UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

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**MEMORANDUM**

**SUBJECT**: Guidance on the Interpretation of the Flow Rate Requirements in the Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 40 CFR Part 50 Appendix B.

**FROM**: Lewis Weinstock, Group Leader
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**TO**: Air Monitoring Program Managers and Staff

We have received questions on the total suspended particulate (TSP) samplers in regards to meeting the maximum flow rates either when the sampler it set up to run at a specific flow rate or when it is calibrated. This guidance provides clarification of the language in 40 CFR Part 50 Appendix B.

There are a few areas in 40 CFR Part 50 Appendix B that describe flow rates, specifications of the sampler (Section 7.2), and the calibration requirements (Sections 9.3 and 9.4). Within Section 7.2 are two flow-related statements:

- 7.2.2 Minimum sampler flow rate heavily loaded filter: 1.1 $m^3$/min (39 $ft^3$/min)
- 7.2.3 Maximum sample flow rate, clean filter: 1.7 $m^3$/min (60 $ft^3$/min)

The specifications above represent the ranges that the EPA requires the samplers to operate within, not a requirement that each sampler be manufactured to meet both the minimum and maximum ranges. For example, a sampler that can achieve a constant flow rate of 1.5 $m^3$/min and will maintain a flow rate above 1.1 $m^3$/min when fully loaded is an acceptable sampler (assuming other sampler specifications of 40 CFR Part 50 Appendix B are met).

There are two calibration procedures described in 40 CFR Part 50 Appendix B:

**Section 9.3 Procedure**

This procedure applies to a conventional orifice-type flow transfer standard and an orifice-type flow indicator in the sampler, the most common type at the time the method was written. Section 9.3 describes the first method and states the following:

> *9.3.8 Repeat steps 9.3.5, 9.3.6, and 9.3.7 for several additional flow rates distributed over a range that includes 1.1 to 1.7 std*[1] $m^3$/min

This implies that the instrument must be tested at 1.7 std $m^3$/min, which has been problematic with some instruments.

**Section 9.4 Procedure**

Section 9.4 provides for an alternate calibration procedure for flow controlled samplers as described below.

> *9.4 Alternate calibration of flow-controlled samplers. A flow-controlled sampler may be calibrated solely at its controlled flow rate, provided that previous operating history of the sampler demonstrates that the flow rate is stable and reliable. In this case, the flow indicator may remain uncalibrated but should be used to indicate any relative change between initial and final flows, and the sampler should be recalibrated more often to minimize potential loss of samples because of controller malfunction.*
>
> *9.4.1 Set the flow controller for a flow near the lower limit of the flow range to allow maximum control range.*
>
> *9.4.2 Install a clean filter in the sampler and carry out steps 9.3.2, 9.3.3, 9.3.4, 9.3.6, and 9.3.7.*
>
> *9.4.3 Following calibration, add one or two additional clean filters to the sampler, reconnect the transfer standard, and operate the sampler to verify that the controller maintains the same calibrated flow rate; this is particularly important at high altitudes where the flow control range may be reduced.*

Although the procedure discussed in Section 9.4 discusses a calibration at its controlled flow rate (set point), we believe it would be good practice to include five calibration points, but it is acceptable to have flow rate set-point within the required calibration range and select the five calibrations points between $\pm$ 10 percent of the calibration set-point where the lowest point is not below 1.1 $m^3$/min, and the highest point is not above 1.7 $m^3$/min. For example, if an operator wants to establish the sampler's flow rate set point at 1.4 $m^3$/min, the operator would perform a 5-point calibration over the range of 1.26 and 1.54 $m^3$/min.

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[1] std = Standard temperature and pressure

The instruments that EPA has heard as having problems meeting the high flow rates are flow-controlled samplers with brushless motors and, therefore, can use the alternate technique to achieve the calibration requirements. These newer models were developed to achieve a constant flow no matter what particulate loadings occur during the sampling event. From that standpoint, these samplers are superior to the older technology where there was a possibility of flow variations within a sampling activity due to particulate loading. We suggest using 5 calibration points in the calibration/verification procedure but it is not necessary to challenge the sampler at the higher range (1.7 $m^3$/min).

If you have any additional questions, please contact the OAQPS Pb Monitoring Lead, Kevin Cavender (cavender.kevin@epa.gov).