

5.0 Technical Assessment of Areas with Incomplete Data at One or More Monitoring Sites to Determine Designation Status

Background

In this chapter, and elsewhere in this Technical Support Document, the term "complete" is used to refer to either: 1) a period of monitoring at a site; 2) the set of PM_{2.5} data from a period and site; or, 3) the design value calculated for the site and period based on such data. In these contexts, the term "complete" means that the PM_{2.5} monitoring data set for that period and site meets the completeness requirement of 40 CFR Appendix N section 4.2(a). This requirement is that, for each calendar quarter in each of three successive years valid concentration data must be available for at least 75% of the scheduled sample days, with a provision for make-up samples to be credited if obtained within specified time limits of a missed scheduled sample. Monitoring schedules at PM_{2.5} monitoring sites may be either every day, every third day, or every sixth day. The schedule may change from one quarter to another. More days of data are required to meet the percentage completeness requirement at sites and quarters with a higher frequency schedule. An Excel spreadsheet submitted to the docket documents the monitoring schedule and the number of days of available and creditable data by quarter for each monitoring site (see Docket ID NO. EPA-HQ-OAR-2007-0052).

A design value which is not "complete" under this meaning may still be "valid", i.e., appropriate for comparison to the NAAQS for the purpose of determining whether a monitoring site meets or exceeds the 24-hour PM_{2.5} NAAQS in a given three-year period. An incomplete design value can be valid in two situations. First, section 4.2(a) provides that years shall be considered valid, notwithstanding quarters with less than complete data, if the resulting annual 98th percentile value or resulting 3-year 24-hour standard design value (rounded according to the conventions of section 4.3 of this appendix) is greater than the level of the standard. Second, section 4.2(b) provides that the use of less than complete data is subject to the approval of EPA, which may consider factors such as monitoring site closures/moves, monitoring diligence, and nearby concentrations in determining whether to use such data for comparisons to the NAAQS.

EPA has issued guidance under the authority of section 4.2(b) which provides for the use of a diagnostic data substitution test to determine whether an incomplete 24-hour design value will be treated as valid for use.¹ In this test, the validity of an incomplete design value is tested by calculating a "test" design value using data substitution. In a case in which the original incomplete design value appears to meet the NAAQS, this appearance is challenged by substituting the worst case (within the respective calendar quarter) observed concentration for all the missing data; if the result is a "test" design value that still meets the NAAQS, the original incomplete design value is deemed valid, and the site is considered to meet the NAAQS. In a case in which the original incomplete design value appears to exceed the NAAQS, this appearance is challenged by substituting the best case (within the respective calendar quarter) observed

¹ Guideline on Data Handling Conventions for the PM NAAQS, EPA-454/R-99-008, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC, April 1999, <http://www.epa.gov/ttn/oarpg/t1/memoranda/pmfinal.pdf>, see "Approach No. 2: How you may use maximum observed values to substitute for missing data" on page 20

concentration for enough of the missing data as needed to meet the 75% requirement; if the result is a "test" design value that still exceeds the NAAQS, the original design value is considered valid, and the site is considered to have violated the NAAQS. In either case, if the result of the "challenge" is that the "test" design value disagrees with the original design value with respect to the NAAQS comparison, the original design value is deemed invalid (and the "test" design value has no further role in NAAQS comparisons, being only hypothetical). In such a case, it cannot be determined under Appendix N whether a site meets or exceeds the NAAQS for the period in question, essentially the same as if the site had not operated.

EPA routinely applies this diagnostic data substitution test when calculating 24-hour $PM_{2.5}$ design values, with the additional restriction that EPA applies this test to validate an incomplete design value that is below the NAAQS only if the incomplete quarter(s) have at least a minimum number of days with good data. All design values described in this Technical Support Document as being "complete" or "valid" are either based on complete data or have been deemed to be valid via the data substitution test. Any design value described as "invalid" or "incomplete" is one which has not been deemed to be valid via the data substitution test. An Excel spreadsheet submitted to the docket indicates which design values are "complete", which are incomplete relative to the 75% requirement but have been validated this way, and which are invalid (see Docket ID NO. EPA-HQ-OAR-2007-0052).

Treatment of Areas with Incomplete Data at One or More Monitoring Site

There were eight areas in which the diagnostic data substitution test did not validate one or more incomplete 2006-2008 design values. Thus, for these eight areas, EPA further evaluated the site level data. For two of the areas, the Gadsden, AL, and Ravalli, MT areas, the areas each had only one monitor, and that monitor violated the 24-hour $PM_{2.5}$ NAAQS in 2004-2006. For 2005-2007 and 2006-2008, data for the monitors were incomplete. However, the invalid design values for both periods in both areas were not above the level of the NAAQS. EPA has determined that there is insufficient information to determine if these areas meet the NAAQS and, therefore, is designating the Gadsden, AL, and Ravalli, MT areas as unclassifiable.

Where an area has an incomplete, violating monitor in 2006-2008, and that monitor was the highest valid design value monitor for the area in 2005-2007, EPA is designating the area as nonattainment. For the Knoxville, TN area, the data for the monitor with the highest valid design value for 2005-2007 were incomplete for 2006-2008. Since this monitor was the highest design value monitor and was violating the 24-hour $PM_{2.5}$ NAAQS in 2005-2007, EPA is designating the area as nonattainment.

For five areas that EPA intended to designate as nonattainment based on 2005-2007 air quality data, in reviewing 2006-2008 air quality data, EPA noted that, for each area, all monitors with complete data were attaining the 24-hour $PM_{2.5}$ NAAQS. However, one or more monitoring sites in each area had incomplete data and, in each area, one monitoring site had previously violated the 24-hour $PM_{2.5}$ NAAQS, in 2005-2007 or 2004-2006. In each of these areas, the incomplete, previously-violating monitor was not the highest design value monitor for 2005-2007. EPA performed further evaluations of data for the following five areas: Chicago-Gary-Lake County, IL-IN; Baltimore, MD; Cincinnati-Hamilton, OH-KY-IN; Green Bay, WI;

and, Indianapolis, IN. If the incomplete monitor was not the highest design value monitor for the area in 2005-2007, if the highest design value monitor in 2005-2007 has a complete and valid design value for 2006-2008 showing attainment of the NAAQS, and if, based on review of the specific data, EPA believes it is reasonable to expect that the incomplete site would have a design value equal to or lower than the NAAQS if it had complete data, then EPA is designating the area as unclassifiable/attainment. This is the situation in the five cases discussed below.

The remainder of this chapter presents technical information supporting the final air quality designation of unclassifiable/attainment for the following five areas: Chicago-Gary-Lake County, IL-IN; Baltimore, MD; Cincinnati-Hamilton, OH-KY-IN; Green Bay, WI; and, Indianapolis, IN.

Chicago-Gary-Lake County, IL-IN

In 2006-2008, twenty-nine PM_{2.5} monitoring sites were operational in the Chicago-Gary-Lake County, IL-IN area. None of these sites violated the 2006 24-hour PM_{2.5} NAAQS in 2006-2008. Twenty-six sites had complete data with valid design values equal to or below the level of the NAAQS.

However, three operating sites had incomplete data; that is, they did not meet the completeness requirements of 40 CFR 50 Appendix N. Two of these sites (AQS sites 180891003 and 181270020) did have complete data in 2005-2007, with valid design values equal to or less than the level of the NAAQS. In addition, the invalid design values for these two sites for 2006-2008 are below the level of the 24-hour PM_{2.5} NAAQS, which is 35 µg/m³.

The third site, AQS site 170316005 in Cook County, IL, referred to here as the Cicero site, had a valid 2005-2007 design value of 37 µg/m³, above the level of the NAAQS, and is the focus of this review. The 2006-2008 design value for this site, computed from available but incomplete data, is 33 µg/m³. At issue is whether, with sufficiently complete data, the design value for the Cicero site might have been higher than the level of the NAAQS. For these purposes, a precise estimate of the design value that hypothetically would have been found with complete data is not necessary.² Therefore, EPA assessed the likelihood that this site would have had a violating design value if it had collected data on enough of the scheduled sample days to satisfy the completeness requirements.

Comparison of 2005-2007 and 2006-2008 Design Values

The Cicero site was not the highest design value site in 2005-2007. Seven other sites had an equal or higher 24-hour design value in 2005-2007, and all seven of those sites met the NAAQS with sufficiently complete data in 2006-2008. The other sites all show a 2006-2008 design value that is about 5 µg/m³ lower than the 2005 to 2007 design value (see Table 1 below), which is approximately the air quality improvement that the incomplete data at the Cicero site suggest.

Comparison of Year-Specific 98th Percentile Concentrations

² This statement also applies to the other four areas discussed in this section.

In addition to comparing three-year design values for multiple sites, EPA considered how PM_{2.5} air quality at the Cicero site has compared to PM_{2.5} air quality at other sites in individual years. In 2006 and 2007, the Cicero site did not have the highest 98th percentile value among all sites. In 2008, this site did have the highest 98th percentile value. This is because, due to the missing sampling days, and thus fewer total measurements for the year, the second highest observed value during the year, 34.1 µg/m³, is selected as the 98th percentile value. With only a few additional measurements, it would have been the third highest value, which was 30.1 µg/m³, and the Cicero site would then not have had the highest 98th percentile value among sites. Even if the true 2008 annual 98th percentile value for the Cicero site were the same as the 98th percentile value of 33.9 µg/m³ observed at the McCook site (the traditionally highest concentration site, and the site with the highest 98th percentile value in 2008), the 3-year design value would be 33 µg/m³, below the level of the NAAQS.

Concentrations During the Specific Period(s) of Data Gaps

Data for the Cicero site were incomplete because this site collected only 50 percent of its scheduled observations during the first quarter of 2008 and only 70 percent of its scheduled observations during the fourth quarter of 2008, both of which fall short of the required 75 percent data collection. EPA conducted further review for the Cicero site (AQS site 170316005) to assess the likelihood that, had it collected complete data during these specific periods, this monitoring site would have shown nonattainment.

First, EPA determined the value of the 98th percentile concentration for 2008 that would have resulted in the Cicero site just meeting the NAAQS for 2006-2008, when averaged with the observed 98th percentile values for 2006 and 2007 (which are themselves based on complete data). This “critical 98th percentile value” for 2008 is 40.1 µg/m³. The actual 98th percentile value observed among the days with monitoring data was 34.1 µg/m³. EPA examined whether any other sites in the area observed a concentration higher than 40.1 µg/m³ on the days that Cicero failed to obtain scheduled measurements. This approach reflects the fact that the annual 98th percentile value at the Cicero site for all of 2008 could not have been higher than 40.1 µg/m³ unless the site had recorded a value higher than 40.1 µg/m³ on at least one of the days that it failed to obtain a scheduled measurement. For the entire network of sites in the Chicago area, no site recorded a value on any of these days that was higher than 40.1 µg/m³. Indeed, if for each of these days, the Cicero site had recorded the highest value recorded at any other site in the area for that day, the 98th percentile value for all of 2008 at the Cicero site would have been lower than 34.1 µg/m³. That is because the site would then have recorded enough values that the 98th percentile would have been the third highest value (32.7 µg/m³) rather than the second highest value (34.1 µg/m³).

Broader Comparison of Design Value Trends

EPA also compared year-to-year variations in design values at the various sites over a longer period. As is evident from Table 1, below, the concentrations at the various sites in the Chicago area are well correlated for the 3-year periods shown. This degree of correlation

suggests the degree of air quality improvement at the various other sites in the area is a good indication of the degree of air quality improvement likely to have occurred at the Cicero site. For the various 3-year periods shown below, the Cicero site has had design values that are consistently about 3 $\mu\text{g}/\text{m}^3$ lower than the design value for the McCook site, which has been the highest design value site over this time period.

For these reasons, EPA is confident that if the Cicero site had collected complete data in 2008, it would have resulted in a design value that would have been at or below 35 $\mu\text{g}/\text{m}^3$. Thus, EPA believes that air quality at this site is meeting the 24-hour $\text{PM}_{2.5}$ NAAQS. Accordingly, EPA is designating the Chicago-Gary-Lake County, IL-IN area as unclassifiable/attainment.

Table 1. Design Values for the 24-Hour $\text{PM}_{2.5}$ NAAQS.

Site ID	Design Value for the 24-Hour $\text{PM}_{2.5}$ NAAQS				
	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008
170310014	37	36	33		
170310022	35	39	35	36	31
170310050	35	38	35	35	29
170310052	38	41	40	40	33
170310057	35	39	36	38	31
170310076	36	39	38	37	32
170311016 (McCook)	43	46	42	40	35
170312001	38	41	37	36	31
170313103	(41)*	(46)*	40	39	33
170313301	39	43	40	38	31
170314007	35	36	33	33	29
170314201	31	32	30	34	30
170316005 (Cicero)	39	42	39	37	(33)*
170434002	33	36	33	35	32
170890003	32	34	32	35	33
170971007	27	(44)*	(35)*	35	29
171110001	31	31	33	35	27
171971002	33	33	31	31	28
171971011	28	37	36	37	32
180890006	35	32	30	(32)*	26
180890022	44	35	34	36	31
180890026	40	44	38	35	31
180890027	32	41	38	36	33
180891003	31	34	31	(32)*	29
180891016	(40)*	(39)*	(33)*	34	31
180892004	33	34	32	33	(30)*
180892010	34	34	32	33	30
180896000	(21)*	36	32	35	30
181270020	32	35	31	32	(29)*
181270024	31	32	31	32	29

*Data are incomplete.

Baltimore, MD

In 2006-2008, nine PM_{2.5} monitoring sites were operational in the Baltimore area. None of these sites violated the 24-hour PM_{2.5} NAAQS in 2006-2008. Eight sites had complete data with valid design values which did not exceed the NAAQS. One site (AQS site 245100035) had incomplete data for this period (per the completeness requirements of 40 CFR 50 Appendix N).

AQS site 245100035 had incomplete data because it was shut down in August 2008 due to the closure and demolition of the industrial facility at which it was located. This site had previously violated the 24-hour PM_{2.5} standards for 2005-2007 with a design value of 36 µg/m³. Based on the air quality evidence stated below, EPA believes it is reasonable to expect that, if the incomplete site had complete data, it would have a design value equal to, or lower than, the sites with the higher design values.

Comparison of 2005-2007 and 2006-2008 Design Values

First, AQS site 245100035 was not the highest 24-hour design value site for Baltimore in 2004-2006 or 2005-2007. AQS site 245100035 had a 24-hr PM_{2.5} design value that ranked second out of nine sites with valid/complete design value in the Baltimore area in 2004-2006, and third out of nine sites in 2005-2007. All other sites with complete data, and which formerly violated the NAAQS, met the 24-hour PM_{2.5} NAAQS in 2006-2008, including the sites which in earlier periods showed worse PM_{2.5} air quality than AQS site 245100035. In 2005-2007, two other sites had design values of 37 µg/m³, higher than the 2005-2007 design value of 36 µg/m³ for AQS site 245100035. In 2006-2008, the design values at these two sites had decreased to 34 and 35 µg/m³, respectively, which is evidence that PM_{2.5} concentrations have decreased in the Baltimore area in general. Another site (AQS site 245100040) also had a higher design value than AQS site 245100035 in 2004-2006 although not in 2005-2007; AQS site 245100040 also has experienced decreases in PM_{2.5} concentrations and has met the NAAQS in 2006-2008.

Comparison of Year-Specific 98th Percentile Concentrations

In addition to considering comparisons among sites based on three-year design values, EPA considered how PM_{2.5} air quality at AQS site 245100035 has compared to that at other sites in individual years. Between 2004 and 2008, AQS site 245100035 did not have, except for one year, the highest annual 98th percentile compared to the other sites in the area. By this measure, its annual ranking among sites was 2nd out of 13 in 2004, 3rd out of 12 in 2005, 1st out of 9 in 2006, 6th out of 9 in 2007, and 4th out of 9 in 2008. Its average rank over those five years was 3.2 out of 10.4. Of the 13 sites that had at least one valid 98th percentile between 2004 and 2008, three sites had higher 5-year 98th percentile averages. These facts also bolster a conclusion that the likelihood is very low that the site in question would have had the highest 98th percentile concentration among monitoring sites even if its data set had been complete. The actual highest 98th percentile concentration among monitoring sites in 2008 was 34.4 µg/m³, as compared with

the 98th percentile value of 31.6 $\mu\text{g}/\text{m}^3$ observed at AQS site 245100035. Even if more complete monitoring in 2008 had resulted in a 98th percentile value of 34.4 for AQS site 245100035, its hypothetical 2006-2008 design value (35.2 $\mu\text{g}/\text{m}^3$) would have met the NAAQS.

Concentrations During the Specific Period(s) of Data Gaps

EPA also examined data during the specific period in which the site in question had closed (and thus had missing data; i.e., 8/19/2008 through 12/31/2008). During this period, $\text{PM}_{2.5}$ concentrations at the other sites were low relative to the NAAQS level of 35 $\mu\text{g}/\text{m}^3$; the maximum value seen during this period at the eight still-operating sites in the area was 27.2 $\mu\text{g}/\text{m}^3$, and all other values were below 26 $\mu\text{g}/\text{m}^3$. In 2007, two monitoring sites had one exceedance each between those same dates, indicating that the period from mid-August to the end of December generally has low $\text{PM}_{2.5}$ concentrations compared to the rest of the year. Thus, it appears that, if AQS site 245100035 had sampled between 8/19/2008 and 12/31/2008, there is a high likelihood that all values would have been at least below the NAAQS level, and probably all would have been below 27.2 $\mu\text{g}/\text{m}^3$. If that were the case, then a true 98th percentile for this site for the entire 2008 year would have to be no more than (but could be less than) the 31.6 $\mu\text{g}/\text{m}^3$ level now stated for it, and hence, a "real" three-year design value would be no more than the 34 $\mu\text{g}/\text{m}^3$ level it is now (albeit incomplete).

Broader Comparison of Design Value Trends

Finally, looking across all sites, EPA has observed that there is not a lot of inter-site variability in 24-hour design value trends in the Baltimore area, indicating that high concentrations are due to geographically broad causes, rather than to unique emission events near individual monitoring sites. Of the eight Baltimore sites with complete design values for 2006-2008 and 2005-2007, six sites had a decrease in 24-hr design values over that span and two had no change. A comparison of the previous periods of 2004-2006 and 2005-2007 revealed that, of the nine sites with complete design values for these two periods, five showed declines and four showed no change. Thus, it is likely that a 2006-2008 design value based on complete data for AQS site 245100035 would have shown the same general pattern (i.e., a decline) as the other sites. The average change in site-level design values between 2005-2007 and 2006-2008 was 1 $\mu\text{g}/\text{m}^3$ and the median site change was 2 $\mu\text{g}/\text{m}^3$. The incomplete 2006-2008 design value for the site in question compared to its prior (2005-2007) complete design is less by 2 $\mu\text{g}/\text{m}^3$, the same as the median change among all sites. However, even if the real change had only been a reduction of 1 $\mu\text{g}/\text{m}^3$, the site and the area would still have attained the 24-hour $\text{PM}_{2.5}$ NAAQS.

These facts suggest that AQS site 245100035 very likely would not have had the highest design value in the Baltimore area in 2006-2008 even if it had complete data for 2008. Since the highest valid site design value in the area was 35 $\mu\text{g}/\text{m}^3$, it follows that it is very likely that AQS site 245100035 would have met the 35 $\mu\text{g}/\text{m}^3$ NAAQS level if it were complete. Accordingly, EPA is designating the Baltimore area as unclassifiable/attainment.

EPA also observes that quarterly data completeness at operating sites in the Baltimore area between 2004-2008 was excellent. Even when including site-quarters in which sites began or ended monitoring during that quarter (i.e., not on the first or last day), the averages of site-

quarter data completeness were between 82% and 95% at individual sites, and 92% when averaged across all sites. When excluding site quarters in which a monitor began or ended sampling during the quarter, then site-quarter data completeness averaged between 89% and 96% at each site, and 93% for all sites. Only 3 of the 205 site-quarter data capture rates did not meet the 75% goal; those 3 were close though, at 67%, 73%, and 74% data capture, and eventually were usable based on CFR- and guidance-permitted data substitution protocols. As noted above, AQS site 245100035 never had a deficient quarter (i.e., less than 75% capture) between 2006-2008 in the quarters when it operated the entire quarter (i.e., all 3 months). These facts show that the monitoring agency was diligent in its monitoring obligations.

Cincinnati-Hamilton, OH-KY-IN

In 2006-2008, fifteen PM_{2.5} monitoring sites were operational in the Cincinnati area. None of these sites violated the 24-hour PM_{2.5} NAAQS in 2006-2008. Eleven sites had complete data with valid design values which did not exceed the NAAQS. Four sites had incomplete data for this period (per the completeness requirements of 40 CFR 50 Appendix N).

AQS site 210370003 had incomplete data because operation was terminated in March 2006; the latest (i.e., most recent) valid design value for this site was the one for 2003-2005, at 31 µg/m³, that showed attainment. AQS site 210373002 had incomplete data for 2006-2008 because it only began operation in August 2007, and hence, has not yet produced a valid 3-year design value. AQS site 391650007 only began operation in January 2007, and thus, it too has not yet had sufficient time to produce a valid 3-year design value.

The fourth site, AQS site 390171004 had incomplete data for 2006-2008 because it was shut down in December 2007. This site had previously violated the 24-hour PM_{2.5} standards for 2005-2007 with a design value of 38 µg/m³; this site is the subject of additional focus.

Comparison of 2005-2007 and 2006-2008 Design Values

In 2005-2007, there were ten sites that violated the 24-hour PM_{2.5} NAAQS. AQS site 390171004 had a design value of 38 µg/m³, which was not the highest in the Cincinnati area for 2005-2007, as there was a site with a design value of 41 µg/m³. Although AQS site 390171004 had a design value for 2005-2007 that ranked second in the area, it was tied with six additional sites that also had design values of 38 µg/m³. If the 24-hour PM_{2.5} design values were carried with one decimal, as opposed to being rounded to have zero decimals (per the Appendix N protocol), the site in question would actually have ranked fifth instead of being tied for second among the 10 violators and 12 overall sites. (Two sites in the area had valid 2005-2007 design values that met the NAAQS.) For the 11 sites that had valid 2005-2007 design values and valid 2006-2008 design values, all showed significant reductions. Reductions ranged from 2 to 7 µg/m³, with an average and median of 5 µg/m³. Applying the same concentration reductions to the focus site (i.e., estimating the 2006-2008 design value at the focus location as its 2005-2007 design value minus the different concentration reductions seen at each of those 11 sites) would derive hypothetical 2006-2008 design values for the focus site that met the NAAQS in 10 out of 11 cases (each case defined by the change in the design value at another monitor). Applying the

average/median reduction to the subject site would produce a hypothetical 2006-2008 design value of $33\mu\text{g}/\text{m}^3$ at the subject location. Looking at just the six sites that had 2005-2007 design value levels comparable to the focus site (i.e., those that tied with this site in 2005-2007 with a design value $38\mu\text{g}/\text{m}^3$ and that have a valid design value for 2006-2008), the concentration reduction ranged from 4 to $7\mu\text{g}/\text{m}^3$, with average and median changes of 5; assuming similar reductions at the focus site would generate hypothetical design values that met the NAAQS in all cases. The incomplete design value of $35\mu\text{g}/\text{m}^3$ at the focus site is higher than the $33\mu\text{g}/\text{m}^3$ estimate derived from the means/medians of the two distributions described above, because the former ostensibly does not have the advantage of a third and lowest data point (see discussion below on annual 98th percentiles).

Comparison of Year-Specific 98th Percentiles & Concentrations During the Specific Period of Data Gaps

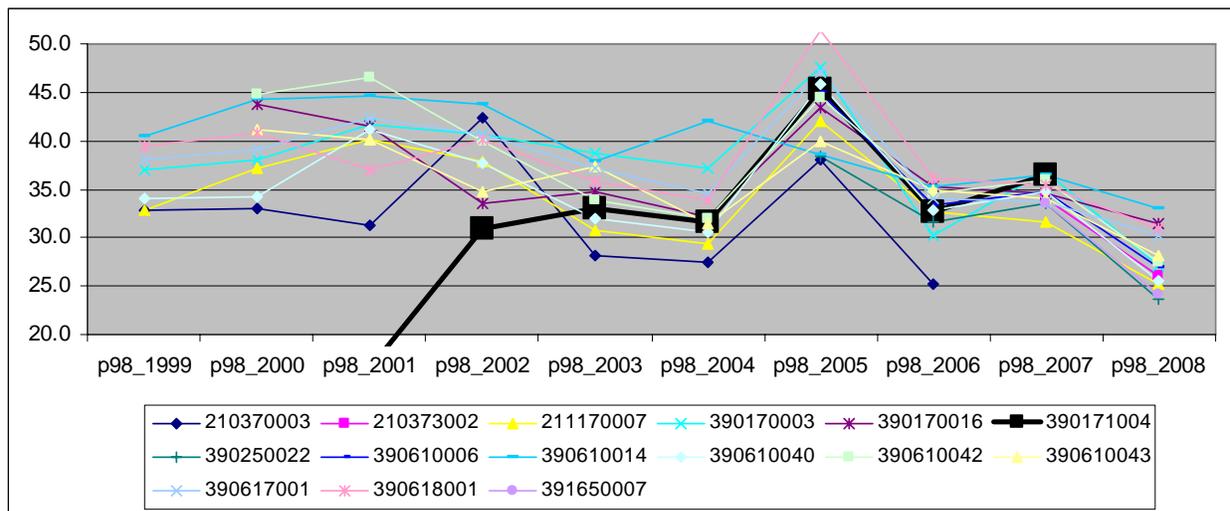
An analysis of year-specific 98th percentiles is more robust than the above design value-based analysis because of the latter's multi-year smoothing effect. Because the focus site is missing an entire year of data (i.e., all of 2008), the 2008 98th percentile approximation (or actually, maximum estimation, as shown in the hypothetical substitutions described below), is appropriate as a method of accounting for the missing period of data. Provided below, in Table 2 and in Figure 1, are site-level 98th percentile $\text{PM}_{2.5}$ concentrations for the Cincinnati area, for 1999-2008. In Figure 1, the focus site is represented by the heavy black line with large square symbols. The focus site's 98th percentile $\text{PM}_{2.5}$ concentrations have generally been among the lowest of the Cincinnati sites, and have never been the highest in the area. Over the seven years that the site in question produced a valid annual 98th percentile, its corresponding average rank among in the Cincinnati was 7.7 out of 12 sites. Twice in seven years, it had the lowest 98th percentile of all sites, and only twice was its 98th percentile in the top half of the distribution; its highest rank ever was only third. Of the 13 Cincinnati sites with valid 2007 and 2008 98th percentiles, all showed declines in the annual 98th percentile metric between those years; reductions ranged from 9 to 30 percent, the mean reduction was 20 percent and the median was 22 percent. Applying the smallest reduction (9 percent) to the focus site's 2007 98th percentile to estimate the missing 2008 value, yields a hypothetical high-end value of $33.1\mu\text{g}/\text{m}^3$ which, combined with the real, valid 2006 and 2007 focus site 98th percentiles, gives a hypothetical 3-year design value (on the high end) of $34\mu\text{g}/\text{m}^3$, which is under the NAAQS nonattainment threshold. Note that the highest actual, valid 98th percentile in the Cincinnati area was only $33.0\mu\text{g}/\text{m}^3$; using that value in the calculation also produces a test design value of $34\mu\text{g}/\text{m}^3$.

Thus, EPA believes it is reasonable to expect that, if the incomplete site had complete data, it would have a design value equal to, or lower than, the sites with the higher design values. Accordingly, EPA is designating the Cincinnati area as unclassifiable/attainment.

Table 2. Site Level 98th Percentile $\text{PM}_{2.5}$ Concentrations for the Cincinnati Area, 1999-2008.

site	p98_1999	p98_2000	p98_2001	p98_2002	p98_2003	p98_2004	p98_2005	p98_2006	p98_2007	p98_2008
210370003	32.9	33.0	31.3	42.3	28.1	27.5	38.0	25.2		
210373002									34.0	26.1
211170007	32.9	37.2	40.2	37.8	30.8	29.4	42.1	32.6	31.6	25.2
390170003	37.0	38.1	41.7	40.7	38.7	37.2	47.6	30.2	36.8	27.1
390170016		43.8	41.5	33.6	34.8	32.2	43.4	35.2	34.5	31.5
390171004			16.5	30.9	33.0	31.6	45.4	32.7	36.4	
390250022							38.3	31.6	33.5	23.6
390610006							45.0	33.3	34.7	27.0
390610014	40.5	44.3	44.6	43.7	37.8	42.0	38.5	35.2	36.5	33.0
390610040	34.1	34.3	41.2	37.7	31.9	30.5	45.8	32.8	34.7	25.5
390610042		44.8	46.6	40.0	33.8	31.9	44.4	34.5	35.9	27.5
390610043		41.2	40.1	34.8	37.3	31.4	39.9	34.9	34.0	28.2
390617001	38.0	39.1	42.3	40.7	37.1	34.6	47.1	34.0	33.7	30.3
390618001	39.5	40.8	37.0	40.1	35.8	33.9	51.4	36.1	35.4	31.0
391650007									33.6	24.2
rank of focus site			11	11	8	7	5	9	3	
count	7	10	11	11	11	11	13	13	14	13

Figure 1. Site Level 98th Percentile PM_{2.5} Concentrations for the Cincinnati Area, 1999-2008.



Green Bay, WI

In 2006-2008, two PM_{2.5} monitoring sites were operational in the Green Bay, Wisconsin area. None of these sites violated the 2006 24-hour PM_{2.5} NAAQS in 2006-2008. One site (AQS site 550090005) had complete data with a valid design value of 35 µg/m³ which did not exceed the NAAQS. One site (AQS site 550090009) had incomplete data for this period (per the completeness requirements of 40 CFR 50 Appendix N).

AQS site 550090009 had incomplete data because it was shut down in January 2006, after achieving only six measurements in 2006. This site is considered to have violated the 24-hour PM_{2.5} standards for 2004-2006, despite there having been only six measurements in 2006, because of a particular provision in 40 CFR 50 Appendix N. This provision specifies that a three-year design value which exceeds the NAAQS is to be considered valid even if data capture in one or more of the years did not meet the normal requirement for 75 percent of scheduled

samples in each calendar quarter. For AQS site 550090009, the 98th percentile of the six available measured values is the highest of those values, under the terms of Appendix N, which is 32.8 $\mu\text{g}/\text{m}^3$. When averaged with the 98th percentile values for 2004 and 2005, which were 30.5 and 44.3 $\mu\text{g}/\text{m}^3$, respectively, the result is a three-year design value for 2004-2006 of 36 $\mu\text{g}/\text{m}^3$. This site started operating in the middle of 2003, and its only valid design value is for 2004-2006; the three-year average of its 98th percentile concentrations for 2003-2005 did not exceed the NAAQS and, hence, is not a valid design value, as the three-year data do not meet the Appendix N completeness requirements.

In contrast, the other operating site in Green Bay, AQS site 550090005, has had complete data since the second quarter of 1999. The complete and valid design values for this site are as follows:

2000-2002: 32 $\mu\text{g}/\text{m}^3$
 2001-2003: 32 $\mu\text{g}/\text{m}^3$
 2002-2004: 32 $\mu\text{g}/\text{m}^3$
 2003-2005: 36 $\mu\text{g}/\text{m}^3$
 2004-2006: 37 $\mu\text{g}/\text{m}^3$
 2005-2007: 37 $\mu\text{g}/\text{m}^3$
 2006-2008: 35 $\mu\text{g}/\text{m}^3$

Thus, in the one period in which both monitors produced valid design values, 2004-2006, the focus site (AQS site 550090009) had a lower design value than the design value from the still-running site (AQS site 550090005). The invalid design value for the focus site in 2003-2005 (35 $\mu\text{g}/\text{m}^3$) was also less than the same-period, valid design value for the still-running site.

From 1999 through 2006, AQS site 550090005 operated on a one-in-three day schedule. Since the beginning of 2007, this site has operated on an every day schedule, increasing the confidence that its design value for 2006-2008 accurately reflects true $\text{PM}_{2.5}$ air quality at the site.

The violating 2004-2006 design value for site 550090009 is largely due to the 98th percentile value of 44.3 for 2005. The 98th percentile concentrations at both sites in all other years have been such that no combination of any three of them (one for each year) would result in a design value above the NAAQS (see Table 3 below). EPA believes that, in light of the more than three years that have elapsed since the day of this 98th percentile value, the 2004-2006 design value for that site should be given little weight in determining whether Green Bay meets the NAAQS, and that the complying design value from the still-running site should be treated as determinative. Accordingly, EPA is designating the Green Bay area as unclassifiable/attainment.

Table 3. Site Level 98th Percentile $\text{PM}_{2.5}$ Concentrations for the Green Bay, Wisconsin Area, for 1999-2008.

98th Percentile $\text{PM}_{2.5}$ Concentrations in Green Bay, WI										
Monitor	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008

98th Percentile PM _{2.5} Concentrations in Green Bay, WI										
Monitor	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
550090009 ("Focus Site")					30.0	30.5	44.3	32.8		
550090005 ("Comparison Site")	31.9	32.4	33.5	29.1	33.5	32.3	41.5	36.9	32.7	34.6

Indianapolis, IN

In 2006-2008, seven PM_{2.5} monitoring sites were operational in the Indianapolis area. None of these sites violated the 2006 24-hour PM_{2.5} NAAQS in 2006-2008. Five sites had complete data with valid design values which did not exceed the NAAQS. Two sites had incomplete data for this period (per the completeness requirements of 40 CFR 50 Appendix N).

AQS site 180970042 had incomplete data for 2006-2008 because it was shut down in December 2007. This site was attaining the 2006 24-hour PM_{2.5} NAAQS in 2005-2007 with a valid (i.e., “complete”) design value of 35 µg/m³; thus, its most recent valid design value status was “attainment”. AQS site 180970079 also had incomplete data because it was shut down in December 2007. However, this site had previously violated the 24-hour PM_{2.5} standard for 2005-2007 with a design value of 36µg/m³ and was the focus of this additional assessment.

Comparison of 2005-2007 and 2006-2008 Design Values

AQS site 180970079 was not the highest design value site in 2005-2007, as two other sites had design values of 40 µg/m³. There were actually six Indianapolis sites that violated the 24-hour PM_{2.5} NAAQS in 2005-2007, and five of these (all except AQS site 180970079) had valid 2006-2008 design values that met the NAAQS. AQS site 180970079 had the lowest design value of the six 2005-2007 violators. As noted above, its design value for that period was 36 µg/m³ and two other sites had design values of 40 µg/m³; of the remaining three violating sites, one had a design value of 39 µg/m³ and two had design values of 37 µg/m³. The five sites that violated the 24-hour PM_{2.5} NAAQS in 2005-2007, but had valid 2006-2008 data showing attainment of the NAAQS, showed reductions in design value levels of 4 to 6 µg/m³ between those periods. The site in question also had a 4 µg/m³ reduction between 2005-2007 and 2006-2008, albeit the latter period design value is considered incomplete. The seventh monitoring site in the Indianapolis area, the one that showed attainment with 2005-2007 data and also shut down at the end of 2007, shows a 2 µg/m³ reduction between 2005-2007 and 2006-2008 (i.e., the difference between its valid 2005-2007 design value of 35 µg/m³ and its incomplete 2006-2008 design value of 33 µg/m³). That site and the focus site appear to have smaller reductions between their 2005-2007 and 2006-2008 design values than the other sites because they both are missing (all) 2008 data, which, as discussed below, was markedly cleaner for the still-active sites, and hence their 2006-2008 design values do not reflect the improvement in air quality in 2008. However, even if the focus site had shown a real improvement of only 2 µg/m³ (the minimum reduction) between 2005-2007 and 2006-2008; that is, if it had a valid 2006-2008

design value of 34 $\mu\text{g}/\text{m}^3$, then the site and area would unquestionably be “attainment”. EPA believes it is reasonable to expect that, if the incomplete site had complete data, it would have a design value equal to or lower than the sites with the higher design values.

Comparison of Year-Specific 98th Percentiles & Concentrations During the Specific Period of Data Gaps

An analysis of year-specific 98th percentiles is more robust than the above design value-based analysis because of the latter’s multi-year smoothing effect. Because the focus site is missing an entire year of data (i.e., all of 2008), the 2008 98th percentile approximation (or actually, maximum estimation, as shown in the hypothetical substitutions described below), is appropriate as a method of accounting for the missing period of data. Provided below, in Table 4 and in Figure 2, are site-level 98th percentile PM_{2.5} concentrations for the Indianapolis area, for 1999-2008. In Figure 2, the focus site is represented by the heavy black line with large square symbols. The focus site’s 98th percentile PM_{2.5} concentrations have generally been among the lowest of the Indianapolis sites, and have never been the highest in the area. Both its 2006 and its 2007 98th percentiles are the lowest of the seven sites for those years. Over the 10-year monitoring history (1999 through 2008), AQS site 180970079’s annual 98th percentiles have only once been in the top half of the Indianapolis distribution; in 2003, its 98th percentile was the 3rd highest out of seven sites. Its annual 98th percentile average rank in the area over the 10-year period is 5.8 out of 7.0. All five Indianapolis sites with 2008 data showed large similar reductions in 98th percentile levels between 2007 and 2008; the maximum reduction was 27 percent, the minimum reduction was 18 percent, and the average and median reductions were 22 percent. If the focus site did have a 2008 98th percentile that was 18 percent less (i.e., the area minimum) than the previous year’s value, then that 2008 hypothetical value would be 27.5 $\mu\text{g}/\text{m}^3$, and the corresponding 3-year average (i.e., the hypothetical design value) would be 31 $\mu\text{g}/\text{m}^3$, which would meet the 24-hour PM_{2.5} NAAQS by a margin. Furthermore, if the focus site’s 2008 98th percentile was actually nearer the top of the area distribution, for example, if it were the highest recorded value of 30.5 $\mu\text{g}/\text{m}^3$, then its hypothetical design value would still be below the NAAQS threshold (e.g., averaging 30.5 with the 2006 and 2007 figures of 30.7 and 35.5 yields a design value of 32 $\mu\text{g}/\text{m}^3$).

Accordingly, EPA is designating the Indianapolis area as unclassifiable/attainment.

Table 4. Site Level 98th Percentile PM_{2.5} Concentrations for the Indianapolis Area, 1999-2008.

site	p98_1999	p98_2000	p98_2001	p98_2002	p98_2003	p98_2004	p98_2005	p98_2006	p98_2007	p98_2008
180970042	31.1	33.5	31.0	39.6	33.7	29.3	39.4	31.0	35.6	
180970043	40.3	36.8	36.4	36.5	37.9	31.7	43.9	37.5	38.3	30.1
180970066	39.4	39.5	44.1	44.8	39.4	31.1	44.0	36.2	38.8	28.2
180970078	40.6	36.5	37.2	35.0	39.3	31.0	42.5	31.7	37.6	28.9
180970079	32.2	35.1	35.9	33.3	38.0	28.7	43.4	30.7	33.5	
180970081	40.2	36.3	38.5	26.8	36.2	31.9	45.7	34.8	37.1	30.5
180970083	39.0	35.7	39.5	36.7	36.7	31.8	40.3	33.5	37.2	29.0
rank of focus site	6	6	6	6	3	7	4	7	7	
count	7	7	7	7	7	7	7	7	7	5

Figure 2. Site Level 98th Percentile PM_{2.5} Concentrations for the Indianapolis Area, 1999-2008.

