



**Redesignation to Attainment and
Limited Maintenance Plan for the City of New Haven
PM₁₀ Nonattainment Area**

State Implementation Plan Revision

June 2005

**Connecticut Department of Environmental Protection
Bureau of Air Management**

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1.0 INTRODUCTION

The information in this submission provides a basis in accordance with United States Environmental Protection Agency (EPA) guidance¹ for EPA to redesignate the City of New Haven, Connecticut from nonattainment to attainment of the PM₁₀ National Ambient Air Quality Standards (NAAQS) and approve the enclosed limited maintenance plan (LMP). Elements supporting this redesignation request -- a monitoring network verification, a contingency plan, an approved attainment plan -- are addressed in subsequent sections of this document.

1.1 Composition and Effects of Particulate Matter

Particulate matter (PM) represents a broad class of chemically and physically diverse substances that exist as discrete particles (liquid droplets or solids) over a wide range of sizes. Particles with a diameter less than or equal to 10 microns are referred to as PM₁₀. These particles and droplets are produced as a direct result of human activity and natural processes, and they are also formed as secondary particles from the atmospheric transformation of emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), ammonia and volatile organic compounds (VOCs). Natural sources of PM₁₀ particles include windblown dust, salt from dried sea spray, fires, biogenic processes (*e.g.*, pollen from plants, fungal spores) and volcanoes. Fugitive dust and crustal material (geogenic materials) comprise approximately 80% of the coarse fraction of the PM₁₀ inventory, with the coarse fraction referring to those particles between 2.5 and 10 µm in diameter. Manmade sources of these coarser particles arise predominantly from combustion of fossil fuel by large and small industrial sources (including power generating plants, manufacturing plants, quarries and kilns); wind erosion from crop land, roads and construction; dust from industrial and agricultural grinding and handling operations; metals processing; and burning of firewood and solid waste. The fine particle fraction of PM₁₀ includes carbon-based particles emitted directly from gasoline and diesel internal combustion engines, sulfate-based particles formed from SO_x and ammonia, nitrate-based particles formed from NO_x and ammonia and carbonaceous particles formed through transformation of VOC emissions.

Particulate matter, like ozone, has been linked to a range of serious respiratory health problems. Scientific studies suggest a likely causal role of ambient particulate matter in contributing to a series of health effects. The key health effects categories associated with particulate matter include premature mortality, aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions and emergency room visits, school absences, work loss days and restricted activity days), changes in lung function and increased respiratory symptoms, changes to lung tissues and structure and altered respiratory defense mechanisms. PM also causes damage to materials and soiling. It is a major cause of substantial visibility impairment in many parts of the U.S. Due to these negative effects, the EPA established NAAQS for PM₁₀ in 1987. The NAAQS limited PM₁₀ concentrations to no more than 150 µg/m³ averaged over a 24-hour period or 50 µg/m³ averaged over a calendar year.

¹ *Limited Maintenance Plan Option for Moderate PM₁₀ Nonattainment Areas*, L. Wegman, 2001, hereafter the "LMP Guidance." (See Appendix A)

1.2 PM₁₀ Designations in Connecticut

In 1984, the Connecticut Department of Environmental Protection (CTDEP) began operating five PM₁₀ monitors for the purpose of assessing the State's attainment status. Based on data from these monitors, EPA officially designated an area covering I-95 from Madison to Greenwich as non-attainment, with the remainder of Connecticut designated as attainment. In 1988, CTDEP expanded its PM₁₀ monitoring network to 42 sites to determine more precisely the attainment status. As a result, EPA officially redesignated the non-attainment area to just the City of New Haven. Upon the passage of the 1990 Clean Air Act Amendments (CAA), the City of New Haven was classified as a moderate nonattainment area.

Under the CAA, EPA requested that states with initial moderate PM₁₀ nonattainment areas submit a demonstration plan to provide for attainment by the statutory attainment date of December 31, 1994. EPA specified that the demonstration plan should include, among other things, reasonably available control measures for sources in the area and contingency measures should the area fail to obtain the PM₁₀ NAAQS by the deadline. CAA Section 188(d) allows EPA to grant a 1-year extension attainment date to a state lacking the necessary number of clean data years to show attainment.

On March 24, 1994, CTDEP submitted a PM₁₀ attainment plan and contingency measures for New Haven, which EPA approved on September 11, 1995 (60 FR 47076). Subsequently, two one-year extensions of the New Haven PM₁₀ attainment date were granted: until December 31, 1995 (60 FR 47097) and until December 31, 1996 (62 FR 14327).

In July 1997, EPA promulgated new PM₁₀ standards, which would have allowed EPA to revoke the nonattainment status for areas meeting the 1987 PM₁₀ NAAQS. However, in May 1999, the United States D.C. Circuit Court of Appeals vacated these new standards. Previously, CTDEP had submitted a formal request to EPA to both revoke the pre-existing PM₁₀ 24-hour NAAQS for New Haven and the PM₁₀ nonattainment designation for the New Haven area. In July 1999, EPA informed Connecticut that the entire State of Connecticut was monitoring attainment of the 1987 PM₁₀ NAAQS. However, EPA indicated that the recent Circuit Court opinion brought into question EPA's potential revocation of the PM₁₀ NAAQS and nonattainment designation. Such a revocation was never made, and the nonattainment designation for the City of New Haven remains to date.

1.3 Request for Redesignation to Attainment and Limited Maintenance Plan Overview

To qualify for a redesignation to attainment under EPA's Limited Maintenance Plan (LMP) option, the LMP Guidance (see Appendix A) requires a potential qualifying area to meet the following criteria:

The area should be attaining the NAAQS and the average PM₁₀ design value² for the area, based upon the most recent 5 years of air quality data at all monitors in the area,

²The methods for calculating design values for PM₁₀ are presented in the "PM₁₀ SIP Development Guideline," EPA-450/2-86-001, June 1987. The State should determine the most appropriate method to use from this Guideline in consultation with the appropriate EPA Regional office staff. (See section 2.2)

should be at or below 40 $\mu\text{g}/\text{m}^3$ for the annual and 98 $\mu\text{g}/\text{m}^3$ for the 24-hr PM_{10} NAAQS with no violations at any monitor in the nonattainment area.³ If an area cannot meet this test it may still be able to qualify for the LMP option if the average design values of the site are less than their respective site-specific CDV [Critical Design Value].

CTDEP and EPA have confirmed that both the Federal Reference Method (FRM) and the Federal Equivalent Method (FEM) PM_{10} monitors in the New Haven area have measured attainment of the PM_{10} NAAQS for the five year period of 1999-2003. Likewise, both agencies have determined that the New Haven Stiles Street monitors have been achieving the site-specific critical design value criteria. Thus, CTDEP is eligible for the LMP option.

The LMP Guidance specifies five necessary elements that must be addressed for a LMP to be approved: an approved attainment plan and Section 110 and Part D CAA requirements; an attainment inventory; a maintenance demonstration; a monitoring network verification of continued operation; and a contingency plan. Regarding each of these elements:

- 1) **Approved Attainment Plan and Section 110 and Part D CAA Requirements.** In accordance with the CAA, areas seeking to be redesignated to attainment under the LMP Guidance must have an attainment plan that has been approved by EPA. The plan must include all control measures that were relied on by the State to demonstrate attainment of the NAAQS. The LMP should clearly indicate that all controls that were relied on to demonstrate attainment will remain in place. As previously mentioned, CTDEP's SIP revision attainment plan for New Haven was approved on September 11, 1995 (60 FR 47076).
- 2) **Attainment Plan (Emissions Inventory).** CTDEP's approved attainment plan includes an emissions inventory (attainment inventory), which can be used to demonstrate attainment of the NAAQS. That inventory is updated in Section 3.0 of this LMP.
- 3) **Maintenance Demonstration.** The maintenance demonstration requirement will be satisfied for a moderate PM_{10} nonattainment area if the area meets the air quality criteria necessary to qualify for the LMP option. Consequently, there is no need to project emissions over the maintenance period.
- 4) **Monitoring Network Verification of Continued Attainment.** Section 5.0 includes Connecticut's verification of continued operation of an appropriate, EPA-approved air quality monitoring network to verify attainment status for the City of New Haven.
- 5) **Contingency Plan.** Section 6.0 includes contingency provisions, as necessary, to make prompt correction of any violation of the NAAQS that may occur after redesignation of the area to attainment. The contingency plan is an enforceable part of the SIP, and the contingency measures will be adopted as soon as possible if such measures are triggered by a specific event. Section 6.0 identifies the measures to be adopted and provides a schedule and procedure for adoption and implementation of the measures if they are required.

³If EPA determines that the meteorology was not representative during the most recent five-year period, EPA may reject the State's request to use the LMP option and request, instead, submission of a full maintenance demonstration.

The following sections of this document set forth in detail the required elements of the LMP to support a PM₁₀ attainment redesignation for the City of New Haven.

2.0 ANALYSIS OF MONITORED PM₁₀ DATA

2.1 Monitoring Network

At the time of the original PM₁₀ SIP submittal (March 1994), there were 34 Wedding filter-based FRM monitors operating throughout the State. Since the PM₁₀ standards were promulgated in 1998, the PM₁₀ monitoring network has been downsized substantially. Figure 1 shows the current statewide configuration of the remaining seven monitors in the network, as of December 2004. CTDEP operates all monitors in accordance with EPA procedures specified in 40 Code of Federal Regulations (CFR) Part 58. All monitors are the Wedding FRM type except for at Stiles Street. The Stiles Street location has a co-located Wedding FRM PM₁₀ sampler and a Met One BAMS Continuous PM₁₀ monitor (FEM). During the period from April 1998 to June 2003, a Rupprecht & Patashnick model 1400a TEOM was measuring PM₁₀ at Stiles Street instead of the Met One BAMS. PM₁₀ concentrations from both the FRM and FEM methods were considered to determine the design values for the site.

2.2 PM₁₀ Design Values

Figures 2, 3 and 4 show the PM₁₀ design value trends since 1988 for the 24-hour standards. Recently calculated 24-hour design values from 2004 are also included in the graphs. Design values were calculated according to Appendix K to 40 CFR 50. The 24-hour primary standards are attained when the expected number of exceedances per year at each monitoring site is less than or equal to one. The expected number of exceedances per year are determined by recording the number of exceedances in each calendar year and averaging them over the past three years. Compliance with the 24-hour NAAQS is determined by plotting the 4th highest concentration over a three-year period at each site.

All PM₁₀ sites in Connecticut have been measuring levels below the 24-hour NAAQS during the five-year period of 1999-2003 and below the default LMP criteria of 98 µg/m³ (Table 1). Likewise, all sites have been achieving the annual average NAAQS and the corresponding default LMP criteria of 40 µg/m³ during that five-year period (Table 2), and there has been a general downward trend in the annual design values since 1989 (Figure 5). Recently calculated annual design values from 2004 maintain this trend. Annual design values are calculated by averaging the arithmetic average from the previous three years.

Table 1. PM₁₀ 24-hour Design Values¹ from 1999-2003 (µg/m³)

Town	Site #	1999	2000	2001	2002	2003	Average (5-year)
Bridgeport	0010*	46	46	48	51	49	48.0
Darien	1401	46	46	47	47		46.5
Norwalk	2014*	50	50	55	55	68	55.6
Westport	9003*		40	40	40	40	40.0
Hartford	0013	38	38	39	39		38.5
Burlington	2001	38	31	32	29		32.5
E. Hartford	2006*			38	44	44	42.0
Torrington	6001	41	40	36	36		38.3
New Haven (Stiles St)	0018FRM*	54	53	54	62	70	58.6
New Haven (Stiles St)	0018BAMS*		80	91	93	107	**97.2
New Haven	1123	44	44	45	56	47	47.2
Waterbury	2123*	46	48	46	62	49	50.2
New London	0009	39	39	40	42		40.0
Norwich	3002	41	41	40	40	35	39.4
Default Critical Design Value							98.0

* Site is part of current (2004) PM₁₀ monitoring network (See Figure 1)

** Average includes recently updated data from 2004 (DV=115 µg/m³)

¹i.e., the 4th highest 24-hour concentration over the previous 3 years

Table 2. PM₁₀ Annual Average Design Values² from 1999-2003 (µg/m³)

Town	Site	1999	2000	2001	2002	2003	Average (5-year)
Bridgeport	0010*	21	20	20	19	19	19.8
Darien	1401	25	24	23	21	19	22.4
Norwalk	2014*	29	29	29	29	29	29.0
Westport	9003*		16	15	15	14	15.0
Hartford	0013	18	17	16	15	15	16.2
Burlington	2001	13	12	11	11	11	11.6
E. Hartford	2006*			17	17	17	17.0
Torrington	6001	17	16	15	15	14	15.4
New Haven (Stiles St)	0018FRM*	28	27	28	28	30	28.2
New Haven (Stiles St)	0018BAMS*		32	33	34	37	** 35.0
New Haven (State St)	1123	21	20	20	19	19	19.8
Waterbury	2123*	21	20	20	20	20	20.2
New London	0009	17	16	16	15	15	15.8
Norwich	3002	18	17	17	16	16	16.8
Default Critical Design Value							40

* Site is part of current (2004) PM₁₀ monitoring network (See Figure 1)

** Average includes recently updated data from 2004 (DV=39µg/m³)

²i.e., the arithmetic average concentration over the previous 3 years

Like all other sites, the measurements of PM10 at the Stiles Street monitor have declined since the early 1990s. However, CTDEP and EPA determined that site-specific critical design values needed to be calculated for the continuous monitors at Stiles Street because the 5 year averaged design values approach the default critical design values of the 98 µg/m³ 24-hour average or the 40 µg/m³ annual average. These calculations were done in accordance with Attachment A of the LMP Guidance, which describes how an area not meeting the 98 µg/m³ 24-hour average or the 40 µg/m³ annual average criteria can calculate a site specific design value. These calculations are summarized in Table 3.

A critical design value (CDV) is the highest possible average design value (ADV) at which there is less than a 10% risk of future violations of the standard. To calculate the CDV, at least 5 years of data must be available from the site. The Stiles Street site has over 10 years of FRM data and over 5 years of FEM data to calculate the CDV. The following equation was used to calculate the CDV:

$$CDV = NAAQS / (1 + tc * CV)$$

Where:

- CDV** = the critical design value
- CV** = the coefficient of variation of the annual design values (the ratio of standard deviation divided by the mean design value in the past)
- tc** = is the critical t-value corresponding to a probability, c %, of exceeding the NAAQS in the future and the degree of freedom in the estimate for the CV.

When a one-tail tc is used for a 10% probability of exceedance (i.e. tc for two-tail distribution for a 20% probability of exceedance), the critical design values can be calculated and compared to the 5 year ADV (Table 3). The 24-hour ADV of 97.2 µg/m³ at Stiles Street is well below the CDV of 124 µg/m³ (Table 3). Likewise the annual ADV of 35.0 µg/m³ at Stiles Street is well below the CDV of 45 µg/m³ (Table 3).

Table 3. Summary of Calculations for Critical Design Value for Stiles Street Continuous Monitors (1998-2004).

Parameter	24-hour Average	Annual Average
5-year ADV	97.2	35
Standard Deviation	13.83	2.92
CV	.14	0.08
Count	5	5
Degrees of Freedom	4	4
tc 10% (1-tail)	1.53	1.53
Critical Design Value	124	45

3.0 ANALYSIS OF PM₁₀ EMISSIONS

According to the LMP Guidance:

The State's approved attainment plan should include an emissions inventory (attainment inventory), which can be used to demonstrate attainment of the NAAQS. The inventory should represent emissions during the same five-year period associated with the air quality data used to determine whether the area meets the applicability requirements of this policy (i.e., the most recent five years of air quality data). If the attainment inventory year is not one of the most recent five years, but the State can show that the attainment inventory did not change significantly during that five-year period, it may still be used to satisfy the policy.

Subsections 3.1 and 3.2 satisfy this emissions inventory requirement.

3.1 1999 NEI for Connecticut

The State of Connecticut currently maintains a PM₁₀ emissions inventory for point sources only. Therefore, in order to estimate PM₁₀ emissions from all source sectors, the 1999 National Emissions Inventory (NEI) estimates were used. The 1999 inventory represents the level of emissions during the same five-year period associated with the air quality data used to demonstrate compliance with the LMP policy. Table 4 lists the NEI values for each source sector of the primary PM₁₀ inventory.

Table 4. 1999 NEI Inventory for New Haven County, Connecticut

Category	Tons per year
On-road	546
Non-road	562
Area	6573 (4232 fugitive dust)
Point	1363
Total	9044

3.2 Motor Vehicle Design Value

The LMP Guidance states that:

The final criterion is related to mobile source emissions. The area should expect only limited growth in on-road motor vehicle PM₁₀ emissions (including fugitive dust) and should have passed a motor vehicle regional emissions analysis test. It is important to consider the impact of future transportation growth in the LMP, since the level of PM₁₀ emissions (especially from fugitive dust) is related to the level of growth in vehicle miles traveled (VMT). Attachment B (described below) should be used for making the motor vehicle regional emissions analysis demonstration.

Attachment B of the LMP Guidance supplies the following formula to determine the contribution from motor vehicles:

$$DV + (VMT_{pi} \times DV_{mv}) \leq MOS$$

Where:

- DV** = the area's design value based on the most recent 5 years of quality assured data in $\mu\text{g}/\text{m}^3$
- VMT_{pi}** = the projected % increase in vehicle miles traveled (VMT) over the next 10 years
- DV_{mv}** = motor vehicle design value based on on-road mobile portion of the attainment year inventory in $\mu\text{g}/\text{m}^3$
- MOS** = margin of safety for the relevant PM-10 standard for a given area: 40 $\mu\text{g}/\text{m}^3$ (CDV) for the annual standard or 98 $\mu\text{g}/\text{m}^3$ (CDV) for the 24-hour standard (or using site specific CDV)

The highest 5-year average PM₁₀ design value for New Haven County was from the Stiles Street site (Nhv-0018BAMS, Table 2): 97.2 $\mu\text{g}/\text{m}^3$ for the 24-hour average. The projected VMT increase over the next ten years (2005-2010) can be estimated from the Connecticut Department of Transportation Air Quality Conformity Report, January 2004 (see Table 5).

Table 5. VMT for the New Haven-Meriden-Waterbury Maintenance Area

Year	Daily VMT
1990	17,490,850
2005 (Interpolated)	20,137,293
2008	20,666,581
2015	22,018,753

Year 2005 daily VMT was estimated by interpolation. Therefore the projected VMT increase (VMT_{pi}) from 2005-2015 would be 9.3%.

The motor vehicle portion of the inventory for New Haven County, based on the on-road mobile source and area mobile source fugitive dust contribution (Table 4), was 4778 tons of primary PM₁₀. The total PM₁₀ emissions were 9044 tons, conservatively yielding a 52.7% contribution from the mobile source sector (tailpipe and fugitive dust). The DV_{mv} is thus determined to be 51.2 $\mu\text{g}/\text{m}^3$. Using the equation:

$$DV + (VMT_{pi} \times DV_{mv}) \leq MOS, \text{ yields: } (97.2 + (.093)(51.2)) = 102 \mu\text{g}/\text{m}^3$$

$$102 \mu\text{g}/\text{m}^3 \leq 124 \mu\text{g}/\text{m}^3$$

Therefore, the motor vehicle regional emissions analysis demonstration for the 24-hour NAAQS has been satisfied.

4.0 MAINTENANCE DEMONSTRATION

According to the LMP Guidance:

The maintenance demonstration requirement of the Act will be considered to be satisfied for the moderate PM₁₀ nonattainment areas meeting the air quality criteria discussed above. If the tests described in Section IV are met, we will treat that as a demonstration that the area will maintain the NAAQS. Consequently, there is no need to project emissions over the maintenance period.

Connecticut has satisfied the specified maintenance demonstration criteria and thus will not need to project emissions from 2005-2015.

5.0 MONITORING NETWORK VERIFICATION

Through signature on this submission, CTDEP commits to the following actions with regard to its monitoring network:

- 1) CTDEP will maintain a network of PM₁₀ monitors, meeting the requirements of 40 CFR 58, which provide adequate coverage to verify continued compliance of the PM₁₀ NAAQS for the State of Connecticut. Connecticut currently has seven active PM₁₀ monitors. *See* Figure 1.
- 2) Connecticut will use PM₁₀ monitoring data to ascertain whether it is monitoring PM₁₀ levels below the LMP requirement of 98 µg/m³ for the 24-hour NAAQS and 40 µg/m³ for the annual average NAAQS. If five-year average design values at any monitor exceed these limits, CTDEP will coordinate with EPA to determine the validity of the data and then determine whether a full maintenance plan submittal is required.
- 3) CTDEP agrees to maintain a continuous PM₁₀ BAM (Beta Attenuation Mass) monitor or other continuous FRM or FEM continuous PM₁₀ monitor at the Criscuolo Park site, or if this site becomes unsuitable, at an alternate site, which is agreeable to EPA and the CTDEP. CTDEP will track the annual design values for the Criscuolo Park continuous PM₁₀ monitor and report them annually to EPA when the validated data becomes available. After five years, the calculated critical design value and five year average design values for Criscuolo Park will be reported annually to the EPA until the end of the Limited Maintenance Plan period of ten years.

6.0 CONTINGENCY PLAN

CAA Section 175A requires that a maintenance plan include contingency measures in the event that any violation of the NAAQS occurs after the redesignation of an area. At a minimum, the contingency measures must include a requirement to implement all measures that were contained

in the attainment plan, prior to the redesignation. Identified below are the procedures that will be taken if a measured violation of the PM₁₀ NAAQS occurs.

In the supplement to the March 1994 PM₁₀ Attainment Plan, CTDEP submitted a contingency plan for the City of New Haven. This contingency plan incorporates the contingency measures included in the approved attainment plan (60 FR 47076). These measures are set forth in State Order 8073, issued to the City of New Haven, which requires the City to:

- a) Install granite curbs along Waterfront Street Between Forbes Avenue and Alabama Street;
- b) Plant vegetation in barren areas between Waterfront Street and the exit ramp to the west, including new trees to act as permanent barriers from illegal parking;
- c) Reconstruct Stiles Street including installation of sewers, catch-basins, curbs and sidewalks on both sides of the street;
- d) Install granite curbing along both sides of Connecticut Avenue from the edge of the existing curbing north to Albia and to the south to connect with the existing curbing;
- e) Repave Alabama Street from Waterfront Street to its end at the east, including installation of sewers, catch basins, curbs, handicapped curb cuts at the corners and vegetation between curb and lot lines, and install fencing where necessary; and
- f) Put all unpaved streets east of the New Haven Harbor, south of the Quinnipiac River and west of Woodward and Fairfield Avenues, on a permanent mechanical sweeping program. These streets shall be swept on an as-needed basis but at no time shall the interval between sweepings be greater than 31 calendar days, weather permitting;

Consistent with EPA's LMP guidance (See Appendix A of this hearing report), CTDEP commits to take action following a measured and verified exceedance of the PM₁₀ critical design value to ensure that the LMP will remain in effect. Within several working days following a 24-hour average critical design value exceedance, a CTDEP inspector will be sent to the site to attempt to determine the cause of the exceedance. If necessary, CTDEP will consult with the appropriate local, regional, and State agencies to design and implement, within one year of the verified exceedance, an effective control strategy to avoid another such exceedance. If another exceedance of the critical design value is measured after adoption of such control strategy, then CTDEP will submit a full maintenance plan according to Section IV of the LMP guidance.

If an exceedance of the PM₁₀ standard is measured in the City of New Haven, CTDEP will, within several working days, send an inspector to the site to investigate the cause of the exceedance. Depending on when the data (BAM or FRM; annual or 24-hour average) are available to CTDEP, the Department will, within several working days, determine the validity of the data by verifying all monitor operating parameters and quality assurance procedures. CTDEP will then determine if any actions are needed to avoid another exceedance. If remedial action is necessary, CTDEP will consult with the appropriate local, regional, and State agencies to design and implement an effective control strategy within one year of a confirmed PM₁₀ NAAQS exceedance.

In the case of a measured violation of the PM₁₀ NAAQS, the CTDEP will, within one year of such an occurrence, submit a plan to EPA to bring the site back into attainment with respect to the PM₁₀ NAAQS. The plan will include development of emissions inventories and modeling analyses appropriate to determine what additional control measures must be implemented and to estimate the expected future reductions and expected air quality in the area of concern.

7.0 CONCLUSION

This submission provides the necessary information, in accordance with the LMP Guidance, to redesignate the City of New Haven from nonattainment to attainment of the PM₁₀ NAAQS and to approve the LMP. The analyses of the monitored data, explained in detail in Sections 2 and 3 of this submission, demonstrate that both FRM and FEM PM₁₀ monitors in the New Haven nonattainment area have measured attainment for the past five years. Taken together with the contingency and maintenance plans, this submission addresses all the criteria necessary for approval.

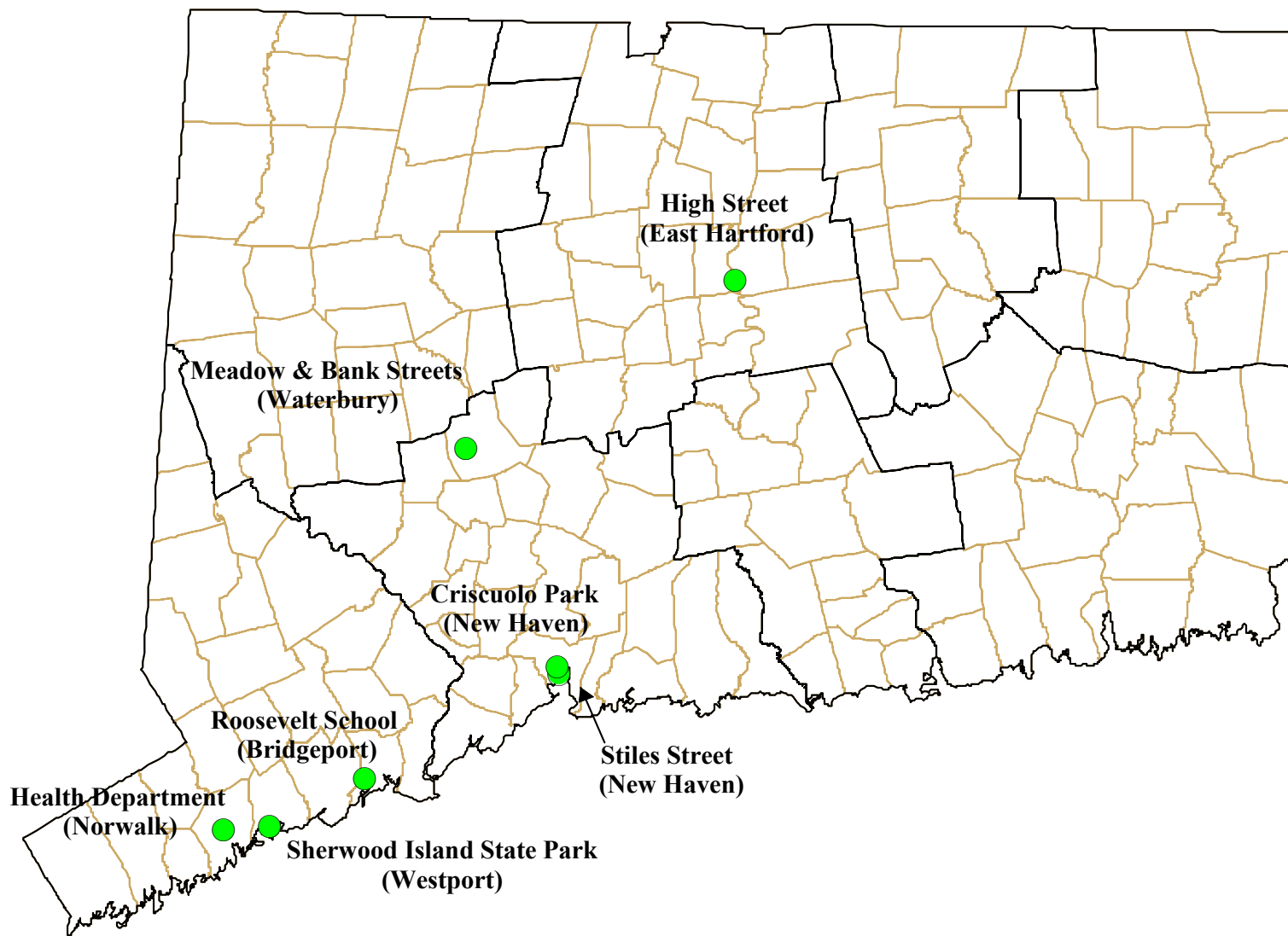


Figure 1. PM₁₀ Monitors in Connecticut (2004)

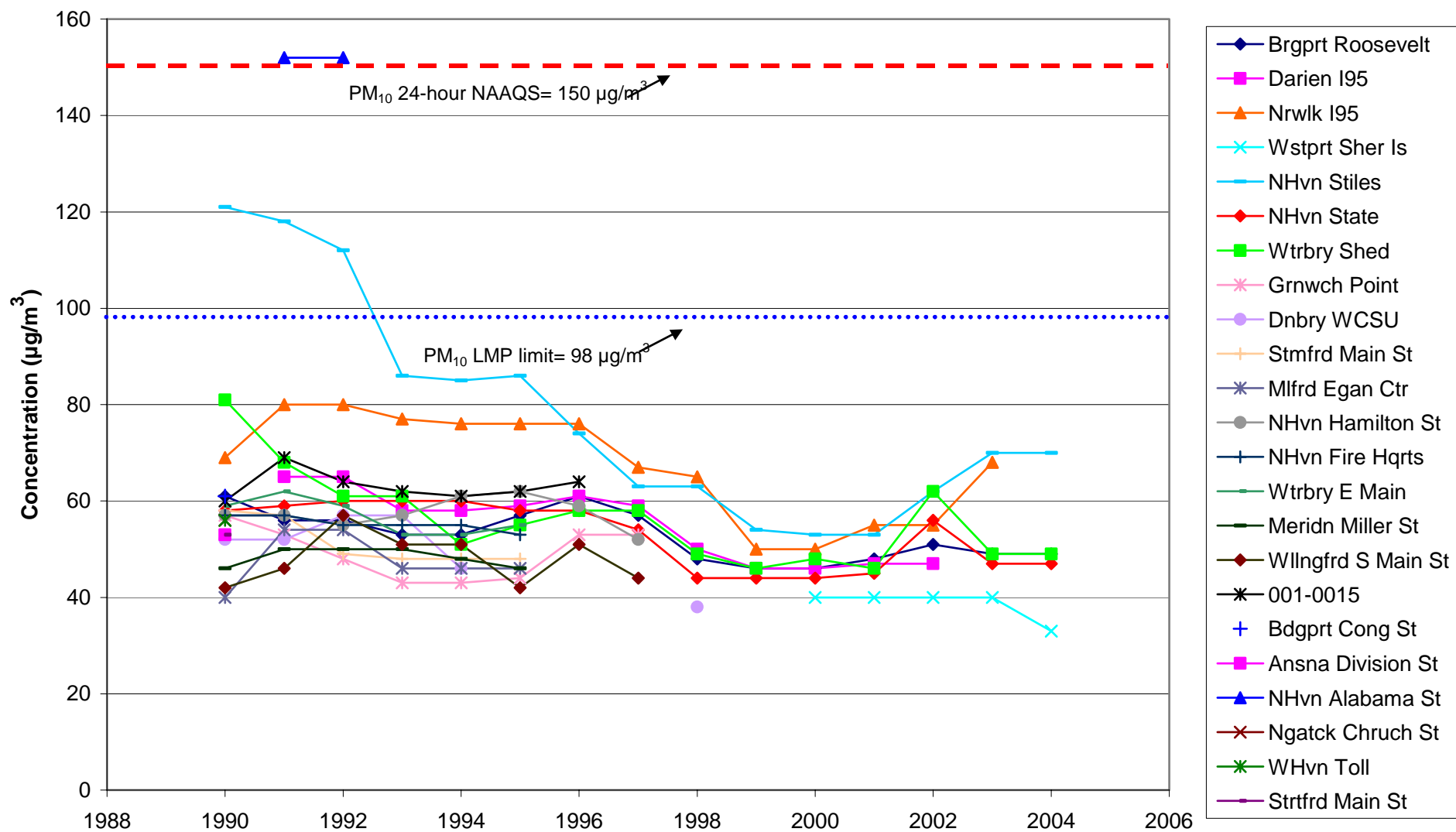


Figure 2. PM₁₀ 24-hour Design Values for Fairfield and New Haven Counties (FRM)

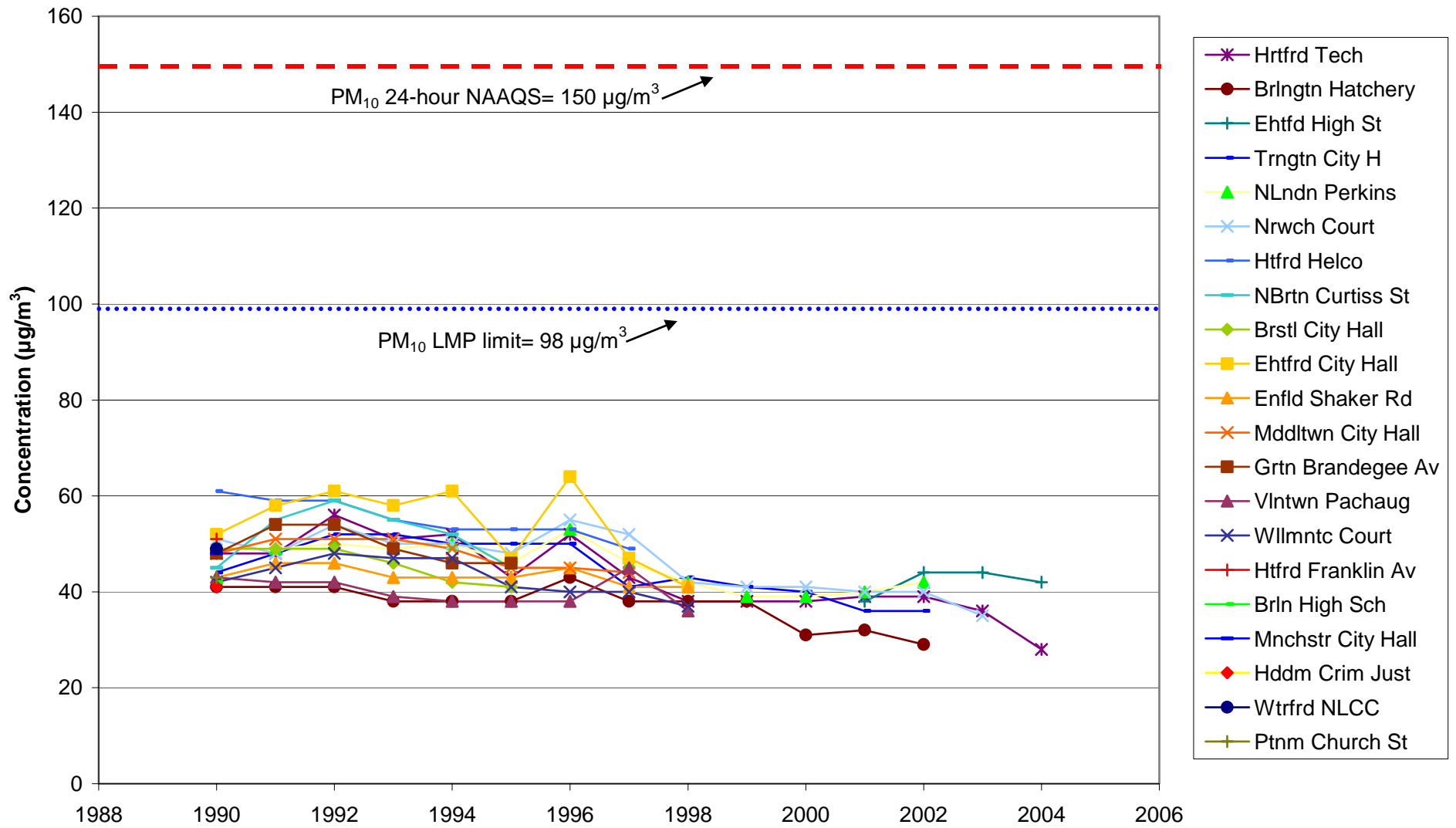


Figure 3. PM₁₀ 24-hour Design Values for Hartford, Litchfield, Middlesex, Tolland and New London Counties (FRM)

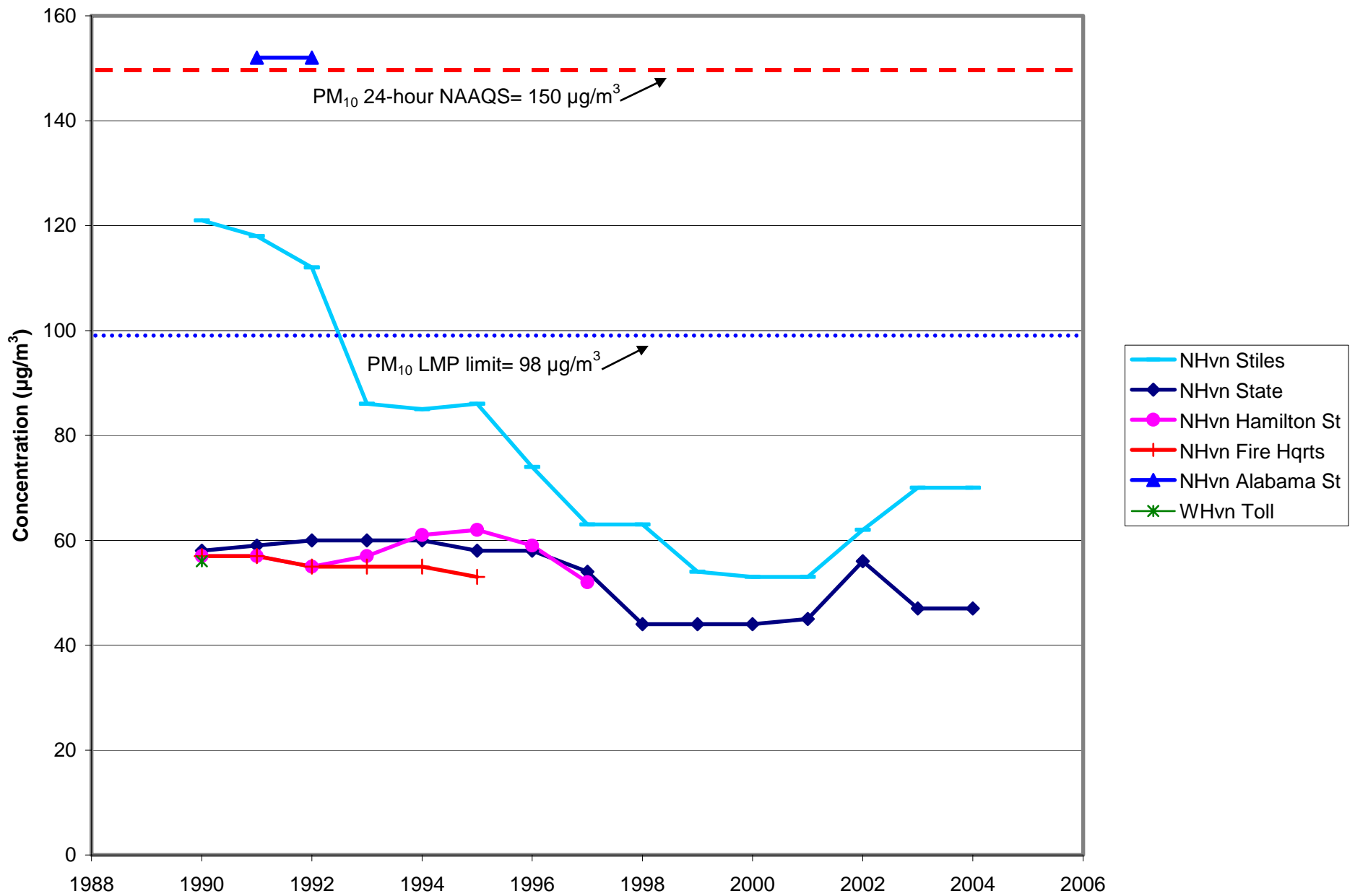


Figure 4. PM_{10} 24-hour Design Values for New Haven County (FRM)

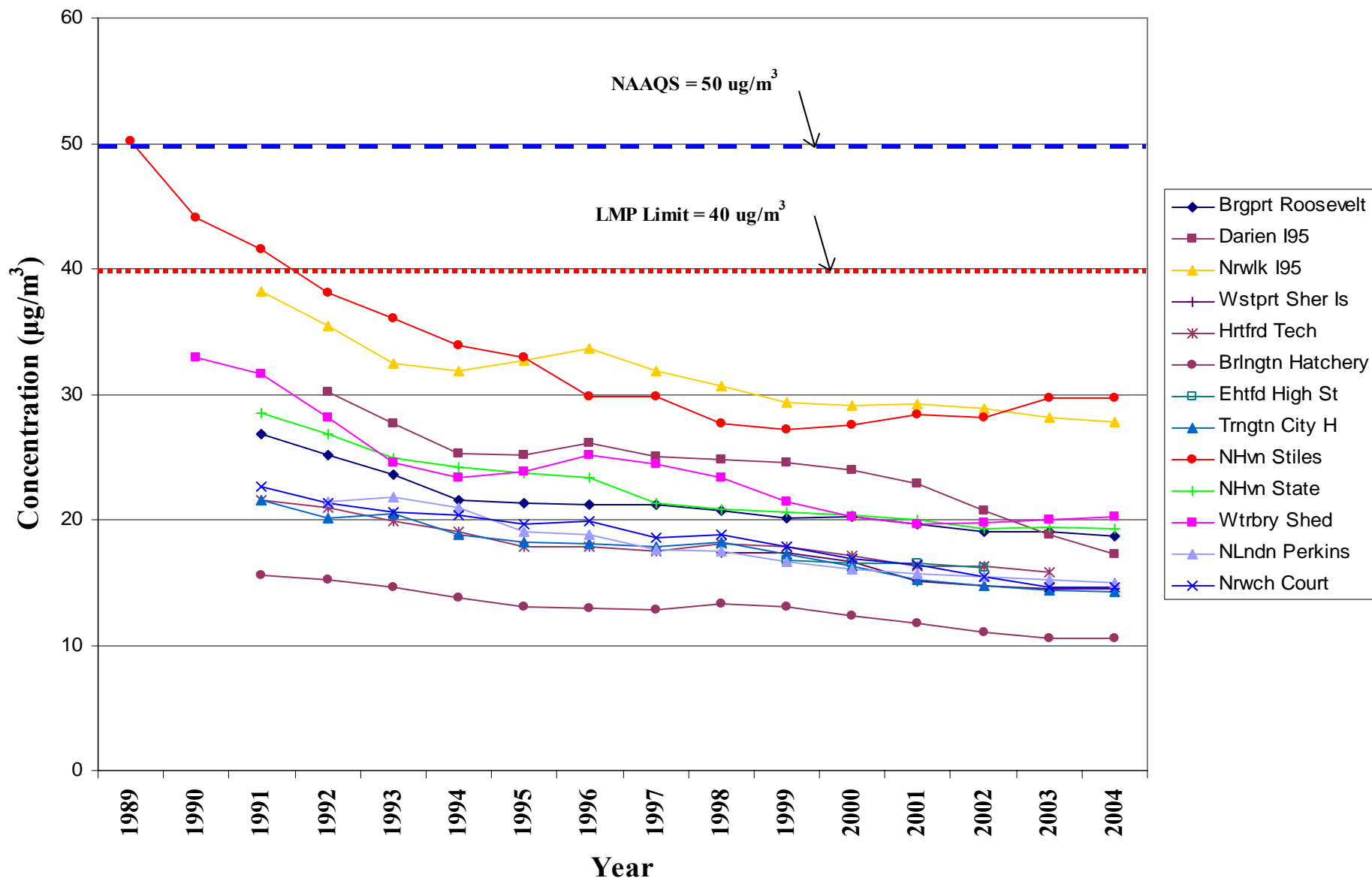


Figure 5. PM₁₀ Annual Design Values (*i.e.* 3-year average) for Connecticut FRM monitors

APPENDIX A EPA Guidance Regarding Limited Maintenance Plans

- “Limited Maintenance Plan Option for Moderate PM₁₀ Nonattainment Areas”: Memorandum from Lydia Wegman (EPA USEPA OAQPS) to EPA Regional Air Directors, dated August 21, 2001.
- ATTACHMENT A: Critical Design Value Estimation and Its Applications; Shao-Hang Chu US Environmental Protection Agency Office of Air Quality Planning and Standards Air Quality Strategies and Standards Division (MD-15)
- ATTACHMENT B: Motor Vehicle Regional Analysis Methodology

MEMORANDUM

SUBJECT: Limited Maintenance Plan Option for Moderate PM₁₀ Nonattainment Areas

FROM: Lydia Wegman, Director
AQSSD (MD-15)

TO: Director, Office of Ecosystem Protection, Region I
Director, Division of Environmental Planning & Protection, Region II
Director, Air Protection Division, Region III
Director, Air, Pesticides & Toxics Management Division, Region IV
Director, Air and Radiation Division, Region V
Director, Air Pesticides & Toxics, Region VI
Director, Air and Toxics Division, Regions VII, IX
Director, Air Program, Region VIII
Director, Office of Air Quality, Region X

1. What is a Limited Maintenance Plan?

This memorandum sets forth new guidance⁴ on maintenance plan submissions for certain moderate particulate matter (PM₁₀) nonattainment areas seeking redesignation to attainment (see section IV for further details on qualifying for the policy). If the area meets the criteria listed in this policy the State may submit a maintenance plan at the time it is requesting redesignation that is more streamlined than would ordinarily be permitted. This new option is being termed a limited maintenance plan (LMP)⁵.

2. Why is there a need for a limited maintenance plan policy?

⁴This memorandum is intended to provide EPA's preliminary views on how certain moderate PM₁₀ nonattainment areas may qualify to submit a maintenance plan that meets certain limited requirements. Since it represents only the Agency's preliminary thinking that is subject to modification, this guidance is not binding on States, Tribes, the public, or EPA. Issues concerning the applicability of the limited maintenance plan policy will be addressed in actions to redesignate moderate PM₁₀ nonattainment areas under § 107 of the CAA. It is only when EPA promulgates redesignations applying this policy that those determinations will become binding on States, Tribes, the public, and EPA as a matter of law.

⁵Moderate PM₁₀ areas that do not meet the applicability criteria of this policy, and all serious PM₁₀ nonattainment areas, should submit maintenance plans that meet our guidance for submission of a full maintenance plan as described in the September 4, 1992 memorandum, "Procedures for Processing Requests to Redesignate Areas to Attainment," from John Calcagni, former Director of the Office of Air Quality Planning and Standards (OAQPS) Air Quality management Division to the Regional Air Division Directors (hereafter known as the Calcagni Memo).

Before the U.S. Court of Appeals for the District of Columbia handed down its decision vacating the 1997 PM₁₀ national ambient air quality standards (NAAQS)(see American Trucking Associations, et al. v. Environmental Protection Agency (EPA), 175 F.3d 1027 (D.C. Cir. 1999), we were prepared to make case-by-case determinations that would make the 1987 PM₁₀ NAAQS no longer applicable in any area meeting the standards. In taking actions to remove the applicability of the 1987 NAAQS, we would have removed, as well, the nonattainment designation and Clean Air Act (CAA) part D requirements from qualifying areas. As a result of the D.C. Circuit's decision, for areas subject to the 1987 NAAQS, the only route to recognized attainment of the NAAQS and removal of nonattainment status and requirements is formal redesignation to attainment, including submittal of a maintenance plan. Since many areas have been meeting the PM₁₀ NAAQS for 5 years or more and have a low risk of future exceedances, we believe a policy that would allow both the States and EPA to redesignate speedily areas that are at little risk of PM₁₀ violations would be useful.

III. How did EPA develop the approach used in the LMP option?

The EPA has studied PM₁₀ air quality data information for the entire country over the past eleven years (1989-1999) and has determined that some moderate PM₁₀ nonattainment areas have had a history of low PM₁₀ design values with very little inter-annual variation. When we looked at all the monitoring sites reporting data for those years, the data indicate that most of the average design values fall below 2 levels, 98 µg/m³ for the 24-hr PM₁₀ NAAQS and 40 µg/m³ for the annual PM₁₀ NAAQS. For most monitoring sites these levels are also below their individual site-specific critical design values (CDV). The CDV is an indicator of the likelihood of future violations of the NAAQS given the current average design value and its variability. The CDV is the highest average design value an area could have before it may experience a future exceedance of the NAAQS with a certain probability. A detailed explanation of the CDV is found in Attachment A⁶ to this policy which, because of its length, is a separate document accompanying this memorandum.

We believe that the very small amount of variation between the peaks and means in most of the data indicates a very stable relationship that can be reasonably expected to continue in the future absent any significant changes in emissions. The period we assessed provides a fairly long historical record and the data could therefore be expected to have been affected by a full range of meteorological conditions over the period. Therefore, the amount of emissions should be the only variable that could affect the stability in the air quality data. We believe we can reliably make estimates about the future variability of PM₁₀ concentrations across the country based on our statistical analysis of this data record, especially in areas where the amount of emissions is not expected to change.

⁶ Dr. Shao-Hang Chu's paper entitled "Critical Design Value and Its Applications" explains the CDV approach and is included in its entirety in Attachment A. This paper has been accepted for publication and presentation at the 94th Air and Waste Management Association (A&WMA) Annual Conference in June 2001 in Orlando, Florida.

IV. How do I qualify for the LMP option ?

To qualify for the limited maintenance plan option, an area should meet the following applicability criteria. The area should be attaining the NAAQS and the average PM₁₀ design value⁷ for the area, based upon the most recent 5 years of air quality data at all monitors in the area, should be at or below 40 µg/m³ for the annual and 98 µg/m³ for the 24-hr PM₁₀ NAAQS with no violations at any monitor in the nonattainment area⁸. If an area cannot meet this test it may still be able to qualify for the LMP option if the average design values of the site are less than their respective site-specific CDV.

We believe it is appropriate to offer this second method of qualifying for the LMP because, based on the air quality data we have studied, we believe there are some monitoring sites with average design values above 40 µg/m³ or 98 µg/m³, depending on the NAAQS in question, that have experienced little variability in the data over the years. When the CDV calculation was performed for these sites we discovered that their average design values are less than their CDVs, indicating that the areas have a very low probability (1 in 10) of exceeding the NAAQS in the future. We believe it is appropriate to provide these areas the opportunity to qualify for the LMP in this circumstance since the 40 µg/m³ or 98 µg/m³ criteria are based on a national analysis and don't take into account each local situation.

The final criterion is related to mobile source emissions. The area should expect only limited growth in on-road motor vehicle PM₁₀ emissions (including fugitive dust) and should have passed a motor vehicle regional emissions analysis test. It is important to consider the impact of future transportation growth in the LMP, since the level of PM-10 emissions (especially from fugitive dust) is related to the level of growth in vehicle miles traveled (VMT). Attachment B (below) should be used for making the motor vehicle regional emissions analysis demonstration.

If the State determines that the area in question meets the above criteria, it may select the LMP option for the first 10 year maintenance period. Any area that does not meet these criteria should plan to submit a full maintenance plan that is consistent with our guidance in the Calcagni Memo in order to be redesignated to attainment. If the LMP option is selected, the State should continue to meet the qualifying criteria until EPA has redesignated the area to attainment. If an area no longer qualifies for the LMP option because a change in air quality affects the average design values before the redesignation takes effect, the area will be expected to submit a full maintenance plan.

Once an area selects the LMP option and it is in effect, the State will be expected to recalculate the average design value for the area annually and determine if the criteria

⁷The methods for calculating design values for PM₁₀ are presented in a document entitled the "PM₁₀ SIP Development Guideline", EPA-450/2-86-001, June 1987. The State should determine the most appropriate method to use from this Guideline in consultation with the appropriate EPA Regional office staff.

⁸If the EPA determines that the meteorology was not representative during the most recent five-year period, we may reject the State's request to use the LMP option and request, instead, submission of a full maintenance demonstration.

used to qualify for the LMP will still be met. If, after performing the annual recalculation of the area's average design value in a given year, the State determines that the area no longer qualifies for the LMP, the State should take action to attempt to reduce PM₁₀ concentrations enough to requalify for the LMP. One possible approach the State could take is to implement a contingency measure or measures found in its SIP. If, in the next annual recalculation the State is able to re-qualify for the LMP, then the LMP will go back into effect. If the attempt to reduce PM₁₀ concentrations fails, or if it succeeds but in future years it becomes necessary again to address increasing PM₁₀ concentrations in the area, that area no longer qualifies for the LMP. We believe that repeated increases in PM₁₀ concentrations indicate that the initial conditions that govern air quality and that were relied on to determine the area's qualification for the LMP have changed, and that maintenance of the NAAQS can no longer be assumed. Therefore, the LMP cannot be reinstated by further recalculations of the design values at this point. Once the LMP is determined to no longer be in effect, a full maintenance plan should be developed and submitted within 18 months of the determination.

Treatment of data used to calculate the design values.

Flagged Particulate Matter Data:

Three policies allow PM-10 data to be flagged for special consideration:

- Exceptional Events Policy (1986) for data affected by infrequent events such as industrial accidents or structural fires near a monitoring site;
- Natural Events Policy (1996) for data affected by wildfires, high winds, and volcanic and seismic activities, and;
- Interim Air Quality Policy on Wildland and Prescribed Fires for data affected by wildland fires that are managed to achieve resource benefits.

We will treat data affected by these events consistently with these previously-issued policies. We expect States to consider all data (unflagged and flagged) when determining the design value. The EPA Regional offices will work with the State to determine the validity of flagged data. Flagged data may be excluded on a case-by-case basis depending on State documentation of the circumstances justifying flags. Data flagged as affected by exceptional or natural events will generally not be used when determining the design value. However, in order for data affected by a natural event to be excluded, an adequate Natural Events Action Plan is required as described in the Natural Events policy.

Data flagged as affected by wildland and prescribed fires will be used in determining the design value. If the State is addressing wildland and prescribed fire use with the application of smoke management programs, the State may submit an LMP if the design value is too high only as a result of the fire-affected data.

We are in the process of developing a policy to address agricultural burning. When it is finalized we will amend the LMP option to account for the new policy.

V. What should an LMP consist of?

Under the LMP, we will continue to satisfy the requirements of Section 107(d)(3)(E) of the Act which provides that a nonattainment area can be redesignated to attainment only if the following criteria are met:

1. The EPA has determined that the NAAQS for the applicable pollutant has been attained.
2. The EPA has fully approved the applicable implementation plan under section 110(k).
3. The EPA has determined that the improvement in air quality is due to permanent and enforceable reductions in emissions.
4. The State has met all applicable requirements for the area under section 110 and part D.
5. The EPA has fully approved a maintenance plan, including a contingency plan, for the area under section 175A.

However, there are some differences between what our previous guidance (the Calcagni memo) recommends that States include in a maintenance plan submission and what we are recommending under this policy for areas that qualify for the LMP. The most important difference is that under the LMP the demonstration of maintenance is presumed to be satisfied. The following is a list of core provisions which should be included in an LMP submission. Note that any final EPA determination regarding the adequacy of an LMP will be made following review of the plan submitted in light of the particular circumstances facing the area proposed for redesignation and based upon all available information.

a. Attainment Plan

The State's approved attainment plan should include an emissions inventory (attainment inventory) which can be used to demonstrate attainment of the NAAQS. The inventory should represent emissions during the same five-year period associated with the air quality data used to determine whether the area meets the applicability requirements of this policy (i.e., the most recent five years of air quality data). If the attainment inventory year is not one of the most recent five years, but the State can show that the attainment inventory did not change significantly during that five-year period, it may still be used to satisfy the policy. If the attainment inventory is determined to not be representative of the most recent 5 years, a new inventory must be developed. The State should review its inventory every three years to ensure emissions growth is incorporated in the attainment inventory if necessary.

b. Maintenance Demonstration

The maintenance demonstration requirement of the Act will be considered to be satisfied for the moderate PM₁₀ nonattainment areas meeting the air quality criteria discussed above. If the tests described in Section IV are met, we will treat that as a demonstration that the area will maintain the NAAQS. Consequently, there is no need to project emissions over the maintenance period.

c. Important elements that should be contained within the redesignation request

1. Monitoring Network Verification of Continued Attainment

To verify the attainment status of the area over the maintenance period, the maintenance plan should contain a provision to assure continued operation of an appropriate, EPA-approved air quality monitoring network, in accordance with 40 CFR part 58. This is particularly important for areas using an LMP because there will be no cap on emissions.

2. Contingency Plan

Section 175A of the Act states that a maintenance plan must include contingency provisions, as necessary, to promptly correct any violation of the NAAQS which may occur after redesignation of the area to attainment. These contingency measures do not have to be fully adopted at the time of redesignation. However, the contingency plan is considered to be an enforceable part of the SIP and the State should ensure that the contingency measures are adopted as soon as possible once they are triggered by a specific event. The contingency plan should identify the measures to be adopted, and provide a schedule and procedure for adoption and implementation of the measures if they are required.

Normally, the implementation of contingency measures is triggered by a violation of the NAAQS but the State may wish to establish other triggers to prevent a violation of the NAAQS, such as an exceedance of the NAAQS.

3. Approved attainment plan and section 110 and part D CAA requirements:

In accordance with the CAA, areas seeking to be redesignated to attainment under the LMP policy must have an attainment plan that has been approved by EPA, pursuant to section 107(d)(3)(E). The plan must include all control measures that were relied on by the

State to demonstrate attainment of the NAAQS. The State must also ensure that the CAA requirements for PM₁₀ pursuant to section 110 and part D of the Act have been satisfied. To comply with the statute, the LMP should clearly indicate that all controls that were relied on to demonstrate attainment will remain in place. If a State wishes to roll back or eliminate controls, the area can no longer qualify for the LMP and the area will become subject to full maintenance plan requirements within 18 months of the determination that the LMP is no longer in effect.

VI. How is Conformity treated under the LMP option?

The transportation conformity rule (40 CFR parts 51 and 93) and the general conformity rule (58 FR 63214; November 30, 1993) apply to nonattainment areas and maintenance areas operating under maintenance plans. Under either conformity rule one means of demonstrating conformity of Federal actions is to indicate that expected emissions from planned actions are consistent with the emissions budget for the area. Emissions budgets in LMP areas may be treated as essentially not constraining for the length of the maintenance period because it is unreasonable to expect that an area satisfying the LMP criteria will experience so much growth during that period of time such that a violation of the PM₁₀ NAAQS would result. While this policy does not exempt an area from the need to affirm conformity, it does allow the area to demonstrate conformity without undertaking certain requirements of these rules. For transportation conformity purposes, EPA would be concluding that emissions in these areas need not be capped for the maintenance period, and, therefore, a regional emissions analysis would not be required. Similarly, Federal actions subject to the general conformity rule could be considered to satisfy the “budget test” specified in section 93.158 (a)(5)(i)(A) of the rule, for the same reasons that the budgets are essentially considered to be unlimited.

EPA approval of an LMP will provide that if the LMP criteria are no longer satisfied and a full maintenance plan must be developed to meet CAA requirements (see Calcagni Memo referenced in footnote #2 for full maintenance plan guidance), the approval of the LMP would remain applicable for conformity purposes only until the full maintenance plan is submitted and EPA has found its motor vehicle emissions budgets adequate for conformity purposes under 40 CFR parts 51 and 93. EPA will condition its approval of all LMPs in this fashion because in the case where the LMP criteria are not met and a full maintenance plan is required EPA believes that LMPs would no longer be an appropriate mechanism for assuring maintenance of the standards.

For further information concerning the LMP option for moderate PM₁₀ areas please contact Gary Blais at (919) 541-3223, or for questions about the CDV approach contact Dr. Shao-Hang Chu at (919) 541-5382. For information concerning transportation conformity requirements, please contact Meg Patulski of the Office of Transportation and Air Quality at (734) 214-4842.

ATTACHMENT A

Critical Design Value Estimation and Its Applications

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ABSTRACT

The air quality design value is the mathematically determined pollutant concentration at a particular site that must be reduced to, or maintained at or below the National Ambient Air Quality Standards (NAAQS) in order to assure attainment. The design value may be calculated based on ambient measurements observed at a local monitor in a 3-year period or on model estimates. The design value, however, varies from year to year due to both the pollutant emissions and natural variability such as meteorological conditions, wildfires, dust storms, volcanic activities etc. In order to investigate certain policy options related to pollution controls it would be desirable to estimate a critical design value above which the NAAQS is likely to be violated with a certain probability.

In this paper, a statistical technique has been developed to estimate a critical design value that is based on the average design value and its variability in the past. The critical design value could be used as a planning tool for regulatory agencies because it is an indicator of the likelihood of future violations of the NAAQS given the current average design value and its variability. The approach is general and could be applied to estimate the critical design value for any pollutant.

As an example, eleven years (1989-1999) of PM₁₀ data nationwide were extracted from the US EPA AIRS database to estimate the PM₁₀ critical design values. The analyses indicate that PM₁₀ design values in the West have much larger inter-annual variability than those in the East as reflected in their much lower critical design values. This, in turn, suggests that the inter-annual variability in meteorology, wildfires, and dust storms may have played a more significant role in the West, and also this larger variability could be partly explained by the once every six days sampling schedule at most PM₁₀ monitoring sites.

INTRODUCTION

The air quality design value is the mathematically determined pollutant concentration at a particular site that must be reduced to, or maintained at or below the National Ambient Air Quality Standards (NAAQS) in order to assure attainment¹. The design value may be

calculated based on ambient measurements observed at a local monitor in a 3-year period or on model estimates. The detailed calculation of the design values for various criteria pollutants is described in the Appendices of the Code of Federal Regulations². In certain cases, the design value has been used for regulatory purposes to determine whether the local pollutant concentration has violated the National Ambient Air Quality Standard (NAAQS). Most often, however, the design value is used to determine the level of control needed to reduce the pollutant concentration to the NAAQS^{3,4,5}.

The design value, however, varies from year to year due to both the pollutant emissions and natural variability such as meteorological conditions, wildfires, dust storms, volcanic activities etc. In order to investigate certain policy options related to pollution controls it would be desirable to define a critical design value above which future violations of the air quality standard are likely to occur with a certain probability.

In this paper, an effort has been made to statistically estimate a critical design value based on the average of these yearly design values and their variability in the past. This critical design value is defined in such a way as it is the highest average design value any monitoring site could have before it runs a risk of violating the NAAQS in the future at a certain probability. The technical basis of this estimation approach and its applications will be discussed in the following paragraphs.

CRITICAL DESIGN VALUE ESTIMATION

Our intention is to find a critical design value (CDV) that is the highest possible average design value (ADV) any site could have before it risks a future violation of the standard at a certain probability. First, we try to formulate a relationship among a set of variables involved: such as the CDV, NAAQS, the ADV, the standard deviation of the design values in the past, and a desirable risk factor. We find that if we assume that the design values are normally distributed and the coefficient of variation (CV), which is the ratio of the standard deviation versus the mean of the design values, does not change in the near future, then we can write the relationship as:

$$CDV = NAAQS / (1 + t_c * CV) \quad (1)$$

Where CDV is the critical design value, CV is the coefficient of variation of the annual design values (the ratio of standard deviation divided by the mean design value in the past), and t_c is the critical t-value corresponding to a probability, c %, of exceeding the NAAQS in the future and the degree of freedom in the estimate to the CV. Equation (1) says that based on the variability of the design values in the past, the probability of any monitoring site with an ADV less than or equal to the CDV to exceed the NAAQS in the future would be no more than c % given the same CV. In other words, the CDV is the

highest ADV any monitoring site could have before it may record a future violation of the NAAQS with a certain probability. The percent probability, c , is the chosen risk factor. One can choose either a more, or less, conservative c value depending on how much risk one is willing to take.

The inter-annual variability of the air quality design values at a monitoring site can be estimated from historical data at that station. Using the air quality data in the past, one can calculate the design values for each year. With these design values one can calculate the ADV and its variability in terms of the coefficient of variation (CV). Thus, one can calculate the CDV for any site with a minimum of five years of data.

CHARACTERISTICS OF THE CRITICAL DESIGN VALUE

From equation (1) we see that the CDV is a nonlinear function of the NAAQS of the pollutant, the critical t -value, t_c , and the coefficient of variation, CV, of the design values. The normalized

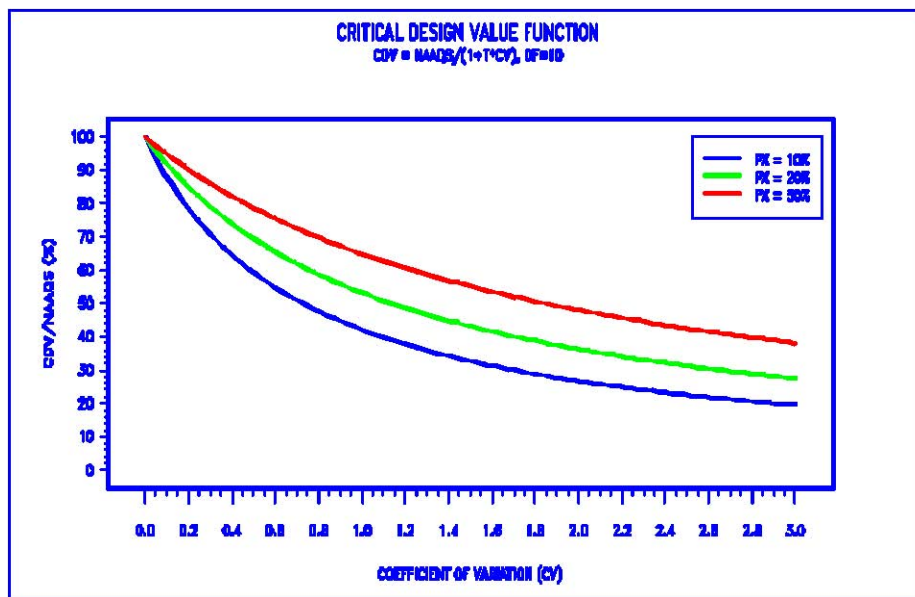


Figure 1.

relationship of the CDV to the product of t_c and CV is shown in figure 1.

The dependency of CDV on the other two variables can be summarized as:

1. The larger the variability (CV) of the design values in the past, the smaller the CDV will be;
2. The lower the probability of risk for future violations (PX), the lower the CDV will be;

3. If $CV=0$, i.e., no variability in the design values in the past, then from Figure 1 and Equation (1) we find the highest CDV equal to the NAAQS;
4. As CV increases, the CDV approaches zero;
5. If CV is not zero but $t_c = 0$, then we will also have a CDV equal to the NAAQS, but it will have a 50% chance of violating the standard in the future because $t_c = 0$ corresponds to a probability of 50%.

In Figure 2 we have chosen a risk factor of 10% probability of future violation and plotted two examples using generated data with significantly different variability in the annual PM10 design values. It is intended to illustrate the relationship among design values, ADV, CDV, and the PM10 annual NAAQS of 50 ug/m³. In this example we see that the CDV depends strongly on the inter-annual variability of the design values rather than on their means. Also, from the upper panel of Figure 2 we see that once the ADV is higher than the CDV, the probability of violating the standard will be higher than the risk we have chosen (in this case, it is one out of ten).

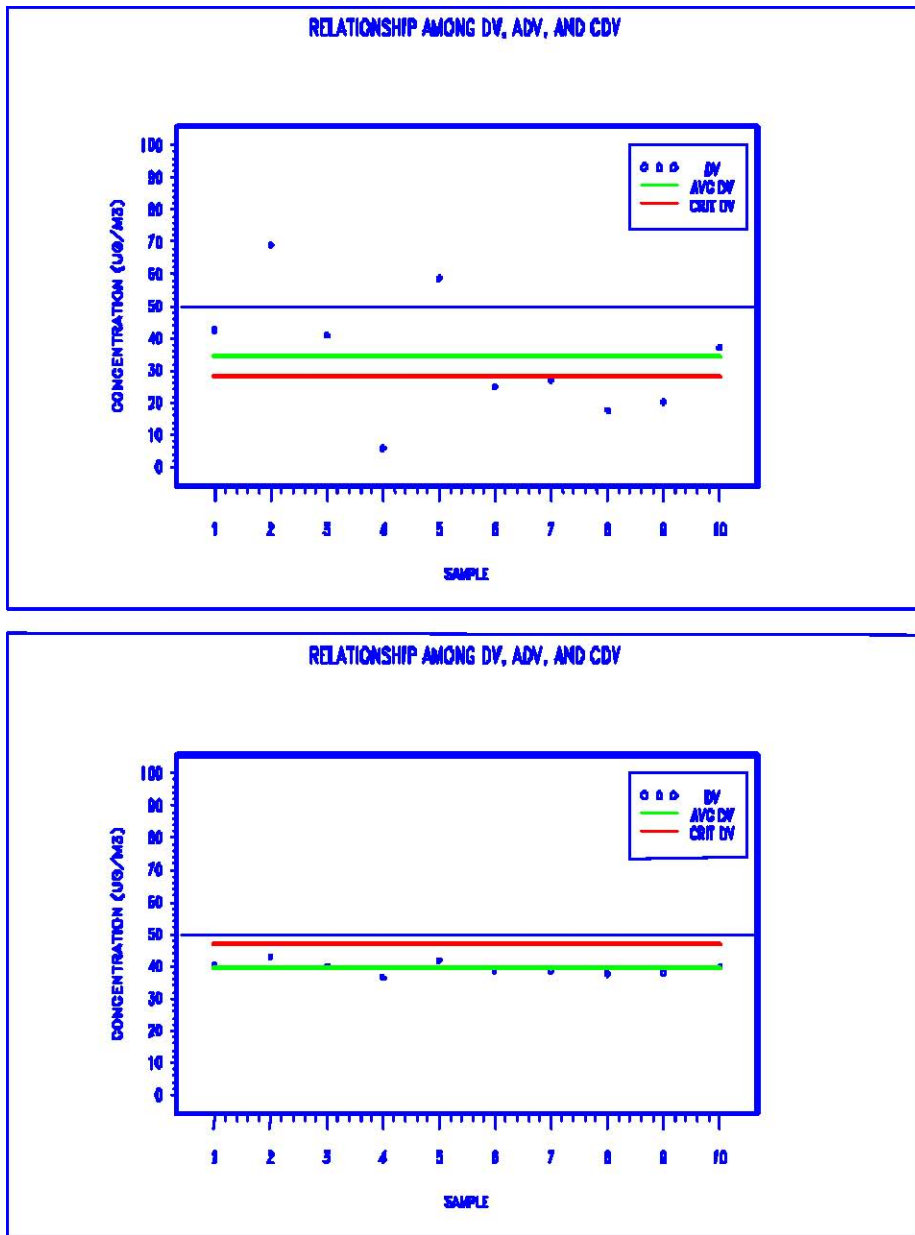


Figure 2.

Contrasting the two panels of Figure 2, we see that whether a site will have a higher or lower risk of violating the NAAQS in the future depends on how much higher or lower the ADV is to the CDV. Thus, unless some drastic change in emissions occurred in the past or should occur in the future, the CDV can be used to assess the likelihood of violating the NAAQS in the future in that area based on normal probability predictions. For this reason, this technique and the estimated CDV could be used as a planning tool for regulatory agencies to decide whether more or fewer pollutant controls are needed in a specific area.

PM10 CRITICAL DESIGN VALUES AND DISCUSSIONS

To demonstrate this approach, eleven years (1989-1999) of PM10 data nationwide were extracted from the United States Environmental Protection Agency AIRS database. The annual and 24-hr PM10 design values were calculated following the US EPA Guidance¹. Then the methodology described in the previous section was applied using a tolerable risk factor of 10% probability of future violation of the NAAQS to calculate the CDVs for all monitor sites with more than five years of valid data. The analyses are discussed and presented in the following figures.

Figure 3 is a frequency distribution of these calculated annual and 24-hr CDVs. We see that the distributions of both the annual and the 24-hr CDVs are skewed to the left with a median annual CDV of 45.3 ug/m³ and a median 24-hr CDV of 123.2 ug/m³. The long tails to the left (low values) suggest that there are places where the inter-annual variability of the design values are quite large. It also suggests that these areas are likely to have a higher probability of violating the standards if they are already in a major PM10 source region with relatively high PM10 concentrations.

In Figure 4 a longitudinal scatter plot of both the ADVs and the CDVs at all sites spanning from Maine to California, was produced to see whether there is a difference from the East to the West. Comparing the differences between these overlaid ADVs and CDVs we see clearly that most of the higher risk areas (i.e., the areas where the ADVs are greater than the CDVs) are in the West and Midwest. The geographical distribution of the CDVs and the actual ADVs are shown in Figures 5 and 6 respectively. For comparison purposes, the ADVs in Figure 6 are color coded to show their probability of future violation of the NAAQS. The probability of future violation of the NAAQS at each site is calculated by inverting the t-values using equation (1).

The East-West difference in CDVs can be explained largely by the fact that the West, in general, has a much larger inter-annual variability of the design values than the East. However, since the anthropogenic emissions in a region usually do not change very much from year to year, the large variability in the inter-annual PM10 design values in the West may be largely attributable to the inter-annual variation in natural conditions such as meteorology, wildfires, dust storms, and volcanic emissions, etc. The higher occurrences of wildfires and dust storms in the West are known to be associated with its much drier climate, meteorological conditions, and topography. Another influencing factor on the inter-annual variability could be related to the sampling frequency of the PM10 data, which for many sites is only once every six days. However, this is more likely in the East because fewer sites are in non-attainment status and thus not required to sample more frequently than once in six days.

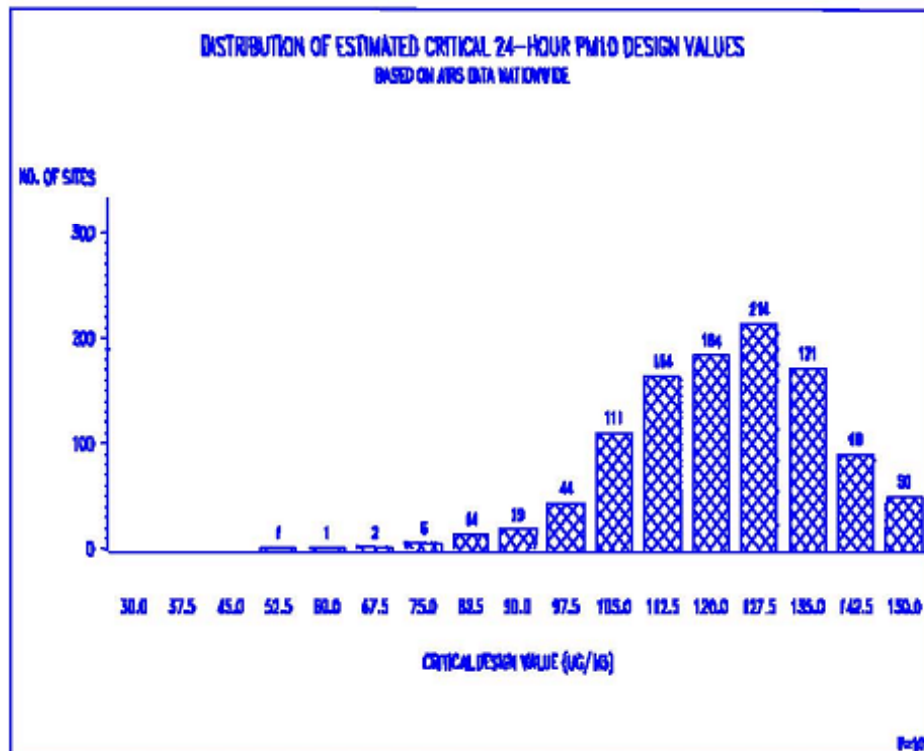
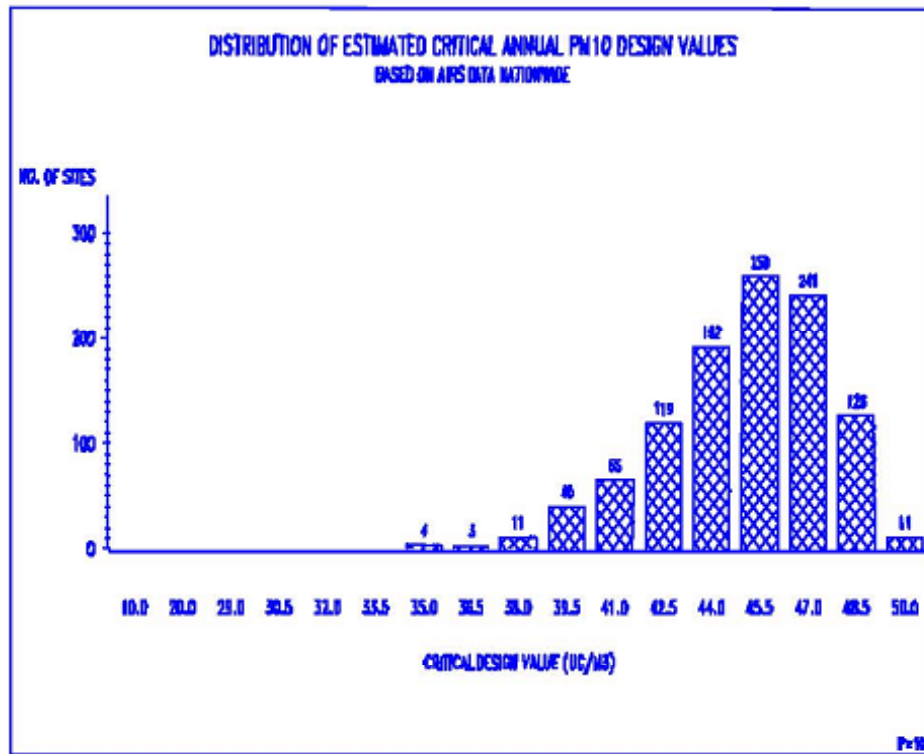


Figure 3.

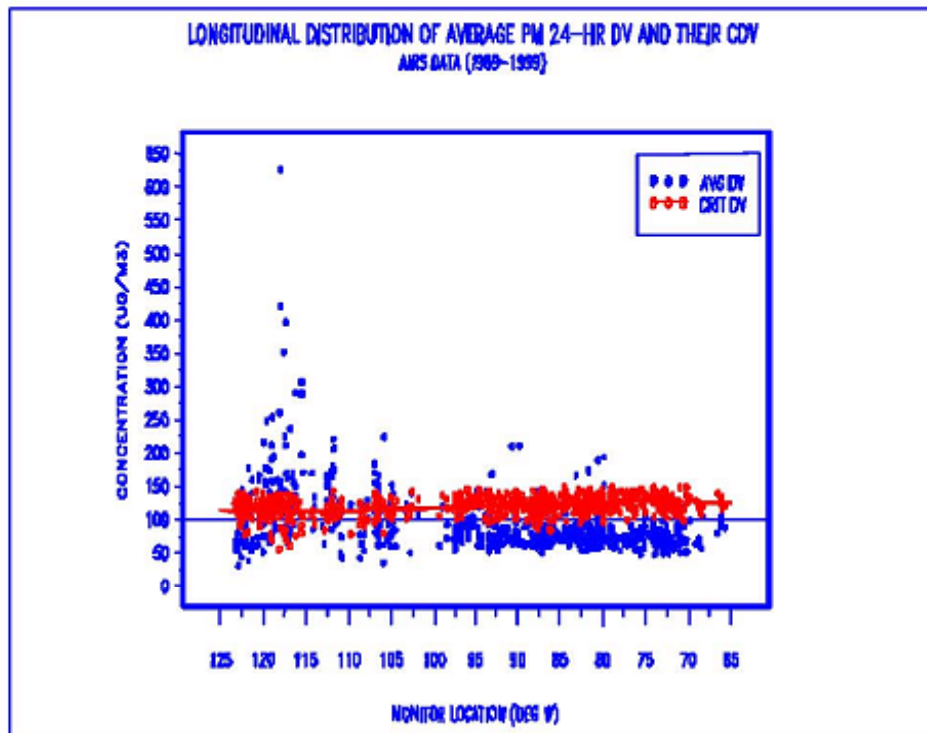
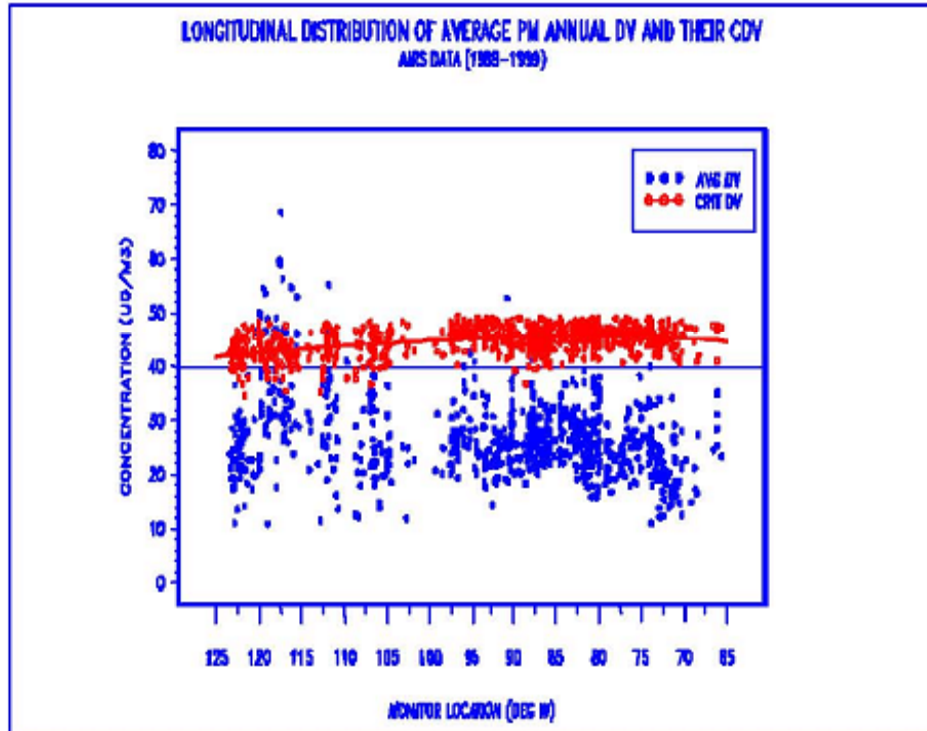


Figure 4.

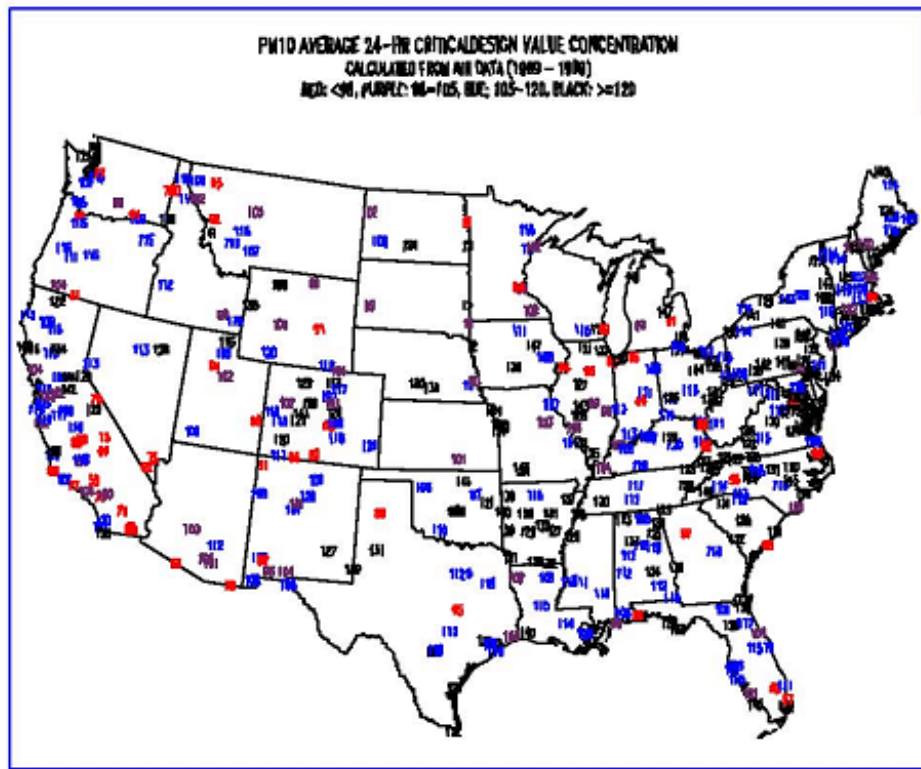
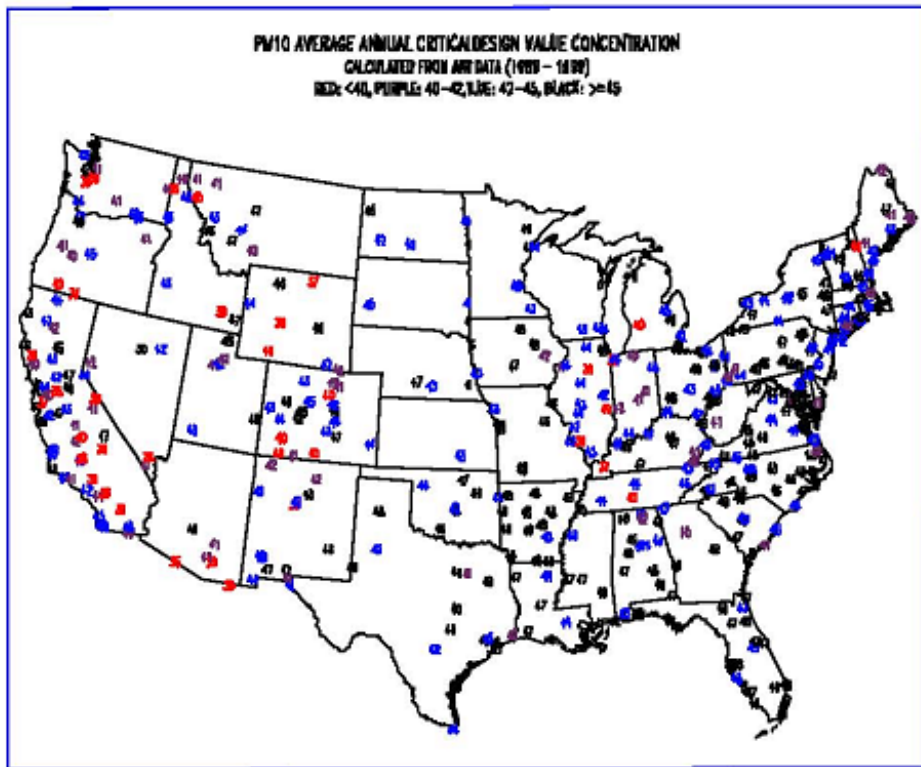


Figure 5.

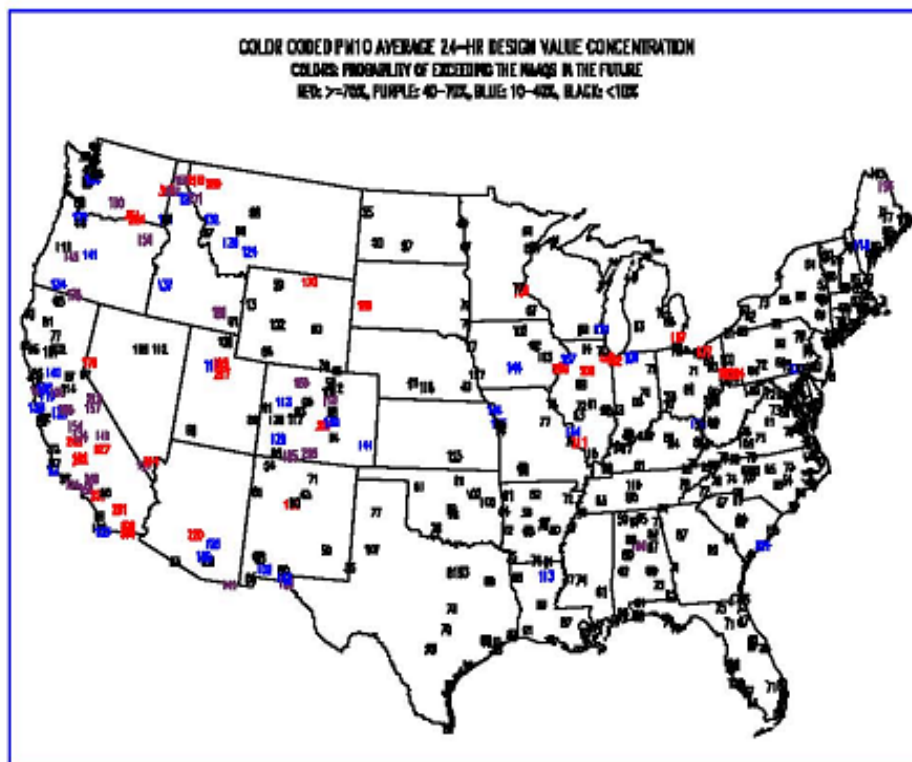
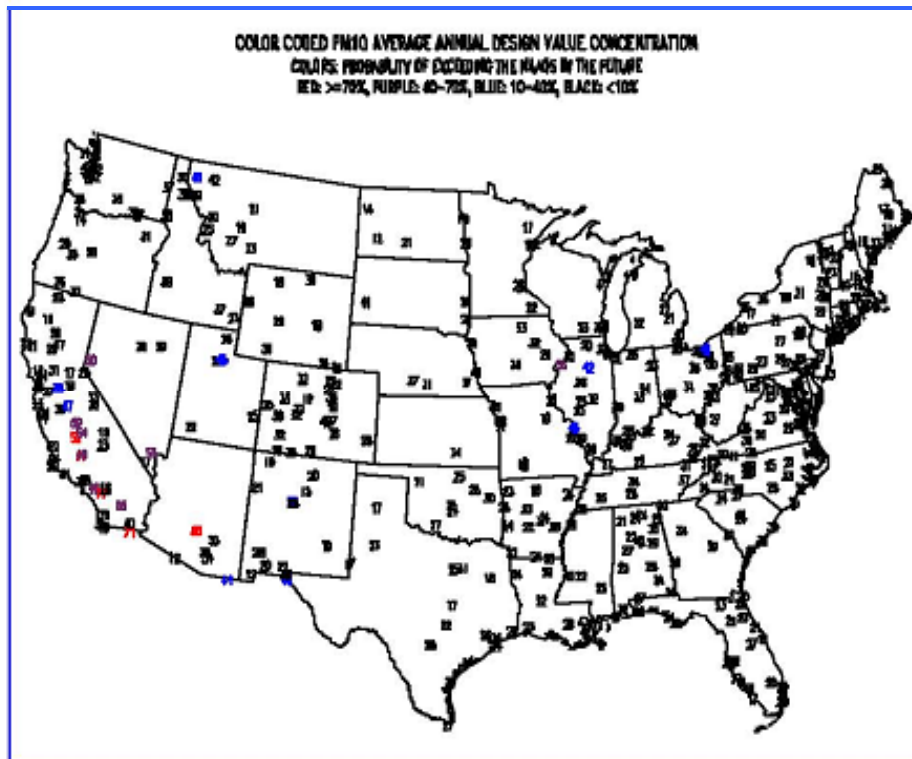


Figure 6.

CONCLUSIONS

In this paper a statistical technique has been developed to determine the CDV which is the highest possible average design value any monitoring site could have before it may record a future violation of the NAAQS with a certain probability. The critical design value is calculated based on the average design value and its variability in the past, and it also involves a risk factor of our choice in the estimation. The difference between the ADV and CDV is a good indicator of whether the site is running a higher or lower risk of violating the NAAQS in the future than one is willing to take. Using this approach, one can even predict the probability of violating the NAAQS in the near future at any given site with adequate data length. Thus, this technique could be used as a planning tool for regulatory agencies to assess the risk of future violation of the NAAQS at any monitoring site and to make decisions about emissions controls. Further, since this technique is very general, it can be applied to any pollutant with a minimum of five years of valid data.

As an example, 11 years (1989-1999) of PM₁₀ data were analyzed using this technique. The results suggest that the inter-annual variability of the design values in the West is, on the average, much larger than that in the East, which is reflected in the calculated CDVs. Since anthropogenic emissions in a region usually do not change very much from year to year, the large variability in the inter-annual PM₁₀ design values in the West may be largely attributable to the inter-annual variation in natural conditions such as meteorology, wildfires, dust storms, and volcanic activities, etc. The higher occurrences of wildfires and dust storms in the West are known to be associated with its much drier climate, meteorological conditions, and topography. The once every six days sampling practice of PM₁₀ monitoring may also have some influence on the inter-annual variability of PM₁₀ design values.

FUTURE WORK

Some further studies have been planned which include applying the same technique to other pollutants, and searching for a better estimate of CV in case when significant trend exists in the yearly design values. Since the variance estimate could be affected by an underlying trend and that a better estimate could be made of the CV if the trend and/or serial correlation could be removed from the estimate.

ACKNOWLEDGMENTS

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KEYWORDS

Critical design value, design value, inter-annual variability, PM10, probability

ATTACHMENT B: MOTOR VEHICLE REGIONAL ANALYSIS METHODOLOGY

The following methodology is used to determine whether increased emissions from on-road mobile sources could, in the next 10 years, increase concentrations in the area and threaten the assumption of maintenance that underlies the LMP policy. This analysis must be submitted and approved in order to be eligible for the LMP option.

The following equation should be used:

$$DV + (VMT_{pi} \times DV_{mv}) \leq MOS$$

Where:

DV	=	the area's design value based on the most recent 5 years of quality assured data in $\mu\text{g}/\text{m}^3$
VMT_{pi}	=	the projected % increase in vehicle miles traveled (VMT) over the next 10 years
DV_{mv}	=	motor vehicle design value based on on-road mobile portion of the attainment year inventory in $\mu\text{g}/\text{m}^3$
MOS	=	margin of safety for the relevant PM-10 standard for a given area: $40 \mu\text{g}/\text{m}^3$ for the annual standard or $98 \mu\text{g}/\text{m}^3$ for the 24-hour standard

Please note that DV_{mv} is derived by multiplying DV by the percentage of the attainment year inventory represented by on-road mobile sources. This variable should be based on both primary and secondary PM_{10} emissions of the on-road mobile portion of the attainment year inventory, including re-entrained road dust.

States should consult with EPA regarding the three inputs used in the above calculation, and all EPA comments and concerns regarding inputs and results should be addressed prior to submitting a limited maintenance plan and redesignation request.

The VMT growth rate (VMT_{pi}) should be calculated through the following methods:

- 1) an extrapolation of the most recent 10 years of Highway Performance Monitoring System (HPMS) data over the 10-year period to be addressed by the limited maintenance plan; and
- 2) a projection of VMT over the 10-year period that would be covered by the limited maintenance plan, using whatever method is in practice in the area (if different than #1).

Areas where method #1 is the current practice for calculating VMT do not also have to do calculation #2, although this is encouraged. All other areas should use methods #1 and #2, and VMT_{pi} is whichever growth rate produced by methods #1 and #2 is highest. Areas will be expected to use transportation models for method #2, if transportation models are available. Areas without transportation models should use reasonable professional practice.

Examples

1. DV = 80 $\mu\text{g}/\text{m}^3$
 VMT_{pi} = 36%
 DV_{mv} = 30 $\mu\text{g}/\text{m}^3$
 MOS = 98 $\mu\text{g}/\text{m}^3$ for 24-hour PM-10 standard

$$80 + (.36 * 30) = 91$$

Less than 98 – Area passes regional analysis criterion.

2. DV = 35 $\mu\text{g}/\text{m}^3$
 VMT_{pi} = 25%
 DV_{mv} = 6 $\mu\text{g}/\text{m}^3$
 MOS = 40 $\mu\text{g}/\text{m}^3$ for annual PM-10 standard

$$35 + (.25 * 6) = 37$$

Less than 40 – Area passes regional analysis criterion.

3. DV = 115 $\mu\text{g}/\text{m}^3$
 VMT_{pi} = 25%
 DV_{mv} = 60 $\mu\text{g}/\text{m}^3$
 MOS = 98 $\mu\text{g}/\text{m}^3$ for 24-hour PM-10 standard

$$115 + (.25 * 60) = 130$$

More than 98 – Area does not pass criterion. Full section 175A maintenance plan required.

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