## Section 5 - Network Design

### Introduction:

The $PM_{2.5}$ monitoring program has been implemented with a heavy emphasis on Federal Reference Method (FRM) samplers in order to support comparing mass data to the National Ambient Air Quality Standards (NAAQS). Approximately 1143 (July 11, 2001 AIRS) monitoring sites in the United States are now operational with FRM samplers. The entire $PM_{2.5}$ network includes components for chemical speciation and advanced measurements (Attachment B). Only the FRM or Federal Equivalent Method (FEM) can be used for direct comparisons to the NAAQS. This plan proposes a more balanced hybrid network of filter based and continuous mass samplers, assuming that data analysts would incorporate filter based and continuous methods (seamlessly) when utilizing network data for broad scale spatial applications such as positive matrix factorization (PMF) and air quality model evaluation. This hybrid network would include a reduced number of existing FRM samplers for direct comparison to the NAAQS and continuous samplers that meet specified performance goals related to their ability to produce sound comparisons[9] to FRM data. Two approaches described in sections 3 and 4 for integrating continuous mass monitors are proposed to maximize flexibility for agencies; an expanded use of Correlated Acceptable Continuous Monitors (CAC), and Regional Equivalent Monitors (REMs). The CAC approach would enable agencies to address any monitoring objective, other than ***direct***[10] comparisons to NAAQS for attainment and non-attainment designations, while the REM approach would serve any objective.

There is an unknown amount of degraded data quality risk associated with moving from the current design based system to one relying on performance based specifications. Therefore, this hybrid network will maintain a core of FRMs to maintain an ability to quantify the relationship between FRMs and continuous samplers for continuity to both the historical record as well as ongoing and prospective use of continuous methods. The remaining network of FRMs might constitute 30% to 50% of the current network. A large network of continuous monitors meeting performance criteria would eventually be in place to improve the data base for: public reporting of Air Quality indices (AQI) and mapping through AIRNow; supporting health effects and exposure studies addressing short term exposures; evaluating air quality models and emission inventories, and supporting compliance needs related to direct comparisons with the NAAQS and delineating the spatial extent of attainment/nonattainment areas.

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[9] Comparability between FRMs and continuous samplers is desired, based on the extensive FRM network available. This practical need also recognizes inherent differences between measurement principles of integrated and continuous methods and does not assume any one type of measurement best represents true atmospheric aerosols conditions. Further discussion on incommensurabilities between measurement systems is provided in section 7.

[10] Data from CACs would be expected to be incorporated in as yet undetermined weight-of-evidence analyses to define boundaries of non-attainment/attainment areas.

**Minimum number of Federal Reference Method (FRM) Samplers**

A separate but parallel effort is underway to better identify redundant monitoring for all pollutants as part of the National Monitoring Strategy (see section 10). This national strategy supports an investment in continuous PM monitors balanced by a divestment in $PM_{2.5}$ FRM sampling. Progress in enhancing PM continuous monitoring requires a burden reduction in FRM sampling. Currently, nearly 1100 FRM samplers operate across the United States, and an additional 200-300 IMPROVE and continuous samplers. The spatial richness this network should not be severely compromised; however, areas of redundancy are evident based on a variety of national and regional based assessments that illustrate broad expanse of homogeneous aerosol behavior. A reduction in required FRM samplers is possible using network assessment processes to determine effective numbers of samplers across regional and urban spatial scales. Nationally, we are suggesting that a minimum of 300-500 FRM/FEMs be retained to ensure consistency with the existing network, and provide the primary regulatory base of data. A total of approximately 600 equivalent samplers (including FRMs, FEMs and REMs) for direct comparisons to the NAAQS are recommended. The network size of approximately 600 is based on several data analyses. One analysis shows that the large spatial patterns in $PM_{2.5}$ are nearly identical whether using 300 or 1200 monitoring locations in an area that covers much of the eastern United States. A second analysis indicates that several urban areas are likely over-sampled by approximately 25-35%. Perhaps as many as 1000 (or more) $PM_{2.5}$ mass (FRM and continuous) sites nationally are needed for spatial characterization, but request that actual number of sites be a function State/local agency discretion as agencies must balance several competing monitoring priorities. Note, that this approach while increasing flexibility could have unintended negative consequences by accommodating too many diverse methods that do not relate well with each other. Agencies are encouraged to strive for consistency in deploying their continuous PM network and consider not only consistency of methods within an agency, but attempt to harmonize technology across regional areas.

Table 5-1 summarizes the applicability of each monitoring method category to the type of site in the network. Tables 5-2 and 5-3 include examples of revised network requirements for $PM_{2.5}$ samplers. Specific modifications to the $PM_{2.5}$ monitoring regulations are being addressed through a workgroup of state/local agency, Tribal nation, and EPA representatives (see section 11).

**Table 5-1 PM Method Applicability**

| Method | Required Sites for NAAQS | | | | | | |
|---|---|---|---|---|---|---|---|
| | **< 80% of NAAQS** | **80% to 120% of NAAQS** | **>120% of NAAQS** | **Sites that are currently required but are not required in a future network.** | **Current Supplemental Sites** | **Background and Transport Sites** | **Speciation and IMPROVE** |
| **FRM/FEM** | **T** | **T** | **T** | **T** | **T** | **T** | |
| **REM** | **T •** With 30% FRM collocation in network | **T •** With 30% FRM collocation in network | **T •** With 30% FRM collocation in network | **T** | **T** | **T** | |
| **CAC** | **T •** With 100% FRM Collocation in network FRM operates 1-6 | | **T •** With 100% FRM Collocation in network FRM operates 1-6 | **T** | **T** | **T •** | |
| **IMPROVE** | | | | | | **T** | **T** |
| **Speciation** | | | | | | **T •** | **T** |
| **Existing Continuous mass PM** | | | | | **T** | | |

**T** The method category in the row is applicable for the monitoring objective in the column.
• This symbol indicates a change to the monitoring regulation is needed

**Method Applicability Summary**

*FRM/FEM/REM* - These methods can be used at a required site, regardless of the concentration; at any current or future supplemental sites; and at any background or transport sites. REMs would be required or have at least 30% collocation with FRMs when they are sited at required sites. The FRM would be the primary sampler when collocated with an REM.

*CAC* - This monitor could provide relief up to 3 new ways:

To convert a site from a filter based sampler to a CAC:

1.) At current supplemental, background, and transport sites CAC monitors may be used as the primary monitor. Collocation at these sites would follow the provisions of Appendix A; which is expected to be 15% collocation with the first collocated monitor being an FRM and the next one being of the same make and model as the CAC.

2.) The minimum number of required sites is to be reduced in Appendix D of Part 58. There is an expectation that there will be more sites operating than the minimum number required. For sites that are no longer required to be operated; but the agency still intends to operate the site to meet other monitoring objectives, the agency may choose to operate the site with a CAC. Appendix A collocation requirements would apply for these CACs. Moreover, it is feasible that revised monitoring regulations may require a similar total number of monitors currently required or operating (i.e., 850 to 1100) with a subset required to have reference/equivalent status and the remainder being satisfied by an equivalent/reference or CAC designation.

To provide additional sample frequency relief:

3.) For required reference/equivalent sites (current or future) that are either substantially above or below the NAAQS, the CAC may be operated to provide a signal of PM provided it is collocated with a FRM operating on at least a 1 in 6 day schedule. The FRM maintains the status as the primary monitor.

The conventional sample frequency relief for a CAC would still apply:

A FRM site that is required to operate daily may have its sample frequency reduced to 1 in 3 provided it is collocated with a CAC regardless of the concentration or NAAQS status.

**Table 5-2 Network Design Criteria for $PM_{2.5}$ Required SLAMS**

| Network Design Criteria | Current Network | Example Revised Network |
|---|---|---|
| Required minimum number of sites at State and local Air Monitoring Stations (SLAMS) | Approximately 850*<br><br>* 100 are for background and can use IMPROVE samplers | Assuming ~600 sites are reasonable we envision a hybrid network of FRM and continuous methods meeting acceptable performance standards. A minimum of ~ 30% of each monitoring agencies future network would be required to remain as FRMs. |
| Scale of representativeness - Annual Average | Neighborhood or Urban Scale with FRM or FEM | Neighborhood or Urban Scale with FRM/FEM or hybrid network of FRM and continuous monitors meeting performance based criteria |
| Scale of representativeness - Daily Average | Micro, Neighborhood, Urban Scale | Micro, Neighborhood, Urban Scale. For sites that are expected to only have a violation of the daily standard, but not the annual average, site with a FRM/FEM. Collocated with a Continuous monitor, if needed |
| Community Monitoring Zones | Optional | Consider deleting this provision since no agencies are using |