring and other data to assess whether the control measures relied on in a SIPs attainment demonstration have resulted in adequate improvement of the ozone air quality. The EPA believes that a commitment to perform a MCR is a critical element in any attainment demonstration that employs a long term projection period and relies on a weight of evidence test.<sup>4</sup> In proposing to approve the attainment demonstration SIPs for ten serious and severe nonattainment areas for the 1-hour ozone NAAQS on December 16, 1999, EPA indicated that in order for EPA to approve the SIPs, the States would need to commit to perform a MCR, since they relied on a weight of evidence test with long term projections. EPA also requested the States to work with EPA in a public consultative process to develop a methodology for performing the MCR and develop the criteria by which adequate progress would be judged. The States have participated in such a consultative process with EPA, which

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<sup>2</sup>See, e.g., *Federal Register* December 16, 1999 (64 FR 70318 at 70323).

<sup>3</sup>*Ibid.*

<sup>4</sup>U.S. EPA (1996) op. cit.

resulted in the development of the attached MCR technical guidance. A methodology other than the one developed from the public consultative process would need to be approved in advance by EPA.

The attached technical guidance contains three basic steps: (1) perform an administrative test (e.g., demonstrate whether the appropriate emission limits were adopted and implemented); (2) analyze available air quality, meteorology, emissions and modeling data and document findings; and (3) document conclusions regarding whether progress toward attainment is being made using a weight of evidence determination (which may or may not include new modeling analyses).

In the December 16, 1999, notices of proposed rulemaking, EPA did not request that States commit in advance to adopt new control measures as a result of the MCR process. Based on the MCR, if EPA determines additional control measures are needed for attainment, EPA would determine whether additional emission reductions are necessary from the State or States in which the nonattainment area is located or upwind States, or both. The EPA would then require the appropriate State or States to adopt and submit the new measures within a specified period. The rulemaking proposals noted that EPA anticipated that these findings would be made as calls for SIP revisions under section 110(k)(5) and, therefore, the period for submission of the measures would be no longer than 18 months after the EPA finding.

## GUIDANCE

### A. Overall Process and Timing

The basic MCR process has several steps:

1. At the mid-course period, the State performs an assessment of progress toward attainment using available data. The attached technical document provides guidance on various analyses that can be used in a MCR. Table 1 below provides a summary of the analyses that EPA highly recommends be included in this assessment, together with additional analyses that the State may want to consider. The State also performs an “administrative” test, which includes several determinations, such as whether the necessary emission limits have been adopted and implemented.
2. Using this information, the State determines whether sufficient progress is being made toward attainment. The State may rely on a weight of evidence demonstration in which a number of factors may be considered, such as fluctuations due to meteorology or impacts of transported ozone and precursors. These results are presented to EPA for review.
3. The EPA evaluates the MCR and determines whether sufficient progress is being made.
4. If EPA determines that sufficient progress is not being made, EPA may call for a SIP revision that includes either or both of the following:

- a. A near-term correction, for which the State could apply one or more of its contingency measures (contained in the SIP for failure to make reasonable further progress) or additional measures. One way to identify additional emission reductions needed is found in the attached technical guidance document.
- b. A longer term correction, which may require new modeling, following the June 1996, EPA “Guidance on Use of Modeled Results to Demonstrate Attainment of the Ozone NAAQS,” and which may result in the need for adoption of new additional emission control measures.

TABLE 1  
HIGHLY RECOMMENDED AND OPTIONAL ANALYSES FOR MID-COURSE REVIEW

<b>Highly Recommended Analyses</b>	<b>Additional Optional Analyses</b>
<p>1. Review/Assessment of monitored ozone trends from 1994 to the year the MCR is performed (e.g., 2004). This should address year-to-year variations with emphasis on the most recent 5 years. <u>Tech. Guidance citation:</u> 2.1</p>	<p>Trends assessment over a longer period (that corresponds to the time period of the SIP) that accounts for year-to-year variation.</p>
<p>2. Adjustment of monitored ozone trends for year-to-year meteorological variations using curve fitting technique. <u>Tech. Guidance citation:</u> 2.1</p>	<p>Adjustment for Meteorology using CART or other Technique <u>Tech. Guidance citation:</u> 2.1</p>
<p>3. An assessment of observed ozone trends in relation to previous projections of emission reductions from 1996 to the year the MCR is performed (e.g., 2004), including an interpretation of observed changes in ozone concentrations resulting from the NO<sub>x</sub> SIP call.<sup>5</sup> It is not intended to suggest that an entire emission inventory needs to be developed for the year for which the MCR is performed. But, some assessment of the relative change in ozone concentrations compared to the relative change in emissions is needed. EPA expects that any emissions assessment should be based on MOBILE6. <u>Tech. Guidance citation:</u> 2.1</p>	

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<sup>5</sup>Based on the meteorology in the year the MCR is performed and the previous year (e.g., 2003 and 2004) and an anticipated report from EPA on the status of regional NO<sub>x</sub> emission reductions.

<b>Highly Recommended Analyses</b>	<b>Additional Optional Analyses</b>
<p>4. An identification of an ozone “target”<sup>6</sup> for the year the MCR is performed (e.g., 2004) using techniques cited in the technical guidance.<sup>7</sup></p> <p><u>Tech. Guidance citation:</u> 3.2</p>	<p>Identification of an ozone target for the year the MCR is performed (e.g., 2004) using Air Quality Modeling.</p> <p><u>Tech. Guidance citation:</u> 2.3</p>
<p>5. A discussion of observed differences in upwind and downwind monitors to attempt to ascertain if any lack of progress toward attainment is caused by local or transported emissions and ozone concentrations</p> <p><u>Tech. Guidance citation:</u> 2.2</p>	
<p>6. A statement of the state’s current overall VOC / NO<sub>x</sub> emission reduction strategy/approach. Where data are available, PAMs ambient hydrocarbon data and NO<sub>y</sub> measurements should be considered in this assessment.</p> <p><u>Tech. Guidance citation:</u> 2.1</p>	

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<sup>6</sup>The target needs to be derived only if results of analyses 1, 2 and 3 above does not project attainment.

<sup>7</sup>Estimates of inventory change from the year the MCR is performed (e.g., 2004) to the attainment date are derived from interpolation of ROP SIP 2002, 2005, and (where appropriate) 2007 inventories and new control measure emission benefits and implementation schedules. A new inventory would not be needed for the year the MCR is performed (e.g., 2004). This approach assumes that Regional NO<sub>x</sub> reductions are substantially implemented by 5/2004. The emission change from the year the MCR is performed (e.g., 2004) to the attainment date can be multiplied by previously-derived ozone/emissions sensitivity factors, and the result added to 124 ppb to obtain the target.

Highly Recommended Analyses	Additional Optional Analyses
<p>7. Administrative reviews:</p> <p>a. Review of progress on previous State and local control measures implemented or underway. At a minimum, the review must address whether all the rules needed to effect emission reductions have been adopted. The review must assess the degree of implementation of local measures using available information.</p> <p>b. A conclusion as to whether attainment is expected by the attainment date (on or off-track). This would account for an anticipated EPA assessment of national and regional measures.</p> <p>c. If attainment is not anticipated by the attainment date, the review should contain an identification of reasons why attainment is not anticipated.</p> <p>d. If attainment is not anticipated by the attainment date, and the MCR analysis indicates that local short-term corrective measures could be taken to help put the area back on track toward attainment, then the submission could identify such measures.</p>	
<p>8. Consultation with EPA regarding any analyses contemplated that is not in Columns 1 or 2 above.</p>	

Table 2 below outlines the process and recommended timing of the MCR process. The dates in this table are based on performance of the MCR in 2004, but comparable timeframes should be used where the MCR is performed in a different year. Deviations in timing or approach should be discussed in advance with the appropriate Regional Office.

TABLE 2  
MID-COURSE REVIEW TIMEFRAME

DATE*	ACTIVITY
As soon as possible	Using the technical guidance for performing the MCR, State identifies air quality expected to be achieved at “mid-course” period (at the end of the year the MCR is performed (e.g., 2004))

DATE*	ACTIVITY
between 12/31/03 and 6/30/04	Recommended effort: States should identify analyses and data bases which will be used to support a mid-course review and discuss these with the appropriate U.S. EPA Regional Office.
10/1/04	EPA to provide any available assessments of national and regional control measures.
12/31/04	State submits its MCR to EPA that determines whether sufficient progress toward attainment is being made. Even though the MCR is not a SIP revision, EPA recommends that the State provide an opportunity for public comment on the MCR before submission to EPA.

DATE*	ACTIVITY
3/31/05 to 12/31/05	<p>If the State determines that sufficient progress is being made, the State would continue implementing the SIP. If the State determines that progress is not being made, the State would proceed as follows depending on the degree of progress:</p> <ol style="list-style-type: none"> <li>a. In all cases, the State should identify the already adopted control measures for which emission reductions phase-in after the year in which the MCR is performed (e.g., post-2004), and potential new control measures that could form the bases for the emission reduction inventory input for future air quality modeling if needed.</li> <li>b. EPA recommends that the State implement some or all of the short-term corrections identified in its MCR to expedite getting the area back on course toward attainment.</li> <li>c. If the problem is more severe and not readily addressed by short-term corrections, EPA recommends that the State voluntarily and expeditiously begin the process to revise its SIP, including new modeling as appropriate.</li> </ol> <p>EPA will also review the MCR. If EPA determines that sufficient improvement in ozone air quality is not occurring within the State, and that the State is not implementing sufficient corrective measures to address its contribution to that lack of progress, EPA would either find that the State has failed to implement a part of its SIP and/or issue a call for SIP revision for the State. Also, if EPA determines that sufficient progress is not being made by any upwind State that had previously been found to contribute significantly to the State's ozone problem, EPA would concurrently either find that an upwind State has failed to implement a part of its SIP and/or issue a call for a SIP revision from such an upwind State. (Likely timeframes for proposed and final rule on call for SIP revision: 4/30/05 and 8/31/05.) See section B below regarding transport.</p> <p>The EPA would specify the time period for a State to act; that time would be no longer than 18 months from the determination of lack of progress or call for SIP revision (e.g., 2/28/07). Actions the State may need to take are--</p> <ul style="list-style-type: none"> <li>--any corrective action identified in the MCR</li> <li>--submitting a new attainment demonstration with new modeling based on a new base year emission inventory and appropriate meteorological episodes.</li> </ul>
3/31/05 to 2/28/07	State voluntarily completes the corrective actions or submits a SIP revision in response to an EPA SIP call.

DATE*	ACTIVITY
<p>* In the notices of proposed rulemaking of December 16, 1999, EPA originally asked the States with serious and severe ozone nonattainment areas to commit to submit their mid-course review by the end of 2003; the selection of this time by EPA and the States was based in large part on the expectation that NO<sub>x</sub> emission reduction controls under EPA's NO<sub>x</sub> SIP call would be implemented by that time. However, in August 2000, the U.S. Court of Appeals for the D.C. Circuit ruled that EPA could not require compliance with the NO<sub>x</sub> SIP call reductions before 5/31/04. Therefore, many States affected by the NO<sub>x</sub> SIP call emission reductions revised their commitment to submit the MCR on the schedule suggested above.</p>	

It is recognized that a revised attainment demonstration submitted in response to the MCR may not provide emission reductions in sufficient time to result in attainment for areas with an attainment date earlier than November 2007 (however, see section D below). If implemented in the ozone season of 2007, these reductions should be sufficient for an area with a 2007 attainment date to qualify for the first of two possible one-year attainment date extensions.

In cases where the analysis will not result in corrective actions by the ozone season of the attainment year, the analysis should more correctly be termed an "accelerated attainment assessment" rather than a true mid-course review, since it will serve the purpose of beginning corrective analyses and actions early when it appears that the SIP will not result in attainment by the attainment date.

#### B. Where Failure to Make Progress Is Due to Transport

Section 2.2 of the MCR technical guidance provides a tool for assessing the relative importance of transported emissions compared to local emissions. The analysis may show that an area's failure to make adequate progress toward attainment may be largely due to transported ozone and precursors. The State should identify this situation in its MCR and recommend or propose ways of addressing control, including filing a petition with EPA under section 126 to require control of upwind sources contributing to the continuing nonattainment. To the extent that EPA determines that the lack of adequate progress is due to transport from across State lines, EPA will use its authority under the Clean Air Act to address the contributing emission sources. To the extent that the lack of progress is due to local emissions, EPA will address that situation through an appropriate remedy (e.g., a call for a SIP revision if additional control is needed or a finding of failure to implement and/or federal enforcement if existing controls requirements are not being enforced).

Staff from some of the northeast Ozone Transport Commission (OTC) States have recommended that the issue of transport be addressed in a more comprehensive manner and have provided EPA with some ideas for the format of such an activity. OAQPS intends to follow up with the affected States on their ideas.

### C. Special Schedule for Serious Areas with Proposed Attainment Dates of 2004 or Earlier

The December 1999 notices of proposed rulemaking (NPRs) on the 1-hour O<sub>3</sub> SIPs for these areas (Atlanta and Western Massachusetts) acknowledged that in order to approve the attainment demonstration SIP for the serious areas requesting an attainment date extension to a year prior to 2005, a review that occurs at a midpoint prior to the attainment date would be impractical in terms of timing. Therefore, for these areas, EPA requested the State's commitment to an MCR be a commitment to perform an early attainment assessment to be submitted by the end of the attainment year. Such an early attainment assessment should follow the MCR technical guidance noted above. This early attainment assessment will help guide the State and EPA in determining what further action might be required if the area does not attain by its attainment date.

### D. New Attainment Demonstration and Modeling as Part of MCR

Some States may wish to perform new modeling and develop a new attainment demonstration as part of their MCR. This approach is actually preferable to a mid-course assessment without new modeling, since it will result in a more timely assessment of the magnitude of the problem that exists at a point in time prior to the attainment date. More importantly, it will address any problems (i.e., identify and plan for additional emission reductions that might be needed to ensure attainment) much sooner than any SIP revision that EPA would require subsequent to submission of a mid-course review.

New attainment demonstration and modeling should make use of the most up-to-date guidance (e.g., EPA 1996 modeling guidance), analytical techniques, and models such as MOBILE6, BEIS3 and/or NONROAD. In many cases this will require an assessment of the impact changing from one analytical technique or model to another will have on the original SIP analysis results.

### E. Pilot Demonstration of MCR Guidance

Several State agency representatives have recommended that EPA perform a pilot application of the MCR technical guidance. At this time, EPA plans to perform such an effort.

### F. Documentation

A State should include the following documentation for its mid-course review:

- the administrative review;
- descriptions of the data bases used to support each analysis;
- identification of models and analytical techniques used to perform the analysis;
- the outcome of each analysis and whether or not it is consistent with a conclusion that the SIP is on track;
- a narrative describing the rationale used to conclude that the weight of evidence does or does not suggest that the SIP is on track toward timely attainment.

### G. Relationship to SIP Revisions Needed as a Result of MOBILE6 Model

The EPA recognizes that for some areas, States are required to submit revisions to their SIP to account for the new MOBILE6 mobile source emissions model on a schedule earlier than that required for the mid-course review. SIP revisions that revise interim MOBILE5 Tier 2 estimates with MOBILE6 are not intended to duplicate any technical analyses completed for mid-course reviews in those areas. The MOBILE6 SIP and budget revisions are primarily intended to revise the motor vehicle emissions inventories with the new model. Although the overall SIP must continue to demonstrate attainment or maintenance with these revised MOBILE6 inventories as described in question 5 of the guidance memorandum, "Policy Guidance on the use of MOBILE6 for SIP Development and Transportation Conformity,"<sup>8</sup> for areas completing mid-course reviews, EPA believes that new attainment modeling or additional control measures to ensure attainment may be delayed until the mid-course reviews. EPA will work with these States on a case-by-case basis to decide what additional documentation is necessary to show that the MOBILE6 SIP revision demonstrates attainment.

If the State cannot demonstrate that the SIP shows attainment with the revised MOBILE6 inventories as described in question 5 of EPA's guidance on use of MOBILE6, the State can submit an enforceable commitment to do one of the following in its mid-course review: 1) submit additional measures needed to fill any emission reduction shortfall in the SIP at the time of the submission of the mid-course review; or 2) document that there is no emission reduction shortfall as demonstrated through the mid-course review. Such a commitment would be submitted as part of the MOBILE6 SIP revision, and this commitment is necessary for EPA to find the revised MOBILE6-based motor vehicle emission budgets adequate for conformity purposes.

If the time between the submission of the MOBILE6 revision and the submission of the mid-course review is not sufficient for adoption of the additional measures needed as a result of the MOBILE6 revision, the State may submit the additional measures pursuant to these commitments as a separate SIP revision as expeditiously as practicable after the submission of the mid-course review, but no later than 12/31/04. Also, some areas may have committed to perform the MOBILE6 revision at the same time as the MCR; these areas would be given a sufficient amount of time to adopt any measures needed as a result of their MOBILE6 revision, but no later than 12/31/04.

## CONCLUSION

The EPA believes that a mid-course review is an important element of the SIP planning-implementation-assessment-revision process. It is particularly important for cases where the attainment demonstration relies on a weight of evidence demonstration.

The Regional Offices should provide this guidance to the appropriate State air pollution control agencies.

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<sup>8</sup>Memorandum of January 18, 2002, from John S. Seitz and Margo Tsirigotis Oge to EPA Regional Air Division Directors re: "Policy Guidance on the Use of MOBILE6 for SIP Development and Transportation Conformity."

cc: Air Program Managers, RO 1-10, Regional Meteorologists, RO 1-10, Tom Helms, Joe Tikvart, John Silvasi, Sharon Reinders, Denise Gerth, Ellen Baldrige, Jan Tierney, Sara Schneeberg, Kevin McLean, Meg Patulski

EPA:OAR:OAQPS:AQSSD:OPSG:JSILVASI\LLassiter:N. Campus C545E\1-5526\C-539-02

File Name: I:\SEC\SILVASI\POLICYMEM33D.WPD

March 21, 2002

**Recommended Approach  
For Performing Mid-course Review of SIP's  
To Meet The 1-hour NAAQS For Ozone**

**U.S. Environmental Protection Agency  
Office of Air and Radiation  
Office of Air Quality Planning and Standards  
Emissions, Monitoring and Analysis Division  
Research Triangle Park, NC 27711**

**January 2002**

## **INTRODUCTION**

**In this paper, we identify several methods for reviewing whether a State is on track toward attaining the 1-hour national ambient air quality standard (NAAQS) for ozone within prescribed time limits. These methods may be used during a mid-course review (MCR). In the event that a required attainment date occurs too soon to permit a mid-course review, these methods may also be used to perform an early attainment assessment submitted by the end of the attainment year. Given the fact that attainment determinations are based on three years of data, the early attainment assessment is especially important for areas in which, during the two years prior to the attainment year, the areas have registered violations or continue to observe exceedances. An early assessment will help determine why the air quality has not improved as expected and provide an early opportunity to develop additional emission reductions.**

### **1.0 How Do I Determine If A SIP Is On Track Toward Attainment?**

**First we recommend an administrative review to determine whether the scheduled number of measures called for in the SIP have been implemented. Then we recommend data analyses to determine if it is likely that the State implementation plan (SIP) is on track toward attainment. We recommend that analyses be performed to address several issues which need to be understood to make a reliable judgment about whether a SIP is on track. Information resulting from these analyses may be used in a weight of evidence determination to see if the preponderance of evidence suggests attainment will occur within prescribed time limits.**

**Analysis to support the MCR should make use of the most up-to-date guidance (e.g., EPA 1996 modeling guidance), analytical techniques, and models such as MOBILE6, BEIS3 and/or NONROAD. In many cases this will require an assessment of the impact changing from one analytical technique or model to another will have on the original SIP analysis results.**

#### **1.1 Perform Administrative Review**

**A State should document whether it has implemented the measures planned prior to the date of the mid-course review. This determination will need to be confirmed by the appropriate U.S. EPA Regional Office(s). A State also should show whether administrative/legal prerequisites are in place to implement previously agreed to measures prior to the required attainment date.**

**If a State's implementation plan relies on regional control measures, for a MCR to be productive, a substantial portion of these need to have been implemented prior to the most recent ozone season in the nonattainment area for which the mid-course review is being performed. For example, if NO<sub>x</sub> SIP call measures are implemented by Spring, 2004, and this constitutes an important part of the strategy for meeting the NAAQS in a particular nonattainment area, the mid-course review should include data from the Summer 2004.**

Further to facilitate a productive review, a substantial portion of a State's local control measures needs to have been put in place prior to the most recent ozone season preceding the mid-course review. Unless substantial progress has been made implementing local and (where necessary) regional measures, it is unlikely that the signal resulting from implementation of a SIP will be sufficiently strong to permit a meaningful mid-course analysis.

## **1.2 Analyze Available Air Quality, Meteorological, Emissions And Modeling Data**

These analyses should address several key issues to help judge whether a SIP is on track toward attainment.

(1) Taking estimated changes in precursor emissions and meteorological factors affecting air quality into account, do measured air quality and measured changes in air quality observed between the time of the mid-course review and earlier suggest improvement at a sufficient rate so that attainment is likely by the required date? Will the remaining measures provide a rate of air quality improvement that is consistent with attainment by the attainment date?

(2) To what extent does transport of ozone and/or precursors from areas upwind of a nonattainment area account for air quality in the nonattainment area subject to the mid-course review?

(3) Is progress toward meeting the ozone NAAQS (reflected by changes in air quality normalized for meteorological differences) consistent with relative progress toward the ozone NAAQS predicted earlier with air quality models?

Prior to performing an analysis to address one or more of the issues, indicate why the particular analysis is relevant for making a judgment on whether the SIP is on track. In addition, prior to performing each analysis, identify an outcome which is consistent with a hypothesis that the SIP is on track toward attainment.

It takes time to perform analyses needed to address these issues. Therefore, we recommend that 6 months to a year prior to the time a mid-course review is due, States should identify analyses and data bases which will be used to support a mid-course review and discuss these with the appropriate U.S. EPA Regional Office. Analyses to address each of these issues are described more fully in Section 2.0.

## **1.3 Perform A Weight Of Evidence Determination**

A weight of evidence determination consists of a review of the results of the analyses mentioned in Section 1.2. Analysis results for each of the three identified issues should be considered. Make a determination on how the preponderance of information from each set of results are consistent with the hypothesis that the SIP is on track toward attainment. If, for some reason, it is not feasible to address one of these issues, document the reasons why not.

**Include the following documentation for the weight of evidence determination used in the mid-course review:**

- descriptions of the data used to support each analysis;**
- identification of air quality models, statistical models or analytical techniques used;**
- outcome of each analysis and whether it is consistent with the hypothesis that the SIP is on track;**
- assessment of the credibility of each type of analysis used in the mid-course review;**
- a narrative describing the rationale used to conclude that the weight of evidence supports or does not support a conclusion that the SIP is on track.**

**The mid-course review should make use of the most up-to-date analytical techniques and models such as MOBILE6, BEIS3 and/or NONROAD. In many cases this will require an assessment of the impact changing from one analytical technique or model to another will have on the original SIP analysis results.**

## **2.0 What Types Of Analysis Should I Consider To Address Key Issues In The Mid-course Review?**

**In this section, we identify several means of analysis for addressing the issues identified in section 1.2. States should perform the set of analyses that is most appropriate based on available data bases for the area under review.**

- (1) What do air quality trends (normalized for meteorological differences) at mid-course review suggest about the likelihood of meeting the NAAQS on time?**
- (2) What does aerometric analysis of the role of transport vs. local emissions suggest about the likelihood of meeting the NAAQS?**
- (3) Are aerometric data observed at mid-course review time consistent with modeled projections used earlier to conclude that the most recent SIP revision is sufficient to meet the NAAQS on time?**

### **2.1 Use Air Quality Trends To Assess Whether A SIP Is On Track Toward Attainment**

**These analyses require decisions to be made about four factors to make well informed judgments about whether timely attainment is likely: (1) choosing one or more trend parameters, (2) adjusting (i.e., normalizing) observed ozone trends in the selected trend**

parameters for meteorological differences, (3) deciding whether ozone trends are likely to be most responsive to changes in VOC or NO<sub>x</sub> emissions or changes in both, and (4) selecting the area for which trends in emissions will be estimated.

Choosing trend parameters. There are several things to consider when choosing trend parameters in a mid-course review. Closeness of the parameter to the definition (i.e., form) of the NAAQS, susceptibility to extreme or unusual meteorological conditions, stability of the parameter, dependence on the number of sites with measured values. Table 2.1 presents some potential trend parameters along with comments about the suitability of each. Table 2.1 is not comprehensive. Other trend parameters may be used, so long as a rationale for doing so is presented. Since trend parameters could behave differently from one another, it is advisable to select several parameters to get a better overall sense of how air quality is changing.

**Table 2.1. Some Candidate Ozone Trend Parameters**

Measure	Comments
# of exceedances (monitor with most exceedances)	Identity of monitor may change; closest measure of the NAAQS, however number of exceedances may often be small and reflects use of a step function, making this an unstable trend parameter.
Ozone design value (monitor with highest 4 <sup>th</sup> high hourly daily maximum over a 3-year period)	Close to definition of NAAQS & more stable than # of exceedances, however the design value could be dominated by a single year and could be sensitive to meteorological differences.
Total number of exceedances (all monitors in nonattainment area or nearby)	More stable than similar measure for a single monitor, but still likely subject to large annual fluctuations.
Highest 2nd high daily maximum ozone concentration observed each year	Avoids problem of one bad year dominating for 3-years, but still subject to large annual fluctuations.
Highest running average 2nd high daily maximum ozone concentration, averaged over 3 consecutive years	Somewhat more stable, but diverges more from the form of the NAAQS.
Highest 95 <sup>th</sup> percentile daily maximum ozone concentration	More stable, but differs from the form of the NAAQS.

<p><b>Total number of hours with observed concentrations greater than 124 ppb</b></p>	<p><b>Differs from form of NAAQS, may be subject to some of the same problems as parameters dealing with number of exceedances, but likely less so.</b></p>
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In addition to ozone trend parameters, States with data from Photochemical Air Monitoring Stations (PAMS) and/or reliable NO<sub>x</sub> measurements can consider trends in precursor concentrations to see whether they appear to track emission control programs which have been implemented. Use of PAMS data to estimate trends is described by Main and Roberts (2000). Because precursor data may be subject to larger fluctuations than ozone concentrations, we suggest using trend parameters like median or mean concentrations observed during the summer (or ozone season) months. Since some of these data are not likely to be measured continuously, mean values measured at a specific time of day (e.g., 6-9 am) may need to be used. The standard deviation in the chosen precursor trend parameter may also be useful to compute to get a sense of how variable precursor concentrations are during the course of each ozone season. Comparing this intra-annual variability with trends in mean or median observations may provide a sense of the strength of the trend evidence resulting from the precursor measurements.

Normalizing observed trends in ozone for meteorological differences. Generally, the trend parameters we identify for ozone reflect the fact that the NAAQS focuses on extreme values. Year to year fluctuations in meteorology may have a more pronounced effect on extremes than on concentrations in the middle of a range of observations. Thus, in order to be able to interpret observed changes in selected trend parameters, it is necessary to adjust the trend so that it reflects differences in meteorology. Any credible procedure for adjusting air quality trends for meteorological differences is acceptable. Several procedures for doing this are reported in the literature.

Cox, *et al.* (1993) describe a method which has been used to adjust daily maximum ozone concentrations for severity in meteorological conditions during any particular year. The methodology develops a regression relationship between daily maximum ozone (dependent variable) and several meteorological variables. This relationship defines each day's ozone forming potential. By going back over a long period of record (e.g., 40 years), severity of meteorological conditions accompanying any given incident of high ozone can be characterized in terms of climatological norms. This information can be used as a basis for adjusting the raw observed air quality values. Use of the Cox, *et al.* methodology is illustrated in U.S. EPA trend reports, as well as in U.S. EPA (1996).

Another method for adjusting observed trends is use of the Classification of Regression Tree (CART) analysis procedure, as described in Dueul, *et al.* (1996). The widely-used CART procedure identifies combinations of meteorological parameters which frequently appear to coincide with high observed ozone concentrations. Noting differences in the

frequency of favorable meteorological combinations provides a means for considering meteorological differences as a mitigating factor in observed ozone trends.

More recently, Milanchus, *et al.* (1998) and Hogrefe, *et al.* (2000) have described a procedure which is able to suppress short term variability in observed ozone attributable to diurnal and synoptic differences (i.e., general differences over a wide area or seasonal variations) so that underlying base level trends can be discerned.

Perhaps the simplest procedure for normalizing an observed trend for meteorological differences is to fit a curve through observed values of a trend parameter over the 10 years preceding the mid-course review. In the following discussion, this is illustrated for the maximum observed ozone design (across all monitors in the area) value in each year. The fitted curve is used in concert with observed maximum design values in each year to calculate residual values for each year (i.e., the difference between the design value indicated by the fitted curve and the actual observation). These residuals may be used to account for variability in meteorology as described in the following paragraphs.

To illustrate, Table 2.2 shows hypothetical data for a 10-year period.

**Table 2.2. Example Of Best Fit Design Values And Residuals**

<b>Year</b>	<b>Residual, ppb (Absolute Value)</b>	<b>Best Fit Design Value, ppb</b>	<b>r/(best fit)</b>
<b>1995</b>	<b>12</b>	<b>185</b>	<b>.06</b>
<b>1996</b>	<b>6</b>	<b>185</b>	<b>.03</b>
<b>1997</b>	<b>10</b>	<b>179</b>	<b>.06</b>
<b>1998</b>	<b>9</b>	<b>166</b>	<b>.05</b>
<b>1999</b>	<b>8</b>	<b>166</b>	<b>.05</b>
<b>2000</b>	<b>7</b>	<b>155</b>	<b>.05</b>
<b>2001</b>	<b>9</b>	<b>153</b>	<b>.06</b>
<b>2002</b>	<b>0</b>	<b>148</b>	<b>0</b>
<b>2003</b>	<b>7</b>	<b>137</b>	<b>.05</b>
<b>2004</b>	<b>7</b>	<b>134</b>	<b>.05</b>
		<b>MEAN =</b>	<b>0.046</b>

**This says that, on average, an area's observed maximum design value for a given year varies by about 4.6% from a best fit design value based on a review of 10 years' data. So as not to connote greater precision than warranted, we recommend rounding this variability upward to the next whole integer. Thus, in this example, so long as the most recent observed design value is not more than 5% above a pre-determined air quality target for the year of the mid-course review (2004 in this example), this factor would support a conclusion that the SIP is on track.**

**Deciding whether ozone is sensitive to reductions in VOC, NO<sub>x</sub> or both. This step is needed in order to judge whether to pay most attention to changes in VOC emissions, NO<sub>x</sub> emissions or changes in emissions for both precursors to make a judgment about whether an observed (adjusted) trend in ozone is likely to continue at a sufficient pace to meet the NAAQS within prescribed times. Since ozone's sensitivity to changes in VOC, NO<sub>x</sub>, or both emissions may vary from one location to another, and from one date and time to another, the approach selected must consider a composite of results from several days and locations throughout the area.**

**There are at least two approaches which may be used to judge whether an estimated change in emissions of VOC, NO<sub>x</sub> or changes in both should be tracked when interpreting normalized trends in ambient ozone concentrations. A State may use another approach if it presents sufficient justification for doing so to the appropriate U.S. EPA Regional Office. If it is not clear whether an ozone problem is limited by available VOC or NO<sub>x</sub> emissions, a State should estimate changes in emissions for both precursors.**

#### **Use results of model sensitivity tests**

**Air quality model applications may be used to indicate whether future reductions in ozone are most likely to result from reductions in VOC emissions or NO<sub>x</sub> emissions. If the results are ambiguous (e.g., differ for different modeled days), then the State should assume that it is necessary to track projected reductions in emissions of both precursors. For purposes of a mid-course review, simulations of uniform reductions in anthropogenic VOC emissions and uniform reductions in anthropogenic NO<sub>x</sub> emissions may be performed to assess which precursor to focus on when assessing likelihood of future attainment. The preferred approach for doing this is to use a photochemical grid model. However, if it appears that an area's nonattainment problem is dominated by local emissions and/or there is another means for considering effects of ozone/precursors transported regionally into the nonattainment area, the OZIPP/EKMA approach may be used for judging whether local changes in VOC or local changes in NO<sub>x</sub> should be tracked to understand observed normalized trends in ozone. Methods for judging potential significance of transport are discussed in Section 2.2.**

**It may happen that conclusions reached concerning which of the two precursors to track depend on the size of the modeling domain used in the sensitivity tests. For example, if a regional modeling domain is used, a State might conclude that predicted ozone is most**

sensitive to changes in NO<sub>x</sub> emissions. In contrast, if an urban scale domain is used (e.g., < ~ 300 km on a side), results might suggest future changes in VOC emissions are more important. In fact, a finding like this is important if the analysis described in Section 2.2 suggests transport is an important part of an area's nonattainment problem. It implies that local changes in VOC emissions along with regional changes in NO<sub>x</sub> emissions should be tracked in order to interpret the meaning of observed normalized trends in ambient ozone.

#### Use measured ambient precursor data

**Ratio of indicator species.** The indicator species approach is described at length in such references as Sillman (1995), Sillman (1998), Lu, *et al.*, (1998) and Blanchard, *et al.*, (1999). The approach relies on past modeling simulations (performed by others) which have noted that predicted reduction in daily maximum ozone is sensitive to reductions in VOC if the predicted ratio of certain indicator species (e.g., O<sub>3</sub>/NO<sub>y</sub>) is low, but is sensitive to reductions in NO<sub>x</sub> if the ratio is high. If measurements of indicators exist, a State can review these data on days where monitored ozone exceeds 0.12 ppm, to note whether the ratio is in the VOC-sensitive or NO<sub>x</sub>-sensitive range. There is generally also a range of values for the ratio in which it is unclear whether maximum observed ozone is limited by availability of VOC or NO<sub>x</sub>. If the observations fall in this latter range, it would be necessary to estimate future changes in both NO<sub>x</sub> and VOC emissions in order to interpret whether the ozone trend data suggest timely attainment is likely.

**Trends in ambient precursor concentrations.** If a downward trend in ambient ozone concentrations is accompanied by changes in one precursor (e.g., VOC) but not the other, this may be considered in judging which precursor is likely affecting observed changes in ozone.

**Deciding on the area for which to estimate past and future changes in emissions.** In order to decide whether a nonattainment area is on track toward attainment, a State needs to (1) review available normalized ozone trend data, (2) review changes in emissions accompanying these observed trends, (3) note the reduction in ozone still needed to meet the NAAQS, (4) estimate the corresponding additional reductions in emissions needed to realize the needed additional reduction in ozone, and (5) compare additional emission reductions provided for in the SIP revision with the necessary additional reductions estimated as necessary in (4).

Earlier, we discussed how a State may determine whether it needs to focus on VOC emissions, NO<sub>x</sub> emissions or both. However, it is also necessary to define the area for which past and future changes in emissions should be estimated. The nonattainment area is one such area for which States should estimate changes in emissions. If a State believes that regional transport is an important factor affecting observed exceedances of 0.12 ppm, changes in VOC and/or NO<sub>x</sub> emissions also need to be calculated for an additional, larger geographic area. To determine *how* large this area should be, we recommend that States note every day with one or more observed exceedances within the nonattainment area between the time of the most current SIP revision (e.g., 1999) and the time of the mid-course review (e.g.,

2004). For each day, states should compute a back trajectory for 36 hours, beginning at the time and site with the highest observed exceedance. For this purpose, we recommend using the HY-SPLIT model developed by NOAA (NOAA, 1999). However, other peer reviewed trajectory models may also be used. This analysis will yield a bundle of 36-hour back-trajectories. States should use the smallest geographic area for estimating emission changes which is consistent with including 90% of the total hours represented by the trajectories (i.e., 90% of 36 hours times number of days with exceedances). This example assumes that most of the impact at a monitoring site occurs as a result of emissions occurring within 36 hours' travel time, and provides a means to avoid having to consider a very large area on the basis of a small number of trajectories. Periods differing from 36 hours may be considered if justified on a case-by-case basis.

## **2.2 Use Air Quality Data To Assess Relative Importance Of Regional Transport And Local Emissions**

States may use this analysis to determine whether to be concerned with past and projected changes in emissions, (1) only within the nonattainment area , or (2) within a larger geographical area (including the nonattainment area) as well. The analysis consists of several steps:

- (1) determine the resultant wind direction for each day with a monitored exceedance;**
- (2) identify monitors which are upwind and downwind on each day with an observed exceedance;**
- (3) select air quality measures to consider at upwind and downwind sites;**
- (4) compare and note differences in upwind and downwind ozone as well as trends in upwind and downwind ozone;**
- (5) use the information developed in (4) to decide whether it is sufficient to consider only emission changes occurring within the nonattainment area or whether a larger geographical area should also be considered.**

**Determining resultant wind direction.** This may be done in one of two ways: (a) using surface wind velocity measurements, or (b) through use of a meteorological model. If surface wind velocity measurements are used, the resultant wind direction should be estimated solely on the basis of daytime measurements (e.g., 7am-8pm) made on each day with a recorded exceedance. If the resultant wind direction is estimated using a trajectory or other meteorological model, a 24-hour period (ending at the time of the observed exceedance) may be considered, so long as an effort is made to account for overnight wind shear.

**Identifying upwind and downwind monitors.** This step is used to identify which monitored data are likely to be most impacted by emissions in the nonattainment area. Using previously estimated resultant wind directions, a group of monitors is identified as downwind and another group is identified as upwind. To illustrate, for a nonattainment area characterized by large concentrations of emissions in the center of the designated nonattainment area, downwind

sites on a day might be characterized as those included within a relatively large arc (e.g., 120°) whose vertex is at the center of the emissions and whose axis is the resultant wind direction. All other sites in this example would be upwind sites.

Select air quality measures to consider at upwind and downwind sites. Since the identity of downwind and upwind sites is a function of the resultant wind direction, individual monitoring locations may be upwind on some days and downwind on others. Thus, to assess relative importance of transport, it is more appropriate to look at concentrations and trends for the group of upwind vs. the group of downwind sites rather than focus on all observations at individual sites. We recommend looking at measures such as the highest, second highest and spatially averaged daily maximum observed ozone concentrations at downwind vs. upwind sites on individual days, as well as values for these variables which have been averaged over an ozone season. In addition, we recommend looking at trends in these parameters observed over the period between the SIP revision and the mid-course review and, perhaps, over a longer period stretching back 10 years from the mid-course review.

Compare absolute ozone concentrations and trends at upwind and downwind sites. The purpose of this step is to contrast ozone concentrations and trends in ozone concentrations for each of the air quality measures selected in the previous step. This comparison is used to judge whether transport is an important factor affecting a nonattainment area's attainment status. Large contrasts between upwind and downwind sites suggest that local emissions are an important factor affecting the area's attainment status. A mixed set of results is probably consistent with both local emissions and transport playing a significant role. If results for upwind and downwind monitors are nearly identical, this suggests that an area's nonattainment status is dominated by regional transport.

Determine which area(s) should be used to characterize estimated changes in emissions. If there are consistent, major contrasts between downwind and upwind sites, States may focus their emission estimates on those emissions which occur within the nonattainment area. If there is a contrast using some measures, but a less apparent or small difference using other measures, States should focus emission estimates on the nonattainment area and on a larger geographical area determined as described in the last paragraph in Section 2.1. If there are only small or indiscernible differences between measures at upwind and downwind sites, States should focus their emission estimates on a larger geographical area, determined as described in Section 2.1.

### **2.3 Use Air Quality Model Estimates**

In Section 2.1, we noted that air quality models may be used in a relatively non-resource intensive fashion to determine whether the mid-course review should focus on changes in VOC emissions, changes in NO<sub>x</sub> emissions or changes in both. In Section 2.3, we describe other uses of model-generated results which we believe would increase the credibility of a mid-course review.

Using model projections as a target against which to compare air quality observations. Model results, obtained prior to the mid-course review, may be used to check whether changes in air quality observed at the time of the mid-course review are consistent with likely attainment. We suggest the following procedure. Model most recent available emissions present during a base period (i.e., 1996 emissions<sup>9</sup>), projected emissions for the year of the mid-course review (e.g., 2004 assuming the mid-course review is to be completed by the end of 2004) and emissions projected for two years prior to the required attainment date (e.g., 2005 for a 2007 attainment date). Select a modeled air quality metric to use as predicted values corresponding to each of these three emission scenarios. For the 1-hour ozone NAAQS, this metric would ordinarily be the highest 1-hour daily maximum ozone concentration predicted within the non-attainment area(s) or at locations clearly impacted by the area(s) being reviewed. Other metrics can be considered on a case by case basis.

Next, note the relative progress made by 2004 in reducing the predicted metric from its value corresponding to 1996 emissions to its value corresponding to 2005 emissions. *This relative modeled progress is the value against which observed progress in reducing the area's monitored design value (or other selected measure) is compared.* The procedure for using modeled results as a means for assessing whether a monitored design value indicates a SIP revision is on track toward attainment is illustrated in the following example.

#### EXAMPLE

**Given:** An area's average maximum monitored design value for 1994-96, 1995-97 and 1996-98 is 155 ppb, and the observed design value in 2004 is 136 ppb. Using a curve fitting technique like that described in Section 2.1, variability in the maximum monitored design value attributable to fluctuations in meteorology has been determined to be 5%. Modeling results available prior to the mid-course review show predicted peak 1-hour daily maximum ozone predictions of 150, 139 and 131 ppb corresponding to 1996, 2004 and 2005 emissions.

**Find:** Is the SIP revision on track toward attainment of the 1-hr NAAQS for ozone by 2007?

**Solution:**

(1) Calculate the relative modeled progress predicted for 2004.

$$\text{Rel.modeled progress} = ((150 - 139)/(150 - 131)) \times 100 = 58\%$$

(2) Apply this relative progress to the average maximum design value for the three 3-year periods including the year of the current inventory. Thus, if the base inventory reflects

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<sup>9</sup> If per chance States have conducted regional scale modeling for 2002, we recommend consideration of this information, especially it's viable use in assessing the role of transport.

emissions from 1996, the average maximum design value is determined using the maxima observed in 1994-96, 1995-97 and 1996-98. For purposes of illustration, let us assume this average maximum design value is 155 ppb. The target for the year of the mid-course review projected inventory (i.e., 2004 in this example) is derived using the expression below.

$$\text{Mid-course review target} = 155 \text{ ppb} - (155 \text{ ppb} - 124 \text{ ppb}) ( 0.58) = 137 \text{ ppb}$$

So long as this value (137 ppb) is not 5% or more below the observed air quality design value in 2004, the SIP is on track toward attainment.<sup>10</sup> Earlier, we noted that the observed current maximum design value is 136 ppb. We note that 95% of this value is 129 ppb. Clearly, the predetermined target of 137 ppb is not 5% or more below the observed design value (136 ppb). Thus, in this example, the SIP is on track toward attainment.

**Estimating relative importance of regional transport vs. local emissions.** States should review results of past model applications which may be relevant for addressing this issue. Applications in which regional control measures were added to previously simulated locally applied control measures may be germane. Alternatively, applications in which locally applied control measures are superimposed over previously simulated regional measures may be reviewed. Comparing effects of regional/superimposed on local measures vs. local/superimposed on regional measures may provide further insight into the relative importance of regional transport vs. local emissions as contributors to a nonattainment problem.

### **3.0 Using Weight Of Evidence To Estimate If A SIP Is On Track**

In this Section, we describe how to combine information from the previous analyses to determine if the weight of available air quality monitoring, meteorological, emissions and modeling evidence supports a hypothesis that a SIP is on track toward attainment.

#### **3.1 Compute Normalized (For Meteorology) Trend For Ozone Within And Nearby A Nonattainment Area**

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<sup>10</sup>We recognize that the design value in 2004 may not accurately reflect current air quality at that time. The design value at a monitoring site is ordinarily the 4<sup>th</sup> highest daily maximum concentration observed over a continuous 3-year period. However, if a major change in emissions occurs during this 3-year period (e.g., in Spring, 2004) the 4<sup>th</sup> highest value may well be observed before these changes (e.g., in 2002 or 2003). If none of the observed top 4 daily maximum ozone concentrations at a monitor occurs in 2004, we also recommend that States compare the observed 2nd high daily maximum concentration observed in 2004 with the mid-course review target, and present supporting information that 2004 is not an unusually low year due to benign meteorological conditions.

Select appropriate ozone trend parameters. If available, use robust measures of ambient precursor trends to help confirm emissions reductions. Normalize ozone trends for meteorological differences using a curve fitting approach like the one described in Section 2.1 or other approaches like the Cox, et al. (1993), CART or filtering approach described by Milanchus, et al. (1998).

### 3.2 Compare The Observed Trend With A Target Consistent With Attainment By The Prescribed Date

This comparison may be performed in several ways.

#### Comparison with photochemical grid model estimates

For example the first way may be to compare the monitored observations with modeled estimates previously obtained for a base period, mid-course and attainment date. This method is illustrated in Section 2.3. If a fitted curve and residuals are calculated, actual observations may be compared with model estimates, as described. If another method is used in which residuals are not estimated, the normalized, rather than actual observations should be compared with the target. Use of model results for this purpose is advantageous, because it does not require a State to make a number of explicit assumptions about which emissions trends to consider or to make assumptions about the role of transport. The disadvantages are resources needed to do the modeling and the likelihood that the model results will be based on a relatively limited sample (i.e., few days).

#### Using proportional extrapolations

If new model results are unavailable to establish a target for the mid-course year which is consistent with attainment, a proportional approach may be needed to assess whether it is likely that a SIP is on track. This approach uses ozone/emission sensitivity factors from prior modeling or observed correspondence between normalized ozone trends (which ever is most appropriate) at mid-course review time with net estimated reduction in emissions between the SIP's base period (e.g., 1999) and mid-course review time (e.g., 2004). Either approach may be used to estimate a unit sensitivity factor of ozone to emission changes.

$$\text{Unit Sensitivity} = (\Delta O_3 / \Delta(\text{emissions})) \quad (1)$$

The preceding information may be used in concert with (1) information about the net reduction in emissions anticipated between time of the mid-course review and the attainment date, and (2) the remaining difference between the design value at mid-course review time and 124 ppb to estimate if attainment is likely by the required time. If the method suggests attainment is likely by the required time, the SIP is assumed to be on track toward attainment. This is shown by the expression below.

$$(O_3)_{\text{attainment}} = (O_3)_{\text{@mid-course review}} + (\text{Unit Sensitivity}) (\Delta(\text{future emissions})) \leq 124 \text{ ppb}$$

where

$(O_3)_{\text{attainment}}$  is the estimated ozone design value for the attainment year.

$(O_3)_{\text{@mid-course review}}$  is the normalized design value at mid-course review.

$\Delta(\text{future emissions})$  is the change in emissions anticipated between mid-course review time and the required attainment date—note that this is generally a negative number.

Note, if the estimated ozone design value for the attainment year is greater than 124 ppb, the “Unit Sensitivity” parameter may be used to estimate the level of emission reductions needed to achieve 124 ppb. However, since this is a linear extrapolation, the farther the estimated ozone design value is from 124 ppb the less reliable these results are.

For the proportional extrapolation methodology to be applied, it is necessary to make a series of assumptions about which emissions to consider in the preceding expressions. We make recommendations about this in the following subsection.

### 3.2.1 Which Emissions Trends Should I Use In The Proportional Extrapolation Technique?

First, use the analysis of transport described in Section 2.2 and results of available modeling, described in Section 2.3 to assess whether transport is a major reason for nonattainment of the NAAQS in the designated nonattainment area being reviewed. If it is not, consider only emission trends within the nonattainment area. If transport and local emissions both appear to play important roles, then consider emission trends in the nonattainment area and emissions trends in a larger geographic area, determined using a method like the one described near the end of Section 2.1. If transport seems to clearly dominate local emissions, consider only the trends in the larger geographical area.

Next, determine *which* emissions trends to consider. This requires two questions to be addressed: (1) do I consider VOC, NO<sub>x</sub> or emissions of both? and (2) what trend parameter should I use to characterize the change in emissions? To address the first question, use available urban scale modeling or ambient precursor data (Section 2.1) to identify the precursor of principal concern in the local (i.e., nonattainment) area. Use results from past regional modeling analyses to identify the precursor of principal concern in the larger, regional area. If it is not clear from the available information which precursor is the controlling one in the local area or the regional area, consider trends for both precursors in the area(s) for which this is unclear.

**To address the second question, we recommend using seasonal mean emissions estimates. This, in effect normalizes year-to-year emissions for meteorological differences. Further, uncertainties in estimating emissions factors and activity levels for specific days are likely to be sufficiently large so as not to warrant this level of detail.**

### 3.2.2 Some Concerns And Caveats

We have several concerns about the proportional extrapolation approach. Thus, for various reasons, we recommend that States use results from photochemical grid models to establish targets for comparison whenever feasible. First, the relationship between ozone formation and precursor emissions can be a non-linear process under a number of environmental conditions. Linear approximations work best if the current ozone (i.e., at mid-course review time) is close to 124 ppb. If this difference is more than, say, 5 ppb, States should consider developing an EKMA isopleth diagram to ensure that there is no intervening ridge line between the current and desired air quality if a given precursor is reduced. Presence of a ridge line indicates that reductions of one precursor may result in little or no change in ozone while reductions in the other precursor may result in large changes in ozone. Another analysis which might be performed to increase the weight of evidence produced by an extrapolation methodology is to review correspondence between observed air quality trends and estimated emissions trends to see whether something other than a linear curve provides a better description of this correspondence. An extrapolation methodology which is analogous to the one described herein (but reflecting a non-linear correspondence) could be applied. Second, the extrapolation requires one to make previous assumptions about what kind of emissions are important determinants of observed ozone, as well as where these emissions are located. It is unlikely that these assumptions will be as reliable as those made with models, as the models are better able to consider meteorological factors which influence the importance of emission configurations on ozone concentrations.

## 4.0 Summary

States should first do an administrative review to determine whether the scheduled number of measures called for in the SIP have been implemented and that legal/administrative prerequisites are in place to implement the remaining measures identified in the SIP revision. If these targets are not met, there is cause for concern that the SIP is not on track toward attainment.

States should also perform a series of analyses to ascertain trends in ozone and precursors, emission trends, relative importance of transport vs. local emissions and to review modeling efforts to identify ozone-limiting precursors and the role of transport.

A weight of evidence determination may be performed to assess the likelihood that a SIP is on track toward attainment. Two example analytical methods are provided and are recommended for use as part of the weight of evidence determination to see if observed air quality at the time of the mid-course review meets a target considered to be consistent with meeting the NAAQS in a timely manner. The first and preferred approach is to use modeled results to establish a target at the time of a mid-course review which is consistent with ultimate attainment of the NAAQS. The second approach is to use proportional extrapolations based on past observed correspondence between air quality and emissions and

anticipated future changes in emissions. Other factors that may be considered in the weight of evidence analysis include consideration of the assumptions and methods underlying the two analytical approaches or other analytical approach used and use of refinements which appear more appropriate based on data and analyses performed for a specific area.

For a mid-course review to be acceptable, a State should include the following documentation:

- results of the administrative review;
- descriptions of the data used to support each analysis;
- identification of models and analytical techniques used to perform the analysis
- outcome of each analysis and whether it is consistent with a conclusion that the SIP is on track;
- a narrative describing the rationale used to conclude that the weight of evidence supports or does not support a conclusion that the SIP is on track.

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