

AECOM Environment

2 Technology Park Drive, Westford, MA 01866
T 978.589.3000 F 978-589-3374 www.aecom.com

Memorandum

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To: Dr. Holly Stallworth,
Designated Federal Officer (DFO)
EPA Science Advisory Board
Clean Air Scientific Advisory Committee (CASAC)

From: David Heinold, CCM and Robert Paine, CCM, QEP
on behalf of the American Petroleum Institute

Subject: **Public Comments on the PM NAAQS: Scope and Methods Plan for Urban Visibility Impact Assessment (Welfare Assessment Plan)**

AECOM Environment has reviewed EPA's *Particulate Matter NAAQS: Scope and Methods Plans for Urban Visibility Impact Assessment*, which in part will be the subject of the April 1 and 2, 2009 meeting of CASAC. AECOM's focus for this review has been the aspects related to characterization of urban visibility. Our comments on EPA's planned study are provided below.

1. Several Other EPA Programs Will Address Urban Visual Air Quality

The previous NAAQS secondary standard PM review identified the limited nature of urban visibility preference studies for western urban areas with scenic mountain backdrops as a source of "critical uncertainty". Rather than an uncertainty, however, the use of these western surveys as a benchmark of public preferences results in a bias toward more pristine environments than would be considered by city dwellers in other parts of the country.

This difference is due in part due to background visual range, scenic vistas and cultural aspects. To develop a more complete cross-section of personal preferences, EPA plans to conduct interviews and focus groups in eastern cities as part of the Urban Visual Air Quality (VAQ) Preference Assessment. In this evaluation, it seems clear that most people would indicate a preference to clearer view, such that almost any degree of visibility that can be noticed would not be preferred by most individuals. Some studies (see, for example, a Canadian study at http://www.env.gov.bc.ca/air/airquality/pdfs/visibility_goal_report_final.pdf) have indicated that a broad-based goal for visibility improvement in urban areas would include the following components:

- Limit the number of poor visibility days;
- Increase or maintain the number of excellent visibility days; and
- Improve visibility on all days.

However, there are several programs and initiatives already underway that will result in better urban visibility, so it is not clear why an additional, somewhat poorly defined program will also be needed. These programs and initiatives include the following partial list:

- The Regional Haze Rule (RHR) has the goal of “natural conditions” in Prevention of Significant Deterioration (PSD) Class I areas by the year 2064. An initial milestone of substantial progress by the year 2018 will result in considerable visibility improvement in all areas of the United States, including urban areas everywhere.
- The Best Available Retrofit Technology program that is part of the first RHR milestone is resulting in substantial emission reductions of visibility-affecting (and deposition-affecting) pollutants such as SO₂ and NO_x from large emission sources put into operation during the period of 1962-1977.
- In the Eastern United States, initiatives such as the NO_x SIP call have led and will lead to improvements in visibility.
- For New Source Review, the use of Best Available Control Technology (BACT) in attainment areas and Lowest Achievable Emission Rate (LAER) in nonattainment areas has resulted in very low visibility impacts for new emission sources, and a gradual improvement in visibility as new sources replace older ones that are retired.
- Continued implementation of cleaner fuels for on- and off-road vehicles will result in further emission reductions as the fleets turn over.

Therefore, it is not clear why a separate PM_{2.5} welfare-related standard based on visibility is being proposed, especially since visibility is affected by pollutants other than just PM_{2.5} and because different species of PM_{2.5} have large variations in their impact on visibility, as discussed below.

It is also unclear on how EPA will determine a bright line for the degree of Visible Air Quality (VAQ) degradation that constitutes a welfare issue. This appears to be somewhat of an intractable problem and would require specific, but somewhat arbitrary, guidelines to be established. For example, if it is decided that VAQ should be defined where 50% of a panel indicates a WinHaze (visual software) simulation to be “objectionable”, should this be applied to the worst-case day per year, the 98th percentile day, the 90th percentile day, or some other statistical event? How should “objectionable” be defined?

2. Particulate Matter is only one of Several Variables Impacting VAQ

The premise of the visibility impact assessment is that VAQ in urban areas can be directly related to airborne particulate. In addition to particulate, in urban environments it is well known that nitrogen dioxide can be significant component to visibility degradation, contributing to the brown-yellow hue of photochemical smog. In addition, as EPA has learned from the Regional Haze Rule program, the effect of particulate concentrations on visibility is highly dependent on other factors such as:

- optical effects associated with time of day and the non-isotropic nature of Mie scattering, observer sun orientation, coloration and reflectivity of background being viewed
- particle size distribution
- speciation between hygroscopic and non-hydroscopic particulate
- relative humidity
- fraction of elemental carbon resulting in a complex index of refraction (light absorption)

Relative humidity, which is an important factor in both natural obscuration (fog and precipitation) as well as increasing the scattering from certain PM species, is a very important determinant of visibility in urban areas. Many urban areas have complicated geometries with nearby bodies of water that significantly affect visibility beyond human influences. In addition, the urban heat island can actually result in better local visibility in urban cores by lowering the relative humidity (via higher temperatures and increased runoff of surface water) and increasing the turbulent mixing due to increased heating and mechanical mixing from buildings.

Given that these parameters, some of which have nothing to do with pollutant emissions, vary to a wide degree among urban areas, a VAQ standard based on a single parameter such as 24-hour average PM_{2.5} concentration may have no useful effect. It is very likely that at a minimum, to be consistent with the Regional Haze Rule implementation, the standard would need to account not only for PM_{2.5} mass concentration, but also speciation, possibly combined with ambient concentrations of nitrogen dioxide and relative humidity. This would be a very complicated program to attempt to implement, and it would be redundant with other activities as described above.

3. There is no Precedent for Defining Policy Relevant Background (PRB) in an Urban Environment

The development of a PRB based on “natural conditions” is illogical for the purposes of establishing a secondary NAAQS for PM for highly developed urban areas. The concept of natural is based on the objective of regional haze in federal Class I areas as clarified in the 1990 Clean Air Act Amendments. The concept does not apply to setting NAAQS, because “natural conditions” as interpreted for Class I area protection are inconsistent with human habitation and associated societal activities that by nature, alter airborne PM. There is no policy regarding regulation of human activity that could be established by EPA that could totally eliminate these emissions. Furthermore, in defining PRB, EPA plans to assume, through “zero-out” modeling, that there are no anthropogenic emissions that contribute to primary or secondary PM not only in the U.S., but throughout Canada and Mexico as well (where the U.S. has no sovereignty and cannot dictate emissions). EPA’s approach also does not recognize that in remote areas, especially in the western U.S., it is well established that the prevention of naturally occurring fires can cause “natural” ambient concentrations to exceed present day PM concentrations. Rather than relying on “zero-out” modeling and no human activity to estimate natural background EPA should investigate alternative, viable approaches at developing realistic PRB concentrations.

It is important for EPA to consider that monitoring data has been considered in PRBs for other pollutants, and that it should be considered, in conjunction with modeling, for the PM_{2.5} PRB. One way to do this is to run an advanced regional model with baseline emissions and future emissions consistent with an appropriate PRB approach to develop factor adjustments to be applied to appropriately selected present day monitored PM species-dependent concentrations in order to determine what the future monitored PRB concentrations would be. In the event that the modeled concentrations indicate that the modeling tool is unreliable for one or more PM species, then reliance upon appropriate monitoring data should be seriously considered to determine the PRB.

4. CMAQ’s Limitations will Affect Attempts to Estimate PRB and “Just Meeting” Current and Alternative Secondary NAAQS

Rather than relying on measurement data and receptor modeling to estimate the fraction of “background” PM_{2.5}, EPA plans on using GeosChem to set the boundary conditions for EPA’s Community Multiscale Air Quality Modeling System (CMAQ), which will be applied only with non-anthropogenic sources for the U.S., Mexico and Canada. This “perfect model” approach relies on models that have not received extensive validation. Specifically, EPA’s plan discusses how CMAQ is incapable of accurately simulating PM concentrations in the Western U.S. and that there are issues

related to the simulation of secondary species, especially nitrates and organics, that are as yet unresolved. The use of a “relative reduction factor” approach to apply the ratio of two different modeling scenarios to a base case for each PM species would be needed to reduce the model bias problem. In addition, the understanding of “natural background” emissions is limited and somewhat speculative. Therefore, while the application of these models may possibly contribute to the understanding of PRB levels, given their biases and limitations, they should not be used in an absolute fashion. It would be useful for EPA to compare model estimates to those derived from measurement-based, e.g., receptor modeling, methods to arrive at the most scientifically sound estimate of PRB.

The plan calls for using the same assessment methods as for the PM health effects assessment using CMAQ to address just meeting current and alternative secondary NAAQS. While this is likely to be an improvement to the simple roll-up technique, the limited ability of CMAQ in being able to accurately characterize PM_{2.5} speciation during all times of the year throughout the U.S. will affect the viability of this assessment.

5. Conclusions

A review of EPA’s plan to study VAQ in urban areas raises questions as to whether it is necessary, practical, or feasible for EPA to establish a welfare-based particulate standard that protects urban visibility. The following factors contribute to this conclusion.

- Particulate matter is only one of several components that affect urban visibility, with other contributors being nitrogen dioxide and relative humidity.
- The effect of particles on visibility is highly species and size dependent. Therefore, a PM mass concentration standard would be inadequate for visibility protection.
- Many initiatives are already underway to reduce urban pollutants and, as a result, improve visibility.
- Natural conditions as defined in the 1990 Clean Air Act Amendments for visibility protection in pristine Class I areas do not apply as PRB for NAAQS review, especially for urban areas.
- Use of CMAQ to model PM species and their effect on visibility assessments is complicated by seasonally-dependent biases that have not been addressed in EPA’s plan.