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3 Dear Administrator Jackson,
4

5 The Clean Air Scientific Advisory Committee (CASAC) Particulate Matter (PM) Review
6 Panel met on March 10 – 11, 2010 to review the *Quantitative Health Risk Assessment for*
7 *Particulate Matter – Second External Review Draft* (February 2010) and *Particulate*
8 *Matter Urban-Focused Visibility Assessment – Second External Review Draft* (January
9 2010). In this letter, CASAC offers general comments on the *Particulate Matter Urban-*
10 *Focused Visibility Assessment*, followed by our consensus responses to the Agency’s
11 charge questions. Comments from individual panelists are also attached.
12

13 CASAC was favorably impressed with the quality and clarity of the second draft
14 *Particulate Matter Urban-Focused Visibility Assessment (UFVA)*. As we indicated in our
15 letter of November 24, 2009 regarding the first draft of the UFVA, CASAC strongly
16 supports the introduction of a new PM light extinction indicator for a secondary standard
17 to protect against adverse effects on visibility. We concur with an hourly averaging time
18 as the most appropriate to represent the nearly instantaneous nature of human perception
19 of impaired visibility. We also agree with the 20 to 30 deciview (dv) range of light
20 extinction levels as a reasonable representation of the levels of visibility impairment
21 considered acceptable based on currently available studies.
22

23 In its second draft UFVA, EPA staff were responsive to previous CASAC
24 recommendations, adding a detailed logit analysis to better understand similarities and
25 differences in results of the urban visibility preference studies, recalculating estimated
26 extinction levels using a 90% relative humidity (RH) screen, and considering (90th, 95th
27 and 98th) percentiles based on all available daylight hours as well as on the single worst
28 daylight hour in each day.
29

30 CASAC recommends the addition of an integrative summary chapter to the *UFVA*. At
31 present, it lacks a summary that brings main findings and their implications together.
32 This chapter might be included as an executive summary or as new chapter at its
33 conclusion. CASAC has also identified needs for the next review cycle in terms of further
34 research on a number of topics related to urban visibility; these needs should be
35 assembled, highlighted and prioritized. In particular, there is a need for the Agency to
36 conduct additional urban visibility preference studies over a broad range of urban areas
37 and viewing conditions, to further evaluate and refine the range of visibility levels
38 considered to be acceptable in the current assessment.
39

40 The *UFVA* presents logical and persuasive arguments for use of a PM light extinction
41 indicator, with a 1-hour (daylight) averaging time as a sound basis for a secondary
42 PM standard to protect urban visibility. The *UFVA* also presents and evaluates reasonable
43 ranges for the level (20 to 30 deciviews) and form (90th to 98th percentile) that such a
44 standard might take, and clearly illustrates the differences among the many resulting
45 optional combinations of levels and forms in terms of protectiveness and/or stringency
46 across the 15 diverse urban study areas selected for this analysis. The approaches

1 employed here, the ranges of options considered, and the estimates of visual air quality
2 resulting from the various combinations of options considered should provide a sound
3 basis for more detailed consideration in the *Policy Assessment*.

4
5 In addition, if the Agency is also considering options of using a PM_{2.5} light extinction
6 indicator or a PM_{2.5} mass indicator as the basis for secondary PM standard, it would be
7 important to see a more detailed comparison of the affected PM_{2.5} concentrations, species
8 compositions and levels of visibility protection that would result from the use of
9 alternative PM₁₀ light extinction, PM_{2.5} light extinction or PM_{2.5} mass indicators.

10
11 We thank the Agency for the opportunity to provide advice on the UFVA, and look
12 forward to continued discussions with the Agency as we review the first draft *Policy*
13 *Assessment for the Review of the Particulate Matter National Ambient Air Quality*
14 *Standards* (March 2010).

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17 Sincerely,
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2 **CASAC Responses to Charge Questions**
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4 **1) In general, what are the Panel's views on the level of detail provided in the body**
5 **of the report and associated appendices? Does the Panel agree that all of this**
6 **information is useful to retain or is there material that the Panel would recommend**
7 **deleting? Does the Panel have any suggestions regarding the organization and**
8 **distribution of information throughout the document and in the appendices?**
9

10 While a substantial level of detail has been provided in the *UFVA*, many of the
11 calculations included therein are complex, and a wide range of optional combinations of
12 levels and forms is presented and compared. The report is long, but its completeness and
13 detail are useful, particularly given that we are looking, for the first time, at a very
14 different indicator for this secondary standard. The discussion is clear, and the associated
15 appendices are valuable for examining questions raised by the main text. The CASAC
16 would not recommend deleting any of the material. With the few exceptions noted below,
17 the organization is good as it stands, both in the main body of the report and in the
18 appendices.
19

20 Chapter 2 may contain more information than is required with respect to the individual
21 cities. Much of this material could be moved to the appendices. The memo of 2/3/2010
22 on the statistical analysis of the preference studies should also be placed in the
23 appendices, and consolidated with related material from Chapter 2 to avoid redundancy.
24 Similarly, much of the material in sections 4.1.3 and 4.1.4 might be better suited to an
25 appendix. In any case, the transition into future monitoring site characteristics (middle of
26 page 4-2) is rather abrupt, and might be more appropriate for inclusion in the Policy
27 Assessment, where it could be expanded based on recent feedback from the CASAC
28 Ambient Air Monitoring and Methods Subcommittee.
29

30 The SANDWICH method described in Chapter 3 does not include sea salt, which can be
31 an important contributor to PM at coastal sites. The sea salt component of PM may be a
32 source of uncertainty in the light extinction calculation at these sites. The SANDWICH
33 approach has other sources of uncertainty that should be mentioned. Relying on mass
34 closure to determine the hourly organic carbon assumes that all other species are
35 accurately determined. This is problematic for nitrate, as well as for sea salt. These
36 factors should be mentioned as areas of uncertainty that are associated with this method.
37

38 **2) In the Panel's view, to what extent does the logit analysis presented in Chapter 2**
39 **of the second draft Visibility Assessment, and further expanded and described in the**
40 **supplemental memorandum, add value to the urban visibility preference study**
41 **analysis and provide additional support for combining and comparing the results**
42 **from the four cities, as shown in Figure 2-16? What are the Panel's views on the**
43 **clarity and adequacy of the descriptions associated with such a combined**
44 **assessment and on the conclusions that can be drawn from the assessments? Please**
45 **provide comments on any additional insights that might be drawn from these**
46 **analyses or on any additional caveats that should be considered.**

1 The analysis presented in Section 2.6 and summarized in Figure 2-16 is quite reasonable.
2 The characteristics of the studies that produced the data are discussed. The modeling
3 approach is clearly presented and explained, with an appropriate level of detail, given that
4 this approach has not been previously described in EPA visibility documents. Figure 2-16
5 is very useful for comparing the four realizations of the model in comparison to the study
6 data. Table 2-3 provides valuable information regarding the statistical significance of
7 each model coefficient. The results in Table 2-3 are appropriately explained. The model
8 is appropriately critiqued in terms of goodness-of-fit, statistical significance of the
9 coefficients, and the interpretation of the coefficients. The limitations of the model with
10 respect to limitations of the underlying data are appropriately discussed.

11
12 The text does a good job of identifying limitations associated with the sample population
13 in the UBC study (all participants were university students and therefore had advanced
14 educational background), and discusses the broader socioeconomic distribution of the
15 population participating in the Phoenix study. Absent is a comparable discussion of the
16 demographic distribution in the second Washington DC study, other than noting the
17 relatively small size of the sample population, and limitation that all participants were
18 employees of the research firm conducting the study. It is therefore likely that all
19 participants were well educated, and may have understood the methods and goals of the
20 study better than the populations participating in the other studies. Since this is a
21 preference study, this point is worth acknowledging in the text.

22
23 The additional information presented in the supporting memo by Stratus Consulting is
24 very helpful and should be retained as an attachment or in an appendix. The memo
25 evaluates several alternative specifications of a logit model, of which the one presented in
26 the assessment is Model 2. Confidence intervals on the predicted mean were estimated
27 using a numerical method, and verified with another numerical method. Models 1 and 2
28 are generally found to provide similar results. Thus, the results of the assessment are not
29 substantially sensitive to the choice in functional form between these two models.
30 Overall, the use of the logit model is reasonable, since the output is a binary variable.
31 The model is appropriately evaluated and reasonably represents the data to which it was
32 fit. The limitations of the underlying data are discussed qualitatively. The overall
33 findings are reasonably supported by the data, model, and appropriately take into account
34 limitations of the data. The associated discussion presents a number of reasonable
35 hypotheses that could account for the significant differences in the acceptability response
36 curves among the different cities, and could explain why some of the study results have
37 greater variability than others.

38
39 While it is appropriate to move forward on the basis of available data, CASAC believes
40 the data suggest some heterogeneity that needs to be explored with further research,
41 especially to evaluate potential differences among regions or among cities that have
42 different inherent scenic characteristics. The need for additional urban visibility
43 preference studies, using consistent and robust survey methods, over a broader range of
44 urban areas and viewing conditions, should be emphasized as a research priority. The
45 results from these studies could help refine a secondary PM light extinction standard in
46 future NAAQS review cycles.

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2 **3) What are the Panel’s views on the extent to which the analysis of the frequency of**
3 **co-occurrences of hourly relative humidity values below and above 90 percent with**
4 **other meteorological events such as rain or fog (Chapter 3, section 3.3.5; Table 3-6)**
5 **provides scientific support for consideration of how to address relative humidity in**
6 **defining the form of a standard based on a PM light extinction indicator?**
7

8 An informative, new analysis was presented in section 3.3.5 (as revised by the 3/4/10
9 memo from Philip Lorang and Mark Schmidt to the PM NAAQS Review Docket)
10 comparing hourly daytime relative humidity (RH) and the incidence of natural weather
11 visibility-impairing conditions (fog, rain, snow, etc.). CASAC concurred that this
12 presentation provided a persuasive argument for the use of a 90% RH screen as an
13 effective and efficient way to discard most of the hours potentially affected by natural
14 weather conditions while removing only a small fraction of total daylight hours from
15 consideration.
16

17 CASAC also found that a 90% RH screen was not only a logical revision for use in the
18 *UFVA* assessment, but would also be an appropriate component of a new secondary
19 NAAQS based on PM light extinction. It would be an effective way to remove periods
20 when weather influences might be the dominant cause of visibility impairment from the
21 regulatory metric, and would also have other benefits relating to PM light extinction
22 measurements, such as accommodating spatial variability in RH and weather influences,
23 minimizing effects of RH measurement errors at high humidity, and allowing for
24 measurement modifications (such as a “smart heater” on a nephelometer) that could
25 substantially reduce instrument maintenance needs and improve data quality.
26

27 **4) In response to CASAC recommendations, descriptions of current conditions and**
28 **results of just meeting NAAQS scenarios that considered all daylight hours were**
29 **added to those based on maximum daily 1-hour indicators. The 98th percentile form**
30 **was also included along with the 90th and 95th percentiles. Tile plots of hourly PM**
31 **light extinction (Figure 3-12) and composition bar graphs of the top 10% of days for**
32 **maximum daily 1-hour and aggregated individual daylight hours (Figure 3-13) were**
33 **shown in part to help illuminate the similarities and differences between these**
34 **various indicators with respect to current conditions. Similarly, additional figures**
35 **and table entries were generated to illustrate the characteristics of various PM light**
36 **extinction NAAQS scenario forms (Tables 4-2, 4-3, 4-5, and 4-7; Figures 4-1 through**
37 **4-3).**
38

39 **What are the Panel’s views regarding EPA staff interpretations of these displays**
40 **included in the text? Are there supplemental or alternative interpretations the Panel**
41 **would suggest? Are there additional approaches the Panel would suggest regarding**
42 **ways to summarize, display, or assess the results of these analyses, including**
43 **similarities and differences between the various scenarios?**
44

45 The revisions to accommodate the 90% RH screen, the inclusion of a higher (98th)
46 percentile form, and consideration of an alternative way of calculating percentiles – based

1 on all daylight hours, rather than just the worst hour in a day – were valuable additions to
2 the *UFVA*. When these are combined with other options including 90th and 95th
3 percentiles and different levels (64, 112, 191 Mm^{-1}) of PM light extinction, the many
4 resulting options are complex and difficult to communicate and compare. The various
5 new graphical displays are quite helpful in communicating this complex new information
6 clearly and illustrating the differences and similarities among the many options.

7
8 CASAC found that the tile plots were especially informative and greatly helped to show
9 the seasonal and diurnal patterns and similarities and differences across the different
10 study areas. The stacked bar charts of maximum hourly extinction on top 10% days vs.
11 compositions on top percentiles considering all daylight hours are useful for seeing
12 differences between cities, and the accompanying interpretation and discussion are
13 reasonable and informative. The plots also illustrate interesting differences in hourly
14 compositions within individual cities for the (relatively few) hours which represent the
15 single worst hours in a day. However, these comparisons do not really allow for a direct
16 “apples vs. apples” comparison of the effect of calculating percentiles based on the single
17 worst daylight hour each day, vs. using all daylight hours to calculate the percentiles.

18
19 It seems likely that the two optional approaches may tend to focus on different kinds of
20 visibility impairing PM species, sources, meteorological conditions, times of day, and/or
21 seasons. It would be useful to have a clearer picture of what their similarities and
22 differences really are before recommending one approach over the other. Additional
23 suggestions on approaches for this are included in comment from individual panelists.
24 Several panelists also expressed concerns that some of the occasionally very high coarse
25 particle contributions in a few of the cities (St. Louis and Los Angeles) appeared
26 questionable, and might benefit from closer scrutiny or warrant some cautionary language
27 in the *UFVA*.

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Compendium of Individual Preliminary Panelists Comments
Urban-Focused Visibility Assessment for Particulate Matter (January 2010)

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1 **Comments from Dr. Lowell Ashbaugh**

2
3 January 2010 2nd External Review Draft Particulate Matter Urban-Focused Visibility
4 Assessment,

5 Charge question 1

- 6 1) *In general, what are the Panel's views on the level of detail provided in the body*
7 *of the report and associated appendices? Does the Panel agree that all of this*
8 *information is useful to retain or is there material that the Panel would*
9 *recommend deleting? Does the Panel have any suggestions regarding the*
10 *organization and distribution of information throughout the document and in the*
11 *appendices?*

12 The report contains a lot of detail, but it is presented well. The discussion is clear and the
13 associated appendices are valuable for examining questions raised by the main text. I
14 would not recommend deleting any of the material. The organization is good, both in the
15 main body of the report and in the appendices. I have some comments on the presentation
16 of material that I'll put later in this review.

17 The introductory material is excellent. It's short, but it's complete and it lays the
18 foundation for review of the NAAQS. The overview of the science of visibility and PM
19 might be too brief for readers new to the field, but the references are sufficient to fill in
20 the details.

21 Charge question 2

- 22 2) *In the Panel's view, to what extent does the logit analysis presented in Chapter 2*
23 *of the second draft Visibility Assessment and further expanded and described in*
24 *the supplemental memorandum add value to the urban visibility preference study*
25 *analysis and provide additional support for combining and comparing the results*
26 *from the four cities, as shown in Figure 2-16? What are the Panel's views on the*
27 *clarity and adequacy of the descriptions associated with such a combined*
28 *assessment and on the conclusions that can be drawn from the assessments?*
29 *Please provide comments on any additional insights that might be drawn from*
30 *these analyses or on any additional caveats that should be considered.*

31 The logit analysis is important to this assessment. It provides a common basis to analyze
32 the results from the four studies in different cities and it sets forth a quantitative method
33 to establish boundaries on the CPL levels. The discussion of the hypotheses that might
34 explain the different VAQ acceptability responses is clear. There may be other factors
35 involved in the differences between cities, but it would take more research to confirm or
36 refute them. For example, one hypothesis that was not discussed is the possible
37 differences in population that inhabits the different cities that makes them more or less
38 sensitive to VAQ. Denver and BC are known for their outdoors activities; people who
39 live there may be more attuned to the visual environment and more sensitive to poor
40 VAQ. People living in Washington, DC may be less attuned to the outdoor environment
41 and therefore less sensitive to poor VAQ.

42 Page 2-31 suggests that additional studies would be useful to gain further understanding.
43 Are there plans for such studies? Is there an outline or more comprehensive listing of the

1 studies that would be useful? Such a list or discussion would be very useful if funding
2 becomes available at some time in the future.

3 Charge question 3

4 3) *What are the Panel’s views on the extent to which the analysis of the frequency of*
5 *co- occurrences of hourly relative humidity values below and above 90 percent*
6 *with other meteorological events such as rain or fog (Chapter 3, section 3.3.5;*
7 *Table 3-6) provides scientific support for consideration of how to address relative*
8 *humidity in defining the form of a standard based on a PM light extinction*
9 *indicator?*

10 The analysis of the frequency of co-occurrences of rain and/or fog with relative
11 humidity above or below 90 percent has a flaw in it. I don’t believe it would
12 change the conclusions, but on page 3-29, lines 11-12, is the statement “Based on
13 this assessment, the 90% relative humidity cutoff criteria is effective in that on
14 average less than 6% of the hours are removed from consideration...” This is not
15 correct. It’s correct that (except for Tacoma) less than 6% of the hours with
16 $RN \leq 90\%$ co-occur with rain or fog. The number of daylight hours with relative
17 humidity $>90\%$ and their percentage of all daylight hours is shown below (data
18 extracted from Table 3-6). On average, about 10% of all hours in all study areas
19 would be removed with the $RH > 90\%$ criterion. This percentage varies from city
20 to city, with a low of 1% at Phoenix and a high of 30% at Tacoma. Birmingham,
21 Atlanta, Pittsburgh, Baltimore, and Philadelphia are also above 6%.

Study area	Number of Daylight hours with $RH \leq 90\%$	Number of Daylight hours with $RH > 90\%$	Percent of Daylight Hours with $RH > 90\%$
Tacoma	18293	7987	30%
Fresno	24245	1615	6%
Los Angeles			
Phoenix	26045	235	1%
Salt Lake City	24989	1291	5%
Dallas	25519	761	3%
Houston			
St. Louis			
Birmingham	23826	2454	9%
Atlanta	23696	2584	10%
Detroit			
Pittsburgh	22254	4026	15%
Baltimore	22867	3413	13%
Philadelphia	24302	1978	8%
New York	24963	1314	5%
Overall total	260999	27658	10%

22 I can’t reconcile the data in this table with Table G-1 in Appendix G, but the
23 statement on page 3-29 is also not consistent with Table G-1. Whatever the cause

1 of the inconsistency, it should be rectified so that the statements and tables are
2 consistent. If I've misunderstood the presentation, it should be clarified.

3 It's difficult to see the contrast in the distributions shown in Figure G-2. It's
4 probably not important to see the difference (i.e. the distribution of extinction in
5 the excluded hours), so I recommend the text be revised to bring the reader's
6 attention to the important aspects of the plot. In particular, it appears that the
7 horizontal bar on the display for each city shows the 90th percentile extinction
8 design value, but it isn't mentioned in the text or in the table. It would be useful to
9 highlight how the design value drops with the excluded hours.

10 Charge question 4

11 4) *In response to CASAC recommendations, descriptions of current conditions and*
12 *results of just meeting NAAQS scenarios that considered all daylight hours were*
13 *added to those based on maximum daily 1-hour indicators. The 98th percentile*
14 *form was also included along with the 90th and 95th percentiles. Tile plots of*
15 *hourly PM light extinction (Figure 3-12) and composition bar graphs of the top*
16 *10% of days for maximum daily 1-hour and aggregated individual daylight hours*
17 *(Figure 3-13) were shown in part to help illuminate the similarities and differences*
18 *between these various indicators with respect to current conditions. Similarly,*
19 *additional figures and table entries were generated to illustrate the*
20 *characteristics of various PM light extinction NAAQS scenario forms (Tables 4-2, 4-*
21 *3, 4- 5, and 4-7; Figures 4-1 through 4-3).*

22
23 *What are the Panel's views regarding EPA staff interpretations of these displays*
24 *included in the text? Are there supplemental or alternative interpretations the*
25 *Panel would suggest? Are there additional approaches the Panel would suggest*
26 *regarding ways to summarize, display, or assess the results of these analyses,*
27 *including similarities and differences between the various scenarios?*

28 The tile plots in Figure 3-12 are an excellent way to show the hourly light
29 extinction. I would like to see all plots scaled so the time periods directly
30 correspond across the years. In particular, the 9-month plots for Houston and
31 Phoenix should be scaled such that the 9 months shown correspond to the same
32 period as in the 12-month plots, i.e. not stretched out to fill the space. All the 12-
33 month plots are currently scaled slightly differently so that the same time period is
34 not directly opposite for different years.

35 The staff interpretation of the plots is good, but the conditions at each city could
36 be more fully explained. Section 3.4.5 has highlights of the extinction budgets for
37 individual urban areas. I would like to see something similar for Section 3.4.4.
38 For example, the description at Tacoma could read: *The hours excluded at*
39 *Tacoma are primarily in the late fall and winter, and are generally in the*
40 *morning. Occasional periods last all day. Few hours are excluded due to high RH*
41 *in spring, summer, and early fall. High light extinction periods also occur more*
42 *often in late fall and winter, and with few exceptions occur mostly in the early*
43 *daylight hours in other seasons. Fresno could be described as: The hours excluded*
44 *in Fresno due to high RH are exclusively in the late fall and winter. This is the fog*
45 *season in California's Central Valley, and periods of high humidity can last for*

1 *days at a time. The highest light extinction occurs during this period, also.*
 2 *Episodes of high light extinction also occur in spring and summer, sometimes*
 3 *lasting for many days. Many of these episodes last well into the afternoon. For*
 4 *Los Angeles, the following description could apply: Most hours excluded due to*
 5 *high RH at Los Angeles occur during the morning, and are primarily in the*
 6 *spring, summer, and early fall. High light extinction periods occur at all times of*
 7 *the year, but are more frequent in the spring and summer. These periods*
 8 *generally last all day. Each city has some characteristics that could be described*
 9 *more fully; this would more completely establish the conditions of high RH and*
 10 *light extinction in different urban areas of the country.*

11 The extinction budgets shown in Figure 3-13 are very helpful in explaining the
 12 causes of poor VAQ in the different cities. I particularly like the separate displays
 13 of the top 10% of days and the top 10% of individual daylight hours. The staff
 14 interpretation of these plots is very good.

15 I question the high contribution to light extinction at Los Angeles from coarse PM
 16 during two of the top 10% of days. Having done considerable data validation of
 17 IMPROVE data, I can attest to the possibility of invalid values entering the
 18 database. I also know that hourly concentrations can be quite high under the right
 19 conditions, but such extreme values warrant further investigation of their validity.
 20 The explanation that the coarse PM is determined in part from measurements at
 21 Victorville could well explain the high values, and would make these values
 22 suspect for use at Los Angeles. There is no doubt that coarse PM measured at
 23 Victorville would be unrepresentative of coarse PM at Rubidoux, and especially
 24 in the wider South Coast Air Basin.

25 I have a few comments relating to particular sections of the assessment, and a few
 26 editorial comments that I'll list separately. First, the comments:

Page	Line	Comment
3-16		No suggestions – just a comment that this is an excellent description.
3-21	36-27	Sea salt is an important contributor at coastal sites. This may be a source of uncertainty in the light extinction calculation at these sites.
3-25	31-36	The approach described here has other sources of uncertainty that should be mentioned. Relying on mass closure to determine the hourly organic carbon assumes that all other species are accurately determined. This is problematic for nitrate, as pointed out just a few paragraphs earlier, and it leaves out sea salt that is an important contributor to mass at coastal sites. These factors should be mentioned as areas of uncertainty that are introduced by this method.
3-26	14-15	Setting negative values to zero introduces a bias in the results. There is inherent uncertainty in both PM ₁₀ and PM _{2.5} measurements. During periods of very low coarse mass, the PM ₁₀ and PM _{2.5} measurements are very close, and their uncertainties may cause the PM _{2.5} measurement to be higher than the PM ₁₀ measurement. It's important to retain negative

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		values as a measure of the uncertainty during low coarse mass periods.
3-32, 3-33		I have grave doubts about the outlier concentrations in these plots, particularly for Los Angeles and St. Louis. I have seen many cases of invalid high mass measurements of filter while performing data validation of IMPROVE samples. I have no doubt that there are high hourly PM concentrations for short periods, but the extreme values shown, coupled with the caveats mentioned, cast doubt on their validity.

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I have the following suggestions for editorial changes in the document.

3

The Table of Contents is hard to read with the mix of all caps and mixed case font that is currently used. I suggest making Level 1 all caps, Level 2 small caps or mixed case, and Level 3 mixed case. This would more effectively set off the major and minor sections of the document in the Table of Contents. The appendices are good as they are.

8

In the list of acronyms/abbreviations, the description for IMPROVE should have an “s” at the end, i.e. “Interagency Monitoring of Protected Visual Environments”. The description of NARSTO is out of date. It was originally the North American Research Strategy for Tropospheric Ozone, but is now just NARSTO. This could be noted in the description. For SMOKE, “Kernel” is misspelled.

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Other editorial suggestions:

Page	Line	Suggestion
1-1	5	Change to “...which are to reflect accurately...”
2-11	15	“Visibility” in the graph heading is misspelled
2-20	8	I suggest using different colors or symbols in Figure 2-11. These are the same as are used in Figure 2-10, but they have different meanings. It would be a good idea to review all graphics with this in mind, in particular those that are adjacent to each other.
2-28	15	Do you mean to say “insignificant” as written, or “significant”? It looks to me as if this term is significant.
2-30	13	Change “it” to “is”
3-19	1	For some reason this line that ends a sentence appears as a heading in the Table of Contents. Please correct this.
3-32	12-13	Do you mean to say section 3.3.1? I can’t find the referenced step in section 3.4.1.
3-33		Figure 3-7 might be better using a logarithmic scale on the y-axis. The linear scale compresses the bulk of the data to the point that differences between the cities are not distinguishable. A logarithmic scale would show the outliers and still allow the lower values to be observable.

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Page	Line	Suggestion
3-35	16-17	It looks like the references to Figures 3-8b and 3-8a are reversed.
3-36	3	Fresno is listed as a city without a preference for morning high PM light extinction. The figures in Appendix E indicate otherwise. There are other cities that show such a preference that aren't listed here.
3-37		There is no units label on Figure 3-8. I assume it should be Mm^{-1} , but it should be on the graph.
3-44	31	Remove the first "a"
3-44	32	Change "than" to "that"
3-62	31	Change the comma to a semicolon
3-63	10 and 23	Remove "of" after "as high as"
3-63	25	End the sentence with a period
4-7	44	Change to "...in <u>one</u> or more..."
4-10	3	Figure 4-2 should be a square plot so the units have equivalent length on the x- and y-axes.
4-11	15	Table 4-4 says Dallas meets the 15/35 NAAQS, not Salt Lake City.
4-11	30	Table 4-5 should be the next one in sequence.
4-15, 4-16		The scale on Figures 4-3(a) and (b) is very high. Why? It compresses the bulk of the data and makes it difficult to see the differences between the cities.
App. F		The comments for Figure 4-3 also apply to the figures in Appendix F.
G-1	Para. 3	In the second line, change to "...prior to the their exclusion."
I-1	Para. 3	I believe the references to "top of figure" and "bottom of figure" should be interchanged.

1 **Comments from Dr. David Grantz:**

2 **3-16-10**

3 **Urban-Focused Visibility Assessment, Second External Review Draft**

4 **Charge Question 1) Level of detail provided in the body of the report and**
5 **appendices and suggestions regarding organization of the document.**

6 This review draft of the UFVA appears to be of appropriate length and complexity, with
7 very few exceptions. Staff is to be commended for preparing an excellent document.

8 Chapter 2 may contain more information than is required with respect to the individual
9 cities. Much of this material could be moved to the Appendices. The memo of 2/3/2010
10 on the statistical analysis of the preference studies could also be placed in the
11 Appendices, and consolidated with related material from Chapter 2 to avoid redundancy.
12 Similarly, much of the material in sections 4.1.3 and 4.1.4 might be better suited to an
13 Appendix. In any case, the transition into future monitoring site characteristics (middle of
14 page 4 – 2) is rather abrupt.

15 **Charge Question 2) Contribution of the logit analysis.**

16 I remain concerned that despite the abundant statistical analysis of visual preference data
17 performed since the first external review draft, the amount of data is simply insufficient
18 to determine what level of air quality/visibility may be acceptable nationwide. The most
19 important conclusions from these preliminary studies are the closely related concepts that
20 (1) the range of haziness views presented to panelists is important, as suggested by Smith
21 and Howell, and (2) that there may be true regional differences in expected air quality,
22 due to the range of visibility to which residents have become accustomed. This is
23 considered explicitly at the bottom of page 2 – 30, although it may be premature to
24 attempt to identify the reasons for these differences. This has significant policy
25 implications. While the agency has every reason to move forward on this, these results
26 should be flagged throughout as tentative and subject to further research.

27 **Charge Question 4) All daylight versus maximum daily 1-hour indicators.**

28 The distinction between all daylight hours and maximum daily 1 hour indicators is not
29 made completely clear in the document. This could be defined more definitively
30 somewhere early in the text. In general, the abundant consideration of various indicators
31 and end points is useful and probably unavoidable.

32 **Other editorial points.**

33 The definition of haziness in deciview units and light extinction in inverse mega meters
34 on page 1 -- 6 is useful and well presented. However, visual range is used later in the
35 document (first appearing on page 1 – 10) but is not defined here. Explanation of the
36 utility of each parameter would help the narrative. While visual range may be most
37 intuitive to many readers, it is dropped on page 1 – 15, in favor of explicit definition of
38 CPLs in terms of light extinction. For general readability, explicit interconversion
39 between the different measures could be carried through the document.

40 Page 1 – 13, lines 4 - 8: The relationship between organic compounds, carbon mass, and
41 air mass aging needs to be better explained here.

42 Page 1 – 14, line 35: “indictor” or should be “indicator”

43 Page 3 – 44, line 32. “such than average” should be changed to “such that average”.

44 **Figures**

1 Maps, Page 3 – 2. It is disconcerting to find Alaska, Hawaii, and Puerto Rico lumped
2 into the Gulf of Mexico. There may be room off the Pacific and Atlantic coasts,
3 respectively, if the legend were placed in the Gulf.
4 Figure 3 – 9, Page 3 – 40. The X axis labels are unclear.
5
6

1 **Comments from Dr. Philip Hopke**

2
3 Hopke: Responses to the Charge Questions
4
5

- 6 1) In general, what are the Panel's views on the level of detail provided in the body of the
7 report and associated appendices? Does the Panel agree that all of this information is
8 useful to retain or is there material that the Panel would recommend deleting? Does the
9 Panel have any suggestions regarding the organization and distribution of information
10 throughout the document and in the appendices?
11

12 Yes, it is long and somewhat dry, but its completeness and detail are useful particularly given
13 that we are looking at a very different indicator for this secondary standard. It is not obvious
14 to me that alternative organization or distribution of the information would be more
15 informative to the reader.
16
17

- 18 2) In the Panel's view, to what extent does the logit analysis presented in Chapter 2 of the
19 second draft Visibility Assessment and further expanded and described in the
20 supplemental memorandum add value to the urban visibility preference study analysis
21 and provide additional support for combining and comparing the results from the four
22 cities, as shown in Figure 2-16? What are the Panel's views on the clarity and adequacy
23 of the descriptions associated with such a combined assessment and on the conclusions
24 that can be drawn from the assessments? Please provide comments on any additional
25 insights that might be drawn from these analyses or on any additional caveats that should
26 be considered.
27

28 The logit analysis is useful in exploring these data. One point that is not adequately made
29 regarding the Washington studies is that the DC photo is significantly different from the
30 others in the lack of significant scenic features at a distance. There is a brief mention of this
31 on the top of page 2-31 and only in comparison to Denver. However, all of the other studies
32 have mountains some tens of miles from the point of view. I suspect that the lack of a distant
33 object has significantly biased the acceptable level values upward. In fact the distance to the
34 background features might well be a key factor in the acceptability ratings. Has there been an
35 effort to look at the relationship between the 50% acceptability level and the maximum
36 distance to visible objects in the pictures? That might be informative.
37
38

- 39 3) What are the Panel's views on the extent to which the analysis of the frequency of co-
40 occurrences of hourly relative humidity values below and above 90 percent with other
41 meteorological events such as rain or fog (Chapter 3, section 3.3.5; Table 3-6) provides
42 scientific support for consideration of how to address relative humidity in defining the
43 form of a standard based on a PM light extinction indicator?
44

45 This section seemed adequate.
46
47

1 4) In response to CASAC recommendations, descriptions of current conditions and results
2 of just meeting NAAQS scenarios that considered all daylight hours were added to those
3 based on maximum daily 1-hour indicators. The 98th percentile form was also included
4 along with the 90th and 95th percentiles. Tile plots of hourly PM light extinction (Figure 3-
5 12) and composition bar graphs of the top 10% of days for maximum daily 1-hour and
6 aggregated individual daylight hours (Figure 3-13) were shown in part to help illuminate
7 the similarities and differences between these various indicators with respect to current
8 conditions. Similarly, additional figures and table entries were generated to illustrate the
9 characteristics of various PM light extinction NAAQS scenario forms (Tables 4-2, 4-3, 4-
10 5, and 4-7; Figures 4-1 through 4-3).

11
12 What are the Panel's views regarding EPA staff interpretations of these displays included
13 in the text? Are there supplemental or alternative interpretations the Panel would suggest?
14 Are there additional approaches the Panel would suggest regarding ways to summarize,
15 display, or assess the results of these analyses, including similarities and differences
16 between the various scenarios?

17
18 I would suggest there be more exploration of what if any potential problems would arise
19 if there would be for a PM_{2.5} visibility standard only. There are substantial advantages
20 to establishing monitoring systems for fine particle scattering (nephelometers) that would
21 avoid the difficulties of the predominately forward scattering by coarse particles. In most
22 locations, it is likely that a PM_{10-2.5} primary standard could reduce the effect of this
23 fraction on extinction to the point where it is not a significant part of the visibility
24 problem. Such an approach would be easier to implement on both a monitoring and
25 implementation basis.

1 **Comments from Mr. Rich Poirot:**

2
3
4 **Review Comments on 2nd Draft January 2010 PM UFVA, R. Poirot, 2/4/10**

5
6 I thought the first draft UFVA was well done, especially considering the limited time
7 schedule and complexity of the required calculations. In the second draft, EPA staff has
8 been very responsive to CASAC recommendations, adding a detailed logit analysis to
9 better understand similarities and differences in the urban visibility preference studies,
10 recalculating estimated extinction levels using a 90% RH screen, and considering (90th,
11 95th and 98th) percentiles based on all available daylight hours as well as based on the
12 single worst daylight hour in each day. These additions represent a substantial body of
13 new work, again conducted in a very limited time period, and as before the additional
14 calculations and results are explained, compared and illustrated in clear detail.

15
16 The UFVA presents logical and persuasive arguments for use of a PM light extinction
17 indicator with a 1-hour (daylight) averaging time as a sound basis for a secondary PM
18 standard to protect visibility. The UFVA also presents reasonable ranges for the level
19 (20 to 30 deciviews) and form (90th to 98th percentile) that such a standard might take,
20 and clearly illustrates the differences among the many resulting optional combinations in
21 terms of the protectiveness and/or stringency across the 15 diverse urban areas selected
22 for this analysis.

23
24 I don't believe that any major revisions are required in this second draft, and that the
25 methods employed here – if not some of the specific calculations – would make a sound
26 basis for recommending and comparing optional ranges of a secondary PM light
27 extinction standard in the upcoming Policy Assessment document.

28
29 **1) In general, what are the Panel's views on the level of detail provided in the body of**
30 **the report and associated appendices? Does the Panel agree that all of this**
31 **information is useful to retain or is there material that the Panel would recommend**
32 **deleting? Does the Panel have any suggestions regarding the organization and**
33 **distribution of information throughout the document and in the appendices?**

34
35 While a substantial level of detail has been provided in the UFVA, many of the calculations
36 included here are very complex, and a fairly wide range of optional combinations of levels
37 and forms are presented and compared. I think the level of detail provided is appropriate in
38 relation to the level of complexity and the range of options considered, allowing the
39 "interested reader" to understand just exactly how the many calculations have been made,
40 and often providing several different views for "seeing" the results in several different
41 contexts. For the "disinterested reader" there are several summary tables toward the end
42 which condense most of the varied results to a single page or two. I don't believe the
43 document could be better organized or more succinctly written.

44
45 **2) In the Panel's view, to what extent does the logit analysis presented in Chapter 2 of**
46 **the second draft Visibility Assessment and further expanded and described in the**
47 **supplemental memorandum add value to the urban visibility preference study**

1 **analysis and provide additional support for combining and comparing the results**
2 **from the four cities, as shown in Figure 2-16? What are the Panel's views on the**
3 **clarity and adequacy of the descriptions associated with such a combined**
4 **assessment and on the conclusions that can be drawn from the assessments? Please**
5 **provide comments on any additional insights that might be drawn from these**
6 **analyses or on any additional caveats that should be considered.**

7
8 The logit analysis presented in chapter 2 helps in more clearly quantifying and understanding
9 the similarities and differences among results from the 4 urban visibility preference studies.
10 The associated discussion of the logit results and consideration of alternative hypotheses for
11 the differences and similarities across the different study areas (and different study
12 approaches) are also helpful. While the resulting 20 to 30 deciview range of visual air
13 quality levels meeting a 50% acceptability criteria, remains rather broad, I doubt that much
14 more can be learned or that this range could be substantially reduced by additional analyses
15 of these limited results, and think that selecting a level or levels from within this 20 to 30 dv
16 range is well justified for the initial establishment of a secondary PM standard. Additional
17 studies using consistent methods and conducted over a range of different kinds of urban areas
18 and different views will help refine this range in the future.

19
20 **3) What are the Panel's views on the extent to which the analysis of the frequency of**
21 **co-occurrences of hourly relative humidity values below and above 90 percent with**
22 **other meteorological events such as rain or fog (Chapter 3, section 3.3.5; Table 3-6)**
23 **provides scientific support for consideration of how to address relative humidity in**
24 **defining the form of a standard based on a PM light extinction indicator?**

25
26 Eliminating hours when RH exceeds 90% is a good idea - for conducting this assessment as
27 well as for specifying conditions for and determining compliance with a secondary PM light
28 extinction standard. The analysis presented in the 2nd draft UFVA provides a compelling
29 demonstration that a 90% RH screen can efficiently eliminate periods when "natural"
30 visibility-impairing weather events are occurring, and when PM light extinction is not likely
31 to be the predominant cause of impaired visibility. The spatial (& temporal) variability of
32 RH and weather (& PM species) are important related issues, in that there may be natural
33 weather event impairing visibility along the sight path but not observed at the location of the
34 RH (or PM or PM light extinction observation). I don't think its warranted here, but it might
35 be possible to explore this possibility a bit by considering the RH and weather observations at
36 a range of stations within say a 30 mile radius and looking for co-occurrences of RH above or
37 below 90% and weather events across all the sites.

38
39 In addition to screening out weather events, there are other benefits of employing this RH
40 screen. It will help avoid any public perception, however faulty, that the regulatory metric is
41 influenced by uncontrollable weather events. RH can be difficult to measure, especially at
42 high levels, such that an indicated RH of 90% may actually be significantly higher (or lower)
43 than that. The hygroscopic growth curve gets very steep at high humidity such that a small
44 error in the RH or (sulfate or nitrate) PM species measurement or in its spatial or temporal
45 representativeness of the actual (or in the case of this assessment, estimated) extinction
46 throughout the site path could result in a large error in estimated extinction, or in the
47 visibility relevance of extinction measured at a single location. An RH screen might also
48 allow for measurement options such as adding a "smart heater" to a nephelometer that would
49 only kick in at high RH but would prevent larger water droplets from entering and soiling the

1 measurement chamber, reducing instrumental maintenance costs, and promoting better data
2 quality and capture efficiency.

3
4 Screening out the higher RH values will slightly “dry out” the regulatory metric, eliminate
5 some of the highest (but most uncertain) periods of estimated and measured PM extinction,
6 shift the distribution downward and reduce, somewhat, the differences between East and
7 West. It would also limit the extent to which the influences of hygroscopic sulfate and nitrate
8 species are enhanced relative to the other PM species. At 95% RH the extinction efficiencies
9 of ammonium sulfate and ammonium nitrate would be more than 22 m²/g, compared to
10 efficiencies of 10 m²/g for EC, 4 m²/g for organic matter, 1 m²/g for fine soil and 0.6 m²/g for
11 coarse particles. At 90% RH the maximum extinction efficiencies of ammonium sulfate and
12 ammonium nitrate would be limited to 12.5 m²/g. This would be an “artificial” limit, and
13 there will likely be hours of very poor visibility when natural weather is not the cause which
14 will not be considered with this RH screen, but I think it’s use is well justified for the other
15 reasons indicated above, and that there are other benefits associated with having a slightly
16 dryer and more stable regulatory metric.

17
18 **4) In response to CASAC recommendations, descriptions of current conditions and**
19 **results of just meeting NAAQS scenarios that considered all daylight hours were**
20 **added to those based on maximum daily 1-hour indicators. The 98th percentile form**
21 **was also included along with the 90th and 95th percentiles. Tile plots of hourly PM**
22 **light extinction (Figure 3-12) and composition bar graphs of the top 10% of days for**
23 **maximum daily 1-hour and aggregated individual daylight hours (Figure 3-13) were**
24 **shown in part to help illuminate the similarities and differences between these**
25 **various indicators with respect to current conditions. Similarly, additional figures**
26 **and table entries were generated to illustrate the characteristics of various PM light**
27 **extinction NAAQS scenario forms (Tables 4-2, 4-3, 4-5, and 4-7; Figures 4-1 through**
28 **4-3).**

29
30 **What are the Panel’s views regarding EPA staff interpretations of these displays**
31 **included in the text? Are there supplemental or alternative interpretations the Panel**
32 **would suggest? Are there additional approaches the Panel would suggest regarding**
33 **ways to summarize, display, or assess the results of these analyses, including**
34 **similarities and differences between the various scenarios?**

35
36 I think applying the 90% RH screen, including a higher (98th) percentile form and
37 considering an alternative way of calculating percentiles – based on all daylight hours ,
38 rather than just the worst hour in a day – were valuable additions to the UFVA. When
39 these are combined with other options including 90th and 95th percentiles, different levels
40 (64, 112, 191 Mm⁻¹) of a secondary standard and assuming attainment of different levels
41 of a primary standard (15/35, 12/25 ug/m³), the many resulting options are complex and
42 difficult to communicate and compare. I think the UFVA does an excellent job of
43 presenting this information as clearly as possible.

44 I think the tile plots are very informative (not to mention beautiful!) and really help show
45 the seasonal and diurnal patterns and similarities and differences across the different
46 study areas. They also help show that the effect of the 90% RH screen tends to often be
47 elimination of the first few early morning hours when fog is most likely and when its

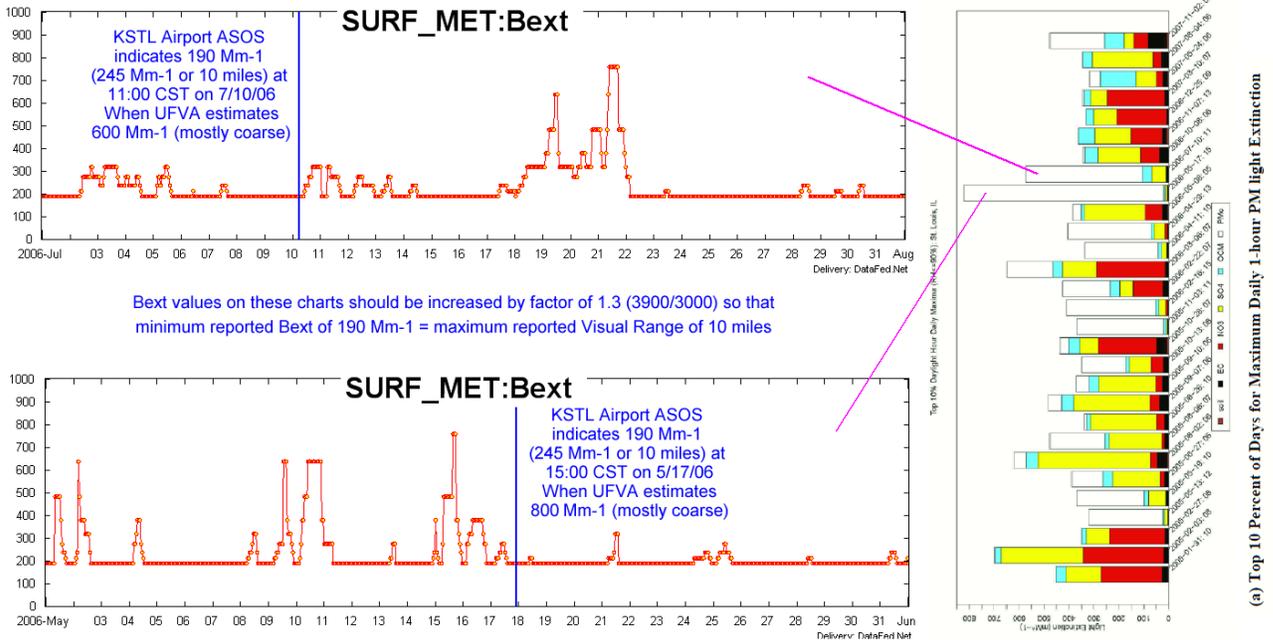
1 most difficult for human observers to discern the differences between natural and
2 manmade effects, and provide added confidence that the use of this screen is appropriate.
3 The plots of maximum hourly extinction on top 10% days vs. compositions on top
4 percentiles considering all daylight hours are useful for seeing differences between cities,
5 on different worst days (hours) and (to a lesser extent) for different high percentiles. I
6 think the accompanying interpretation and discussion are reasonable and informative. I
7 don't these graphs necessarily make for an effective direct comparison or evaluation of
8 whether percentiles calculated from the single worst hour of each day would be a better
9 regulatory metric. Personally, I think I prefer using all daylight hours to only using the
10 worst single hour each day, since I think a day that's hazy all day long is more
11 objectionable than one where its hazy for just one humid hour just after sunrise. I also
12 don't think there are many 1-hr control strategies, especially for SO_x and NO_x (and
13 NH_x) sources, which I think get additionally emphasized by the single worst hour
14 approach, with a consequent relative de-emphasis of carbonaceous pollutants. I also
15 imagine that using all daylight hours would produce a more stable and somewhat dryer
16 metric, reducing, somewhat, the differences between East and West. I think this could be
17 important if the Agency finds it necessary to employ a traditional fixed "threshold-based"
18 approach for the secondary NAAQS, rather than the "progress-based" approach
19 recommended by the PM panel as scientifically preferable, and a conceptual approach to
20 consider during implementation – even though it may not currently be a practical option
21 for the Agency.

22 Possibly it would be informative to present side by side bar graphs showing an average of
23 the compositions on the worst 10%, 5% and 2% hours calculated using the 2 different
24 approaches. Are the compositions really much different? Would it be informative to
25 know how many days would be involved using the 2 different approaches, or perhaps to
26 consider the days or kinds of pollution events that tend to get considered in one approach
27 but not the other?

28 Certain aspects of the discussion seem directed toward supporting the original worst hour
29 of day approach – for example a repeated observation that the 98th percentile using all
30 daylight hours is not much different from the 98th percentile using worst daylight hours
31 and expressing the results of both approaches in Table 4.7 in units of single worst hour of
32 day. As indicated, I think I conceptually prefer the all-hours approach but think it would
33 be useful to see more clearly what the differences are. I don't think this is needed in the
34 Risk Assessment, but maybe the Policy Assessment could explore these options in more
35 detail.

36 **Other Comments:**

1 As indicated in comments on the 1st draft UFVA, I am very suspicious of the results for
 2 St. Louis and especially the extremely high coarse mass concentrations there – which
 3 often dominate the reconstructed extinction estimates during the haziest hours. I note that
 4 the 2 estimated haziest hours at STL for which the estimated coarse mass is the major
 5 contributor to extinction are 7/10/06 at 11:00 (estimated extinction of about 600 Mm^{-1})
 6 and 5/17/06 at 15:00 (estimated extinction of about 800 Mm^{-1}). However, the ASOS
 7 visibility data from the STL airport (15 miles from downtown) indicates visibility was 10
 8 miles or greater (Bext was 245 Mm^{-1} or less) during both of these time periods. I
 9 suggest discarding the STL estimates, or using other PM_{10} and $\text{PM}_{2.5}$ data for making



10 these estimates. Note that these Bext data were extracted from the Datafed.net system, in
 11 which a Koschmeider constant of 3000, rather than 3912 was used (incorrectly, I think) to
 12 convert the visual range data to extinction.
 13