Attachment 3

Memo to PM NAAQS Review Docket (OAR-2001-0017)
Potential changes being evaluated for the
$PM_{2.5}$ Federal Reference Method

MEMORANDUM

SUBJECT: Potential changes being evaluated for the $PM_{2.5}$ Federal Reference Method

FROM: Timothy Hanley, EPA-OAQPS-Ambient Air Monitoring Group

TO: PM NAAQS Review Docket (OAR-2001-0017)

DATE: June 30th, 2005.

The monitoring approach used as the indicator of fine particles is defined in 40 CFR Part 50, Appendix L as the Federal Reference Method (FRM). This method provides for the measurement of the mass concentration of fine particulate matter having an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$) in ambient air over a 24-hour period. When finalized in 1997, the FRM was specified with both design and performance specifications to achieve a consistent method for measurement of fine particles linked to the largest segment of epidemiological data forming the basis for the $PM_{2.5}$ standards. This resulted in a gravimetric method that included a substantial number of field and laboratory requirements. These requirements are embedded in either the design and performance specifications of FRM samplers or the performance specifications for gravimetric laboratories monitoring agencies use for filter analyses. Since the $PM_{2.5}$ FRM monitoring network became operational in 1999, EPA has been working with agencies at the State and local level; and instrument manufacturers to conduct studies evaluating options for improvement to the FRM. Based on that work, the EPA staff are recommending four changes to the $PM_{2.5}$ FRM to improve the performance and minimize the burden on agencies conducting the monitoring. These changes are intended to produce data that are neutral with respect to bias compared to the currently prescribed $PM_{2.5}$ FRM. The first three recommendations have already been incorporated partly or in whole into the operation of the network as either designated Federal Equivalent Methods (FEMs) or through the use of national user modifications to the FRM approved by EPA's Office of Research and Development.

1. Very Sharp Cut Cyclone (VSCC)[1]. The VSCC is an approved equivalent method[2] when used as a replacement for the second stage separator - currently the WINS - on several makes and models of FRMs. According to the test data submitted to EPA by the manufacturer, the VSCCs performance curve is virtually identical to that of the WINS fractionator with respect to cutpoint and slope. Field tests have shown that FRMs equipped with a VSCC provide $PM_{2.5}$ concentrations virtually identical to concentrations measured by collocated FRMs

equipped with reference method WINS[3]. The VSCC has advantages over the WINS by operating substantially longer in the field without servicing and by the avoidance of oil use. The VSCC has been used successfully in the $PM_{2.5}$ monitoring network since shortly after its approval. The EPA staff recommends either replacing the specification for a second stage separator from the WINS to the VSCC or allowing the VSCC to be used interchangeably with the WINS on the FRM. The practical advantage of having the VSCC as a FRM rather than a FEM is that is would become the default $PM_{2.5}$ separator in performance audits and designation studies.

2. WINS oil. An alternative oil identified as dioctyl sebacate (DOS) for use in the WINS has been tested and approved as a national user modification[4,5]. The DOW 704 oil described in the reference method had on occasion crystallized in areas with cold and damp weather conditions. Although the DOW 704 oil, when solidified, was tested and found to allow for accurate particle size separation in the WINS, its solidified appearance naturally led users to question the validity of the resulting data. Since introduction of the DOS oil into the network in 2000, no crystallization of this new oil has been reported. The EPA staff thus recommend use of the DOS oil in the WINS fractionator as a viable replacement to the DOW oil. The EPA staff further recommend that the WINS with use of the DOS oil become an approved equivalent method if the VSCC becomes the sole second-stage impactor in the FRM.

3. Filter Recovery Time. The time period for recovery of samples after the end of the sample period has been extended to the morning of the eighth day (177 hours) after sampling as part of a nationally administered user modification[6]. The current FRM requirement for this activity is 96 hours. This requirement was identified by a group of State and local monitoring agencies as burdensome with an unknown amount of value for ensuring the quality of data. A study was conducted with participation at six sample platforms around the country to determine if the precision and bias goals could still be met for the FRM[7]. Following successful operation of the study the filter recovery extension time was extended in February of 2002 by authorization of a national user modification. The EPA staff recommend allowing FRM samples to be recovered up to 177 hours past the end of the sample period. This will effectively allow for recovery of up to three samples at a time on a one-in-three day sample schedule on a sequential FRM.

4. Filter Transport Temperature and Post Sampling Recovery Time. There are two approaches to meeting the filter temperature transport requirements of the $PM_{2.5}$ FRM. The first option states that "the filter shall be maintained as cool as practical and continuously protected from exposure to temperatures over 25 degrees C." If this is met the filters are to be post-weighed within 10 days following the end of the sample period. The second option states that if the "filter sample is maintained at 4 degrees C or less during the entire time between retrieval from the sampler and the start of the conditioning...", the period shall not exceed 30 days. These requirements have been interpreted to mean that additional cooling during transport and storage of the filters allows additional time, up to 30 days, before post-weighing of the sample is complete[8]. With the recommended extension of the allowable filter recovery time from 96 to 177 hours, insufficient time remains to practically transport, equilibrate and post-weigh the filters within 10 days. Also, due to centralization of many gravimetric laboratory

services requiring additional shipping, most agencies are not able to post-weigh their filters within the described 10 days. Since the inception of the $PM_{2.5}$ FRM network, monitoring agencies have shared the concern that the shipping requirements are inconsistent with sampling and post-sample conditions in the sampler, where samples are exposed to ambient temperature. The filter recovery extension study demonstrated that filters residing in samplers at ambient temperatures for several days have an acceptable bias[5]. The EPA staff recommends requiring that recovered filters be maintained at sub-ambient temperature (cool with a minimal number of ice-packs or other cooling mechanism) or up to a nominal four degrees C in extremely cold conditions, during transport of filters from sample stations to their gravimetric laboratory. When satisfying this criteria and so long as recovered filters are maintained nominally at less than or equal to four degrees C prior to post-weighing equilibration, then agencies would have up to 30 days after the end of the sample period to complete weighing. This new procedure would still require moderate cooling of samples to minimize any potential volatilization; however, it would provide a more practical approach to sample transport and analyses scheduling.

These recommendations represent modest changes to the FRM that have already been demonstrated in field studies in the $PM_{2.5}$ monitoring network. Recommendations one through three have also already been deployed as part of the routine $PM_{2.5}$ monitoring network. The fourth recommendation, although not currently employed, would provide more consistency with other filter based networks such as IMPROVE. The changes if formalized as part of the FRM should allow for more efficient use of monitoring agencies resources while maintaining consistency with the current FRM.

REFERENCES

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