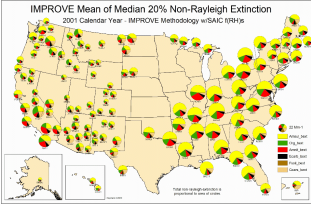


## Summary of Reviewer's Comments on Attribution of Haze Phase I Draft Report

This document lists the Attribution of Haze Phase I Draft Report review comments received by ARS between December 23, 2004 and February 11, 2005. Review comments are organized by reviewer/agency, not by report section or topic, and have been copied verbatim from the original e-mails or other review documents. The final report sections where reviewers can find content modifications based on the review comments are indicated in the table below. Not all of the comments received in the form of red-line/strike out Word documents have been incorporated in the table due to the large effort it would take to do this. Some comments have not been addressed in the final report, and these are indicated by "N/A."

Review Comment	Addressed in...
<p><b>Wayne Leipold</b></p> <p>- The graph standard visual range says 20% highest 2002. Do you mean 20% best days or 20% worst days? The best days would have the highest visual ranges, but the legend only goes to 131 so I expect it is the worst days. Is the 1/R2 Interpolation explained anywhere? What is that kind of interpolation? I suspect my comment applies to all the graphs.</p> <p>- In Section 2 you show Figure 2-3 map of emissions for California. The test says maps are available for all WRAP states. However I can not find any other than California. Where are they or is that a later addition?</p> <p>- After browsing around the site and trying to download and save various pieces I think if this can be done it would be very useful. Is there a way to have let's say all the Arizona graphs for extinction or a whole category be presented on one page so you don't have to keep going back two pages to get to the point where you can select again? I really took a lot of time to go back and forth after I realized that I wanted to save something. Considering that states are going to be one of the users it would be useful for them if they could more easily look at the graphs for their state.</p>	<p>Web site: "State Reports" / Regional Aerosol Extinction"</p> <p>Web site: "State Reports" / "State Emissions Maps"</p> <p>Web site modified to accommodate</p>
<p><b>Frank VanHaren</b></p> <p>- I've been looking over the AoH report and the associated links to additional info. Ton of info in it - thanks! I do have a question that you may be able to save me some time in looking for the answer. So far I have not found any projections of emissions to 2018 and the modeled visibility based on those projected emissions, especially with respect to staying on the glide path to natural conditions. Is this type of info available yet?</p> <p>The State of Washington legislatively abolished our visibility program in 2003 and all work associated with the development and periodic review of the visibility and RH SIP. We will probably be under a FIP for the RH SIP as it appears we will not reinstate the program any time soon. In our negotiations with EPA Region 10 over this issue, it would be nice to know if the current suite of control strategies and those looming on the horizon will be enough to keep us on the glide path. If so, it will be a relatively simpler task for EPA R-10 to do a FIP as it would not entail any additional control strategy development. If additional strategies are needed, then EPA may tag us with stiffer consequences for doing a FIP.</p>	<p>Sec. 1.2, 5</p>

<p>- Another question. On page 3-49, second paragraph of the AoH report, it states that 50% of the aerosol extinction at WRAP monitoring sites is due to organic carbon. But the isopleth map (figure 3-28) on the following page seems to tell a different story. Although there are some red and orange spots, most of the WRAP region is yellow, blue and green, indicating something less than 40%. Is the 50% statement a typo?</p>	<p>Sec. 4.2.2</p>
<p><b>Diane Arnst</b>  First, my compliments on an impressive amount of work and eye-catching visuals within the report to portray the information. Second, on page 2-2, the paragraph that discusses "Point sources in the WRAP Region" needs to cross-reference and explain similarities to or differences from the Milestone Report. A number of adjustments were made to the emission inventory that are explained in the Milestone Report. These adjustments may or may not be the same adjustments used for the Point Source 2002 Emission Estimates for purposes of Attribution of Haze. Whatever the consistency or inconsistency is, it would be helpful to explain it and the reason for it at this point in the AoH document. Just want to make sure there is coordination between the two projects, or readers could get confused (or I could get confused). Thanks for the opportunity to review it at this stage. DLA 1/11/05</p>	<p>Sec. 2.1.1</p>
<p><b>Lee Alter</b>  This might be a good map to include in the final AoH report. Of course, it should be updated to 2002 and show only the western U.S. It was included in a presentation John Vimont gave about 1.5 years ago. He also had a map of just the western sites. So he might be able to instantly email you a 2002 western pie map. Might be worth including 2003 too, if available. - Lee</p>  <p>The draft milestone report is not on our website yet because it's somewhat confidential, but going out for review next week. Anyhow, let me try to clear this up. The SO2 milestone report takes the actual 2003 SO2 emissions and "adjusts" them at a few sources in the 5 states for the sole purpose of comparing the total 5-state (slightly adjusted) emissions to the 5-state milestone (or cap). I won't bother explaining why, but the net adjustment (some are positive, some negative) is only about 1,000 tons.</p> <p>I don't think there is any risk of anybody noticing (or caring) about discrepancies that may appear between the AoHA report and the milestone report. I don't even think that's possible since the only state-specific SO2 numbers you provided are in the state emission summary bar charts, and they contain data for all point sources, whereas the milestone report only tracks sources &gt; 100 tpy.</p> <p>Nonetheless, I think we can and should respond to Diane's comment by adding the following sentence (or footnote) to the end of the second paragraph on page 2-2: "Note, this is not the method used to estimate 2003 emissions for the SO2 milestone report under development by the WRAP for the five states</p>	<p>Sec. 2.2.1</p> <p>Sec. 2.1.1</p>

<p>which submitted SIPs under Section 309 of the regional haze rule. That report uses actual 2003 emissions for all SO<sub>2</sub> sources greater than 100 tpy, slightly adjusted in some cases for purposes of comparison to the regional milestone."</p> <p>Sec. 2.3.1 – Need more comprehensive description of model performance.</p> <p>Sec. 3.1 – Determine appropriate emphasis of TSSA vs. TRA.</p> <p>Variety of suggested clarifications presented in a red-lined version of the document.</p>	<p>Sec. 2.3.1</p> <p>Sec. 4.1</p> <p>Generally accepted</p>
<p><b>Jean-Paul Huys (Nevada)</b></p> <ul style="list-style-type: none"> <li>- Do we need "deminimus" levels/values for the level of impacts?</li> <li>- On page 2-8, the explanation for SO<sub>2</sub> formation from sulfur fuels... states ...SO<sub>2</sub> were dominated by point sources (..&amp; residential sources that burn fuel) residential fuel is an area source</li> <li>- We were looking for an explanation of the ANO<sub>3</sub>I, ANo<sub>3</sub>J, ASo<sub>4</sub>I, ASO<sub>4</sub>J, HNO<sub>3</sub>, NTR... and how the report uses these to relate back to the Visibility Impairing Pollutants...</li> <li>- Might need some more explanation on the groupings of the class I areas, tables 3-3 and 3-4 on pages 3-12, 3-14.</li> <li>- Section 2.3.2 discussion of model evaluation results. Organic carbon in text equates to organic material on timelines? Sulfate and nitrate equate to ammonium sulfate and ammonium nitrate on timelines? For PM does over prediction and under prediction equate to positive bias and negative bias, respectively? Can percentages of bias be assigned for large and small (i.e. is large 40 to 50%)? PM data are not shown on the timelines but were evaluated (i.e. model and monitoring data compared). Why not?</li> <li>- Figure 2-7 back trajectory map. More explanation of what the title means is needed, as is a listing and discussion of the other types of back trajectory summary maps mentioned in the text on page 2-17. It maybe more informative to include the 2002 back trajectory maps rather than 2000-2002, especially in Section 3.1.2 Results for Selected Sites</li> <li>- Figures 3-6 and 3-11, residence time maps for Rocky Mountain and Yellowstone NP, respectively are grossly different. Why? 3-6 appears to have much smaller grid cells and is much easier to interpret.</li> <li>- Figure 3-30 Organic / Elemental Carbon Ratio, Summer 2001. Why not 2002? 2002 data might show effects of fire at IMPROVE sites as shown by the timelines. The 2001 data suggests wildfire impacts from Canada and Mexico.</li> </ul> <p>Other questions/comments that came to mind while reviewing the report:</p> <ul style="list-style-type: none"> <li>- 2002 Reconstructed Extinction Graphs: which graphs do we use to calculate the glide path? The one with Rayleigh or not? The Total Extinction between the two graphs (for the worst 20% days) is 10 Mn-1 (in our case)</li> <li>- How do we account for future growth in our states? Several facilities (utilities and other) will probably be built between 2004 and 2018 (and beyond). This will probably affect your glide path and 2018 goal. Since we have to use the 2000-2004 data to determine extinction and SIPs are not due until 2008, how do we incorporate growth</li> <li>- Need to figure out the cooperation with other states. How is that going to work?</li> </ul>	<p>Sec. 1.3</p> <p>Sec. 2.1.7</p> <p>N/A</p> <p>Sec. 4.1.1</p> <p>Sec. 2.2.1 and Sec. 2.3.2</p> <p>Sec. 2.3.2</p> <p>Sec. 4.1.2</p> <p>Sec. 4.2.2</p> <p>Sec. 1 and 5 (No glide path in Phase I)</p> <p>Sec. 1 and 5 (No glide path in Phase I)</p> <p>N/A</p>

<ul style="list-style-type: none"> <li>- We need to have more training on the use of the COHA site</li> <li>- It might be interesting to do a case study on how all this information can and will be used. Take a state, look at the impacts within and outside the state, calculate the glide path, determine the reductions needed by 2018 and then look at controls needed within the state and what neighboring states might have to do. (this is kinda the next step I guess...)</li> </ul>	<p>N/A N/A</p>
<p><b>Lee Gribovicz (WY)</b></p> <ul style="list-style-type: none"> <li>- Page 2-6: We need the numerical "tons" values for the entire interim inventory, for each pollutant, listed under the pie charts in figure 2-1</li> <li>- Page 2-17: there might be more, but I found the first paragraph on this page "beginning: For the continental US .....", that this explanation of the EDAS not to be user friendly. I think the intent of this paragraph specifically, and the explanations of monitoring analysis in general, needs to be reviewed with a critical eye towards simplifying and more completely explaining the concepts being conveyed.</li> <li>- Pages 3-2 thru 3-9: in both tables 3-1 and 3-2 there are four Class I areas, which have no impact shown in any of the states or outside impact areas. They are the Washakie Wilderness and Yellowstone National Park in Group 8, Wheeler Peak Wilderness in Group 15, and Chiricahua in Group 17.</li> </ul>	<p>Sec. 2.1.7</p> <p>Sec. 2.3.2</p> <p>Sec. 4.1.1</p>
<p><b>Implementation Workgroup</b></p> <ul style="list-style-type: none"> <li>- Need to reduce multiple layers of windows to get complete picture on several Class I areas <i>Streamline to reduce the number of keystrokes, to combine into one page, and combine files.</i></li> <li>- ID point sources. <i>Links can be instituted, but AoH workgroup has given direction not to show individual point sources, and continue to ID sources by grid.</i></li> <li>- Need to create ability to download everything pertaining to a single state in a single file. <i>Can do. This would be an additional sorting of data, not a substitute. However states impacting Class I areas in other states will still need to access information pertaining to those Class I areas.</i></li> <li>- On point source discrepancies: Indicate EDMS references to reconcile differences with point source info. <i>Can do</i></li> <li>- Will there be tools for states to use to perform 'what if' scenarios? <i>This is possible to do, but outside Phase I scope of work. If AofH workgroup wants to include this, either as an add-on to Phase I or as part of Phase II, it is possible.</i></li> </ul>	<p>Web site</p> <p>N/A</p> <p>Web site</p> <p>Sec. 2.1</p> <p>Sec. 5</p>
<p><b>UTAH</b></p> <ul style="list-style-type: none"> <li>- Can the contractor prepare a table similar to Table 3-3, page 3-12, that eliminates dust, and another one that eliminates fire? That would allow states to better examine what's going on with controllable sources on the days where poor visibility is not attributable to fire or dust. We recognize that would take a full reanalysis to create each of these tables, and thus these would be good candidates for Phase Two work.</li> </ul>	<p>N/A</p>

<p>- Table 3-5, Fire Emissions Inventory Data, needs a footnote or something to briefly explain the various kinds of fire. It is not immediately obvious what is meant by "Wildland Fire Use," and it's not obvious why prescribed fire appears under both Natural Emissions and Anthropogenic Emissions. WRAP Five Categorization Policy, p. 8.</p>	<p>Sec. 4.2.1</p>
<p>- Time line figures of IMPROVE monitoring data and CMAQ model data results need to be on the same Y-axis scale so they are visually comparable. Also, the scale needs to be set so the reader can resolve the bulk of the data and not be dominated by fire events. Perhaps the fire events could be truncated with a numeric indicator of where they top out.</p>	<p>Sec. 4.1.2</p>
<p>- The bullet points describing the accuracy of the modeling in Subsection 2.3.1, page 2-16 leave the reader with a generally poor impression about the model's capability to predict speciated aerosol. An additional paragraph is needed that explains why this level of model skill will be acceptable for the apportionment work. Perhaps an expansion on the following, which is in the intro paragraph to each of the sections on the results for selected sites:  <i>A general sense of model performance can be gauged by comparing the timeline plots. While the model clearly does not predict the monitoring data perfectly, comparisons between the timelines should focus on whether the species seasonal trends and episodes are similar.</i></p>	<p>Sec. 2.3.1</p>
<p>- The report needs a more definite discussion of how the error bars associated with the TRA uncertainty should be used. Further, the report needs a discussion and some background on the intercept/non-intercept approach, and then one or the other needs to be applied along with the statistical reasoning for the choice. Currently the text just states that the "most reasonable attribution results by the regression method are likely within a range set by the regression with and without an intercept." This turns a quantitative approach back into a qualitative approach with no standard way to compare the TSSA results with the TRA results.  <i>Confidence in the conclusions of the TSSA and TRA comparison (weight of evidence) would be greatly enhanced if we could get some measure of uncertainty/performance of the TSSA results. Currently the text suggests that the CMAQ TSSA is better because it is more physically based. Hopefully the comparison of the CMAQ TSSA with the CAMX PSA, that is currently being completed, will shed some light on this issue. These results of the comparison should also be included.</i></p>	<p>Sec. 2.4.3 and Sec. 5.1</p>
<p>- Although IMPROVE data provides speciation of the monitored filters, the TRA has only been completed for SO<sub>2</sub>. Can the back trajectory apportionment analysis be completed for NO<sub>x</sub> and some of the other important species? A TRA for NO<sub>x</sub> would be very helpful since we know that the CMAQ model generally had a "large negative bias in summer" and a "large positive bias in the winter" and thus the TSSA results for NO<sub>x</sub> are suspect.</p>	<p>Sec. 5.1</p>
<p>- There needs to be a way to account for large blocks of missing data in the IMPROVE record due to fire smoke plugging the monitor filters. Currently the monitored data pie charts in the 2002 timeline data figures will be skewed (less organic carbon, etc.) because of the loss of the fire data. The data for Arches National Park is a good example. This results in a poor comparison with the</p>	<p>Sec. 4.1.3</p>

<p>modeled data pie chart. At the very least there should be some discussion pointing this out to readers for sites where the IMPROVE data record has excessive periods of missing fire data.</p>	
<p>- We need a tabulation showing the percent of missing monitored data for each Class I area for the 2002 IMPROVE data set, including an estimate of how much missing data is due to fire. This will give us a better understanding of how skewed the speciation pie charts are.</p>	Sec. 4.1.3
<p>- CMAQ appears to grossly overestimate fire impacts. It's not clear whether there are problems with the fire emissions inventory, or with the algorithm for putting fire emissions into the model. An example is Arches National Park, where the monitored data shows 67 inverse megameters, while the model shows 480; this can also be seen in the data for other Class I areas as well. Also, the speciation seems to show too much elemental carbon.</p>	N/A
<p>- The analyses are helpful that are included with the five sample Class I areas presented in the Report. Is it possible to add a little more discussion with each? For example, some discussion of edge effects is needed with Zion, because of its proximity to Las Vegas, a major emission source just across the boarder into Nevada. Also, some discussion of the trajectories and what they mean could be added.</p>	Sec. 4.1.2
<p>- It is hard to discern trajectory patterns from the Residence Time tile plots. Right now many of the plots are so dominated by dark blue that the patterns of interest may be hidden in the highest bin. Compare Figs 3-6 and 3-19. Perhaps a different density scale or binning would help bring the trajectories out.</p>	N/A
<p>- It is important to put error bars on the TRA plots. We need to know which of the bars are statistically significant, and error bars will tell us that.</p>	N/A
<p>- Back trajectory figures: Units of measurement must be labeled. Are these units parts of a percent? That is, the category on Fig 2-7 that is labeled "0.28-0.84" means 28 hundredths of one percent, and 84 hundredths of one percent, respectively? They must be clear for use in public presentations.</p>	Sec. 2.3.2 (Can't change products generated by other contractor)
<p>- Figure 3-1: What is PMC? Please identify the acronyms in the charts so that states can use them in public presentations. In fact, we need a list of acronyms used throughout the document; it should be up front in the report, or in an appendix, so that we don't have to keep trying to find the original definition.</p>	Acronym Glossary
<p>- Figure 3-3 and all similar graphics: Can the pie charts for best and worst days be proportional in size? That is, can the size of the pie charts indicate the difference in emissions between good days and bad days?</p>	No
<p>- The TSSA charts (Figure 3-4, for instance) need to indicate somehow that "other" does not mean "ALL OTHER." (Table 2-3 lists all the source categories that are not included in "Other.") I don't see how to do it easily, but this will be confusing to use with the public if left as is.</p>	Sec. 4.1.1
<p>- Figure 3-19: The text below the graphic refers to Kaiser Wilderness. Where/what is Kaiser Wilderness, and what does it have to do with Yosemite,</p>	Sec. 4.1.2

<p>which has its own monitors?</p> <p>- Figure 3-23 for Zion: There's a note in the text on page 3-38 saying that "Figure 3-2" needs to be modified to show a large sulfur source in southern NV. The figure is actually Figure <b>3-23</b> on page 3-41. Also, the text on page 3-38 says there is a "significant SO<sub>2</sub> source in the southern most corner of NV," but that source doesn't show on the emissions density map. If the SO<sub>2</sub> map showed the same area as the NO<sub>x</sub> map, which covers a larger area, would that SO<sub>2</sub> source show up? Can the SO<sub>2</sub> map be modified to include the same area as the NO<sub>x</sub> map?</p> <p>- The emission density maps ought to show density for off shore (boundary) areas.</p> <p>- Is there a way to make the report clear in black and white? We simply can't make color copies for everyone who may need a copy.</p>	<p>Sec. 4.1.2</p> <p>Sec. 5.1</p> <p>N/A</p>
<p><b>Darla Potter (Wyoming)</b>  Page 2-4, Section 2.1.3 &amp; 3-44 Section 3.2.1  The characterization of the interim fire EIs being based solely on Section 309 work may be misconstrued as only including information for 309 states and not 308 states/tribes, which is incorrect.</p> <p>Page 2-12, Table 2-1  The location (site latitude and longitude) of the YELL2 site is listed @ Grand Teton NP while it is actually in Yellowstone NP.</p> <p>Page 2-19, Section 2.4.1  The placement of this section seems odd. I suggest either place at the beginning or end of the description of all of the analysis methods not in the middle of those descriptions. (last 2 sentences of the paragraph) Add additional description of how to analyses weighting can/should be conducted be added to this document to make it more useful for those who have to develop the next SIPs/TIPs.</p> <p>Page 3-1, Section 3.1.1  Need more discussion of "other" due to its relative high magnitude contribution at all Class I areas.</p> <p>Page 3-3, 3-4 in Table 3-1  The Class I areas identified contain all zeros: Group 8 Washakie WA and Yellowstone NP, Group 15 Wheeler Peak WA, and Group 17 Chiricahua WA.</p> <p>Page 3-7, 3-8 in Table 3-2  The Class I areas identified contain all zeros: Group 8 Washakie WA and Yellowstone NP, Group 15 Wheeler Peak WA, and Group 17 Chiricahua WA.</p> <p>Page 3-11, Bullets  In the first, third and fourth bullets, add descriptors as in the second bullets as an indicator of what these results mean (e.g., '+' indicates high certainty in the results, etc.)</p> <p>Page 3-12, Table 3-3  It seems strange that only the state of SD column is blank and doesn't even</p>	<p>Sec. 2.1.3 and Sec. 4.2.1</p> <p>Sec. 2.2.1</p> <p>Sec. 2.0</p> <p>Sec. 5.0</p> <p>Sec. 2.4.2 and Sec. 4.1.1</p> <p>Sec. 4.1.1</p> <p>Sec. 4.1.1</p> <p>Sec. 4.1.1</p> <p>Sec. 4.1.1 This</p>

<p>appear as contributing to the Group 12 Class I areas.</p> <p>Page 3-14, 3-15, 3-16, 3-17 in Table 3-4 The Class I areas identified contain all blanks: Group 5 Yolla Bolly-Middle Eel WA, Group 8 Sawtooth WA, Group 9 Confederated Salish and Kootenai Tribes, Group 11 Fort Peck Tribes, Group 16 Carlsbad Caverns NP, and Group 19 Capital Reef NP.</p> <p>Page 3-18, Section 3.1.2 (for each Class I area) Additional explanatory statements such as those in the 5<sup>th</sup> and 6<sup>th</sup> sentences of the first paragraph (e.g., "a general sense of model performance can be gauged by comparing the timeline plots ... whether the species seasonal trends and episodes are similar") need to be added to make it more useful for those who have to develop the next SIPs/TIPs: 2nd-4th paragraphs on the TSSA analysis, 5th paragraph on the emissions maps and back trajectory map, 6th paragraph on the WinHaze image.</p>	<p>is correct. SD impacts are &lt;5%</p> <p>Sec. 4.1.1</p> <p>Sec. 4.1.2</p>
<p><b>Tom Moore</b> You need to add some language to the AoH introduction section, and maybe to the recommendations/conclusions section, to the effect: "The AoH Workgroup also notes and understands the importance of the guidance contained in the WRAP Tribal Template (<a href="http://wrapair.org/WRAP/reports/Gen-Tribe-Temp.pdf">http://wrapair.org/WRAP/reports/Gen-Tribe-Temp.pdf</a>)."</p>	<p>Sec. 1.2</p>
<p><b>Rosanne Sanchez (NM, NTEC)</b> I wanted to share a few suggestions regarding the report. Introduction 1.2 Attribution of Haze Project....I'd recommend you either change the order or separate the sentence where it mentions "100 mandatory federal and tribal Class I areas in the WRAP region." This makes it sound as if the tribal class I areas are mandatory as well, which we know they are not. I saw this in a few places and should be altered.</p> <p>Do I recall correctly, that tribal sources will be looked at and reported on how they attribute to haze during phase II? If so, this should be mentioned when talking about Phase II details. Also, somewhere in the introduction, I would write something regarding how data was applied to tribal class I areas. I see for Pine Mountain Wilderness Area, AZ Monitoring Data is used for the Yavapai-Apache Nation, AZ and uses IKBA1 Monitoring data. In comparing state data and tribal class I areas not all the data is the same as was in this case. I believe it would be helpful if some background information would be provided for tribes regarding this.</p> <p>There is mention of state and regional emissions inventories was any tribal ei's used? If so, it should mention this. If not, it should mention this.</p> <p>2.1 Emissions..."This interim EI is most complete for the WRAP states."... some language that included tribes such as, "and does not include tribes at this time."</p> <p>Page 2-2 what is 2002 EIA-767? Does EIA stand for something? Also EGAS 4.0. EGAS is spelled out at the bottom of page, but is used prior to that. 2-3 missing an "a" in guidance.</p> <p>2.2.1 First paragraph..."It is, in fact, data from this program that states (add and</p>	<p>Sec. 1.2</p> <p>Only IMPROVE data used</p> <p>Sec. 2.1</p> <p>Sec. 2.1</p> <p>Acronym Glossary</p> <p>Sec. 2.2.1</p>

tribes) will use to track progress under the RHR." (need to include tribes where appropriate throughout the document.	
Page 2-20 Figure 2-8 illustrates the TSSA Regions for each state (including tribe(s)?)within the wRAP 36 km modeling domain.	Sec. 2.4.2
3.1.2 results for selected sites... it might be nice to include one tribal example.	N/A
3.2.1 if appropriate mention if data included data from tribes.	N/A
3-58 when talking about tribal class I areas, maybe be specific and say six tribal class I areas.	N/A
- I believe it would be helpful if you added links on the tribal reports to the appropriate state for regional aerosol extinction, Regional Emissions, State Emissions, Emissions Inventory Information and Apportionment of State Emissions to Class I Areas. Obviously this is good background information for a tribe and should be made available from the tribal report link.	N/A
- On page 1-3, 1st paragraph you use SO2 and NOx without distinguishing what they are. 2nd paragraph NOAA Hybrid Single Particle... NOAA should be spelled out.	Sec. 1.3
- You seem to jump between spelling out Class I areas and CIA, you might want to stick with one or the other.	Removed CIA abbreviation
In 2.1.1 I don't believe you spelled out previously what CENRAP stands for.	Sec. 2.1.1
- Page 2-3 need to spell out VOC PM(s)SO4, NH3 and what EC/OC are. I didn't see this prior to seeing them here. Does MOBILE6 stand for anything aside from the program?	Sec. 2.1
- 2-4 top of page it reads NONROAD200 was this suppose to be 2000? Does NONROAD stand for anything or is it just what it is?	Sec. 2.1.2
- 2.1.4 there appears to be a lot of data input sources do they stand for anything in particular? If so, maybe an acronym list at the end of the document?	Acronym Glossary
- Figure 2-1 what does PMC stand for? May need a legend for these?	Sec. 2.1.7
- Does GEAR gas phase stand for something? 2-20	Acronym Gloss.
- Did you say what R2 was ? first bullet page 3-11	Sec. 4.1.1
- Spell out NP before using it 3.1.2 and other places	Sec. 4.1.2
- On page 3-53 you use PMCourse in subscript but use PM10 Elsewhere. Please be consistent.	N/A
<b>Bob Gruening (NTEC)</b> Also add Figure 2.4 and second sentence of page 3-56 as places where "mandatory federal and tribal Class I areas" is used	Sec. 2.2.1 and Sec. 3

<p>Also, do tribal lands get assigned source regions and a unique numeric code? If so, this should be accounted for on page 2-21</p> <p>I would also like to see you showcase a tribal Class I area regarding the interpretation of 200 data. (See p. 3-18)</p> <p>Variety of suggested clarifications presented in a red-lined version of the document.</p>	<p>Sec. 2.4.2</p> <p>N/A</p> <p>Generally Accepted</p>
<p><b>Arizona</b>  Comment/Query No. 1 (Mike Sundblom, Unit Manager, Monitoring Section-ADEQ Air Assessment; member WRAP Emissions Forum):</p> <p>The analysis utilizes two attribution techniques, TSSA and TRA. Analytical results for each method compare well at some locations while others compare poorly. In order for States to effectively utilize the results shown in the Causes of Haze report, an additional section is needed. The additional section should describe methods to integrate results and address differences identified with the two methods.</p> <p>Comment(s)/Queries No. 2 (Diane Arnst, ADEQ Air Quality Planning Section Manager):</p> <ul style="list-style-type: none"> <li>- Should there be an Executive Summary of the apparent results of the Phase I work and what it shows about contributions, or is that impossible because of the nature of this project?</li> <li>- Clarify in text on page 2-2 in Paragraph 2 that the "2002 estimates began with the 1996 WRAP point source database, version 3" is ACTUAL EMISSIONS.</li> <li>- Explain in 3.1 on page 3-1 that the following Tables represent the slice of the pie in Figure 2--7 (Pie Charts) on Page 2-6 representing that particular pollutant--to explain what the Title of each table really means.</li> <li>- Replace the second sentence in 2.4.1 with "The conclusions are based on the weight of evidence approach rather than any single data set, analysis result or line of reasoning."</li> <li>- Correct "site" on page 3-1 in 3.1.1, 4th line of that paragraph to "side" of the table.</li> <li>- Considering the audience that will read/use this report or parts of it, add a footnote below each table with a statement (or range) about uncertainty or plus/minus error %.</li> <li>- In light of the wide differences in results from the TSSA method versus the TRA method [for example, 20% difference on page 3-28 for apportionments identified with Canada], do further work to determine the reasons for the disparities, narrow the gaps, choose one method as superior to the other, or more fully explain the differences. As written, this creates arguments for sources that do not want to add controls to question the credibility of the Attributions. A small WRAP workgroup of modeling experts to focus on this?? DLA 2/9/05</li> </ul>	<p>Sec. 4.1.2</p> <p>N/A</p> <p>Sec. 2.1.1</p> <p>Sec. 4.1.1</p> <p>Sec. 2.4.1</p> <p>Sec. 2.4.1</p> <p>N/A</p> <p>Sec. 5.1 (Phase II)</p>

<p>Comment(s)/Query(s) No. 3 (Corky Martinkovic, Lead RH Planner, ADEQ-AQ Planning Section):</p> <ul style="list-style-type: none"> <li>- Agree that, much like what we needed to do with the 309 TSD, someone needs to read these reports prior to the final release (esp. the more pivotal ones) with an eye to possible press release-type statements like the one Diane cited. We often "finesse" documents for these type of land mines that people can later use to try to show that our work is not reliable, usually at the same time we check for technical language "overload" for the general reader.</li> <li>- In the tables, may want to note what "Other" represents as rather large percentages rest in this column. I know it's explained somewhere in the text, but I can assure you many people will go straight to the charts and tables.</li> <li>- Will the "Other" category be more refined in this Report, later?</li> <li>- The C1A specifics toward the end of the Report - will there be more of these in this Report, Phase II, or as a separate report by request? This may be something we can discuss at the March meeting. I suggested at our meeting, that if they prove useful, perhaps areas that have "issues" can have this type of analysis done as doing it for all the C1As in the WRAP is a bit beyond the scope, yes?</li> </ul>	<p>N/A</p> <p>Sec. 4.1.1</p> <p>Sec. 5.1 (Ph. II)</p> <p>N/A</p>
<p><b>Janice Peterson (FS)</b>  Specific comments follow:  In general, I would like to see more detail in figure titles and table headings. Don't assume the reader is reading through all of the text before looking at a figure or table; the figures and tables should be able to stand alone. Also, quite often a figure could be pulled out for a presentation and become completely separated from the text making the possibility of misinterpretation even greater. For example, Figure 2-2 could be more completely captioned by calling it "WRAP annual 2002 "interim" emissions estimates from all source categories for NOx (top) and SO2 (bottom) by 36km grid cell.</p> <p>Are there plans to include a glossary? It is very difficult to keep up with all the acronyms (eg. NEI, RMC, EGUs, EDMS, MSF, VMT, DRI, CARB, TRA, TSSA, etc.).</p> <p>Table 2-1. You may want to indicate the meaning of the highlighting although I did eventually figure it out.</p> <p>The idea that this report is to be used as a "weight of evidence" approach cannot be over emphasized. The error bounds on most of the modeling results must be huge – far greater than is evident in the report or in the number of decimals displayed throughout the report and in the legends. The uncertainties are mentioned here and there in the text but perhaps this topic is important enough that it deserves a stand alone section.</p> <p>This report is very technical in nature – it reads like it is intended for other scientists. In some cases that will be true but in others it will not. Many state planners do not have sufficient technical backgrounds needed to fully understand this report. This reviewer has a reasonable technical background and I found it a struggle to understand some of the information. For many readers and users a simplified version is needed to prevent misuse of the information or worse –</p>	<p>Done</p> <p>Acronym Glossary</p> <p>Sec. 2.2.1</p> <p>Sec. 5.1</p> <p>N/A</p>

<p>completely disregarding it.</p> <p>Residence time maps. Because of varying seasonal wind climatology, which is dramatic along the coastal areas, the inland valleys, and faces of the Cascades and Sierras it would be useful if these maps were seasonally stratified. Local climatology should be used to determine the most appropriate stratification for each state or Class I area. Perhaps it is too late to apply this concept in phase 1, but should be considered in phase 2.</p> <p>Some figures are very hard to read and interpret on a printed paper copy – especially those with color codes. I realize the expectation was that these figures would be seen online where they can be blown up, however that assumes the reviewer has adequate time to really dig in. Color code keys were particularly troubling and the figures such as 3-22 on page 3-40 were for the most part completely unreadable.</p> <p>In Section 2.3.2 it would be useful to add a discussion about the potential pitfalls associated with using an 80km meteorological grid for the trajectory analysis in complex terrain.</p> <p>There is a problem with the column headings in table 3-4 – the 1<sup>st</sup> column under the r-squared value should probably read “non-intercept”. In this same table a better explanation is needed for the state locations under the differences between TSSA and TRA analysis.</p> <p>In tables 3-1 and 3-2 there are occasionally some obvious logic problems or inconsistencies with the percent contribution. If at all possible these values should be closely examined to find these, identify them, and if possible explain them or at least flag them as inconsistent. The explanation for “Other” could also be expanded. This was a particular problem with the CIA along the Canadian border.</p>	<p>Sec. 2.3.2</p> <p>Done</p> <p>Sec. 2.3.2</p> <p>Sec. 4.1.1</p> <p>Sec. 4.1</p>
<p><b>Tina Suarez-Murias</b>  Most of my comments are the same as points raised by "Utah" (sorry, I don't know who put them together) and Doug Latimer at EPA region 8. So I'll only add these postscripts: on p.2-23 2<sup>nd</sup> Paragraph, 4th line "wee" should be "were" and on p.3-14 in Table 3-4, should "East" or Nevada be a potential source attribute area? (Hoover Wilderness)</p>	<p>Correct as stated</p>
<p><b>Ivar Tombach</b>  PRINCIPAL COMMENTS</p> <p>- General. The draft report is well put together and clearly written. The methods used are described clearly and their limitations are discussed. But the draft seems incomplete and lacks closure in the form of conclusions. The report would be stronger if it (1) drew some general conclusions as to the effectiveness and viability of the attribution approaches that were used and (2) interpreted and drew overall conclusions about the source attribution in the West from the findings of this research.</p> <p>Uncertainty in the Attribution Estimates is Not Addressed. My major concern is that the report does not give the reader a clear idea of how much faith he or she should place in the attribution conclusions. Describing the limitations of the</p>	<p>Sec. 5.1</p>

<p>methods is good, but the implications of those limitations on the credibility and uncertainty of the attribution results is not discussed. When the TSSA (Tagged Species Source Apportionment) and TRA (Trajectory Regression Analysis) attributions are comparable, that gives some confidence (not necessarily warranted, though) that the results have validity. When the methods disagree, that difference is pointed out in the report but there is usually no indication of which result is likely to be the more the more credible. Ideally, whenever possible, a consensus attribution estimate should be provided in terms of a best estimate and an uncertainty.</p>	
<p>For example, the comparisons of CMAQ model performance with IMPROVE data at 5 Class I areas in Section 3.1.2 don't generally show good agreement for the average extinction coefficient on the 20% haziest days, with factor of 2 differences (in both directions) being common. A factor of two difference in the averages of 20 samples cannot be considered good agreement. The important issue here is what impact does this large level of uncertainty have on the uncertainty in the TSSA attributions that are derived using the same model? Furthermore, organic compounds were not included in the TSSA analysis. What does this do to the applicability of the findings in this report to the attribution of haze to sources?</p>	<p>Sec. 2.3.1, 5.1</p>
<p>Trajectory analyses are sensitive to the choice of wind field and air parcel height at the receptor. How large is the uncertainty in the TRA attribution estimates due to these factors? All things considered, when are the TRA attributions likely to be more correct and when are the TSSA attributions likely to be more correct?</p>	<p>Sec. 5.1</p>
<p>In summary, the usefulness of the attribution of haze results in this report and on the web site is diminished by the lack of information concerning the uncertainties in those results. The report would be most useful and effective if it provided best estimates of attribution to each source region and sector, together with an estimate of the uncertainty in each estimate, or quantified the uncertainties in its conclusions in some other way.</p>	<p>Sec. 5.1</p>
<p>- The Draft Report is Incomplete. Several sections of the report are missing, namely Section 2.1.5 (Ammonia Emissions); Section 2.2.2 (Meteorological Monitoring); Section 3.1.3 (Class I Areas with Unique Characteristics); and Section 4 (Recommendations for Phase II). Some important material will be in these sections. Will another draft of the report be available for review and comment once these sections are completed?</p>	<p>Sections have been completed</p>
<p>- The Legibility of the Graphics is Often Poor. The report is chock full of informative graphics. In an effort to allow comparison between different conditions, several graphics are often on one page, with the unfortunate result that the details of the maps, plots, and text are often small and nearly illegible on the printed page and require magnification on the computer screen for readability. The figures don't serve their purposes if they are not readily understandable, so they need to be made larger even at the sacrifice of convenient comparability with similar data on the same page.</p>	<p>Size and resolution of graphics for the final report have been greatly improved</p>
<p>DETAILED TECHNICAL COMMENTS</p>	
<p>- Page 2-1, Section 2.1, first paragraph – There have been several “interim” or</p>	<p>Sec. 2.1</p>

<p>“preliminary” WRAP emission inventories, the most recent of which is pre02d. Pre02d is the final preliminary inventory that has been used for preliminary 2002 modeling, and is being followed by preparation of the first official base 2002 inventory. Somehow, it would be good to point out that inventory pre02c, which was used for the AoH work, was not the last interim inventory and definitely was not the “official” modeling inventory for 2002. The implications of using a preliminary inventory for the AoH work deserve discussion. (Another uncertainty issue!)</p>	
<p>- Page 2-9, last sentence on page – Sodium nitrate need not be confined to coastal sites. Most of the nitrate found at Big Bend NP, an inland site, during the BRAVO Study was sodium nitrate.</p>	Sec. 2.2.1
<p>- Page 2-10, second sentence – The EPA’s monthly f(RH) value is best described as “a climatologically representative monthly value of f(RH).” Quotation marks around “climatologically representative” are at the discretion of the authors.</p>	Sec. 2.2.1
<p>- Page 2-10, Caption of Figure 2-4 – The length of the data record given here is just that up to the end of 2002. The currently available record length is longer.</p>	Sec. 2.2.1
<p>- Page 2-15, first paragraph – It is not correct to say that DRI ran either air quality or meteorological models. It ran trajectory models.</p>	Sec. 2.3
<p>- Page 2-16, Section 2.3.2 – This Back Trajectory Modeling discussion should point out somewhere that (1) the trajectories that are derived depend strongly on the assumption that is made about the altitude of the trajectory when it is over the receptor (it should be near ground level to impact the sampler or Class I area), and (2) the fact that a trajectory passes over a geographic area does not necessarily mean that it picks up emissions from that area. A striking example of (1) appears in Figure 9-6 of the BRAVO Study final report, where 5-day HYSPLIT trajectories arriving at Big Bend NP at 500m and below originate in Tennessee while those arriving between 1000 and 2000m originate in the general vicinity of Baja California, in the diametrically opposite direction. Using different wind field models can also cause the same kind of dichotomy; Figure 9-5 in the BRAVO report shows almost exactly the same kind of split in behavior between using EDAS and MM5 results during one 5-day period. As for (2), the amount of emissions that ends up in the air parcel depends not only on residence time, but also on plume rise, air parcel height, and atmospheric stability/mixing. For example, an air parcel transported aloft over a source region during stable nighttime conditions may not pick up any surface emissions. The TRA approach ends up accounting for these factors implicitly, but they are not reflected in simple residence time plots.</p>	Sec. 2.2.2 and Sec. 2.4.3
<p>- Page 2-18, Figure 2-7 – What are the units of residence time in the legend. The body of the report implies that they are percent of time, but the numbers look more like fraction of time. Also, what trajectory height at the receptor was assumed for this plot? (I realize this is an example, but it may be the only example of a residence time plot that the reader looks at.)</p>	Sec. 2.3.2
<p>- Page 2-20, second full paragraph, last sentence – The pre02c modeling that applies in this sentence is emissions (SMOKE) modeling. You could say “using the pre02c 2002 emissions inventory,” or “for the pre02c 2002 modeling.”</p>	Sec. 2.4.2

<p>- Page 3-11, second sentence – The mention of Group 1 and Group 2 here is the first time groups are mentioned in the text. Such labeling is used in the section headings in Tables 3-1 and 3-2 (buried in dark gray background), but it is never mentioned in the body of the report. Perhaps it should be, so that the reader who did not notice the fine print in the dark gray bands in Tables 3-1 and 3-2 won't wonder what Groups 1 and 2 are.</p>	<p>Sec. 4.1.1</p>
<p>- Page 3-11, bulleted items at end of page – The comparison of TSSA and TRA results in Table 3-4 is critical to the credibility of the report, yet the reader is left hanging here with just a description of the table. The information in the table should be interpreted in a general sense (details could be saved for the site-specific discussions) and its implications for the credibility and uncertainty in the attribution findings of the study should be discussed. A similar table is needed for nitrate, and the discussion should address both sulfate and nitrate as it draws its conclusions.</p>	<p>Sec. 4.1.1</p>
<p>- Page 3-18, Rocky Mountains National Park, first paragraph – The statement that “the model does not predict the monitoring data perfectly” is optimistic for this park and most of the other Class I areas discussed here. The timeline charts of Figure 3-3 show considerably different behavior, the average mass concentration on the 20% best days differs by more than a factor of 2, and even the average mass concentration on the 20% worst days differs by factor of 1.5. (Incidentally, are the days selected for calculating the 20% statistics from the modeling results the days determined by the monitoring or the days selected from the modeling results?)</p>	<p>Sec. 4.1.2</p>
<p>- Page 3-19, Figure 3-3 – Plotting the measurement results as 3-day wide bars on the timeline plot makes it difficult to compare with the modeling results, because of the artificial persistence the 3-day bars cause. They really should be 1-day wide bars with empty spaces between them for two days.</p>	<p>N/A</p>
<p>- Page 3-22, Figure 3-7 – What is the point of this figure in an attribution of haze discussion? Also, a split image is not the right way to show different visibility conditions, because attention is drawn to the contrasting conditions at the dividing line rather than to the image as a whole. The pictures will look very different if a pencil is laid down along the dividing line, covering it up and forcing the eye to look at each part of the image alone. The same effect could be accomplished by a 1/4” strip of white “tape” (real or virtual) over the dividing line. This would be easy to do on the computer and is highly recommended for all such figures in the report. Finally, the caption says that extinction values were taken from the pie charts in Figure 3-3; which ones, measured or modeled?</p>	<p>Sec. 4.1.2</p>
<p>- Similar comments to those concerning the Rocky Mountain NP discussion on pages 3-18 through 3-22 also apply to the discussions concerning the other four Class I areas that follow. The comments below will only highlight differences. As a general comment, trying to use one boilerplate formula for descriptions of all Class I areas can lead to awkward presentations of information. Consistency is desirable, but it should not be a noose. It would be better to address what is important at each Class I area, even if it is totally different from what is important at any other Class I area.</p>	<p>Sec. 4.1.2</p>

<p>- Page 3-23, first paragraph – The mention of the model not fitting the measured data “perfectly” at Yellowstone is a major understatement. The average 20% worst day concentrations in Figure 3-8 differ by more than a factor of 2, but in the opposite direction from Rocky Mountain NP. (The modeled timeline has a huge multi-day peak, about 20 times the average concentration, that doesn’t appear in the monitoring data. Interestingly, the absence of that peak in the measurements appears not to be a certain indicator of poor model performance, though, because it seems that monitoring data happen to be missing at the time of the peak and there are somewhat elevated concentration values when monitoring data resumes.)</p>	<p>Sec. 4.1.2</p>
<p>- Page 3-28, third paragraph – The very large discrepancy between TSSA and TRA sulfate Canadian apportionments deserves comment. What does it say about the uncertainty in the rest of the apportionments?</p>	<p>Sec. 4.1.2</p>
<p>- Page 3-38, fourth paragraphs – Here, a possible reason for a discrepancy is discussed, which is good. But, such a large discrepancy means that other attributions will necessarily be in error. How uncertain are all of the attributions at Zion National Park</p>	<p>Sec. 4.1.2</p>
<p>- Page 3-39, first paragraph – Here, for Zion, the monitoring and modeling values of means of the 20% worst days (in Figure 3-21) are relatively close, but the composition pies differ quite a bit and the modeling shows a very large peak that doesn’t appear in the modeling results, so describing the disagreement as not matching “perfectly” on page 3-38 is still a stretch</p>	<p>Sec. 4.1.2</p>
<p>- Page 3-44, paragraph after the bulleted items – Explain “natural” fire. Humans started some of the fires listed earlier in the paragraph. Are those fires considered anthropogenic or natural?</p>	<p>Sec. 4.2.1</p>
<p>DETAILED COMMENTS ABOUT REPORT COMPOSITION</p>	
<p>- Page 2-7, Figure 2-2 – Some of the colors in the spectrum are indistinguishable on a printed copy of the page. Using the NO<sub>x</sub> plot as an example, the blues of 6000-7000 TPY and 7000-8000 TPY appear identical, as do the grays of 2000-3000 TPY and 3000-4000 TPY. Also, the red of &gt;13,000 is not deep enough to easily distinguish from the orange of 12,000-13,000 tpy when those colors appear on the map, instead of side by side in the legend.</p>	<p>Sec. 2.1.7</p>
<p>- Page 2-8, Figure 2-3. The text of this figure is very difficult to read on the printed page. Enlarging the figure to fill the page would help, but this image is fuzzy enough that the text isn’t clear even when enlarged to 200% on the computer screen.</p>	<p>Sec. 2.1.7</p>
<p>- Page 2-11, Table 2-1 – The text on a laser printed copy is almost impossible to read through the darkest gray shading.</p>	<p>Sec. 2.2.1</p>
<p>- Page 2-15, Figure 2-6 – British Columbia seems to have disappeared into the Pacific Ocean.</p>	<p>N/A</p>
<p>- Page 3-19, Figure 3-3 – The text on this figure is almost illegible on the printed page, and the timeline plots of stacked bar charts are so small that finding the</p>	<p>Sec. 4.1.2</p>

<p>components (especially on the model results) is very difficult. You probably need to put each of the panels on a separate page, perhaps on facing pages in a 2-sided arrangement.</p> <p>- Page 3-20, Figure 3-4 – This figure is the essence of the findings of the report, but it is presented in tiny charts that have nearly unreadable type and small bars. Each of the two panels deserves its own page.</p> <p>- Page 3-21, Figure 3-5 – The figures and text on this page are really fuzzy when printed and not so hot even on the computer screen.</p> <p>- Finally, as a general typographic comment, the report relies heavily on color, in both figures and tables, and is most clear when viewed on a computer screen, with color printing by an inkjet printer ranking next. It can be expected that many readers will print it in black and white, as with a laser printer. The authors should review what this does to readability. The reader should expect that all colored maps and stacked bar graphs will not be totally informative in the absence of color, but yet they should not lead the reader astray, either. It might also be appropriate to place a comment in a preface that advises the reader that viewing the report in color is essential for full and correct understanding of many figures and tables.</p>	<p>Sec. 4.1.2</p> <p>Sec. 4.1.2</p> <p>N/A</p>
<p><b>Doug Latimer</b> General Comments</p> <p>- I think the report could be improved by writing from the perspective of the overall objective of the SIP development process and how the attribution work fits in to that. For example, how exactly will the states determine which control strategies to adopt to make reasonable progress toward the nation’s regional haze goal? Will the attribution study results be used for those assessments? Recognizing that there are uncertainties in the attribution study (and any future refinements) and recognizing that the current attribution study is incomplete, how will the states use the results?</p> <p>- The report could benefit by a section up-front that outlines the steps states must take to develop their SIPs and to coordinate with other states. A flow diagram might help illustrate where the attribution piece fits. I believe the states are doing something like this as part their SIP template.</p> <p>- Also helpful would be an overview of the constituents of regional haze (sulfate, nitrate, organics, elemental carbon, fine particles, coarse particles) and the emissions sources of these or their precursor gases (SO<sub>2</sub>, NO<sub>x</sub>, NH<sub>3</sub>, and VOCs). The current report does not even define “attribution” and at one point unnecessarily introduces another term, “apportionment.” Tom Moore has spent quite a bit of time attempting to define attribution and perhaps his work could be used in the introduction of the report.</p> <p>- It would also be helpful to carefully lay out what is included in the analysis and what is not. Currently there is no attempt to attribute down to individual sources (e.g., BART sources, some of the ones that would be controlled) or even source categories. There is no geographic attribution finer than the state level (and in many instances, for distant states, several states are lumped together). Finally, only a portion of emissions (SO<sub>2</sub> and NO<sub>x</sub>) that cause haze are included in the</p>	<p>N/A</p> <p>N/A</p> <p>Sec. 2.1, 2.2</p> <p>N/A</p>

<p>attribution work. If a state felt it needed to know the relative contribution of each of its BART sources to do a BART analysis, that kind of detail (disaggregation) is clearly not yet available.</p>	
<p>- Some of the key, important results are unlabeled: for example, some tables are labeled simply, “percent contribution” of sulfate or nitrate. However, we are not told (at least I could not find it) what the parameter is (light extinction coefficient) and what the averaging time is (the worst 20% of the days or annual average) for attribution.</p>	<p>Titling of tables and figures has been improved</p>
<p>- In spite of the very best scientific effort on the part of WRAP’s Modeling Forum and the use of the most advanced modeling techniques, the comparison of measured and modeled particulate matter concentrations and composition (that cause regional haze) illustrates that model calculations can significantly over- or under-estimate measured concentrations. Modeled concentrations explain very little of the variance in measured concentrations. Now, it may be that since attribution is a percentage contribution issue, some errors evident in calculating absolute concentrations are eliminated when looking at relative quantities. However, the current report does not dig into the uncertainties of the attribution process or attempt to make an estimate of error bars. Also, the report makes no attempt to ascertain simple relationships that could interpret the complex results of complex models. For example, what if you did an attribution study based simply on a inverse relationship between haze impact and the distance and direction from a source to a Class I area? I call these 1/r attributions. Would the results of such a simple attribution be in line with the results from CMAQ?</p>	<p>Sec. 5.1 (Phase II)</p>
<p>- I am still not clear after reading the report a few times about the relative importance of the Pacific Ocean background and how much of this might be anthropogenic. The report somewhere should have an assessment of what fraction of the total haze is natural. This could be done using EPA’s natural visibility guidance document. This could also be supplemented with other assessments in the literature. The TRA intercepts are usually very large fractions of the total impact; I don’t think the report is clear enough regarding whether these intercepts are mostly background or mostly error.</p>	<p>Sec. 5.1 (Phase II)</p>
<p>- I think the report needs to describe in more detail how the TRA and TSSA processes work. I know how the TSSA works, but I’m not sure I derived that from the report. I think any such scientific discussions could be made appendices, so the reader is not bogged down by scientific detail that many readers will not need.</p>	<p>Sec. 2.4 RMC, COHA Web sites</p>
<p>- The report would benefit from a discussion of previous haze attribution studies, primarily the speciated rollback work done by John Trijonis for the 1993 National Research Council report on regional haze and the work done by Pechan and Environ in 1997 based on my S-R matrix, which supported the development of EPA’s regional haze rule.</p>	<p>N/A</p>
<p><u>Specific Comments</u></p>	
<p>Page 1-1 Describes this as a “policy-level report.” I am not sure that this report is really written for the policy person (see comments above).</p>	<p>Sec. 1.2</p>
<p>Page 1-2 (third bullet at top of page) I am not sure the report provides</p>	<p>Sec. 1.2</p>

	“information and tools [“air regulators”] need to meet” the RHR 308 SIPs (see comments above).	
Page 1-2	The word “attribution” is used throughout the report, but is never carefully and rigorously defined.	Sec. 1.2
Page 1-3	(top paragraph) It is mentioned that the separate contributions of state-wide point and mobile source SO <sub>2</sub> and NO <sub>x</sub> are considered in the analysis. However, it should be noted that these emissions are just a portion (perhaps half) of anthropogenic visibility impairment.	Sec. 1.3
Page 1-3	(third paragraph, 10 <sup>th</sup> line) Change “then” to “than.”	Sec. 1.3
Page 1-5	(Table 1-1) Footnote “1” should be removed from the last three rows in the second to last column. Elemental carbon, soil, and coarse mass are indeed all emitted directly.	Sec. 1.3
Page 2-1	(first bullet) This is very poorly written. I suggest re-writing, perhaps as follows: Emission inventories (EIs) are an important part of understanding the anthropogenic and natural sources of regional haze. EIs characterize the location and type of the emission source as well as the mass emission rates of particulate matter and the precursors of particulate matter that affect visibility. Also, EIs can provide information on existing control levels so that engineering and policy judgments can be as to the degree of additional control that may be achievable.	Sec. 2.0
Page 2-1	(second bullet) This should be rewritten also, perhaps as follows: Monitoring data (measurements) are the most accurate indicators of the spatial and temporal variation of particulate matter and its chemical constituents (species) throughout the country. Monitored PM concentrations can be converted to a visibility-related parameter (light extinction) by multiplying the mass concentration (ug/m <sup>3</sup> ) by a light extinction efficiency (m <sup>2</sup> /g), which is a function of relative humidity and the particle type.	Sec. 2.0
Page 2-1	(first paragraph, under 2.1 Emissions) First internet link is not valid. Are these EIs really helpful to the attribution objective? If so, how? Are there better (for example, simpler) ways to present EIs for the purpose of attribution? Since the report has just focused on total state-level SO <sub>2</sub> and NO <sub>x</sub> emissions from point sources and mobile sources, it would be helpful to have a break-out of these broad categories by geography, by source category, and, at least for the large sources like power plants, by individual source.	Sec. 2.1 and Sec. 2.1.7
Page 2-2	(first sentence) This sentence needs to be re-written.	Sec. 2.1.1
Page 2-2	(fourth paragraph, 5 <sup>th</sup> line) change “estimated” to “estimate”	Sec. 2.1.1
Page 2-2	(second to last paragraph) This should be rewritten.	Sec. 2.1.1

Page 2-3	(second to last line) Change “guidnce” to “guidance.”	Sec. 2.1.2
Page 2-6	(Figure 2-1) This figure is hard to read and interpret. The figure and the key should be made larger so that it is easier to determine what portions of the pie are what source categories. Pies should be made equal size. Just how useful is this?	Sec. 2.1.7
Page 2-8	(Figure 2-3) This figure should be made full page. It is currently illegible. (This comment applies throughout much of the report.)	Sec. 2.1.7
Page 2-10	(Figure 2-4) I love this figure. Let’s make it full-page size. (Here and elsewhere in the report, a rather unfortunate acronym, CIA, is used. Can we spell out “Class I areas” or find another abbreviation?)	Sec. 2.2.1
Page 2-11	(Table 2-1) I question whether this table is needed in a policy report.	N/A
Page 2-13	I wonder whether the color photos are helpful to explaining geographic attribution. They are pretty to look at, but I’m not sure they add value. Also, in this report what is the basis for attribution: light extinction or deciview? I would guess it would have to be the former, which is linear, rather than the latter, which is logarithmic.	N/A
Page 2-16	(second paragraph and subsequent bullets) Since the majority of the report is based on CMAQ modeling, the reader needs more detail on the performance of the model based on a comparison to monitoring data, which are our best indicators of reality). The figures later in the report that compare on the same page the IMPROVE monitoring and the CMAQ modeling give some idea of how poor the modeling results are in some cases. This place in the report is where we need some “truth in advertising.” The report currently says “bias.” Well, how much? Does a policy person know what “bias” is, first of all? The reader needs to be told how big the biases are and “large” the “large bias” is. Let’s use numbers, like we’re over-estimating impacts by x% on average. In addition to bias, the R <sup>2</sup> value needs to be provided. This is the square of the correlation coefficient between modeled and monitored data. This value is precisely the fraction of variance explained by the model. It is an unfortunate but true statement that much of the monitored data are not explained at all by the model (i.e., R <sup>2</sup> = 0). I think a table would be the only way to summarize all this information succinctly. I think the UC Riverside Modeling Center has such tables. A different summary table may be necessary for the policy-maker. The table should have model bias and R <sup>2</sup> for each chemical species and each Class I area (monitoring site) at least at the annual level and possibly, at the seasonal level. What does the model performance mean for the accuracy of the modeled attribution results. Has anyone given any thought to this? It may be that attribution results are less uncertain than absolute modeling results because attribution is always a	Sec. 2.3.1

	fraction of a total. One might have the total wrong, but have the fraction right because errors cancel in the numerator and denominator. In other words, perhaps the total nitrate is over-predicted say by a factor of 15. If the point source impact of a given state is also over-predicted by the same factor. The modeled attribution which is the ratio of the latter to the former would be accurate.	
Page 2-18	(Figure 2-7) The choice of colors makes this and other similar figures difficult to interpret.	N/A
Page 2-21	(last paragraph) I think it would be beneficial to discuss in more detail what “other” is. I know it is everything that is not defined, but can we say in general, say, based on EIs, what the principal contributors to the “other” impact are. My guess is that it is area sources from the state and nearby states. Am I correct to assume from reading the report that we do not think “other” is global Pacific background? Since the undefined “other” is often the largest single contributor, the reader needs more help on this one.	Sec. 2.4.2
Page 2-21	(Figure 2-8) I think you can use words to describe what this figure is attempting to show. Then, you can delete this ugly graphic.	N/A
Page 2-23	(first paragraph, 5 <sup>th</sup> line) Change “contaminates” to “contaminants.”	Sec. 2.4.3
Page 2-23	(third paragraph, second sentence) Change to: This estimates the probability that the regression coefficient value is not different from zero (i.e., that it could be zero).	Sec. 2.4.3
Page 3-1	(first paragraph under 3.1, last line) Add commas before and after “and supplement to.”	Sec. 4.1
Page 3-1	(second paragraph under 3.1.1, 4 <sup>th</sup> line) Change “site” to “side.”	Sec. 4.1.1
Page 3-2ff	(Table 3-1) The text and table do not describe what the attribution is for. Is it for the worst 20% of days or annual average? If it is worst 20% of days, is that based on modeling or monitoring? Is the attribution percentage of total sulfate $b_{ext}$ or some other measure? The policy maker probably doesn’t need to see the 2 <sup>nd</sup> and 3 <sup>rd</sup> columns.	Sec. 4.1.1
Page 3-6ff	(Table 3-2) Similar questions to above for the nitrate. Also, should nitrate non-linearities be discussed here or somewhere?	Sec. 4.1.1
Page 3-10	(Figure 3-1) Hard to read at this size. It’s also duplicative of what’s in Tables 3-1 and -2.	Sec. 4.1.1
Page 3-11	(second paragraph, 1 <sup>st</sup> line) Delete “human”?	Sec. 4.1.1
Page 3-11	(last line) Change “is” to “it.”	Sec. 4.1.1

Page 3-12	(Table 3-3) I love this table because it condenses a lot of information on one page. Could we add an additional column that briefly describes the Class I area group by a name, so that the reader doesn't necessarily have to flip pages to the map key?	N/A
Page 3-14	(Table 3-4, 1 <sup>st</sup> column under R <sup>2</sup> values) Add "Non-."	Sec. 4.1.1
Page 3-18	(2 <sup>nd</sup> paragraph, 5 <sup>th</sup> -8 <sup>th</sup> lines) It is stated that the "model clearly does not predict the monitoring data perfectly," and that comparisons should focus on seasonal trends and episodes. It is not clear to me that those are the most important things to focus on. I would think for attribution purposes the modeled and monitored species contributions, both in an absolute and relative sense, should track each other. However, we see some significant differences at RMNP (which is not the Class I area with the worst model performance). For example, when I look at Figure 3-3, I see significant differences between monitored and modeled attribution based on chemical species, especially for the best days. For worst days, the modeled extinction was 29 Mm <sup>-1</sup> versus a measured 44 Mm <sup>-1</sup> . Of course, we must remember that the IMPROVE monitoring data is only a sampling (every third day) while the model was run for every day. However, statistically one would still expect that the one-in-three day sampling should be representative.	Sec. 4.1.2
Page 3-18	The term "apportionment" is introduced. The report should be consistent and clear on the language. I know Tom Moore was quite concerned about clarity in the use of the language.	Sec. 4.1.2
Page 3-20	(Figure 3-4) It is nearly illegible at this size. What does this graph tell us? You can get significant reductions in haze at RMNP by controlling Colorado sources, but you will also need reductions in other states. Also, the "percent contribution" values in the graph refer to percent of sulfate and nitrate haze, which when summed are only about half of the light extinction in RMNP (see yellow and red slices of pie diagrams in Figure 3-4.)	Sec. 4.1.2
Page 3-21	(Figure 3-5) The figure is illegible at this size. This comment applies throughout much of the remainder of the report.	Sec. 4.1.2
Page 3-22	I like Figure 3-6. It shows graphically the importance of Colorado source regions to impacts in RMNP. To a lesser extent, UT, AZ, and WY are important. It also shows that some trajectories originate as far east as the Mississippi River. I question whether Figure 3-7 is needed to explain attribution; it certainly is beautiful. (Ditto for later photos.)	N/A
Page 3-24	(Figure 3-8) The comparison of monitored and modeled light extinction at Yellowstone NP shows huge differences in time lines, magnitudes of impacts, relative contributions of species, etc. Can the model be trusted for attribution given such performance?	N/A

Page 3-27	(Figure 3-11) A different color scheme would help the reader to understand the ranges of residence time. As it stands, most of the West is a dark smudge. (Ditto on later maps.)	N/A
Page 3-29	(Figure 3-12) This plot for Mt. Rainier NP shows that the CMAQ model results do not compare well with IMPROVE monitoring data, with the model significantly over-predicting nitrate. The question is: are attribution results credible with this model performance?	N/A
Page 3-34	(Figure 3-16) Here is still another comparison of monitored and modeled data; this one is for Yosemite. Here again we see very large differences. Organic carbon impacts on the worst days are measured to be much higher than modeled values. Measured nitrate values are lower than modeled. The apportionment among chemical species based on modeling results is different in both absolute and relative senses from measured values.	N/A
Section 3.2	It is not clear to me that these sections provide information of much value for attribution. It is stated that 2002 was a year with a lot of wildfire, so perhaps the assessment is not representative. I do not get a sense from this section on how one should estimate the geographic attribution of the carbonaceous (organics and elemental carbon) aerosols. There is some interesting information, however. I don't know what to suggest about it.	N/A
<b>Steve Arnold (CO)</b>		
	Section 2.3.1 – Need more comprehensive description of model performance.	Sec. 2.3.1
	Section 3.3 – Move description of Web site forward in the report.	Sec. 3
	Variety of suggested clarifications presented in a red-lined version of the document.	Generally accepted