AIR CHAPTER

Responses to Peer Review Comments on General Issues for All Indicators

Peer Review Comments on General Issues
Some information on the "metadata" forms was copied into multiple indicators, sometimes inappropriately so. The information on the "metadata" forms should be more informative and specific to the individual indicators. More indicator-specific information should be presented on the estimation approaches, sampling and analytical methods, and so on.

EPA Response
The metadata forms were revised to provide additional indicator-specific information.

Peer Review Comments on General Issues for All Indicators
Indicator text would benefit from issue-specific contextual discussion, similar to interpretations presented in annual reports and other documents published by OAR and OAQPS. EPA should use graphics from these reports in the ROE indicators, to the extent practical.

For several indicators, the data presented do not completely characterize the issue being discussed. For instance, the greenhouse gas emission indicator does not include data on the contributions of CFCs, the indicator on mercury deposition does not present information on dry deposition, and several emissions indicators do not include data on contributions of natural sources. In such cases, the text should describe—quantitatively, where possible—the significance of omitting certain aspects of the indicator.

EPA Response
The indicator text was revised to include some issue-specific contextual discussions. However, please be advised, the space allotted for each indicator is limited. The purpose of ROE06 is to show the trends in air quality without discussing specific EPA programs.

Peer Review Comments on General Issues for All Indicators
For several indicators, the data presented do not completely characterize the issue being discussed. For instance, the greenhouse gas emission indicator does not include data on the contributions of CFCs, the indicator on mercury deposition does not present information on dry deposition, and several emissions indicators do not include data on contributions of natural sources. In such cases, the text should describe—quantitatively, where possible—the significance of omitting certain aspects of the indicator.

EPA Response
The indicator was modified with such information where possible.

Peer Review Comments on General Issues for All Indicators
Many indicators do not present data for the entire time period over which data are available. Indicators should present the entire set of data, including older data and more recent data, unless there are strong reasons for not doing so.

EPA Response
Our practice in the ROE has been to use older data whenever they are determined to meet the indicator criteria, including representativeness and comparability. We have found that as one goes back in time, many of the earlier data that would support the indicators are collected using very different methodology, are not as spatially representative as later data, or suffer from poor quality control or documentation. While such data can be used in assessments with the appropriate caveats, we don't believe they should be used for ROE indicators.

Responses to Peer Review Comments on General Issues for All Emissions Indicators

The peer reviewers agreed that the draft indicator text overstates the quality and confidence in emission inventories. They recommended that the indicator text be revised to discuss the relative confidence in the inventories for

individual pollutants (e.g., much higher confidence in emissions data for sulfur dioxide and nitrogen oxides, much lower confidence in emissions data for air toxics, mercury, and VOCs).

EPA Response
EPA has provided more information on the methods used to develop estimates for each sector in order that readers can better understand the confidence associated with the numbers.

Peer Review Comments
Emissions data back to 1980 should be included to allow for better interpretation of ambient air concentrations, except when older data are of insufficient quality. These older data are already available from existing EPA documents. In cases where older data are not of sufficient quality (e.g., mercury), only current data should be presented to establish baseline levels for future trend analyses.

EPA Response
EPA does not agree with this comment since data from earlier years prior to 1990 used different emission estimation methodologies and lack spatial details that would allow us to examine trends at anything less than a national level.

Peer Review Comments
The indicators should document contributions from all sources, not just the anthropogenic ones. Contributions from natural sources (e.g., biogenic sources) can be addressed, whether with a pie chart indicating the breakdown of emissions for the current year or by including additional text. Natural sources should not be included in the trend plots.

EPA Response
EPA agrees that non-anthropogenic sources should not be included in the trends plots. Pie charts presenting relative amounts of anthropogenic versus non-anthropogenic emissions for the most recent year were added.

Peer Review Comments
Emissions trends for pollutants that had significant changes to inventory methodologies can be misleading (e.g., PM with and without "condensables"). For trend analysis, presenting emissions data from a consistently applied methodology, even if not the best methodology, is preferred to presenting data from multiple methodologies applied differently over the years.

EPA Response
We agree that the addition of condensables in 1999 was a significant change. Data for filterable and condensable portions exist only for the years 1999 – 2002. To allow for a valid comparison of emission trends from 1990 – 2002, the indicator was revised to only include data for the filterable portion of PM10 and PM2.5. For the other indicators, data are presented only for years with emissions estimates that are updated to be comparable to the most recent inventories (i.e. many indicators show data only for 1990 and 1996-2002 because data for 1991-1995 were not updated).

Peer Review Comments
Several indicators provide emissions data on groups of compounds (e.g., VOCs, air toxics, and greenhouse gases). EPA should not simply report total mass of compounds emitted within such groups, but rather display data weighted to the issue of concern. For instance, VOCs can be reported as reactivity-weighted emissions to better inform ozone formation potential, and air toxics can be reported as toxicity-weighted emissions to relate to the potential for causing human health effects. Additionally, where possible and appropriate, data on individual compounds should be presented (e.g., show trends for the air toxics believed to account for the largest proportion of cancer risk and non-cancer hazard). This information is already available from existing EPA documents.

EPA Response
The EPA is not aware of the availability of reactivity-weighted VOC inventories from other EPA documents. Also, there are several issues and approaches associated with conducting additional analyses to derive these inventories as well as the interpretation of the results. However, toxicity-weighted emissions (sum of the 188 toxic pollutants) were added. The totals are slightly different compared to emissions reported on mass-weighted basis.

Peer Review Comments that apply to all figures

Include equal spacing between all years shown in graphs.

EPA Response
This comment is directed to the years 1991 – 1995 which were not included in the graphs since data were not developed using methodologies consistent with other inventory years. When compressed, this time series can present problems with visually interpreting the rate of change of the data. A gap was intentionally left in the graph to alert the reader that the time series is not continuous so as to avoid misinterpretation. If the graphs were modified to include equal spacing for the omitted years, later years will be compressed as a result and visually interpreting trends might be more difficult for the more recent years. Therefore, the graphs will be kept with the compressed timeline that includes a gap where there is a break in the data.

Peer Review Comments
Use more transparent terminology when referring to source categories. For instance, use electrical utilities instead of "Title IV facilities;" and do not use overlapping terms such as "fuel combustion" separate from "mobile sources," but instead use "fuel combustion from stationary sources" and "fuel combustion from mobile sources." Use same terminology across all inventory components, to the extent possible.

EPA Response
Source categories were revised to be more transparent and also more consistent across indicators.

Peer Review Comments
Present data back to 1980, as appropriate.

EPA Response
See response to this comment above.

Peer Review Comments
Regional figures would benefit from showing source categories, which can be done using maps with pie charts or stacked bar charts, instead of the current line charts.

EPA Response
The focus of the ROE is on trends and a single trend figure cannot show trends for all 10 Regions broken down by source category. Ten separate graphs would be required to display such information. Due to space limits, the paper ROE will not be able to accommodate this recommendation, however it will be considered for future electronic versions of the ROE (e-ROE).

Peer Review Comments
Use same formats and styles on all emissions figures.

EPA Response
Figures were revised to use consistent formats wherever possible.

Peer Review Comments on General Issues for All Ambient Concentration Indicators

EPA should discuss uncertainties associated with the trends that are reported. In cases where the available data do not span enough years to infer trends (e.g., PM2.5 concentrations), the indicators should not present trend statistics but should explain why future data collection is needed to support trend analyses.

EPA Response
Additional discussion regarding the representation of the 90^{th} and 10^{th} percentiles shown in the graphics was added to the indicator text. The indicator text was modified to include a statement that 80% of the monitored values are between certain values for a given year. References to "trends" were removed as statistical analyses were not performed. Instead, results are presented as "changes" from one time to another.

Peer Review Comments on the Statistical Analysis
-Do not use percent changes between two endpoints when quantifying long-term trends.
-Multiple suggestions were provided for different approaches (e.g., compare 3-year averages at endpoints; use regression analyses, non-parametric trend analyses [e.g., Kendall's Tau], or other statistical analyses or tests) for quantifying the trends.
- Use statistical tests to characterize confidence in quantitative estimates of long-term trends.

EPA Response

EPA agrees that characterizing confidence in quantitative estimates is desirable. Such analyses are complex, and legitimate scientific opinions differ significantly on which models are most appropriate. This is an important goal for future editions of the ROE

Peer Review Comments that apply to all figures
-All figures, to the extent possible, should be presented in a common format. The format currently used for most indicators is a distribution plot for displaying nationwide trends and line charts for displaying regional trends.
-On regional plots, have each time series drawn to the same scale, with a horizontal line drawn at the corresponding NAAQS.

EPA Response
The Regional figures were revised to show a trend line for each Region along with a horizontal line drawn for the NAAQS.

Peer Review Comments
Display median values (not means) on plots that show percentiles.

EPA Response
The revised figures contain the mean values and the median values.

Peer Review Comments
For each criteria pollutant, superimpose on each plot annual trends in the number of stations with concentrations that exceeded the corresponding NAAQS.

EPA Response
These data were computed and provided for each annual plot. A footnote was added to ensure the readers know that this number is based on the monitoring sites used for the trends analysis, and not necessarily the same sites used for regulatory assessments (e.g. Design values for NAAQS compliance).

Peer Review Comments
Text beneath figure should indicate the percent change for only the entire time frame considered, not for multiple time frames.

EPA Response
The text beneath the figures was removed.

Section 1: Outdoor Air Quality

PM Emissions
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Overall recommendation	**Do not include, unless critical modifications are made.**	EPA included the indicator with the modifications as detailed below.
Critical modifications	Starting in 1999, PM emissions were estimated using a different methodology. The indicator implies that a considerable increase in emissions occurred that year, which is entirely an artifact of the new emissions estimation methodology. The reviewers emphasized that statements in the text and the figure must be modified to better reflect actual data trends and not these artifacts. The text beneath this table presents the reviewers' specific suggestions on this matter.	EPA has modified Trend graphs to exclude condensables so as to eliminate this issue. In addition, exclusion of the condensable fraction was also noted on the graphs, and clarification was provided in the text.

Consensus Statements		EPA Response
	The reviewers agreed that it is acceptable for the figures to present data only on emissions source categories of anthropogenic origin. However, they found it unacceptable for the indicator text to not identify non-anthropogenic sources (e.g., wildfires, prescribed burns, geological dust) and their estimated particulate emission levels. The reviewers recommended that a pie chart be added to the indicator to illustrate the breakdown of all PM emissions in the inventory for the current year only. Showing trends in the emissions of non-anthropogenic origin was not considered important, given that these typically do not change dramatically with time.	EPA has excluded sources in the graphics that depict trends for non-anthropogenic emissions since they tend to mask trends in anthropogenic emissions. However, pie charts were added that include PM emissions from all anthropogenic and non-anthropogenic sources as well as "condensables" for the most recent year, as recommended.
	The indicator text should identify any known sources of PM emissions that are not included, regardless of the reason. The peer reviewers noted that is not clear, for example, if diesel exhaust particulate is included in the PM emissions data.	The NEI includes all source categories for emissions of primary particles but does not include emissions of secondary particles. To address the specific question regarding Diesel PM emissions, they are included in the emission totals for each sector.
Suggested modifications	EPA should make the suggested revisions identified in the Executive Summary under "General Issues for All Emissions Indicators." To make these changes, EPA should draw from data already presented in other OAR publications (e.g., the 2004 *Particle Pollution Report*, EPA 454-R-04-002). EPA should also specifically consider the "General Issues for All Indicators."	See "Response to General Issues For All Emissions Indicators" document.
	EPA should revise the figure depicting regional trends, considering the suggestions listed at the end of this table.	See responses below.
Other comments	Several minor revisions were noted during the discussions and are documented at the end of the text below.	See responses below.

Peer Review Comments on Figures 008b-3 and 008b-4

The peer reviewers did not find the regional figures particularly useful because it is difficult to identify the different EPA regions on the plot and because some "trends" depicted in the figure likely represent changes in estimation methodologies (e.g., the increases shown between 1998 and 1999). The reviewers suggested that EPA replace these figures with maps that show either (1) trends in emissions across multiple years or (2) pie charts that illustrate the regional breakdown of PM emissions among source categories for the most recent inventory year available.

EPA Response

The focus of the ROE is on trends and a single trend figure cannot show trends for all 10 Regions broken down by source category. Ten separate graphs would be required to display such information. Due to space limits, the paper ROE will not be able to accommodate this recommendation, however it will be considered for future electronic versions of the ROE (e-ROE). Condensables were removed from the Regional numbers so that trends can be assessed without effect from changing methodologies. (This was done for the national graph as well).

Peer Review Recommendations

The peer reviewers made several additional recommendations they considered important, but not as critical as those listed above. One suggestion was to explain that PM is a complex mixture of multiple constituents, with compositions that vary from one location to the next—an issue the reviewers revisited when discussing PM

concentrations. Another suggestion was to more prominently acknowledge that secondary particles are not included in this inventory and to provide some context on how much airborne PM2.5 results from secondary particle formation, as opposed to primary emissions. The reviewers also suggested revisions to the "metadata" form (see pre-meeting comments submitted by Drs. Fairley and Hidy) and editorial revisions (see pre-meeting comments submitted by Dr. Fairley).

EPA Response
The indicator text includes general information on the complexity of size and composition of particles. The text is meant only to give general background, and references are included that provide interested readers with more detailed information. An additional statement was included to more clearly acknowledge that the indicator addresses only primary particles. The metadata form was revised to address the pre-meeting comments.

SO_2 Emissions
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Decision	**Include with minor revisions**	EPA included the indicator with the modifications as detailed below.
Critical modifications	None	
Suggested modifications	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Emissions Indicators" and under "General Issues for All Indicators."	EPA has made modifications to this indicator.
Other comments	The indicator write-up should include additional context explaining why SO_2 emissions are important. For instance, the text should note that relatively few people live in areas where SO_2 concentrations exceed the National Ambient Air Quality Standards, but a much larger number of people live in PM2.5 non-attainment areas—an issue directly affected by SO_2 emissions.	EPA has added additional text to the indicator.

NO_x Emissions
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Decision	**Include with minor revisions**	EPA has included the indicator with the modifications as detailed below.
Critical modifications	None	
Suggested modifications	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Emissions Indicators" and under "General Issues for All Indicators."	See the "General Comments About All Emissions Indicators" documents

Consensus Statements		EPA Response
Other comments	The indicator text should clarify that the data presented are for anthropogenic sources only and should provide some quantitative context on NO_x emissions from biogenic sources.	EPA has revised the indicator text to address this comment. A new figure and new text were added.

VOC Emissions
Reviewed by the Air Group

Consensus Statements		EPA Response
Decision	**Include with major revisions**	EPA included the indicator with the modifications as detailed below.
Suggested modifications	Compared to the inventories for other pollutants (e.g., sulfur dioxide, nitrogen oxides), the emissions inventory for VOCs is based much more so on estimates rather than direct measurements. The indicator should more prominently acknowledge the greater uncertainty that results from these estimates.	The text has been revised to include further discussion of how the data were obtained (i.e. estimates vs. measurements) to address this comment.
	Lumping emissions of all VOCs into a single number obscures potentially important trends in photochemical reactivity or for individual VOCs or sub-groups of VOCs. The revised indicator track reactivity-weighted emissions or emissions data for selected VOCs or groups of VOCs.	EPA has not yet refined the procedures to develop reactivity-weighted VOC inventories nor have we fully considered how to interpret the results. Until such time that both are addressed, we believe it would be premature to track reactivity-weighted emissions.
	The reviewers found it appropriate to exclude biogenic emissions from the trend figures, but they recommended that the indicator text include an estimate of the total VOC emissions from biogenic sources.	The revised indicator includes a pie chart for the most recent inventory year to help put biogenic sources in perspective with anthropogenic sources. Additional text was added to the indicator text to aid in the interpretation of the data.
	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Emissions Indicators" and under "General Issues for All Indicators."	See the EPA RESPONSE TO GENERAL ISSUES FOR ALL EMISSIONS INDICATORS document.
Other comments	The indicator should clearly describe what chemicals are included in total VOCs, as some reviewers questioned whether the indicator tracked certain organic compounds, most notably methane.	EPA's definition of VOC was included in a footnote in the indicator text. Methane is not considered to be a VOC since it has a negligible photochemical reactivity and is not included on the VOC emission totals.

Lead Emissions
Reviewed by the Air Group

Consensus Statements		EPA Response
Decision	**Include with minor revisions.**	EPA has included the indicator with the modifications as detailed below.

Consensus Statements		EPA Response
Critical modifications	None	
Suggested modifications	By not presenting data on the very significant decrease in lead emissions that occurred in the 1970s and 1980s, Figure 009-1 is very misleading and should be revised to track emissions over a longer time frame. The figure should also present emissions data broken down by source categories to illustrate that the emissions reductions resulted largely from phasing out leaded gasoline.	EPA revised the figure to show trends since 1970 and to include emissions source categories similar to the other emissions indicators.
	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Emissions Indicators" and under "General Issues for All Indicators."	See the "Response to Comments about all Emissions Indicators" document
Other comments	Based on insights provided during the public comment period, the reviewers recommended that EPA verify whether the following statement in the indicator is correct: "The highest air concentrations of lead are usually found in the vicinity of smelters and battery manufacturers."	To verify the accuracy of the statement in question, ambient lead concentrations near battery manufacturing plants were compared with concentrations in other locations. Lead concentrations near the battery manufacturing plants were found to be consistently higher than in other areas (Air Quality System (http://www.epa.gov/air/data/index.html).

Mercury Emissions
Reviewed by the Air Group

Consensus Statements		EPA Response
Overall recommendation	**Do not include, unless critical modifications are made.**	EPA included the indicator with modifications as detailed below.
Critical modifications	After expressing serious concerns about the quality of the 1990 mercury emissions inventory data and their comparability to more recent data (see below for further details), the peer reviewers recommended that the indicator present emissions data only for 1999 and 2002. Trends should not be inferred from the data for these 2 years; rather, these data should be viewed as baseline emissions levels that can be examined in future trend analyses.	The updated 1990 inventory for Mercury addressed the peer reviewer concerns.
Suggested modifications	Given that mercury issues are global in nature, the indicator text should include additional context on how anthropogenic emissions of mercury in the U.S. compare to (1) mercury emissions from natural sources and (2) mercury emissions worldwide.	Statements acknowledging natural and international sources were added. However, international comparisons are outside the scope of this national report and quantitative data on natural mercury emissions was not available.

Consensus Statements		EPA Response
	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Emissions Indicators." EPA should also specifically consider the "General Issues for All Indicators."	See the "Response to Comments About All Emissions Indicators" document.
Other comments	Several minor revisions were noted during the discussions and are documented at the end of the text below.	

Peer Review Comments on the Completeness of Inventories

The mercury emissions data, according to one reviewer, do not include contributions from all potential source categories, such as mobile sources and releases associated with disposal of fluorescent bulbs and mercury switches. He recommended that this be noted among the "indicator limitations." This comment applies to both the 1990 and 1999 inventories.

EPA Response

Most mercury switches are found in older automobiles which are disposed of using electric arc furnaces (EAFs). Emissions from disposal of mercury switches are included in estimates for EAFs in the 1999 NEI. Emissions from fluorescent bulb disposal are also included in the 1999 NEI. Both categories are being added to the 1990 NEI so the categories in each will be consistent. Methodologies for other categories are already consistent.

Peer Review Comments

One reviewer recommended that the indicator text note that the emissions inventory tracks releases of total mercury, even though mercury is emitted in multiple chemical forms, including mercury vapor, mercury salts, and organic mercury compounds. Other peer reviewers wondered if Toxics Release Inventory (TRI) data might offer insights into annual emissions from selected source categories dating back to the 1980s. However, the reviewers identified potential problems associated with using TRI data, including uncertainties in facilities' self-reported emissions data and the fact that many facilities likely were not required to submit TRI reports for mercury in the 1980s and 1990s until EPA drastically lowered the mercury reporting thresholds in recent years.

EPA Response

Before conducting ambient air quality modeling, EPA speciated mercury emissions in the emissions modeling step. This process involved a series of steps to correctly interpret the existing data and apply speciation profiles specific to source categories. At this time, EPA is unable to apply this extensive process to current NEI data. When the EPA reengineers the NEI (which should be completed in 2008), then the feasibility of this recommendation will be considered.

Air Toxics Emissions

Reviewed by the Air Group

Consensus Statements		EPA Response
Overall recommendation	**Do not include, unless critical modifications are made.**	EPA has included this indicator with the modifications as detailed below.

Consensus Statements		EPA Response
Critical modifications	Lumping emissions of all air toxics into a single number (i.e., emissions of all air toxics combined) is somewhat meaningless because that number obscures potentially important trends in individual air toxics. Emissions trends for total air toxics will likely be dominated by the chemicals with greatest emissions, not necessarily those of greatest concern from a health perspective. Accordingly, the reviewers recommended that EPA present emissions data for air toxics of particular interest or present toxicity-weighted emissions data, rather than present emissions data for total air toxics. The text beneath this table lists the reviewers' detailed recommendations to address this issue.	EPA decided that including the "sum of 188" serves as an important backdrop for assessing overall trends in toxics emissions. Therefore, we kept the total. However we are still exploring other ways to present the data. Therefore, the indicator may be revised further..
Suggested modifications	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Emissions Indicators." To make these changes, EPA should draw from data already presented in other OAR publications (e.g., Strum et al. 2005). EPA should also specifically consider the "General Issues for All Indicators."	EPA has addressed these issues in the aforementioned comments and also in the "General Issues for Emissions Indicator" document.
Other comments	Several minor revisions were noted during the discussions and are documented at the end of the text below.	

Peer Review Comments on Air Toxics Emissions Indicators

The peer reviewers unanimously agreed that the air toxics emissions indicator provides important insights on the overarching question on ambient air quality. Accordingly, the reviewers strongly supported including this indicator in ROE06, provided EPA addresses the critical modifications listed above and elaborated upon in the text below:

- **Alternate presentation format.** To address the limitations of presenting emissions data for all air toxics combined, the peer reviewers offered several suggestions for how the air toxics emissions indicator can be more informative. The reviewers' main suggestion was to present emissions data on a subset of air toxics. The chemicals could be selected various ways, such as selecting the air toxics that, according to the National Air Toxics Assessment (NATA), account for the largest portion of nationwide cancer risk or non-cancer hazards. For these chemicals, EPA could simply plot the percent increase or decrease in estimated emissions over the period of inventory record. The peer reviewers noted that EPA already has plots that present data in exactly this manner (Strum et al. 2005).

  Though the reviewers strongly supported this alternate approach to presenting data, they also noted some limitations that the indicator will need to address. First, several reviewers commented that the emissions inventories for individual air toxics likely have considerable uncertainties, which must be acknowledged in the indicator text. If emissions data for a particular air toxic are believed to be unreliable, then these data should not be presented in the indicator. Second, the text should note that EPA has not developed health benchmarks (e.g., unit risk factors for cancer effects, reference concentrations for non-cancer effects) for many air toxics.

Reference: M Strum, A Pope, T Palma, R Mason, S Shedd, R Cook, J Thurman, D Ensley. The Projection of Hazardous Air Pollutant Emissions to Future Years: Methods and Results. Presented at the 2005 Emission Inventory Conference, Las Vegas, Nevada. April 2005.

EPA Response

Please see the response to the proposed critical modifications.

Peer Review Comments

The reviewers recommended that the indicator text note additional assumptions inherent in the data. For instance, text should be added explaining that the emissions inventory data do not include estimates for every harmful substance that is released to the air (e.g., diesel exhaust particulate is not included). Further, the text should note that the emissions inventory does not consider secondary formation of pollutants, which can be significant for some air toxics, like acetaldehyde and formaldehyde.

EPA Response
The indicator text was revised to include a statement regarding the secondary formation of toxic air pollutants.

CO Emissions
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Decision	**Include with minor revisions**	EPA has included the indicator with the modifications as detailed below.
Critical modifications	None	
Suggested modifications	By not presenting data on decreases in CO emissions that occurred prior to 1990, Figure 330-1 provides an incomplete account of emissions reductions that have occurred over the longer term. Presenting data for prior decades will also allow for more meaningful interpretation of the indicator on ambient concentrations of CO.	EPA notes that data prior to 1990 were developed using methodologies that are different from later years and were excluded to reduce the effects of varying emission estimation methodologies on trend line depictions.
	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Emissions Indicators" and under "General Issues for All Indicators."	See the "Response to General Comments for All Emissions Indicators"
Other comments	Additional contextual information should be included in the indicator write-up on the confidence in the CO emissions inventory and on the fact that CO emissions continue to decrease over a time frame when vehicle miles traveled have increased.	EPA revised the indicator text to include a statement regarding the decrease in CO emissions despite the increase in VMT. The indicator text contains more information about sources of emissions data to address the issue of confidence.

Ambient PM Concentrations
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Decision	**Include with major revisions.**	EPA has included the indicator with the modifications as detailed below.
Suggested modifications	Consistent with EPA's air quality standards, the indicator should present data for both annual average and 24-hour average concentrations of PM10 and PM2.5.	EPA added the recommended graphics.
	The indicator should include data collected by the IMPROVE air monitoring network or explain why those data are excluded.	The monitoring sites used in the EPA trends analyses, use monitoring methods based on the Federal Reference Method or equivalent. Many of the IMPROVE sites use different monitoring methods that may or may not be FRM or equivalent. Because of the differences in monitoring methodologies, the IMPROVE sites have not been included in the EPA trends analyses.

	Long-term trends in air quality should be based on more sophisticated statistical analysis and not simply on comparing concentrations at two endpoints in a time series.	Statistical analyses of trend data generally have not been performed for ROE06 indicators. Such analyses are complex, and legitimate scientific opinions differ significantly on which models are most appropriate. This is an important goal for future editions of the ROE, but there was not time to perform such analyses and have them adequately peer reviewed for ROE06.
	The indicator should provide information on particle speciation, whether for recent years or for trends over the longer term. Speciation data are already summarized in other EPA documents (e.g., EPA 2004).	EPA revised the indicator to include information about how the chemical makeup of particles varies across the United States
	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Ambient Concentration Indicators" and under "General Issues for All Indicators."	See the "Response to General Comments for All Ambient Indicators" document
Other comments	The "indicator limitations" should acknowledge potential biases associated with particulate sampling and analytical methods.	EPA added the indicators limitation.

Ambient Ozone Concentrations
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Decision	**Include with major revisions.**	EPA has included the indicator with modifications as detailed below.
Suggested modifications	Improved statistical analyses are needed to characterize long-term trends in ozone concentrations. Simply comparing data collected in 1980 to 2003 is an inappropriate method for quantifying trends. Several suggestions (see below) were provided for a more defensible and meaningful statistical analysis of the monitoring data.	The EPA determined that statistical analyses of trend data generally have not been performed for ROE06 indicators. Such analyses are complex, and legitimated scientific opinions differ significantly on which models are most appropriate. This is an important goal for future editions of the ROE, but time did not permit the Agency to perform such analyses and have them adequately peer reviewed for ROE06.
	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Ambient Concentration Indicators" and under "General Issues for All Indicators."	See responses in the "Responses to General Comments for All Ambient Indicators".
	For consistency with EPA's air quality standards, the indicator should track the running fourth highest daily maximum 1-hour ozone value over 3 years, rather than the second maximum 1-hour ozone value for a single year.	EPA considered this recommendation and the indicator was revised to show 1-hour ozone trends based on the running fourth-highest daily maximum 1-hour ozone over 3 years as illustrated in the 2004 Ozone Report.

Consensus Statements		EPA Response
Other comments	The indicator write-up should provide additional contextual information on ozone formation processes and the role of meteorology, as described below under "other comments."	EPA considered this recommendation and the indicator text was revised to include more contextual information on the ozone formation process and the role of meteorology.
	EPA should consider presenting separate data for rural monitoring stations, possibly drawing from data collected by the CASTNet monitoring stations.	EPA may consider including CASTNet monitoring data to reflect ozone more in rural areas in the next ROE.

Peer Review Comments on the Statistical Analysis

Given that ambient air concentrations of ozone are strongly dependent on local meteorological conditions, which can vary considerably from one year to the next, the reviewers recommended that EPA not quantify long-term trends in ozone concentrations simply by comparing data collected in just 2 years (e.g., 1980 versus 2003). As an example of their concern, the reviewers referred to the 8-hour ozone "trend" shown in Figure 004-4 for EPA Region 10. The figure reports a 17% increase in ozone concentrations, even though visual inspection of the data plotted suggests no discernible trend is apparent. The reviewers noted that the "increase" in 8-hour ozone levels for this region might simply be an artifact of ozone levels being unusually low or high in the endpoint years. The reviewers recommended EPA use other statistical approaches to characterize long-term trends and associated uncertainties. One suggestion was to compare the average of the first 3 years of the time series with the average of the latest 3 years. Other suggestions are listed in the Executive Summary of this report, under "General Issues for All Ambient Concentration Indicators."

EPA Response

Statistical analyses of trend data generally have not been performed for ROE06 indicators. Such analyses are complex, and legitimated scientific opinions differ significantly on which models are most appropriate. This is an important goal for future editions of the ROE, but there was not time to perform such analyses and have them adequately peer reviewed for ROE06.

Peer Review Comments

The reviewers repeatedly recommended that this indicator more prominently acknowledge the strong role that meteorology plays in ground-level ozone. Specific suggestions included displaying ozone monitoring data adjusted for meteorological conditions, as is done on page 13 of *The Ozone Report* (EPA 2004), and adding text to "What the Data Show" explaining that ozone concentrations exhibit considerable year-to-year variations most likely due to fluctuating meteorological conditions.

> The reviewers recommended that EPA consider several additional revisions to the indicator. First, they suggested that the text or the figure describe what is meant by the "ozone season" and describe the time frame (months) over which ozone measurements are recorded. Second, a reviewer recommended that the text provide additional context on how local emissions and long-range transport contribute to ground-level ozone problems. Third, one reviewer recommended that EPA consider separately tracking ozone trends in rural areas, possibly drawing from data collected by the CASTNet monitors.

Reference:

EPA 2004. The Ozone Report: Measuring Progress through 2003. U.S. Environmental Protection Agency. EPA 454/K-04-001. April 2004.

EPA Response

The indictor text was revised to address these comments.

Ambient Lead Concentrations

Reviewed by the Air Group

Consensus Statements		EPA Response
Decision	**Include with minor revisions.**	EPA included the indicator with modifications as detailed below.
Critical modifications	None	
Suggested modifications	The indicator should provide additional context on the relative significance of lead exposures via ambient air as compared to exposures through other media.	EPA believes that the appropriate place to discuss partitioning lead exposure among various pathways would be in the health chapter indicator, "Blood lead level." However, there is no biomeasure of blood lead (or no data available for a biomeasure of blood lead) that can apportion lead among the various exposure pathways, and ROE indicators cannot be based on models that estimate exposures based on ambient concentration indicators.
	EPA should make the suggested revisions identified in the Executive Summary of this section under “General Issues for All Ambient Concentration Indicators” and under “General Issues for All Indicators.”	See the “Response to General Comments for all Ambient Indicators” document.
Other comments	Reviewers offered several suggestions for how EPA can improve the text and associated interpretations. These suggestions are listed under “other comments” (see below).	See response below.

Peer Review General Comments

Several reviewers recommended that the indicator include additional context on the relative significance of exposures via ambient air, as compared to exposures through other media.

EPA Response

The appropriate place to discuss partitioning lead exposure among various pathways would be in the health chapter indicator, "Blood lead level." However, there is no biomeasure of blood lead (or no data available for a biomeasure of blood lead) that can apportion lead among the various exposure pathways, and ROE indicators cannot be based on models that estimate exposures based on ambient concentration indicators.

Peer Review General Comments

One reviewer recommended that EPA quantify and present confidence intervals on the reductions reported for lead concentrations.

EPA Response

Statistical analyses of trend data generally have not been performed for ROE06 indicators. Such analyses are complex, and legitimated scientific opinions differ significantly on which models are most appropriate. This is an important goal for future editions of the ROE, but there was not time to perform such analyses and have them adequately peer reviewed for ROE06.

- After hearing feedback provided during the observer comment period, the reviewers recommended that EPA verify the accuracy of the following statement in the indicator text: “Today, the highest levels of airborne lead are usually found near industrial operations that process materials containing lead, such as smelters and battery manufacturers.”

EPA Response

To verify the accuracy of the statement in question, ambient lead concentrations near battery manufacturing plants were compared with concentrations in other locations. Lead concentrations near the battery manufacturing plants

were found to be consistently higher than in other areas (Air Quality System (http://www.epa.gov/air/data/index.html).

Ambient Concentration of a Selected Air Toxic: Benzene
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Overall recommendation	**Do not include, unless critical modifications are made.**	EPA has included the indicator with modifications as detailed below.
Critical modifications	By focusing on just one chemical, the indicator provides limited insights on the 188 air toxics as a whole. While the reviewers acknowledged that this indicator cannot present data on every air toxic, they strongly recommended that the indicator include ambient concentration data on additional air toxics of interest, such as those recommended for the updated indicator on air toxics emissions. The reviewers noted that a pending publication by Sonoma Technologies, Inc., prepared under contract to EPA, has ambient concentration trends that could be used to revise this indicator.	EPA agrees that benzene is not representative of all air toxics – some (such as benzene) are more ubiquitous in the environment than others and different classes of HAPs target different health effects. However, benzene has more robust data records in terms of spatial coverage and data completeness compared to other air toxics monitoring data. Rather than adding other air toxics to this indicator, we renamed the indicator "Ambient Concentrations of Benzene." The EPA also refers to the National Air Toxics Trends Program (NATTS) which is designed to track the air toxics trends as identified by NATA. This data is expected to be available for the next ROE to indicate trends for additional air toxics based on the NATTS monitoring. The ambient concentration data drafted by Sonoma Technologies, Inc. have not been peer reviewed and made public in time to include in this report.
Suggested modifications	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Ambient Concentration Indicators." EPA should also specifically consider the "General Issues for All Indicators."	See responses in the "Responses to General Comments for All Ambient Indicators" document
Other comments	Some minor revisions were noted during the discussions and are documented at the end of the text below.	

Peer Review General Comments
When commenting on the data specific to benzene, the peer reviewers noted that the indicator limitations should acknowledge both the limited number of monitoring stations and the limited geographic distribution of these monitoring stations. Another reviewer suggested that the indicator better describe how monitoring stations were selected for this indicator, given that some reviewers incorrectly assumed that the data trends presented were based entirely on PAMS monitoring.

EPA Response
Additional language was added to the "Indicator Limitations" section of the text noting the limiting factor of the number and geographical distribution of monitoring sites.

Ambient CO Concentrations
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Decision	**Include with major revisions.**	EPA included the indicator with modifications as detailed below.
Suggested modifications	Quantitative estimates of long-term trends should be based on more sophisticated statistical analyses (e.g., regression analyses), rather than simply comparing observations in 1980 to those in 2003.	EPA has determined that statistical analyses of trend data generally have not been performed for ROE06 indicators. Such analyses are complex, and legitimated scientific opinions differ significantly on which models are most appropriate. This is an important goal for future editions of the ROE, but there was not time to perform such analyses and have them adequately peer reviewed for ROE06.
	EPA should make the additional suggested revisions identified in the Executive Summary of this section under "General Issues for All Ambient Concentration Indicators" and under "General Issues for All Indicators."	See responses in General comments document
Other comments	More contextual information is needed to highlight the fact that decreases in ambient air concentrations of carbon monoxide have occurred over a time frame when vehicle miles traveled increased.	EPA added language to the indicator text indicating the increase in vehicle miles traveled during the time of CO air quality improvements.

Number and Percent of Days AQI Values >100

Consensus Statements		**EPA Response**
Decision	**Do not include, unless critical modifications are made**	EPA included the indicator with modifications as detailed below.
Critical modifications	The approach to calculating AQI values changed in 1999, when ambient concentrations of PM2.5 were first factored into this system. However, the indicator does not acknowledge this change in methodology and therefore presents a very misleading account of trends in AQI data over the past 15 years. The reviewers recommended several ways that EPA can address this issue (see below).	EPA revised the text to include a reference to the contribution of ozone to the percent of days with AQI values >100. A statement was added to the text and a pointer to the graphic indicating when PM2.5 concentrations were added to the AQI.
	The number of AQI days greater than 100 in a given year can be highly influenced by meteorology. As a result, comparing AQI data from one year to AQI data in another year (e.g., 1990 vs. 2004) can be misleading. The reviewers recommended that EPA use more statistically robust approaches when commenting on long-term AQI trends (see below).	EPA will include and compare the 3-year average AQI trend for the beginning period (e.g., '90-'92 in Fig.001-1) with the ending period (e.g., '02-'04). This is illustrated on Pg. 1-85 of the pre-meeting comment booklet.

Important modifications	Even though this indicator technically does not track ambient concentration trends, EPA should still make revisions listed in the Executive Summary under "General Issues for All Ambient Concentration Indicators." EPA should also specifically consider the "General Issues for All Indicators." *Included herewith*	See "Response to General Issues for All Indicators" document.
	The reviewers listed specific revisions that EPA should consider for this indicator's graphic (see below).	The figure was revised to include the percentage of days with AQI values >100.
Other comments	Some minor revisions were noted during the discussions and are documented at the end of the text below.	See response below.

Peer Review Comments

The reviewers had various opinions on the importance of AQI as an indicator. Some reviewers did not find the AQI particularly informative, noting that it basically correlates with data already presented in the ambient concentration indicators. Other reviewers noted that the public has become increasingly aware of the AQI, given that various media outlets now use AQI to provide "air quality forecasts." The reviewers eventually agreed that this indicator is of sufficient importance to remain in the ROE, but provided that EPA makes critical modifications. Detailed information on the reviewers' recommendation follows:

- **Addition of PM2.5 to AQI in 1999.** Figure 001-1 in the draft indicator suggests that the number of days with AQI greater than 100 changed little between 1990 and the present. However, the figure fails to account for the fact that, starting in 1999, EPA began factoring ambient air concentrations of PM2.5 into AQI calculations. Thus, the numbers of days with AQI greater than 100 from 1999 to the present are not directly comparable to those prior to 1999. In years since 1999, roughly 30 to 35% of days with AQI values greater than 100 are attributed to PM2.5 concentrations. By including PM2.5 starting in 1999, the figure actually masks a downward trend in AQI values attributed to ozone concentrations (see page 1-85 of the pre-meeting comment booklet –The peer reviewers agreed that this confounding effect is critical to address, both in the figure and in the text. The reviewers suggested two different approaches for revising the figure: (1) EPA could include two separate figures, one showing AQI values attributed to ozone and the other showing AQI values attributed to PM2.5 (including figures for other criteria pollutants was considered unimportant, given that ozone and PM2.5 account for the overwhelming majority of days with AQI values greater than 100); or (2) EPA could include two separate figures, one showing AQI data for years before PM2.5 factored into the index and the other for years since PM2.5 has been considered. After recalculating the AQI data for the figures, EPA should then revise the text in "what the data show" accordingly. The peer reviewers concluded that these revisions are critical and must be incorporated if EPA intends to keep this indicator in ROE06.

EPA Response

The indicator text includes a description of the contribution of ozone to the number of AQI days greater than 100. A statement was also added indicating that PM2.5 concentrations were added to the AQI in 1999 so numbers are not strictly comparable before and after 1999. A note was added to the figure about the addition of PM2.5 in 1999.

Peer Review Comments on the Statistical analysis

Given that meteorology can strongly influence AQI values in a given year, the peer reviewers strongly recommended that EPA revise statements in the text. Specifically, EPA should revise sentences that compare AQI values in one single year to those in another single year (e.g., "the percentage of days with AQI greater than 100 in 2003 is 27% lower than that for 1990"). To avoid potential biases introduced by years with unique meteorological conditions, the reviewers recommended that EPA instead consider comparing a 3-year average observation at the beginning of the period of record to a 3-year average observation at the end (again, see page 1-85 of the pre-meeting comment booklet for an example). This approach is already used in some EPA publications.

EPA Response

EPA will include and compare the 3-year average AQI trend for the beginning period (e.g., '90-'92 in Fig.001-1) with the ending period (e.g., '02-'04) as illustrated on Pg. 1-85 of the pre-meeting comment booklet.

Peer Review Comments on the Figures

The reviewers debated several different approaches to improving the presentation of the AQI data. One reviewer found Figure 001-1 somewhat confusing in that the number of days with AQI values greater than 100 were always greater than 365. Though he understood how these numbers were derived, the reviewer wondered if this presentation might confuse readers. On the other hand, several reviewers supported the use of percent of total days with AQI values greater than 100. Another suggestion was to present graphs that provide insights on the magnitude of the AQI values, not how often they exceed 100. The peer reviewers eventually recommended that EPA carefully consider these options and review existing plots in other OAR documents (i.e., trends reports) before revising the figures for this indicator.

EPA Response

The figure was modified to remove the number of days with AQI values greater than 100. The figure includes percent of days greater than 100.

Regarding the second comment on insights on the magnitudes of AQI values, some techniques have been developed that illustrated the trend in the severity of AQI values (e.g. maroon, purple, red, orange) within MSAs. However, these techniques have not been fully vetted and published. Therefore, this comment cannot be incorporated into the 2007 ROE but will be considered for future reports.

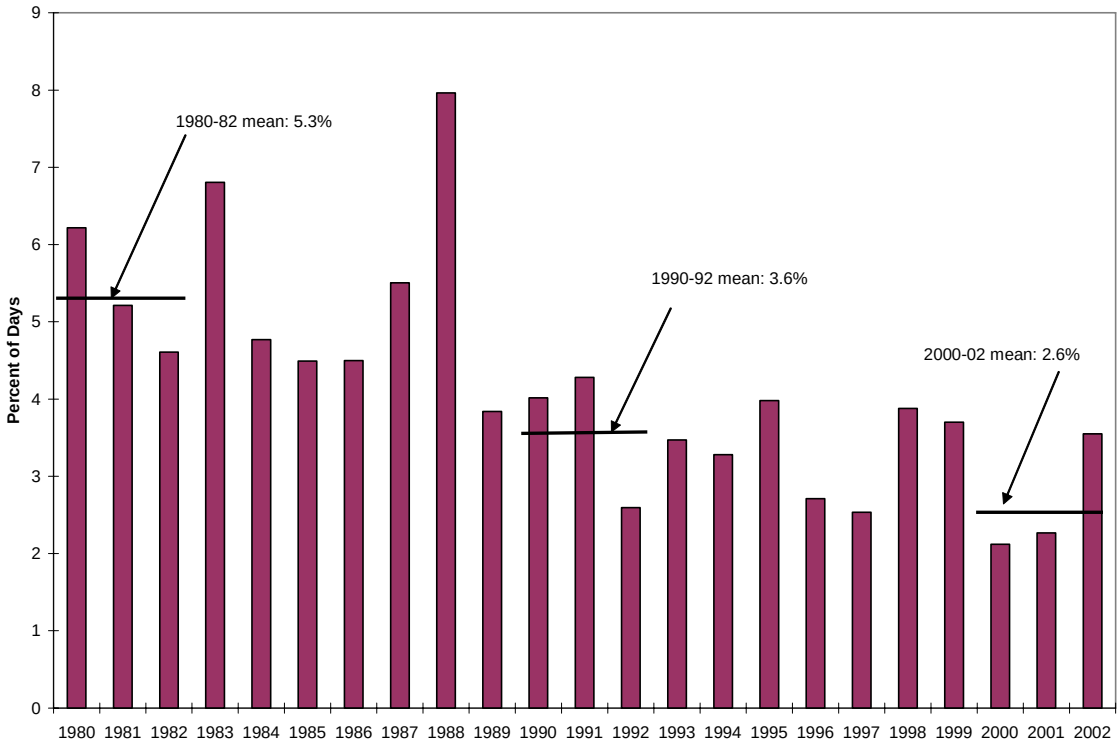
Peer Review Comments

The peer reviewers offered several suggestions for providing additional contextual information on AQI values and how to improve entries on the "metadata" form (see pre-meeting comments submitted by Dr. Fairley). Additionally, the reviewers recommended that the text more prominently acknowledge that the indicator applies exclusively to larger urban and suburban areas (i.e., MSAs with at least 500,000 residents).

EPA Response

EPA will revise text accordingly.

Use percent of days rather than total days. Draw from an existing plot accessed from OAR publications (see page 1-85 of the pre-meeting comment booklet [pasted in below]).



Peer Review Comments on FigureAQI Trends for ozone, 1980-2002. Annual percent of MSA-days with ozone exceeding 100 AQI in 85 Metropolitan areas with long-term records.

This figure is still limited in that it only includes MSAs with large populations and that it weights all MSAs equally. An alternative method would be to compute this metric by county and get a population-weighted average of percent of days with AQI > 100.

EPA Response

County-level population weighting would not be appropriate as the AQI days > 100 are developed for MSAs which may encompass multiple counties. A metropolitan area population-weighting could be developed to accommodate this comment. These types of statistics have been generated for internal use but have not been published.

Ozone Levels Over North America
Reviewed by the Air Group and by the Ecological Condition Group (as a Referenced Indicator)

Air Group

Consensus Statements		**EPA Response**
Decision	**Include with major revisions.**	EPA has included the indicator with the modifications as detailed below.
Suggested modifications	Of all indicators proposed for the Air Chapter, the reviewers found this indicator most difficult to follow and recommended significant revisions to provide necessary context for understanding stratospheric ozone depletion and the significance of the data presented.	EPA decided to include additional contextual information to the indicator text to address this comment.
	The indicator incorrectly states that Figure 015-1 is based on satellite data. In reality, the figure is based entirely on ground-level Dobson Spectrophotometer readings.	EPA determined that this comment is no longer relevant. The revised indicator contains a new figure and data.
	Figure 015-1 should be significantly revised to provide a more transparent account of data trends. Suggested revisions are presented below.	EPA determined the new figure provides a more transparent account of data trends.
	The indicator should describe the statistical methods used to quantify the magnitude of the downward trend and should specify whether this trend is statistically significant.	EPA decided to provide more context with regards to the significance of the depletion observed across North America and how it compares to the depletion observed in other specific areas, a new paragraph was added to the indicator text.
	EPA should make the additional suggested revisions identified in the Executive Summary of this section under "General Issues for All Ambient Concentration Indicators" and "General Issues for All Indicators," to the extent that the suggested revisions apply.	See the "Response to General Comments for all Ambient Indicators" document.
Other comments	The reviewers recommended that EPA consider including data, either within this indicator or as a separate indicator, on the amount of ultraviolet (UV) radiation that reaches the Earth's surface. Data are currently available from an existing NOAA monitoring network to support such an indicator (see below).	EPA operated and maintained a network of 21 UV monitoring stations located across the U.S. from 1994-2004 (see www.epa.gov/uvnet). Operation of the 21 site network was discontinued in 2004, but EPA is working with NOAA to redeploy a limited network utilizing some of the same sites and collocating monitors with other instruments operated by NOAA and USDA. In consultation with experts in NOAA and other organizations, EPA may use these analyses to determine the utility of the ground-based UV data as an environmental indicator in future ROEs.

Peer Review Comments of Figure 015-1

Finding it difficult to visualize trends from the current version of Figure 015-1, the reviewers recommended several alternate approaches to presenting the data. For instance, by displaying only annual average or running annual average observations of "total column ozone," the figure would show a smooth signal that is not obscured by the significant seasonal variations. Additionally, given that all four monitoring stations have nearly identical data, some peer reviewers recommended that the graph present average readings from all stations combined or perhaps just present data from a single station and note that trends observed at other stations are basically the same. Finally, a reviewer recommended that the y-axis on the graph be extended to zero, which would show the trends on an absolute scale and not give the appearance of the decline being larger than it actually is.

EPA Response

This comment is no longer relevant. The original figure was removed. The revised indicator has a new figure.

Peer Review Comments on the Use of UV radiation data

For more direct insights on exposures associated with stratospheric ozone depletion, the reviewers recommended that EPA consider tracking measurements of UV radiation at the Earth's surface. Such information is already being collected in NOAA's Surface Radiation Budget Network (or SURFRAD), described further online at: http://www.srrb.noaa.gov/surfrad. The network currently consists of seven monitoring stations established at different times over the last 12 years. The reviewers recommended that EPA consult with NOAA on the utility of these data for serving as an environmental indicator in ROE. One reviewer also recommended that EPA access UV radiation data from the Atmospheric Radiation Measurement (ARM) network, described further online at: http://www.arm.gov.

EPA Response

EPA operated and maintained a network of 21 UV monitoring stations located across the U.S. from 1994-2004 (see www.epa.gov/uvnet). Operation of the 21 site network was discontinued in 2004, but EPA is working with NOAA to redeploy a limited network utilizing some of the same sites and collocating monitors with other instruments operated by NOAA and USDA. In consultation with experts in NOAA and other organizations, EPA may use these analyses to determine the utility of the ground-based UV data as an environmental indicator in future ROEs.

Ozone Levels Over North America

Reviewed by the Air Group and by the Ecological Condition Group (as a Referenced Indicator)

Ecological Condition Group

Consensus Statements		**EPA Response**
Overall recommendation	**Include with modifications.** (Rank: Medium)	EPA included the indicator with the modifications as detailed below.
Critical modifications	Graphical information on continental and global patterns would provide useful context.	EPA considered these recommendations and decided to revise the indicator text to provide a global context with regards to the observed decrease in total ozone levels for North America
Suggested modifications	Show trend lines in the graphics if appropriate.	EPA considered these recommendations and determined this comment relates to the data/figure used in the original version of the indicator. This comment is no longer valid.
Other comments	The indicator is ecologically important, particularly for aquatic systems.	

Concentrations of Ozone-Depleting Substances

Reviewed by the Air Group

Consensus Statements		EPA Response
Overall recommendation	**Do not include, unless critical modifications are made.**	
Critical modifications	The indicator focuses on a subset of ozone-depleting substances that (based on the 2001 data shown) appear to account for approximately two-thirds of the total concentration of ozone-depleting substances. The reviewers strongly recommended that the indicator include data for additional substances, if available, or more prominently acknowledge and explain the significance of these substances' omission.	EPA has revised the indicator to show the contributions of specific groups of chemicals (i.e., CFCs, HCFCs, methyl bromide [from both natural and anthropogenic sources], methyl chloride, carbon tetrachloride, methyl chloroform, and halons) to the total EESC. The original Figure 017-1 has been replaced with two new figures. Figure 017-1 shows EESC for all ODS over the period 1940 to 2004. Figure 017-2 shows the EECl trend for specific groups of chemicals (i.e., CFCs, HCFCs, methyl bromide, carbon tetrachloride, methyl chloroform, and halons) rather than a weighted index. By providing the trends for each group of ODS separately, the figure shows which chemicals have increased in equivalent chlorine concentration over the time period without presuming to make conclusions about the overall trend of EECl.
	Presenting a weighted index could mask important substance-specific trends, and focusing on 1991 to 2001 leaves out over 10 years of relevant measurements. The reviewers recommended that this indicator, to the extent possible, include substance-specific data over longer time frames. Reviewers noted that the data and graphs should be available from the National Oceanic and Atmospheric Association (NOAA).	EPA revised figure 017-2 was to show the EECl trend for specific groups of chemicals (i.e., CFCs, HCFCs, methyl bromide, carbon tetrachloride, methyl chloroform, and halons) rather than a weighted index. These data are provided over the time period 1992-2004 because, at the time of this writing, that was the only time period for which EECl data were available on the NOAA CDML website. Comprehensive EECl data were also not available for individual monitoring stations. The revised indicator text clarifies that the substance-specific trends are a weighted average of the measured data at several monitoring stations. In response to the comment that data should be provided for" additional years, especially for the 1970s and 1980s,"a new Figure 017-1 has been included which shows EESC for all ODS over the period 1940 to 2004.
Suggested modifications	EPA should make all applicable revisions identified in the Executive Summary under "General Issues for All Ambient Concentration Indicators." EPA should also specifically consider the "General Issues for All Indicators."	See "Response to Comments for All Ambient Indicators"
Other comments	Some minor revisions were noted during the discussions and are documented at the end of the text below.	

Peer Review Comments

Additional context should be provided in the indicator text to explain why ambient concentrations of ozone-depleting substances are decreasing so slowly, even though the Montreal Protocol was ratified nearly 20 years ago. For a more complete picture on stratospheric ozone issues, the peer reviewers recommended that EPA make the revisions necessary to retain this indicator and that EPA not withdraw the indicator on production of ozone-depleting substances.

EPA Response

To respond to this comment, the following text was included in the revised indicator:

> Worldwide production and consumption of ODS is being progressively eliminated under the provisions of the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer. Over time, reducing the atmospheric loading of ODS is expected to result in global increases in stratospheric ozone. However, because some ODS gases have long atmospheric lifetimes, and because of pre-phaseout ODS stockpiling for post-phaseout use ambient concentrations of ODS have only recently begun to stablilize and in some cases begun to decline. While some gases, like methyl chloroform, decay quickly in the atmosphere, other gases, like CFCs and halons, have atmospheric lifetimes on the order of hundreds or thousands of years.

Acid Deposition
Reviewed by the Air Group and by the Ecological Condition Group (as a Referenced Indicator)

Air Group Review

Consensus Statements		**EPA Response**
Overall recommendation	**Include with minor revisions.**	EPA has included this indicator with the modifications as detailed below.
Critical modifications	None	
Suggested modifications	EPA should make suggested revisions listed in the Executive Summary of this section under "General Issues for All Indicators," to the extent that they apply.	EPA has addressed this issue in the "General Response" to all Ambient Indicators document.
	Additional contextual information should be included in the indicator text, and some statements should be clarified.	EPA used the map developed by NAPAP and published in the 1991 NAPAP Report to Congress showing acid sensitive regions. The current version of that map (same data, different colors) has been included in the figures and some text explaining it has been included in the indicator write-up.
Other comments	EPA should consider revising the figures based on the reviewers' feedback (see below). At a minimum, higher resolution figures must be included in ROE06, because the data points in Figures 011-1 and 011-2 and the pie charts in Figures 011-3 and 011-4 are currently illegible.	EPA has revised these figures.

Peer Review Comments related to the use of Figures:
The reviewers unanimously agreed that the data points and pie charts on the draft figures are completely illegible. Accordingly, EPA needs to update the figures, possibly preparing them at a finer resolution, such that all information on the figures is legible in the final report.

Individual reviewers suggested additional revisions to the figures, but no consensus was reached on these revisions. For instance, some reviewers recommended that EPA replace the contoured maps with maps showing average acid deposition data for the EPA regions, following the format used for the regional figures used in the ambient concentration indicators. Use of such maps would better capture the temporal trends in acid deposition, rather than simply comparing baseline and current conditions. On the other hand, other reviewers liked the spatial resolution offered by the draft figures and feared that averaging data over the EPA regions would mask the finer spatial trends currently depicted in the maps.

EPA Response:

The figures were revised and comments from the reviewers were taken into consideration.

Acid Deposition
Reviewed by the Air Group and by the Ecological Condition Group (as a Referenced Indicator)

Ecological Condition Group Review

Consensus Statements		**EPA Response**
Overall recommendation	**Include with modifications.** (Rank: High)	EPA included the indicator with modifications as described below.
Critical modifications	It would be useful to present corresponding regional rates of acid neutralizing capacity (ANC) for both water and soil.	EPA added a graphic showing area with acid-sensitive waters in the U.S. A soils map was not available.
	Trend data from the NADP, which are more extensive than the current snapshots, should be developed either for the nation or for regions.	EPA revised the snapshots of change in deposition presented in the ROE represent our best understanding of how deposition has changed in the last 15 years. Showing intermediate maps does not either change the story or make it simpler to understand; therefore, we suggest not including data for every year from NADP. The text does include a link to the NADP website where readers wanting additional data can access it.

Regional Haze
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Decision	**Include with major revisions.**	EPA included the indicator with modifications as described below.
Suggested modifications	The text and figures should be revised to acknowledge that the indicator does not present visibility measurements. Rather, it presents visibility data calculated from speciated PM measurements.	EPA changed the indicator name to Regional Haze and additional clarifying language was added to the text. A footnote was added to Figures 006-1 and 006-2 saying "Visibility trends are calculated from PM speciation data and not from direct visibility measurements."

Consensus Statements		EPA Response
	EPA should consider including data on visibility in urban areas, possibly drawing from visibility measurements collected at airports nationwide under FAA's Automated Surface Observing System (ASOS) network. If the urban data are not included, EPA should rename the indicator to be more descriptive of its contents (e.g., "Regional Haze" or "Visibility in National Parks").	EPA determined that urban visibility trends measured by NWS, FAA, and DOD at airports could be developed, but their methodologies changed in the mid-1990s from human observation to use of various optical instruments so trends through this period are problematic. Also trends of the direct measures of visibility will include non-air quality visibility effects such as precipitation and humidity. Therefore these trends would not necessarily be similar to the indicator trends from IMPROVE particulate matter estimates of visibility, which reflect on the air quality effects. Therefore this data will not be added to the 2007 ROE. However it may be considered for development of future ROEs. As suggested in the comments, we changed the title of the indicator to Regional Haze.
	The reviewers recommended several revisions to the figure (see below). These suggestions should be specifically considered, along with suggested revisions listed in the Executive Summary of this section under "General Issues for All Ambient Concentration Indicators" and under "General Issues for All Indicators."	See response below and the "Response To General Issues For All Ambient Indicators" document.
Other comments	Several suggested revisions to the indicator text are listed below.	

Peer Review Comments on Figures 006-1 and 006-2

The reviewers recommended several changes to the visibility figures. First, several reviewers noted that the figures should include visibility data for years 2002 and 2003 (and 2004, if available) and should include data for years prior to 1992. Second, for greater consistency throughout the Air Chapter, the reviewers recommended that EPA consider presenting the visibility data in the same format used in the figures for the ambient concentration indicators: distribution plots showing the median, 10^{th} percentile, and 90^{th} percentile values. Third, again in the interest of greater consistency, some reviewers suggested that this indicator include another figure showing calculated visibility broken down by EPA region. Additional figures showing visibility trends in urban areas will need to be developed, depending on EPA's response to the recommendations in the previous bulleted item.

EPA Response

There are insufficient data points to allow the indicator to be broken down by EPA Region. Urban data will not be included based on the comments above, however this recommendation may be considered for future ROEs. Graphics showing visibility trends including 2002 and 2003 are currently not available.

Peer Review Comments on Improved statistical analysis

The reviewers noted that the section on "What the Data Show" does not attempt to quantify temporal trends in calculated visibility. Visual inspection of the figures suggests that the best visibility conditions might be improving; however, regression analyses or some other statistical analyses are needed to confirm whether this trend is indeed occurring. The reviewers recommended that EPA either specify in this section that certain conditions or improving (as backed up by statistical analyses) or acknowledge that no statistically significant temporal trends are apparent. Given the downward trend report for PM10 concentrations, some reviewers expected to see greater improvement among the visibility data.

EPA Response

Statistical analyses of trend data generally have not been performed for ROE06 indicators. Such analyses are complex, and legitimated scientific opinions differ significantly on which models are most appropriate. This is an important goal for future editions of the ROE, but there was not time to perform such analyses and have them adequately peer reviewed for ROE06**.**

Peer Review Comments related to Specific text revisions

The reviewers recommended three additional minor revisions to the text. First, the text should use a map to define (or otherwise define) the difference between "east" and "west" for purposes of visibility assessment. Second, the text should identify the number of monitoring stations located in the "east" and "west" regions. Third, the indicator text should include side-by-side haze photographs to provide visual perspective on what impaired visibility looks like. Examples of such displays can be viewed online at: http://www.epa.gov/air/visibility/index.html.

EPA Response

Text was added to the section text indicating the number of monitors used to derive the trend statistics in Figures 006-1 and 006-2. Text was also added to define "east" and "west."

Lake and Stream Acidity
Reviewed by the Water Group and by the Ecological Condition Group (as a Referenced Indicator)

Water Group Review

Consensus Statements		**EPA Response**
Overall recommendation	**Include with modifications.**	EPA has included the indicator with the modifications as detailed below.
Critical modifications	None.	
Suggested modifications	Explain EPA's decision to limit the indicator to the northeast and Mid-Atlantic.	EPA will show the entire population of surface waters in the U.S. that is geochemically susceptible to acidification due to acid deposition, and explain why this indicator focuses on eastern and Midwest U.S. lakes and streams. Trend data for the other regions are unavailable. Survey for Western Lakes and Florida lakes, but there is no expectation that these lakes surface waters will be resurveyed, and they are not part of the TIME/LTM project.
	Consider data available for other regions in the U.S., and incorporate the most recent available data.	
	Clearly define the population represented by this indicator, and explain that sampling was targeted to reflect the impacts of the Clean Air Act on acid sensitive areas.	EPA explained in paragraph three of indicator description; the indicator does include data for both lakes and streams, as appropriate.
	Revise Figure 041-1 to include data from years pre-1990. Define the year that is considered "current."	EPA determined that the current year is defined in the graphic as 2000. Pre-1990 data is not easily accessible or easy to integrate with the data presented here.
	Relate this indicator to appropriate air indicators to reflect the stressors or ambient conditions.	EPA believes text reflects the link; and the indicator will be moved to follow the acid deposition indicator.
	Define ANC and explain why/how it can be negative.	EPA included the recommended changes.
Other comments	It is not appropriate to represent the existing dataset as a national indicator unless data are included for other areas of the U.S.	Please note the response to first two comments.

Consensus Statements		EPA Response
	If other areas of the nation are not covered in the analysis, consider revising the question to specifically address the region and data included. It is not immediately clear what portion of the more general question this indicator answers.	

Ecological Condition Group Review

Consensus Statements		EPA Response
Overall recommendation	**Include with modifications.** (Rank: High)	
Critical modifications	Change the title to "Changes in Lake and Stream ANC."	EPA determined that while ANC is the technically correct term for the indicator, EPA has found over 20 years of communicating with the public that that acidity (essentially the opposite of ANC) coveys more meaning relative to acid deposition.
	In ROE, put the indicator back-to-back with Acid Deposition.	EPA included the recommended changes.
	Complete the national map. Note that earlier surveys collected baseline data for other regions.	EPA determined that the National Surface Water Survey (NSWS) collected baseline data for 2,300 lakes and 500 stream reaches, representing a nationwide target population of 28,300 lakes and 59,000 stream reaches. According to the National Acid Precipitation Assessment Program *1990 Integrated Assessment Report to Congress* (p. 26 and Box 2.2-4), the NSWS found that: Almost all acidic waters were found in six regions of the United States: New England, the Adirondacks, the mid-Atlantic Highlands, the mid-Atlantic Coastal Plain, Florida, and the upper Midwest." While baseline data from the NSWS exists for areas on a national scale, continued monitoring of surface water conditions currently takes place in only four of the six regions (surface water monitoring was discontinued in the upper Midwest and will not be reported in the future). So, ANC trends can be reported only for these regions.

Consensus Statements		EPA Response
	Modify the text and graphics to make the measures of ANC, alkalinity, pH, and acidity clear to the readers. Explain that ANC values less than zero reflect additional mineral acidity in the absence of carbonate and bicarbonate. Although "ANC" can be used to mean "acidity," the indicator write-up would be clear if it used the term "susceptible" instead (second paragraph).	EPA included the recommended text revisions.

Ozone Injury to Forest Plants
Reviewed by the Air Group and the Ecological Condition Group

Ecological Condition Group Review

Consensus Statements		EPA Response
Overall recommendation	**Include with modifications.** (Rank: Medium) (but do not include unless greater spatial resolution can be provided)	EPA considered this recommendation and the resolution has been refined to cover the ten EPA Regions, and it has been made clear that the indicator covers only the forested areas of the regions.
Critical modifications	The data were collected very precisely using many sites and a rigorous biosite value method. The data of over 1000 sites seems to be a rich source of ozone injury data and were likely developed in a relatively unbiased manner. However, the indicator, as presented, is a poor use of these data. Averaging of the ozone data over such large (and administratively defined) regions is going to obliterate areas of concern. Since the focus is on forested areas, how can the regions include vast areas of the central US that are largely without forested land? This tends to skew the data presentation further. **The indicator must present data at a greater spatial resolution.**	EPA determined that it is true that vast areas of the central US are largely without forests. However, FIA uses a stratified random sampling design to select plots that are classified as forested in the central US, just as in other parts of the country. The data are not biased or skewed. The data are representative of "forested" plots across the entire US.
Suggested modifications	There is uncertainty about the interpretation of the biosite values and associated possible impacts in relation to plant mortality or growth. Other patterns could emerge if suites of different organisms (e.g., understory species, lichens) were incorporated into the metric. It is difficult to infer broader ecological impacts from these results. Differential sensitivity among plants and different plants across regions make this index additionally challenging to interpret. **The indicator should address any potential biases related to the differences in sensitivity in these organisms.**	EPA determined the FIA's ozone biomonitoring indicator includes trees and understory vegetation, not lichens. Lichens have been shown to be sensitive indicators of other criteria pollutants such as nitrates and sulfates, and certain heavy metals. However, lichens are not particularly sensitive to ozone. Thus, they would not be chosen as an ozone-sensitive biomonitoring species. High and severe ozone injury categories have been noted as having expected tree- or ecosystem-level effects (beyond foliar injury) in the text.

Air Group Review

Air Group Review Comment	EPA Response
The indicator text implies that ozone injury data are available dating back to 1994, but no information on temporal variations is presented. The reviewers recommended that the indicator provide some perspective on whether the reported damage has increased or decreased over the last 10 years.	EPA determined that over the last 10 years the number of states that have implemented FIA detection monitoring, inclusive of the ozone bioindicator, has increased. The sample size across the 10-year period is not consistent. Moreover, plant response to ozone is a function of complex interactions between many environmental factors such as soil moisture and ozone levels. Plant stomata are not open under drought conditions, thus ozone cannot enter the plant and cause injury. These environmental factors vary across time and space. At the present time it is not prudent to report temporal trends in ozone injury. FIA has been working towards the development of a flux-based model, similar to that used in Europe, that would relate ozone uptake to ambient ozone levels.
The reviewers were concerned that the coarse resolution used for the four geographic regions might mask important spatial variations over finer scales. As an example of their concern, the "west" region includes Oregon and Washington, which have fairly extensive forests but relatively low ozone concentrations. But, this region also includes California, which has less extensive forest and some of the highest ozone concentrations in the country. As a result, the reviewers wondered if using finer resolution for this and the other regions might reveal greater insights into ozone damage to trees.	EPA determined that Ozone injury data are now aggregated by EPA region, which increases the number of spatial entities from four to 10. This is the finest scale of aggregation allowed for this edition of the ROE, except for the Regional Pilot indicators.
The reviewers recommended that EPA provide greater context for explaining the spatial variations depicted. For instance, the reviewers were surprised that the indicator reports such limited damage to trees in the west region, given the high levels of ozone routinely measured there. This unexpected trend raised several questions: Are the selected tree species in the west more resistant to ozone damage than are tree species elsewhere? Or might the relatively little damage in this region be caused by the forests in Oregon and Washington being sampled more extensively than those in California? Providing additional context in the text will help readers understand trends that otherwise seem counterintuitive.	EPA determined that crews did not start collecting data in southern CA until the year 2000. The new bar chart for 2002 shows a much higher incidence of plots with visible ozone injury in Region 9, which includes southern CA. Understory vegetation is surveyed for visible ozone injury in addition to trees. The ozone-sensitive understory plant species and trees that are monitored differ between the east and west because the same species are not distributed across the entire country. Species in the west are no less sensitive to ozone. Species in the west were selected based on their ozone sensitivity just as species in the east. Ozone-sensitivity of selected biomonitoring plant species is high across the board, as has been repeatedly demonstrated in the field and in the laboratory.

Ambient Nitrogen Dioxide (NO_2) Concentrations

Consensus Statements		EPA Response
Overall recommendation	**Should be included in ROE**	

Critical modifications	• None	
Suggested modifications	• The "indicator limitations" section should more prominently acknowledge the potential interferences in NO_2 measurements. The reviewers noted that other compounds not mentioned in the report, like peroxyacetylnitrate (PAN) and nitric acid, can interfere with the measurements. Further, the limitations can note that measurement devices with ultraviolet photolytic converters are far less prone to interferences than devices with heated surfaces (or catalysts) upstream of the chemiluminescence detector.	EPA modified the indicator limitations section to address this comment.
	• Presenting some information in the text on NO_x emissions trends would provide greater context for interpreting the trend lines for NO_2 concentrations.	EPA revised the text to address this comment.
	• The first paragraph should more accurately describe what is meant by NO_x (nitrogen oxide and nitrogen dioxide), as compared to total reactive nitrogen, or NO_y (nitrogen oxide, nitrogen dioxide, nitric acid, peroxyacetyl nitrate, and others).	EPA revised the text to address this comment.
	• Different colors or line styles should be used in Figure 355-2 such that readers can easily distinguish the different trend lines. One reviewer preferred using maps with 10 separate graphs depicting the individual regional trend lines, rather than presenting all of the trend lines on a single graph.	A conscious decision was made to display the trends for all Regions on a single graph rather than separate graphs on a map in order to facilitate comparisons. Differences are nearly impossible to see when multiple graphs are scattered on a map. EPA will do our best to make the lines as distinct and distinguishable as possible during desktop publishing of the report.
	• EPA should correct an inconsistency in the response to question T4Q1 on the "metadata form." The response refers to 9 years of measurements, while Figure 355-1 presents 25 years of measurements.	EPA revised the Metadata form.

Brief Summary: The peer reviewers agreed that the ambient NO_2 concentration indicator provides important insight on the overall question regarding outdoor air quality and commended EPA for developing this indicator based on recommendations made during the July peer review meeting.

Ambient Concentrations of Manganese Compounds in EPA Region 5

Consensus Statements		**EPA Response**
Overall recommendation	**Should be included in ROE only if the critical modifications are made**	EPA has included the indicator with modifications as detailed below.
Critical modifications	• Additional explanatory text should place the regional issue into a broader national context. While the second paragraph of the indicator now explains why manganese compounds are particularly important to EPA Region 5, the extent to which airborne manganese is (or should be) of concern nationwide is unclear. One suggestion was to briefly compare the Region 5 data to current measurements across the	EPA has determined that TSP and PM10 speciation data is generally too sparse nationally to make a meaningful comparison. In 2004 there were 73 sites nationally which reported speciated TSP data to AQS; 53 of these sites were in Region 5. Although TSP data beyond Region 5

Consensus Statements		EPA Response
	country, using nationwide monitoring data (e.g., EPA's $PM_{2.5}$ Speciation Trends Network, National Air Toxics Trends Sites, Inter-agency Monitoring of Protected Visual Environments) or by quoting relevant data from other EPA reports.	are very limited, the 30 sites with the highest average manganese concentrations were all in Region 5. There were 25 sites nationally that reported PM_{10} metals in 2004; only one of these sites was in Region 5, but it was the site with the highest average manganese concentration. Out of 254 sites reporting speciated $PM_{2.5}$, 18% of the sites are in Region 5; out of the 20 sites with the highest manganese concentrations reported to AQS, 10 are in Region 5.
	• The indicator needs to describe why total suspended particulate (TSP) measurements were selected for this metric and acknowledge the uncertainties and limitations that are introduced as a result. One reviewer noted that TSP measurements, as compared to PM_{10} or $PM_{2.5}$ measurements, are relatively poor for characterizing inhalation exposures. Further, use of TSP data complicates efforts to compare Region 5's trends to those being tracked with PM_{10} or $PM_{2.5}$ data. The indicator should clearly explain why TSP data are being used (e.g., Is it because a more complete data set is available for TSP? Is it because this size fraction continues to be monitored and will allow for tracking trends into the future? Are there other reasons?).	• National Air Toxics Trends Sites data are insufficient for comparison at this time. • IMPROVE rural sites are not appropriate for comparison. • OAQPS recommends use of PM10 for risk assessment. PM2.5 is an underestimate of human exposures. TSP is an overestimate, but it is often advisable to be conservative.
	• The reviewers supported EPA's decision to include information on the Reference Concentration (RfC), but they listed several ways this information could be better communicated. The text should more clearly explain that the RfC is used for evaluating *chronic*, rather than acute, exposures. Consequently, the indicator appropriately compares long-term average concentrations (as opposed to maximum concentrations) to the RfC. Under "What the Data Show," the text should clearly state that *annual* average concentrations were above the RfC, rather than saying that average concentrations were. The peer reviewers questioned the appropriateness of comparing TSP measurements to RfCs, and wondered if data for respirable particle size fractions are better suited for this comparison.	• TSP is used instead of PM10 because the dataset is larger and encompasses historic data. PM10 may become more available in the future. • Each monitoring site is different, but evidence from a limited number of sites where PM10 and TSP are collocated show that the ratio of TSP-Mn to PM10-Mn is about 2:1. Thus highly elevated sites would still exceed RfC. • RfC language is already clear regarding chronic exposures. EPA routinely uses annual average concentrations as a surrogate for lifetime chronic exposures. • The text now notes that TSP overestimates PM10 exposures.
	• The peer reviewers were not convinced that a 5-year data set is a long enough to establish trends. Accordingly, they questioned what the reported decrease in concentrations (14.7%) represents: Does it reflect decreases in emissions, whether from sources in the U.S. or in Canada? Or might it simply reflect fluctuating meteorological conditions? Given this concern, the peer reviewers recommended that Figure 200R-2 not display changes from one year to the next. Rather, this figure should present the distribution of 5-year average concentrations. The text can describe this distribution as baseline conditions, against which future trends will be compared.	EPA has decided that the figure will remain as-is and a comment added to state that this is preliminary trend (short term) until more years of data are collected.
Suggested modifications	• Figure 200R-1 should use box plots that include the minima, maxima, and the percentiles. For both figures, EPA should avoid using colors (yellow) that are difficult to read.	• Box plots have been added and darker colors. Used. • Will attempt to use maxima in place of 90^{th} percentile; however the one extremely high industrial

Consensus Statements		EPA Response
	• The draft indicator presents information on how ambient concentrations changed between 2000 and 2004, but does not provide any similar context on emissions trends. The peer reviewers suggested that the text describe changes in estimated emissions during this time, whether from industrial sources in Region 5 (using Toxic Release Inventory data) or from mobile sources in Canada (due to that nation's use of methylcyclopentadienyl manganese tricarbonyl as a fuel additive).	site may throw off the whole figure. Using 90th percentile is consistent with other parts of the report. • TRI trend info has been included.

Brief Summary: The peer reviewers agreed that the current draft indicator explains why ambient concentrations of manganese compounds are an important air quality issue for EPA Region 5. While they commended EPA for addressing many of the concerns expressed during the July peer review meeting, the peer reviewers noted that several critical modifications must be made before this indicator is included in ROE.

Ozone and PM for the U.S./Mexico Border Counties
Reviewed by the Air Group

Consensus Statements		EPA Response
Overall recommendation	**Do not include.**	EPA has included the indicator with the modifications as detailed below.
Critical comments	1. The reviewers supported EPA's desire to include regional indicators in ROE06, but strongly recommended that EPA not include this indicator primarily because it contributes little to answering the overarching question on ambient air quality beyond what other indicators already address. 2. Moreover, the indicator leads a reader to believe that trans-boundary transport issues are to be addressed, when that issue is not discussed at all. 3. The reviewers identified serious	EPA has altered the indicator to directly focus on the U.S.-Mexican border area by comparing trends in the U.S. border counties with trends in the U.S. as a whole. The indicator offers a regional, county-scale perspective using ambient air quality data for the unique area undergoing rapid industrialization across a border with a country with very different air quality management systems. The indicator shows trends in the mean values for U.S. counties along the Border region where the air may not attain National Ambient Air Quality Standards. Further, it establishes baseline air quality for the Border region that is expected to have increasingly heavy industrial development, population and vehicular traffic in the future. The corresponding national indicators do not offer this important sub-regional perspective. ROE indicators do not necessarily attempt to show <u>how</u> ambient air quality levels came to exist (e.g., possibly from trans-boundary transport). The purpose of the indicator is to present ozone (O3) and particulate matter (PM) past trends for the U.S. counties along the Border region and establish a baseline for future Reports on the Environment. We will provide additional language in the indicator text to clearly state the purpose of this indicator. The indicator is modeled after the National indicators for air, however, the U.S./Mexico Border indicator shows data for a unique area

Consensus Statements		EPA Response
	technical problems with the indicator and found the graphics to be misleading.	subject to air quality pressures (rapid industrialization in another country, rapid population growth, and a climate that can exacerbate air quality problems) It would be of assistance to know specifically what "serious technical problems" The technical problems cited are not explained to show how they undermine the indicator. With regard to and "misleading graphics," we believe that some of the confusion arose from unclear figure legends, Regions 6 and 9 have addressed the inconsistent terminology in the figure legends as well as provided clear graphics that compare and contrast regional trend and Border trend for ozone and PM. The indicator is modeled after the National indicators for air, however, the U.S./Mexico Border indicator shows data for a unique area subject to air quality pressures (rapid industrialization in another country, rapid population growth, and a climate that can exacerbate air quality problems) It would be of assistance to know specifically what "serious technical problems" The technical problems cited are not explained to show how they undermine the indicator. With regard to and "misleading graphics," we believe that some of the confusion arose from unclear figure legends, Regions 6 and 9 have addressed the inconsistent terminology in the figure legends as well as provided clear graphics that compare and contrast regional trend and Border trend for ozone and PM. In regard to the accuracy of data, please be advised - El Paso was designated nonattainment for ozone and PM10 in 1990. However, current data shows El Paso is eligible for redesignation to attainment for both pollutants. There usually is a lag in redesignation of areas to attainment after collection of data showing compliance with the NAAQS, because redesignation to attainment also requires regulatory action (State Implementation Plans, maintenance plans, etc.) to assure continued compliance with the standards.

Consensus Statements		EPA Response
Critical modifications	Specific comments and modifications are provided below, in the event that EPA decides to include this indicator in ROE06. However, the reviewers clearly preferred that the indicator not appear in ROE06, even if substantial revisions are made.	EPA respectfully disagrees with the peer review. EPA has stated that Regional environmental indicators are included in the FY2006 ROE as examples (emphasis added) and, therefore, by implication will not address all geographic areas with environmental problems. Growing population is not the only unique aspect of the Border region. Population growth on both sides of the border has been noticeably rapid, growing far faster than that of the population as a whole in either country. The Border region is also known for rapid industrial growth. The *maguiladora* program, which provided economic incentives to foreign (mostly U.S.-owned) assembly plants located in the border region, grew from fewer than 100 maquiladoras in 1960 to that by 2001, there were nearly 3,800 *maguiladora* plants, 2,700 of which were in the northern border area of Mexico alone.

Peer Review Comments on the Indicator Text and Graphics

The reviewers emphasized, however, that their preference is that EPA not include this indicator in ROE06 rather than simply making the changes listed below.

- **Intent of including this indicator.** An implication of this indicator is that trans-boundary transport issues are important, but the indicator text does not acknowledge or evaluate this phenomenon even though a fairly extensive body of literature is available on such transport issues. The "metadata" form for this indicator explains that monitoring along the border region has been conducted "…to determine air pollution exposures in populated areas…" and "…to supply trends information for sensitive ecosystems." If this is the only unique aspect of this region, one reviewer questioned why the indicator did not instead focus on all areas with a growing population. The peer reviewers eventually agreed that this indicator does not present any unique information that is not already covered by other ambient air concentration indicators.
- **Inadequate spatial coverage of data.** The reviewers noted that the data presented in the indicator are not spatially representative of air quality along the U.S./Mexico border. The data shown (for only a subset of the U.S. border counties) do not characterize air quality along the entire border. Further, the data provide no insights on ambient air concentrations measured in Mexico, even though such measurements are available. The reviewers noted that other indicators (e.g., mercury deposition) present measurements from outside the U.S., and wondered why this indicator does not. Finally, by presenting data at the county level, the indicator mixes measurements collected at stations within a few miles of the border with measurements collected at stations more than 20 miles from the border. Thus, if the indicator focuses on the border itself, then the monitoring stations selected are not reflective of this focus.
- **Inadequate temporal coverage of data.** The ambient air quality data for U.S. border counties are available for many years prior to 1997, at least for ozone and PM10. If this indicator is to remain in the report, the reviewers recommended that EPA include data for as many years prior to 1997 as possible, because doing so would provide a much more meaningful analysis of trends.
- **Other comments.** One peer reviewer noted that the figures' legends use inconsistent terminology: some plots (PM10 and PM2.5) have legends that refer to mean concentrations for an entire EPA region, while other plots (ozone) refer to mean concentrations for the border counties within an EPA region. EPA should correct the legends or explain why different groupings are used. Additionally, one reviewer questioned the accuracy of the data, given that the figures suggest that the El Paso metropolitan area is in attainment with the ozone and PM10 National Ambient Air Quality Standards, when he thought that currently is not the case.

EPA Response

- **Intent of including this indicator**

  We believe the revised indicator does provide unique information at the sub-regional scale. This indicator was one of the few air quality indicators submitted for consideration for the Regional Indicator Pilot project. The

U.S./Mexico Border indicator provides an important basis for showing present ambient air quality in a unique part of the United States that will be subjected to tremendous air quality pressures in the future from increased industry, population and vehicular traffic in a 2000 mile area that has very hot, dry summers.

The Border indicator was not intended to address trans-boundary transport issues. It simply presents ambient air quality trends that reflect the sum total of transboundary transport and other issues associated with rapid industrialization, increased transportion and population growth.

In addition, this indicator will be used to establish a baseline for future ROEs.

- **Inadequate spatial coverage of data**

The same comment can be made for all other indicators. The density of the monitoring network was determined based on Agency monitoring network design criteria. One of the criteria is adequate coverage of potential pollution impact and not county lines. Air monitoring network has been optimized for the U.S. side of the Border region. The indicator does a good job of covering populated areas.

Air quality data in the border counties may not be that different than air quality a few miles on the other side of the border. To date, only a limited amount of Mexico ambient air quality data has been made available to EPA. Before the Mexican ambient air quality data can be added to this indicator, it must be evaluated to see if it meets the EPA and ROE data quality criteria. This arduous task can not be completed within the time frame of the FY06 ROE publication schedule.

In addition, the mercury data from the Canadian stations are highly quality assured and measured using the same techniques and standards as the data in the U.S. The same is not true of the Mexico air quality data.

- **Inadequate temporal coverage of data**

The data for ozone and PM 10 are now displayed from the early 1990's. Data compatibility must be taken into consideration, as well as, number of monitors installed over time and, hence, different coverage. Data quality should also be considered. Design values for PM2.5 data have only been available since 2001. Design values for PM10 data have been available since 1988.

- **Other Comments**

The figures' legends were corrected.

Section 2: Greenhouse Gases

Green House Gas (GHG) Emissions Indicator

Consensus Statements		**EPA Response**
Decision	**Include with minor revisions**	EPA has included the indicator with the modifications as detailed below.
Critical modifications	None	

Consensus Statements		EPA Response
Suggested modifications	The indicator should identify specific greenhouse gases and emissions sources that are not included in the emissions inventory and describe the potential significance of their omission.	EPA determined that we are unable to quantify in comparable terms the emissions or ambient concentrations of GHG that are not included. These other radiatively important substances are identified in the main text and in "Limitations," and a reference to discussion of them is provided under "Limitations." See also other indicators on Substances that Deplete Stratospheric Ozone, and criteria air pollutants.
	The indicator should provide some sense for the extent to which the U.S. contributes to worldwide total greenhouse gas emissions.	EPA included the recommended changes.
	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Emissions Indicators" and under "General Issues for All Indicators," to the extent that these revisions apply.	EPA included the recommended changes.
Other comments	Several additional suggested revisions are listed below, both for the indicator text and figures.	EPA considered this recommendation and addressed where robust, scientific, historical data were available.

Peer Review Comments on Figures 348-1 to 348-4

The peer reviewers had several comments on the proposed figures. Overall, they recommended that revised versions of figures 348-1 and 348-2 remain in the report and that figures 348-3 and figure 348-4 be removed from the report, given that the underlying messages of these figures can easily be described in one or two sentences in the indicator text. The following are specific revisions that the reviewers recommended for figures 348-1 and 348-2:

- It is recommended to the extent possible, to use formats consistent with the other air emissions indicators; the revised figures should be prepared in much higher resolution to improve legibility; and include data for years prior to 1990 and since 2002, if these data are available.
- Additionally, reviewers also recommended that EPA revise figure 348-2 using source categories more consistent with those presented in the other emissions indicators. One concern the reviewers had about this figure is that it currently gives the impression that greenhouse gas emissions are split among many different types of sources; however, some reviewers felt a more important message to convey is that fossil fuel combustion (whether for electricity generation, other industrial operations, or mobile sources) accounts for an overwhelming majority of the U.S. greenhouse gas emissions—a fact that is not readily apparent from figure 348-2 due to the different categories used.

EPA Response to Peer Review Comments:

In response to peer review recommendation, figures 348-3 and 348-4 were removed. The peer reviewers requested data of comparable quality which is not available prior to 1990, and therefore could not be included in the figure. However, a couple of sentences were added to the indicator text to address long-term trends. Additionally, data was not available for the same source definitions as the other emissions indicators so the categories presented could not be made comparable at this stage.

Peer Review Comments on Confidence in the Emissions Inventory

The reviewers agreed that this indicator should briefly discuss the relative confidence in the emissions inventory for individual greenhouse gases. In the case of carbon dioxide emissions, some reviewers suspected that the inventory is fairly robust, given that the predominant sources (i.e., fossil fuel combustion sources) have been extensively studied

over the years. The reviewers suspected that the confidence in the inventories for methane and nitrous oxides were far less developed, and they recommended that the indicator text acknowledge this.

EPA Response

This indicator covers a set of six gases from a wide variety of source categories, with vastly different levels of confidence in the emissions estimates, thus this information can't currently be expressed quantitatively for the inventory overall. To use qualitative terms (like "high confidence)," one has to have a quantitative definition. Language was added concerning the methods used to arrive at the data to give a general sense of uncertainty (i.e. whether the data were based on measurements or estimates) as was done for the other Air emissions indicators.

Peer Review Comments on Additional contextual information

Several minor revisions were recommended to the text to provide the reader more clear insights on how greenhouse gas emissions relate to climate change. First, surprised that the indicator text does not describe potential consequences of climate change, one reviewer recommended that such information be included somewhere in ROE06, whether in this indicator or elsewhere in the report. This reviewer cited several examples of consequences that could be mentioned: droughts leading to food shortages, increased severity and frequency of storms, melting of glaciers, and others. Second, a reviewer encouraged EPA to clarify the term "electricity generation" in the context of greenhouse gas emissions, because only electricity generating facilities that burn fossil fuels are of particular concern for this issue. For nuclear power plants, solar energy facilities, wind farms, hydroelectric dams, and other electricity generating facilities, greenhouse gas emissions are not nearly as significant. Third, one reviewer was concerned that the indicator text currently discusses greenhouse gas emissions from very specific sources (e.g., electricity generating facilities, mobile sources, industrial sources), while not emphasizing the much broader issue of fossil fuel combustion as the main source of greenhouse gas emissions in the United States. He recommended that the indicator text clearly state, quantitatively if possible, the contribution of all fossil fuel combustion sources to the total United States inventory, before breaking the emissions sources up into smaller categories.

EPA Response

The issue of climate effects will be addressed generally in the Ecological Condition chapter. A statement was added to provide some clarification on the magnitude of contribution of fuel consumption to GHG emissions.

Atmospheric Concentrations of Greenhouse Gases
Reviewed by the Air Group

Consensus Statements		**EPA Response**
Decision	**Include with minor revisions**	
Critical modifications	None	
Suggested modifications	The indicator should better explain that the concentrations presented are believed to be globally representative and that they reflect contributions from emissions sources worldwide. To the extent possible, the indicator text should provide some sense for the extent to which the U.S. emissions have contributed to the trends in atmospheric concentrations of greenhouse gases.	EPA made modifications to the indicator as relevant.
	EPA should make the suggested revisions identified in the Executive Summary of this section under "General Issues for All Ambient Concentration Indicators" and under "General Issues for All Indicators," to the extent that these revisions apply.	EPA made modifications to the indicator as relevant.
Other comments	Several additional suggested revisions are listed below, both for the indicator text and figures.	

Peer Review Comments on Figures 349-1 to 349-4 and their associated interpretations

The peer reviewers had several comments on the proposed figures. For instance, given the importance of concentrations of greenhouse gases, the reviewers recommended that EPA use larger, clearer figures for this indicator in ROE06, even if the figures end up spanning more than one page. Comments specific to the individual figures follow:

- For Figure 349-1, the reviewers liked how all graphs had y-axes drawn to the same scale, which allows readers to appreciate how concentrations of carbon dioxide in recent years are much higher than those measured over the last several hundred years. The reviewers recommended that EPA remove the labels (d), (b), and (a) from the individual graphs or explain what these labels mean.
- For Figure 349-2, the reviewers recommended that all graphs have y-axes drawn to the same scale, as was done for Figure 349-1. Similarly, they suggested that EPA remove the labels (e), (c), and (b) from the individual graphs or explain what these labels mean. The reviewers also questioned whether the trend shown in Figure 349-2 supports the following statement in the indicator text: "…rates of increase [in methane concentrations] have slowed almost to zero in recent years." EPA should verify that this statement is true and clarify the text accordingly.
- For Figure 349-3, the reviewers recommended that both graphs have y-axes drawn to the same scale.
- The indicator text does not explain the trends shown in, or even refer to, Figure 349-4. The reviewers recommended that EPA add some text to explain the data shown in the figure. Further, EPA should ensure that the text in the fourth paragraph under "What the Data Show" should be consistent with the figure. Currently, the first sentence in the paragraph lists several gases for which atmospheric concentrations peaked in 1994 and are currently decreasing, but none of the data shown in Figure 349-4 depict such a trend. The reviewers recommended that EPA revise the text to better describe trends shown in Figure 349-4 and that EPA include references as appropriate when presenting trend data that are not depicted in any of the figures.

EPA Response

All the recommendations were completed for the above mentioned comments.

Peer Review Comments on the Additional contextual information

Two minor revisions were recommended to the text to provide the reader context for understanding the importance of atmospheric concentrations of greenhouse gases. First, one reviewer again recommended that information on the potential consequences of climate change be included somewhere in ROE06, whether in this indicator, the previous indicator, or elsewhere in the report. Second, the reviewers recommended that EPA either include figures on other greenhouse gases (e.g., ozone) if data are available or note in the text (possibly in the "Indicator Limitations") that data are presented for only a subset of the known greenhouse gases.

EPA Response

Some language has been added to identify relationships among GHG emissions, GHG concentrations, temperature and precipitation change, sea level rise and sea surface temperatures, mostly in the Ecological Condition chapter. Making scientifically irrefutable statements of attribution about observed changes to specific driving forces is challenging, especially without using modeling (and thus, outside the scope of the ROE). Ozone concentrations are not well mixed over space or time, and thus are not comparable to those presented in this indicator. Over time, the measured concentrations may improve and allow inclusion, in some form, in the future. There are similar problems for most other radiatively important gases not included here.

INDOOR AIR QUALITY

U.S. Homes Above EPA's Radon Action Level
Reviewed by the Air Group

Consensus Statements		
Decision	**Include with minor revisions**	EPA included the indicator with the modifications as detailed below.
Critical modifications	None	
Suggested modifications	Figure 013-1 currently implies that the number of radon mitigation systems being installed outpaces the number of new homes being constructed in areas believed to have radon levels greater than EPA's action level (4 pCi/L), when the opposite is true. The figure will not be misleading if the two data series are plotted on the same scale.	The figure was changed so both datasets are plotted on the same axes.
Other comments	Additional context is needed to help readers understand where radon levels are believed to be highest and the percentage of new homes being constructed in these areas.	See below.
	Some reviewers questioned whether the underlying data truly meet EPA's indicator definition (i.e., "…an indicator is a numerical value derived from actual measurements…"). These reviewers recommended that the indicator text clearly explain exactly how the underlying data were calculated and identify all associated uncertainties and limitations.	See below.

Peer Review Comments

The reviewers had initial concerns about the importance of this indicator for ROE and the indicator's underlying data. After asking EPA questions of clarification regarding lung cancer risks posed by radon exposure and about the agency's evaluation of indoor air issues more generally, the reviewers eventually agreed that this indicator should be included in ROE06 with the following minor revisions:

Figure 013-1. Figure 013-1 clearly shows increases in both radon mitigations and new home construction in areas believed to have radon concentrations above EPA's action level. However, quick inspection of the figure would lead a reader to believe that the rate of radon mitigations is actually outpacing the new home construction data, when the opposite is actually true. The reviewers therefore found the figure misleading, but agreed this could be easily corrected by showing the two different y-axes to the same scale.

EPA Response

The graphic was revised to put both data sets on commonly scaled axes.

Peer Review Comments

The reviewers recommended several changes to the text to provide additional contextual information to readers. First, concerned that this indicator's data were derived mostly from multiple assumptions and extrapolations rather than from direct measurements, some reviewers did not find the indicator transparent. They recommended that EPA revise the text to more clearly describe how EPA determined (1) the areas in the country believed to have radon potentials above 4 pCi/L and (2) the annual housing construction estimates for these areas. The reviewers also

recommended that the indicator text document more thoroughly key uncertainties and limitations associated with the indicator data. Second, one reviewer thought the indicator would benefit greatly from including a radon potential map (e.g., see http://www.epa.gov/radon/zonemap.html for an example). Third, one reviewer recommended that the indicator text should note, for additional context, the percentage of new homes being constructed in areas with radon potentials above EPA's action level.

EPA Response

A radon potential map was added. For this indicator, it was decided that showing the total number of homes in areas with high radon potential versus the number of mitigations completed was more important than tracking new home development. The indicator text was revised to include key data uncertainties/limitations. Text was added on how we determined the areas believed to have radon potentials above 4 pCi/L.

Blood Cotinine
Reviewed by the Air Group and the Health Group

Health Group Review

Consensus Statements		**EPA Response**
Overall recommendation	**Include with modifications.**	EPA has included the indicator with the modifications as detailed below.
Critical modifications	None	
Important modifications	Where available, EPA should present additional trend data—in this case, National Health and Nutrition Examination Survey (NHANES) and Morbidity Mortality Weekly Report (MMWR) data.	EPA determined that CDC's Third National Report on Human Exposure to Environmental Chemicals is now published; consequently, data is presented for two time periods. EPA notes the need for continued data acquisition for longer term comparisons.
	EPA should acknowledge which bodily fluid is the optimum for measuring cotinine levels, and that the best available data are the blood cotinine levels measured in NHANES.	EPA modified the text to stress that cotinine is optimally measured in blood serum. NHANES is acknowledged as the best available data source on blood cotinine levels; NHANES data are reported in CDC's Third National Report on Human Exposure to Environmental Chemicals, EPA's information source for the indicator.
Other comments	None	

Air Group Review

Air Group Review Comment	**EPA Response**
The indicator text implies that data are available for evaluating temporal variations in blood cotinine levels, but the summary table presents only current data. The reviewers recommended that the graphic used in this indicator better track temporal trends—a recommendation that was also made by the peer reviewers of the Health Chapter.	EPA determined that CDC's Third National Report on Human Exposure to Environmental Chemicals is now published; consequently, data is presented for two time periods. EPA notes the need for continued data acquisition for longer term comparisons.
• The peer reviewers recommended that this indicator include, to the extent the underlying data allows, spatial variations in blood cotinine levels, whether across EPA regions or some other geographic subset of the United States.	EPA agrees that spatial variations in blood cotinine are of interest; however, the NHANES sampling strategy is designed to capture nationally representative data and it cannot be stratified in this way.

Air Group Review Comment	EPA Response
• The peer reviewers recommended that the indicator text emphasize that the blood cotinine data are available only for non-smokers, aged 3 years and older. The lack of data for infants is notable, considering this sub-population likely spends the greatest amount of times indoors.	EPA determined that the text mentions clearly the age of the sample for cotinine levels in NHANES 1999-2002.

Atmospheric Deposition of Mercury
Reviewed by the Air Group and by the Ecological Condition Group (as a Referenced Indicator)

Air Group

Consensus Statements		EPA Response
Overall recommendation	**Do not include.**	**This indicator will not be included**

Consensus Statements	EPA Response
Critical comments Without presenting data or context on dry atmospheric deposition of mercury, the reviewers wondered if the indicator fails to track the most important contributor to total atmospheric deposition. The indicator presents data from only 1 year of sampling, which does not meet the indicator criteria of describing changes or trends. Further, by focusing on a single year, the spatial trends shown can be biased by meteorological conditions (especially precipitation totals), which vary from one year to the next. The reviewers found some of the spatial trends depicted counterintuitive, causing them to question the representativeness of the underlying data set. • **Significance of omitting dry deposition.** Failure to present information on dry deposition was viewed as a critical flaw in this indicator. The reviewers recognized that sampling limitations and other factors might currently prevent widespread tracking of dry deposition; however, the indicator provides no context on just how significant dry deposition might be (e.g., Does dry deposition account for 10% of total mercury deposition? Or does it account for 90%?). Assuming that total atmospheric loading of mercury is the most important loading for aquatic ecosystems, the reviewers found the lack of information on dry deposition to be a very significant omission. While they agreed that this indicator should not be included in ROE06, the reviewers suggested that EPA at least rename the indicator to "Wet Atmospheric Deposition of Mercury," should the agency decide to include a modified form of the indicator in the report. • **Lack of trend data.** The reviewers had two concerns about basing an indicator on a single year of data, even though data for several additional years appear to be available. First, focusing on one year of data does not meet EPA's indicator criteria of using data that can characterize trends. (The data presented allow for characterization of spatial variations, but not temporal trends.) Second, the reviewers feared that the data might be biased by meteorological conditions, which can vary considerably from one year to the next. As an example of this concern, some reviewers wondered if Figure 038-2 basically shows spatial patterns in precipitation, with little insights offered on mercury. • **Context.** The indicator write-up, several reviewers commented, provides little contextual information needed for a reader to understand the underlying data. For instance, if power plants are believed to be the most significant anthropogenic emissions source of mercury in the United States, then why are the spatial patterns in the figure not more similar to those shown for acid deposition? And why is the highest mercury concentration in precipitation observed in New Mexico? To what extent is deposition influenced by anthropogenic/non-anthropogenic emissions sources and domestic/foreign emissions sources? The reviewers agreed that, should EPA decide to keep this indicator in ROE06, additional context is needed to understand these trends.	

Ecological Condition Group

Consensus Statements		EPA Response
Overall recommendation	**Include with modifications.** (Rank: High)	**This indicator will not be included (see above)**
Critical modifications	It would be useful to present more data on possible trends. As noted in the indicator text, at least 13 sites should have wet deposition data for mercury over the full period 1995-2003.	

Consensus Statements		EPA Response
Suggested modifications	It would be useful to include more sampling from Western sites.	
	It would be useful to supplement the wet deposition data with any dry deposition data that are available.	
	The absolute loading of mercury is an important stressor. However, as science and technology permit, it would also be useful to present corresponding regional rates of methylation of mercury.	