Technical Note on Reporting PM$_{2.5}$ Continuous Monitoring and Speciation Data to the Air Quality System (AQS)
6/01/2006

Since 2003 EPA with its partners at State, local and Tribal Monitoring Agencies has been successfully reporting PM$_{2.5}$ continuous monitoring data to the public on AIRNow (http://www.airnow.gov). In many cases the State, local and Tribal agencies are also reporting on their own web sites and through other media to the public. While the near real-time data are posted on these web sites, the EPA's repository of validated ambient air data continues to be the Air Quality System (AQS). Storage in AQS provides for a permanent archive of the validated data for further analysis including comparison to pollutant data not available in near real-time such as filter-based Federal Reference Method (FRM) and speciation data.

While reporting of PM$_{2.5}$ continuous monitoring data in AQS appears to be at a high level (522 monitors reporting data as of April 2005), it is often difficult to understand the quality of the data. In many cases the PM$_{2.5}$ continuous monitors are directly producing data that reasonably estimate what an FRM would provide and agencies are reporting those data. In other cases where the continuous monitor does not approximate the FRM, but they are correlated, State, local or Tribal agencies are statistically correcting the data. For submitting data to AQS there has not been a standard protocol for whether raw data or statistically corrected data should be submitted. This severely limits analysts from utilizing the data as they may be unsure of its quality and also may potentially confuse or mislead the general public regarding PM$_{2.5}$ air quality status. To resolve this issue a workgroup of EPA, State, and local agencies identified several options for coding data in AQS. EPA considered this input and at the 2005 National Air Quality and AQS Conferences announced new parameter codes to accommodate raw data from PM$_{2.5}$ continuous monitors and data from continuous methods capturing a total atmospheric measurement of PM$_{2.5}$. At this time several State and local agencies are utilizing these two new parameter codes.

The addition of these two new parameter codes brought to light a need to better distinguish PM$_{2.5}$ data that are used in NAAQS decision making from data usable only for other monitoring objectives, and not just to distinguish those data that reasonably match the FRM from those that do not. For instance, there may be a point in the future where a PM$_{2.5}$ continuous method is approved for NAAQS decisions in one geographical area, but not another. In this example, there would need to be a clear understanding of which data are to be used for the NAAQS decisions. Although method code does provide one way to indicate which methods are reference and equivalent, we have decided to make the AQS data even more transparent by allowing parameter code 88101 (PM2.5 at local conditions) to only be used for PM$_{2.5}$ data obtained with methods eligible for use in the NAAQS decision making process for the applicable geographical area. Therefore, a new and different parameter code has been created to store all other PM$_{2.5}$ concentration measurement data (from continuous monitors and speciation samplers) that still reasonably match the FRM, but are not to be used for NAAQS decisions

To summarize, the following new procedures are to be used when submitting PM$_{2.5}$ continuous monitor data or mass data from speciation samplers to AQS:

1

1.) For the AQS parameter code 88101 – PM2.5 at local conditions, only report those data validated from Federal Reference Methods, Federal Equivalent Methods, or other methods that are to be used in making NAAQS decisions. For instance, Approved Regional Methods may become part of a future $PM_{2.5}$ monitoring network to meet multiple monitoring objectives, including NAAQS decisions. Note: at this time only filter-based FRM and FEMs will use parameter code 88101.

2.) Report to S/L/T web sites, AIRNow, and AQS uncorrected or statistically corrected hourly continuous data that is seasonally or yearly within 10 percent bias[1] and has a correlation of at least 0.9^2 (squared correlation of at least 0.81) with the FRM. When reporting to AQS, use parameter code 88502 – Acceptable PM2.5 AQI and Speciation Mass. This parameter code is also expected to be utilized for mass concentration data produced from the speciation networks. Use the most appropriate method code in AQS that clearly indicates the operation of the monitor when submitting data. For $PM_{2.5}$ continuous methods that have been statistically corrected, use method codes that indicate the use of external correction factors as applicable.

3.) Report valid raw data (uncorrected) to AQS that is not within 10% bias and/or does not have a correlation of at least 0.9 of the FRM with the new parameter code: "PM2.5 Raw Data" (parameter code 88501). In fact, we recommend that agencies report all raw $PM_{2.5}$ concentration data to AQS even if statistically adjusted data is also being reported. This parameter code would ***not*** be readily available for public review on web sites such as AirData (http://www.epa.gov/air/data/), but would be available in AQS for historical review of method performance. This parameter code is expected to only apply to continuous $PM_{2.5}$ methods.

4.) Report Filter Dynamic Measurement System (FDMS) data to AQS associated with the parameter code: "Total Atmospheric $PM_{2.5}$" (parameter code 88500). This should be the total concentration of the monitor including both base and reference channels. This will allow for more insightful interpretation of data when reviewing events that may contain aerosols not normally retained on the FRM during warmer seasons.

5.) Report the reference channel data of the FDMS to AQS with the new parameter code: "PM2.5 Volatile Channel" (parameter code 88503). This should be the reference channel of the FDMS as reported from the instrument. For instance, the calculation of the FDMS reference mass may report a loss of 3.2 micrograms per cubic meter in a one hour time period as -3.2 and this would be reported to AQS as -3.2.

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[1] The suggestion of a bias of +/-10 % is taken from the $PM_{2.5}$ DQOs which define measurement uncertainty goals for automated and manual $PM_{2.5}$ methods. These goals are stated as: "The goal for acceptable measurement uncertainty has been defined as 10 percent coefficient of variation (CV) for total precision and +/10 percent for total bias". However, agencies ultimately have to decide for themselves if the data are of sufficient quality to report to the public.

[2] A correlation of 0.9 (squared correlation of 0.81) is taken from the illustrative guidance document "Data Quality Objectives (DQOs) for Relating Federal Reference Method (FRM) and Continuous $PM_{2.5}$ Measurements to Report an Air Quality Index (AQI)" EPA-454/B-02-002, November 2002.

Table 1, PM2.5 Parameter Codes

Parameter Name	Parameter Code	Purpose	Notes
PM2.5 LOCAL CONDITIONS	88101	Appropriate code for all FRM/FEM/ARMs	Original code for PM2.5 at local conditions
PM2.5 TOTAL ATMOSPHERIC	88500	Valid data from methods measuring total PM2.5 aerosols in the atmosphere, including those that can be volatilized from the FRM	Introduced in 2005
PM2.5 RAW DATA	88501	Valid uncorrected data that does not reasonably match the FRM	Introduced in 2005
ACCEPTABLE PM2.5 AQI & SPECIATION MASS[1]	88502	Valid data that does reasonably match the FRM with or without correction, but not to be used in NAAQS decisions	Introduced in 2006
PM2.5 VOLATILE CHANNEL[1]	88503	Store important related data such as the FDMS reference channel	Introduced in 2006

1 –We anticipate it will take several months to align all reporting agencies with these new codes.

REPORTING NOTES:

I.   These procedures may be implemented in 2006, but without exception should be applied to all data collected on or after January 1, 2007.

II. Agencies are encouraged to apply the procedures retrospectively and update AQS. EPA has created and tested an automated script to facilitate migrating monitor records with the new parameter codes. This script will be used by EPA to re-code the speciation data in the coming weeks. Agencies wishing EPA to migrate their monitor records to the new parameter codes should contact Jonathon Miller of EPA's National Air Data Group (919) 541-7738, E-mail: *miller.jonathan@epa.gov*.

III. Agencies are expected to report the "acceptable" $PM_{2.5}$ continuous monitoring data to AQS. Raw data from $PM_{2.5}$ continuous monitors are **strongly encouraged** to also be reported to AQS so that assessments of the $PM_{2.5}$ data can be performed and a historical performance of the $PM_{2.5}$ method can be determined. The latter includes independent assessments of the data adjustments.

If you have any monitoring questions on these procedures feel free to contact Tim Hanley of the OAQPS Ambient Air Monitoring Group (919) 541-4417, E-mail: *hanley.tim@epa.gov*. For questions on AQS please contact Jake Summers of the OAQPS National Air Data group at (919) 541-5695, E-mail: *summers.jake@epa.gov*.

Other Reporting Notes:

AIRNow:

1) Update PM$_{2.5}$ site information table to describe site, method, and statistical correction, if applicable.
2) Access to AIRNowTech – where the site information table exists for each agency – can now be requested by any member of the ambient air monitoring community. See the webs site: http://www.airnowtech.org/index.cfm?page=login
3) AIRNow may in the future be backfilled with validated AQS data for parameter code 88502 (Acceptable PM2.5 AQI and Speciation Mass) so that invalid PM$_{2.5}$ continuous data are not used from AIRNow. This will provide consistency between AQS and AIRNow so that the appropriate number of days are calculated for the AQI in each area, using either data set.

AQS:

1) For new parameter codes continue to use POCs 3 and 4 for continuous monitors and POCs 5 and 6 for speciation samplers since there is a nice record of these POCs with parameter code 88101.
2) The following table provides the method codes associated with the new parameter codes available in AQS:

Table 2, PM2.5 Method Codes

Parameter Code	Parameter Name / Methodology Code	Recording Mode	Sample Collection Description	Sample Analysis Description
88500	PM2.5 Total Atmospheric			
88500	760	CONTINUOUS	PM2.5 SCC	FDMS-Gravimetric
88500	761	CONTINUOUS	PM2.5 VSCC	FDMS-Gravimetric
88501	PM2.5 Raw Data			
88501	701	CONTINUOUS	PM2.5 SCC w/No Correction Factor	TEOM Gravimetric 50 deg C
88501	703	CONTINUOUS	PM2.5 SCC w/No Correction Factor	TEOM Gravimetric 30 deg C
88501	706	CONTINUOUS	PM2.5 SCC w/No Correction Factor	TEOM Gravimetric 40 deg C
88501	711	CONTINUOUS	PM2.5 SSI w/No Correction Factor	TEOM Gravimetric 50 deg C
88501	715	CONTINUOUS	PM2.5 VSCC w/No Correction Factor	TEOM Gravimetric 30 deg C
88501	716	CONTINUOUS	PM2.5 VSCC w/No Correction Factor	TEOM Gravimetric 50 deg C
88501	721	CONTINUOUS	PM2.5 WINS w/No Correction Factor	TEOM Gravimetric 50 deg C
88501	723	CONTINUOUS	PM2.5 WINS w/No Correction Factor	TEOM Gravimetric 30 deg C
88501	731	CONTINUOUS	Met-One BAM W/PM2.5 SCC	Beta Attenuation
88501	732	CONTINUOUS	Met-One BAM W/PM2.5 WINS	Beta Attenuation
88501	750	CONTINUOUS	Andersen BAM w/PM2.5 SCC	Beta Attenuation
88501	751	CONTINUOUS	Andersen BAM w/PM2.5 SSI	Beta Attenuation
88501	752	CONTINUOUS	Andersen BAM w/PM2.5 WINS	Beta Attenuation

88501	753	CONTINUOUS	Andersen BAM w/PM2.5 VSCC	Beta Attenuation
88502	Acceptable PM2.5 AQI & Speciation Mass			
88502	701	CONTINUOUS	PM2.5 SCC w/No Correction Factor	TEOM Gravimetric 50 deg C
88502	702	CONTINUOUS	PM2.5 SCC w/Correction Factor	TEOM Gravimetric 50 deg C
88502	703	CONTINUOUS	PM2.5 SCC w/No Correction Factor	TEOM Gravimetric 30 deg C
88502	704	CONTINUOUS	PM2.5 SCC w/Correction Factor	TEOM Gravimetric 30 deg C
88502	705	CONTINUOUS	PM2.5 SCC w/Correction Factor	TEOM Gravimetric 40 deg C
88502	706	CONTINUOUS	PM2.5 SCC w/No Correction Factor	TEOM Gravimetric 40 deg C
88502	707	INTERMITTENT	IMPROVE Module A with Cyclone Inlet-Teflon Filter, 2.2 sq. cm.	GRAVIMETRIC
88502	711	CONTINUOUS	PM2.5 SSI w/No Correction Factor	TEOM Gravimetric 50 deg C
88502	712	CONTINUOUS	PM2.5 SSI w/Correction Factor	TEOM Gravimetric 50 deg C
88502	713	CONTINUOUS	PM2.5 SSI w/Correction Factor	TEOM Gravimetric 30 deg C
88502	715	CONTINUOUS	PM2.5 VSCC w/No Correction Factor	TEOM Gravimetric 30 deg C
88502	716	CONTINUOUS	PM2.5 VSCC w/No Correction Factor	TEOM Gravimetric 50 deg C
88502	717	CONTINUOUS	PM2.5 VSCC w/Correction Factor	TEOM Gravimetric 50 deg C
88502	721	CONTINUOUS	PM2.5 WINS w/No Correction Factor	TEOM Gravimetric 50 deg C
88502	722	CONTINUOUS	PM2.5 WINS w/Correction Factor	TEOM Gravimetric 50 deg C
88502	723	CONTINUOUS	PM2.5 WINS w/No Correction Factor	TEOM Gravimetric 30 deg C
88502	724	CONTINUOUS	PM2.5 WINS w/Correction Factor	TEOM Gravimetric 30 deg C
88502	731	CONTINUOUS	Met-One BAM W/PM2.5 SCC	Beta Attenuation
88502	732	CONTINUOUS	Met-One BAM W/PM2.5 WINS	Beta Attenuation
88502	740	CONTINUOUS	PM2.5 SCC	CAMMS Mass pressure drop
88502	741	CONTINUOUS	PM2.5 WINS	CAMMS Mass pressure drop
88502	750	CONTINUOUS	Andersen BAM w/PM2.5 SCC	Beta Attenuation
88502	751	CONTINUOUS	Andersen BAM w/PM2.5 SSI	Beta Attenuation
88502	752	CONTINUOUS	Andersen BAM w/PM2.5 WINS	Beta Attenuation
88502	753	CONTINUOUS	Andersen BAM w/PM2.5 VSCC	Beta Attenuation
88502	760	CONTINUOUS	PM2.5 SCC	FDMS-Gravimetric
88502	761	CONTINUOUS	PM2.5 VSCC	FDMS-Gravimetric
88502	771	CONTINUOUS	Correlated Radiance Research M903	Nephelometry
88502	781	INTERMITTENT	SINGLE-FILTR WINS 2.5UM IMPACT	GRAVIMETRIC
88502	783	INTERMITTENT	SEQUENT SAMPLR WINS 2.5UM IMP	GRAVIMETRIC
88502	785	INTERMITTENT	DICHOTOMOUS APPROVED PM10 REFR	GRAVIMETRIC
88502	787	CONTINUOUS	AUTOMATED WINS 2.5UM IMPACTOR	BETA GUAGE
88502	789	CONTINUOUS	AUTOMATED WINS 2.5UM IMPACTOR	TEOM-GRAVIMETRIC
88502	791	CONTINUOUS	OTHR AUTOMATD 2.5 MASS CONCENT	SURROGATE MEASURE
88502	793	INTERMITTENT	OTHR 24HR FILTER BASED SAMPLER	GRAVIMETRIC
88502	810	INTERMITTENT	Met One SASS Teflon	Gravimetric
88502	820	INTERMITTENT	Andersen RAAS Teflon	Gravimetric
88502	830	INTERMITTENT	URG MASS400 Teflon WINS	Gravimetric
88502	850	INTERMITTENT	R&P MDL2300 PM2.5 SEQ SPEC	GRAVIMETRIC
88502	870	INTERMITTENT	URG MASS400 Teflon VSCC	Gravimetric
88502	899	INTERMITTENT	No Method-None	None
88503	PM2.5 Volatile Channel			

| 88503 | 760 | CONTINUOUS | PM2.5 SCC | FDMS-Gravimetric |
| 88503 | 761 | CONTINUOUS | PM2.5 VSCC | FDMS-Gravimetric |

3) If additional method codes are necessary, reporting agencies should contact EPA.

Data Quality:

1.) There may on occasion be cases where one or a couple of days are well outside of the goal for control of bias of +/-10 % as compared to a FRM. In these cases the data should still be used, so long as there is no apparent reason to otherwise invalidate the data and the general control of bias for the season or year is still acceptable.

2.) In many cases monitoring agencies are correcting their data prospectively. For example, Agencies use a previous year's worth of collocated FRM and raw continuous monitoring data with statistical linear regression to report corrected continuous monitoring data in the current year. In most cases this prediction will be sufficient for archiving in AQS. In a few cases it may be more appropriate to rerun the statistical linear regression using the current year's FRM and continuous monitoring data to determine the current year's corrected data.

3.) It may be unreasonable to expect continuous monitoring technologies with different conditioning and measurement techniques to provide closely matched results with collocated FRM's. However, within a reasonable margin of error (10 percent bias and a correlation of at least 0.9^2 compared to a collocated FRM) many existing continuous monitoring technologies can provide useful results for public reporting purposes and other monitoring objectives.

4.) As pointed out earlier, ultimately agencies must decide for themselves whether the data quality of the methods they are operating are sufficient to be reported to their own web sites and AIRNow. However, regardless of data quality – as compared to collocated FRM's – all valid $PM_{2.5}$ continuous reporting data can now be reported to AQS.