

PM_{2.5} Design Values, 2000-2002: Summary Counts and Maps

Data extracted from EPA's Air Quality System (AQS) on 7/9/03

Contact:

- Mark Schmidt, OAQPS/EMAD
 - (919) 541-2416
 - schmidt.mark@epa.gov

PM_{2.5} Design Values, 2000-2002 - Summary

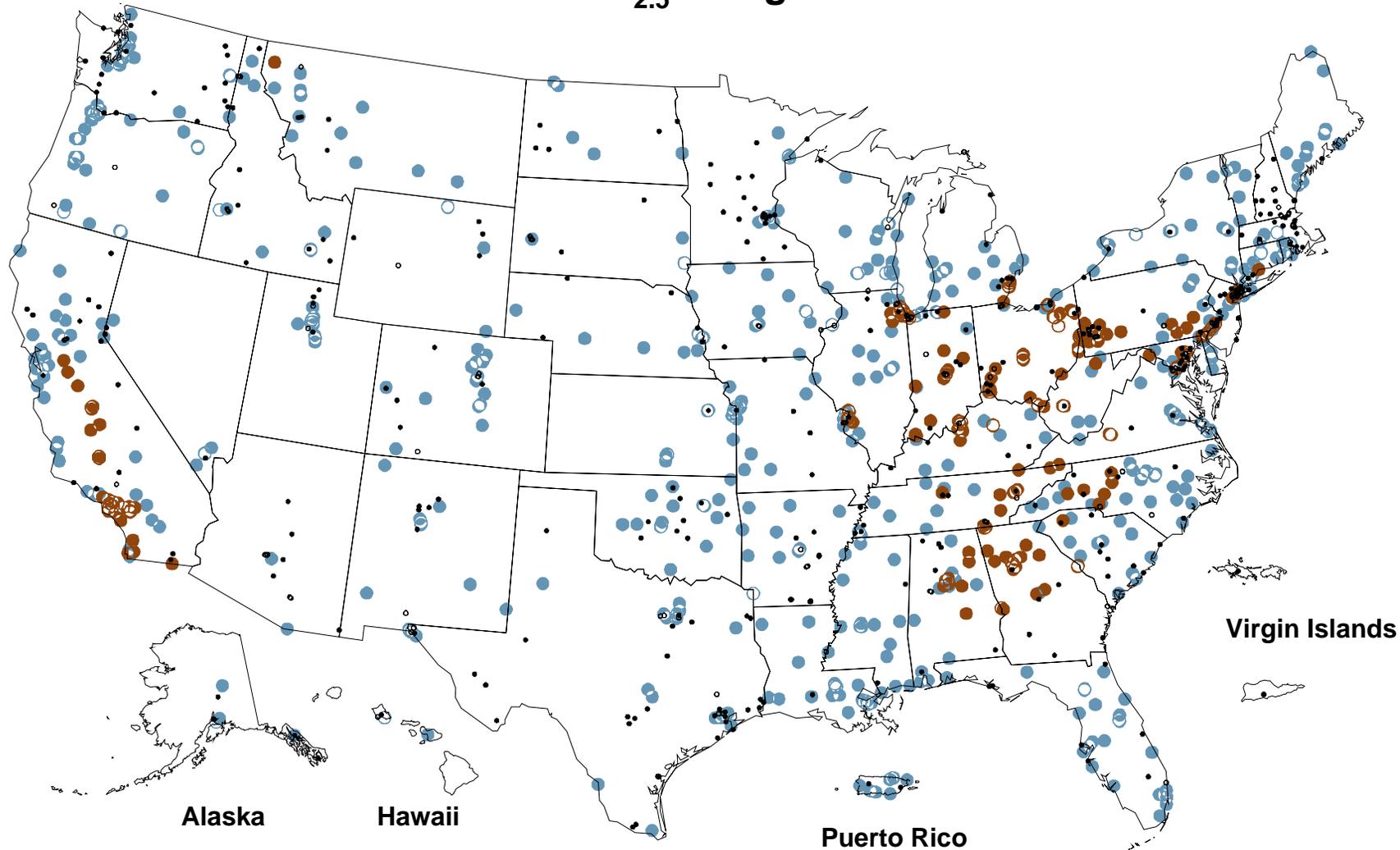
- 1239 sites operated at least part of the 3-year period, 2000-2002.
- 961 sites operated in all 12 quarters of 2000-2002.
- 760 sites met minimum NAAQS data completeness requirements
 - Generally, data capture of at least 75% per quarter is required to show attainment to the PM_{2.5} NAAQS
 - Only 11 samples (or more) per quarter are required to show nonattainment to the annual NAAQS
 - EPA regulations and guidance permit data substitution under certain circumstances in order to bolster completeness. The information shown here are based on data after applying the substitution guidance. For more details see 40CFR Part 50, Appendix N and also, [Guideline on Data Handling for the PM NAAQS](#).
- Of the 760 sites that met completeness requirements (after applying substitution techniques), 206 sites (located in 120 counties) violated the annual NAAQS.
- Only 12 sites (located in 8 counties) violated the daily NAAQS (98th percentile), however, all 12 also violated the annual NAAQS. Because the incidence of violation is significantly greater for the annual standard than for the daily standard, and since all sites that violate the daily standard also violate the annual standard, only annual standard design value information is shown here. The annual standard is considered the 'controlling' one.
- For details on calculation of data capture rates and design values, and implementation of data substitution, see page 7.

PM_{2.5} Design Values – Summary Counts

	<u>2000-2002 (with substitution)</u>		<u>1999-2001 (with substitution)</u>	
By Site	<u>Sites</u>		<u>Sites</u>	
Meet NA Completeness and DV > 15.0	206		199	
Meet A Completeness and DV <= 15.0	554		245	
Incomplete but DV > 15.0	51		117	
Incomplete but DV <= 15.0	421		634	
Not compared to the annual NAAQS*	<u>7</u>		<u>7</u>	
<i>Total Coverage</i>	1239		1202	
By County	<u>Counties</u>	<u>Population '00</u> <u>(thousands)</u>	<u>Counties</u>	<u>Population '00</u> <u>(thousands)</u>
Meet NA Completeness and DV > 15.0	120	64,850	129	65,186
Meet A Completeness and DV <= 15.0	404	110,864	182	50,258
Incomplete but DV > 15.0	14	2,405	50	15,878
Incomplete but DV <= 15.0	189	30,075	344	75,453
Not compared to the annual NAAQS*	<u>1</u>	<u>112</u>	<u>1</u>	<u>112</u>
<i>Total Coverage</i>	728	208,306	706	206,887

- * Some sites that represent unique 'hot-spot' areas are exempt from the annual NAAQS. There is one situation where this type of site is the only one located in its county. This county is included with the 'Incomplete' category in the subsequent maps.

2000-2002 PM_{2.5} Design Values for Sites



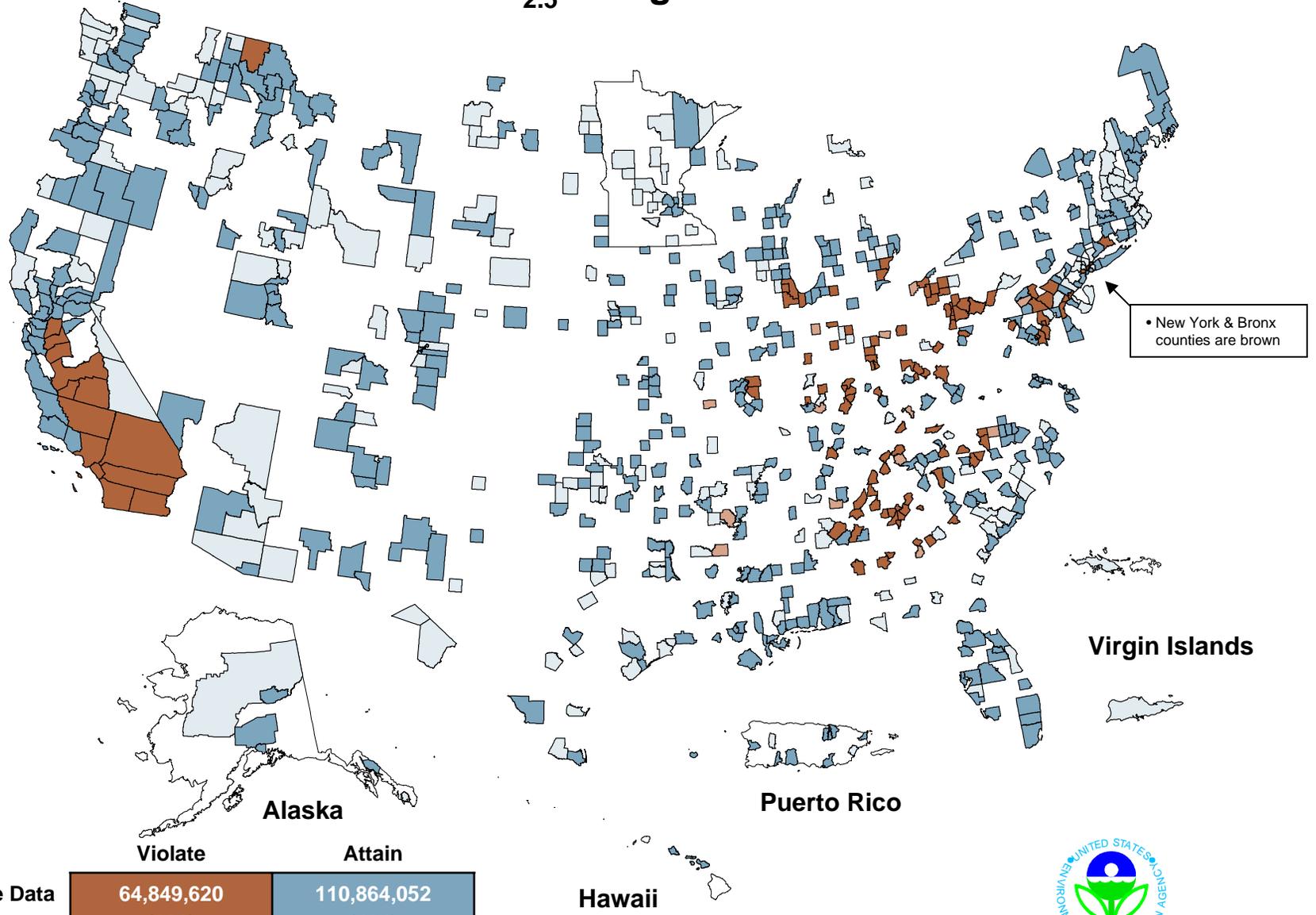
- Meets completeness, DV > 15.0 (206)
- Meets completeness, DV ≤ 15.0 (554)
- Incomplete (479)

Data Source: AQS July 9, 2003



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2000-2002 PM_{2.5} Design Values for Counties



	Violate	Attain
Complete Data	64,849,620 (120)	110,864,052 (404)
Incomplete Data	2,405,338 (14)	30,186,346 (190)

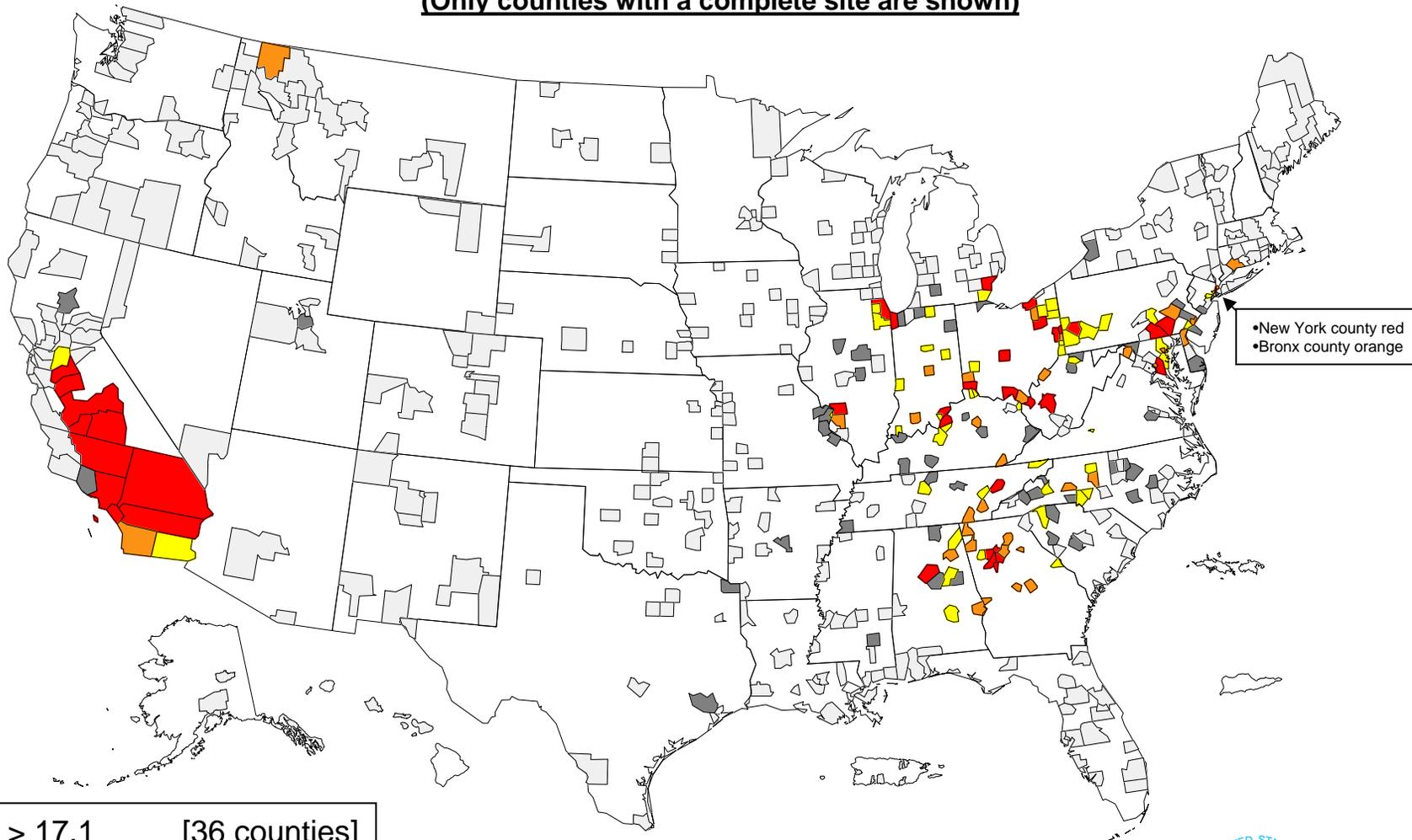
Data Source: AQS July 9, 2003



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2000-2002 PM_{2.5} Design Values for Counties – Concentration Ranges

(Only counties with a complete site are shown)



• New York county red
• Bronx county orange

■ ≥ 17.1	[36 counties]
■ 16.1 - 17.0	[34]
■ 15.1 - 16.0	[50]

■ 14.1 - 15.0	[57]
■ ≤ 14.0	[348]

(brown on previous map)

(blue on previous map)

120 violating counties

Data Source: AQS July 9, 2003



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Calculation of Data Capture Rates and Design Values and Implementation of Data Substitution

Data Completeness Calculation Steps:

1. Determine each PM_{2.5} monitor's quarterly 'sampling frequency' based on AQS contents (required sampling frequency field). If sampling frequency changed within a quarter, use the less stringent frequency for the quarter.
2. Retrieve raw data from AQS: Retrieval date=7/9/03. Parameter=88101, Duration=7, Time Period=1/1/2000 - 12/31/2002.
3. Delete non-FRM data. (Methods other than 116, 117, 118, 119, 120, 123, 142, 143, 144, 145).
4. Establish 'primary' monitor: First occurring (lowest) POC with data. Typically POC 1 .
5. Augment primary data with collocated (typically POC 2) PM_{2.5} FRM data: If a 'valid' (non-null FRM) collocated PM_{2.5} sample exists for a day in which there is no valid sample at the primary monitor, 'move' the collocated concentration into the primary record. Term 'replacements'.
6. Check/adjust for 'make-up' days: If valid sample (including 'replacements') not present on scheduled day, but valid sample present either before next scheduled sample or exactly 7 days later, then count that sample as a 'make-up' for the missed scheduled day. Not applicable to 'every day' sampling. Only 5 make-up days allowed per quarter.
7. 'Extra' samples not credited toward data completeness: 'Extra' samples are ones not taken on scheduled days and not qualifying as 'make-ups'. Extra samples are included in design value calculations.
8. Calculate data capture rates as follows: $\text{Capture-Rate}_{\text{quarter}} = \frac{[\# \text{ scheduled samples taken in quarter (inc. replacements)} + \# \text{ make-ups in quarter}]}{[\# \text{ scheduled days in quarter}]}$. Capture rates are typically shown as percentages; multiply rate by 100. To check compliance with 75% goal, the percentages were rounded to zero decimal places. [E.g., 68 samples out of 91 possible yields 74.7% which rounds to 75% and thus meets criteria.]

Annual Mean ('Annual Standard') Design Value Calculation Steps

1. Calculate quarterly means (12) using all data (scheduled samples, make-ups, extra's, and replacements). Do not round/truncate means.
 2. Calculate annual means (3) from quarterly means. Do not round/truncate.
 3. Average annual means to obtain design value. Round to 1 decimal.
- Note: For Community Monitoring Zones (sets of sites using spatial averaging), a slightly different calculation is used; see Data Handling Guideline.

98th Percentile ('Daily Standard') Design Value Calculation Steps

1. Determine 'applicable' number of samples for each quarter: Applicable number is the lesser of the scheduled number or the actual number taken. [Actual number taken = # scheduled samples taken + # make-ups + # extra's + # replacements.]
 2. Add 4 quarterly 'applicable' numbers to obtain annual 'applicable' number. Determine rank of 98th percentile based on this annual figure. [Applicable Number (AN) = 1-50, 98th percentile rank = 1 (1st max); AN = 51-100, 98th percentile rank = 2 (2nd max); AN = 101-150, 98th percentile rank = 3 (3rd max); etc.]
 3. Average annual 98th percentiles (3) to obtain design value. Round to zero decimal places.
- Note: For monitors on an approved 'seasonal' sampling regime (changing frequencies on a set schedule every year), a 'weighting' approach was used to compute the annual 98th percentile. This logic (see Data Handling Guideline for specifics) essentially lowered 98th percentiles (i.e., went further down the ranked distribution.).

Does Site Meet NAAQS Completeness Criteria?

- If a site registered 75% or more data capture each quarter (12), then the annual standard design value was 'valid'. (The site was 'complete'.)

- Or, if a site had at least 11 samples every quarter and their annual standard design value was > 15.0, then the design value was valid. (The site was ‘complete’.)
- If a site registered 75% or more data capture each quarter, then the daily standard design value was valid. (The site was ‘complete’.)
- Or, if a site had at least 1 sample each year (3) and their daily standard design value was > 65, then the design value was valid. (The site was ‘complete’.)

Implementation of Data Substitution

- To enhance the usability of the 2000-2002 data, ‘data substitution’ techniques were applied to bolster completeness. [The CFR permits the use of ‘incomplete’ data: "Situations may arise in which there are compelling reasons to retain years containing quarters which do not meet the data completeness requirement of 75 percent or the minimum number of 11 samples. The use of less than complete data is subject to the approval of the appropriate Regional Administrator".] Three substitution methods noted in the PM Data Handling Guideline were utilized:
 1. Substitution of Collocated PM₁₀ data ~ For ‘Meeting the Standards’
 - a. If a monitor had at least 50% capture in each quarter (12) but not 75% in all, and the ‘incomplete’ design values (annual and daily) were less than or equal the standards, then an attempt to substitute collocated PM₁₀ for missing samples was made.
 - b. All available PM₁₀ data (originating from the raw input to the PM₁₀ design values) from the site were substituted for missing samples *in quarters less than 75%*. The PM₁₀ data had to be on the same day as the missed sample.
 - c. If the enhanced dataset yielded a capture of 75% or more for each quarter, and the recalculated design values still met the standards, then the site was deemed ‘complete’ via substitution.
 2. Substitution of Maximum Quarterly Values ~ For ‘Meeting the Standards’
 - a. If a monitor had at least 50% capture in each quarter but not 75% in all, and the ‘incomplete’ design values were less than or equal the standards, then an attempt to substitute maximum quarterly values for missing samples was made. Max quarterly values are the highest value for each calendar quarter of the 3-year period, 2000-2002. Hence, for each monitor, a 1st quarter max value was identified, a 2nd quarter max value identified, etc.
 - b. The max values were substituted for *all* missing samples *in quarters less than 75%*. E.g., If quarter 5 (1st quarter 2000) only had 11 samples out of the 15 possible, then the 1st quarter max value was substituted for all 4 missing samples. Thus, the substitution resulted in every quarter having at least 75% capture.
 - c. If the enhanced dataset yielded recalculated design values that still met the standards, then the site was deemed ‘complete’ via substitution.
 3. Substitution of Minimum Values ~ For ‘Not Meeting the Annual Standard’
 - a. If a monitor did not have 11 samples each quarter (but at least some samples each of the 3 years), and the ‘incomplete’ annual standard design value was > 15.0, then an attempt to substitute the ‘minimum value’ for missing samples was made. The ‘minimum value’ is the lowest FRM value reported over the 3-year period.
 - b. The lowest value was substituted for 11-n missing samples (where n is the actual number of samples taken) *in quarters that did not have at least 11*. Hence, the substitution resulted in every quarter having at least 11 samples.
 - c. If the enhanced dataset yielded a recalculated design value that was still > 15.0, then the site was deemed ‘complete’ via substitution.

Note: In all three situations above where the substitution approach ‘worked’, the ‘incomplete’ design value is still identified as the monitor’s ‘true’ design value. The substitution procedure was merely a conservative mechanism to ascertain the likelihood that a site would have met or not met the standards if reporting had met the 75% or 11+ criteria. The ‘incomplete’ design values are more indicative of the monitor’s airshed than the artificial ‘recalculated’ design values.