To: Fred Butterfield, Designated Federal Officer
EPA SAB, Clean Air Scientific Advisory Committee (CASAC)
Ambient Air Monitoring and Methods Subcommittee (AAMM)

From: George Allen, AAMM subcommittee member, July 18, 2008

Re: Consultation on "Options for the Development of a Low Volume Lead in Total Suspended Particulate (Pb-TSP) Sampler"

The following are written comments based on the Charge Questions in the EPA OAQPS memo to the SAB dated June 15, 2008. These comments also reflect discussion during the July 14 teleconference AAMM meeting on a Consultation on "Options for the Development of a Low Volume Lead in Total Suspended Particulate (Pb-TSP) Sampler". A copy of these comments is also being sent to Dr. Ted Russell, CASAC AAMM Subcommittee Chair.

Consultation Charge Questions in **Bold**:

1. Would a low-volume Pb-TSP sampler be an improvement over the existing high-volume Pb-TSP sampler? What advantages and disadvantages do you see associated with a low-volume Pb-TSP sampler?

Yes, a low-volume Pb-TSP sampler that is properly characterized would be an improvement over the existing high-volume TSP sampler. There are few or no relative disadvantages to a low-volume TSP sampler for lead. Depending on the design and wind conditions, the low-volume TSP sampler may or may not collect less Pb than the existing high-volume TSP sampler. Normally, a low-volume TSP inlet would need rigorous wind tunnel testing per CFR 53 subpart D. But it may be possible to proceed with the low-volume TSP inlet and do testing later, since the existing high volume TSP Pb FRM sampler has never undergone any formal size characterization testing. I do not see any substantial issues with disruption of Pb trends when changing the FRM; Pb levels are likely to violate any NAAQS only near sources, and it is not a major concern to introduce a modest change in measured levels for near-source sites. It should also be noted that health effect studies do not use air lead measurements as the exposure indicator; they use blood lead levels. Thus, there is no concern with trend issues with regard to health effects.

2. What inlet designs would be best suited for a low volume Pb-TSP sampler? What designs are not appropriate for a low-volume Pb-TSP sampler?

Assuming we are limited to existing low volume designs and designs that are practical for wide deployment in state and local agency monitoring networks, there are only two choices: a modified version of the existing PM10 FRM low-volume inlet without the PM10 nozzles but with some way to trap water, or the Loo and Cork (LBL) "Bell" PM-15 design from the 1970's

that was used in the early dichotomous samplers (see photo below). Limited characterization of this inlet is in Wedding et al. (EST 11-4, April 1977). Neither of these inlets have undergone rigorous inlet aspiration efficiency tests; thus I see no obvious advantage to simply going with the existing PM10 FRM inlet. It should be noted that it is very difficult to design a low-volume TSP inlet that has reasonably consistent performance up to 24 km/h wind speeds. For practical purposes, the upper bound of any inlet that might pass the wind speed tests is no more than about 15 um aerodynamic diameter. An inlet that has a 15 um D50 cut-point at low and moderate wind speeds may be acceptable even if the cut-point drops somewhat at 24 km/h. But before proceeding with any low-volume TSP inlet design or tests, input from the health effects research community should be sought to determine if an inlet with the potential characteristics described above is acceptable as a lead in air NAAQS indicator.

Photo of disassembled 15 um Loo and Cork Dichot inlet (courtesy Tom Merrifield, BGI).

3. What is your preferred approach for the development of a low-volume Pb-TSP sampler, and why?

There are two preferred approaches. First, evaluate the performance of the inlets noted above by collocation with high-volume TSP and PM10 under a range of wind conditions and Pb levels. Second, evaluate the inlet performance in an appropriate wind tunnel, along the lines of CFR 53 subpart D. Unfortunately, EPA does not have a suitable wind tunnel at this time, which is why the first approach above is included here. CFR 53 subpart D is very outdated and in need of major revisions to allow more modern measurement technologies. It may or may not be possible to identify a wind tunnel elsewhere that meets the needs of TSP inlet evaluation.

4. If the EPA were to develop a low-volume Pb-TSP FRM, how important is it that the sampling capture efficiency be characterized for varying particle sizes?

It is very important that the sampling capture efficiency be characterized for coarse mode and larger particles at different wind speeds up to 24 km/h, even if that can not be done before the method is promulgated.

5. If the EPA were to develop a low-volume Pb-TSP FRM, should the new FRM replace the existing high-volume Pb-TSP FRM, or should the EPA maintain the existing FRM?

The low-volume Pb-TSP FRM should replace the existing high-volume Pb FRM sampler. The high-volume sampler is unlikely to be able to pass any reasonable FEM tests when compared to a low-volume TSP sampler, but the method should be maintained for possible use near sources of very large Pb particles as a diagnostic tool, not a regulatory tool.

6. Is it appropriate to accept alternative sampler and inlet designs as FEM?

Yes, if rigorous FEM acceptance testing criteria are developed. An example here would be the dichotomous sampler; it is highly desirable that this sampler be able to be used as an FEM when used with the same inlet as the FRM.

7. Are the proposed FEM testing criteria for Pb methods adequate to ensure equivalence of alternative sampler and inlet designs? If not, what additional testing requirements should be considered?

I do not recommend using the existing high-volume TSP FRM as the sole reference method for evaluation of an FEM TSP sampler, since the existing TSP FRM collects an undefinable size range of particles in real-world use; it is a poor “gold standard” for any use. A reasonable FEM inlet may fail because of the highly variable performance of the TSP high-volume sampler.

Assuming a low-volume TSP sampler is promulgated as the FRM, any FEM sampler candidate should be compared to the low-volume TSP FRM sampler. It may be useful to include the high-volume TSP sampler in the tests as an additional comparison, but these data should not be used to determine FEM status.