Preliminary Comments from Members of the
Independent Particulate Matter Review Panel

on

EPA’s Policy Assessment for Review of the National Ambient Air
Quality Standards for Particulate Matter (External Review Draft –
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EPA-1. Chapter 1 – Introduction: To what extent does the CASAC find that the information in Chapter 1 is clearly presented and that it provides useful context for the review?

Chapter 1 provides a useful starting point. The depiction of particle sizes in Figure 2-1 does not provide information with regard to why particle size might be important. A discussion of the role of particle size on lung deposition would be appropriate and would provide context for the later discussion of health effects of PM as a function of size. A diagram would be useful and could be discussed later as one talks about the differences between coarse and fine PM.

EPA-2. Chapter 2 – PM Air Quality: To what extent does the CASAC find that the information in Chapter 2 is clearly presented and that it provides useful context for the review?

SCQ-2.1 What are the panel’s views regarding whether the draft PA accurately reflects and communicates the air quality related information most relevant to its subsequent evidence-based assessment of the health and welfare effects studies, including uncertainties, as well as the development of the risk assessment for current and alternative standards? In particular, do the following sections accurately reflect and communicate current scientific understanding, including uncertainties, for: (a) relationships between annual and daily distributions of PM; (b) the review of hybrid modelling approaches used to estimate exposure in some studies and the risk assessment; and (c) information on background levels of various PM indicators?

The discussion of the relationships between daily and annual distributions of PM would have benefited from some integration with potential mechanisms of toxicity. Many of the disease-causing or exacerbating processes induced by PM exposures is related to formation of free radicals and the development of oxidative stress and inflammation. While in healthy individuals there are innate defenses against oxidative stress, One reason to be concerned with short term peak exposures is that normal defenses can be overwhelmed (i.e. antioxidants can be consumed faster than they can be replenished) and the un-neutralized free radicals can injure tissues
and organs. In the California Bay Area there were 13 occasions for which the daily average was below the NAAQS of 35 \( \mu g/m^3 \) but there were 1 hr peak concentrations greater than 3 times the NAAQS, ranging from 113 TO 415 \( \mu g/m^3 \) (mean concentration = 197 ± 102). These days were distributed over various stations in the Bay area and the interval was Feb to November 2018. Thus, on days when the 24hr concentration was within the NAAQS people were exposed for at least 1 hr to PM2.5 concentrations that were equivalent to the levels used in controlled human studies, documented in Table 3-1 from the PA. Note that November 2018 was a severe fire month and there were several days above the NAAQS 24 hr standard and 1 hr concentrations exceeding 105 \( \mu g/m^3 \), but the other months with high 1 hr peak exposures were most likely not fire-related.

### Table 3-2. Summary of information from PM2.5 controlled human exposure studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Exposure Details (average concentration; duration)</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brauner et al., 2006</td>
<td>Healthy adults</td>
<td>10.5 ( \mu g/m^3 ) PM2.5 (unfiltered) vs below detection (filtered); 24 h</td>
<td>No significant effect on markers of vascular function</td>
</tr>
<tr>
<td>Hemmingsen et al., 2015a, 2015b</td>
<td>Healthy, overweight older adults</td>
<td>24 ( \mu g/m^3 ) (unfiltered) vs 3.0 ( \mu g/m^3 ) (filtered) Copenhagen PM; 5 h</td>
<td>Impaired vascular function and altered heart rate variability; no significant changes in blood pressure or markers of inflammation or oxidative stress</td>
</tr>
<tr>
<td>Ureh et al., 2010</td>
<td>Non-asthmatic and mild asthmatic adults</td>
<td>64 ( \mu g/m^3 ) CAP (lower exposure); 2 h</td>
<td>No significant change in blood markers of inflammation or oxidative stress</td>
</tr>
<tr>
<td>Huang et al., 2012</td>
<td>Healthy adults</td>
<td>90 ( \mu g/m^3 ) CAP; 2 h</td>
<td>No significant changes in heart rate variability</td>
</tr>
<tr>
<td>Devlin et al., 2003</td>
<td>Healthy older adults</td>
<td>99 ( \mu g/m^3 ) CAP; 2 h</td>
<td>Decreased heart rate variability</td>
</tr>
<tr>
<td>Hazucha et al., 2013</td>
<td>Adult current and former smokers</td>
<td>109 ( \mu g/m^3 ) CAP; 2 h</td>
<td>No significant changes in markers of inflammation or coagulation</td>
</tr>
<tr>
<td>Ghio et al., 2000</td>
<td>Healthy young adults</td>
<td>120 ( \mu g/m^3 ) CAP; 2 h</td>
<td>Increased fibrinogen (coagulation)</td>
</tr>
<tr>
<td>Ghio et al., 2003</td>
<td>Healthy young adults</td>
<td>120 ( \mu g/m^3 ) CAP; 2 h</td>
<td>Increased fibrinogen; no significant effect on markers of inflammation</td>
</tr>
<tr>
<td>Ureh et al., 2010</td>
<td>Non-asthmatic and mild asthmatic adults</td>
<td>140 ( \mu g/m^3 ) CAP (higher exposure); 2 h</td>
<td>Increased blood inflammatory markers</td>
</tr>
<tr>
<td>Brook et al., 2009</td>
<td>Healthy adults</td>
<td>149 ( \mu g/m^3 ) CAP; 2 h</td>
<td>Impaired vascular function, increased blood pressure; no significant change in markers of inflammation (compared to filtered air)</td>
</tr>
<tr>
<td>Ramanathan et al., 2016</td>
<td>Healthy adults</td>
<td>149 ( \mu g/m^3 ) CAP; 2 h</td>
<td>Decreased anti-oxidant/anti-inflammatory capacity when baseline capacity was low</td>
</tr>
</tbody>
</table>
**EPA-3. Chapter 3 – Review of the Primary PM$_{2.5}$ Standards:** What are the CASAC views on the approaches described in Chapter 3 to considering the PM$_{2.5}$ health effects evidence and the risk assessment in order to inform preliminary conclusions on the primary PM$_{2.5}$ standards? What are the CASAC views regarding the rationales supporting the preliminary conclusions on the current and potential alternative primary PM$_{2.5}$ standards?

**SCQ-3.1** Does the panel find that the questions posed in this chapter appropriately reflect the important policy-relevant issues for the PM$_{2.5}$ review? Are there additional policy-relevant questions that should be addressed?
The question of the importance of short term standards is one that deserves additional consideration. In fact the human controlled exposures suggest that a shorter term (1 hr?) acute standard might have some protective value.

Based on the discussion for 2.1, the controlled human studies, which found significant cardiovascular effects should be considered as relevant to actual exposures and taken into stronger consideration with respect evaluating the adequacy of the current NAAQS levels.

**SCQ 3.3** What are the panel's views on the evidence-based approach, including: The preference for continuing the use of an annual PM$_{2.5}$ standard as the principle means of providing public health protection against the bulk of the distribution of short- and long-term PM$_{2.5}$ exposures?

The use of the annual standard to protect against short and long term exposure health effects may not be the best approach, from the standpoint of biological mechanisms. As stated earlier, many of PM's health effects are subsequent to formation and release of free radicals leading to oxidative stress and inflammation. These are hallmarks of heart diseases, lung diseases, cancer and degenerative nerve diseases. While in healthy individuals there are innate defenses against oxidative stress, short term peak exposures can overwhelm the normal immunological defenses (i.e. antioxidants can be consumed faster than they can be replenished) and the un-neutralized free radicals can injure tissues and organs. This could be especially true in people with impaired immunity, people with pre-existing diseases, the very young and the elderly.

**SCQ-3.5** What are the panel's views on the draft PA preliminary conclusion that, taken together, the available scientific evidence, air quality analyses, and the risk assessment can reasonably be viewed as calling into question the adequacy of the public health protection afforded by the current primary PM$_{2.5}$ standards?

The evidence and discussion consistently demonstrate that the current standards do not provide an adequate margin of safety to prevent health effects. It should be noted that while the weight of evidence for PM's effects cardiovascular disease causation is stronger than that for pulmonary disease, having an impaired pulmonary system will put significant extra load on the cardiac system and could be a contributing factor to the ultimate cause of death, i.e. cardiac-related disease.

**GC-1.** What scientific evidence has been developed since the last review to indicate if the current primary and/or secondary NAAQS need to be revised or if an alternative level or form of these standards is needed to protect public health and/or public welfare? Please recommend to the Administrator any new NAAQS or revisions of existing criteria and standards as may be appropriate. In providing advice, please consider a range of options for standard setting, in terms of indicators, averaging times, form, and levels for any alternative standards, along with a description of the alternative underlying interpretations of the scientific evidence and risk/exposure information that might support such alternative standards and that could be considered by the Administrator in making NAAQS decisions.
Shorter averaging times (1 hr ?) to protect against acute health effects (sudden cardiac death, acute asthma attacks)

**GC-2.** Do key studies, analyses, and assessments which may inform the Administrator’s decision to revise the NAAQS properly address or characterize uncertainty and causality? Are there appropriate criteria to ensure transparency in the evaluation, assessment, and characterization of key scientific evidence for this review?

There are appropriate criteria that are relevant to any scientific endeavor. Thorough documentation of methods and approaches, documentation of quality control and quality assurance, rigorous, objective analysis of the data are all necessary. The studies that were discussed in the documents were evaluated and selected because they were quality science.

**GC-3.** Are there areas in which additional knowledge is required to appraise the adequacy and basis of existing, new, or revised NAAQS? Please describe the research efforts necessary to provide the required information.

New areas of health effects studies and new assessment methods are continuing to evolve. Evaluation and characterization of “hot spots” of high exposure, especially where those areas can be identified with impacts from local sources are needed.

**GC-4.** What is the relative contribution to air pollution concentrations of natural as well as anthropogenic activity? In providing advice on any recommended NAAQS levels, please discuss relative proximity to peak background levels.

Recent laboratory studies have demonstrated that natural organic vapors when combined with atmospheric photochemical processes and anthropomorphic combustion gases (NOx) form particles that are more toxic than secondary organic particles formed in the absences of the human pollutants. Some future attention to these could be warranted.