Comments on Monitoring for Pb NAAQS
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The charge questions given the Subcommittee include the following general groupings.

1. Selection of sampling technology and siting:
… *sampling and analysis of Pb-TSP versus sampling and analysis of Pb-PM10.*
… *monitor for Pb-PM10 near Pb sources?*
… *"scaling factors"?*
… *appropriate to use the low-volume PM10 FRM sampler?*

Purely as sampling technology, the advantages of the lo-vol PM_{10} sampler over hi-vol TSP should be decisive. The PM_{10} FRM collects a well-characterized and replicable sample on a clean substrate that is well-suited to XRF analysis. As I noted during the call, the uniformity of the sample deposit collected by any sampler can affect the precision of XRF analyses and should be verified before a final commitment to this approach. The fact that the lo-vol sampler is automated and already widely deployed is no small additional virtue. As several CASAC and AAMM commenters have already observed, a TSP-PM_{10} scaling factor is an unnecessary distraction to the consideration of an order-of-magnitude change in the level.

EPA hesitates to adopt a 10-micron particle-size cut for Pb because ingestion of larger particles is believed a significant exposure pathway for children, the most sensitive group. The relevance of air monitoring for assessing the ingestion of ultra-coarse Pb depends on the following specific questions:
- Are the ingested particles from ongoing or historical air emissions?
- Do they arrive by air or are they tracked in by tires and shoes?

These questions lie in the areas of exposure- and risk-assessment presumably represented and actively considered by members of the CASAC Pb panel. They lie outside the areas of special expertise for which I and other members of the AAMM subcommittee were selected, so I defer to CASAC's unambiguous recommendations on sampling technology and siting.

2. Selection of analysis methods:
… *XRF an appropriate Pb-PM10 FRM analysis method?*
… *appropriate precision, bias, and method detection limit requirements for FEM?*

As the documentation notes, XRF is a relatively inexpensive and reasonably sensitive method that would also provide information on other metals of potential concern. A paper* that is currently in review at ES&T reports that the routine Pb-$PM_{2.5}$ measurements in the CSN/STN and IMPROVE networks demonstrate XRF detection limits of 5-7 ng/cm^2, corresponding to air levels of ~3 ng/m^3 for a 24h sample at 16.7 lpm. The paper defined this as the actual Pb concentration at which 95% of the observations detect Pb and report it to be significantly above blank levels.

* N.P. Hyslop and W.H. White, An Empirical Approach to Estimating Detection Limits using Collocated Data.

3. Sampling frequency options:
… if the Pb NAAQS is based on a monthly average?
… in areas of low Pb concentration?
… in areas considerably higher than the NAAQS?

One-in-six-day sampling clearly will not produce a reliable estimate of the monthly average. Determining an appropriate sampling frequency will require specification of acceptable rates for Type I and Type II decision errors, along with careful statistical modeling, and all this will be part of the DQO process that is undertaken before any new monitoring plan is finalized. During the call I asked whether there was any reason to believe that a month of high concentrations, in a year of otherwise low concentrations, is more harmful to a child's development than the same number of high concentrations scattered throughout the year. I have subsequently waded through enough of the Criteria Document to understand the prudence of considering current as well as cumulative exposures. However ingestion, where the questions of current vs. historical emissions and atmospheric transport vs. surface tracking still seem open, may not track current air concentrations.

For a given analytical method, there is little value in frequent sampling if concentrations are only marginally detectable. However I would be inclined to maintain normal sampling frequencies in any location with routinely measurable levels. As other committee members noted, at concentrations much higher than NAAQS there is a need to verify the atmospheric effects of the control measures undertaken. At concentrations well below NAAQS, we should keep in mind the possibility that next decade's Pb CASAC panel may find itself reviewing new evidence of adverse effects at levels below today's contemplated NAAQS.