(/)Cornell University Law School (https://www.lawschool.cornell.edu/)Search Cornell (https://www.cornell.edu/search/)

CFR (/cfr/text) › Title 40 (/cfr/text/40) › Chapter I (/cfr/text/40/chapter-I) › Subchapter C (/cfr/text/40/chapter-I/subchapter-C) › Part 50 (/cfr/text/40/part-50) › Appendix K

CFR (/cfr/text/40/part-50/appendix-K?qt-cfr_tabs=0#qt-cfr_tabs)

Updates (/cfr/text/40/part-50/appendix-K?qt-cfr_tabs=1#qt-cfr_tabs)

View PDF at GPO (http://www.gpo.gov/fdsys/pkg/CFR-2012-title40-vol2/pdf/CFR-2012-title40-vol2-part50-appK.pdf)Pt. 50, App. K

APPENDIX K TO PART 50 (/CFR/TEXT/40/50)—INTERPRETATION OF THE NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICULATE MATTER

1.0General

(a) This appendix explains the computations necessary for analyzing particulate matter data to determine attainment of the 24-hour standards specified in 40 CFR 50.6 (/cfr/text/40/50.6). For the primary and secondary standards, particulate matter is measured in the ambient air as PM_{10} (particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers) by a reference method based on appendix J of this part and designated in accordance with part 53 of this chapter (/cfr/text/40/53), or by an equivalent method designated in accordance with part 53 of this chapter (/cfr/text/40/53). The required frequency of measurements is specified in part 58 of this chapter (/cfr/text/40/58).

(b) The terms used in this appendix are defined as follows:

Average refers to the arithmetic mean of the estimated number of exceedances per year, as per Section 3.1 (/cfr/text/40/3.1).

Daily value for PM_{10} refers to the 24-hour average concentration of PM_{10} calculated or measured from midnight to midnight (local time).

Exceedance means a daily value that is above the level of the 24-hour standard after rounding to the nearest 10 $\mu g/m^3$ (*i.e.*, values ending in 5 or greater are to be rounded up).

Expected annual value is the number approached when the annual values from an increasing number of years are averaged, in the absence of long-term trends in emissions or meteorological conditions.

Year refers to a calendar year.

(c) Although the discussion in this appendix focuses on monitored data, the same principles apply to modeling data, subject to EPA modeling guidelines.

2.0Attainment Determinations

2.124-Hour Primary and Secondary Standards

(a) Under 40 CFR 50.6(a) (/cfr/text/40/50.6#a) the 24-hour primary and secondary standards are attained when the expected number of exceedances per year at each monitoring site is less than or equal to one. In the simplest case, the number of expected exceedances at a site is determined by recording the number of exceedances in each calendar year and then averaging them over the past 3 calendar years. Situations in which 3 years of data are not available and possible adjustments for unusual events or trends are discussed in sections 2.3 and 2.4 of this appendix. Further, when data for a year are incomplete, it is necessary to compute an estimated number of exceedances for that year by adjusting the observed number of exceedances. This procedure, performed by calendar quarter, is described in section 3.0 of this appendix. The expected number of exceedances is then estimated by averaging the individual annual estimates for the past 3 years.

(b) The comparison with the allowable expected exceedance rate of one per year is made in terms of a number rounded to the nearest tenth (fractional values equal to or greater than 0.05 are to be rounded

up; e.g., an exceedance rate of 1.05 would be rounded to 1.1, which is the lowest rate for nonattainment).

2.2 Reserved

2.3 Data Requirements

(a) 40 CFR 58.12 (/cfr/text/40/58.12) specifies the required minimum frequency of sampling for PM_{10}. For the purposes of making comparisons with the particulate matter standards, all data produced by State and Local Air Monitoring Stations (SLAMS) and other sites submitted to EPA in accordance with the part 58 (/cfr/text/40/58) requirements must be used, and a minimum of 75 percent of the scheduled PM_{10} samples per quarter are required.

(b) To demonstrate attainment of the 24-hour standards at a monitoring site, the monitor must provide sufficient data to perform the required calculations of sections 3.0 and 4.0 of this appendix. The amount of data required varies with the sampling frequency, data capture rate and the number of years of record. In all cases, 3 years of representative monitoring data that meet the 75 percent criterion of the previous paragraph should be utilized, if available, and would suffice. More than 3 years may be considered, if all additional representative years of data meeting the 75 percent criterion are utilized. Data not meeting these criteria may also suffice to show attainment; however, such exceptions will have to be approved by the appropriate Regional Administrator in accordance with EPA guidance.

(c) There are less stringent data requirements for showing that a monitor has failed an attainment test and thus has recorded a violation of the particulate matter standards. Although it is generally necessary to meet the minimum 75 percent data capture requirement per quarter to use the computational equations described in section 3.0 of this appendix, this criterion does not apply when less data is sufficient to unambiguously establish nonattainment. The following examples illustrate how nonattainment can be demonstrated when a site fails to meet the completeness criteria. Nonattainment of the 24-hour primary standards can be established by the observed annual number of exceedances (e.g., four observed exceedances in a single year), or by the estimated number of exceedances derived from the observed number of exceedances and the required number of scheduled samples (e.g., two observed exceedances with every other day sampling). In both cases, expected annual values must exceed the levels allowed by the standards.

2.4 Adjustment for Exceptional Events and Trends

(a) An exceptional event is an uncontrollable event caused by natural sources of particulate matter or an event that is not expected to recur at a given location. Inclusion of such a value in the computation of exceedances or averages could result in inappropriate estimates of their respective expected annual values. To reduce the effect of unusual events, more than 3 years of representative data may be used. Alternatively, other techniques, such as the use of statistical models or the use of historical data could be considered so that the event may be discounted or weighted according to the likelihood that it will recur. The use of such techniques is subject to the approval of the appropriate Regional Administrator in accordance with EPA guidance.

(b) In cases where long-term trends in emissions and air quality are evident, mathematical techniques should be applied to account for the trends to ensure that the expected annual values are not inappropriately biased by unrepresentative data. In the simplest case, if 3 years of data are available under stable emission conditions, this data should be used. In the event of a trend or shift in emission patterns, either the most recent representative year(s) could be used or statistical techniques or models could be used in conjunction with previous years of data to adjust for trends. The use of less than 3

years of data, and any adjustments are subject to the approval of the appropriate Regional Administrator in accordance with EPA guidance.

3.0 Computational Equations for the 24-Hour Standards

3.1 Estimating Exceedances for a Year

(a) If PM$_{10}$ sampling is scheduled less frequently than every day, or if some scheduled samples are missed, a PM$_{10}$ value will not be available for each day of the year. To account for the possible effect of incomplete data, an adjustment must be made to the data collected at each monitoring location to estimate the number of exceedances in a calendar year. In this adjustment, the assumption is made that the fraction of missing values that would have exceeded the standard level is identical to the fraction of measured values above this level. This computation is to be made for all sites that are scheduled to monitor throughout the entire year and meet the minimum data requirements of section 2.3 of this appendix. Because of possible seasonal imbalance, this adjustment shall be applied on a quarterly basis. The estimate of the expected number of exceedances for the quarter is equal to the observed number of exceedances plus an increment associated with the missing data. The following equation must be used for these computations:

Equation 1

$$e_q = v_q \times \left(\frac{N_q}{n_q} \right)$$ (http://ecfr.gpoaccess.gov/graphics/er17oc06.000.gif)

Where:

e_q = the estimated number of exceedances for calendar quarter q;

v_q = the observed number of exceedances for calendar quarter q;

N_q = the number of days in calendar quarter q;

n_q = the number of days in calendar quarter q with PM$_{10}$ data; and

q = the index for calendar quarter, q = 1, 2, 3 or 4.

(b) The estimated number of exceedances for a calendar quarter must be rounded to the nearest hundredth (fractional values equal to or greater than 0.005 must be rounded up).

(c) The estimated number of exceedances for the year, e, is the sum of the estimates for each calendar quarter.

Equation 2

$$e = \sum_{q=1}^{4} e_q$$ (http://ecfr.gpoaccess.gov/graphics/er17oc06.001.gif)

(d) The estimated number of exceedances for a single year must be rounded to one decimal place (fractional values equal to or greater than 0.05 are to be rounded up). The expected number of exceedances is then estimated by averaging the individual annual estimates for the most recent 3 or more representative years of data. The expected number of exceedances must be rounded to one decimal place (fractional values equal to or greater than 0.05 are to be rounded up).

(e) The adjustment for incomplete data will not be necessary for monitoring or modeling data which constitutes a complete record, i.e., 365 days per year.

(f) To reduce the potential for overestimating the number of expected exceedances, the correction for missing data will not be required for a calendar quarter in which the first observed exceedance has occurred if:

(1) There was only one exceedance in the calendar quarter;

(2) Everyday sampling is subsequently initiated and maintained for 4 calendar quarters in accordance with 40 CFR 58.12 (/cfr/text/40/58.12); and

(3) Data capture of 75 percent is achieved during the required period of everyday sampling. In addition, if the first exceedance is observed in a calendar quarter in which the monitor is already sampling every day, no adjustment for missing data will be made to the first exceedance if a 75 percent data capture rate was achieved in the quarter in which it was observed.

Example 1

a. During a particular calendar quarter, 39 out of a possible 92 samples were recorded, with one observed exceedance of the 24-hour standard. Using Equation 1, the estimated number of exceedances for the quarter is:

e_q = 1 × 92/39 = 2.359 or 2.36.

b. If the estimated exceedances for the other 3 calendar quarters in the year were 2.30, 0.0 and 0.0, then, using Equation 2, the estimated number of exceedances for the year is 2.36 2.30 0.0 0.0 which equals 4.66 or 4.7. If no exceedances were observed for the 2 previous years, then the expected number of exceedances is estimated by: (1/3) × (4.7 0 0) = 1.57 or 1.6. Since 1.6 exceeds the allowable number of expected exceedances, this monitoring site would fail the attainment test.

Example 2

In this example, everyday sampling was initiated following the first observed exceedance as required by 40 CFR 58.12 (/cfr/text/40/58.12). Accordingly, the first observed exceedance would not be adjusted for incomplete sampling. During the next three quarters, 1.2 exceedances were estimated. In this case, the estimated exceedances for the year would be 1.0 1.2 0.0 0.0 which equals 2.2. If, as before, no exceedances were observed for the two previous years, then the estimated exceedances for the 3-year period would then be (1/3) × (2.2 0.0 0.0) = 0.7, and the monitoring site would not fail the attainment test.

3.2 Adjustments for Non-Scheduled Sampling Days

(a) If a systematic sampling schedule is used and sampling is performed on days in addition to the days specified by the systematic sampling schedule, e.g., during episodes of high pollution, then an adjustment must be made in the equation for the estimation of exceedances. Such an adjustment is needed to eliminate the bias in the estimate of the quarterly and annual number of exceedances that would occur if the chance of an exceedance is different for scheduled than for non-scheduled days, as would be the case with episode sampling.

(b) The required adjustment treats the systematic sampling schedule as a stratified sampling plan. If the period from one scheduled sample until the day preceding the next scheduled sample is defined as a sampling stratum, then there is one stratum for each scheduled sampling day. An average number of observed exceedances is computed for each of these sampling strata. With nonscheduled sampling days, the estimated number of exceedances is defined as:

Equation 3

$$e_q = \left(\frac{N_q}{m_q}\right) \times \sum_{j=1}^{m_q} \left(\frac{v_j}{k_j}\right)$$

(http://ecfr.gpoaccess.gov/graphics/er17oc06.002.gif)

Where:

e_q = the estimated number of exceedances for the quarter;

N_q = the number of days in the quarter;

m_q = the number of strata with samples during the quarter;

v_j = the number of observed exceedances in stratum j; and

k_j = the number of actual samples in stratum j.

(c) Note that if only one sample value is recorded in each stratum, then Equation 3 reduces to Equation 1.

Example 3

A monitoring site samples according to a systematic sampling schedule of one sample every 6 days, for a total of 15 scheduled samples in a quarter out of a total of 92 possible samples. During one 6-day period, potential episode levels of PM_{10} were suspected, so 5 additional samples were taken. One of the regular scheduled samples was missed, so a total of 19 samples in 14 sampling strata were measured. The one 6-day sampling stratum with 6 samples recorded 2 exceedances. The remainder of the quarter with one sample per stratum recorded zero exceedances. Using Equation 3, the estimated number of exceedances for the quarter is:

$E_q = (92/14) \times (2/6\ 0 \ldots 0) = 2.19$.

[71 FR 61224 (http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?
dbname=2006_register&position=all&page=61224), Oct. 17, 2006]

CFR Toolbox

8+1 3

Stay Involved

- LII Announce Blog (http://blog.law.cornell.edu)
- LII Supreme Court Bulletin (http://liibulletin.law.cornell.edu)

- Make a donation (http://www.law.cornell.edu/donors/)
- Contribute content (http://www.law.cornell.edu/wex)
- Become a sponsor (http://www.law.cornell.edu/lii/business_opportunities)
- Give feedback (http://www.law.cornell.edu/contact)

Find a Lawyer

Lawyers
near Portland, Oregon
Lawyers: get listed for free! (https://lawyers.justia.com/signup?ref=cornell)

(http://lawyers.law.cornell.edu/lawyer/todd-grewe-1491309)

Todd Grewe (http://lawyers.law.cornell.edu/lawyer/todd-grewe-1491309)

Construction Law, Insurance Claims, Real Estate Law
Portland, OR
  silver Badge

(http://lawyers.law.cornell.edu/lawyer/matthew-d-kaplan-786833)
Matthew D. Kaplan (http://lawyers.law.cornell.edu/lawyer/matthew-d-kaplan-786833)

Insurance Claims, Medical Malpractice, Personal Injury, Products Liability
Portland, OR
  gold Badge

(http://lawyers.law.cornell.edu/lawyer/gayle-a-shields-1492575)

Gayle A. Shields (http://lawyers.law.cornell.edu/lawyer/gayle-a-shields-1492575)

Workers' Compensation
Portland, OR
  silver Badge

(http://lawyers.law.cornell.edu/lawyer/jacob-braunstein-792001)

Jacob Braunstein (http://lawyers.law.cornell.edu/lawyer/jacob-braunstein-792001)

Bankruptcy, Criminal Law, DUI & DWI, Estate Planning, Personal Injury
Portland, OR
  gold Badge

(http://lawyers.law.cornell.edu/lawyer/larry-gray-787358)

Larry Gray (http://lawyers.law.cornell.edu/lawyer/larry-gray-787358)

Divorce, Elder Law, Estate Planning, Family Law, Probate, Real Estate Law
Newberg, OR
  silver Badge

See More Lawyers (http://lawyers.law.cornell.edu/lawyers/oregon/portland)
All lawyers (http://lawyers.law.cornell.edu/lawyers/locate/)

About LII
(/lii/about/about_lii)

Contact us
(/lii/about/contact_us)

Advertise here (/lii/help_out/sponsor)

Help
(/lii/help)

Terms of use
(/lii/terms/documentation)

Privacy
(/lii/terms/privacy_policy)

$$[LII]$$ (/)