January 2006

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U.S. PIRG Education Fund

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Executive Summary

While air quality has improved in the U.S. since the inception of the Clean Air Act in 1970, more than 88 million Americans still live in areas with unsafe levels of fine particle pollution. Fine particle pollution is one of the nation's most pervasive air pollutants and its most deadly, causing tens of thousands of premature deaths every year. This report examines levels of fine particle pollution in cities and towns nationwide in 2004 and finds that fine particles continue to pose a grave health threat to Americans.

Fine particle, or "soot," pollution can cause serious respiratory and cardiovascular problems, including asthma attacks, heart attacks, strokes, lung cancer, and premature death. Moreover, recent scientific studies show that such adverse effects occur at levels below the current national health-based air quality standards, which include an annual standard of 15 micrograms per cubic meter ($\mu g/m^3$) and a daily standard of 65 $\mu g/m^3$. Combustion sources such as coal-fired power plants and diesel engines are the largest source of fine particle pollution.

This report is based on a compilation of 2004 data from the nation's network of fine particle air quality monitors, as detailed by the state environmental agencies we surveyed. Key findings include the following:

- In 2004, fine particle pollution exceeded the annual and/or daily national health standard at air quality monitors in 55 small, mid-sized, and large metropolitan areas located in 21 states and home to 96 million people. States with exceedances of both standards included California, Georgia, Pennsylvania, and Utah.

- In 2004, fine particle pollution exceeded the annual national health standard in 43 metropolitan areas crossing 21 states' borders. Riverside-San Bernardino-Ontario, a large metropolitan area in California, had the worst annual fine particle pollution of any metropolitan area, with a maximum average annual level nearly 50 percent higher than the health standard. Among mid-sized and small metropolitan areas, Bakersfield and the Hanford-Corcoran areas in California had the worst annual fine particle pollution.

- In 2004, fine particle pollution exceeded the daily national health standard in 20 metropolitan areas crossing 10 states' borders. Fine particle pollution in these areas spiked above the standard 92 times on 45 days.

- Among the states, Utah suffered the most spikes in fine particle pollution due to a winter-time temperature inversion, with 47 exceedances of the daily standard on 18 days in January and February of 2004. California experienced spikes in fine particle pollution on 16 days, recording 30 exceedances in cities and towns across the state.

- Of the largest metropolitan areas, Pittsburgh, Pennsylvania experienced the most days with spikes in fine particle pollution, recording seven exceedances on seven different days. The Riverside-San Bernardino-Ontario metropolitan area in California ranked second among the largest metropolitan areas, recording 14 exceedances on six different days.

- Logan, a small metropolitan area on the border of Utah and Idaho, suffered the most spikes in fine particle pollution of any metropolitan area in the country—17 exceedances on 17 days. The Logan metropolitan area also recorded one of the highest exceedances in 2004, a maximum spike of 132.8, more than double the health standard.

Unfortunately, the Clean Air Act's New Source Review program, which is critical to reducing fine particle pollution from aging power plants, continues to come under attack. A recent analysis found that eliminating the program would cut short the lives of 70,000 Americans in the next two decades, as a result of higher levels of fine particle pollution in the air than current law permits. Policymakers should reject weakening changes to the program and instead enforce the law.

Rather than take additional steps to further limit levels of fine particle pollution in our air, however, the Bush administration recently proposed to maintain the status quo. Under the Clean Air Act, the Environmental Protection Agency (EPA) must set air quality standards at levels that protect public health, including the health of sensitive populations, with an adequate margin of safety. EPA also must review the standards every five years to ensure they reflect the latest scientific knowledge and update the standards as needed.

EPA staff scientists and the Clean Air Scientific Advisory Committee, an independent review committee, separately concluded in 2005 that the current standards do not adequately protect public health and recommended substantially strengthening the standards. The Bush administration, however, disregarded the advice of these experts, proposing in December 2005 to maintain the annual health standard of 15 $\mu g/m^3$ and slightly lower the daily health standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$.

Given the extent of fine particle pollution in the U.S. and the science showing serious adverse health effects below the current fine particle standards, the Bush administration should adopt an annual standard no higher than 12 $\mu g/m^3$ and a daily standard no higher than 25 $\mu g/m^3$ when it finalizes the standards in September 2006.

Background: Fine Particle Pollution

Particle pollution is composed of various solid particles and liquid droplets that are suspended in the air—a "mixture of mixtures," as the Environmental Protection Agency (EPA) describes it.[1] The body's natural defenses, such as coughing and sneezing, help us expel larger particles, but smaller particles can bypass these defenses and lodge deep within our lungs or even pass through the lungs into our bloodstream, causing serious adverse health effects.[2]

Such smaller particles are commonly categorized by size, with inhalable "coarse" particles ranging in diameter from 2.5 to 10 micrometers ($PM_{2.5-10}$) and "fine" particles being 2.5 or fewer micrometers in diameter ($PM_{2.5}$).[3] By contrast, a strand of human hair measures about 70 micrometers in diameter.[4]

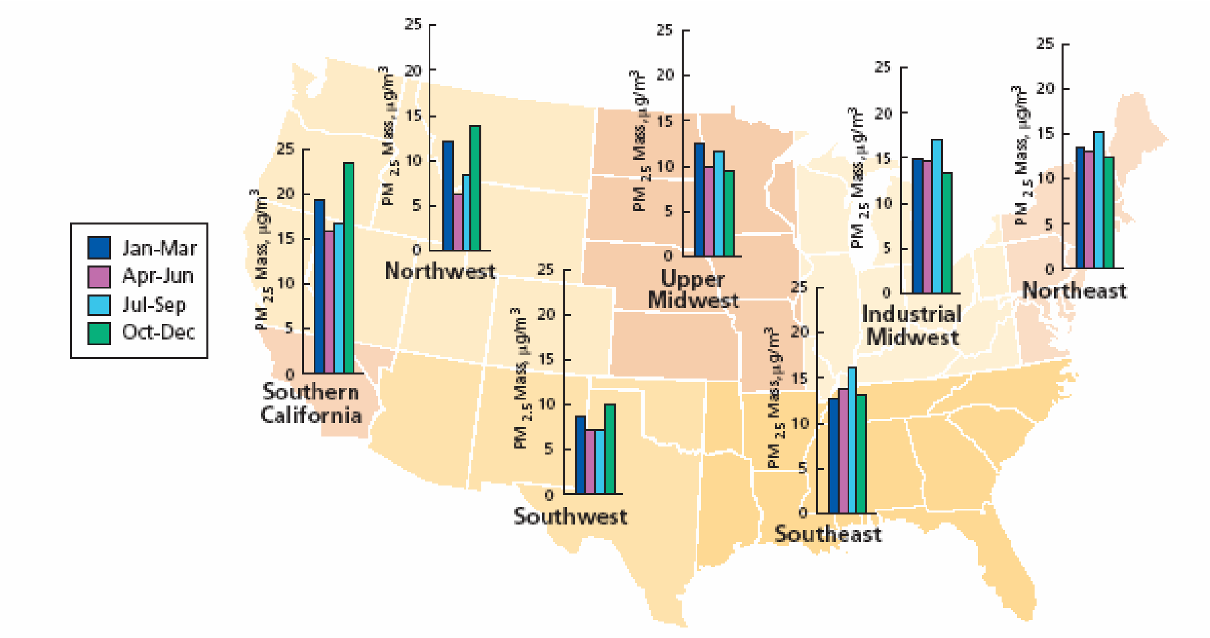
Particles are formed through both mechanical and chemical processes. Mechanical processes, such as construction, mining, agriculture, and coal combustion, break down larger particles into smaller ones and mainly produce coarse particles.[5] Chemical processes, which occur in the atmosphere when gases emitted by combustion sources such as power plants and diesel engines condense into particles or react with other gases and particles to form new particles, primarily produce fine particles.[6] As such, fine particles are a mixture including sulfates, nitrates, ammonium compounds, organic carbon, elemental carbon, and metals.[7] Motor vehicles and power plants are the primary contributors to fine particles,[8] which can travel long distances through the atmosphere, even thousands of miles from their source.[9]

Fine particles often have a seasonal pattern (Figure A). $PM_{2.5}$ values in the eastern half of the United States are typically higher in the third quarter of the year (July-September) when sulfur dioxide emissions from power plants in that region readily form sulfates. Fine particle concentrations tend to be higher in the fourth calendar quarter in many areas of the West, in part because fine particle nitrates are more readily formed in cooler weather.[10]

Health Effects of Fine Particle Pollution

Both coarse particles and fine particles are associated with serious respiratory and cardiovascular problems. With respect to fine particles—the focus of this report—EPA has concluded that "[t]he health effects associated with exposure to $PM_{2.5}$ are significant."[11] As the agency explains, "[e]pidemiological studies have shown a significant correlation between elevated $PM_{2.5}$ levels and premature mortality. Other important effects associated with $PM_{2.5}$ exposure include aggravation of respiratory and cardiovascular disease . . ., lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems."[12]

Figure A. Seasonal Averages of $PM_{2.5}$ Concentration by Region, 1999–2003[13]



Notably, both short-term and long-term exposure to fine particles can cause premature death. Numerous studies have linked fine particle exposure to premature death,[14] and EPA has estimated that particle pollution shortens the lives of its victims by an average of 14 years.[15] Indeed, agency scientists recently estimated that, even at the level of current air quality standards for fine particles, fine particle pollution causes more than 4,700 premature deaths each year in just nine cities: Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Phoenix, Seattle, and San Jose.[16] Moreover, a 2004 study by Abt Associates, EPA's air quality consultants, found that fine particles from U.S. power plants alone cause 23,600 premature deaths per year, in addition to 38,200 non-fatal heart attacks and 554,000 asthma attacks.[17]

Likewise, both short-term and long-term exposure to fine particles can cause serious illness. Adverse impacts of short-term increases in fine particle pollution include non-fatal heart attacks, especially among the elderly and people with heart conditions; hospitalization for cardiovascular disease, including strokes; emergency room visits for acute respiratory ailments; inflammation of lung tissue in young, healthy adults; hospitalization for asthma among children; and severe asthma attacks in children.[18] Adverse impacts of long-term (chronic) exposure to fine particle pollution include significant damage to the small airways of the lungs, slowed lung function growth in children and teens, and hospitalization for asthma attacks among children who live near roads with heavy truck or trailer traffic.[19] Moreover, long-term exposure to fine particle pollution also is associated with premature births even at low levels.[20]

Groups at greatest risk from fine particle pollution include older adults, people with heart or lung disease, and children.[21] Recent research indicates that diabetics are also at increased risk from fine particle pollution.[22]

Current Fine Particle Standards

The Clean Air Act requires that EPA set national air quality standards for six outdoor "criteria" air pollutants, including particulate matter, that limit the amount of the pollutant over a given period of time. Specifically, EPA must set air quality standards at levels that protect public health, including the health of sensitive populations, with an adequate margin of safety.[23] Under the Act, these standards must be based solely on a pollutant's health effects, not on any other factors, such as cost.[24]

In 1997, after an extensive scientific review process, EPA established the first national air quality standards for fine particles. Having linked both short-term exposure and long-term exposure to fine particles to illness and death, the agency established both a daily, or 24-hour, average standard and an annual, or year-round, average standard. The daily standard was set at 65 micrograms per cubic meter (65 $\mu g/m^3$), and the annual standard was set at 15 micrograms per cubic meter (15 $\mu g/m^3$).[25]

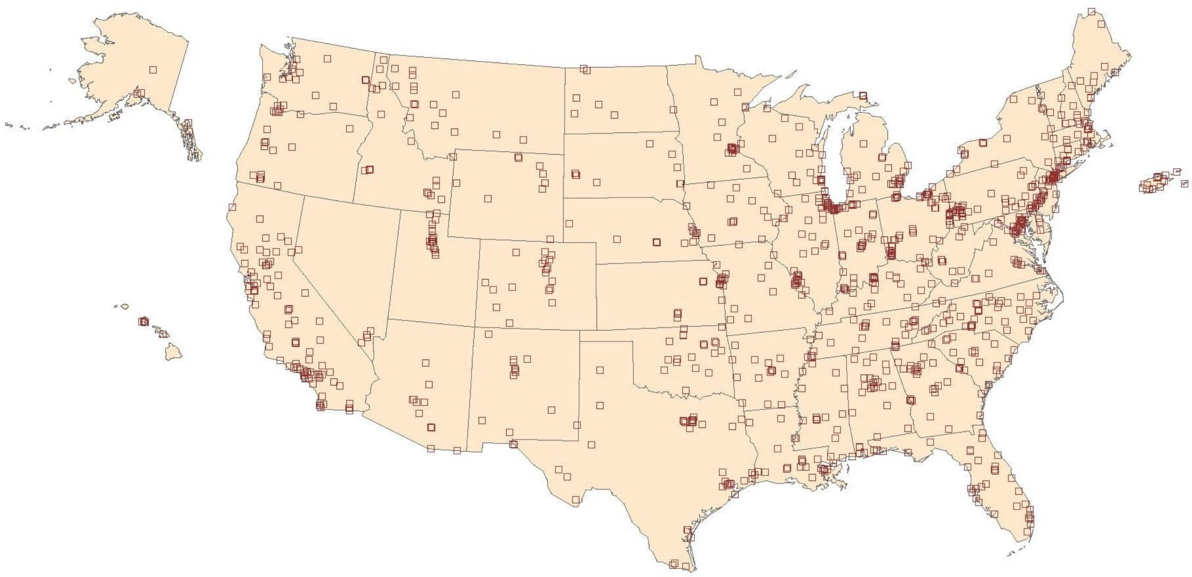
States work with cities and counties to meet these air quality standards; areas that meet the standards are said to be in "attainment." When setting these standards, EPA estimated that attainment would result in major health benefits. Specifically, the agency estimated that meeting the standards would prevent, on an annual basis, at least 15,000 premature deaths, 20,000 cases of acute bronchitis, 75,000 cases of chronic bronchitis, 10,000 hospital admissions for respiratory and cardiovascular diseases, hundreds of thousands of occurrences of aggravated asthma, and more than three million lost work days due to particle-related symptoms.[26] Subsequently, in 2004, EPA indicated that the benefits might be even greater, given new studies linking fine particle exposure to premature death and quantifying infant mortality and non-fatal heart attacks related to fine particle exposure.[27]

According to EPA, in 2003, air quality monitors in 97 counties—home to 62 million people—recorded levels of coarse or fine particle pollution that exceeded the national health standards.[28] Seventy two (72) of these counties, with a combined population of 53 million, recorded fine particle exceedances. Yet as high as these numbers are, they are almost certainly an underestimate; EPA's network of fine particle monitors, established in 1999,[29] has significant gaps (see Figure B), and fine particle pollution is not limited to areas with monitors. Using EPA's Air Quality Index, the American Lung Association recently estimated that 76.5 million people—more than a quarter of the U.S. population—live in areas with unsafe short-term levels of fine particle pollution and that 58.3 million live in areas with unsafe annual levels of fine particle pollution.[30]

In December 2004, following a lawsuit brought by the American Lung Association, EPA completed its designation of "nonattainment" areas, classifying all or part of 224 counties nationwide as not meeting the fine particle standards.[31] EPA then revised its designations in April 2005, resulting in a total of 39 areas comprised of 208 counties with a population of 88 million people being classified as nonattainment areas.[32]

Nonattainment areas must meet the current fine particle standards by 2010.[33] EPA issued a proposed implementation rule for the standards this year[34] and is expected to finalize the rule in 2006.

Figure B. Location of Fine Particle Pollution Monitoring Stations, 2004[35]



Findings: Fine Particle Pollution in 2004

This report examines fine particle levels recorded in 2004 by the nation's network of 1,175 fine particle air quality monitors, as reported by the states and the District of Columbia. Specifically, the report identifies exceedances in 2004 of the annual and daily national health standards for fine particles. For the daily standard, it also identifies the number of soot days—days on which at least one air quality monitor in a given area exceeded the daily fine particle standard.

In order to compare cities of similar size, we divided metropolitan areas into three categories: large metropolitan areas with populations above 1 million; mid-sized metropolitan areas with populations from 250,000 to 1 million; and small metropolitan areas with populations under 250,000.

Overall, fine particle pollution exceeded the annual and/or daily national health standard at air quality monitors in 55 small, mid-sized, and large metropolitan areas located in 21 states and home to 96 million people. The states experiencing exceedances, listed in Tables 1a and 1b, included Alabama, California, Georgia, Hawaii, Idaho, Illinois, Indiana, Maryland, Michigan, Nevada, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Utah, and West Virginia. States with exceedances of both standards included California, Georgia, Pennsylvania, and Utah.

Table 1a. States Exceeding Annual Fine Particle Health Standard, 2004

Rank	State[a]	Max. Average Annual Fine Particle Value (µg/m³)	Rank	State[a]	Max. Average Annual Fine Particle Value (µg/m³)
1	CA	22.09	9	WV	16.57
2	PA	20.66	10	MD	16.53
3	UT	17.81	11	SC	16.37
4	GA	17.58	12	NY	15.6
5	OH	17.53	13	TN	15.58
6	MI	16.83	14	NC	15.51
7	AL	16.8	15	IL	15.4
8	IN	16.7	16	NJ	15.2
National					22.09

Table 1b. States Exceeding Daily Fine Particle Health Standard, 2004

Rank	State[a]	Soot Days	Exceedances of Daily Fine Particle Health Standard, 2004	Max. Daily Fine Particle Value (µg/m³)
1	UT	18	47	132.8
2	CA	16	30	93.8
3	PA	7	7	94
4	HI[b]	2	2	103
4	NV[b]	2	2	146.1
6	GA	1	1	77.3
6	ID	1	1	69.7
6	NM	1	1	70
6	OR	1	1	69
National		45	92	146.1

[a] Based on the location of the air quality monitor, even if the metropolitan area in which it is located crosses state lines.

[b] Fireworks caused the two exceedances in Hawaii; forest fires in California caused the two exceedances in Nevada.

Annual Fine Particle Pollution

In 2004, fine particle pollution exceeded the annual national health standard of 15 $\mu g/m^3$ in 43 metropolitan areas and two non-metropolitan areas crossing 21 states' borders. (See Tables 2-5.) In these areas, fine particle levels were chronically high.

Overall, fine particle pollution exceeded the annual standard in 2004 in 17 large metropolitan areas crossing 17 states' borders. California's Riverside-San Bernardino-Ontario metropolitan area, home to more than three million people, suffered the worst annual fine particle pollution of any metropolitan area in 2004. The maximum average annual level in the area was 22.09 $\mu g/m^3$, nearly 50 percent higher than the standard. Pittsburgh, Pennsylvania, with nearly 2.5 million people, and Los Angeles-Long Beach-Santa Ana, California, with more than 12 million people, were close behind, with maximum average year-round levels 33 percent higher than the standard.

Other large metropolitan areas topping the list included Atlanta-Sandy Springs-Marietta, Georgia; Cleveland-Elyria-Mentor, Ohio; Detroit-Warren-Livonia, Michigan; Birmingham-Hoover, Alabama; Indianapolis, Indiana; Baltimore-Towson, Maryland; and Chicago-Naperville-Joliet, which includes a tri-state area in Illinois, Indiana, and Wisconsin. See Table 2 for the full list of large metropolitan areas where fine particle pollution exceeded the annual standard in 2004.

Among mid-sized metropolitan areas, fine particle pollution exceeded the annual standard in 2004 in 17 areas crossing 11 states' borders. Bakersfield, California experienced the highest annual fine particle pollution in 2004, followed by Salt Lake City, Utah. Other mid-sized metropolitan areas with fine particle pollution exceeding the annual standard included two in California (Visalia-Porterville and Fresno) and four in Pennsylvania (Lancaster, York-Hanover, Harrisburg-Carlisle, and Reading). See Table 3 for the full list of mid-sized metropolitan areas where fine particle pollution exceeded the annual standard in 2004.

Among small metropolitan areas, fine particle pollution exceeded the annual standard in 2004 in nine areas crossing eight states' borders. California's Hanford-Corcoran area experienced the highest annual fine particle pollution, followed by Macon, Georgia and Weirton-Steubenville, which covers parts of West Virginia and Ohio. Other small metropolitan areas with annual fine particle pollution above the standard in 2004 were California's Merced and Chico; Rome, Georgia; Hagerstown-Martinsburg, spanning parts of Maryland and West Virginia; Lexington-Thomasville, North Carolina; and Logan, which covers parts of Utah and Idaho. See Table 4 for a list of these areas.

In Georgia, monitors in Sandersville and Gordon, towns that do not fall in metropolitan areas, also recorded exceedances of the annual fine particle pollution standard. See Table 5.

Table 2. Large Metropolitan Areas Plagued by Annual Fine Particle Pollution, 2004

Rank	Metropolitan Area	Population	Maximum Average Annual Fine Particle Value (µg/m³)
1	Riverside-San Bernardino-Ontario, CA	3,254,821	22.09
2	Pittsburgh, PA	2,431,087	20.66
3	Los Angeles-Long Beach-Santa Ana, CA	12,365,627	20
4	Atlanta-Sandy Springs-Marietta, GA	4,247,981	17.58
5	Cleveland-Elyria-Mentor, OH	2,148,143	17.53
6	Detroit-Warren-Livonia, MI	4,452,557	16.83
7	Birmingham-Hoover, AL	1,052,238	16.8
8	Indianapolis, IN	1,525,104	16.7
9	Baltimore-Towson, MD	2,552,994	16.53
10	Chicago-Naperville-Joliet, IL-IN-WI	9,098,316	16.5
11	Cincinnati-Middletown, OH-KY-IN	2,009,632	16.39
12	New York-Northern New Jersey-Long Island, NY-NJ-PA	18,323,002	15.6
13	Charlotte-Gastonia-Concord, NC-SC	1,330,448	15.51
14	St. Louis, MO-IL	2,698,687	15.4
15	Louisville, KY-IN	1,161,975	15.1
16	Philadelphia-Camden-Wilmington, PA-NJ-DE	5,687,147	15.02
17	Columbus, OH	1,612,694	15.01

Table 3. Mid-Sized Metropolitan Areas Plagued by Annual Fine Particle Pollution, 2004

Rank	Metropolitan Area	Population	Maximum Average Annual Fine Particle Value (µg/m³)
1	Bakersfield, CA	661,645	18.92
2	Salt Lake City, UT	968,858	17.81
3	Visalia-Porterville, CA	368,021	17.01
4	Fresno, CA	799,407	17
5	Lancaster, PA	470,658	16.64
6	York-Hanover, PA	381,751	16.54
7	Greenville, SC	559,940	16.37
8	Charleston, WV	309,635	15.88
9	Harrisburg-Carlisle, PA	509,074	15.66
10	Reading, PA	373,638	15.64
11	Augusta-Richmond County, GA-SC	499,684	15.61
12	Chattanooga, TN-GA	476,531	15.58
13	Columbus, GA-AL	281,768	15.4
14	Huntington-Ashland, WV-KY-OH	288,649	15.18
15	Knoxville, TN	616,079	15.1
16	Akron, OH	694,960	15.02
17	Hickory-Morganton-Lenoir, NC	341,851	15.00507

Table 4. Small Metropolitan Areas Plagued by Annual Fine Particle Pollution, 2004

Rank	Metropolitan Area	Population	Maximum Average Annual Fine Particle Value (μg/m³)
1	Hanford-Corcoran, CA	129,461	17.45
2	Macon, GA	222,368	16.79
3	Weirton-Steubenville, WV-OH	132,008	16.57
4	Rome, GA	90,565	15.62
5	Hagerstown-Martinsburg, MD-WV	222,771	15.38
6	Merced, CA	210,554	15.23
7	Lexington-Thomasville, NC	147,246	15.174
8	Logan, UT-ID	102,720	15.17
9	Chico, CA	203,171	15.05

Table 5. Non-Metropolitan Areas Plagued by Annual Fine Particle Pollution, 2004

State	City	County	Maximum Average Annual Fine Particle Value (μg/m³)
GA	Sandersville	Washington	15.85
GA	Gordon	Wilkinson	15.46

Daily Spikes in Fine Particle Pollution

In 2004, fine particle pollution exceeded the daily national health standard of 65 μg/m³ in 20 metropolitan areas crossing 10 states' borders. (See Tables 6-8.) Fine particle pollution in these areas spiked above the standard 92 times on 45 "soot" days; a "soot day" is a day on which at least one monitor exceeded the daily fine particle standard. Exposure to high short-term levels of fine particles can result in illness and death, even when the annual average is within the current standard.[36]

Among the states, Utah suffered the most spikes in fine particle pollution in 2004, with 47 exceedances of the daily standard on 18 days in January and February of 2004. Three mid-sized metropolitan areas in Utah experienced numerous soot days, including Provo-Orem, which recorded 10 spikes on seven days; Salt Lake City, which recorded 12 spikes on eight days; and Ogden-Clearfield, which recorded seven spikes on two days. Logan, a small metropolitan area on the border of Utah and Idaho, suffered the most spikes in fine particle pollution of any metropolitan area in the country—17 exceedances on 17 days. Utah officials point to winter-time temperature inversion as the likely cause of the numerous exceedances in the first two months of 2004.[37] A temperature inversion occurs when cold air close to the ground is trapped by a layer of warmer air, which acts like a lid and suppresses vertical mixing. As pollutants from vehicles, wood-burning fireplaces, and industry are emitted into the air, the inversion traps these pollutants near the ground, leading to poor air quality.

Of the largest metropolitan areas, Pittsburgh, Pennsylvania experienced the most soot days in 2004, recording seven exceedances on seven different days. In California, the Riverside-San Bernardino-Ontario metropolitan area ranked second, recording 14 exceedances on six days. Also in California, the Los-Angeles-Long Beach-Santa Ana area recorded four exceedances on four days, and the San Francisco-Oakland-Fremont and San Diego-Carlsbad-San Marcos areas each experienced one soot day in 2004.

California was plagued with spikes in fine particle pollution in smaller metropolitan areas as well. Bakersfield and Fresno, both mid-sized metropolitan areas, experienced four and two soot days, respectively. Bishop and El Centro, two small metropolitan areas, each experienced one soot day. Overall, California recorded a total of 30 exceedances across the state on 16 different days in 2004.

The highest daily fine particle levels among all metropolitan areas were recorded in small metropolitan areas. The Gardnerville Ranchos metropolitan area in Nevada suffered the worst spike in fine particle pollution, 146.1 $\mu g/m^3$, well over double the national health standard of 65 $\mu g/m^3$. Nevada officials point to two California forest fires as the reason for this and another exceedance recorded in October 2004.[38] The Logan metropolitan area spanning parts of Utah and Idaho experienced a maximum spike of 132.8—also more than double the standard.

Table 6. Large Metropolitan Areas with Spikes in Fine Particle Pollution, 2004

Rank	Metropolitan Area	Population	Soot Days	Exceedances of Daily Fine Particle Health Standard	Maximum Daily Fine Particle Value ($\mu g/m^3$)
1	Pittsburgh, PA	2,431,087	7	7	94
2	Riverside-San Bernardino-Ontario, CA	3,254,821	6	14	93.8
3	Los Angeles-Long Beach-Santa Ana, CA	12,365,627	4	4	75.6
4	San Francisco-Oakland-Fremont, CA	4,123,740	1	1	73.7
4	San Diego-Carlsbad-San Marcos, CA	2,813,833	1	1	67.3

Table 7. Mid-Sized Metropolitan Areas with Spikes in Fine Particle Pollution, 2004

Rank	Metropolitan Area	Population	Soot Days	Exceedances of Daily Fine Particle Health Standard	Maximum Daily Fine Particle Value (µg/m^3)
1	Salt Lake City, UT	968,858	8	12	94.1
2	Provo-Orem, UT	376,774	7	10	82.2
3	Bakersfield, CA	661,645	4	5	70.04
4	Honolulu, HI[c]	876,156	2	2	103
4	Ogden-Clearfield, UT	442,656	2	7	74.3
4	Fresno, CA	799,407	2	3	71
7	Columbus, GA-AL	281,768	1	1	77.3
7	Albuquerque, NM	729,649	1	1	70
7	Eugene-Springfield, OR	322,959	1	1	69

Table 8. Small Metropolitan Areas with Spikes in Fine Particle Pollution, 2004

Rank	Metropolitan Area	Population	Soot Days	Exceedances of Daily Fine Particle Health Standard	Maximum Daily Fine Particle Value (µg/m^3)
1	Logan, UT-ID	102,720	17	17	132.8
2	Gardnerville Ranchos, NV[d]	41,259	2	2	146.1
3	Bishop, CA	17,945	1	1	81
3	El Centro, CA	142,361	1	1	74.2
3	Pocatello, ID	83,103	1	1	69.7
3	Brigham City, UT	42,745	1	1	67

[c] The two exceedances in Hawaii were due to fireworks.
[d] The two exceedances in Nevada were due to two California forest fires.

Stronger Fine Particle Standards Needed

Under the Clean Air Act, EPA must review air quality standards every five years to ensure that they reflect the latest scientific knowledge and update the standards as needed to protect public health with an adequate margin of safety.[39]

Since 1996, when EPA previously reviewed the science on particle pollution in the standard-setting process, more than 2,000 peer-reviewed studies on particle pollution have been published, confirming prior findings on the relationship between fine particle pollution and illness, hospitalization, and premature death.[40] These studies also have shown serious adverse health effects at levels at or below—even well below—the current fine particle standards, indicating the need for much stronger standards to protect public health.

New Science on Health Effects

Several major studies published in the last few years show adverse effects from fine particle pollution, whether short-term or long-term, at levels at or below the current standards. Studies showing adverse effects at the current standards include the California Children's Health Study,[41] which found decreased lung function and increased cough and bronchitis among children in communities with an average long-term level of fine particle pollution at the current annual standard. Two studies in Phoenix[42] and Santa Clara, California[43] found a connection between short-term increases in fine particle pollution and premature death.

Major studies showing mortality effects at levels below the current standards include an American Cancer Society cohort study, which found that long-term fine particle exposure increases the risk of premature death from lung cancer and heart disease;[44] the Harvard Six Cities Study, which found that long-term fine particle exposure increases the risk of premature death from heart and lung disease;[45] and a study of eight Canadian cities, which found that short-term (daily) increases in fine particle exposure were linked to increases in daily deaths.[46] Notably, in the Harvard and Canadian cities studies, the connection between exposure to fine particle pollution and premature death was observed at levels well below the current standards.

Most recently, epidemiologists determined that experts may be significantly underestimating air pollution's role in causing early death. Using two decades' worth of data, the researchers examined links between particle pollution and mortality within more than 260 Los Angeles neighborhoods and found that pollution's chronic health effects are two to three times greater than earlier believed. For each increase of 10 micrograms per cubic meter ($\mu g/m^3$) of fine particles in the neighborhood's air, the risk of death from any cause rose by 11 to 17 percent. Ischemic heart disease mortality risks rose by 25 to 39 percent for each 10 $\mu g/m^3$ increase in air pollution.[47]

EPA's Review Process

In March 2003, the American Lung Association and several environmental groups brought suit against EPA for failing to conduct the required five-year review of the particle pollution standards. Now, pursuant to the terms of a consent decree, EPA is in the midst of the review process, which requires assessing recent research on particle pollution, generating a staff paper with analysis and recommendations regarding the particle standards, proposing new particle standards, and finalizing the standards.[e]

In October 2004, the agency issued its final particulate matter criteria document, a review of the current science on the health effects of particle pollution.[48] The agency's final staff paper came out in June 2005,[49] and an independent review committee, the Clean Air Scientific Advisory Committee (CASAC), issued its recommendations in June 2005, after seven years of deliberations.[50]

Notably, both the EPA's staff scientists and CASAC agree that the current fine particle standards do not adequately protect public health. Accordingly, both the staff and CASAC have recommended tightening the standards for fine particle pollution. EPA staff presented two options in their final staff paper: (1) to retain the current 15 μg/m^3 annual standard and lower the daily standard to 25-30 μg/m^3 if the form of the standards remains at the 98th percentile, or 30-35 μg/m^3 if the form is tightened to the 99th percentile;[f] or (2) to lower the annual standard to 12-14 μg/m^3 and lower the daily standard to 35-40 μg/m^3.[51] CASAC, which advocates lowering both standards, recommended an annual standard of 13-14 μg/m^3 and a daily standard of 30-35 μg/m^3.[52]

The medical and scientific communities support the strongest standards within the EPA's recommended ranges: 12 μg/m^3 for the annual standard and 25 μg/m^3 for the daily standard (99th percentile form). The American Lung Association has endorsed these standards,[53] as have the American Thoracic Society, the American Association of Cardiovascular and Pulmonary Rehabilitation, the American Association of Respiratory Care, the American College of Cardiology, the American College of Preventative Medicine, the American Public Health Association, and the National Association for the Medical Direction of Respiratory Care, which sent a joint letter to EPA Administrator Stephen Johnson endorsing these standards.[54] In addition, in December 2005, more than 100 of the nation's leading air pollution researchers sent Administrator Johnson a letter endorsing these same recommendations, writing, "…PM2.5 is causally associated with numerous adverse health effects in humans, at exposure levels far below the current standards. Such a conclusion demands prompt action to protect human health."[55]

[e] EPA also is reviewing the current standards for coarse particles.

[f] The 99th percentile form would allow fewer high pollution days to be excused when calculating compliance. The current 98th percentile form exempts the worst 21 days over three years.

The Bush Administration's Proposed Fine Particle Standards

On December 20, 2005, the Bush administration proposed new standards for particle pollution that disregard the advice of its own science advisors and EPA staff scientists. Specifically, the administration rejected tightening the annual health standard for fine particle pollution, maintaining it at 15 $\mu g/m^3$, and opted only to slightly lower the daily health standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$.

As noted above, under the Clean Air Act, air quality standards must be set at a level that protects public health, including the health of sensitive populations, with an adequate margin of safety. EPA's own risk assessment shows that the current fine particle standards of 15 $\mu g/m^3$ (annual) and 65 $\mu g/m^3$ (daily) protect only 56 million people.[56] The administration's proposed standards would leave millions of Americans unprotected from particle pollution.

New Source Review: A Critical Program Under Attack

Nearly three-quarters of all power plant boilers are over 30 years old, and most continue to operate without modern pollution control technology.[57] These older plants release approximately 99 percent of the sulfur dioxide from power plants, which forms fine particle pollution, as well as 98 percent of the nitrogen oxides and 91 percent of carbon dioxide from power plants.[58] Nitrogen oxides are a precursor to both fine particle and ozone pollution, and carbon dioxide is the leading global warming pollutant. (Power plants release nearly 40 percent of the nation's carbon dioxide emissions.[59]) In addition, mercury from these plants contributes to learning disabilities and other health problems in children.[60]

The Clean Air Act's New Source Review (NSR) program is critical to cleaning up these aging plants.[61] The program requires power plants to meet specific emissions standards – the "best available control technologies" (BACT) – if the plants are located in areas without air quality problems and more aggressive "lowest achievable emission rates" (LAER) in areas that violate national air quality standards. In 1977, when Congress created the NSR program, it allowed existing facilities to meet the law's new plant-by-plant requirements when the facility made a modification, since it would be less costly to install pollution controls when a plant was already undergoing construction.[62]

Nearly three decades after Congress enacted the NSR program, however, many power plants built prior to 1977 have avoided installing modern pollution controls to meet BACT or LAER standards.[63] These are the power plants that are responsible for the vast majority of the nation's power plant pollution.

In 1999, after a three-year investigation of compliance with the NSR program, the Clinton administration concluded that violations of the NSR program were common, finding that plant owners were making enormous modifications without applying for or obtaining NSR permits. As a result, the Clinton administration initiated enforcement actions against eight utilities for NSR violations at more than 50 power plants.[64]

Since the start of the Bush administration, however, the program has come under attack.[65] Some policymakers want to eliminate the program for existing power plants and substitute the Clean Air Act's plant-specific requirements with national caps on pollution.

Pollution caps are not enough to drive the cleanup at old plants, nor are caps sufficient to protect local air quality. Though total annual sulfur dioxide emissions from power plants decreased by 10 percent nationwide since 1995, the first year the Clean Air Act capped sulfur dioxide emissions, annual sulfur dioxide emissions have increased at 54 percent of the nation's most-polluting power plants.[66] A recent analysis of data from Abt Associates found that eliminating the NSR program for existing power plants would result in 70,000 more premature deaths by 2025, as a result of higher levels of fine particle pollution in the air than current law permits. Enforcing the NSR program would reduce sulfur dioxide and nitrogen oxide emissions from power plants far below the limits established under EPA's recent Clean Air Interstate Rule, which caps pollution levels.[67]

Conclusion

As this report shows, metropolitan areas of all sizes across the country continue to struggle with fine particle pollution. Since the air quality standards for fine particle pollution were adopted in 1997, thousands of peer-reviewed studies have reaffirmed that exposure to fine particles can cause serious health effects, even at levels well below the current standards.

Aging power plants are a major contributor to fine particle pollution, but the key Clean Air Act program that requires the dirtiest plants to eventually meet modern pollution standards remains under attack. Policymakers should reject all attempts to weaken or eliminate the New Source Review program.

Moreover, the Bush administration's proposed new air quality standards for fine particles disregard the recommendations of experts and would largely maintain the status quo, leaving millions of Americans to suffer the consequences of high levels of fine particles in the air. Given the extent of fine particle pollution in the U.S. and the science showing serious adverse health effects below the current fine particle standards, the Bush administration should adopt an annual standard for fine particles no higher than 12 $\mu g/m^3$ and a daily standard no higher than 25 $\mu g/m^3$ when it finalizes the standards in September 2006.

Methodology

From June to August 2005, we collected 2004 fine particle data directly from all 50 state environmental agencies and the District of Columbia. For each fine particle monitoring site, we obtained maximum daily fine particle concentrations exceeding 65.0 micrograms per cubic meter (μg/m^3) and annual average fine particle concentrations exceeding 15.0 μg/m^3. We defined a "soot day" as a day on which at least one monitor in a given area exceeded the daily fine particle standard.

We obtained data on metropolitan statistical areas, defined by the Office of Management and Budget as of June 6, 2003, from the U.S. Census.[68]

Data Sources by State

Alabama: Personal communications with Alabama Department of Environmental Management, Air Division; data received 6/24/05.

Alaska: Personal communications with Alaska Department of Environmental Conservation, Division of Air Quality, Air Monitoring & Quality Assurance; department reported no fine particle exceedances in 2004, 7/6/05.

Arizona: Personal communications with Arizona Department of Environmental Quality; department reported no fine particle exceedances in 2004, 7/18/05.

Arkansas: Personal communications with Arkansas Department of Environmental Quality; department reported no fine particle exceedances in 2004, 8/8/05.

California: Personal communications with California Air Resources Board, Air Quality Data Department; data received 6/27/05.

Colorado: Personal communications with Colorado Department of Public Health and Environment, Air Pollution Control Division; department reported no fine particle exceedances in 2004, 6/30/05.

Connecticut: Personal communications with Connecticut Department of Environmental Protection, Bureau of Air Management; data received 7/11/05.

Delaware: Personal communications with Delaware Department of Natural Resources & Environmental Control; data received 7/5/05.

District of Columbia: Personal communications with District of Columbia Department of Health, Environmental Health Administration, Bureau of Environmental Quality; department reported no fine particle exceedances in 2004, 7/13/05.

Florida: Personal communication with Florida Department of Environmental Protection, Division of Air Resource Management, and the agency website http://www.dep.state.fl.us/Air/flaqs.htm; data showing no exceedances in 2004 retrieved 6/27/05.

Georgia: Personal communication with Georgia Department of Natural Resources, Environmental Protection Division, Air Protection Branch (data received 6/28/05) and Georgia's *2004 Ambient Air Surveillance Report*, accessed 12/9/05 at www.air.dnr.state.ga.us/amp/report04.pdf.

Hawaii: Personal communications with Hawaii Department of Health, Environmental Health, Air Quality, Clean Air Branch; data received 7/13/05.

Idaho: Personal communications with Idaho Department of Environmental Quality, Air Quality Division; data received 7/20/05.

Illinois: Personal communication with Illinois Environmental Protection Agency, Bureau of Air, Air Quality Data; data received 6/29/05.

Indiana: Personal communications with Indiana Department of Environmental Management; data received 6/27/05.

Iowa: Personal communication with Iowa Department of Natural Resources, Air Quality Bureau, and the agency website www.iowadnr.com/air/prof/monitor/monitor.html; website showed no fine particle exceedances in 2004, 6/27/05.

Kansas: Personal communications with Kansas Department of Health and Environment; department reported no exceedances in 2004, 7/5/05.

Kentucky: Personal communications with Kentucky Division for Air Quality; department reported no exceedances in 2004, 6/29/05.

Louisiana: Personal communications with Louisiana Department of Environmental Quality; department reported no exceedances in 2004, 7/27/05.

Maine: Personal communications with Maine Department of Environmental Protection, Bureau of Air Quality; department reported no exceedances in 2004, 7/5/05.

Maryland: Personal communications with Maryland Department of the Environment, Air & Radiation Management Administration; data received 7/21/05.

Massachusetts: Personal communications with Massachusetts Department of Environmental Protection, Bureau of Waste Prevention, Business Compliance Division; department reported no exceedances in 2004, 7/5/05.

Michigan: Personal communications with Michigan Department of Environmental Quality, Air Quality Division; data received 8/10/05.

Minnesota: Personal communications with Minnesota Pollution Control Agency; department reported no exceedances in 2004, 7/5/05.

Mississippi: Personal communication with Mississippi Department of Environmental Quality; department reported no exceedances in 2004, 6/28/05.

Missouri: Personal communications with Missouri Department of Natural Resources; department reported no exceedances in 2004, 6/29/05.

Montana: Personal communications with Montana Department of Environmental

Quality; data obtained 8/23/05.

Nebraska: Personal communications with Nebraska Department of Environmental Quality, Air Quality Division, Compliance Unit; department reported no exceedances in 2004, 6/29/05.

Nevada: Personal communications with Nevada Division of Environmental Protection, Bureau of Air Quality Planning; department reported no exceedances in 2004, data received 7/21/04.

New Hampshire: Personal communication with New Hampshire Department of Environmental Services, Air Resources Division; department reported no exceedances in 2004, 6/30/05.

New Jersey: Personal communication with New Jersey Department of Environmental Protection, Bureau of Air Monitoring; data received 6/30/05.

New Mexico: Personal communications with New Mexico Environment Department, Air Quality Bureau (which handles monitoring in all areas except Albuquerque), and Albuquerque Air Pollution Control Division; departments reported no exceedances in 2004, 7/5/05.

New York: Personal communications with New York State Department of Environmental Conservation, Air Resources Division; data received 6/30/05.

North Carolina: Personal communications with North Carolina Department of Environmental and Natural Resources, Division of Air Quality; data received 7/5/05.

North Dakota: Personal communications with North Dakota Department of Health, Division of Air Quality; department reported no exceedances in 2004, 7/6/05.

Ohio: Personal communications with Ohio Environmental Protection Agency, Division of Air Pollution Control; data received 7/7/05.

Oklahoma: Personal communications with Oklahoma Department of Environmental Quality; department reported no exceedances in 2004, 6/30/05.

Oregon: Oregon Department of Environmental Quality, *2004 Oregon Air Quality Annual Report*, accessed 6/28/05 at www.deq.state.or.us/aq/data/annrpt.htm.

Pennsylvania: Personal communications with Pennsylvania Department of Environmental Protection, Bureau of Air Quality, Monitoring Department; data received 7/11/05.

Rhode Island: Personal communication with Rhode Island Department of Environmental Management, Office of Air Resources; department reported no exceedances in 2004, 7/5/05.

South Carolina: Personal communication with South Carolina Department of Health and Environmental Control, Bureau of Air Quality; data received 7/8/05.

South Dakota: Personal communication with South Dakota Department of Environment and Natural Resources, Air Quality Program; department reported no exceedances in 2004, 7/6/05.

Tennessee: Personal communication with Tennessee Department of Environment and Conservation, Division of Air Pollution Control; data received 7/19/05.

Texas: Personal communications with Texas Commission on Environmental Quality, Office of Environmental Policy, Analysis and Assessment, and the EPA; departments reported no exceedances in 2004, 8/16/05 (daily, Texas Commission on Environmental Quality) and 8/19/05 (annual, EPA).

Utah: Personal communications with Utah Department of Environmental Quality, Division of Air Quality, Utah Air Monitoring Center and the Utah Air Monitoring Center website at www.airmonitoring.utah.gov/archpm25.htm, 8/1/05.

Vermont: Personal communications with Vermont Department of Environmental Conservation, Air Pollution Control Division; department reported no exceedances in 2004, 7/11/05.

Virginia: Virginia Department of Environmental Quality, accessed 6/27/05 at www.deq.virginia.gov/airmon/pm25home.html.

Washington: Personal communications with Washington Department of Ecology, Air Quality Program; department reported no exceedances in 2004, 7/6/05.

West Virginia: Personal communications with West Virginia Department of Environmental Protection, Division of Air Quality, Air Monitoring Section, and the West Virginia Department of Environmental Protection *2004 Air Quality Annual Report*.

Wisconsin: Personal communications with Wisconsin Department of Natural Resources; department reported no exceedances in 2004, 7/26/05.

Wyoming: Personal communications with Wyoming Department of Environmental Quality, Air Quality Division; department reported no exceedances in 2004, 7/6/05.

End Notes

[1] U.S. Environmental Protection Agency (EPA), Air Quality Criteria for Particulate Matter (Oct. 2004), p.2-2.
[2] EPA, *National Air Quality and Emissions Trends Report: 2003 Special Studies Edition* (Sept. 2003) (hereinafter "2003 EPA Report"), p.34. See also EPA, *The Particle Pollution Report: Current Understanding of Air Quality and Emissions though 2003* (Dec. 2004) (hereinafter "*EPA Particle Pollution Report*"), pp. 3 &13; A. Nenmar et al., "Passage of Inhaled Particles in to the Blood Circulation in Humans," *Circulation* (2002), 105: 411-414.
[3] *EPA Particle Pollution Report*, p.2. Coarse particles range from about 2.5-40 or more micrometers in diameter, but inhalable coarse particles range in diameter only from 2.5-10 micrometers. Ibid.
[4] Ibid.
[5] American Lung Association (ALA), *State of the Air 2005* (hereinafter "*ALA Report*"), p.54; *EPA Particle Pollution Report*, p.2-9.
[6] *ALA Report*, p.54.
[7] See, e.g., Proposed Rule to Implement the Fine Particle National Ambient Air Quality Standards, 70 Fed. Reg. 65984 (Nov. 1, 2005). See also *EPA Particle Pollution Report*, pp. 1, 3, & 6 (identifying carbon, sulfates, nitrates, and crustal material as major components of fine particles).
[8] *EPA Particle Pollution Report*, pp. 1, 6.
[9] *EPA Particle Pollution Report*, p.6.
[10] *EPA Particle Pollution Report*, p.4.
[11] EPA, Proposed Rule to Implement the Fine Particle National Ambient Air Quality Standards, 70 Fed. Reg. 65984, 65988 (Nov. 1, 2005).
[12] EPA, Proposed Rule to Implement the Fine Particle National Ambient Air Quality Standards, 70 Fed. Reg. 65984, 65988 (Nov. 1, 2005).
[13] *EPA Particle Pollution Report*, p.4.
[14] See, e.g., C. Arden Pope III et al., "Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution," *JAMA* (Mar. 6, 2002), 287(9): 1132-1141 (finding that long-term exposure to fine particle pollution increases the risk of dying from lung cancer and heart disease); C. Arden Pope et al., "Cardiovascular Mortality and Long-Term Exposure to Particulate Air Pollution: Epidemiological Evidence of General Pathophysiological Pathways of Disease," *Circulation* (2004), 109: 71-77 (finding that long-term exposure to fine particle pollution increases the risk of dying from ischemic heart disease, arrhythmias, heart failure, and cardiac arrest); Y. Hong, et al., "Effects of Air Pollutants on Acute Stroke Mortality," *Environmental Health Perspectives* (2002), 110: 187-191 (finding that short-term exposure to fine particle pollution is linked to deaths from strokes).
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[16] EPA, *Review of the National Ambient Air Quality Standards for Particle Pollution: Policy Assessment of Scientific and Technical Information*, EPA-452/R-05-005, June 2005, available at http://www.epa.gov/ttn/naaqs/standards/pm/data/pmstaffpaper_20050630.pdf.
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[18] *ALA Report*, p.56 (citing studies documenting each of these effects).
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[22] *ALA Report*, p.56 (citing A. Zanobetti et al., "Are Diabetics More Susceptible to the Health Effects of Airborne Particles?," *American Journal of Respiratory and Critical Care Medicine* (2001), 164: 831-833; A. Zanobetti et al., "Cardiovascular Damage by Airborne Particles: Are Diabetics More Susceptible?," National Research Council, National Academy of Sciences, *Research Priorities for Airborne Particulate Matter: IV. Continuing Research Progress* (2004)).

[23] Clean Air Act, § 109 (b)(1).
[24] *Whitman v. American Trucking Assns., Inc.*, 531 U. S. 457 (2001).
[25] EPA, "National Ambient Air Quality Standards for Particulate Matter; Final Rule," 62 Fed. Reg. 38652 (July 18, 1997). The Whitman v. American Trucking case in the Supreme Court decision reaffirmed that only the effects on health were to be the basis for the standards.
[26] EPA, "Benefits of Meeting the PM2.5 Standard," available at www.epa.gov/pmdesignations/documents/120/benefits.htm (downloaded Nov. 23, 2005).
[27] EPA, "Benefits of Meeting the PM2.5 Standard" (2004), available at www.epa.gov/pmdesignations/documents/120/benefits.htm (downloaded Nov. 23, 2005).
[28] *EPA Particle Pollution Report*, p.10.
[29] *EPA Particle Pollution Report*, p.10.
[30] *ALA report*, pp. 5, 18. The Air Quality Index reports daily air quality, providing information about the cleanliness of the air and associated health effects. See *EPA Particle Pollution Report*, p.5.
[31] EPA, "Air Quality Designations and Classifications for the Fine Particles (PM2.5) National Ambient Air Quality Standards; Final Rule," 70 Fed. Reg. 944 (Jan. 5, 2005). Nonattainment designation involves identifying which counties either do not meet national air quality standards or contribute to nonattainment in another county.
[32] EPA, "Air Quality Designations for the Fine Particles (PM2.5) National Ambient Air Quality Standards - Supplemental Notice," 70 Fed. Reg. 19844 (Apr. 14, 2005); see also EPA, "Twelve Additional Areas now Meet National Air Quality Standards for Fine Particle Pollution," press release, April 5, 2005, available at http://www.epa.gov/pmdesignations/regs.htm.
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[37] Personal communication with Ken Symons, Utah Department of Environmental Quality, November 30, 2005.
[38] Personal communication with Sheryl Bryant of the Nevada Department of Environmental Protection, December 1, 2005.
[39] Clean Air Act, § 108.
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[41] W. Gauderman et al., "Association Between Air Pollution and Lung Function Growth in Southern California Children: Results from a Second Cohort," *American Journal of Respiratory and Critical Care Medicine* (2002), 166: 76-84; W. Gauderman et al., "The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age," *New England Journal of Medicine* (2004), 351: 1057-67.
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[46] R. Burnett et al., "Association Between Particulate- and Gas-Phase Components of Urban Air Pollution and Daily Mortality in Eight Canadian Cities," (2000), 12 Suppl. 4: 15-39; R. Burnett et al., "Size-Fractionates particulate Mass and Daily Mortality in Eight Canadian Cities," *Revised Analyses of Time-Series Studies of Air Pollution and Health* (special report) (Boston, MA: Health Effects Institute, 2003), pp.85-90.
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[50] Clean Air Scientific Advisory Committee (CASAC), *EPA's Review of the National Ambient Air Quality Standards for Particulate Matter (Second Draft PM Staff Paper, January 2005): A Review by the Particulate Matter Review Panel of the EPA Clean Air Scientific Advisory Committee*, EPA-SAB-CASAC-05-007, June 2005, available at http://www.epa.gov/sab/pdf/casac-05-007.pdf. For more information on the panel, see EPA, Clean Air Scientific Advisory Committee (CASAC) Particulate Matter (PM) Review Panel, at http://www.epa.gov/sab/panels/casacpmpanel.html.
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