UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

December 2, 1997

MEMORANDUM

SUBJECT: Waivers for PM$_{10}$ Sampling Frequency

FROM: William F. Hunt, Jr. *(original signed by William F. Hunt, Jr.)*
             Director, Emissions, Monitoring,
                and Analysis Division (MD-14)

TO: Director, Office of Environmental Measurement and Evaluation, Region I
             Director, Division of Environmental Planning and Protection, Region II
             Director, Environmental Assessment and Protection Division, Region III
             Director, Air, Pesticides, and Toxics Management Division, Region IV
             Director, Air and Radiation Division, Region V
             Director, Multimedia Planning and Permitting Division, Region VI
             Director, Environmental Services Division, Region VII
             Director, Air Program, Region VIII
             Director, Air Division, Region IX
             Director, Office of Air Quality, Region X

        Attached is important guidance which will allow the Regional Offices to grant waivers to
the States to the regulatory sampling schedule for one in three day PM$_{10}$ data collection. Most of
the current PM$_{10}$ sites will be allowed to sample at a reduced schedule of once every six days.
This will allow them to direct needed resources to the PM$_{2.5}$ program. This guidance should be
applied annually to ensure that appropriate sampling frequencies are utilized on an on-going
basis.

        Please share this information directly with your States. If you have any questions, feel
free to contact Terence Fitz-Simons at (919) 541-0889.

Attachment

cc: Deputy Director, Office of Ecosystem Protection, Region I
        Director, Division of Environmental Science and Assessment, Region II
        Director, Air, Radiation and Toxics Division, Region III
        Director, Science & Ecosystems Support Division, Region IV
        Director, Air, RCRA, and Toxics Division, Region VII
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Guidelines for Granting Schedule Exemptions for PM_{10} Monitoring

This guidance provides methods and decision rules for exempting certain sites from everyday and 1 in 3 day sampling schedules to 1 in 6 day sampling schedules for PM_{10}. Since new monitoring requirements took effect in September but were waived until January 1, 1998, the availability of this guidance was considered necessary before the complete PM guidance will be available in 1998.

Since it can be burdensome to sample for particulates every day or even 1 in 3 days, the recently promulgated monitoring regulation for PM_{10} provides for exemptions to the required monitoring schedule. These exemptions take the form of seasonal exemptions from everyday sampling (to 1 in 3 or to 1 in 6 day sampling during certain low seasons) and year-round exemptions from 1 in 3 day sampling to 1 in 6 day sampling for a site where there is little or no chance that the daily PM_{10} standard will be exceeded.

The exemptions to be granted from everyday and the 1 in 3 day sampling should be based on an historical ability to meet the daily PM_{10} standard or upon distributional aspects of available monitoring data that would indicate this same ability. In other words, if high values have not historically been observed at a site, it may be assumed that such high values will not likely be observed in the future. However, since most existing sites monitor less than everyday, the probabilities are high that single high values could historically be missed (not observed). Although high values tend to have episodic characteristics in many areas, the characteristics are difficult to quantify with incomplete sampling. This needs to be addressed when examining historical data. For the methods described here, high values are considered a random event.

Another valid reason to exempt a site from the more frequent sampling schedule is the situation where the annual form of the standard is controlling (i.e., where a site is more likely to fail the annual standard than the daily standard). For the annual standard, 1 in 6 day sampling is sufficient to determine compliance.

While these guidelines provide help in deciding to grant exemptions to the required sampling schedules, they are not intended to provide exemptions from the obligation to report the Pollutant Standards Index (PSI) as required in part 58.50 of 40CFR.

History of meeting the Daily Standard

The monitoring history approach is based on the observed ability to meet the daily standard. Since most PM_{10} sites now sample 1 in 6 days, there is a larger probability to miss days with high values than if the site had been sampling at 1 in 3 days or more. Because of this, the site should demonstrate in a clear manner that the daily standard has been met. This is accomplished in the form of a statistical hypothesis test. Such a test can take into account how much year-to-year variation is observed in the data, thus allowing sites even with high variability to develop a reliable demonstration that the daily standard will likely be met in future years. For this test, the latest 3 years of PM_{10} monitoring data are examined. The 99th percentiles are calculated according to 40 CFR Part 50, appendix N, the mean and standard deviation of the 99th percentiles are calculated, and the statistical test is performed as follows:

Calculate the 99th percentile for each of the 3 years ($P_{.99,1}$, $P_{.99,2}$, and $P_{.99,3}$) as the i+1st value in a sorted set of values for the year where I = integer part of 0.99*n (the number of valid samples in a year).

▸ Calculate the mean 99th percentile for the 3-year period as

$$\bar{P}_{.99} = \frac{\sum_{i=1}^{3} P_{.99,i}}{3}$$

▸ Calculate the standard deviation of the average 99th percentile as

$$S_{\bar{P}} = \sqrt{\frac{\sum_{i=1}^{3} (P_{.99,i} - \bar{P}_{.99})^2}{2 \cdot 3}}$$

▸ Calculate the test statistic, $t_{.10,2df}$, as

$$t_{.10,2df} = \frac{\bar{P}_{.99} - 155}{S_{\bar{P}}}$$

▸ If $t_{.10,2df}$ as calculated above is less than -1.886 then the site could be considered eligible for an exemption.

Sites not meeting the above criteria should then be checked to see if the annual standard is controlling. This is done by comparing the annual form of the standard to its level and the daily form to its level. If the annual form of the standard is a higher percentage of the level of the annual standard than the daily form of the standard is to the daily standard, then the annual form of the standard is said to be controlling and these sites could also be considered for exemptions.

Based on our review of existing PM_{10} data currently in AIRS, the following is a list of sites that do **not** meet either the monitoring history or the annual controlling criteria and should **not** be granted exemptions.

Table 1. Sites not eligible for a sampling schedule exemption

St.	County	Site-ID
AK	Anchorage Borough	020200026
CA	Imperial County	060250003
		060250004
		060250005
		060251003
		060254002
		060254003
CA	Inyo County	060270018
		060271001
		060271003
		060271014
	Kern County	060290012
		060290232
	Kings County	060310003
	Mono County	060510007
	Orange County	060590001
	Riverside County	060652002
		060658001
	Santa Cruz County	060870003
	Siskiyou County	060930005
	Stanislaus County	060990002
	Sutter County	061010003
CO	Prowers County	080990001
	Teller County	081190001
CT	New Haven County	090090021
ID	Kootenai County	160550010
	Lewis County	160610002

St.	County	Site-ID
IL	Cook County	170310014
		170310070
	Randolph County	171570003
IA	Scott County	191630016
KS	Sedgwick County	201730008
		201730009
		201731012
MO	Christian County	290430001
MT	Fergus County	300270004
	Flathead County	300290039
MT	Park County	300670002
NV	Lander County	320150002
	Pershing County	320270003
	White Pine County	320330002
NM	Dona Ana County	350130016
		350130017
OK	Muskogee County	401010167
PA	Philadelphia County	421010049
		421010149
		421010449
TX	El Paso County	481410043
		481410044
WA	Chelan County	530070005
	Walla Walla County	530711001
WY	Park County	560290001
PR	Guayama County	720570008

Distributional Approach

If a monitoring history of three years is not available, then the following method should be considered. The method should be applied to at least a total of 40 measured values from a site. Sites with less than 40 values to use in this method could easily result in inappropriate decisions due to the lack of complete data.

This approach is to assume a distributional form for the upper tail of the available PM_{10} data, then use this information to estimate the 99th percentile and compare this to the level of the daily standard. The method assumes that the exponential distribution is a reasonable assumption for the upper 75% of a year of daily PM_{10} values. The method also disregards the temporal correlation that is expected in such data. However, this assumption is not unreasonable for the sake of the following calculations.

The method is to 1) calculate the 75th percentile of all the available data; 2) calculate the old values minus the 75th percentile; 3) calculate the mean of these transformed values; 4) calculate a distributional 99th percentile by calculating the 96th percentile of the transformed distribution (i.e., the upper tail); and 5) compare this percentile with the level of the daily standard.

Step 1. Calculate 75th percentile, $P_{.75}$: given X_i, i= 1, 2, 3, ..., n as the i+1st value in a sorted set of values for all available measured PM_{10} values where i = integer part of 0.75*n.

Step 2. Calculate $Y_i = X_i - P_{.75}$ for every X_i greater than or equal to $P_{.75}$.

Step 3. Calculate:

$$\bar{Y} = \frac{\sum_{i=1}^{n} Y_i}{n}$$

Step 4. The Y corresponding to the 96th percentile can be found as:

$$Y_{.96} = -\bar{Y}\ln(1-0.96)$$

Which means that X corresponding to the 99th percentile can be found as:

$$X = Y_{.96} + P_{.75} = P_{.75} - \bar{Y}\ln(1-0.96)$$

Step 5. Compare this number to 155. If it is greater, an exemption should not be granted. If it is equal to or less than 155, an exemption could be granted.

Following this procedure, the data from these additional sites suggest that they should not be granted waivers in the sampling schedule.

Table 2. Additional Sites (less than 3 years of data) that should not be granted a waiver in sampling schedule.

St.	County	Site-ID
CA	Imperial County	060250006
	Kern County	060290004
	Kings County	060310004
IL	Cook County	170311016
MO	Greene County	290770038
	Howell County	290910001
MO	Howell County	290910002
NV	Clark County	320030539
NM	Dona Ana County	350130018
		350130019
		350130020
		350130021
		350130022
TX	Lubbock County	483030025
VI	St. Croix	780010012

Seasonal Exemptions

Seasonal exemptions allowing 1 in 6 day sampling can also be based on historical data. The data should meet minimum data requirements as stated in 40 CFR Part 50, appendix N. Seasons should be identifiable (periods of a year with high values as opposed to periods of a year without high values). Since high values would only add to a possible violation of the standard, the data in question should be entirely free of any values above the level of the daily PM_{10} daily standard for the most recent 3-year period. Because seasonal exemptions are inherently based on limited datasets, a minimum of 3 years of data are required to be eligible for such an exemption.