



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

REGION 1

1 CONGRESS STREET, SUITE 1100  
BOSTON, MASSACHUSETTS 02114-2023

Honorable M. Jodi Rell  
Governor of Connecticut  
210 Capital Avenue  
Hartford, CT, 06106

Dear Governor Rell:

Thank you for your recommendations on the status of fine particle pollution throughout Connecticut. Fine-particle pollution represents one of the most significant barriers to clean air facing our nation today. Health studies link these tiny particles – about 1/30<sup>th</sup> the diameter of a human hair – to serious human health problems including aggravated asthma, increased respiratory symptoms like coughing and difficult or painful breathing, chronic bronchitis, decreased lung function, and even premature death in people with heart and lung disease. Fine particle pollution can remain suspended in the air for long periods of time and create public health problems far away from emission sources. Reducing levels of fine-particle (PM<sub>2.5</sub>) pollution is an important part of our nation's commitment to clean, healthy air.

We have reviewed the December 14, 2007 letter from Commissioner McCarthy submitting Connecticut's recommendations on air quality designations for the 2006 24-hour PM<sub>2.5</sub> standards. We have also reviewed the technical information submitted to support Connecticut's recommendations. We appreciate the effort your State has made to develop this supporting information. Consistent with the Clean Air Act, this letter is to inform you that the Environmental Protection Agency (EPA) intends to support all of Connecticut's recommended designations and boundaries.

We have enclosed a detailed analysis of relevant areas that serves as the basis for EPA's preliminary concurrence with your state recommendations. Commissioner McCarthy will also receive a copy of this letter and the enclosure. Should you have additional information that you wish to be considered by EPA in this process, please provide it to us by October 20, 2008.

EPA has taken steps to reduce fine particle pollution across the country, such as the Clean Diesel Program to dramatically reduce emissions from highway, nonroad and stationary diesel engines. In addition, State programs to attain the 1997 PM<sub>2.5</sub> standards will also help to reduce unhealthy levels of fine particle pollution.

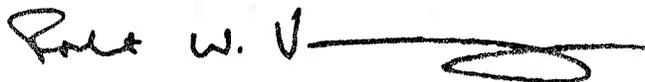
Toll Free • 1-888-372-7341

Internet Address (URL) • <http://www.epa.gov/region1>

Recycled/Recyclable • Printed with Vegetable Oil Based Inks on Recycled Paper (Minimum 30% Postconsumer)

We intend to make final designation decisions for the 2006 24-hour PM<sub>2.5</sub> standards by December 18, 2008. Please also be aware that in near future, EPA is planning to publish a notice in the Federal Register to solicit public comments on our intended designation decisions. If you have any questions, please do not hesitate to contact me. Your air quality staff may wish to contact Anne Arnold, Manager of the Air Quality Planning Unit, at 617-918-1047. We look forward to a continued dialogue with you as we work together to implement the PM<sub>2.5</sub> standards.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert W. Varney", followed by a long horizontal flourish that ends in a loop.

Robert W. Varney  
Regional Administrator

Enclosure

cc: Gina McCarthy, Commissioner, CT DEP  
Anne Gobin, CT DEP

## Attachment 1

### **CONNECTICUT Area Designations For the 24-Hour Fine Particle National Ambient Air Quality Standard**

The table below identifies the counties in the Connecticut portion of the New York City metropolitan area that EPA intends to designate as not attaining the 2006 24-hour fine particle (PM<sub>2.5</sub>) standard.<sup>1</sup> A county will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the county is determined to be contributing to the violation of the standard.

Area	Connecticut-Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
New York City Metropolitan Area	New Haven County Fairfield County	New Haven County Fairfield County

EPA intends to designate New Haven and Fairfield Counties in Connecticut as nonattainment for the 24-hour PM<sub>2.5</sub> NAAQS (National Ambient Air Quality Standard) as part of the New York City metropolitan nonattainment area, and the remaining counties in the state as "attainment/unclassifiable." EPA's proposed nonattainment area for Connecticut is the same as that recommended by the state (See Figure 1).

The nine-factor analysis presented herein focuses on the EPA Region 1 portion of the New York City metropolitan area (i.e., Fairfield and New Haven Counties in Connecticut) and also considers one ring of counties in Connecticut outside of the current nonattainment area (i.e., Middlesex, Hartford, and Litchfield Counties). See the EPA Region 2 nine-factor analysis for a detailed analysis of the portion of the New York City metropolitan area in New York and New Jersey.

---

<sup>1</sup> EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour PM<sub>2.5</sub> standard was revised from 65 micrograms per cubic meter (average of 98<sup>th</sup> percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the annual standard for PM<sub>2.5</sub> remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

## EPA Technical Analysis for the Connecticut Portion of the New York City Metropolitan Area

### Discussion

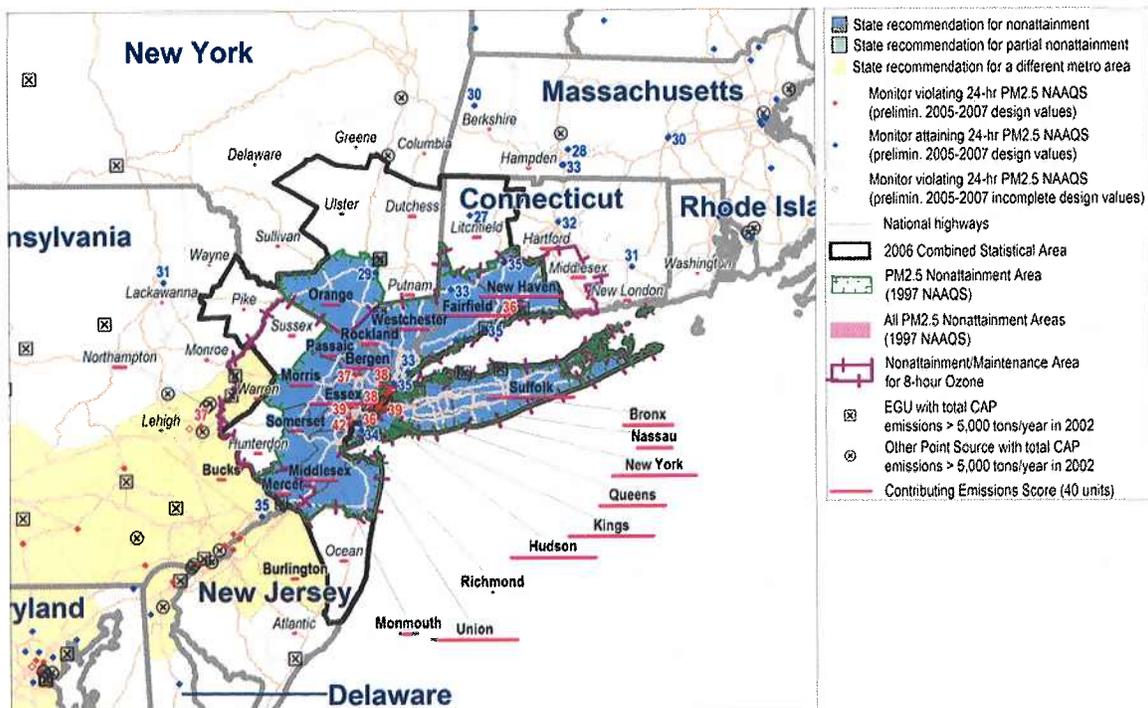
Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the NAAQS and those areas that contribute to violations. This technical analysis for the Connecticut portion of the New York-Northern New Jersey-Long Island, NY-NJ-CT area (i.e., New York City metropolitan area) identifies the counties with monitors that violate the 24-hour PM<sub>2.5</sub> standard and evaluates the counties that potentially contribute to fine particle concentrations in the area. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth
- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

Figure 1 is a map of the counties in the area and other relevant information such as the locations and design values of air quality monitors, the metropolitan area boundary, and counties recommended as nonattainment by the State.

**Figure 1**

### New York-N. New Jersey-Long Island, NY-NJ-CT

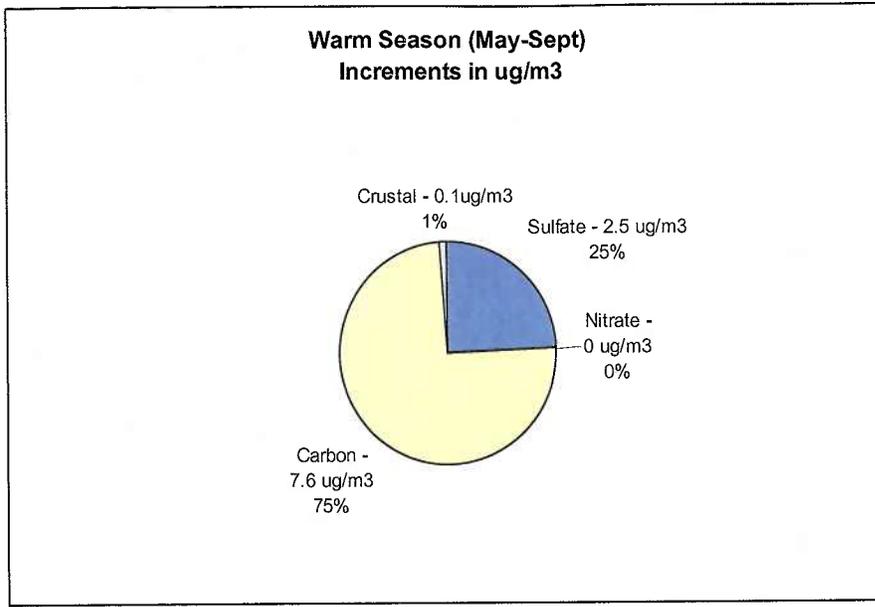


For this area, EPA previously established PM<sub>2.5</sub> nonattainment boundaries for the 1997 PM<sub>2.5</sub> NAAQS for the New York City metropolitan area that included Hartford and Fairfield Counties in Connecticut.

In December 2007, Connecticut recommended that the same Connecticut counties be designated as “nonattainment” for the 2006 24-hour PM<sub>2.5</sub> standard based on air quality data from 2004-2006 (letter from Connecticut DEP to EPA, December 14, 2007). These data are from Federal Reference Method (FRM) and Federal Equivalent Method (FEM) monitors located in the state. Connecticut performed a technical analysis which they submitted with their recommendation letter. The state’s technical support document is, in all major respects, consistent with the analysis EPA has done, and we have arrived at the same conclusions as the state.

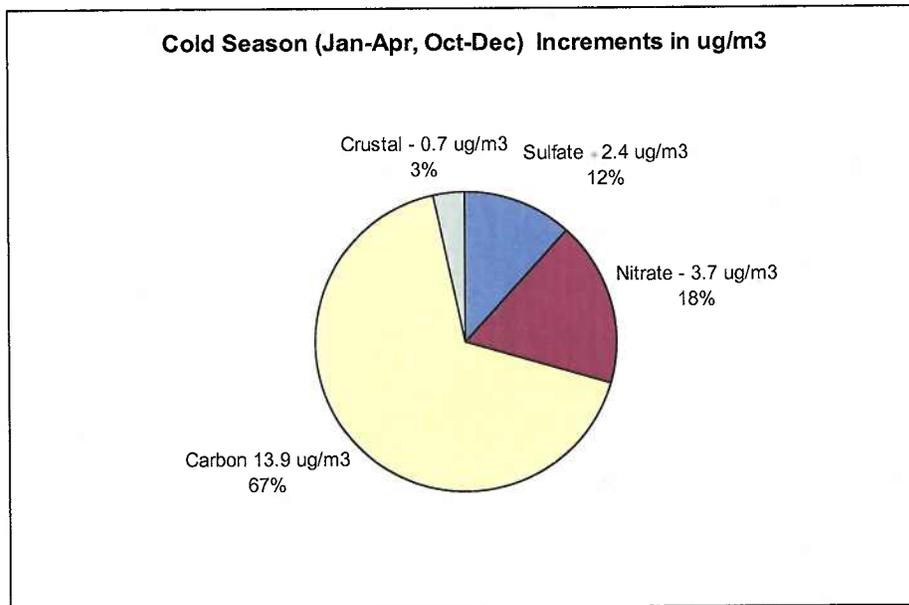
EPA’s analysis shows that on most days in 2004-2006 when PM<sub>2.5</sub> levels were elevated in Fairfield and New Haven counties in Connecticut, the average prevailing surface wind direction was from the southwest, which is the direction of New York City. Air quality monitoring data on the composition of fine particles are available from the EPA Chemical Speciation Network and the IMPROVE monitoring network. Analysis of these data for the New York City metropolitan area indicates that the days with the highest fine-particle concentrations occur predominantly in the warm season.

As shown in Figures 2 and 3, during these high PM<sub>2.5</sub> days, the PM<sub>2.5</sub> urban increment for the New York City metropolitan area is dominated by total carbon in both the warm and cold season months (i.e. 75 percent in the warm season, and 67 percent in the cold season). Sulfates and nitrates comprise most of the remaining PM<sub>2.5</sub> urban increment during the cold season (12 and 18 percent, respectively). However, during the warm season, sulfates comprise most of the remaining PM<sub>2.5</sub> (25 percent), and nitrates are insignificant. This analysis of the composition of the PM<sub>2.5</sub> urban increment did not play a major role in our decisions concerning PM<sub>2.5</sub> nonattainment areas. However, it did show that the composition of the PM<sub>2.5</sub> urban increment in the New York City metropolitan area is similar to many other urban areas in the eastern United States, and suggests that strategies to reduce PM<sub>2.5</sub> may differ depending on the season.



**Total Urban Increment = 10.2 ug/m<sup>3</sup>**

Figure 2. PM<sub>2.5</sub> composition of warm-season “urban increment” for the New York City Metropolitan area.



**Total Urban Increment = 20.7 ug/m<sup>3</sup>**

Figure 3. PM<sub>2.5</sub> composition of cold-season “urban increment” for the New York City Metropolitan area.

Based on EPA's nine-factor analysis described below, EPA believes that Fairfield and New Haven Counties in Connecticut, the same counties that were previously designated for PM<sub>2.5</sub>, should be designated nonattainment for the 24-hour PM<sub>2.5</sub> air-quality standard as part of the New York City metropolitan nonattainment area, based upon currently available information. These counties are listed in the table below.

New York City Metropolitan Area	Connecticut-Recommended Nonattainment Counties	EPA's Intended Nonattainment Counties
New York-Northern New Jersey-Long Island, NY-NJ-Connecticut area	New Haven County Fairfield County	New Haven County Fairfield County

The following is a summary of the nine-factor analysis for the EPA Region 1 portion of the New York City metropolitan area.

#### **Factor 1: Emissions data**

For this factor, EPA evaluated county level emission data for the following PM<sub>2.5</sub> components and precursor pollutants: "PM<sub>2.5</sub> emissions total," "PM<sub>2.5</sub> emissions carbon," "PM<sub>2.5</sub> emissions other," "SO<sub>2</sub>," and "NO<sub>x</sub>." "PM<sub>2.5</sub> emissions total" represents direct Connecticut emissions of PM<sub>2.5</sub> and includes: "PM<sub>2.5</sub> emissions carbon," "PM<sub>2.5</sub> emissions other", primary sulfate (SO<sub>4</sub>), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO<sub>2</sub> and NO<sub>x</sub>, are part of "PM<sub>2.5</sub> emissions total," they are not shown on the template or data spreadsheet as separate items). "PM<sub>2.5</sub> emissions carbon" represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and "PM<sub>2.5</sub> emissions other" represents other inorganic particles (crustal). Emissions of SO<sub>2</sub> and NO<sub>x</sub>, which are precursors of the secondary PM<sub>2.5</sub> components sulfate and nitrate, are also considered.

Emissions data were derived from the 2005 National Emissions Inventory (NEI), version 1. See [http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html).

EPA also considered the Contributing Emissions Score (CES) for each county. The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Note that this metric is not the exclusive way for consideration of data for these factors. A summary of the CES is included in the Appendix, and a more detailed description can be found at:

[http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C).

Table 1 shows emissions of PM<sub>2.5</sub> and precursor pollutants components (given in tons per year) and the CES for violating and potentially contributing counties in the New York City metropolitan area. Counties that are part of the New York City metropolitan nonattainment area for the 1997 PM<sub>2.5</sub> NAAQS are shown in boldface. Counties are listed in descending order by CES. The five Connecticut counties shown on Table 1 comprise the areas that are considered in this nine-factor analysis as candidates for nonattainment status for the 2006 PM<sub>2.5</sub> 24-hour standard. See the nine-factor analysis for EPA Region 2 for candidate areas for nonattainment in that region.

County	State Recommended Nonattainment?	CES	PM <sub>2.5</sub> emissions total (tpy)	PM <sub>2.5</sub> emissions carbon (tpy)	PM <sub>2.5</sub> emissions other (tpy)	SO <sub>2</sub> (tpy)	NO <sub>x</sub> (tpy)
<b>Kings, NY</b>	<b>Yes</b>	<b>100</b>	<b>2,230</b>	<b>1,053</b>	<b>1,176</b>	<b>8,274</b>	<b>27,886</b>
<b>New York, NY</b>	<b>Yes</b>	<b>100</b>	<b>3,522</b>	<b>1,864</b>	<b>1,658</b>	<b>13,060</b>	<b>36,742</b>
<b>Hudson, NJ</b>	<b>Yes</b>	<b>100</b>	<b>2,933</b>	<b>671</b>	<b>2,261</b>	<b>27,305</b>	<b>26,889</b>
<b>Suffolk, NY</b>	<b>Yes</b>	<b>100</b>	<b>4,408</b>	<b>1,836</b>	<b>2,572</b>	<b>47,134</b>	<b>54,932</b>
<b>Fairfield, CT</b>	<b>Yes</b>	<b>100</b>	<b>3,056</b>	<b>1,630</b>	<b>1,426</b>	<b>9,533</b>	<b>26,382</b>
<b>Union, NJ</b>	<b>Yes</b>	<b>100</b>	<b>1,092</b>	<b>603</b>	<b>488</b>	<b>3,806</b>	<b>20,040</b>
<b>New Haven, CT</b>	<b>Yes</b>	<b>97</b>	<b>2,871</b>	<b>1,642</b>	<b>1,230</b>	<b>8,250</b>	<b>21,693</b>
<b>Queens, NY</b>	<b>Yes</b>	<b>78</b>	<b>2,976</b>	<b>1,430</b>	<b>1,545</b>	<b>18,460</b>	<b>40,922</b>
<b>Essex, NJ</b>	<b>Yes</b>	<b>77</b>	<b>942</b>	<b>637</b>	<b>304</b>	<b>4,647</b>	<b>22,221</b>
<b>Bronx, NY</b>	<b>Yes</b>	<b>58</b>	<b>1,106</b>	<b>535</b>	<b>571</b>	<b>3,703</b>	<b>14,362</b>
<b>Richmond, NY</b>	<b>Yes</b>	<b>Not Available</b>	<b>790</b>	<b>307</b>	<b>483</b>	<b>2,623</b>	<b>9,466</b>
<b>Bergen, NJ</b>	<b>Yes</b>	<b>48</b>	<b>1,219</b>	<b>886</b>	<b>333</b>	<b>1,691</b>	<b>23,827</b>
<b>Westchester, NY</b>	<b>Yes</b>	<b>43</b>	<b>1,751</b>	<b>947</b>	<b>805</b>	<b>4,770</b>	<b>24,755</b>
<b>Middlesex, NJ</b>	<b>Yes</b>	<b>42</b>	<b>1,549</b>	<b>951</b>	<b>598</b>	<b>3,129</b>	<b>29,172</b>
<b>Nassau, NY</b>	<b>Yes</b>	<b>41</b>	<b>2,149</b>	<b>1,091</b>	<b>1,058</b>	<b>6,203</b>	<b>31,877</b>
<b>Morris, NJ</b>	<b>Yes</b>	<b>24</b>	<b>1,498</b>	<b>953</b>	<b>545</b>	<b>1,177</b>	<b>13,774</b>
<b>Monmouth, NJ</b>	<b>Yes</b>	<b>21</b>	<b>1,506</b>	<b>989</b>	<b>517</b>	<b>1,789</b>	<b>16,771</b>
<b>Rockland, NY</b>	<b>Yes</b>	<b>20</b>	<b>1,296</b>	<b>327</b>	<b>968</b>	<b>12,711</b>	<b>12,777</b>

<b>Orange, NY</b>	<b>Yes</b>	<b>19</b>	<b>2,637</b>	<b>934</b>	<b>1,704</b>	<b>32,973</b>	<b>18,631</b>
<b>Mercer, NJ</b>	<b>Yes</b>	<b>16</b>	<b>1,658</b>	<b>579</b>	<b>1,079</b>	<b>17,891</b>	<b>17,640</b>
Middlesex, CT	No	15	1,173	641	533	2,684	6,941
<b>Somerset, NJ</b>	<b>Yes</b>	<b>15</b>	<b>801</b>	<b>451</b>	<b>349</b>	<b>577</b>	<b>7,886</b>
Hartford, CT	No	14	2,713	1528	1,185	5,301	24,631
<b>Passaic, NJ</b>	<b>Yes</b>	<b>12</b>	<b>755</b>	<b>471</b>	<b>284</b>	<b>733</b>	<b>8,770</b>
Litchfield, CT	No	8	1,671	949	721	1,234	4,400

**Table 1. PM<sub>2.5</sub> Related Emissions and Contributing Emissions Score**

Based on emissions levels shown in Table 1, New Haven and Fairfield Counties in Connecticut rank well above the other Connecticut counties. CES scores are also quite low for the adjacent Connecticut counties (i.e., 15, 14, and 8 for Middlesex, Hartford, and Litchfield Counties, respectively), which indicates a low potential for emissions from these counties to contribute significantly to PM<sub>2.5</sub> levels at violating monitors.

Note that this factor (emissions data) alone (or any other factor) is not a definitive test for identifying areas for inclusion in a nonattainment area. The boundary of an area may expand or contract during the nine-factor analysis. Final proposed boundaries were based on the weight of evidence of all relevant factors.

### **Factor 2: Air quality data**

This factor considers the 24-hour PM<sub>2.5</sub> design values (in  $\mu\text{g}/\text{m}^3$ ) for air-quality monitors in counties in the New York City metropolitan area based on data for the 2005-2007 period. A monitor's design value indicates whether that monitor attains a specified air-quality standard. The 24-hour PM<sub>2.5</sub> standard is met when the 3-year average of a monitor's 98<sup>th</sup> percentile values are  $35 \mu\text{g}/\text{m}^3$  or less. A design value is only valid if minimum data completeness criteria are met. Table 2 gives 24-hour PM<sub>2.5</sub> design values for counties in the New York City metropolitan area.

Table 2. Air Quality Data.

<b>County</b>	<b>State Recommended Nonattainment</b>	<b>Design Values 2005-07 (<math>\mu\text{g}/\text{m}^3</math>)</b>
<b>Bronx, NY</b>	<b>Yes</b>	<b>39</b>
<b>Kings, NY</b>	<b>Yes</b>	<b>36</b>

<b>Nassau, NY</b>	<b>Yes</b>	<b>33</b>
<b>New York, NY</b>	<b>Yes</b>	<b>39</b>
<b>Orange, NY</b>	<b>Yes</b>	<b>29</b>
<b>Queens, NY</b>	<b>Yes</b>	<b>34*</b>
<b>Richmond, NY</b>	<b>Yes</b>	<b>34</b>
<b>Rockland, NY</b>	<b>Yes</b>	<b>No monitor</b>
<b>Suffolk, NY</b>	<b>Yes</b>	<b>32*</b>
<b>Westchester, NY</b>	<b>Yes</b>	<b>33</b>
<b>Bergen, NJ</b>	<b>Yes</b>	<b>38</b>
<b>Middlesex, NJ</b>	<b>Yes</b>	<b>34*</b>
<b>Monmouth, NJ</b>	<b>Yes</b>	<b>No monitor</b>
<b>Essex, NJ</b>	<b>Yes</b>	<b>39</b>
<b>Mercer, NJ</b>	<b>Yes</b>	<b>34*</b>
<b>Hudson, NJ</b>	<b>Yes</b>	<b>42</b>
<b>Union, NJ</b>	<b>Yes</b>	<b>42</b>
<b>Morris, NJ</b>	<b>Yes</b>	<b>31*</b>
<b>Passaic, NJ</b>	<b>Yes</b>	<b>37</b>
<b>Somerset, NJ</b>	<b>Yes</b>	<b>No monitor</b>
<b>Fairfield, CT</b>	<b>Yes</b>	<b>35</b>
<b>New Haven, CT</b>	<b>Yes</b>	<b>36</b>
Litchfield, CT	No	27
Hartford, CT	No	32
Middlesex, CT	No	No monitor

*\* Data is from 2004-2006. 2005-2007 data was not available*

[Note: Counties that are part of the New York City Metropolitan nonattainment area for the 1997 PM<sub>2.5</sub> NAAQS are shown in boldface.]

In EPA Region 1, air-quality monitors in only two counties in Connecticut, New Haven and Fairfield Counties (all FRM monitors), violate the 24-hour PM<sub>2.5</sub> standard based on data for the 2004-2006 and 2005-2007 periods. Therefore, these counties are candidates for inclusion in the New York City metropolitan nonattainment area. However, the absence of a violating monitor alone is not a sufficient reason to eliminate the other

counties in EPA Region 1 as candidates for nonattainment status. EPA considered the nine factors and the CES for each county (plus other relevant factors or circumstances) when determining which counties to propose for a nonattainment designation.

Many of the violating monitors in the New York City metropolitan area are near major transportation routes, which is an indication of a significant mobile source contribution. Figure 4 shows a map of the location of PM<sub>2.5</sub> air-quality monitors and major roadways in the New York City metropolitan area.

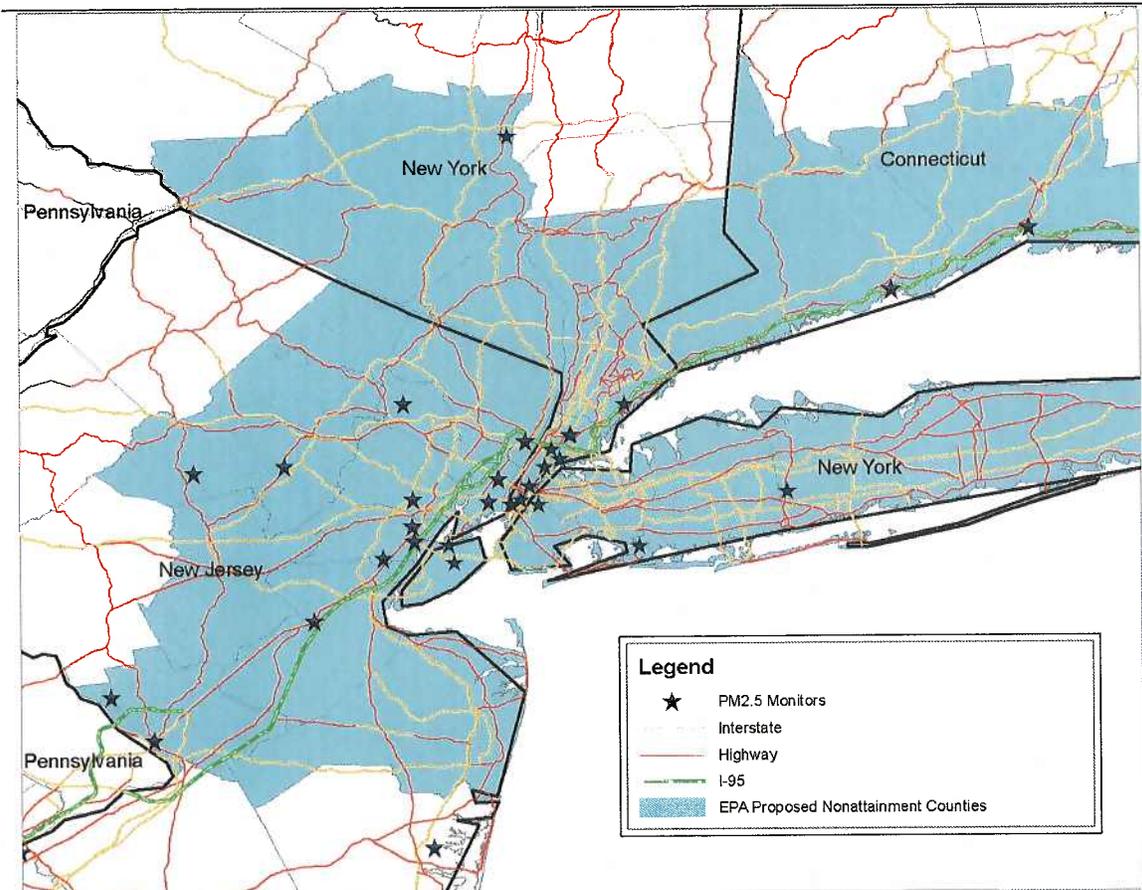


Figure 4. Map of state-recommended nonattainment counties, PM<sub>2.5</sub> air-quality monitors, and major roadways in the New York City metropolitan area.

[Note: Eligible monitors for providing design value data generally include State and Local Air Monitoring Stations (SLAMS) at population-oriented locations with a FRM or FEM monitor. All data from Special Purpose Monitors (SPM) using an FRM, FEM, or Alternative Reference Method (ARM) which has operated for more than 24 months is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements

given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hr PM<sub>2.5</sub> NAAQS for designation purposes.]

**Factor 3: Population density and degree of urbanization (including commercial development)**

Table 3 shows the 2005 population for counties in the New York City metropolitan area, as well as the population density for each county. Population data give an indication of whether it is likely that population-based emissions might contribute to violations of the 24-hour PM<sub>2.5</sub> standards. Table 3 is sorted by 2005 population.

Table 3. Population and population density.

County	2005 Population	2005 Population Density (pop/sq mi)
Kings, NY	2,511,408	37,206
Queens, NY	2,256,576	20,477
New York, NY	1,606,275	70,451
Suffolk, NY	1,472,086	1369
Bronx, NY	1,364,566	31.882
Nassau, NY	1,331,620	4289
Westchester, NY	947,719	1989
Bergen, NJ	902,308	3718
Fairfield,	901,086	1385
Hartford, Connecticut	875,422	1168
New Haven,	844,510	1358
Middlesex, NJ	789,283	2487
Essex, NJ	789,166	6099
Monmouth, NJ	634,841	1308
Hudson, NJ	602,970	11,208

<b>Union, NJ</b>	<b>530,710</b>	<b>5035</b>
<b>Passaic, NJ</b>	<b>496,985</b>	<b>2525</b>
<b>Morris, NJ</b>	<b>490,084</b>	<b>1019</b>
<b>Richmond, NY</b>	<b>475,014</b>	<b>7625</b>
<b>Orange, NY</b>	<b>372,750</b>	<b>445</b>
<b>Mercer, NJ</b>	<b>366,070</b>	<b>1601</b>
<b>Somerset, NJ</b>	<b>319,830</b>	<b>1049</b>
<b>Rockland, NY</b>	<b>294,636</b>	<b>1479</b>
Litchfield,	189,358	201
Middlesex,	162,824	422

*Note: Counties that are part of the New York City Metropolitan nonattainment area for the 1997 PM<sub>2.5</sub> NAAQS are shown in boldface.*

Counties within New York City (e.g., Kings, Queens, New York, Bronx) have high population and high population densities relative to the remainder of the area. Of the five candidate counties for a nonattainment designation in CT, three (Fairfield, New Haven, Hartford) have moderately sized populations and population densities relative to other counties in the New York City metropolitan area. Analysis of this factor suggests that Litchfield and Middlesex counties in Connecticut are not likely to have population-based emissions that contribute to violations of the 24-hour PM<sub>2.5</sub> standards in the New York City metropolitan area.

#### **Factor 4: Traffic and commuting patterns**

This factor considers the number of commuters in each county who drive to another county within the New York City metropolitan area, the percent of total commuters in each county who commute to violating counties within the New York City metropolitan area, as well as the total Vehicle Miles Traveled (VMT) for each county in millions of miles (see Table 4). A county with numerous commuters is generally an integral part of an urban area and is likely contributing to fine particle concentrations in the area. The listing of counties in Table 4 reflects a ranking based on the number of people commuting to any violating county.

Table 4. Traffic and Commuting Patterns.

County	2005 VMT (million miles)	Number Commuting to any violating counties	Percent Commuting to any violating counties	Number Commuting into New York City area	Percent Commuting into New York City area
Kings, NY	4,899	861,160	96	895,130	99
Queens, NY	7,839	833,770	90	925,290	99
New York, NY	4,378	718,530	95	742,870	99
Bergen, NJ	9,124	394,140	92	424,530	99
Fairfield, Connecticut	7,649	387,340	93	413,090	99
Bronx, NY	4,721	374,820	90	412,900	100
New Haven, Connecticut	6,948	343,410	89	353,820	91
Essex, NJ	5,611	281,290	86	325,570	99
Hudson, NJ	2,543	244,470	93	262,640	99
Nassau, NY	11,920	201,260	33	616,330	100
Passaic, NJ	3,302	186,060	89	208,770	99
Union, NJ	4,704	181,030	76	237,010	100
Westchester, NY	9,166	141,680	33	421,720	99
Richmond, NY	2,002	97,040	51	190,220	100
Middlesex, NJ	8,014	90,710	25	358,740	99
Suffolk, NY	19,815	81,780	12	667,130	100
Morris, NJ	5,398	77,050	32	236,040	99
Monmouth, NJ	6,230	55,040	19	287,550	99
Rockland, NY	2,731	43,780	33	131,200	99
Somerset, NJ	2,702	32,080	21	148,750	99
Litchfield, Connecticut	1,557	25,520	27	78,750	84
Orange, NY	4,696	24,190	16	150,080	99

Hartford, Connecticut	7,951	20,400	5	24,380	6
Middlesex, Connecticut	1,786	14,320	18	14,660	18
<b>Mercer, NJ</b>	<b>2,668</b>	<b>11,130</b>	<b>7</b>	<b>150,970</b>	<b>93</b>

**Notes:**

**1. Counties that are part of the New York City Metropolitan nonattainment area for the 1997 PM<sub>2.5</sub> NAAQS are shown in boldface.**

**2. The 2005 VMT data was derived using methodology similar to that described in "Documentation for the final 2002 Mobile National Emissions Inventory, Version 3, September 2007, prepared for the Emission Inventory Group, U.S. EPA. This document may be found at:**

***atftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002\_mobile\_nei\_version\_3\_report\_092807.pdf. The 2005 VMT data were taken from documentation which is still in draft form, but which should be released in 2008.***

The counties in the New York City metropolitan area with the largest numbers of commuters (more than 700,000 vehicles per year) that travel to counties with violating monitors are from three New York counties (Kings, Queens, and New York). All other counties in the current New York City nonattainment area have less than 400,000 vehicles that make these trips. Of the Connecticut counties, however, Fairfield and New Haven Counties both have a moderately high number of commuters (about 400,000 to 350,000) that travel to counties with violating monitors compared to the other three Connecticut counties (all less than 26,000). Also note that three Connecticut counties (Fairfield, New Haven, and Hartford) score relatively high for VMT when compared to other counties in the New York City metropolitan area.

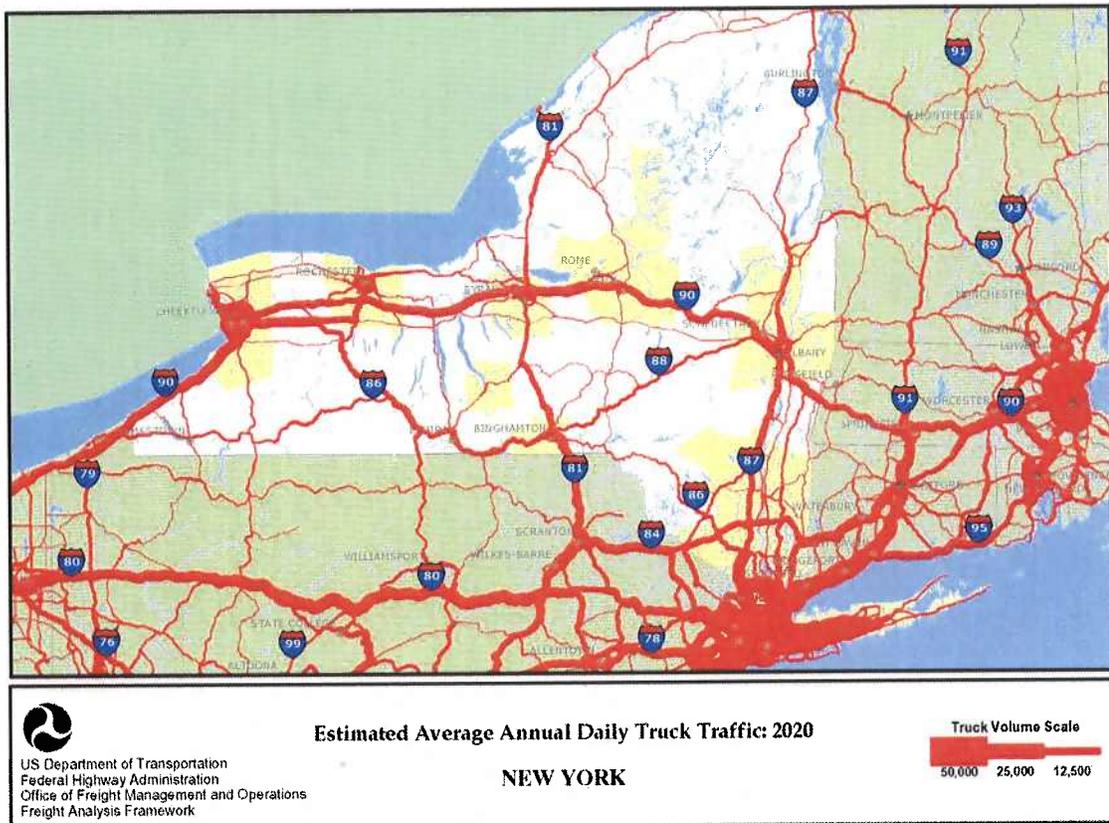
However, the above traffic analysis may not adequately take into account heavy-duty truck traffic from Connecticut to both New York and New Jersey. Traffic count data from the New York State Department of Transportation indicate that average annual daily traffic crossing the NY-Connecticut border in both directions on Route 1 was 10,017 vehicles (2001), on Interstate 95 was 121,214 vehicles (1998), and on the Hutchinson/Merritt Parkway was 41,177 vehicles (2001). Furthermore, there are 66,476 vehicles (2003) entering and leaving Connecticut daily via Interstate 84 north of Westchester County. (See

<https://www.nysdot.gov/portal/page/portal/divisions/engineering/technical-services/highway-data-services/traffic-data> and <https://www.nysdot.gov/portal/page/portal/divisions/engineering/technical-services/hds-respository/westchestertvbk.pdf>.

Fairfield and New Haven Counties are a conduit for a large percentage of the truck traffic that flows throughout New England. Information from the Federal Highway Administration illustrates that Interstate 95 is the major thoroughfare for truck traffic entering and exiting Connecticut. Moreover, this truck traffic is expected to increase

significantly at least until 2020. (See [ops.fhwa.dot.gov/freight/freight\\_analysis/state\\_info/connecticut/profile\\_ct.htm](http://ops.fhwa.dot.gov/freight/freight_analysis/state_info/connecticut/profile_ct.htm)).

Figure 5 shows the Federal Highway Administration's estimate of average annual daily truck traffic in 2020 for the New York City metropolitan area.



**Figure 5. Estimated Average Annual Daily Truck Traffic in 2020**

This factor on traffic and commuting patterns highlights Fairfield and New Haven counties in Connecticut as those Connecticut counties most likely to contribute to PM<sub>2.5</sub> violations at air-quality monitors in the New York City metropolitan area.

### **Factor 5: Growth rates and patterns**

This factor looks at population (2005), expected population change (2000-2005), VMT (2005), and VMT growth (1996-2005) for counties in the New York metropolitan area. A county with rapid population or VMT growth is generally an integral part of an urban area and could be an appropriate county for implementing mobile-source and other emission-control strategies, thus warranting inclusion in the nonattainment area.

Table 5 shows population, population growth, VMT, and VMT growth for counties in the New York metropolitan area. Counties are listed in descending order based on VMT growth between 1996 and 2005.

Table 5. Population and VMT Growth and Percent Change.

County	2005 Population	Percent Population Change (2000–2005)	Vehicle Miles Traveled in 2005 (millions annually)	Percent VMT Growth (1996-2005)
Suffolk, NY	1,472,086	3	19,815	191
Westchester, NY	947,719	2	9,166	123
Rockland, NY	294,636	2	2,731	111
Nassau, NY	1,331,620	0	11,920	89
Middlesex, NJ	789,283	5	8,014	56
Morris, NJ	490,084	4	5,398	56
Bergen, NJ	902,308	2	9,124	52
Litchfield, Connecticut	189,358	4	1,557	46
Orange, NY	372,750	9	4,696	39
Somerset, NJ	319,830	7	2,702	39
Monmouth, NJ	634,841	3	6,230	37
Union, NJ	530,710	1	4,704	31
Middlesex, Connecticut	162,824	5	1,786	29
New Haven, Connecticut	844,510	2	6,948	10
Fairfield, Connecticut	901,086	2	7,649	9
Richmond, NY	475,014	7	2,002	8
Hartford, Connecticut	875,422	2	7,951	8
Passaic, NJ	496,985	1	3,302	3

<b>Essex, NJ</b>	<b>789,166</b>	<b>0</b>	<b>5,611</b>	<b>(1)</b>
<b>Queens, NY</b>	<b>2,256,576</b>	<b>1</b>	<b>7,839</b>	<b>(18)</b>
<b>Bronx, NY</b>	<b>1,364,566</b>	<b>2</b>	<b>4,721</b>	<b>(20)</b>
<b>Mercer, NJ</b>	<b>366,070</b>	<b>4</b>	<b>2,668</b>	<b>(22)</b>
<b>Hudson, NJ</b>	<b>602,970</b>	<b>(1)</b>	<b>2,543</b>	<b>(37)</b>
<b>New York, NY</b>	<b>1,606,275</b>	<b>4</b>	<b>4,378</b>	<b>(40)</b>
<b>Kings, NY</b>	<b>2,511,408</b>	<b>2</b>	<b>4,899</b>	<b>(57)</b>

*Note: The counties that are in the nonattainment area for the 1997 PM<sub>2.5</sub> NAAQS are shown in boldface.*

In general, except for New York and Suffolk Counties in NY, the most populated counties in the New York City metropolitan area (i.e., those with populations greater than 800,000), experienced lower growth rates from 2000 to 2005 than suburban counties. As Table 5 shows, most of the high growth-rate counties (i.e., 4 to 9 percent population change from 2000 to 2005) are suburban counties in New York, New Jersey, and Connecticut. In Connecticut, the most populated counties (Fairfield, Hartford, and New Haven) experienced a slower population growth rate (2 percent) during this period.

In the Connecticut counties, this pattern of higher population growth for the less populated counties at the outskirts of the New York City metropolitan area also held for VMT growth. The percent growth in VMT for Middlesex and Litchfield Counties from 1996 to 2005 was 26 and 49 percent, respectively. In the more urban Fairfield, Hartford, and New Haven Counties, VMT grew by 10 percent or less during the same period.

This factor played a role in our decision process as it showed that there were many counties in the New York City metropolitan area where there is continued growth in both population and VMT.

#### **Factor 6: Meteorology (weather/transport patterns)**

For this factor, EPA considered the most representative National Weather Service wind direction and speed data throughout the year, with an emphasis on “high PM<sub>2.5</sub> days” for each of two seasons (an October-April “cold” season and a May-September “warm” season). These high days are defined as days where any FRM or FEM air-quality monitors had 24-hour PM<sub>2.5</sub> concentrations above 95 percent on a frequency distribution curve of PM<sub>2.5</sub> 24-hour values.

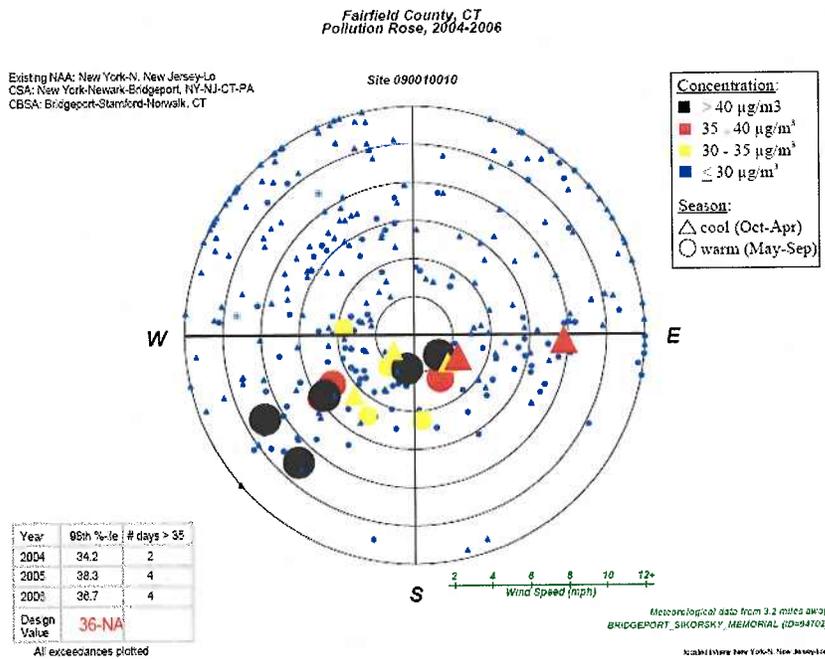
For each air quality monitoring site, EPA developed a “pollution rose” to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. A pollution rose identifies 24-hour PM<sub>2.5</sub> values by color; days exceeding 35 ug/m<sup>3</sup> are denoted with a red or black icon. A dot indicates the day occurred in the

warm season and a triangle indicates the day occurred in the cool season. The center of the figure indicates the location of the air quality monitoring site, and the location of the icon in relation to the center indicates the direction from which the wind was blowing on that day. An icon that is close to the center indicates a low average wind speed on that day. Higher wind speeds are indicated when the icon is further away from the center.

For this factor, EPA also considered each county's CES because the method for deriving these scores included an analysis of trajectories of air masses for high PM<sub>2.5</sub> days.

Figure 6 shows pollution roses for violating monitors in Fairfield and New Haven Counties. These pollution roses show the average prevailing surface wind direction and PM<sub>2.5</sub> concentration for high PM<sub>2.5</sub> days. The roses show that while 24-hour PM<sub>2.5</sub> levels for any specified air-quality monitor can be influenced by emissions from any direction at various times, concentrations are more likely to be higher for some wind directions than others.

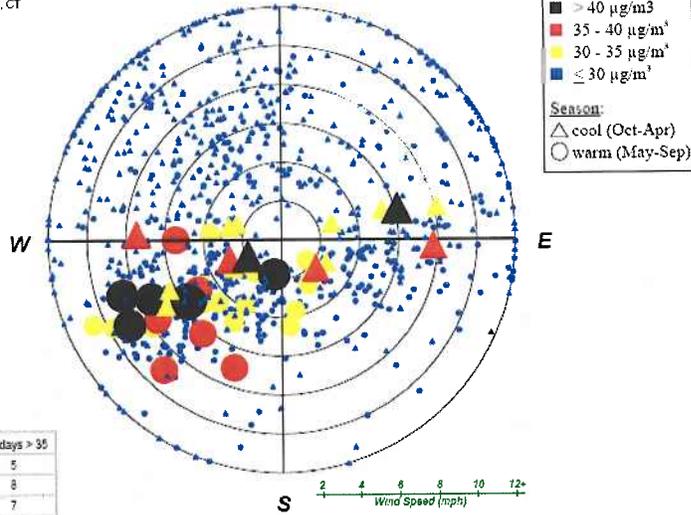
Figure 6. Pollution Roses for Connecticut Counties in the New York City Metropolitan Area.



New Haven County, CT  
Pollution Rose, 2004-2006

Existing NAA: New York-N. New Jersey-La.  
CSA: New York-Newark-Bridgeport, NY-NJ-CT-PA  
CBSA: New Haven-Milford, CT

Site 090090027



Year	95th %ile	# days > 35
2004	38.7	5
2005	38.2	8
2006	38.7	7
Design Value	37-NA	

All exceedances plotted

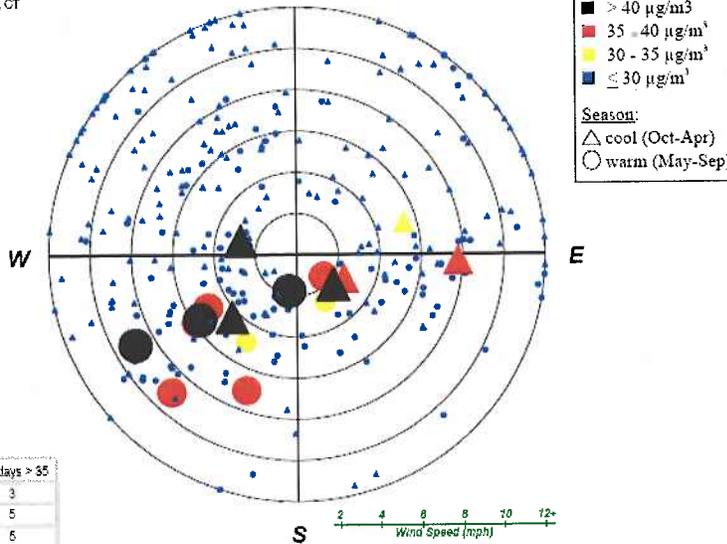
Meteorological data from 15.2 miles away  
BRIDGEPORT\_SIKORSKY\_MEMORIAL (ID#94703)

Scale: Inter New York-N. New Jersey-La.

New Haven County, CT  
Pollution Rose, 2004-2006

Existing NAA: New York-N. New Jersey-La.  
CSA: New York-Newark-Bridgeport, NY-NJ-CT-PA  
CBSA: New Haven-Milford, CT

Site 090091123



Year	95th %ile	# days > 35
2004	38.2	3
2005	40.8	5
2006	38.1	5
Design Value	33-NA	

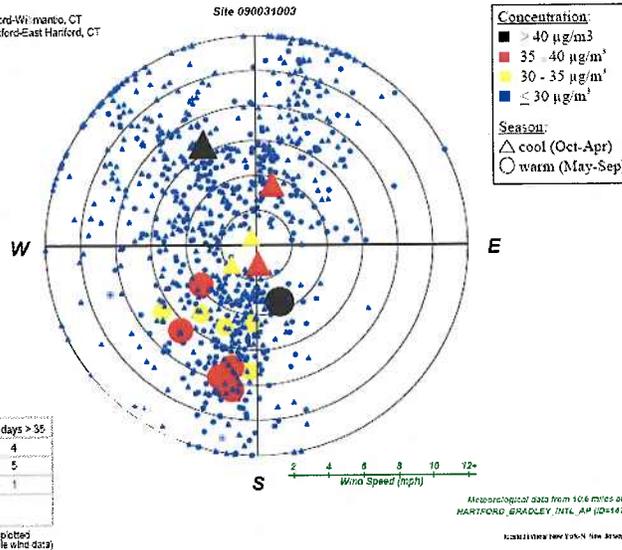
All exceedances plotted

Meteorological data from 15.0 miles away  
BRIDGEPORT\_SIKORSKY\_MEMORIAL (ID#94703)

Scale: Inter New York-N. New Jersey-La.

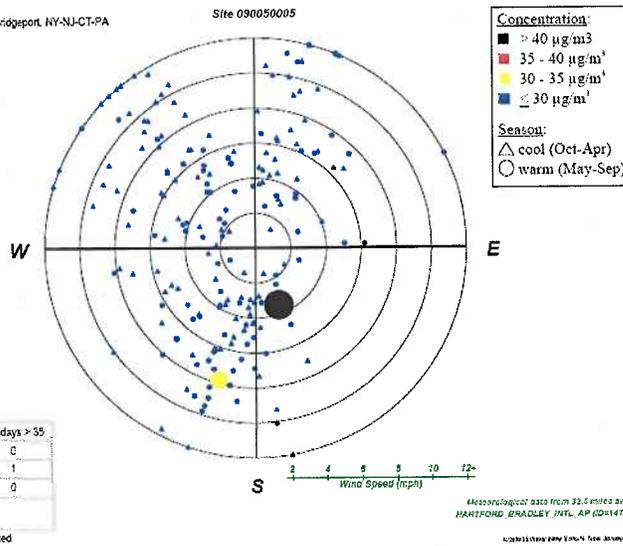
Hartford County, CT  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: Hartford-West Hartford-Wilmanito, CT  
CBSA: Hartford-West Hartford-East Hartford, CT



Litchfield County, CT  
Pollution Rose, 2004-2006

Not in an existing NAA  
CSA: New York-Newark-Bridgeport, NY-NJ-CT-PA  
CBSA: Torrington, CT



EPA's analysis of meteorology for the New York City Metropolitan area shows that, in general for the entire area, PM<sub>2.5</sub> emissions during high PM<sub>2.5</sub> days in 2004-2006

primarily originated from, or passed through, locations from a southerly to a southwesterly direction.

This is also generally true for the five Connecticut counties considered herein for a nonattainment designation for the 2006 PM<sub>2.5</sub> 24-hour NAAQS. Pollution roses for Fairfield and New Haven counties show a strong tendency for higher levels of PM<sub>2.5</sub> when the average prevailing surface wind direction is from the southwest, which is the direction of New York City. Pollution roses for Hartford and Litchfield Counties also show an influence from the southwest (particularly Hartford), but also show some component of elevated PM<sub>2.5</sub> originating from southeastern and northerly directions. (There are no pollution roses for Middlesex County because there are no PM<sub>2.5</sub> monitors in this county.)

Based on analysis of this factor, EPA concludes that Litchfield, Middlesex, and Hartford Counties, which are further removed geographically and meteorologically from other counties in the New York City metropolitan area and contain no violating PM<sub>2.5</sub> monitors are low-ranked candidates for a 24-hour PM<sub>2.5</sub> nonattainment designation. This conclusion is also supported by the CES scores for the Connecticut counties, which are much lower for Middlesex, Hartford, and Litchfield Counties (15, 14, and 8, respectively) than for Fairfield and New Haven (100 and 97, respectively), indicating that emissions from Middlesex, Hartford, or Litchfield Counties are unlikely to contribute significantly to PM<sub>2.5</sub> levels at violating monitors in the New York City area.

#### **Factor 7: Geography/topography (mountain ranges or other air basin boundaries)**

The geography/topography analysis looks at physical features of the land that might have an effect on the air shed and, therefore, on the distribution of PM<sub>2.5</sub> over the New York City metropolitan area.

The New York City metropolitan area does not have any geographical or topographical barriers significantly limiting air-pollution transport within its air shed. Therefore, this factor did not play a significant role in the decision-making process.

#### **Factor 8: Jurisdictional boundaries**

In evaluating the jurisdictional boundary factor, consideration should be given to existing boundaries and organizations that may facilitate air quality planning and the implementation of control measures to attain the standard. Areas designated as nonattainment (e.g. for the PM<sub>2.5</sub> annual or 8-hour ozone standards) represent important boundaries for state air quality planning.

From a New England perspective, the major jurisdictional boundary for the New York City metropolitan area (and adjacent counties) is the state line between New York and Connecticut. The State of Connecticut has limited jurisdictional say in the air quality regulations and policies developed by either New York or New Jersey to address PM<sub>2.5</sub> emissions in areas within those states that have violating monitors. In addition,

Connecticut has limited influence in the transportation policies developed by other states to address traffic and vehicle miles traveled in the New York City metropolitan area.

Areas designated as 8-hour ozone nonattainment areas are also important boundaries for state air-quality planning. On April 15, 2004, Fairfield, New Haven, and Middlesex counties in Connecticut were included in the 8-hour ozone nonattainment area associated with the New York City metropolitan area. Other Connecticut counties included in this nine-factor analysis (i.e., Litchfield and Hartford Counties) are also designated as 8-hour ozone nonattainment areas, but are not associated with the New York City area (see 40 CFR 81.307). A goal in designating PM<sub>2.5</sub> nonattainment areas is to achieve a degree of consistency with ozone nonattainment areas. Comparison of ozone areas with potential PM<sub>2.5</sub> nonattainment areas, therefore, gives added weight to designation of Fairfield, New Haven, and Middlesex counties. However, previously considered factors (e.g., Factors 1, 3, and 4) reduce this weight for Middlesex County.

In EPA's June 2007 Guidance for Area Designations for the 24-hr PM<sub>2.5</sub> NAAQS, EPA had indicated that the boundaries for the existing 1997 PM<sub>2.5</sub> nonattainment areas might be appropriate for the boundaries of the new nonattainment areas for the 2006 PM<sub>2.5</sub> NAAQS. The following counties were included in the EPA Region 1 and 2 portions of the 1997 PM<sub>2.5</sub> NAAQS nonattainment area for the New York City metropolitan area: New York, Bronx, Queens, Kings, Richmond, Nassau, Suffolk, Westchester, Orange, and Rockland Counties in New York; Union, Bergen, Essex, Hudson, Mercer, Middlesex, Monmouth, Morris, Passaic, and Somerset Counties in New Jersey, and Fairfield and New Haven Counties in Connecticut.

#### **Factor 9: Level of control of emission sources**

This factor considers emission controls currently implemented for major sources in the New York City Metropolitan area.

The emission estimates on Table 1 (under Factor 1) include any control strategies implemented by the States in the New York City Metropolitan area before 2005 that may influence emissions of any component of PM<sub>2.5</sub> emissions (i.e., total carbon, SO<sub>2</sub>, NO<sub>x</sub>, and crustal PM<sub>2.5</sub>). EPA believes that the emissions listed in Table 1 have not changed significantly since 2005.

## **Appendix**

### **Description of the Contributing Emissions Score**

The CES is a metric that takes into consideration emissions data, meteorological data, and air quality monitoring information to provide a relative ranking of counties in and near an area. Using this methodology, scores were developed for each county in and around the relevant metro area. The county with the highest contribution potential was

assigned a score of 100, and other county scores were adjusted in relation to the highest county. The CES represents the relative maximum influence that emissions in that county have on a violating county. The CES, which reflects consideration of multiple factors, should be considered in evaluating the weight of evidence supporting designation decisions for each area.

The CES for each county was derived by incorporating the following significant information and variables that impact  $PM_{2.5}$  transport:

- Major  $PM_{2.5}$  components: total carbon (organic carbon (OC) and elemental carbon (EC)),  $SO_2$ ,  $NO_x$ , and inorganic particles (crustal).
- $PM_{2.5}$  emissions for the highest (generally top 5%)  $PM_{2.5}$  emission days (herein called “high days”) for each of two seasons, cold (Oct-Apr) and warm (May-Sept)
- Meteorology on high days using the NOAA HYSPLIT model for determining trajectories of air masses for specified days
- The “urban increment” of a violating monitor, which is the urban  $PM_{2.5}$  concentration that is in addition to a regional background  $PM_{2.5}$  concentration, determined for each  $PM_{2.5}$  component
- Distance from each potentially contributing county to a violating county or counties

A more detailed description of the CES can be found at:

[http://www.epa.gov/ttn/naaqs/pm/pm25\\_2006\\_techinfo.html#C](http://www.epa.gov/ttn/naaqs/pm/pm25_2006_techinfo.html#C)