Report on Air Quality in Nonattainment Areas For 2003-2005 Covering Ozone, Particulate Matter, Carbon Monoxide, Sulfur Dioxide, Nitrogen Dioxide, and Lead

Technical Summary

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U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Air Quality Assessment Division
Air Quality Analysis Group
Research Triangle Park, NC 27701

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INTRODUCTION

This report presents information on outdoor air quality based on monitoring data collected throughout the country during 2003-2005. It focuses on areas where air quality was previously determined by the U.S. Environmental Protection Agency (EPA or agency) to be unhealthy and designated as nonattainment for one or more of the six principal outdoor air pollutants referred to as criteria pollutants. The criteria pollutants are ozone, particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and lead. Each year the EPA looks at the levels of these pollutants in the air measured at monitors located across the country to evaluate how air quality has changed over time and summarizes the current status of air quality in designated nonattainment areas. Background information on the pollutants is included to set the context for readers.

SUMMARY

- Ozone
  - o Ozone design values in designated nonattainment areas are improving.
  - o An increasing number of designated nonattainment areas are attaining the ozone National Ambient Air Quality Standards (NAAQS or standards).
  - o There are no areas newly violating the ozone NAAQS.
- $PM_{2.5}$
  - o $PM_{2.5}$ design values in designated nonattainment areas are improving.
  - o One designated nonattainment area is measuring attainment with monitoring data collected during 2003-2005.
  - o There are five areas newly violating the $PM_{2.5}$ NAAQS.
- PM_{10}
  - o There are 46 designated nonattainment areas for the PM_{10} NAAQS. Air quality in 29 of these areas is measuring attainment.
  - o There are 21 areas newly violating the PM_{10} NAAQS.
  - o There are three maintenance areas violating the PM_{10} NAAQS.
- CO
  - o All of the designated nonattainment areas have air quality monitoring data measuring attainment of the CO NAAQS.
  - o There is one area newly violating the CO NAAQS.
- SO_2
  - o All of the designated nonattainment areas have air quality monitoring data measuring attainment of the SO_2 NAAQS.
  - o There is one area newly violating both the 24-hour and 3-hour secondary SO_2 NAAQS.
- NO_2
  - o There are no designated NO_2 nonattainment areas.
  - o All areas are meeting the NO_2 NAAQS.

- Lead

- There are two areas designated as nonattainment for the lead NAAQS. Air quality monitoring is no longer conducted in one area and air quality in the second area is violating the NAAQS.
- There is one area that is designated as attainment with a monitor that is violating the lead NAAQS.

BACKGROUND INFORMATION

The Clean Act (CAA) requires EPA to set NAAQS for ‘criteria pollutants.’ Currently, lead and five other major pollutants are listed as criteria pollutants. (The others are ozone, nitrogen oxides, carbon monoxide, sulfur dioxide, and particulate matter.) The law also requires EPA to periodically review the standards to ensure that they provide adequate health and environmental protection, and to update those standards as necessary. The CAA requires two types of national air quality standards. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings. The NAAQS for criteria pollutants are shown in Table 1. It is followed by a discussion of terms or names that are applied to an area based on how air quality compares to the NAAQS.

Table 1. National Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Primary Stds.	Averaging Times	Secondary Stds.
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour[1]	None
	35 ppm (40 mg/m^3)	1-hour[1]	None
Lead	1.5 µg/m^3	Quarterly Average	Same as Primary
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)	Same as Primary
Particulate Matter (PM_{10})	Revoked[2]	Annual (Arith. Mean)	Same as Primary
	150 µg/m^3	24-hour[3]	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual[4] (Arith. Mean)	Same as Primary
	35 µg/m^3	24-hour[5]	
Ozone	0.12 ppm	1-hour[6] Applies only in limited areas	Same as Primary
	0.08 ppm	8-hour[7]	Same as Primary
Sulfur Oxides	0.03 ppm	Annual (Arith. Mean)	-------
	0.14 ppm	24-hour[1]	-------
	-------	3-hour[1]	0.5 ppm (1300 µg/m^3)

Units of measure for the standards are parts per million (ppm) by volume, milligrams per cubic meter of air (mg/m^3), and micrograms per cubic meter of air (µg/m^3).

[1] Not to be exceeded more than once per year.
[2] Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in 2006.
[3] Not to be exceeded more than once per year on average over 3 years.
[4] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.
[5] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3
[6] (a) This standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm (235 µg/m^3) is equal to or less than 1.
(b) As of June 15, 2005, the agency revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact Areas.
[7] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

AIR QUALITY DESIGNATIONS AND CLASSIFICATIONS

A designation is the term EPA uses to describe how the air quality status in a given area compares to the NAAQS for any of the six criteria pollutants. To determine the correct designation, air quality data is collected at each monitoring site and used to calculate a design value. The design value is the pollutant concentration that describes whether a site is at, above, or below the level of the NAAQS. Design values are especially helpful when the standard is exceedance-based because they are expressed as a concentration instead of an exceedance count, thereby allowing a direct comparison to the level of the standard. Information on how design values are determined for selected pollutants is included in the Appendix.

EPA designates areas as nonattainment, unclassifiable/attainment, or unclassifiable. When air quality in an area exceeds the NAAQS for one of the criteria pollutants or contributes to a nearby area that exceeds the NAAQS, EPA designates that area as nonattainment. Under certain conditions, a designated nonattainment area may consist of a full or partial county or counties within an urbanized area or a rural area. Where data show that air quality in an area meets the NAAQS, that is, the pollution concentration is at or below the level of the NAAQS, the area may be designated as unclassifiable/attainment. If an area cannot be determined on the basis of available information as meeting or not meeting the NAAQS, EPA may designate the area unclassifiable. A nonattainment or unclassifiable area may be eligible for redesignation to attainment when air quality data show that the NAAQS and other requirements for redesignation are met. In addition to a nonattainment designation, EPA classifies O_3, CO, and some PM nonattainment areas, based on the area's design value, for the purpose of applying an attainment date or to specify the requirements to which it will be subject. For example, an area's ozone classification may be marginal, moderate, serious, severe, or extreme. Subpart 1 is not a classification but is a term used in connection with certain areas to indicate the section of the CAA containing basic requirements that must be met to improve air quality. The technical details underlying classifications are contained in Title I of the CAA, Sections 172 and 181 and in the Title 40 of the Code of Federal Regulations (CFR) Part 51 Subpart X. General information on classifications is provided in the Appendix. The following discussion provides information on each of the criteria pollutants.

CRITERIA POLLUTANTS

Ozone

Ozone is a photochemical oxidant that is the prime ingredient of smog in cities and other areas of the country. While ozone in the upper atmosphere is beneficial to life by shielding the earth from harmful ultraviolet radiation from the sun, high concentrations of ozone at ground level are a major health and environmental concern. Ozone is not emitted directly into the air but is formed through complex chemical reactions between precursor emissions of volatile organic compounds (VOCs) and oxides of nitrogen (NOx) in the presence of sunlight. These reactions are stimulated by sunlight and temperature so that peak ozone levels occur typically during the warmer times of the year. Both VOCs and NOx are emitted by human activity such as transportation and industrial processes. VOCs are emitted from sources as diverse as autos, chemical manufacturing, dry cleaners, paint shops and other sources using solvents. NOx is emitted as a byproduct of most combustion processes. Changing weather patterns contribute to yearly differences in ozone concentrations from city to city. Also, ozone and the pollutants that cause ozone can be carried to an area from pollution sources located hundreds of miles upwind.

The reactivity of ozone causes health problems because it damages lung tissue, reduces lung function and sensitizes the lungs to other irritants. Ozone can irritate your respiratory system, causing coughing, irritation in your throat or a burning sensation in your airways. It can reduce lung function, so that you may have feelings of chest tightness, wheezing, or shortness of breath. Ozone can aggravate asthma and trigger asthma attacks. People at greater risk from ground-level ozone are people with lung diseases, such as asthma, and children and adults who are active outdoors. Damage to lung tissue may be caused by repeated exposures to ozone -- something like repeated sunburns of the lungs -- and this could result in a reduced quality of life as people age.

Ground-level ozone interferes with the ability of plants to produce and store food, so that growth, reproduction and overall plant health are compromised. By weakening sensitive vegetation, ozone makes plants more susceptible to disease, pests, and environmental stresses. Ground-level ozone has been shown to reduce agricultural yields for many economically important crops (e.g., soybeans, kidney beans, wheat, cotton). The effects of ground-level ozone on long-lived species such as trees are believed to add up over many years so that whole forests or ecosystems can be affected. For example, ozone can adversely impact ecological functions such as water movement, mineral nutrient cycling, and habitats for various animal and plant species. Ground-level ozone can kill or damage leaves so that they fall off the plants too soon or become spotted or brown. These effects can significantly decrease the natural beauty of an area, such as in national parks and recreation areas. One of the key components of ozone, nitrogen oxides, contributes to fish kills and algae blooms in sensitive waterways, such as the Chesapeake Bay.

8-Hour Ozone

In June 2004, EPA designated and classified 126 areas in the U.S. as nonattainment for the 8-hour ozone NAAQS based on air quality data exceeding the NAAQS collected primarily in 2001-2003. These areas included 462 whole and part counties and the District of Columbia. Approximately 159 million people were living in areas designated as not meeting the standard (2000 census). The area names and classifications are shown in Table 2. Table 3 shows the design values for 2001-2003 at designation, 2002-2004, and 2003-2005, and if the area's design value meets the 8-hour ozone NAAQS based on the most recent data collected during 2003-2005. Fourteen of these areas had the effective date of their nonattainment designation date delayed. These areas have entered into an Early Action Compact (EAC or compact) with EPA as discussed below. The remaining areas were designated as unclassifiable/attainment or unclassifiable. At designation, design values of the nonattainment areas ranged from 0.085 to 0.131 ppm. The average value was 0.092 ppm.

Table 2. Areas Designated Nonattainment in June 2004 and Classifications for the 8-Hour Ozone NAAQS

Table 2					
State	**Area**	**Classification**	**State**	**Area**	**Classification**
NY	Albany-Schenectady-Troy	Subpart 1	MI	Kalamazoo-Battle Creek	Subpart 1
MI	Allegan County	Subpart 1	MD	Kent and Queen Anne's Counties	Marginal
PA	Allentown-Bethlehem-Easton	Subpart 1	CA	Kern County (Eastern Kern)	Subpart 1
PA	Altoona	Subpart 1	WI	Kewaunee County	Subpart 1
CA	Amador and Calaveras Counties (Central Mtn)	Subpart 1	TN	Knoxville	Subpart 1
GA	Atlanta	Marginal	IN	La Porte	Marginal
MD	Baltimore	Moderate	PA	Lancaster	Marginal
LA	Baton Rouge	Marginal	MI	Lansing-East Lansing	Subpart 1
TX	Beaumont-Port Arthur	Marginal	NV	Las Vegas	Subpart 1
MI	Benton Harbor	Subpart 1	OH	Lima	Subpart 1
MI	Benzie County	Subpart 1	CA	Los Angeles South Coast Air Basin	Severe 17
WV	Berkeley and Jefferson Counties	Subpart 1	CA	Los Angeles-San Bernardino Counties (W Mojave)	Moderate
AL	Birmingham	Subpart 1	KY-IN	Louisville	Subpart 1
MA	Boston-Lawrence-Worcester (E. MA)	Moderate	GA	Macon	Subpart 1
NH	Boston-Manchester-Portsmouth (SE)	Moderate	VA	Madison and Page Counties (Shenandoah NP)	Subpart 1
NY	Buffalo-Niagara Falls	Subpart 1	WI	Manitowoc County	Subpart 1
OH	Canton-Massillon	Subpart 1	CA	Mariposa and Tuolumne Counties (Southern Mtn)	Subpart 1
MI	Cass County	Marginal	MI	Mason Co	Subpart 1
WV	Charleston	Subpart 1	TN-AR	Memphis	Marginal
NC-SC	Charlotte-Gastonia-Rock Hill	Moderate	WI	Milwaukee-Racine	Moderate
TN-GA	Chattanooga	Subpart 1	IN	Muncie	Subpart 1
IL-IN	Chicago-Gary-Lake County	Moderate	GA	Murray Co (Chattahoochee National Forest)	Subpart 1
CA	Chico	Subpart 1	MI	Muskegon	Marginal
OH-KY-IN	Cincinnati-Hamilton	Subpart 1	TN	Nashville	Subpart 1
TN-KY	Clarksville-Hopkinsville	Subpart 1	CA	Nevada County (Western Part)	Subpart 1
PA	Clearfield and Indiana Counties	Subpart 1	NY-NJ-CT	New York-N. New Jersey-Long Island	Moderate
OH	Cleveland-Akron-Lorain	Moderate	VA	Norfolk-Virginia Beach-Newport News (HR)	Marginal
SC	Columbia	Subpart 1	WV-OH	Parkersburg-Marietta	Subpart 1
OH	Columbus	Subpart 1	PA-NJ-MD-DE	Philadelphia-Wilmington-Atlantic City	Moderate
TX	Dallas-Fort Worth	Moderate	AZ	Phoenix-Mesa	Subpart 1
OH	Dayton-Springfield	Subpart 1	PA	Pittsburgh-Beaver Valley	Subpart 1
CO	Denver-Boulder-Greeley-Ft Collins-Loveland	Subpart 1	ME	Portland	Marginal
MI	Detroit-Ann Arbor	Marginal	NY	Poughkeepsie	Moderate
WI	Door County	Subpart 1	RI	Providence (All RI)	Moderate
PA	Erie	Subpart 1	NC	Raleigh-Durham-Chapel Hill	Subpart 1
NY	Essex County (Whiteface Mtn)	Subpart 1	PA	Reading	Subpart 1
IN	Evansville	Subpart 1	VA	Richmond-Petersburg	Marginal
NC-SC	Fayetteville	Subpart 1	CA	Riverside County (Coachella Valley)	Serious
MI	Flint	Subpart 1	VA	Roanoke	Subpart 1
IN	Fort Wayne	Subpart 1	NY	Rochester	Subpart 1
PA	Franklin County	Subpart 1	NC	Rocky Mount	Subpart 1
VA	Frederick County	Subpart 1	CA	Sacramento Metro	Serious
VA	Fredericksburg	Moderate	TX	San Antonio	Subpart 1
MI	Grand Rapids	Subpart 1	CA	San Diego	Subpart 1
CT	Greater Connecticut	Moderate	CA	San Francisco Bay Area	Marginal
PA	Greene County	Subpart 1	CA	San Joaquin Valley	Serious
IN	Greene County	Subpart 1	PA	Scranton-Wilkes-Barre	Subpart 1
NC-SC	Greensboro-Winston Salem-High Point	Marginal	WI	Sheboygan	Moderate

Table 2 State	Area	Classification	State	Area	Classification
SC	Greenville-Spartanburg-Anderson	Subpart 1	IN	South Bend-Elkhart	Subpart 1
ME	Hancock, Knox, Lincoln & Waldo Counties	Subpart 1	MA	Springfield (Western MA)	Moderate
PA	Harrisburg-Lebanon-Carlisle	Subpart 1	MO-IL	St Louis	Moderate
NC	Haywood and Swain Counties (Great Smoky NP)	Subpart 1	PA	State College	Subpart 1
NC	Hickory-Morganton-Lenoir	Subpart 1	OH-WV	Steubenville-Weirton	Subpart 1
TX	Houston-Galveston-Brazoria	Moderate	CA	Sutter County (Sutter Buttes)	Subpart 1
WV-KY	Huntington-Ashland	Subpart 1	IN	Terre Haute	Subpart 1
MI	Huron County	Subpart 1	PA	Tioga County	Subpart 1
CA	Imperial County	Marginal	OH	Toledo	Subpart 1
IN	Indianapolis	Subpart 1	CA	Ventura County	Moderate
IN	Jackson County	Subpart 1	DC-MD-VA	Washington	Subpart 1
NY	Jamestown	Subpart 1	MD	Washington County (Hagerstown)	Moderate
NY	Jefferson County	Moderate	WV-OH	Wheeling	Subpart 1
TN	Johnson City-Kingsport-Bristol	Subpart 1	PA	York	Subpart 1
PA	Johnstown	Subpart 1	OH-PA	Youngstown-Warren-Sharon	Subpart 1

Table 3. Trends in Design Values for the 8-Hour Ozone NAAQS 2001-2005 for Designated Nonattainment Areas

Table 3 State	Area	Design Value 2001-2003 (ppm)	2002-2004 (ppm)	2003-2005 (ppm)	Meets NAAQS 2003-2005
NY	Albany-Schenectady-Troy	0.087	0.086	0.082	Yes
MI	Allegan County	0.097	0.093	0.089	No
PA	Allentown-Bethlehem-Easton	0.091	0.088	0.087	No
PA	Altoona	0.085	0.081	0.077	Yes
CA	Amador and Calaveras Counties (Central Mtn)	0.091	0.09	0.091	No
GA	Atlanta	0.091	0.093	0.09	No
MD	Baltimore	0.103	0.094	0.091	No
LA	Baton Rouge	0.086	0.089	0.096	No
TX	Beaumont-Port Arthur	0.091	0.092	0.088	No
MI	Benton Harbor	0.091	0.086	0.084	Yes
MI	Benzie County	0.088	0.083	0.083	Yes
WV	Berkeley and Jefferson Counties (EAC area)	0.086	0.08	0.076	Yes
AL	Birmingham*	0.087	0.085	0.084	Yes
MA	Boston-Lawrence-Worcester (E. MA)	0.095	0.091	0.086	No
NH	Boston-Manchester-Portsmouth (SE)	0.087	0.084	0.08	Yes
NY	Buffalo-Niagara Falls	0.099	0.091	0.086	No
OH	Canton-Massillon	0.09	0.086	0.082	Yes
MI	Cass County	0.093	0.089	**	Incomplete Data
WV	Charleston*	0.086	0.081	0.078	Yes
NC-SC	Charlotte-Gastonia-Rock Hill	0.1	0.094	0.088	No
TN-GA	Chattanooga (EAC area)	0.088	0.086	0.08	Yes
IL-IN	Chicago-Gary-Lake County	0.101	0.094	0.086	No
CA	Chico	0.089	0.088	0.083	Yes
OH-KY-IN	Cincinnati-Hamilton	0.096	0.091	0.089	No
TN-KY	Clarksville-Hopkinsville*	0.085	0.082	0.077	Yes
PA	Clearfield and Indiana Counties	0.09	0.085	0.082	Yes
OH	Cleveland-Akron-Lorain	0.103	0.095	0.091	No
SC	Columbia (EAC area)	0.089	0.086	0.083	Yes
OH	Columbus	0.095	0.091	0.088	No
TX	Dallas-Fort Worth	0.1	0.098	0.095	No
OH	Dayton-Springfield	0.09	0.087	**	Incomplete Data
CO	Denver-Boulder-Greeley-Ft Collins-Loveland (EAC	0.087	0.084	0.084	Yes

Table 3 State	Area	Design Value 2001-2003 (ppm)	2002-2004 (ppm)	2003-2005 (ppm)	Meets NAAQS 2003-2005
	area)				
MI	Detroit-Ann Arbor	0.097	0.092	0.09	No
WI	Door County	0.094	0.088	0.09	No
PA	Erie	0.092	0.087	0.083	Yes
NY	Essex County (Whiteface Mtn)	0.091	0.083	**	Incomplete Data
IN	Evansville*	0.085	0.083	0.077	Yes
NC-SC	Fayetteville (EAC area)	0.087	0.084	0.083	Yes
MI	Flint	0.09	0.085	0.082	Yes
IN	Fort Wayne	0.088	0.085	0.083	Yes
PA	Franklin County	0.093	0.085	0.075	Yes
VA	Frederick County (EAC area)	0.085	0.078	0.073	Yes
VA	Fredericksburg*	0.088	0.084	0.079	Yes
MI	Grand Rapids	0.089	0.084	0.082	Yes
CT	Greater Connecticut	0.095	0.089	0.087	No
IN	Greene County*	0.088	0.084	0.08	Yes
PA	Greene County	0.089	0.084	0.081	Yes
NC-SC	Greensboro-Winston Salem-High Point (EAC area)	0.093	0.087	0.082	Yes
SC	Greenville-Spartanburg-Anderson (EAC area)	0.087	0.084	0.081	Yes
ME	Hancock, Knox, Lincoln & Waldo Counties	0.094	0.088	0.082	Yes
PA	Harrisburg-Lebanon-Carlisle	0.088	0.082	0.078	Yes
NC	Haywood and Swain Counties (Great Smoky NP)	0.085	0.082	0.078	Yes
NC	Hickory-Morganton-Lenoir (EAC area)	0.088	0.082	0.077	Yes
TX	Houston-Galveston-Brazoria	0.102	0.101	0.103	No
WV-KY	Huntington-Ashland	0.091	0.086	0.079	Yes
MI	Huron County	0.087	0.08	0.077	Yes
CA	Imperial County	0.087	0.085	0.084	Yes
IN	Indianapolis	0.096	0.092	0.087	No
IN	Jackson County*	0.085	0.08	0.075	Yes
NY	Jamestown	0.094	0.093	0.089	No
NY	Jefferson County	0.097	0.086	0.081	Yes
TN	Johnson City-Kingsport-Bristol (EAC area)	0.086	0.084	0.079	Yes
PA	Johnstown	0.087	0.08	0.077	Yes
MI	Kalamazoo-Battle Creek	0.086	0.081	0.078	Yes
MD	Kent and Queen Anne's Counties	0.095	0.089	0.082	Yes
CA	Kern County (Eastern Kern)	0.098	0.092	0.09	No
WI	Kewaunee County	0.093	0.087	0.086	No
TN	Knoxville	0.092	0.091	0.086	No
IN	La Porte	0.093	0.086	**	Incomplete Data
PA	Lancaster	0.092	0.087	0.083	Yes
MI	Lansing-East Lansing	0.086	0.08	0.078	Yes
NV	Las Vegas	0.086	0.085	0.085	No
OH	Lima	0.089	0.087	0.081	Yes
CA	Los Angeles South Coast Air Basin	0.131	0.127	0.127	No
CA	Los Angeles-San Bernardino Counties (W. Mojave)	0.106	0.107	0.105	No
KY-IN	Louisville	0.092	0.088	0.082	Yes
GA	Macon	0.086	0.086	0.083	Yes
VA	Madison and Page Counties (Shenandoah NP)*	0.087	0.082	**	Incomplete Data
WI	Manitowoc Co	0.09	0.083	0.087	No
CA	Mariposa and Tuolumne Counties (Southern Mtn)	0.091	0.09	0.088	No
MI	Mason Co	0.089	0.082	0.081	Yes
TN-AR	Memphis	0.092	0.087	0.086	No
WI	Milwaukee-Racine	0.101	0.094	0.088	No
IN	Muncie*	0.088	0.083	0.078	Yes
GA	Murray Co (Chattahoochee National Forest)	0.085	0.083	0.079	Yes
MI	Muskegon	0.095	0.086	0.084	Yes
TN	Nashville (EAC area)	0.086	0.083	0.082	Yes

Table 3 State	Area	Design Value 2001-2003 (ppm)	 2002-2004 (ppm)	 2003-2005 (ppm)	Meets NAAQS 2003-2005
CA	Nevada County (Western Part)	0.098	0.097	0.098	No
NY-NJ-CT	New York-N. New Jersey-Long Island	0.102	0.095	0.091	No
VA	Norfolk-Virginia Beach-Newport News (HR)	0.09	0.086	0.078	Yes
WV-OH	Parkersburg-Marietta	0.087	0.084	0.081	Yes
PA-NJ-MD-DE	Philadelphia-Wilmington-Atlantic City	0.106	0.099	0.094	No
AZ	Phoenix-Mesa	0.087	0.085	0.084	Yes
PA	Pittsburgh-Beaver Valley	0.094	0.09	0.084	Yes
ME	Portland	0.091	0.084	0.077	Yes
NY	Poughkeepsie	0.094	0.089	0.086	No
RI	Providence (All RI)	0.095	0.09	0.089	No
NC	Raleigh-Durham-Chapel Hill	0.094	0.089	0.085	No
PA	Reading	0.091	0.083	0.08	Yes
VA	Richmond-Petersburg	0.094	0.09	0.082	Yes
CA	Riverside County (Coachella Valley)	0.108	0.104	0.104	No
VA	Roanoke (EAC area)	0.085	0.079	0.074	Yes
NY	Rochester	0.088	0.081	0.073	Yes
NC	Rocky Mount	0.089	0.085	0.079	Yes
CA	Sacramento Metro	0.107	0.102	0.097	No
TX	San Antonio (EAC area)	0.089	0.091	0.086	No
CA	San Diego	0.093	0.089	0.086	No
CA	San Francisco Bay Area	0.086	0.084	0.078	Yes
CA	San Joaquin Valley	0.115	0.116	0.113	No
PA	Scranton-Wilkes-Barre	0.086	0.081	0.077	Yes
WI	Sheboygan	0.1	0.092	0.089	No
IN	South Bend-Elkhart	0.093	0.088	0.083	Yes
MA	Springfield (Western MA)	0.094	0.09	0.084	Yes
MO-IL	St Louis	0.092	0.089	0.086	No
PA	State College	0.088	0.084	0.079	Yes
OH-WV	Steubenville-Weirton	0.086	0.083	0.077	Yes
CA	Sutter County (Sutter Buttes)	0.088	0.09	0.083	Yes
IC	Terre Haute*	0.087	0.083	0.076	Yes
PA	Tioga County	0.086	0.085	0.081	Yes
OH	Toledo	0.093	0.089	0.086	No
CA	Ventura County	0.095	0.094	0.091	No
MD	Washington County (Hagerstown) (EAC area)	0.086	0.083	0.078	Yes
DC-MD-VA	Washington	0.099	0.096	0.091	No
WV-OH	Wheeling	0.087	0.078	0.076	Yes
PA	York	0.089	0.086	0.082	Yes
OH-PA	Youngstown-Warren-Sharon	0.095	0.091	0.086	No

*This area was originally designated as nonattainment for the ozone NAAQS; however, based on later air quality data, it has been redesignated to attainment.
**A determination of whether this area meets the NAAQS cannot be made due to incomplete data.
Source: AQS July 10, 2006

Table 3 demonstrates that ozone air quality is improving in designated nonattainment areas. Ozone air quality in 73 of the original 126 O_3 areas is meeting the NAAQS based on data collect during 2003-2005; thus, satisfying one of several criteria that must be met prior to redesignation to attainment. Table 3 further shows that 10 of the original areas have effective redesignations to attainment. These redesignations were based on earlier data collected during 2002-2004 or 2003-2005 showing attainment of the NAAQS and other criteria needed to assure that the area will remain in attainment. Based on the redesignations, there are now 116 areas with 157 million people living in areas designated as nonattainment for the 8-hour ozone NAAQS (2000 census).

Figure 1 displays designated ozone nonattainment areas. The map on the left shows areas designated as nonattainment for the 8-hour ozone NAAQS in 2004 based on air quality data collected during 2001-2003. The map on the right shows 48 remaining areas with air quality above the NAAQS based on data collected during 2003-2005. Included on the map are four additional areas with incomplete data for 2003-2005 (Cass County, Michigan; Dayton-Springfield, Ohio; Essex County (Whiteface Mountain), New York; and, La Porte, Indiana). Not included on the map is one area with incomplete data 2003-2005 that is redesignated to attainment based on earlier data (Madison and Page Counties (Shenandoah National Park), Virginia. These areas do not have complete data as of this writing; therefore, a determination of whether the areas are attaining or not attaining cannot be made at this time. Only one area, Mariposa and Tuolumne Counties in California with air quality monitoring data measuring attainment of the standard during the 2002-2004 time period, went back into nonattainment based on their monitoring data collected during 2003-2005. Twenty-two areas not attaining in 2002-2004 are now attaining based on 2003-2005 data. In 2005, there were no new areas monitoring air quality in violation of the ozone NAAQS.

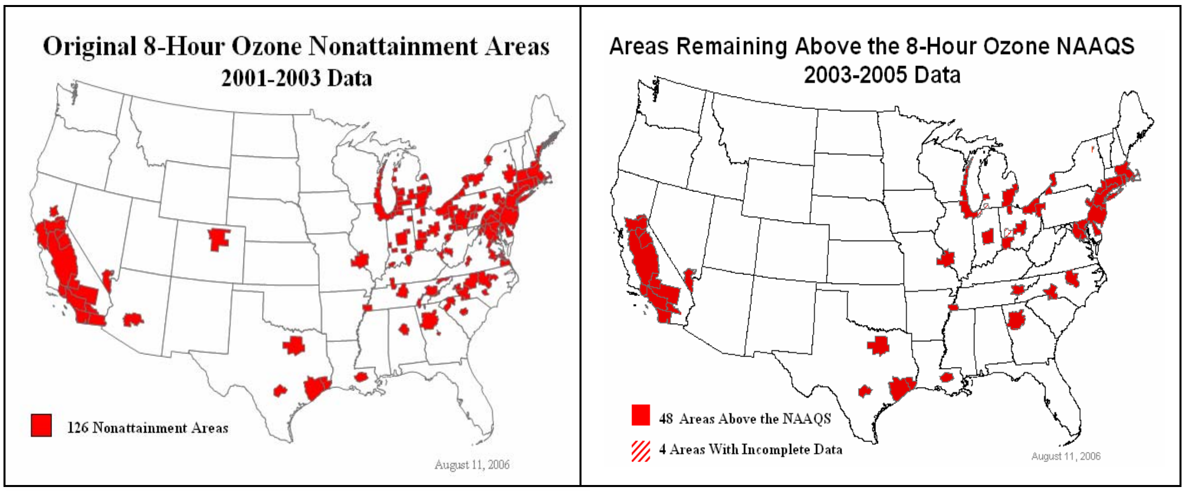

Figure 1. Ozone Nonattainment Areas with 2001-2003 Data and Areas Above the NAAQS with 2003-2005 Data

During 2002-2004, design values of the original nonattainment areas ranged from 0.078 ppm to 0.127 ppm. The average was 0.088 ppm. Air quality improved in all but four areas. In the four areas, air quality in Amador and Calaveras Counties and Nevada County, California remained the same while ozone design values in Baton Rouge, Louisiana and Houston, Texas increased from 0.086 to 0.096 ppm and 0.102 to 0.103 ppm, respectively.

During 2003-2005, design values of the original nonattainment areas ranged from 0.073 ppm to 0.127 ppm. The average was 0.084 ppm. Reflecting the lower ozone pollution, all but eight areas show lower design values than those measured during the 2002 through 2004 time period. The improvements range from about 1 percent to 12 percent. There are 44 areas with five percent or more improvement. The areas are:

- California: Chico, San Francisco Bay Area, and Sutter County (Sutter Buttes);
- District of Columbia-Maryland-Virginia: Washington;
- Illinois-Indiana: Chicago-Gary-Lake County;
- Indiana: Evansville, Indianapolis, Jackson County, Muncie, South Bend-Elkhart, and Terre Haute;
- Kentucky-Indiana; Louisville;
- Maine: Hancock, Knox, Lincoln & Waldo Counties; and Portland;
- Maryland: Kent and Queen Anne's Counties, and Washington County (Hagerstown);
- Massachusetts: Boston-Lawrence-Worcester (Eastern. MA), and Springfield (Western MA);
- Michigan: Grand Rapids;
- New York: Buffalo-Niagara Falls, Jefferson County, and Rochester;
- North Carolina: Greensboro-Winston Salem-High Point, Hickory-Morganton-Lenoir, and Rocky Mount;
- North Carolina-South Carolina: Charlotte-Gastonia-Rock Hill;
- Ohio: Lima;
- Ohio-Pennsylvania: Youngstown-Warren-Sharon;
- Ohio-West Virginia: Steubenville-Weirton;
- Pennsylvania: Franklin County, Pittsburgh-Beaver Valley, and State College;
- Pennsylvania-New Jersey-Maryland-Delaware: Philadelphia-Wilmington-Atlantic City;
- Tennessee: Johnson City-Kingsport-Bristol, and Knoxville;
- Tennessee-Georgia: Chattanooga;
- Tennessee-Kentucky: Clarksville-Hopkinsville;
- Texas: San Antonio;
- Virginia: Frederick County, Norfolk-Virginia Beach-Newport News (HR), Richmond-Petersburg, and Roanoke;
- West Virginia: Berkeley and Jefferson Counties;
- West Virginia-Kentucky: Huntington-Ashland; and,
- Wisconsin: Milwaukee-Racine.

In the same time period, air quality in six areas worsened from about 1 percent to 8 percent. The areas are:

- Louisiana: Baton Rouge, from 0.089 ppm to 0.096 ppm;
- Texas: Houston-Galveston-Brazoria, from 0.101 ppm to 0.103 ppm;
- Wisconsin: Manitowoc County, from 0.083 ppm to 0.087 ppm;
- Wisconsin: Door County, from 0.088 ppm to 0.090 ppm;
- California: Amador and Calaveras Counties (Central Mtn), from 0.090 ppm to 0.091 ppm; and,
- California: Nevada County (Western Part), from 97 ppm to 98 ppm.

Table 4 and Figure 2 show the top 20 areas with ozone air quality problems in the U.S. along with their design values for data collected in 2003-2005. Although these areas have the highest ozone design values, air quality has improved since 2001-2003 in all areas except Baton Rouge, Louisiana, and Houston-Galveston-Brazoria, Texas, where it has worsened as noted above and several areas where it has remained stable.

Table 4. 20 Areas Measuring Highest 8-Hour Ozone Design Values Above the NAAQS: 2003-2005

Table 4 State	Area	Design Value (ppm)
CA	Los Angeles South Coast Air Basin	0.127
CA	San Joaquin Valley	0.113
CA	Los Angeles-San Bernardino Counties (W Mojave)	0.105
CA	Riverside County (Coachella Valley)	0.104
TX	Houston-Galveston-Brazoria	0.103
CA	Nevada County (Western Part)	0.098
CA	Sacramento Metro	0.097
LA	Baton Rouge	0.096
TX	Dallas-Fort Worth	0.095
PA-NJ-MD-DE	Philadelphia-Wilmington-Atlantic City	0.094
CA	Amador and Calaveras Counties (Central Mtn)	0.091
MD	Baltimore	0.091
OH	Cleveland-Akron-Lorain	0.091
NY-NJ-CT	New York-N. New Jersey-Long Island	0.091
CA	Ventura County	0.091
DC-MD-VA	Washington	0.091
GA	Atlanta	0.090
MI	Detroit-Ann Arbor	0.090
WI	Door County	0.090
CA	Kern County (Eastern Kern)	0.090
Source: AQS July 10, 2006		

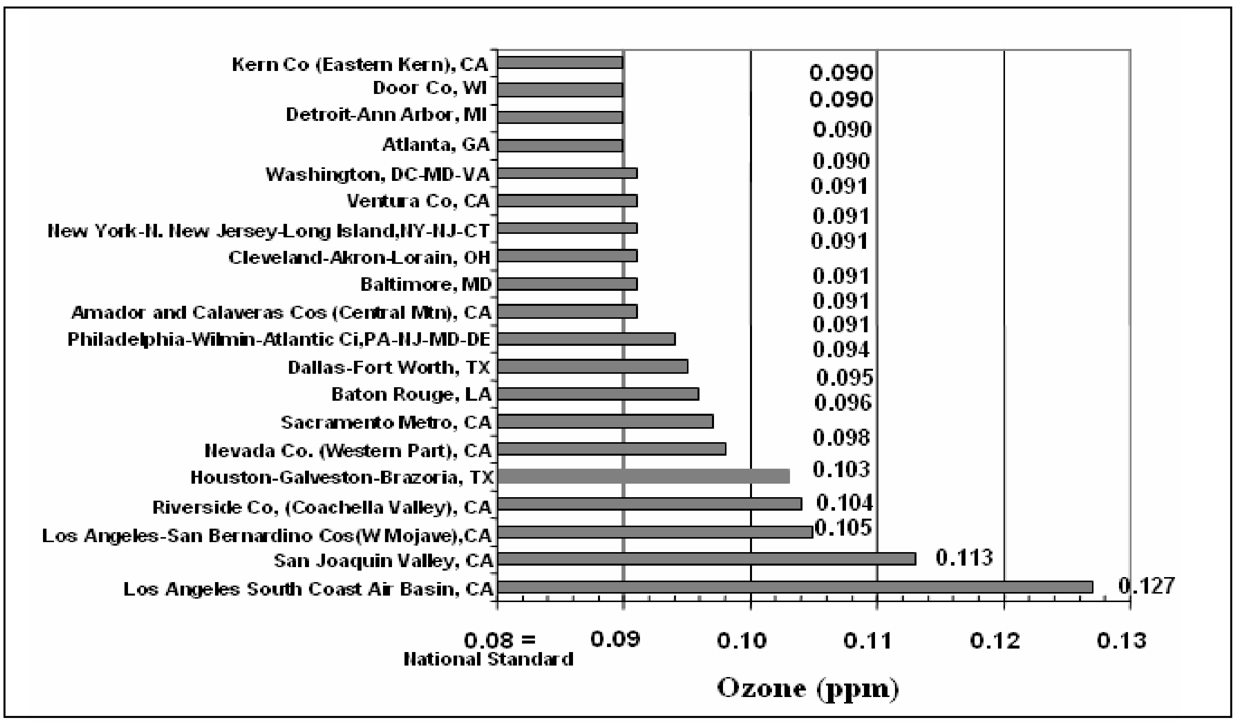

Figure 2. 20 Areas Measuring Highest 8-Hour Ozone Design Values Above the NAAQS: 2003-2005

Early Action Compacts

Several communities around the country are working with EPA to achieve clean air as soon as possible. The communities are:

- Berkeley and Jefferson Counties, West Virginia; - Chattanooga, Tennessee-Georgia; - Columbia, South Carolina; - Denver-Boulder-Greeley-Fort Collins-Loveland, Colorado; - Fayetteville, North Carolina-South Carolina; - Frederick County, Virginia; - Greensboro-Winston-Salem-Highpoint, North Carolina-South Carolina;	- Greenville-Spartanburg-Anderson, South Carolina; - Hickory-Morganton-Lenoir, North Carolina; - Johnson City-Kingsport-Bristol, Tennessee; - Nashville, Tennessee; - Roanoke, Virginia; - San Antonio, Texas; and - Washington County (Hagerstown), Maryland.

Together with EPA, these communities entered into Early Action Compacts (EACs). The goal of EACs is to reduce ground-level ozone as quickly as possible. Communities with EACs started reducing air pollution about two years sooner than required by the CAA. For example, states with communities participating in the EACs submitted plans for meeting the national 8-hour ozone standard in December 2004, rather than waiting until 2007 -- the deadline for other areas not meeting the 8-hour ozone standard. By reducing pollution ahead of schedule, these communities will bring substantial, sustainable health and environmental improvements to their residents sooner than would have been achieved without these agreements.

These areas are listed in Table 2 as nonattainment areas for the 8-hour standard. However, EPA has deferred the effective date of the nonattainment designation for as long as areas meet agreed upon milestones. This means that the impact of nonattainment designation for the 8-hour ozone standard will be deferred, i.e., certain CAA requirements, such as controls on new sources, will not apply. Air quality in all of the EAC areas is meeting the 8-hour ozone NAAQS during the 2003-2005 time period except San Antonio where the design value of 0.086 ppm is slightly above the NAAQS. The 1-hour NAAQS applies to these areas until one year after the effective date of the designation of that area for the 8-hour ozone NAAQS. All of the areas are in attainment for the 1-hour O_3 NAAQS.

Particulate Matter

Particulate matter, also known as particle pollution, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids and their neutralized precipitates such as nitrates and sulfates, organic chemicals, metals, and soil or dust particles. They are directly emitted into the air by sources such as factories, power plants, cars and trucks, construction activity, fires and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases such as SO_2, NO_x, and VOCs are also considered particulate matter.

Based on studies of human populations exposed to high concentrations of particles and laboratory studies of animals and humans, there are major effects of concern for human health. These include effects on breathing and respiratory symptoms, aggravation of existing respiratory and cardiovascular disease, alterations in the body's defense systems against foreign materials, damage to lung tissue, carcinogenesis and premature death. Even if you are healthy, you may experience temporary symptoms from exposure to elevated levels of particles. Symptoms may include irritation of the eyes, nose and throat; coughing; phlegm, chest tightness; and shortness of breath. The major subgroups of the population that appear to be most sensitive to the effects of PM include individuals with chronic obstructive pulmonary or cardiovascular disease or influenza, asthmatics, the elderly and children. Particulate matter also soils and damages materials, and is a major cause of visibility impairment in the United States.

EPA established a set of standards to PM in 1997 covering particle size up to 2.5 microns in diameter and also particle size up to 10 microns in diameter. To be in attainment, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 $\mu g/m^3$ and the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 $\mu g/m^3$. For PM_{10}, an area may not exceed the daily standard of 150 $\mu g/m^3$ more than once per year on average over 3 years and the 3-year average weighted annual arithmetic mean of 50 $\mu g/m^3$ at each monitor. On September 21, 2006, EPA completed a review of the particle pollution NAAQS. In the final rule, EPA retained the annual $PM_{2.5}$ standard and lowered the 24-hour $PM_{2.5}$ standard. The revision is effective December 18, 2006.

$PM_{2.5}$

In January 2005, EPA designated 39 areas in the U.S. as nonattainment for the $PM_{2.5}$ NAAQS based on air quality data exceeding the NAAQS collected during 2001-2003. These areas include a combination of 208 whole and part counties including the District of Columbia. This means that approximately 89,000 people are living in areas designated as not meeting the standard (2000 census). Greenville, South Carolina was designated as unclassifiable. The remaining areas were designated as unclassifiable/attainment. Table 5 shows the areas designated as nonattainment, the design value for 2001-2003 at designation, the design value for 2002-2004 and 2003-2005, and if the area's design value meets the $PM_{2.5}$ NAAQS based on the most recent data collected during 2003-2005. At designation, annual design values of the nonattainment areas ranged from 15.2 $\mu g/m^3$ to 27.8 $\mu g/m^3$.

Table 5. Current Designated Nonattainment Areas (Jan 2005) and Design Values for the $PM_{2.5}$ NAAQS

Table 5		Design Value (µg/m³)						
State	**Area**	**Annual 2001-2003**	**24-Hour 2001-2003**	**Annual 2002-2004**	**24-Hour 2002-2004**	**Annual 2003-2005**	**24-Hour 2003-2005**	**Meets NAAQS 2003-2005**
GA	Atlanta	18	39	17.5	39	17.4	38	No
MD	Baltimore	16.6	42	16.3	41	16.6	41	No
AL	Birmingham [1]	17.3	40	16.8	40	17.4	44	No
OH	Canton-Masillon	17.3	40	16.5	37	16.7	*	No
WV	Charleston	17.1	40	16.4	36	16.6	36	No
TN-GA-AL	Chattanooga	16.1	37	15.7	35	16.1	36	No
IL-IN	Chicago-Gary-Lake County	17.7	40	17.2	39	16.1	46	No
OH-KY-IN	Cincinnati-Hamilton	17.8	42	16.9	41	17.9	40	No
OH	Cleveland-Akron-Lorain	18.3	46	17.6	45	18.1	46	No
OH	Columbus	16.7	40	15.7	38	16	40	No
OH	Dayton-Springfield	15.2	39	15.5	37	15.9	40	No
MI	Detroit-Ann Arbor	19.5	44	18.6	43	18.2	45	No
IN	Evansville	16.2	40	15.5	37	15.7	37	No
NC	Greensboro-Winston Salem-High Point	15.8	35	15.4	33	15.2	32	No
PA	Harrisburg-Lebanon-Carlisle	15.7	43	15.4	41	15.8	40	No
NC	Hickory-Morganton-Lenoir	15.5	34	15.1	34	15.3	36	No
WV-KY-OH	Huntington-Ashland	17.2	41	15.8	37	16.3	35	No
IN	Indianapolis	16.7	39	16	38	16.4	38	No
PA	Johnstown	15.8	41	15.3	40	15.6	39	No
TN	Knoxville	16.4	35	15.7	34	15.6	33	No
PA	Lancaster	17	45	16.8	42	17.5	44	No
MT	Libby	16.2	45	15.2	42	15.1	*	No
PA	Liberty-Clairton	21.2	63	20.4	65	20.8	68	No
CA	Los Angeles-South Coast Air Basin	27.8	72	24.8	67	22.6	65	No
KY-IN	Louisville	16.9	42	15.9	38	16.5	37	No
GA	Macon	15.2	33	15.5	34	16.1	34	No
MD	Martinsburg, WV-Hagerstown	16.3	40	16.1	39	16.2	36	No
NY-NJ-CT	New York-N. New Jersey-Long Island	17.7	48	16.8	50	17	46	No
WV-OH	Parkersburg-Marietta	16	37	15.2	35	15.4	34	No
PA-NJ-DE	Philadelphia-Wilmington	16.2	43	15.4	39	15.7	37	No
PA	Pittsburgh-Beaver Valley	16.9	45	16.5	45	16.6	43	No
PA	Reading	16.4	46	16.1	42	16.2	39	No
GA	Rome	15.6	36	15.5	35	16.2	36	No
CA	San Joaquin Valley	21.8	76	20.6	62	19	60	No
MO-IL	St. Louis	17.5	40	16.9	40	17	40	No
OH-WV	Steubenville-Weirton	17.8	46	17	47	17.2	45	No
DC-MD-VA	Washington	15.8	44	15.1	42	14.8	37	Yes
WV-OH	Wheeling	15.7	37	15.1	36	15.3	33	No
PA	York	17	45	16.9	43	17.3	41	No

[1]Two sites in Jefferson County, AL are encompassed in a Community Monitoring Zone (i.e. utilize spatial averaging); the spatially averaged design value for the CMZ is 17.4, which is the maximum for the county.
*The 24-hour PM 2.5 design value cannot be determined due to incomplete data.

Note: Data that have been flagged for natural and exceptional events, for which documentation has been submitted and approved by the EPA (AQS concurrence field set to 'Y'), were excluded from the design value calculations.
Source: AQS July 10, 2006

Table 5 shows that $PM_{2.5}$ air quality in designated nonattainment areas is improving. The range of annual design values of the nonattainment areas during 2002-2004 dropped to 15.1 µg/m^3 to 24.8 µg/m^3 and during 2003-2005 the range dropped to 14.8 µg.m^3 to 22.6 µg/m^3. Reflecting the lower $PM_{2.5}$ pollution, all but ten areas show an air quality improvement over that monitored during 2001-2003. Most improved although still in violation of the $PM_{2.5}$ NAAQS are the Los Angeles-South Coast Air Basin and San Joaquin Valley areas in California whose design values went from 27.8 to 22.6 µg/m^3 and 21.8 to 19.0 µg/m^3, respectively. One of the areas, Washington, DC-MD-VA, is now meeting the NAAQS, thus satisfying one of several criteria that must be met prior to redesignation to attainment. Of the remaining areas, eight show a degradation in air quality over the 2001-2003 time period and two have no change. The degradation concentrations range from 0.1 to 0.9 µg/m^3 or 0.6 percent to 5.9 percent. The areas showing poorer air quality are: Birmingham, Alabama; Cincinnati-Hamilton, Ohio-Kentucky-Indiana; Dayton-Springfield, Ohio; Harrisburg-Lebanon-Carlisle, Pennsylvania; Lancaster, Pennsylvania; Macon, Georgia; Reading, Pennsylvania; and, York, Pennsylvania. No areas have been redesignated to attainment.

In the 2001-2003 time period, two areas, the Los Angeles-South Coast Air Basin and the San Joaquin Valley in California, were violating the 24-hour $PM_{2.5}$ NAAQS whereas only the Liberty-Clairton area in Pennsylvania is violating the 24-hour $PM_{2.5}$ NAAQS during 2003-2005. Most improved is the San Joaquin Valley with a 21 percent decrease in 24-hour design values from 76 µg/m^3 during 2001-2003 to 60 µg/m^3 during 2003-2005.

Figure 3 displays designated $PM_{2.5}$ nonattainment areas. The map on the left shows areas designated as nonattainment in 2005 based on air quality data collected during 2001-2003. The map on the right shows the remaining areas with air quality above the NAAQS based on data collected during 2003-2005.

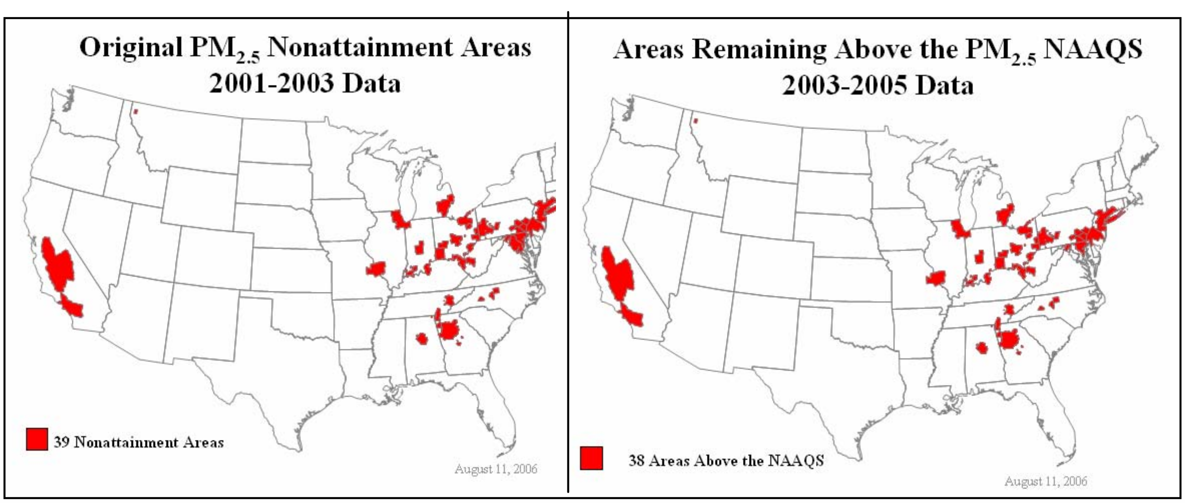

Figure 3. $PM_{2.5}$ Nonattainment Areas with 2001-2003 Data and Areas Above the NAAQS with 2003-2005 Data

Table 6 shows the top 20 areas with $PM_{2.5}$ quality problems in the U.S. along with their design values during 2003-2005. Although these areas have the highest $PM_{2.5}$ design values, since 2001-2003 air quality has improved with decreases in design values ranging from 0.3 µg/m^3 in Pittsburg-Beaver Valley, Pennsylvania, and Indianapolis, Indiana, to 5.2 µg/m^3 in the Los Angeles-South Coast Air Basin area in California. Most improved is the Los Angeles-South Coast Valley area with a 19 percent decrease in annual design values from 27.8 µg/m^3 during 2001-2003 to 22.6 µg/m^3 during 2003-2005. Lastly, there are five areas newly violating the annual $PM_{2.5}$ NAAQS. They are shown in Table 7.

Table 6. 20 Areas Measuring Highest Annual $PM_{2.5}$ Design Values Above the NAAQS: 2003-2005

Table 6	**Area**	**Design Value (µg/m^3)**
CA	Los Angeles-South Coast Air Basin	22.6
PA	Liberty-Clairton	20.8
CA	San Joaquin Valley	19.0
MI	Detroit-Ann Arbor	18.2
OH	Cleveland-Akron-Lorain	18.1
OH-KY-IN	Cincinnati-Hamilton	17.9
PA	Lancaster	17.5
GA	Atlanta	17.4
AL	Birmingham	17.4
PA	York	17.3
OH-WV	Steubenville-Weirton	17.2
NY-NJ-CT	New York-N.New Jersey-Long Island	17.0
MO-IL	St. Louis	17.0
OH	Canton-Masillon	16.7
MD	Baltimore	16.6
WV	Charleston	16.6
PA	Pittsburgh-Beaver Valley	16.6
KY-IN	Louisville	16.5
IN	Indianapolis	16.4
WV-KY-OH	Huntington-Ashland	16.3
Source: AQS July 10, 2006		

Table 7. Areas Newly Violating the $PM_{2.5}$ NAAQS: 2003-2005

Table 7		Design Value (µg/m^3)	
State	**Area**	**Annual**	**24-hr**
AL-GA	Columbus-Phenix City[1]	15.2	37
GA	Richmond County (Augusta)	15.5	33
KY	Fayette County (Lexington)	15.1	31
NC	Mecklenburg County (Charlotte)	15.3	32
OH	Mahoning County (Youngstown)	15.5	38

[1]Two sites in the Columbus-Phenix City, Al-GA metropolitan area have opted to use spatial averaging. The spatially averaged design value is 15.2 µg/m^3 which is the maximum for the area (Community Monitoring Zone.)
Note: Data that have been flagged for natural and exceptional events, for which documentation has been submitted and approved by the EPA (AQS concurrence field set to 'Y'), were excluded from the design value calculations.
Source: AQS July 10, 2006

PM_{10}

Following the amendments to the Clean Air Act in 1990, 73 areas were designated as nonattainment by law and 13 additional areas through other redesignation actions were designated as nonattainment for the PM_{10} NAAQS. The names and classifications are shown in Table 8. Since that time, air quality in 40 areas attained the PM_{10} NAAQS and the areas have an effective redesignation to attainment leaving 46 areas currently designated as nonattainment. As a result of this progress, approximately seven million additional people are now living in areas that are meeting the PM_{10} NAAQS (2000 census). Table 9 shows the areas that are currently designated as nonattainment, the design value for 2001-2003, 2002-2004, and 2003-2005, and if the area meets the NAAQS based on the most recent data collected during 2003-2005. On September 21, 2006, EPA completed a review of the particle pollution NAAQS. In the final rule, EPA retained the 24-hour PM_{10} standard but revoked the annual PM_{10} standard. Design values for the annual PM_{10} NAAQS in 2003-2005 are shown because the revocation did not become effective until December 18, 2006.

Table 8. Area Designations and Classifications for the PM_{10} NAAQS

Table 8 State	Area	Classification
AZ	Ajo	Moderate
NM	Anthony	Moderate
CO	Aspen*	Moderate
ID	Boise*	Moderate
AZ	Bullhead City*	Moderate
MT	Butte	Moderate
CO	Canon City*	Moderate
PA	Clairton & 4 Boroughs*	Moderate
IN	Clinton Township*	Moderate
CA	Coachella Valley	Serious
MT	Columbia Falls and vicinity	Moderate
CA	Coso Junction	Moderate
OH	Cuyahoga County*	Moderate
CO	Denver Metro*	Moderate
MI	Detroit*	Moderate

Table 8 State	Area	Classification
AZ	Douglas/Paul Spur	Moderate
AK	Eagle River	Moderate
IN	East Chicago (Lake County)*	Moderate
TX	El Paso	Moderate
OR	Eugene-Springfield	Moderate
WV	Follansbee*	Moderate
ID	Fort Hall	Moderate
IL	Granite City, Nameoki Township*	Moderate
OR	Grants Pass*	Moderate
PR	Guaynabo County	Moderate
AZ	Hayden/Miami	Moderate
CA	Imperial Valley	Serious
CA	Indian Wells*	Moderate
AK	Juneau	Moderate
MT	Kalispell	Moderate
WA	Kent*	Moderate
OR	Klamath Falls*	Moderate
OR	LaGrande*	Moderate
OR	Lakeview*	Moderate
CO	Lamar*	Moderate
MT	Lame Deer	Moderate
NV	Las Vegas	Serious
MT	Libby	Moderate
IL	Lyons Township*	Moderate
CA	Mammoth Lakes	Moderate
OR	Medford-Ashland*	Moderate
OH	Mingo Junction*	Moderate
MT	Missoula	Moderate
CA	Mono Basin	Moderate
CT	New Haven*	Moderate
NY	New York County	Moderate
AZ	Nogales	Moderate
OR	Oakridge	Moderate
UT	Ogden	Moderate
IL	Oglesby*	Moderate
WA	Olympia, Tumwater, Lacey*	Moderate
CA	Owens Valley	Serious
CO	Pagosa Springs*	Moderate
AZ	Payson*	Moderate
AZ	Phoenix	Serious
ID	Pinehurst	Moderate
MT	Polson	Moderate
ID	Portneuf Valley*	Moderate
ME	Presque Isle*	Moderate
NV	Reno	Moderate
AZ	Rillito	Moderate
MN	Rochester*	Moderate
MT	Ronan	Moderate
CA	Sacramento County	Moderate
MN	Saint Paul*	Moderate
UT	Salt Lake County	Moderate
CA	San Bernardino	Moderate
CA	San Joaquin Valley	Serious
ID	Sandpoint (Bonner County)	Moderate
WA	Seattle*	Moderate
WY	Sheridan	Moderate
ID	Shoshone County	Moderate

Table 8 State	Area	Classification
CA	South Coast Air Basin	Serious
IL	Southeast Chicago*	Moderate
WA	Spokane*	Moderate
CO	Steamboat Springs*	Moderate
WA	Tacoma*	Moderate
CO	Telluride*	Moderate
MT	Thompson Falls and vicinity	Moderate
CA	Trona	Moderate
UT	Utah County	Moderate
WA	Wallula*	Serious
WV	Weirton*	Moderate
MT	Whitefish and vicinity (Flathead County)	Moderate
WA	Yakima*	Moderate
AZ	Yuma	Moderate
*Since designation as a nonattainment area for the PM_{10} NAAQS, this area has been redesignated to attainment.		

Table 9. Current Designated Nonattainment Areas and Design Values for the PM_{10} NAAQS: 2001-2003 through 2003-2005

Table 9		Design Value ($\mu g/m^3$)							
		Annual 2001-2003	24-Hour 2001-2003	Annual 2002-2004	24-Hour 2002-2004	Annual 2003-2005	Number of Expected Exceedances	24-Hour 2003-2005	Meets NAAQS 2003-2005
State	Area								
AZ	Ajo	18	139	20	139	22	0	139	Yes
NM	Anthony	34	394	31	333	30	0.7	148	Yes
MT	Butte	16	66	17	60	19	0	69	Yes
CA	Coachella Valley	53	309	50	276	47	4	227	No
MT	Columbia Falls and vicinity	19	125	22	123	22	0	125	Yes
CA	Coso Junction	17	175	18	483	18	1.2	118	No
AZ	Douglas/Paul Spur	30	137	30	127	30	2.1	207	No
AK	Eagle River	23	590	20	92	18	0	90	Yes
TX	El Paso County	47	589	54	533	49	10.3	504	No
OR	Eugene-Springfield	19	65	18	63	18	0	50	Yes
ID	Fort Hall	29	214	24	214	24	0.8	134	Yes
PR	Guaynabo County	35	117	34	95	35	0	115	Yes
AZ	Hayden/Miami	34	141	33	128	31	0	128	Yes
CA	Imperial Valley	81	647	74	373	63	11.1	211	No
AK	Juneau	7	29	7	34	10	0	42	Incomplete data
MT	Kalispell	21	117	22	117	24	0	105	Yes
MT	Lame Deer	29	169	26	169	24	0.7	117	Incomplete data
NV	Las Vegas	46	274	46	358	42	3.8	274	No
MT	Libby	24	110	25	110	27	0	103	Yes
CA	Mammoth Lakes	13	134	22	129	22	0	86	Incomplete data
MT	Missoula	13	116	20	110	22	0	110	Yes
CA	Mono Basin	54	5283	78	5745	70	22.2	5283	No
NY	New York County	4	77	No data	No data	No data	No data	No data	No data
AZ	Nogales	49	213	44	188	46	10.2	280	No
OR	Oakridge	18	89	19	80	18	0	76	Yes
UT	Ogden	27	163	31	136	27	0.7	111	Yes
CA	Owens Valley	189	12160	120	7071	89	23.5	4125	No
AZ	Phoenix	63	280	61	248	62	4.6	240	No

ID	Pinehurst	2	39	19	78	20	0	85	Yes
MT	Polson	20	108	20	105	20	0	105	Yes
NV	Reno	41	113	41	126	42	0.3	153	Yes
AZ	Rillito	37	118	36	118	37	0	118	Yes
MT	Ronan	17	58	19	58	17	0	61	Yes
CA	Sacramento County	25	144	27	144	26	0	110	Yes
UT	Salt Lake County	42	421	41	169	40	2.1	421	No
CA	San Bernardino	31	172	31	198	29	1.3	162	No
CA	San Joaquin Valley	52	212	51	217	46	<u>0.3</u>	150	Yes
ID	Sandpoint (Bonner County)	12	96	17	67	17	0	71	Yes
WY	Sheridan	30	137	30	137	31	0	137	Yes
ID	Shoshone County	19	68	19	78	20	0	85	Yes
CA	South Coast Air Basin	59	166	57	159	54	1.1	149	No
MT	Thompson Falls and vicinity	16	69	16	69	13	0	48	Yes
CA	Trona	20	186	24	186	19	<u>0.5</u>	136	Yes
UT	Utah County	31	111	29	118	27	0.3	111	Yes
MT	Whitefish and vicinity (Flathead County)	17	109	26	100	25	0	104	Yes
AZ	Yuma	39	154	42	127	38	0	127	Yes

Table 9 Notes: 1. Underlined values are based on incomplete data and are generally not valid for regulatory usage. Either there are no other sites in the area with complete data for this 3-year period or a complete site or sites are located in the area but have an expected estimated exceedance value of zero and an incomplete site in the area registered the non-zero value shown.
2. Data that have been flagged for natural and exceptional events, for which documentation has been submitted and approved by the EPA (AQS concurrence field set to "Y"), were excluded from the design value calculations.
3. Some valid values are based on sites that did not meet the minimum 75 percent data capture requirements per quarter (for all 12 quarters). These values are considered valid for regulatory usage per 40 CFR Part 50 Appendix K or the *Guideline on Exceptions to Data Requirements for Determining Attainment of Particulate Matter Standards*. An incomplete, potentially violating annual standard design value is valid if by substituting one half the minimum detectable concentration values for missing values in deficient quarters, i.e., those with less than 75 percent data capture, the recalculated 3-year metric still exceeds 50. Incomplete, potentially 'meeting' values for expected numbers of exceedances and annual standard design value are valid if same-site maximum quarterly values for the 3-years period are substituted for missing data and both recalculated 3-year metrics still meet the NAAQS. See substitution requirements and computation detail in stated references.
Source: AQS October 6, 2006

In 29 of the remaining 46 nonattainment areas, air quality is now attaining the PM_{10} NAAQS based on monitoring data collected during 2003-2005. About 28 million people live in these 46 areas (2000 census). Of the 17 remaining nonattainment areas, four areas have incomplete or no data on which to make a determination of attainment or nonattainment. Also, three maintenance areas have air quality data during 2003-2005 that does not meet the PM_{10} NAAQS. Maintenance areas are previously designated nonattainment areas that have been redesignated to attainment with a plan to maintain clean air quality. The areas are Detroit, Michigan; East Chicago (Lake County), Indiana; and, Indian Wells Valley, California. A total of 16 of the 86 areas previously designated as nonattainment for the PM_{10} NAAQS failed to meet the standards based on 2003-2005 air quality data. Lastly, there are 21areas (counties) newly violating the PM_{10} standard. These areas are listed in Table 10.

Table 10. Areas Newly Violating the PM_{10} NAAQS: 2003-2005

Table 10 State	County	Design Value ($\mu g/m^3$)[1] Annual 2003-2005	Expected Number of Exceedances	Design Value ($\mu g/m^3$)[1] 24-Hour 2003-2005
WY	Campbell	30	1.1	159
WY	Carbon	24	7.4	167
NM	Dona Ana[2]	42	6.1	205
SC	Georgetown	26	1.2	157
MT	Glacier	18	2.0	195
MO	Jasper	32	1.1	152
AL	Jefferson	53	3.1	179
MN	Kandiyohi	37	6.1	209
WY	Lincoln	23	4.4	221
AZ	Maricopa[2]	54	3.2	158
CO	Mesa	31	4.0	198
WY	Natrona	19	2.1	194
NV	Nye	37	4.9	252
AZ	Pinal[2]	44	8.1	289
CA	San Diego	30	3.1	155
NM	Sandoval	27	2.9	165
OH	Scioto	20	2.8	210
MO	St. Louis (city)	50	7.7	191
WY	Sweetwater	24	2.9	306
TN	Union	39	1.1	148
CA	Yolo	26	2.0	169

Underlined annual design values are based on incomplete data. The corresponding expected number of exceedances are valid per data substitution protocol. See endnote for Table 9.

[1]Data that have been flagged for natural and exceptional events, for which documentation has been submitted and approved by the EPA (AQS concurrence field set to “Y”), were excluded from the design value calculations.

[2]These counties are near or, in some cases, overlap or totally contain previously designated PM_{10} nonattainment areas. However, the monitoring sites from which these design values are derived are located outside the boundaries of the nonattainment area. Therefore, these counties are listed here as new areas.

Source: AQS October 6, 2006

Carbon Monoxide

CO is a colorless, odorless and poisonous gas produced by incomplete burning of carbon in fuels. When CO enters the bloodstream, it reduces the delivery of oxygen to the body's organs and tissues. Health threats are most serious for those who suffer from cardiovascular disease, particularly those with angina or peripheral vascular disease. Exposure to elevated CO levels can cause impairment of visual perception, manual dexterity, learning ability and performance of complex tasks.

Seventy-seven percent of the nationwide CO emissions are from transportation sources. The largest emissions contribution comes from highway motor vehicles. Thus, the focus of CO monitoring has been on traffic oriented sites in urban areas where the main source of CO is motor vehicle exhaust. Other major CO sources are wood-burning stoves, incinerators and industrial sources.

There are six areas designated as nonattainment for the 8-hour CO NAAQS consisting of all or parts of 10 counties. About 15 million people live in these areas (2000 census). All designated nonattainment areas meet the CO NAAQS based on 2004-2005 data. Table 11 shows the areas designated as nonattainment, the design value for

2002-2003, 2003-2004, and 2004-2005. There is one area newly violating the 8-hour CO standard. The area and design values are shown in Table 12. All areas met the 1-hour NAAQS based on 2004-2005 data.

Table 11. Current Designated Nonattainment Areas and Design Values for the 8-Hour CO NAAQS: 2002-2003 through 2004-2005

Table 11			8-Hour (ppm)			
State	Area	Classification	2002-2003	2003-2004	2004-2005	Meets NAAQS 2004-2005
TX	El Paso	Moderate	6.8	6.4	6.4	Yes
NV	Las Vegas	Serious	5.8	5.3	5.2	Yes
CA	Los Angeles South Coast Air Basin	Serious	8.5	7.2	6.1	Yes
MT	Missoula	Moderate	3.6	3.6	3.6	Yes
NV	Reno	Moderate	4.4	3.9	3.9	Yes
OR	Salem	Not Classified	5.2	4.9	3.8	Yes
Source: AQS October 28, 2006						

Table 12. Area Newly Violating the CO NAAQS: 2004-2005

Table 12		8-Hour (ppm)			
State	Area	2002-2003	2003-2004	2004-2005	Meets NAAQS 2004-2005
WV	Hancock County	12.1	12.0	12.0	No
Source: AQS October 28, 2006					

Sulfur Dioxide

High concentrations of SO_2 affect breathing and may aggravate existing respiratory and cardiovascular disease. Sensitive populations include asthmatics, individuals with bronchitis or emphysema, children and the elderly. SO_2 is also a primary contributor to acid deposition, or acid rain, which causes acidification of lakes and streams and can damage trees, crops, historic buildings and statues. In addition, sulfur compounds in the air contribute to visibility impairment in large parts of the country. This is especially noticeable in national parks. SO_2 also contributes to the formation of $PM_{2.5.}$

Ambient SO_2 results largely from stationary sources such as coal and oil combustion, steel mills, refineries, pulp and paper mills and from nonferrous smelters.

There are 11 areas designated as nonattainment for the SO_2 NAAQS consisting of all or parts of ten counties. The areas are

Pennsylvania: Armstrong County;
Montana: East Helena and Laurel Areas;
Arizona: Hayden, Miami, and San Manual;
Guam: Piti and Tanguisson;
Utah: Salt Lake and Tooele Counties; and,

New Jersey: Warren County.

About 1 million people are living in these areas (2000 census). All of the areas meet the SO_2 NAAQS based on air monitoring data collected during 2004-2005. However, there is one newly violating area, Volcanoes National Park in Hawaii, with air quality monitoring data that is not meeting both the 3-hour standard and the 24-hour standard in 2004-2005. The area's design value is 0.19 ppm and 0.6 ppm for the 24-hour and 3-hour NAAQS, respectively.

Nitrogen Dioxide

NO_2 is a brownish, highly reactive gas that is present in all urban atmospheres. Nitrogen dioxide can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections. Nitrogen oxides are an important precursor both to O_3 and acid rain, and may affect both terrestrial and aquatic ecosystems. The major mechanism for the formation of NO_2 in the atmosphere is the oxidation of the primary air pollutant nitric oxide (NO). NOx plays a major role, together with VOCs, in the atmospheric reactions that produce O_3. NOx forms when fuel is burned at high temperatures. The two major emissions sources are transportation and stationary fuel combustion sources such as electric utility and industrial boilers. There are no designated nonattainment areas for NO_2. There are no newly violating areas based on 2004-2005 data.

Lead

Exposure to lead can occur through multiple pathways, including inhalation of air and ingestion of lead in food, water, soil or dust. Excessive lead exposure can cause seizures, mental retardation and/or behavioral disorders. A recent National Health and Nutrition Examination Survey reported a 78 percent decrease in blood lead levels from 12.8 to 2.8 µg/dL between 1976 and 1980 and from 1988 to 1991. This dramatic decline can be attributed to the reduction of leaded gasoline and to the removal of lead from soldered cans. Although this study shows great progress, infants and young children are especially susceptible to low doses of lead, and this age group still shows the highest levels. Low doses of lead can lead to central nervous system damage. Recent studies have also shown that lead may be a factor in high blood pressure and in subsequent heart disease in middle-aged males.

Lead gasoline additives, non-ferrous smelters, and battery plants are the most significant contributors to atmospheric lead emissions. In 1993 transportation sources contributed 33 percent of the annual emissions, down substantially from 81 percent in 1985. Total lead emissions from all sources dropped from 20,100 tons in 1985 to 4,900 tons in 1993. The decrease in lead emissions from highway vehicles accounts for essentially all of this decline. The reasons for the decrease are noted below.

Two air pollution control programs implemented by EPA before promulgation of the lead standard in October 1978 have resulted in lower ambient lead levels. First, regulations issued in the early 1970's required gradual reduction of the lead content of all gasoline over a period of many years. The lead content of the leaded gasoline pool was reduced from an average of 12.0 gram/gallon, to 0.5 gram/gallon on July 1, 1985, and still further to 0.1 gram/gallon on January 1, 1986. Second, as part of the EPA's overall automotive emission control program, unleaded gasoline was introduced in 1975 for automobiles equipped with catalytic control devices. These devices reduce emissions of CO, VOCs and NOx. In 1993, unleaded gasoline sales accounted for 99 percent of the total gasoline market. In contrast, the unleaded share of the gasoline market in 1984 was approximately 60 percent. These programs have essentially eliminated violations of the lead standard in urban areas except those areas with lead point sources.

Programs are also in place to control lead emissions from stationary point sources. Lead emissions from stationary sources have been substantially reduced by control programs oriented toward attainment of the PM_{10} and lead ambient standards. However, significant and ambient problems still remain around some lead point sources, which are now the focus of new monitoring initiatives. Lead emissions in 1993 from industrial sources, e.g., primary and secondary lead smelters, dropped by about 91 percent from levels reported in 1970. Emissions of lead from solid waste disposal are down about 76 percent since 1970. In 1993, emissions from solid waste disposal, industrial processes and transportation were: 500, 2,300 and 1,600 short tons, respectively. The overall effect of the control programs for these three categories has been a major reduction in the amount of lead in the ambient air.

There are two areas currently designated as nonattainment for the lead NAAQS. They are East Helena Area portion of Lewis and Clark Counties, Montana; and the area within the city limits of Herculaneum in Jefferson County, Missouri. That means that about 4600 people are living in areas designated as nonattainment for the standard (2000 census). Air quality monitoring in the East Helena Nonattainment Area has been discontinued and the lead source has closed. Air quality in Herculaneum is violating the NAAQS as shown in Table 13. There is one area, Delaware County, Indiana, with newly violating air quality monitoring data for the lead NAAQS. Table 13 shows lead design values for these areas for 2003-2004 and 2004-2005 and if the areas’ design values meet the NAAQS based on the most recent data collected during 2004-2005.

Table 13. Areas Currently Designated Nonattainment for the Lead NAAQS or Designated Attainment But Not Meeting the Lead NAAQS: 2003-2004 through 2004-2005

Table 13		Design Value ($\mu g/m^3$)		
State	Area	2003-2004	2004-2005	Meets NAAQS 2004-2005
MT	E. Helena	Source closed, site remediated, monitoring discontinued		
MO	Herculaneum	1.49	1.93	No
IN	Delaware County	4.09	4.09	No

Source: AQS November 2, 2006

Additional air quality information for all ozone and particulate matter monitors can be found at http://www.epa.gov/air/airtrends/. Sstatistics and capability for the user to create maps, graphs, and data tables is located at http://www.epa.gov/airexplorer/.

Daily and forecast air quality information is available at http://airnow.gov/.

EPA's tracking system for all criteria pollutant designated nonattainment and maintenance areas is located at http://www.epa.gov/oar/oaqps/greenbk/index.html.

List of Appendices

Appendix A

Additional Information on Area Classifications for the 8-Hour Ozone Standard

40 CFR Part 51.902

Sec. 51.902 Which classification and nonattainment area planning provisions of the CAA shall apply to areas designated nonattainment for the 8-hour NAAQS?

(a) Classification under subpart 2. An area designated nonattainment for the 8-hour NAAQS with a *1-hour ozone design value equal to or greater than 0.121 ppm* at the time the Administrator signs a final rule designating or redesignating the area as nonattainment for the 8-hour NAAQS will be classified in accordance with section 181 of the CAA, as interpreted in §51.903(a), for purposes of the 8-hour NAAQS, and will be subject to the requirements of subpart 2 that apply for that classification.

(b) Covered under subpart 1. An area designated nonattainment for the 8-hour ozone NAAQS with a *1-hour design value less than 0.121 ppm* at the time the Administrator signs a final rule designating or redesignating the area as nonattainment for the 8-hour NAAQS will be covered under section 172(a)(1) of the CAA and will be subject to the requirements of subpart 1.

Sec. 51.903 How do the classification and attainment date provisions in section 181 of subpart 2 of the CAA apply to areas subject to section 51.902(a)?

(a) In accordance with section 181(a)(1) of the CAA, each area subject to §51.902(a) shall be classified by operation of law at the time of designation. However, the classification shall be based on the 8-hour design value for the area, in accordance with Table 1 below, or such higher or lower classification as the State may request as provided in paragraphs (b) and (c) of this section. The 8-hour design value for the area shall be calculated using the three most recent years of air quality data. For each area classified under this section, the primary NAAQS attainment date for the 8-hour NAAQS shall be as expeditious as practicable but not later than the date provided in the following Table.

CLASSIFICATION FOR 8-HOUR OZONE NAAQS FOR AREAS SUBJECT TO SECTION 51.902(a)			
Area class		8-hour design value (ppm ozone)	Maximum Period for Attainment Dates in State Plans (years after effective date of nonattainment designation for 8-hour NAAQS)
Marginal	from	0.085	3
	up to*	0.092	
Moderate	from	0.092	6
	up to*	0.107	
Serious	from	0.107	9
	up to*	0.120	
Severe-15	from	0.120	15
	up to*	0.127	
Severe-17	from	0.127	17
	up to*	0.187	
Extreme	equal to or above	0.187	20
* but not including			

(b) A State may request a higher classification for any reason in accordance with section 181(b)(3) of the CAA.

(c) A State may request a lower classification in accordance with section 181(a)(4) of the CAA.

Appendix B

Interpretation of the 8-Hour Primary and Secondary National Ambient Air Quality Standards for O_3

40 CFR Part 50 Appendix I

1. General.

This appendix explains the data handling conventions and computations necessary for determining whether the national 8-hour primary and secondary ambient air quality standards for ozone specified in Sec. 50.10 are met at an ambient ozone air quality monitoring site. Ozone is measured in the ambient air by a reference method based on appendix D of this part. Data reporting, data handling, and computation procedures to be used in making comparisons between reported ozone concentrations and the level of the ozone standard are specified in the following sections. Whether to exclude, retain, or make adjustments to the data affected by stratospheric ozone intrusion or other natural events is subject to the approval of the appropriate Regional Administrator.

2. Primary and Secondary Ambient Air Quality Standards for Ozone.

2.1 Data Reporting and Handling Conventions.

2.1.1 Computing 8-hour averages. Hourly average concentrations shall be reported in parts per million (ppm) to the third decimal place, with additional digits to the right being truncated. Running 8-hour averages shall be computed from the hourly ozone concentration data for each hour of the year and the result shall be stored in the first, or start, hour of the 8-hour period. An 8-hour average shall be considered valid if at least 75 percent of the hourly averages for the 8-hour period are available. In the event that only 6 (or 7) hourly averages are available, the 8-hour average shall be computed on the basis of the hours available using 6 (or 7) as the divisor. (8-hour periods with three or more missing hours shall not be ignored if, after substituting one-half the minimum detectable limit for the missing hourly concentrations, the 8-hour average concentration is greater than the level of the standard.) The computed 8-hour average ozone concentrations shall be reported to three decimal places (the insignificant digits to the right of the third decimal place are truncated, consistent with the data handling procedures for the reported data.)

2.1.2 Daily maximum 8-hour average concentrations. (a) There are 24 possible running 8-hour average ozone concentrations for each calendar day during the ozone monitoring season. (Ozone monitoring seasons vary by geographic location as designated in part 58, appendix D to this chapter.) The daily maximum 8-hour concentration for a given calendar day is the highest of the 24 possible 8-hour average concentrations computed for that day. This process is repeated, yielding a daily maximum 8-hour average ozone concentration for each calendar day with ambient ozone monitoring data. Because the 8-hour averages are recorded in the start hour, the daily maximum 8-hour concentrations from two consecutive days may have some hourly concentrations in common. Generally, overlapping daily maximum 8-hour averages are not likely, except in those non-urban monitoring locations with less pronounced diurnal variation in hourly concentrations.

(b) An ozone monitoring day shall be counted as a valid day if valid 8-hour averages are available for at least 75percent of possible hours in the day (i.e., at least 18 of the 24 averages). In the event that less than 75 percent of the 8-hour averages are available, a day shall also be counted as a valid day if the daily maximum 8-hour average concentration for that day is greater than the level of the ambient standard.

2.2 Primary and Secondary Standard-related Summary Statistic. The standard-related summary statistic is the annual fourth-highest daily maximum 8-hour ozone concentration, expressed in parts per million, averaged over three years. The 3-year average shall be computed using the three most recent, consecutive calendar years of monitoring data meeting the data completeness requirements described in this appendix. The computed 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentrations shall be expressed to three decimal places (the remaining digits to the right are truncated.)

2.3 Comparisons with the Primary and Secondary Ozone Standards. (a) The primary and secondary ozone ambient air quality standards are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.08 ppm. The number of significant Figures in the level of the standard dictates the rounding convention for comparing the computed 3-year average annual fourth-highest daily maximum 8-hour average ozone concentration with the level of the standard. The third decimal place of the computed value is rounded, with values equal to or greater than 5 rounding up. Thus, a computed 3-year average ozone concentration of 0.085 ppm is the smallest value that is greater than 0.08 ppm.

(b) This comparison shall be based on three consecutive, complete calendar years of air quality monitoring data. This requirement is met for the three year period at a monitoring site if daily maximum 8-hour average concentrations are available for at least 90 percent, on average, of the days during the designated ozone monitoring season, with a minimum data completeness in any one year of at least 75 percent of the designated sampling days. When computing whether the minimum data completeness requirements have been met, meteorological or ambient data may be sufficient to demonstrate that meteorological conditions on missing days were not conducive to concentrations above the level of the standard. Missing days assumed less than the level of the standard are counted for the purpose of meeting the data completeness requirement, subject to the approval of the appropriate Regional Administrator.

(c) Years with concentrations greater than the level of the standard shall not be ignored on the ground that they have less than complete data. Thus, in computing the 3-year average fourth maximum concentration, calendar years with less than 75 percent data completeness shall be included in the computation if the average annual fourth maximum 8-hour concentration is greater than the level of the standard.

(d) Comparisons with the primary and secondary ozone standards are demonstrated by examples 1 and 2 in paragraphs (d)(1) and (d) (2) respectively as follows:

(1) As shown in example 1, the primary and secondary standards are met at this monitoring site because the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentrations (i.e., 0.084 ppm) is less than or equal to 0.08 ppm. The data completeness requirement is also met because the average percent of days with valid ambient monitoring data is greater than 90 percent, and no single year has less than 75 percent data completeness.

Example 1. Ambient monitoring site attaining the primary and secondary ozone standards

Year	Percent Valid Days	1st Highest Daily Max 8-hour Conc. (ppm)	2nd Highest Daily Max 8-hour Conc. (ppm)	3rd Highest Daily Max 8-hour Conc. (ppm)	4th Highest Daily Max 8-hour Conc. (ppm)	5th Highest Daily Max 8-hour Conc. (ppm)
1993	100%	0.092	0.091	0.090	0.088	0.085
1994	96%	0.090	0.089	0.086	0.084	0.080
1995	98%	0.087	0.085	0.083	0.080	0.075
Average	98 %					

(2) As shown in example 2, the primary and secondary standards are not met at this monitoring site because the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations (i.e., 0.093 ppm) is greater than 0.08 ppm. Note that the ozone concentration data for 1994 is used in these computations, even though the data capture is less than 75 percent, because the average fourth-highest daily maximum 8-hour average concentration is greater than 0.08 ppm.

Example 2. Ambient monitoring site failing to meet the primary and secondary ozone standards

Year	Percent Valid Days	1st Highest Daily Max 8-hour Conc. (ppm)	2nd Highest Daily Max 8-hour Conc. (ppm)	3rd Highest Daily Max 8-hour Conc. (ppm)	4th Highest Daily Max 8-hour Conc. (ppm)	5th Highest Daily Max 8-hour Conc. (ppm)

1993	96%	0.105	0.103	0.103	0.102	0.102
1994	74%	0.090	0.085	0.082	0.080	0.078
1995	98%	0.103	0.101	0.101	0.097	0.095
Average	89 %					

3. Design Values for Primary and Secondary Ambient Air Quality Standards for Ozone. The air quality design value at a monitoring site is defined as that concentration that when reduced to the level of the standard ensures that the site meets the standard. For a concentration-based standard, the air quality design value is simply the standard-related test statistic. Thus, for the primary and secondary ozone standards, the 3-year average annual fourth-highest daily maximum 8-hour average ozone concentration is also the air quality design value for the site.

[62 FR 38895, July 18, 1997]

Appendix C

Interpretation of the National Ambient Air Quality Standards for $PM_{2.5}$

40 CFR Part 50 Appendix N

1. General.

(a) This appendix explains the data handling conventions and computations necessary for determining when the annual and 24-hour primary and secondary national ambient air quality standards (NAAQS) for $PM_{2.5}$ specified in §50.7 and §50.13 of this part are met. $PM_{2.5}$, defined as particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers, is measured in the ambient air by a Federal reference method (FRM) based on appendix L of this part, as applicable, and designated in accordance with part 53 of this chapter, or by a Federal equivalent method (FEM) designated in accordance with part 53 of this chapter, or by an Approved Regional Method (ARM) designated in accordance with part 58 of this chapter. Data handling and computation procedures to be used in making comparisons between reported $PM_{2.5}$ concentrations and the levels of the $PM_{2.5}$ NAAQS are specified in the following sections.

(b) Data resulting from exceptional events, for example structural fires or high winds, may be given special consideration. In some cases, it may be appropriate to exclude these data in whole or part because they could result in inappropriate values to compare with the levels of the $PM_{2.5}$ NAAQS. In other cases, it may be more appropriate to retain the data for comparison with the levels of the $PM_{2.5}$ NAAQS and then for EPA to formulate the appropriate regulatory response.

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

Annual mean refers to a weighted arithmetic mean, based on quarterly means, as defined in section 4.4 of this appendix.

Creditable samples are samples that are given credit for data completeness. They include valid samples collected on required sampling days and valid “make-up” samples taken for missed or invalidated samples on required sampling days.

Daily values for $PM_{2.5}$ refers to the 24-hour average concentrations of $PM_{2.5}$ calculated (averaged from hourly measurements) or measured from midnight to midnight (local standard time) that are used in NAAQS computations.

Designated monitors are those monitoring sites designated in a State or local agency PM Monitoring Network Description in accordance with part 58 of this chapter.

Design values are the metrics (i.e., statistics) that are compared to the NAAQS levels to determine compliance, calculated as shown in section 4 of this appendix:

(1) The 3-year average of annual means for a single monitoring site or a group of monitoring sites (referred to as the "annual standard design value"). If spatial averaging has been approved by EPA for a group of sites which meet the criteria specified in section 2(b) of this appendix and section 4.7.5 of appendix D of 40 CFR part 58, then 3 years of spatially averaged annual means will be averaged to derive the annual standard design value for that group of sites (further referred to as the "spatially averaged annual standard design value"). Otherwise, the annual standard design value will represent the 3-year average of annual means for a single site (further referred to as the "single site annual standard design value").

(2) The 3-year average of annual 98th percentile 24-hour average values recorded at each monitoring site (referred to as the "24-hour standard design value").

Extra samples are non-creditable samples. They are daily values that do not occur on scheduled sampling days and that can not be used as make-ups for missed or invalidated scheduled samples. Extra samples are used in mean calculations and are subject to selection as a 98th percentile.

Make-up samples are samples taken to supplant missed or invalidated required scheduled samples. Make-ups can be made by either the primary or the collocated instruments. Make-up samples are either taken before the next required sampling day or exactly one week after the missed (or voided) sampling day. Also, to be considered a valid make-up, the sampling must be administered according to EPA guidance.

98th percentile is the daily value out of a year of $PM_{2.5}$ monitoring data below which 98 percent of all daily values fall.

Year refers to a calendar year.

2.0 Monitoring Considerations.

(a) Section 58.30 of this chapter specifies which monitoring locations are eligible for making comparisons with the $PM_{2.5}$ standards.

(b) To qualify for spatial averaging, monitoring sites must meet the criterion specified in section 4.7.5 of appendix D of 40 CFR part 58 as well as the following requirements:

(1) The annual mean concentration at each site shall be within 10 percent of the spatially averaged annual mean.

(2) The daily values for each site pair among the 3-year period shall yield a correlation coefficient of at least 0.9 for each calendar quarter.

(3) All of the monitoring sites should principally be affected by the same major emission sources of $PM_{2.5}$. For example, this could be demonstrated by site-specific chemical speciation profiles confirming all major component concentration averages to be within 10 percent for each calendar quarter.

(4) The requirements in paragraphs (b)(1) through (3) of this section shall be met for 3 consecutive years in order to produce a valid spatially averaged annual standard design value. Otherwise, the individual (single) site annual standard design values shall be compared directly to the level of the annual NAAQS.

(c) Section 58.12 of this chapter specifies the required minimum frequency of sampling for $PM_{2.5}$. Exceptions to the specified sampling frequencies, such as a reduced frequency during a season of expected low concentrations (i.e., "seasonal sampling"), are subject to the approval of EPA. Annual 98th percentile values are to be calculated according to equation 6 in section 4.5 of this appendix when a site operates on a "seasonal sampling" schedule.

3.0 Requirements for Data Used for Comparisons with the $PM_{2.5}$ NAAQS and Data Reporting Considerations.

(a) Except as otherwise provided in this appendix, only valid FRM/FEM/ARM $PM_{2.5}$ data required to be submitted to EPA's Air Quality System (AQS) shall be used in the design value calculations.

(b) $PM_{2.5}$ measurement data (typically hourly for continuous instruments and daily for filter-based instruments) shall be reported to AQS in micrograms per cubic meter ($\mu g/m^3$) to one decimal place, with additional digits to the right being truncated.

(c) Block 24-hour averages shall be computed from available hourly $PM_{2.5}$ concentration data for each corresponding day of the year and the result shall be stored in the first, or start, hour (i.e., midnight, hour '0') of the 24-hour period. A 24-hour average shall be considered valid if at least 75 percent (i.e., 18) of the hourly averages for the 24-hour period are available. In the event that less than all 24 hourly averages are available (i.e., less than 24, but at least 18), the 24-hour average shall be computed on the basis of the hours available using the number of available hours as the divisor (e.g., 19). 24-hour periods with seven or more missing hours shall be considered valid if, after substituting zero for all missing hourly concentrations, the 24-hour average concentration is greater than the level of the standard. The computed 24-hour average $PM_{2.5}$ concentrations shall be reported to one decimal place (the additional digits to the right of the first decimal place are truncated, consistent with the data handling procedures for the reported data).

(d) Except for calculation of spatially averaged annual means and spatially averaged annual standard design values, all other calculations shown in this appendix shall be implemented on a site-level basis. Site level data shall be processed as follows:

(1) The default dataset for a site shall consist of the measured concentrations recorded from the designated primary FRM/FEM/ARM monitor. The primary monitor shall be designated in the appropriate State or local agency PM Monitoring Network Description. All daily values produced by the primary sampler are considered part of the site record (i.e., that site's daily value); this includes all creditable samples and all extra samples.

(2) Data for the primary monitor shall be augmented as much as possible with data from collocated FRM/FEM/ARM monitors. If a valid 24-hour measurement is not produced from the primary monitor for a particular day (scheduled or otherwise), but a valid sample is generated by a collocated FRM/FEM/ARM instrument (and recorded in AQS), then that collocated value shall be considered part of the site data record (i.e., that site's daily value). If more than one valid collocated FRM/FEM/ARM value is available, the average of those valid collocated values shall be used as the daily value.

(e) All daily values in the composite site record are used in annual mean and 98th percentile calculations, however, not all daily values are give credit towards data completeness requirements. Only "creditable" samples are given credit for data completeness. Creditable samples include valid samples on scheduled sampling days and valid make-up samples. All other types of daily values are referred to as "extra" samples.

4.0 <u>Comparisons with the $PM_{2.5}$ NAAQS</u>.

4.1 <u>Annual $PM_{2.5}$ NAAQS</u>.

(a) The annual $PM_{2.5}$ NAAQS is met when the annual standard design value is less than or equal to 15.0 micrograms per cubic meter ($\mu g/m^3$).

(b) For single site comparisons, 3 years of valid annual means are required to produce a valid annual standard design value. In the case of spatial averaging, 3 years of valid spatially averaged annual means are required to produce a valid annual standard design value. Designated sites with less than 3 years of data shall be included in annual spatial averages for those years that data completeness requirements are met. A year meets data completeness requirements when at least 75 percent of the scheduled sampling days for each quarter have valid data. [Quarterly data capture rates (expressed as a percentage) are specifically calculated as the number of creditable samples for the quarter divided by the number of scheduled samples for the quarter, the result then multiplied by 100 and rounded to the nearest integer.] However, years with at least 11 samples in each quarter shall be considered valid, notwithstanding quarters with less than complete data, if the resulting annual mean, spatially averaged annual mean concentration, or resulting annual standard design value concentration (rounded according to the conventions of section 4.3 of this appendix) is greater than the level of the standard. Furthermore, where the explicit 11 sample per quarter requirement is not met, the site annual mean shall still be considered valid if, by substituting a low value (described below) for the missing data in the deficient quarters (substituting enough to meet the 11 sample minimum), the computation still yields a recalculated annual mean, spatially averaged annual mean concentration, or annual standard design value concentration over the level of the standard. The low value used for this substitution test shall be the lowest reported daily value in the site data record for that calendar quarter over the most recent 3-year period. If an annual mean is deemed complete using this test, the original annual mean (without substituted low values) shall be considered the official mean value for this site, not the result of the recalculated test using the low values.

(c) The use of less than complete data is subject to the approval of EPA, which may consider factors such as monitoring site closures/moves, monitoring diligence, and nearby concentrations in determining whether to use such data.

(d) The equations for calculating the annual standard design values are given in section 4.4 of this appendix.

4.2 24-Hour $PM_{2.5}$ NAAQS.

(a) The 24-hour $PM_{2.5}$ NAAQS is met when the 24-hour standard design value at each monitoring site is less than or equal to 35 $\mu g/m^3$. This comparison shall be based on 3 consecutive, complete years of air quality data. A year meets data completeness requirements when at least 75 percent of the scheduled sampling days for each quarter have valid data. However, years shall be considered valid, notwithstanding quarters with less than complete data (even quarters with less than 11 samples), if the resulting annual 98^{th} percentile value or resulting 24-hour standard design value (rounded according to the conventions of section 4.3 of this appendix) is greater than the level of the standard.

(b) The use of less than complete data is subject to the approval of EPA which may consider factors such as monitoring site closures/moves, monitoring diligence, and nearby concentrations in determining whether to use such data for comparisons to the NAAQS.

(c) The equations for calculating the 24-hour standard design values are given in section 4.5 of this appendix.

4.3 Rounding Conventions. For the purposes of comparing calculated values to the applicable level of the standard, it is necessary to round the final results of the calculations described in sections 4.4 and 4.5 of this appendix. Results for all intermediate calculations shall not be rounded.

(a) Annual $PM_{2.5}$ standard design values shall be rounded to the nearest 0.1 $\mu g/m^3$ (decimals 0.05 and greater are rounded up to the next 0.1, and any decimal lower than 0.05 is rounded down to the nearest 0.1).

(b) 24-hour $PM_{2.5}$ standard design values shall be rounded to the nearest 1 $\mu g/m^3$ (decimals 0.5 and greater are rounded up to the nearest whole number, and any decimal lower than 0.5 is rounded down to the nearest whole number).

4.4 Equations for the Annual $PM_{2.5}$ NAAQS.

(a) An annual mean value for $PM_{2.5}$ is determined by first averaging the daily values of a calendar quarter using equation 1 of this appendix:

Equation 1

$$\bar{X}_{q,y,s} = \frac{1}{n_q} \sum_{i=1}^{n_q} X_{i,q,y,s}$$

Where:

$\bar{X}_{q,y,s}$ = the mean for quarter q of the year y for site s;
n_q = the number of daily values in the quarter; and
$x_{i\,q,y,s}$ = the i^{th} value in quarter q for year y for site s.

(b) Equation 2 of this appendix is then used to calculate the site annual mean:

Equation 2

$$\bar{X}_{y,s} = \frac{1}{4} \sum_{q=1}^{4} \bar{X}_{q,y,s}$$

Where:

$\bar{X}_{y,s}$ = the annual mean concentration for year y (y = 1, 2, or 3) and for site s; and
$\bar{X}_{q,y,s}$ = the mean for quarter q of year y for site s.

(c) If spatial averaging is utilized, the site-based annual means will then be averaged together to derive the spatially averaged annual mean using equation 3 of this appendix. Otherwise (i.e., for single site comparisons), skip to equation 4.B of this appendix.

Equation 3

$$\bar{x}_y = \frac{1}{n_s} \sum_{s=1}^{n_s} \bar{x}_{y,s}$$

Where:

$\bar{x}_y$ = the spatially averaged mean for year y,

$\bar{x}_{y,s}$ = the annual mean for year y and site s for sites designated to be averaged that meet completeness criteria , and

n_s = the number of sites designated to be averaged that meet completeness criteria

(d) The annual standard design value is calculated using equation 4A of this appendix when spatial averaging and equation 4B of this appendix when not spatial averaging:

Equation 4A
When spatial averaging

$$\bar{x} = \frac{1}{3}\sum_{y=1}^{3}\bar{x}_y$$

Equation 4B
When not spatial averaging

$$\bar{x} = \frac{1}{3}\sum_{y=1}^{3}\bar{x}_{y,s}$$

Where:

$\bar{x}$ = the annual standard design value (the spatially averaged annual standard design value for equation 4A of this appendix and the single site annual standard design value for equation 4B of this appendix); and

$\bar{x}_y$ = the spatially averaged annual mean for year y (result of equation 3 of this appendix) when spatial averaging is used, or

$\bar{x}_{y,s}$ = the annual mean for year y and site s (result of equation 2 of this appendix) when spatial averaging is not used.

(e) The annual standard design value is rounded according to the conventions in section 4.3 of this appendix before a comparison with the standard is made.

4.5 Equations for the 24-Hour $PM_{2.5}$ NAAQS.

(a) When the data for a particular site and year meet the data completeness requirements in section 4.2 of this appendix, calculation of the 98th percentile is accomplished by the steps provided in this subsection. Equation 5 of this appendix shall be used to compute annual 98th percentile values, except that where a site operates on an approved seasonal sampling schedule, equation 6 of this appendix shall be used instead.

(1) Regular formula for computing annual 98th percentile values. Calculation of annual 98th percentile values using the regular formula (equation 5) will be based on the creditable number of samples (as described below), rather than on the actual number of samples. Credit will not be granted for extra (non-creditable) samples. Extra samples, however, are candidates for selection as the annual 98th percentile. [The creditable number of samples will determine how deep to go into the data distribution, but all samples (creditable and extra) will be considered when making the percentile assignment.] The annual creditable number of samples is the sum of the four quarterly creditable number of samples. Sort all the daily values from a particular site and year by

ascending value. (For example: (x[1], x[2], x[3], ..., x[n]). In this case, x[1] is the smallest number and x[n] is the largest value.) The 98th percentile is determined from this sorted series of daily values which is ordered from the lowest to the highest number. Compute (0.98) x (cn) as the number "i.d," where 'cn' is the annual creditable number of samples, "i" is the integer part of the result, and "d" is the decimal part of the result. The 98th percentile value for year y, $P_{0.98,\,y}$, is calculated using equation 5 of this appendix:

Equation 5

$$P_{0.98,y} = X_{[i+1]}$$

Where:

$P_{0.98,\,y}$	=	98th percentile for year y;
$x_{[i+1]}$	=	the (i+1)th number in the ordered series of numbers;
i	=	the integer part of the product of 0.98 and cn.

(2) Formula for computing annual 98th percentile values when sampling frequencies are seasonal. Calculate the annual 98th percentiles by determining the smallest measured concentration, x, that makes W(x) greater than 0.98 using equation 6 of this appendix:

Equation 6

$$W(x) = \frac{d_{High}}{d_{High} + d_{Low}} F_{High}(x) + \frac{d_{Low}}{d_{High} + d_{Low}} F_{Low}(x)$$

Where:

d_{High}	=	number of calendar days in the "High" season;
d_{Low}	=	number of calendar days in the "Low" season;
$d_{High} + d_{Low}$	=	days in a year; and
$F_a(x)$	=	$\frac{\textit{number of daily values in season a that are} \le x}{\textit{number of daily values in season a}}$

Such that "a" can be either "High" or "Low"; "x" is the measured concentration; and "$d_{High}/(d_{High} + d_{Low})$ and $d_{Low}/(d_{High} + d_{Low})$" are constant and are called seasonal "weights."

(b) The 24-hour standard design value is then calculated by averaging the annual 98th percentiles using equation 7 of this appendix:

Equation 7

$$P_{0.98} = \frac{\sum_{y=1}^{3} P_{0.98,y}}{3}$$

(c) The 24-hour standard design value (3-year average 98th percentile) is rounded according to the conventions in section 4.3 of this appendix before a comparison with the standard is made.

Appendix D

Interpretation of the National Ambient Air Quality Standards for PM

40 CFR Part 50 Appendix K

1.0 *General.*

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

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

Average refers to the arithmetic mean of the estimated number of exceedances per year, as per Section 3.1.

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

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

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

Year refers to a calendar year.

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

2.0 *Attainment Determinations.*

2.1 *24-Hour Primary and Secondary Standards.*

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

(b) The comparison with the allowable expected exceedance rate of one per year is made in terms of a number rounded to the nearest tenth (fractional values equal to or greater than 0.05 are to be rounded up; e.g., an exceedance rate of 1.05 would be rounded to 1.1, which is the lowest rate for nonattainment).

2.2 Reserved

2.3 *Data Requirements.*

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

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

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

2.4 *Adjustment for Exceptional Events and Trends.*

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

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

3.0 *Computational Equations for the 24-hour Standards.*

3.1 *Estimating Exceedances for a Year*.

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

Equation 1

$$e_q = v_q \times \left(\frac{N_q}{n_q} \right)$$

where:

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

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

N_q = the number of days in calendar quarter q;

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

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

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

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

Equation 2

$$e = \sum_{q=1}^{4} e_q$$

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

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

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

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

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

(3) Data capture of 75 percent is achieved during the required period of everyday sampling. In addition, if the first exceedance is observed in a calendar quarter in which

the monitor is already sampling every day, no adjustment for missing data will be made to the first exceedance if a 75 percent data capture rate was achieved in the quarter in which it was observed.

Example 1

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

$eq=1\times 92/39=2.359$ or 2.36.

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

Example 2

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

3.2 *Adjustments for Non-Scheduled Sampling Days.*

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

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

Equation 3

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

where:

e_q = the estimated number of exceedances for the quarter;

N_q = the number of days in the quarter;

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

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

k_j = the number of actual samples in stratum j.

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

Example 3

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

Eq = (92/14)×(2/6+0+. . .+0)=2.19.