UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

MAR 3 2008

MEMORANDUM

SUBJECT: Lead NAAQS Ambient Air Monitoring Network: Sampling Frequency Options Under Consideration

FROM: Mike Papp, OAQPS/AQAD/AAMG

TO: Lead NAAQS Review Docket (OAR-2006-0735)

The Environmental Protection Agency (the Agency) is in the process of reviewing the National Ambient Air Quality Standard (NAAQS) for Lead (Pb). As part of that review, the Agency is considering changing the averaging period from the current quarterly average to a monthly averaging period. The purpose of this memorandum is to provide a basis for consultation with the Clean Air Scientific Advisory Committee (CASAC) Ambient Air Monitoring & Methods (AAMM) Subcommittee on March 25, 2008.

The current sampling frequency requirement is for one 24-hour sample every six days [40 CFR 58.12(b)]. For the current NAAQS, which is based on a quarterly average, the 1-in-6 sampling schedule yields 15 samples per quarter on average with 100% completeness, or 12 samples with 75% completeness. A change to a monthly averaging period would result in between 4 and 6 samples per month at the current sampling frequency with 100% completeness, or between 3 and 5 samples with 75% completeness.

In order to provide a reliable pollutant concentration estimate of a population (site or area), be it a monthly, quarterly, annual or a 3-year average, one needs to have "enough" values of acceptable quality. The term enough relates to collecting the data necessary to properly characterize the spatial and temporal uncertainties of the area the data represent. Spatial uncertainty is addressed by determining the number of sites needed in the area of concern. The temporal uncertainty is addressed by sampling frequency- how often a "valid" sample is collected. Data completeness is also an important facet of sampling frequency since it relates to the final number of data values available for an estimate.

In general, the fewer the number of valid samples available for an estimate the less confidence one has in that estimate. This is especially true if pollutant concentrations are more variable in time and space. As an example, during the review of the development of data quality objectives for $PM_{2.5}$, EPA compared the annual means of $PM_{2.5}$ sites against the three approved sampling frequencies. Figure 1 represents annual averages from sites that were collecting samples every day (blue line) and then used that data and eliminated data values to provide estimates for a 1-in-3 day (yellow line) sampling frequency and a 1-in-6 day (green line) sampling frequency for those same sites. As can be seen, different sampling frequencies provide different estimates. If

one looks at estimates around the 3-year NAAQS standard (15 ug/m^3) it can be observed that some sites, depending on what sampling frequency was used, would be considered attainment or non-attainment. In addition, as mentioned earlier, confidence in an estimate increases with the increased sample size. So, in Figure 1, it would be expected that one would have more confidence (tighter confidence intervals) in the estimate based on an every day sampling frequency than on 1-in-3 or 1-in- 6 sampling frequencies. This example does not take into the additional measurement errors associated with precision and bias.

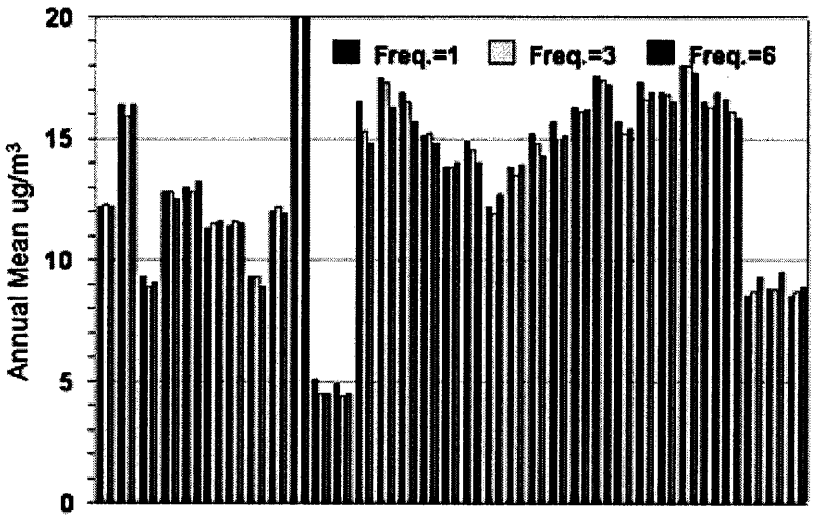

Figure1. PM2.5 Annual mean estimates for sites based on sampling frequencies.

For a Pb NAAQS based on a monthly average, it may be appropriate to move to a 1-in-3 day sampling at 75% completeness. A 1-in-3 day sampling frequency would yield 10 samples at 100% completeness. If the completeness requirement remains at 75% EPA would expect approximately 7 samples per month.

This sampling frequency may or may not be acceptable depending on:

- the level of the standard (lower concentrations that get closer to the method sensitivity have the probability of yielding more uncertainty),
- how close the monthly estimate is to the NAAQS standard, i.e., more variability may be tolerated if the monthly concentration is significantly higher or lower than the standard ($\pm$ 30% of NAAQS), and
- the temporal variability of the pollutant. If Pb concentrations at sites are very variable from day to day, more values will provide better confidence in the estimate of the mean. If Pb concentrations at sites are less variable, then fewer samples would not significantly effect the confidence in the mean.

EPA is currently addressing data quality objectives for the Pb NAAQS. This assessment will include evaluating temporal variability at current Pb monitoring sites (both TSP and NATTS PB PM10 sites) in order to provide uncertainty estimates associated with various sampling frequency

scenarios. Similar to our other DQO assessments, EPA will use a conservative approach, meaning that EPA will select a monitoring site temporal variability model that is within the current data set but tends to be representative of the higher end of the variability spectrum. EPA will evaluate every day, 1-in-3 day and 1-in-6 day sampling frequencies and provide a general a margin of error about a mean monthly estimate focusing on estimates close to the proposed NAAQS.

It is also appropriate to encourage make up sampling for data loss, but due to monthly averaging, this will require a more expedited sampling/analysis schedule or quick decisions to resample for samples whose integrity may be suspect.

It may also be appropriate to allow for a reduction in sampling frequency to 1-in-6 day if all 12 monthly averages in a calendar year are either greater than or less than 30 percent of the NAAQS. If monthly values start trending either upwards or downwards into the 30 percent window, sampling frequencies should be required to increase to 1-in-3 day sampling. A 30 percent margin of error seems reasonable, based on preliminary data assessments, but this may change as EPA proceeds through DQO evaluations.

Based upon the additional DQO evaluations, including the evaluation of the effects of imprecision and bias, EPA will be able to better assess the uncertainties around a monthly estimate. If decision makers feel that these uncertainties are too great, and it can be shown that more frequent sampling can significantly reduce these uncertainties, EPA may propose more frequent sampling.