# State of the Air 2009

AMERICAN LUNG ASSOCIATION® LungUSA.org / 1-800-LUNGUSA

# Acknowledgments

The American Lung Association State of the Air 2009 is the result of the hard work of many people:

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The American Lung Association assumes sole responsibility for the content of the *American Lung Association State of the Air 2009*.

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# Executive Summary



Air pollution continues to threaten the lives and health of millions of people in the United States despite great progress since the modern Clean Air Act was first passed in 1970. Even as the nation explores the complex challenges of global warming and energy, air pollution remains widespread and dangerous.

This year marks the tenth annual *American Lung Association State of the Air* report and provides an excellent opportunity to look back over the changes in the past ten years. This 2009 report looks at ozone and particle pollution year-round (annual average) and over short-term levels (24-hour) of particle pollution ($PM_{2.5}$) found in monitoring sites across the United States in 2005, 2006, and 2007.

## Ozone

In March 2008, the U.S. Environmental Protection Agency adopted a new, tighter standard for ozone pollution. Measured against the new standard, the air quality in many new places failed to meet the test. Other communities with a long history of ozone problems face an even more serious challenge. Evaluating the most recent data against the new standard, the American Lung Association found that approximately 175.4 million Americans live in counties where ozone monitors recorded too many days with unhealthy ozone levels, far more than the 92.5 million identified in the *State of the Air 2008* report.

Progress in reducing ozone shows up even when using the new standard to look backward. The American Lung Association analysis shows that ozone levels have improved in some of the cities facing the greatest burden, such as Los Angeles and Houston. However, so does the impact of warmer summers and continuing pollution challenges: Sixteen of the cities in this year's 25 most polluted experienced a worsening problem with ozone since last year's report, including Charlotte, Phoenix, Las Vegas, and Cincinnati.

## Year-round particle pollution

Particle pollution improved in 9 of the cities in the list of the 25 most polluted by year-round levels, including five cities which recorded their best levels since the report began covering particle pollution in 2004: Pittsburgh, Cincinnati, Atlanta, York, PA and Lancaster, PA. However, the annual average level of particles worsened in 12 cities, including Bakersfield, CA which took over the most polluted ranking from Los Angeles, and Houston, TX which this year moved into the list of the 25 cities most-polluted by particle pollution for the first time.

## Short-term particle pollution

Eleven cities experienced fewer days, or fewer severe days, of unhealthy levels of particle pollution in the *State of the Air 2009* report, including Pittsburgh, the city ranked number one on the list of cities most polluted by short-term exposure to particles. All eleven showed continued improvement since the 2007 report, which first incorporated the tighter standards for short-term levels of particle pollution. Unfortunately, 13 cities had more days—or more severe days—of particle pollution in the 2009 report than in last year's report. Eleven of those cities had consistently increased the number of days or the severity of the levels of particle pollution in the past three reports.

**40.5 Million**

The number of people in the U.S. who live in counties where the outdoor air failed all three tests.

**186.1 Million**

The number of people in the U.S. who live in counties where the outdoor air got an F.

## Cleanest cities

Fargo-Wahpeton, ND-MN emerged as the cleanest city in the U.S., the only city to appear on all three lists of cleanest cities. Seventeen cities appeared on two of the three lists of cleanest cities: Billings, MT; Bismarck, ND; Cheyenne, WY; Colorado Springs, CO; Farmington, NM; Ft. Collins, CO; Honolulu, HI; Lincoln, NE; Midland-Odessa, TX; Port St. Lucie, FL; Pueblo, CO; Redding, CA; Salinas, CA; San Luis Obispo, CA; Santa Fe-Espanola, NM; Sioux Falls, ND; and Tucson, AZ.

Looking at the nation as a whole, the *American Lung Association State of the Air 2009* finds:

- **Six out of ten people (61.7%) in the United States population lives in counties that have unhealthful levels of either ozone or particle pollution.**
  Almost 186.1 million Americans live in the 525 counties where they are exposed to unhealthful levels of air pollution in the form of either ozone or short-term or year-round levels of particles.
- **Roughly six out of ten people in the United States—58 percent—live in areas with unhealthful levels of ozone. This reflects the much lower threshold for unhealthy ozone as well as warmer temperatures in much of the eastern U.S.**
  Counties that were graded F for ozone levels have a combined population of 175.4 million. These people live in the 485 counties where the monitored air quality places them at risk for lower lung function, respiratory infection, lung inflammation and aggravation of respiratory illness. The actual number who breathe unhealthy levels of ozone is likely much larger, since this number does not include people who live in adjacent counties in metropolitan areas where no monitors exist. Note that this number is much greater than previous *State of the Air* reports because this estimate is based on the new national standards for ozone adopted in 2008. This increase does not represent that ozone levels have worsened; rather, this means that the problem of ozone is much more widespread than previously recognized.
- **Roughly three out of ten people in the United States live in an area with unhealthful short-term levels of particle pollution, an increase from the last report.**
  Over 92.7 million Americans live in 134 counties that experienced too many days with unhealthy spikes in particle pollution, an increase from the last report. Short-term spikes in particle pollution can last from hours to several days and can increase the risk of heart attacks, strokes and emergency-room visits for asthma and cardiovascular disease, and most importantly, can increase the risk of early death.
- **One in six people in the United States lives in an area with unhealthful year-round levels of particle pollution.**
  Just over 47 million U.S. residents live in areas where chronic levels are regularly a threat to their health. Even when levels are fairly low, exposure to particles over time can increase risk of hospitalization for asthma, damage to the lungs and, significantly, increase the risk of premature death.
- **Just under one in eight people—roughly 40.5 million in the United States—live in the 37 counties with unhealthful levels of all three: ozone and short-term and year-round particle pollution.**

With the risks from airborne pollution so great, the American Lung Association seeks to inform people who may be in danger. Many people are at greater risk because of their age or because they have asthma or other chronic lung, cardiovascular disease or diabetes. Here are the numbers of people in each at-risk group.

- **People with Asthma**—Approximately 4 million children and 10.9 million adults with asthma live in parts of the

United States with very high levels of ozone. Over 5.7 million adults and over 2.1 million children with asthma live in areas with high levels of short-term particle pollution. Over 2.8 million adults and nearly 1.1 million children with asthma live in counties with unhealthful levels of year-round particle pollution.

- **Older and Younger**—Over 20.4 million adults age 65 and over and nearly 44 million children age 18 and under live in counties with unhealthful ozone levels. Nearly 10.7 million seniors and 23.3 million children live in counties with unhealthful short-term levels of particle pollution. Nearly 5.3 million seniors and over 12 million children live in counties with unhealthful levels of year-round particle pollution.
- **Chronic Bronchitis and Emphysema**—Over 4.4 million people with chronic bronchitis and over 2.1 million people with emphysema live in counties with unhealthful ozone levels. Over 2.3 million people with chronic bronchitis and over 1.1 million people with emphysema live in counties with unhealthful levels of short-term particle pollution. Nearly 1.2 million people with chronic bronchitis and nearly 556,000 people with emphysema live in counties with unhealthful year-round levels of particle pollution.
- **Cardiovascular Disease**—Nearly 24.5 million people with cardiovascular diseases live in areas with unhealthful levels of short-term particle pollution; nearly 12.2 million people live in counties with unhealthful levels of year-round particle pollution. Cardiovascular diseases include coronary heart disease, heart attacks, strokes, hypertension and angina pectoris.
- **Diabetes**—Over 5.2 million people with diabetes live in areas with unhealthful levels of short-term particle pollution; nearly 2.6 million people live in counties with unhealthful levels of year-round particle pollution. Research indicates that because diabetics are already at higher risk of cardiovascular disease, they may face increased risk due to the impact of particle pollution on their cardiovascular systems.

## What needs to be done

Many major challenges require the Obama Administration and Congress to take steps to protect the health of the public. Here are a few key steps that the American Lung Association also calls for to improve the air we all breathe.

- **Clean up dirty power plants.** Coal-fired power plants are among the largest contributors to particulate pollution, ozone, mercury, and global warming. The EPA should immediately take action to reduce emissions and expand clean-up requirements for power plants nationwide. The American Lung Association has taken legal action repeatedly to fight to require power plants to clean up.
- **Clean up the existing fleet of dirty diesel.** Rules the EPA put in effect over the past several years mean that new diesel vehicles and equipment must be much cleaner. Still, the vast majority of diesel trucks, buses and heavy equipment (such as tractors and bulldozers) will likely be in use for thousands more miles, spewing dangerous diesel exhaust into communities and neighborhoods. The good news is that affordable technology exists to virtually eliminate this problem and the economic recovery legislation is investing $300 million at the EPA for the voluntary diesel retrofit program.
- **Clean up ocean-going vessels.** Ocean-going vessels, like cruise ships, container ships and tankers deliver staggering amounts of smog-forming oxides of nitrogen, particle pollution, sulfur dioxide and heat-trapping carbon dioxide. By 2030 these vessels will produce approximately 45 percent of the national inventory of mobile source particle pollution emissions, harming health, worsening global warming and creating acid rain. New evidence

shows that pollution from these vessels reaches parts of the country far inland from the 40 port cities that have recognized air pollution problems. The International Maritime Organization must grant the EPA the right to maximize the clean air protections under international agreements, carrying out faster and deeper cuts in particulate- and smog-forming pollutants.

- **Strengthen the 2008 ozone standards.** The EPA issued new national air quality standards for ozone in March 2008, after legal action by the American Lung Association forced them to complete a formal review. Unfortunately, the Bush Administration chose to disregard the unanimous recommendations of the EPA's official science advisors and adopted standards that fail to meet the requirements of the Clean Air Act. These standards are still in the early stage of implementation and have been challenged in court by the American Lung Association, states, public health and environmental groups. The EPA should voluntarily remand its March rule and issue a new rule that meets the recommendations of the expert panel and the nation's leading public health organizations. A voluntary remand can be designed to maintain clean air progress while transitioning to more protective standards.

- **Strengthen the national standard for particle pollution.** In 2006, the EPA failed to strengthen the annual standard for fine particles, despite the near unanimous recommendation by the Clean Air Scientific Advisory Committee. the EPA can save thousands of lives each year by dramatically lowering the annual average standard. The Lung Association challenged this decision in court and, on February 25, 2009, won the case as the U.S. Court of Appeals told the EPA to review the science again. Proposed revisions to the PM standards are due in late 2010.

- **Require all appropriate counties to clean up particle pollution.** In December 2008, the EPA failed to take any action to designate counties that had violated the annual standard for fine particulates, a pollutant found to increase the risk of premature death. The EPA's most egregious omission was Houston, where the EPA's own calculations show that the year-round level of particle pollution are growing and clearly violate the standard, but the EPA also failed to recognize at least four other cities with the same problem. This omission means that Houston and the other cities will not have to reduce their pollution to restore healthy air. The EPA should revise the final rule to include plans to address the annual standard and designate all appropriate counties for the 24-hour standard.

## What you can do

Individual citizens can do a great deal to help reduce air pollution outdoors as well. Simple but effective ways include:

- **Drive less.** Combine trips, walk, bike, carpool or vanpool, and use buses, subways or other alternatives to driving. Vehicle emissions are a major source of air pollution. Support community plans that provide ways to get around that don't require a car, such as more sidewalks, bike trails and transit systems.

- **Don't burn wood or trash.** Burning firewood and trash are among the largest sources of particles in many parts of the country. If you must use a fireplace or stove for heat, convert your woodstoves to natural gas, which has far fewer polluting emissions. Compost and recycle as much as possible and dispose of other waste properly; don't burn it. Support efforts in your community to ban outdoor burning of construction and yard wastes. Avoid the use of outdoor hydronic heaters, also called outdoor wood boilers, which are often much more polluting than woodstoves.

- **Make sure your local school system requires clean school buses,** which includes replacing or retrofitting old school buses with filters and other equipment to reduce emissions. Make sure your local schools don't idle their buses, a step that can immediately reduce the emissions.
- **Get involved.** Participate in your community's review of its air pollution plans and support state and local efforts to clean up air pollution.
- **Use less electricity.** Turn out the lights and use energy-efficient appliances. Generating electricity is one of the biggest sources of pollution, particularly in the eastern United States.
- **Send a message to decision makers.** Send an email or fax to urge Congress to oppose measures that weaken the Clean Air Act. Log on at www.LungUSA.org to see how easy that can be.

# The State of the Air 2009

The first *State of the Air* report came out in 2000 and focused solely on ozone pollution. In the past ten years,

**most ranked cities have cut their ozone levels.**

However, some have gotten worse.

This year marks the tenth annual American Lung Association *State of the Air* report and provides an excellent opportunity to look back over the changes in the past ten years. This 2009 report looks at ozone and particle pollution year-round (annual average) and over short-term levels (24-hour) of particle pollution ($PM_{2.5}$) found in monitoring sites across the United States in 2005, 2006, and 2007.

## Ozone

The first *State of the Air* report, issued in 2000, covered the period 1996, 1997, and 1998 and only evaluated the levels of ozone smog, using the standard for ozone that the EPA had just established as a basis for evaluating air quality across the nation. A decade of research has demonstrated that the levels of ozone considered safe then no longer meet the critical test of protecting public health. To provide better protection, in March 2008 the U.S. Environmental Protection Agency adopted a new, tighter standard for ozone pollution. Measured against the new standard, the air quality in many additional places failed to meet the test. Other communities with long histories of ozone problems face an even more serious challenge. Evaluating the most recent data against the new standard, the American Lung Association found that approximately 175.4 million Americans live in counties where ozone monitors recorded too many days with unhealthy ozone levels, far more than the 92.5 million identified in the *State of the Air 2008* report.

Progress in reducing ozone shows up even when using the new standard to look backward. The American Lung Association analysis shows that ozone levels have improved in some of the cities facing the greatest burden, such as Los Angeles and Houston. However, so does the impact of warmer summers and continuing pollution challenges: Sixteen of the cities in this year's 25 most polluted cities experienced a worsening problem with ozone since last year's report, including Charlotte, Phoenix, Las Vegas, and Cincinnati.

Looking back over the past ten years, the ozone levels have improved in most cities, including in #1 ranked Los Angeles where ozone levels have improved consistently in each report. Most cities have improved primarily in the past five reports (covering 2001-2007), and many actually had ozone levels worsen significantly during the period covered by the first five reports (1996-2002). However, some cities have seen their ozone levels trend higher over the past decade, including Dallas-Fort Worth, TX, and Las Vegas, NV.

## Year-round particle pollution

Particle pollution improved in 9 of the cities in the list of the 25 most polluted by year-round levels, including five cities which recorded their best levels since the report began covering particle pollution in 2004: Pittsburgh, Cincinnati, Atlanta, York, PA and Lancaster, PA. However, the annual average level of particles worsened in 12 cities, including Bakersfield, CA, which took over the most polluted ranking from Los Angeles, and Houston, TX which this year moved into the list of the 25 cities most-polluted by particle pollution for the first time.

Compared to the findings first included in the *State of the Air 2004* report, much of the nation has less year-round particle pollution. However, many cities have seen little change or even faced higher levels in the past three reports. Among those showing significant, continued improvement in the past

Particle pollution grades first appeared in the *State of the Air* report five years ago. Since then **many places have improved their levels,** though many continue to struggle.

**Fargo-Wahpeton, ND-MN** is the only city to appear on all three lists of **cleanest cities** in the nation. Seventeen others appear on two lists each.

5 years are Los Angeles (which improved its ranking to 4th place this year), Detroit, Cleveland, and St. Louis. Stagnating problems show up particularly in eastern cities where coal-fired power plants contribute to the problem: Birmingham, AL; Charleston WV; Huntingdon, WV; Louisville, KY; Macon, GA; Indianapolis, IN; Rome, GA; and Hagerstown, MD.

Cheyenne, WY has the lowest annual level of particle pollution in the United States. Cheyenne has ranked #1 on this list of cleanest cities for the past 5 reports.

## Short-term particle pollution

Eleven cities experienced fewer days of unhealthy levels of particle pollution in the *State of the Air 2009* report, including Pittsburgh, the city ranked number one on the list of cities most polluted by short-term exposure to particles. All eleven showed continued improvement since the 2007 report, which first incorporated the tighter standards for short-term levels of particle pollution. Unfortunately, 13 cities had more days—or more severe days—of particle pollution in the 2009 report than in last year's report. Eleven of those cities had consistently increased the number of days or the severity of the levels of particle pollution in the past three reports.

Twenty-four cities had straight "As"—awarded because they had no days with unhealthy levels of particle pollution during 2005-2007. They range across the nation from Portland-Lewiston-South Portland, ME to San Luis Obispo-Paso Robles, CA; from Alexandria, LA to Sioux Falls, SD.

### Some short-term particle pollution occurs naturally

Not all particle pollution is made by human activity. Two examples of the natural sources that present serious problems each year are smoke from wildfires, which create fine particles and gases, and "vog," the sulfur dioxide and other emissions from volcanic eruptions that create acid gases and aerosols which occur primarily in Hawaii. For official record keeping and evaluation, the U.S. Environmental Pollution Agency generally does not include days where natural sources of particle pollution predominate. Natural sources can be just as dangerous as human-made sources. Because wildfire smoke and vog are caused by natural sources, they do not usually appear in the monitor records used in the State of the Air reports. However, the American Lung Association offices provide community warnings when such problems occur and information to assist residents to protect themselves.

## Cleanest cities

Fargo-Wahpeton, ND-MN emerged as the only city to appear on all three lists of cleanest cities. Seventeen cities appeared on two of the three lists of cleanest cities: Billings, MT; Bismarck, ND; Cheyenne, WY; Colorado Springs, CO; Farmington, NM; Ft. Collins, CO; Honolulu, HI; Lincoln, NE; Midland-Odessa, TX; Port St. Lucie, FL; Pueblo, CO; Redding, CA; Salinas, CA; San Luis Obispo, CA; Santa Fe-Espanola, NM; Sioux Falls, ND; and Tucson, AZ.

## What needs to be done to get healthy air

Many major challenges require the Obama Administration and Congress to take steps to protect the health of the public. Here are a few key steps that the American Lung Association calls for to improve the air we all breathe.

- **Clean up dirty power plants.** Coal-fired power plants are among the largest contributors to particulate pollution, ozone, mercury, and global warming. The EPA should immediately take action to reduce emissions of sulfur dioxide, nitrogen oxides, and air toxics including mercury below the levels allowed under the Clean Air Interstate Rule and expand clean-up requirements for power plants nationwide. An analysis released in 2004 attributed 24,000 premature deaths *each year* to power plant pollution, as well as tens of thousands of asthma attacks, hospital admissions and emergency room visits.[1] Greater reductions in power plant pollution levels are essential to enable states and local governments to reduce air pollution to safe levels. The American Lung Association has taken legal action repeatedly to fight against efforts to allow power plants to continue to pollute. We and our partners will continue to take steps to ensure that coal-fired power plants are cleaned up.

- **Clean up the existing fleet of dirty diesel.** Rules the EPA put in effect over the past several years mean that new diesel vehicles and equipment must be much cleaner. Still, the vast majority of the diesel fleet will likely be in use for thousands more miles, spewing dangerous diesel exhaust into communities and neighborhoods. The good news is that affordable technology exists to virtually eliminate this problem. Congress should fully fund programs to retrofit diesel trucks, buses, heavy equipment (such as tractors and bulldozers) and other existing sources of dirty diesel exhaust. States should use these funds to retrofit diesel engines. Funding and requirements for these retrofits should be part of federal transportation funding. The economic recovery legislation invests $300 million at the EPA for the voluntary diesel retrofit program. Further, the EPA should require that long-haul trucks upgrade their emissions controls whenever their engines are rebuilt, similar to new requirements that just went into effect for locomotive and marine diesel engines.

- **Clean up ocean-going vessels.** Ocean-going vessels, like cruise ships, container ships and tankers deliver staggering amounts of smog-forming oxides of nitrogen, particle pollution, sulfur dioxide and heat-trapping carbon dioxide. By 2030 these vessels will produce approximately 45 percent of the national inventory of mobile source particle pollution emissions, harming health, worsening global warming and creating acid rain. New evidence shows that pollution from these vessels reaches parts of the country far inland from the 40 port cities that have recognized air pollution problems. The International Maritime Organization must grant the EPA the right to place an Emissions Control Area in American waters to maximize the clean air protections under international agreements, carrying out faster and deeper cuts in particulate- and smog-forming pollutants.

- **Strengthen the 2008 ozone standards.** The EPA issued new national air quality standards for ozone in March 2008, after legal action by the American Lung Association forced them to complete a formal review. Unfortunately, the Bush Administration chose to disregard the unanimous recommendations of the EPA's official science advisors and adopted standards that fail to meet the requirements of the Clean Air Act, including a decision by the President himself to overturn recommendations from key EPA staff for stronger protections for forests, vegetation and natural systems. These standards are still in the early stage of implementation and have been challenged in court by the American Lung Association, states, public health and environmental groups. The EPA should voluntarily remand its March rule and issue a new rule that meets the recommendations of the expert panel and the nation's leading public health organizations. A voluntary remand can be designed to maintain clean air progress while transitioning to more protective standards.

- **Strengthen the national standards for particle pollution.** Fine particulate air pollution ($PM_{2.5}$) is responsible for tens of thousands of premature deaths

1 Abt Associates. Power Plant Emissions: Particulate Matter-Related Health Damages and the Benefits of Alternative Emission Reduction Scenarios for the Clean Air Task Force. June 2004. Available at www.catf.us.

each year in the U.S., as well as a cascade of other adverse health effects ranging from increased hospitalization and emergency room visits to decreased lung function in children. Scientific studies show that long-term exposures to fine particles can shorten life by months to years. In 2006, the EPA failed to strengthen the annual standard for fine particles, despite the near unanimous recommendation by the Clean Air Scientific Advisory Committee. The Lung Association challenged this decision in court and, on February 25, 2009, won the case as the U.S. Court of Appeals told the EPA to review the science again. The EPA can save thousands of lives each year by dramatically lowering the annual average standard. Proposed revisions to the PM standards are due in late 2010.

- **Require all appropriate counties to clean up particle pollution.** A key step to reducing the burden of air pollution around the nation is the EPA officially determining where air pollution poses a threat to public health. The EPA issues a formal rule listing the counties that fail to meet or "attain" the national air quality standards. The counties that violate the standards ("nonattainment") must take steps to reduce emissions and meet the standards by a certain date. Historically, that process has fallen short in failing to include areas with unhealthy pollution levels. In December 2008, the EPA failed to take any action to designate counties that had violated the annual standard for fine particulates ($PM_{2.5}$), a pollutant found to increase the risk of premature death. The EPA's most egregious omission was Houston, where the EPA's own calculations show that the year-round levels of $PM_{2.5}$ are growing and clearly violate the standard, but the EPA also failed to recognize at least four other cities. This omission means that Houston and the other cities will not have to reduce their particle pollution to restore healthy air. The EPA also failed to designate many other counties that should have been included in the list of those not meeting the short-term (24-hour $PM_{2.5}$) standard. The EPA currently has the final rule held for review by the Obama Administration. The EPA should revise the final rule to include plans to address the annual standard and designate all appropriate counties for the short-term standard.

## People at Risk from Short-term Particle Pollution (24-Hour $PM_{2.5}$)

| In Counties where the Grades were: | Chronic Diseases: Adult Asthma | Pediatric Asthma | Chronic Bronchitis | Emphysema | CV Disease | Diabetes | Age Groups: Under 18 | Over 65 | Total Population | Number of Counties |
|---|---|---|---|---|---|---|---|---|---|---|
| Grade A (0.0) | 829,553 | 285,298 | 337,702 | 165,471 | 3,569,069 | 765,450 | 3,138,239 | 1,621,022 | 13,080,289 | 79 |
| Grade B (0.3-0.9) | 1,508,328 | 587,947 | 654,603 | 320,398 | 6,914,480 | 1,482,837 | 6,467,372 | 3,116,360 | 25,737,174 | 114 |
| Grade C (1.0-2.0) | 3,039,579 | 1,077,734 | 1,277,031 | 635,278 | 13,587,841 | 2,925,415 | 11,854,949 | 6,261,138 | 49,112,969 | 182 |
| Grade D (2.1-3.2) | 1,615,570 | 599,558 | 678,505 | 331,719 | 7,163,388 | 1,535,736 | 6,595,070 | 3,226,800 | 26,583,196 | 75 |
| Grade F (3.3+) | 5,745,865 | 2,114,718 | 2,337,548 | 1,121,158 | 24,468,633 | 5,222,298 | 23,261,650 | 10,676,585 | 92,794,285 | 134 |
| National Population in Counties with $PM_{2.5}$ Monitors | 13,125,794 | 4,801,690 | 5,441,329 | 2,652,011 | 57,366,628 | 12,290,279 | 52,818,024 | 25,673,306 | 213,344,636 | 670 |

## People at Risk from Year-Round Particle Pollution (Annual $PM_{2.5}$)

| In Counties where the Grades were: | Chronic Diseases: Adult Asthma | Pediatric Asthma | Chronic Bronchitis | Emphysema | CV Disease | Diabetes | Age Groups: Under 18 | Over 65 | Total Population | Number of Counties |
|---|---|---|---|---|---|---|---|---|---|---|
| Pass | 8,900,962 | 3,222,756 | 3,725,035 | 1,827,567 | 39,389,136 | 8,451,886 | 35,450,023 | 17,817,941 | 144,968,781 | 466 |
| Fail | 2,846,454 | 1,099,884 | 1,168,859 | 555,959 | 12,190,347 | 2,596,401 | 12,098,580 | 5,261,998 | 47,024,001 | 61 |
| National Population in Counties with $PM_{2.5}$ Monitors | 13,125,798 | 4,801,679 | 5,441,335 | 2,652,005 | 57,366,628 | 12,290,287 | 52,818,024 | 25,673,306 | 213,344,636 | 670 |

## People at Risk from Ozone

| | | Report Year | Chronic Diseases: Adult Asthma | Pediatric Asthma | Chronic Bronchitis | Emphysema | Age Groups: Under 18 | Over 65 | Total Population | Number of Counties |
|---|---|---|---|---|---|---|---|---|---|---|
| Grade A | (0.0) | 2009 | 360,716 | 122,369 | 160,463 | 80,466 | 1,346,061 | 814,035 | 6,017,415 | 40 |
| Grade B | (0.3-0.9) | 2009 | 406,226 | 152,226 | 163,920 | 80,278 | 1,674,464 | 797,027 | 6,509,310 | 37 |
| Grade C | (1.0-2.0) | 2009 | 872,014 | 328,182 | 400,503 | 205,192 | 3,609,961 | 2,151,902 | 15,156,293 | 81 |
| Grade D | (2.1-3.2) | 2009 | 413,060 | 149,032 | 194,139 | 100,545 | 1,639,337 | 1,058,261 | 7,198,179 | 43 |
| Grade F | (3.3+) | 2009 | 10,875,304 | 3,996,013 | 4,439,068 | 2,145,510 | 43,955,790 | 20,441,256 | 175,378,757 | 485 |
| National Population in Counties with Ozone Monitors | | 2009 | 14,025,715 | 5,110,896 | 5,802,213 | 2,831,715 | 56,219,254 | 27,444,372 | 227,268,090 | 821 |

Note: The State of the Air 2009 covers the period 2005-2007. The Appendix provides a full discussion of the methodology.

## People at Risk In 25 U.S. Cities Most Polluted by Short-term Particle Pollution (24-hour $PM_{2.5}$)

| 2009 Rank[1] | Metropolitan Statistical Areas | Total Population[2] | Under 18[3] | 65 and Over[3] | Pediatric Asthma[4,10] | Adult Asthma[5,10] | Chronic Bronchitis[6,10] | Emphysema[7,10] | CV Disease[8,10] | Diabetes[9,10] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pittsburgh-New Castle, PA | 2,446,703 | 507,784 | 419,558 | 46,163 | 177,396 | 69,954 | 38,243 | 777,887 | 171,074 |
| 2 | Fresno-Madera, CA | 1,045,861 | 309,724 | 102,399 | 28,157 | 55,216 | 23,939 | 10,840 | 244,484 | 51,388 |
| 3 | Bakersfield, CA | 790,710 | 237,021 | 69,710 | 21,548 | 41,503 | 17,709 | 7,723 | 17,798 | 37,077 |
| 4 | Los Angeles-Long Beach-Riverside, CA | 17,755,322 | 4,737,865 | 1,849,322 | 430,719 | 977,873 | 428,819 | 198,167 | 4,416,799 | 933,827 |
| 5 | Birmingham-Hoover-Cullman, AL | 1,188,764 | 289,712 | 153,673 | 26,338 | 78,595 | 30,989 | 15,555 | 331,055 | 71,441 |
| 6 | Salt Lake City-Ogden-Clearfield, UT | 1,799,959 | 541,481 | 166,355 | 49,226 | 101,790 | 40,759 | 18,220 | 413,907 | 86,780 |
| 7 | Sacramento--Arden-Arcade--Yuba City, CA-NV | 2,397,691 | 591,294 | 284,980 | 53,755 | 135,649 | 60,679 | 29,190 | 636,141 | 135,775 |
| 8 | Logan, UT-ID | 121,090 | 38,091 | 9,654 | 3,463 | 6,707 | 2,549 | 1,032 | 24,876 | 5,073 |
| 9 | Chicago-Naperville-Michigan City, IL-IN-WI | 9,745,165 | 2,514,619 | 1,067,601 | 228,604 | 601,160 | 242,586 | 115,412 | 2,529,721 | 539,206 |
| 9 | Detroit-Warren-Flint, MI | 5,405,918 | 1,344,926 | 645,820 | 122,268 | 380,857 | 139,501 | 69,019 | 1,479,974 | 318,683 |
| 11 | Indianapolis-Anderson-Columbus, IN | 2,014,267 | 529,001 | 225,995 | 48,091 | 130,321 | 50,201 | 24,207 | 526,608 | 112,621 |
| 12 | Visalia-Porterville, CA | 421,553 | 134,499 | 39,663 | 12,227 | 21,524 | 9,305 | 4,190 | 9,481 | 19,898 |
| 13 | Eugene-Springfield, OR | 343,591 | 69,463 | 48,187 | 6,315 | 26,418 | 9,465 | 4,780 | 10,141 | 21,907 |
| 14 | Washington-Baltimore-Northern Virginia, DC-MD-VA-WV | 8,241,912 | 2,006,709 | 872,143 | 182,430 | 513,892 | 209,541 | 99,161 | 2,179,127 | 464,484 |
| 15 | Hanford-Corcoran, CA | 148,875 | 40,640 | 11,124 | 3,695 | 8,084 | 3,301 | 1,299 | 3,184 | 6,458 |
| 16 | New York-Newark-Bridgeport, NY-NJ-CT-PA | 21,961,994 | 5,173,130 | 2,824,292 | 470,288 | 1,447,924 | 574,690 | 285,495 | 6,111,329 | 1,315,110 |
| 17 | Modesto, CA | 511,263 | 147,066 | 52,226 | 13,370 | 27,347 | 11,976 | 5,529 | 12,332 | 26,056 |
| 18 | Merced, CA | 245,514 | 77,534 | 23,405 | 7,049 | 12,588 | 5,429 | 2,438 | 5,527 | 11,585 |
| 19 | Louisville-Jefferson County-Elizabethtown-Scottsburg, KY-IN | 1,332,214 | 324,395 | 165,296 | 29,490 | 89,830 | 34,720 | 17,313 | 369,687 | 79,721 |
| 20 | Philadelphia-Camden-Vineland, PA-NJ-DE-MD | 6,385,461 | 1,539,070 | 834,464 | 139,917 | 435,170 | 167,232 | 84,143 | 1,788,499 | 386,150 |
| 20 | San Jose-San Francisco-Oakland, CA | 493,306 | 169,546 | 31,347 | 15,413 | 25,908 | 9,646 | 3,611 | 91,284 | 18,255 |
| 22 | Provo-Orem, UT | 7,264,887 | 1,639,367 | 861,264 | 149,035 | 423,837 | 190,849 | 92,528 | 2,006,694 | 429,823 |
| 23 | San Diego-Carlsbad-San Marcos, CA | 2,974,859 | 741,404 | 330,820 | 67,401 | 167,704 | 73,751 | 34,396 | 76,282 | 161,535 |
| 24 | Harrisburg-Carlisle-Lebanon, PA | 656,781 | 146,271 | 96,234 | 13,298 | 47,490 | 17,925 | 9,323 | 194,665 | 42,344 |
| 25 | St. Louis-St. Charles-Farmington, MO-IL | 2,890,593 | 703,793 | 372,199 | 63,982 | 184,766 | 75,542 | 37,992 | 807,635 | 174,421 |

Notes:
(1) Cities are ranked using the highest weighted average for any county within that metropolitan statistical area.
(2) **Total Population** represents the at-risk populations for all counties within the respective Combined Statistical Area or Metropolitan Statistical Area.
(3) Those **18 & under** and **65 & over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
(4) **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2007 based on national rates (NHIS) applied to county population estimates (U.S. Census).
(5) **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma during 2007 based on state rates (BRFSS) applied to county population estimates (U.S. Census).
(6) **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2007, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(7) **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(8) **CV disease** estimates are based on National Heart Lung and Blood Institute (NHLBI) estimates of cardiovascular disease applied to county population estimates (U.S. Census).
(9) **Diabetes** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(10) Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.

## People at Risk In 25 U.S. Cities Most Polluted by Year-Round Particle Pollution (Annual $PM_{2.5}$)

| 2009 Rank[1] | Metropolitan Statistical Areas | Total Population[2] | Under 18[3] | 65 and Over[3] | Pediatric Asthma[4,10] | Adult Asthma[5,10] | Chronic Bronchitis[6,10] | Emphysema[7,10] | CV Disease[8,10] | Diabetes[9,10] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Bakersfield, CA | 790,710 | 237,021 | 69,710 | 21,548 | 41,503 | 17,709 | 7,723 | 17,798 | 37,077 |
| 2 | Pittsburgh-New Castle, PA | 2,446,703 | 507,784 | 419,558 | 46,163 | 177,396 | 69,954 | 38,243 | 777,887 | 171,074 |
| 3 | Los Angeles-Long Beach-Riverside, CA | 17,755,322 | 4,737,865 | 1,849,322 | 430,719 | 977,873 | 428,819 | 198,167 | 4,416,799 | 933,827 |
| 4 | Visalia-Porterville, CA | 421,553 | 134,499 | 39,663 | 12,227 | 21,524 | 9,305 | 4,190 | 9,481 | 19,898 |
| 5 | Birmingham-Hoover-Cullman, AL | 1,188,764 | 289,712 | 153,673 | 26,338 | 78,595 | 30,989 | 15,555 | 331,055 | 71,441 |
| 6 | Hanford-Corcoran, CA | 148,875 | 40,640 | 11,124 | 3,695 | 8,084 | 3,301 | 1,299 | 3,184 | 6,458 |
| 7 | Fresno-Madera, CA | 1,045,861 | 309,724 | 102,399 | 28,157 | 55,216 | 23,939 | 10,840 | 244,484 | 51,388 |
| 8 | Cincinnati-Middletown-Wilmington, OH-KY-IN | 2,176,749 | 548,199 | 258,266 | 49,837 | 144,472 | 55,519 | 27,209 | 586,626 | 125,943 |
| 9 | Detroit-Warren-Flint, MI | 5,405,918 | 1,344,926 | 645,820 | 122,268 | 380,857 | 139,501 | 69,019 | 1,479,974 | 318,683 |
| 10 | Cleveland-Akron-Elyria, OH | 2,896,968 | 685,096 | 411,961 | 62,282 | 193,475 | 77,860 | 40,524 | 845,716 | 184,099 |
| 11 | Charleston, WV | 303,950 | 66,486 | 47,045 | 6,044 | 21,312 | 8,505 | 4,551 | 93,571 | 20,506 |
| 11 | Huntington-Ashland, WV-KY-OH | 284,026 | 61,030 | 44,610 | 5,548 | 19,934 | 7,856 | 4,139 | 85,861 | 18,713 |
| 11 | Louisville-Jefferson County-Elizabethtown-Scottsburg, KY-IN | 1,332,214 | 324,395 | 165,296 | 29,490 | 89,830 | 34,720 | 17,313 | 369,687 | 79,721 |
| 14 | Macon-Warner Robins-Fort Valley, GA | 386,534 | 102,065 | 45,073 | 9,278 | 21,597 | 9,673 | 4,727 | 102,072 | 21,892 |
| 14 | St. Louis-St. Charles-Farmington, MO-IL | 2,890,593 | 703,793 | 372,199 | 63,982 | 184,766 | 75,542 | 37,992 | 807,635 | 174,421 |
| 16 | Weirton-Steubenville, WV-OH | 122,580 | 24,215 | 23,297 | 2,201 | 8,616 | 3,623 | 2,050 | 40,970 | 9,079 |
| 17 | Atlanta-Sandy Springs-Gainesville, GA-AL | 5,626,400 | 1,521,556 | 467,243 | 138,325 | 311,600 | 133,797 | 59,199 | 1,351,339 | 283,618 |
| 18 | Indianapolis-Anderson-Columbus, IN | 2,014,267 | 529,001 | 225,995 | 48,091 | 130,321 | 50,201 | 24,207 | 526,608 | 112,621 |
| 18 | Rome, GA | 95,618 | 23,801 | 13,654 | 2,164 | 5,441 | 2,476 | 1,264 | 2,668 | 5,765 |
| 20 | Canton-Massillon, OH | 407,180 | 93,626 | 62,939 | 8,512 | 27,270 | 11,182 | 5,969 | 122,909 | 26,899 |
| 20 | York-Hanover-Gettysburg, PA | 521,828 | 120,265 | 71,421 | 10,933 | 37,560 | 13,972 | 7,131 | 150,396 | 32,584 |
| 22 | Lancaster, PA | 498,465 | 125,753 | 71,955 | 11,432 | 34,753 | 13,026 | 6,767 | 14,143 | 30,724 |
| 22 | New York-Newark-Bridgeport, NY-NJ-CT-PA | 21,961,994 | 5,173,130 | 2,824,292 | 470,288 | 1,447,924 | 574,690 | 285,495 | 6,111,329 | 1,315,110 |
| 24 | Hagerstown-Martinsburg, MD-WV | 261,198 | 62,892 | 33,213 | 5,718 | 16,957 | 6,731 | 3,309 | 71,251 | 15,281 |
| 24 | Houston-Baytown-Huntsville, TX | 5,729,027 | 1,612,940 | 469,062 | 146,633 | 337,275 | 133,968 | 59,157 | 1,351,987 | 283,571 |

Notes:
(1) Cities are ranked using the highest design value for any county within that metropolitan statistical area.
(2) **Total Population** represents the at-risk populations for all counties within the respective Combined Statistical Area or Metropolitan Statistical Area.
(3) Those **18 & under** and **65 & over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
(4) **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2007 based on national rates (NHIS) applied to county population estimates (U.S. Census).
(5) **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma during 2007 based on state rates (BRFSS) applied to county population estimates (U.S. Census).
(6) **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2007, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(7) **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(8) **CV disease** estimates are based on National Heart Lung and Blood Institute (NHLBI) estimates of cardiovascular disease applied to county population estimates (U.S. Census).
(9) **Diabetes** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(10) Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.

## People at Risk In 25 Most Ozone-Polluted Cities

| 2009 Rank[1] | Metropolitan Statistical Areas | Total Population[2] | Under 18[3] | 65 and Over[3] | Pediatric Asthma[4,8] | Adult Asthma[5,8] | Chronic Bronchitis[6,8] | Emphysema[7,8] |
|---|---|---|---|---|---|---|---|---|
| 1 | Los Angeles-Long Beach-Riverside, CA | 17,755,322 | 4,737,865 | 1,849,322 | 430,719 | 977,873 | 428,819 | 198,167 |
| 2 | Bakersfield, CA | 790,710 | 237,021 | 69,710 | 21,548 | 41,503 | 17,709 | 7,723 |
| 3 | Visalia-Porterville, CA | 421,553 | 134,499 | 39,663 | 12,227 | 21,524 | 9,305 | 4,190 |
| 4 | Fresno-Madera, CA | 1,045,861 | 309,724 | 102,399 | 28,157 | 55,216 | 23,939 | 10,840 |
| 5 | Houston-Baytown-Huntsville, TX | 5,729,027 | 1,612,940 | 469,062 | 146,633 | 337,275 | 133,968 | 59,157 |
| 6 | Sacramento--Arden-Arcade--Yuba City, CA-NV | 2,397,691 | 591,294 | 284,980 | 53,755 | 135,649 | 60,679 | 29,190 |
| 7 | Dallas-Fort Worth, TX | 6,498,410 | 1,798,184 | 559,482 | 163,473 | 385,101 | 152,456 | 67,352 |
| 8 | Charlotte-Gastonia-Salisbury, NC-SC | 2,277,074 | 585,184 | 238,952 | 53,199 | 131,101 | 56,689 | 26,761 |
| 9 | Phoenix-Mesa-Scottsdale, AZ | 4,179,427 | 1,140,354 | 472,541 | 103,670 | 260,150 | 101,155 | 48,005 |
| 10 | El Centro, CA | 161,867 | 47,423 | 16,913 | 4,311 | 8,571 | 3,713 | 1,691 |
| 11 | Hanford-Corcoran, CA | 148,875 | 40,640 | 11,124 | 3,695 | 8,084 | 3,301 | 1,299 |
| 12 | Las Vegas-Paradise-Pahrump, NV | 1,880,449 | 494,380 | 199,688 | 44,944 | 94,854 | 46,154 | 21,674 |
| 13 | San Diego-Carlsbad-San Marcos, CA | 2,974,859 | 741,404 | 330,820 | 67,401 | 167,704 | 73,751 | 34,396 |
| 14 | Washington-Baltimore-Northern Virginia, DC-MD-VA-WV | 8,241,912 | 2,006,709 | 872,143 | 182,430 | 513,892 | 209,541 | 99,161 |
| 15 | Cincinnati-Middletown-Wilmington, OH-KY-IN | 2,176,749 | 548,199 | 258,266 | 49,837 | 144,472 | 55,519 | 27,209 |
| 16 | Philadelphia-Camden-Vineland, PA-NJ-DE-MD | 6,385,461 | 1,539,070 | 834,464 | 139,917 | 435,170 | 167,232 | 84,143 |
| 17 | St. Louis-St. Charles-Farmington, MO-IL | 2,890,593 | 703,793 | 372,199 | 63,982 | 184,766 | 75,542 | 37,992 |
| 17 | New York-Newark-Bridgeport, NY-NJ-CT-PA | 21,961,994 | 5,173,130 | 2,824,292 | 470,288 | 1,447,924 | 574,690 | 285,495 |
| 19 | Knoxville-Sevierville-La Follette, TN | 1,029,155 | 227,580 | 148,377 | 20,689 | 69,468 | 27,885 | 14,317 |
| 20 | Birmingham-Hoover-Cullman, AL | 1,188,764 | 289,712 | 153,673 | 26,338 | 78,595 | 30,989 | 15,555 |
| 21 | Baton Rouge-Pierre Part, LA | 793,028 | 202,254 | 81,268 | 18,387 | 37,014 | 19,552 | 9,051 |
| 22 | Kansas City-Overland Park-Kansas City, MO-KS | 2,053,928 | 530,224 | 233,084 | 48,203 | 128,867 | 51,779 | 25,151 |
| 23 | Atlanta-Sandy Springs-Gainesville, GA-AL | 5,626,400 | 1,521,556 | 467,243 | 138,325 | 311,600 | 133,797 | 59,199 |
| 24 | Merced, CA | 245,514 | 77,534 | 23,405 | 7,049 | 12,588 | 5,429 | 2,438 |
| 25 | Memphis, TN-MS-AR | 1,280,533 | 352,214 | 130,189 | 32,020 | 76,368 | 31,237 | 14,812 |

Notes:
(1) Cities are ranked using the highest weighted average for any county within that metropolitan statistical area.
(2) **Total Population** represents the at-risk populations for all counties within the respective Combined Statistical Area or Metropolitan Statistical Area.
(3) Those **18 & under** and **65 & over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
(4) **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2007 based on national rates (NHIS) applied to county population estimates (U.S. Census).
(5) **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma during 2007 based on state rates (BRFSS) applied to county population estimates (U.S. Census).
(6) **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2007, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(7) **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(8) Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.

# People at Risk in 25 Counties Most Polluted by Short-term Particle Pollution (24-hour $PM_{2.5}$)

| | | | | At-Risk Groups | | | | | | | | High $PM_{2.5}$ Days in Unhealthy Ranges, 2005-2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 Rank[1] | County | ST | Total Population[2] | Under 18[3] | 65 and Over[3] | Pediatric Asthma[4,10] | Adult Asthma[5,10] | Chronic Bronchitis[6,10] | Emphysema[7,10] | CV Disease[8] | Diabetes[9] | Weighted Avg.[11] | Grade[12] |
| 1 | Allegheny | PA | 1,219,210 | 253,521 | 205,511 | 23,048 | 88,567 | 34,705 | 18,848 | 38,471 | 84,479 | 55.5 | F |
| 2 | Fresno | CA | 899,348 | 268,840 | 87,342 | 24,440 | 47,296 | 20,503 | 9,278 | 20,933 | 43,995 | 51.0 | F |
| 3 | Kern | CA | 790,710 | 237,021 | 69,710 | 21,548 | 41,503 | 17,709 | 7,723 | 17,798 | 37,077 | 47.5 | F |
| 4 | Riverside | CA | 2,073,571 | 582,711 | 233,367 | 52,974 | 111,620 | 48,630 | 22,507 | 50,171 | 105,771 | 39.0 | F |
| 5 | Jefferson | AL | 658,779 | 158,741 | 88,364 | 14,431 | 43,762 | 17,371 | 8,841 | 18,674 | 40,432 | 36.0 | F |
| 6 | Los Angeles | CA | 9,878,554 | 2,582,550 | 1,030,100 | 234,780 | 548,194 | 240,506 | 111,145 | 247,705 | 523,822 | 28.7 | F |
| 7 | Salt Lake | UT | 1,009,518 | 297,294 | 85,972 | 27,027 | 57,606 | 22,947 | 10,058 | 23,101 | 48,262 | 24.5 | F |
| 8 | Sacramento | CA | 1,386,667 | 362,861 | 154,056 | 32,988 | 76,932 | 34,049 | 16,063 | 35,390 | 75,181 | 23.5 | F |
| 9 | Cache | UT | 108,887 | 34,015 | 8,208 | 3,092 | 6,003 | 2,272 | 894 | 2,192 | 4,438 | 17.5 | F |
| 10 | Cook | IL | 5,285,107 | 1,319,728 | 618,729 | 119,977 | 326,958 | 133,325 | 64,106 | 139,729 | 298,297 | 14.3 | F |
| 10 | Wayne | MI | 1,985,101 | 529,335 | 234,076 | 48,122 | 136,555 | 49,947 | 24,716 | 53,000 | 114,087 | 14.3 | F |
| 12 | Marion | IN | 876,804 | 234,486 | 94,581 | 21,317 | 56,193 | 21,520 | 10,217 | 22,421 | 47,762 | 13.7 | F |
| 13 | Tulare | CA | 421,553 | 134,499 | 39,663 | 12,227 | 21,524 | 9,305 | 4,190 | 9,481 | 19,898 | 13.5 | F |
| 14 | Lane | OR | 343,591 | 69,463 | 48,187 | 6,315 | 26,418 | 9,465 | 4,780 | 10,141 | 21,907 | 13.2 | F |
| 15 | San Bernardino | CA | 2,007,800 | 597,417 | 165,379 | 54,311 | 105,834 | 45,095 | 19,471 | 45,116 | 93,887 | 13.0 | F |
| 15 | Baltimore City | MD | 637,455 | 155,155 | 75,658 | 14,105 | 39,656 | 16,254 | 7,844 | 17,062 | 36,462 | 13.0 | F |
| 17 | Kings | CA | 148,875 | 40,640 | 11,124 | 3,695 | 8,084 | 3,301 | 1,299 | 3,184 | 6,458 | 12.8 | F |
| 18 | Orange | CA | 2,997,033 | 766,234 | 331,797 | 69,658 | 167,815 | 74,630 | 35,414 | 77,748 | 165,540 | 12.2 | F |
| 19 | Union | NJ | 524,658 | 130,760 | 65,865 | 11,887 | 32,748 | 13,571 | 6,786 | 14,471 | 31,213 | 12.0 | F |
| 20 | Stanislaus | CA | 511,263 | 147,066 | 52,226 | 13,370 | 27,347 | 11,976 | 5,529 | 12,332 | 26,056 | 11.7 | F |
| 20 | Washington | PA | 205,553 | 42,168 | 35,282 | 3,833 | 14,952 | 5,892 | 3,219 | 6,550 | 14,402 | 11.7 | F |
| 22 | Merced | CA | 245,514 | 77,534 | 23,405 | 7,049 | 12,588 | 5,429 | 2,438 | 5,527 | 11,585 | 11.5 | F |
| 23 | Jefferson | KY | 709,264 | 170,787 | 94,963 | 15,526 | 48,204 | 18,771 | 9,587 | 20,210 | 43,812 | 11.3 | F |
| 24 | Philadelphia | PA | 1,449,634 | 363,648 | 186,573 | 33,059 | 103,046 | 36,802 | 18,128 | 39,005 | 83,636 | 11.0 | F |
| 24 | Santa Clara | CA | 1,748,976 | 419,320 | 186,665 | 38,120 | 100,048 | 44,224 | 20,662 | 45,750 | 97,105 | 11.0 | F |

Notes:
(1) Counties are ranked by weighted average. See note 11 below.
(2) **Total Population** represents the at-risk populations in counties with $PM_{2.5}$ monitors.
(3) Those **18 & under** and **65 & over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
(4) **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2007 based on national rates (NHIS) applied to county population estimates (U.S. Census).
(5) **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma during 2007 based on state rates (BRFSS) applied to county population estimates (U.S. Census).
(6) **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2007, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(7) **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(8) **CV disease** estimates are based on National Heart Lung and Blood Institute (NHLBI) estimates of cardiovascular disease applied to county population estimates (U.S. Census).
(9) **Diabetes** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(10) Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.
(11) The **Weighted Average** was derived by counting the number of days in each unhealthful range (orange, red, purple, maroon) in each year (2005-2007), multiplying the total in each range by the assigned standard weights (i.e., 1 for orange, 1.5 for red, 2.0 for purple, 2.5 for maroon), and calculating the average.
(12) Grade is assigned by weighted average as follows: A=0.0, B=0.3-0.9, C=1.0-2.0, D=2.1-3.2, F=3.3+.

## People at Risk In 25 Counties Most Polluted by Long-term Particle Pollution (Annual $PM_{2.5}$)

| | | | | At-Risk Groups | | | | | | | | $PM_{2.5}$ Annual 2005–2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 Rank[1] | County | ST | Total Population[2] | Under 18[3] | 65 and Over[3] | Pediatric Asthma[4,10] | Adult Asthma[5,10] | Chronic Bronchitis[6,10] | Emphysema[7,10] | CV Disease[8] | Diabetes[9] | Design Value[11] | Pass/ Fail[12] |
| 1 | Kern | CA | 790,710 | 237,021 | 69,710 | 21,548 | 41,503 | 17,709 | 7,723 | 17,798 | 37,077 | 20.3 | FAIL |
| 2 | Allegheny | PA | 1,219,210 | 253,521 | 205,511 | 23,048 | 88,567 | 34,705 | 18,848 | 38,471 | 84,479 | 19.8 | FAIL |
| 3 | Riverside | CA | 2,073,571 | 582,711 | 233,367 | 52,974 | 111,620 | 48,630 | 22,507 | 50,171 | 105,771 | 19.6 | FAIL |
| 4 | Tulare | CA | 421,553 | 134,499 | 39,663 | 12,227 | 21,524 | 9,305 | 4,190 | 9,481 | 19,898 | 19.3 | FAIL |
| 5 | Jefferson | AL | 658,779 | 158,741 | 88,364 | 14,431 | 43,762 | 17,371 | 8,841 | 18,674 | 40,432 | 18.9 | FAIL |
| 6 | San Bernardino | CA | 2,007,800 | 597,417 | 165,379 | 54,311 | 105,834 | 45,095 | 19,471 | 45,116 | 93,887 | 18.5 | FAIL |
| 7 | Kings | CA | 148,875 | 40,640 | 11,124 | 3,695 | 8,084 | 3,301 | 1,299 | 3,184 | 6,458 | 17.6 | FAIL |
| 8 | Fresno | CA | 899,348 | 268,840 | 87,342 | 24,440 | 47,296 | 20,503 | 9,278 | 20,933 | 43,995 | 17.4 | FAIL |
| 9 | Hamilton | OH | 842,369 | 205,266 | 112,942 | 18,661 | 56,046 | 22,139 | 11,277 | 23,810 | 51,559 | 17.3 | FAIL |
| 10 | Wayne | MI | 1,985,101 | 529,335 | 234,076 | 48,122 | 136,555 | 49,947 | 24,716 | 53,000 | 114,087 | 17.2 | FAIL |
| 11 | Los Angeles | CA | 9,878,554 | 2,582,550 | 1,030,100 | 234,780 | 548,194 | 240,506 | 111,145 | 247,705 | 523,822 | 17.1 | FAIL |
| 12 | Cuyahoga | OH | 1,295,958 | 307,509 | 195,936 | 27,956 | 86,090 | 35,135 | 18,656 | 38,527 | 84,217 | 16.8 | FAIL |
| 13 | Kanawha | WV | 191,306 | 40,821 | 31,633 | 3,711 | 13,510 | 5,448 | 2,974 | 6,052 | 13,319 | 16.6 | FAIL |
| 13 | Cabell | WV | 94,435 | 19,407 | 15,334 | 1,764 | 6,738 | 2,621 | 1,373 | 2,858 | 6,213 | 16.6 | FAIL |
| 13 | Clark | IN | 105,035 | 25,356 | 13,219 | 2,305 | 6,989 | 2,731 | 1,356 | 2,903 | 6,249 | 16.6 | FAIL |
| 16 | Bibb | GA | 154,709 | 41,945 | 19,842 | 3,813 | 8,563 | 3,892 | 1,966 | 4,170 | 9,007 | 16.5 | FAIL |
| 16 | Beaver | PA | 173,074 | 35,777 | 31,630 | 3,252 | 12,443 | 5,029 | 2,818 | 5,659 | 12,516 | 16.5 | FAIL |
| 16 | Madison | IL | 267,347 | 62,322 | 37,242 | 5,666 | 16,898 | 7,071 | 3,586 | 7,593 | 16,402 | 16.5 | FAIL |
| 19 | Brooke | WV | 23,661 | 4,482 | 4,556 | 407 | 1,723 | 707 | 401 | 800 | 1,774 | 16.4 | FAIL |
| 20 | Clayton | GA | 272,217 | 81,802 | 18,323 | 7,437 | 14,415 | 6,054 | 2,531 | 5,972 | 12,365 | 16.2 | FAIL |
| 21 | Marion | IN | 876,804 | 234,486 | 94,581 | 21,317 | 56,193 | 21,520 | 10,217 | 22,421 | 47,762 | 16.1 | FAIL |
| 21 | Floyd | GA | 95,618 | 23,801 | 13,654 | 2,164 | 5,441 | 2,476 | 1,264 | 2,668 | 5,765 | 16.1 | FAIL |
| 21 | Jefferson | OH | 68,730 | 13,635 | 13,066 | 1,240 | 4,729 | 2,023 | 1,141 | 2,284 | 5,057 | 16.1 | FAIL |
| 24 | Cobb | GA | 691,905 | 181,550 | 56,954 | 16,505 | 38,794 | 16,826 | 7,548 | 17,086 | 36,034 | 16 | FAIL |
| 24 | Stark | OH | 378,664 | 87,280 | 58,696 | 7,935 | 25,341 | 10,392 | 5,551 | 11,427 | 25,010 | 16 | FAIL |
| 24 | York | PA | 421,049 | 97,661 | 57,226 | 8,878 | 30,222 | 11,270 | 5,758 | 12,136 | 26,307 | 16 | FAIL |

Notes:
(1) Counties are ranked by design value. See note 11 below.
(2) **Total Population** represents the at-risk populations in counties with $PM_{2.5}$ monitors.
(3) Those **18 & under** and **65 & over** are vulnerable to $PM_{2.5}$ and are, therefore, included. They should not be used as population denominators for disease estimates.
(4) **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2007 based on national rates (NHIS) applied to county population estimates (U.S. Census).
(5) **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma during 2007 based on state rates (BRFSS) applied to county population estimates (U.S. Census).
(6) **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2007, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(7) **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(8) **CV disease** estimates are based on National Heart Lung and Blood Institute (NHLBI) estimates of cardiovascular disease applied to county population estimates (U.S. Census).
(9) **Diabetes** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(10) Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.
(11) The **Design Value** is the calculated concentration of a pollutant based on the form of the National Ambient Air Quality Standard, and is used by EPA to determine whether the air quality in a county meets the standard. The source for the Design Values is EPA, Office of Air Quality Planning & Standards, available at http://www.epa.gov/air/airtrends/values.html, downloaded September 12, 2008.
(12) **Grades** are based on EPA's determination of meeting or failure to meet the NAAQS for annual $PM_{2.5}$ levels during 2005-2007. Counties meeting the NAAQS received grades of Pass; counties not meeting the NAAQS received grades of Fail.

## People at Risk in 25 Most Ozone-Polluted Counties

| 2009 Rank[1] | County | ST | Total Population[2] | At-Risk Groups: Under 18[3] | 65 and Over[3] | Pediatric Asthma[4,8] | Adult Asthma[5,8] | Chronic Bronchitis[6,8] | Emphysema[7,8] | High Ozone Days in Unhealthy Ranges, 2005-2007: Weighted Avg.[9] | Grade[10] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | San Bernardino | CA | 2,007,800 | 597,417 | 165,379 | 54,311 | 105,834 | 45,095 | 19,471 | 138.8 | F |
| 2 | Riverside | CA | 2,073,571 | 582,711 | 233,367 | 52,974 | 111,620 | 48,630 | 22,507 | 129.5 | F |
| 3 | Kern | CA | 790,710 | 237,021 | 69,710 | 21,548 | 41,503 | 17,709 | 7,723 | 110.5 | F |
| 4 | Tulare | CA | 421,553 | 134,499 | 39,663 | 12,227 | 21,524 | 9,305 | 4,190 | 101.2 | F |
| 5 | Los Angeles | CA | 9,878,554 | 2,582,550 | 1,030,100 | 234,780 | 548,194 | 240,506 | 111,145 | 96.5 | F |
| 6 | Fresno | CA | 899,348 | 268,840 | 87,342 | 24,440 | 47,296 | 20,503 | 9,278 | 62.7 | F |
| 7 | Harris | TX | 3,935,855 | 1,132,408 | 306,779 | 102,947 | 229,730 | 90,690 | 39,502 | 53.7 | F |
| 8 | El Dorado | CA | 175,689 | 38,421 | 19,893 | 3,493 | 10,384 | 4,750 | 2,341 | 49.7 | F |
| 9 | Nevada | CA | 97,027 | 17,765 | 17,087 | 1,615 | 5,994 | 2,899 | 1,605 | 49.5 | F |
| 10 | Placer | CA | 332,920 | 73,398 | 49,152 | 6,673 | 19,506 | 8,942 | 4,559 | 43.3 | F |
| 11 | Tarrant | TX | 1,717,435 | 483,789 | 144,105 | 43,981 | 101,080 | 40,063 | 17,688 | 38.8 | F |
| 12 | Sacramento | CA | 1,386,667 | 362,861 | 154,056 | 32,988 | 76,932 | 34,049 | 16,063 | 37.5 | F |
| 13 | Rowan | NC | 137,383 | 32,515 | 19,373 | 2,956 | 8,198 | 3,648 | 1,872 | 37.3 | F |
| 14 | Maricopa | AZ | 3,880,181 | 1,063,282 | 432,375 | 96,663 | 241,050 | 93,704 | 44,350 | 36.8 | F |
| 15 | Ventura | CA | 798,364 | 208,953 | 88,679 | 18,996 | 44,410 | 19,958 | 9,630 | 34.2 | F |
| 16 | Imperial | CA | 161,867 | 47,423 | 16,913 | 4,311 | 8,571 | 3,713 | 1,691 | 32.8 | F |
| 17 | Kings | CA | 148,875 | 40,640 | 11,124 | 3,695 | 8,084 | 3,301 | 1,299 | 32.5 | F |
| 18 | Clark | NV | 1,836,333 | 485,273 | 190,174 | 44,116 | 92,418 | 44,862 | 20,923 | 30.5 | F |
| 19 | Dallas | TX | 2,366,511 | 667,478 | 199,401 | 60,680 | 139,207 | 54,747 | 23,913 | 29.8 | F |
| 20 | San Diego | CA | 2,974,859 | 741,404 | 330,820 | 67,401 | 167,704 | 73,751 | 34,396 | 29.5 | F |
| 21 | Mecklenburg | NC | 867,067 | 230,633 | 70,952 | 20,967 | 49,470 | 20,719 | 9,128 | 29.3 | F |
| 22 | Denton | TX | 612,357 | 169,092 | 34,308 | 15,372 | 36,340 | 13,780 | 5,429 | 29.0 | F |
| 23 | Fairfax | VA | 1,010,241 | 245,455 | 96,133 | 22,314 | 61,474 | 26,260 | 12,598 | 28.8 | F |
| 24 | Hamilton | OH | 842,369 | 205,266 | 112,942 | 18,661 | 56,046 | 22,139 | 11,277 | 28.5 | F |
| 25 | Camden | NJ | 513,769 | 128,429 | 62,967 | 11,675 | 32,060 | 13,199 | 6,534 | 27.3 | F |
| 25 | Mariposa | CA | 18,036 | 3,162 | 3,280 | 287 | 1,121 | 534 | 292 | 27.3 | F |

Notes:
(1) Counties are ranked by weighted average. See note 10 below.
(2) **Total Population** represents the at-risk populations in counties with ozone monitors.
(3) Those **18 & under** and **65 & over** are vulnerable to ozone and are, therefore, included. They should not be used as population denominators for disease estimates.
(4) **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2007 based on national rates (NHIS) applied to county population estimates (U.S. Census).
(5) **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma during 2007 based on state rates (BRFSS) applied to county population estimates (U.S. Census).
(6) **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed in 2007, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(7) **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime, based on national rates (NHIS) applied to county population estimates (U.S. Census).
(8) Adding across rows does not produce valid estimates, e.g., summing pediatric and adult asthma and/or emphysema and chronic bronchitis.
(9) The **Weighted Average** was derived by counting the number of days in each unhealthful range (orange, red, purple) in each year (2005-2007), multiplying the total in each range by the assigned standard weights (i.e., 1 for orange, 1.5 for red, 2.0 for purple), and calculating the average.
(10) **Grade** is assigned by weighted average as follows: A=0.0, B=0.3-0.9, C=1.0-2.0, D=2.1-3.2, F=3.3+.

## Cleanest U.S. Cities for Short-term Particle Pollution (24-hour $PM_{2.5}$)[1]

| Metropolitan Statistical Area | Population |
|---|---|
| Alexandria, LA | 149,837 |
| Amarillo, TX | 242,240 |
| Austin-Round Rock, TX | 1,598,161 |
| Bismarck, ND | 103,242 |
| Brownsville-Harlingen-Raymondville, TX | 407,723 |
| Cheyenne, WY | 86,353 |
| Colorado Springs, CO | 609,096 |
| Corpus Christi-Kingsville, TX | 414,376 |
| Fargo-Wahpeton, ND-MN | 215,333 |
| Farmington, NM | 122,427 |
| Fort Collins-Loveland, CO | 287,574 |
| Grand Junction, CO | 139,082 |
| Longview-Marshall, TX | 267,115 |
| Midland-Odessa, TX | 255,978 |
| Oklahoma City-Shawnee, OK | 1,262,027 |
| Portland-Lewiston-South Portland, ME | 619,917 |
| Pueblo, CO | 154,538 |
| Redding, CA | 179,427 |
| Salinas, CA | 407,637 |
| San Luis Obispo-Paso Robles, CA | 262,436 |
| Santa Barbara-Santa Maria-Goleta, CA | 404,197 |
| Santa Fe-Espanola, NM | 183,782 |
| Sioux Falls, SD | 227,171 |
| Tucson, AZ | 967,089 |

Notes:
(1) This list represents cities with the lowest levels of short term $PM_{2.5}$ air pollution. Monitors in these cities reported no days with unhealthful $PM_{2.5}$ levels.

## Top 25 Cleanest U.S. Cities for Long-term Particle Pollution (Annual $PM_{2.5}$)[1]

| Rank[2] | Design Value[3] | Metropolitan Statistical Area | Population |
|---|---|---|---|
| 1 | 4.3 | Cheyenne, WY | 86,353 |
| 2 | 4.7 | Santa Fe-Espanola, NM | 183,782 |
| 3 | 4.9 | Honolulu, HI | 905,601 |
| 4 | 5.8 | Great Falls, MT | 81,775 |
| 4 | 5.8 | Farmington, NM | 122,427 |
| 6 | 6.0 | Anchorage, AK | 362,340 |
| 6 | 6.0 | Tucson, AZ | 967,089 |
| 8 | 6.7 | Bismarck, ND | 103,242 |
| 9 | 6.9 | Flagstaff, AZ | 127,450 |
| 9 | 6.9 | Salinas, CA | 407,637 |
| 11 | 7.2 | Redding, CA | 179,427 |
| 12 | 7.4 | Fort Collins-Loveland, CO | 287,574 |
| 13 | 7.6 | Duluth, MN-WI | 274,308 |
| 14 | 7.7 | Colorado Springs, CO | 609,096 |
| 14 | 7.7 | Pueblo, CO | 154,538 |
| 14 | 7.7 | Fargo-Wahpeton, ND-MN | 215,333 |
| 17 | 7.8 | Albuquerque, NM | 835,120 |
| 18 | 7.9 | San Luis Obispo-Paso Robles, CA | 262,436 |
| 19 | 8.0 | Midland-Odessa, TX | 255,978 |
| 20 | 8.2 | Palm Bay-Melbourne-Titusville, FL | 536,161 |
| 20 | 8.2 | Boise City-Nampa, ID | 587,698 |
| 20 | 8.2 | Reno-Sparks-Fernley, NV | 462,751 |
| 23 | 8.3 | Cape Coral-Fort Myers, FL | 590,564 |
| 24 | 8.5 | Port St. Lucie-Sebastian-Vero Beach, FL | 531,958 |
| 25 | 8.6 | Billings, MT | 149,657 |
| 25 | 8.6 | Lincoln, NE | 292,219 |

Notes:
(1) This list represents cities with the lowest levels of annual $PM_{2.5}$ air pollution.
(2) Cities are ranked by using the highest design value for any county within that metropolitan area.
(3) The **Design Value** is the calculated concentration of a pollutant based on the form of the National Ambient Air Quality Standard, and is used by the EPA to determine whether the air quality in a county meets the standard. The source for the Design Values is the EPA, Office of Air Quality Planning & Standards, available at http://www.epa.gov/air/airtrends/values.html, downloaded September 12, 2008.

## Cleanest U.S. Cities for Ozone Air Pollution[1]

| Metropolitan Statistical Area | Population |
|---|---|
| Billings, MT | 149,657 |
| Carson City, NV | 54,939 |
| Coeur d'Alene, ID | 134,442 |
| Fargo-Wahpeton, ND-MN | 215,333 |
| Honolulu, HI | 905,601 |
| Laredo, TX | 233,152 |
| Lincoln, NE | 292,219 |
| Port St. Lucie-Sebastian-Vero Beach, FL | 531,958 |
| Sioux Falls, SD | 227,171 |

Notes:
(1) This list represents cities with no monitored ozone air pollution in unhealthful ranges using the Air Quality Index based on 2008 NAAQS.

## Cleanest Counties for Short-term Particle Pollution (24-hour $PM_{2.5}$)[1]

| COUNTY | ST | MSAs and Respective CSA[2] |
|---|---|---|
| Baldwin | AL | Mobile-Daphne-Fairhope, AL |
| Gila | AZ | |
| Pima | AZ | Tucson, AZ |
| Polk | AR | |
| Calaveras | CA | |
| Humboldt | CA | |
| Lake | CA | |
| Mendocino | CA | |
| Monterey | CA | Salinas, CA |
| Nevada | CA | Sacramento--Arden-Arcade--Yuba City, CA-NV |
| San Luis Obispo | CA | San Luis Obispo-Paso Robles, CA |
| Santa Barbara | CA | Santa Barbara-Santa Maria-Goleta, CA |
| Santa Cruz | CA | San Jose-San Francisco-Oakland, CA |
| Shasta | CA | Redding, CA |
| Boulder | CO | Denver-Aurora-Boulder, CO |
| Elbert | CO | Denver-Aurora-Boulder, CO |
| El Paso | CO | Colorado Springs, CO |
| Larimer | CO | Fort Collins-Loveland, CO |
| Mesa | CO | Grand Junction, CO |
| Pueblo | CO | Pueblo, CO |
| Citrus | FL | |
| Maui | HI | |
| Johnson | KS | Kansas City-Overland Park-Kansas City, MO-KS |
| Linn | KS | Kansas City-Overland Park-Kansas City, MO-KS |
| Rapides Parish | LA | Alexandria, LA |
| St. Tammany Parish | LA | New Orleans-Metairie-Bogalusa, LA |
| Androscoggin | ME | Portland-Lewiston-South Portland, ME |
| Aroostook | ME | |
| Cumberland | ME | Portland-Lewiston-South Portland, ME |
| Hancock | ME | |
| Kennebec | ME | |
| Oxford | ME | |
| Middlesex | MA | Boston-Worcester-Manchester, MA-RI-NH |
| Missaukee | MI | |
| Cass | MO | Kansas City-Overland Park-Kansas City, MO-KS |
| Clay | MO | Kansas City-Overland Park-Kansas City, MO-KS |
| Hall | NE | |
| Scotts Bluff | NE | |
| Cheshire | NH | |
| Grafton | NH | Claremont-Lebanon, NH-VT |

| COUNTY | ST | MSAs and Respective CSA[2] |
|---|---|---|
| Chaves | NM | |
| Grant | NM | |
| Lea | NM | |
| San Juan | NM | Farmington, NM |
| Santa Fe | NM | Santa Fe-Espanola, NM |
| St. Lawrence | NY | |
| Chatham | NC | Raleigh-Durham-Cary, NC |
| Duplin | NC | |
| Haywood | NC | Asheville-Brevard, NC |
| Orange | NC | Raleigh-Durham-Cary, NC |
| Billings | ND | |
| Burleigh | ND | Bismarck, ND |
| Cass | ND | Fargo-Wahpeton, ND-MN |
| Mercer | ND | |
| Oklahoma | OK | Oklahoma City-Shawnee, OK |
| Ottawa | OK | |
| Josephine | OR | |
| Brookings | SD | |
| Brown | SD | |
| Codington | SD | |
| Custer | SD | |
| Jackson | SD | |
| Minnehaha | SD | Sioux Falls, SD |
| Roane | TN | Knoxville-Sevierville-La Follette, TN |
| Brewster | TX | |
| Cameron | TX | Brownsville-Harlingen-Raymondville, TX |
| Ector | TX | Midland-Odessa, TX |
| Ellis | TX | Dallas-Fort Worth, TX |
| Harrison | TX | Longview-Marshall, TX |
| Nueces | TX | Corpus Christi-Kingsville, TX |
| Potter | TX | Amarillo, TX |
| Travis | TX | Austin-Round Rock, TX |
| Ashland | WI | |
| Forest | WI | |
| Taylor | WI | |
| Vilas | WI | |
| Campbell | WY | |
| Converse | WY | |
| Laramie | WY | Cheyenne, WY |

Notes:
(1) This list represents cities with the lowest levels of short term $PM_{2.5}$ air pollution. Monitors in these cities reported no days with unhealthful $PM_{2.5}$ levels.
(2) MSA and CSA are terms used by the U.S. Office of Management and Budget for statistical purposes. MSA stands for Metropolitan Statistical Area. CSA stands for Combined Statistical Area, which may include multiple metropolitan statistical areas and individual counties.

## Top 25 Cleanest Counties for Long-term Particle Pollution (Annual $PM_{2.5}$)[1]

| 2008 Rank[2] | County | ST | Design Value[3] |
|---|---|---|---|
| 1 | Gallatin | MT | 4.3 |
| 1 | Laramie | WY | 4.3 |
| 3 | Lake | CA | 4.5 |
| 3 | Elbert | CO | 4.5 |
| 5 | Maui | HI | 4.7 |
| 5 | Santa Fe | NM | 4.7 |
| 5 | Billings | ND | 4.7 |
| 8 | Honolulu | HI | 4.9 |
| 9 | Jackson | SD | 5.4 |
| 10 | Inyo | CA | 5.5 |
| 10 | Hancock | ME | 5.5 |
| 12 | Custer | SD | 5.6 |
| 13 | Cass | MN | 5.7 |
| 14 | Cascade | MT | 5.8 |
| 14 | San Juan | NM | 5.8 |
| 16 | Mendocino | CA | 5.9 |
| 16 | Essex | NY | 5.9 |
| 18 | Anchorage Municipality | AK | 6.0 |
| 18 | Pima | AZ | 6.0 |
| 18 | Scotts Bluff | NE | 6.0 |
| 21 | Mercer | ND | 6.2 |
| 21 | Ashland | WI | 6.2 |
| 23 | Nevada | CA | 6.4 |
| 24 | Chaves | NM | 6.6 |
| 25 | Mille Lacs | MN | 6.7 |
| 25 | Burleigh | ND | 6.7 |

Notes:
(1) This list represents counties with the lowest levels of monitored long term $PM_{2.5}$ air pollution.
(2) Counties are ranked by design value.
(3) The **Design Value** is the calculated concentration of a pollutant based on the form of the National Ambient Air Quality Standard, and is used by the EPA to determine whether the air quality in a county meets the standard. The source for the Design Values is EPA, Office of Air Quality Planning & Standards, available at http://www.epa.gov/air/airtrends/values.html, downloaded September 12, 2008.

## Cleanest Counties for Ozone Air Pollution[1]

| County | State | |
|---|---|---|
| Yukon-Koyukuk Borough | AK | |
| Lake | CA | |
| Marin | CA | San Jose-San Francisco-Oakland, CA |
| Mendocino | CA | |
| Napa | CA | San Jose-San Francisco-Oakland, CA |
| San Francisco | CA | San Jose-San Francisco-Oakland, CA |
| San Mateo | CA | San Jose-San Francisco-Oakland, CA |
| Santa Cruz | CA | San Jose-San Francisco-Oakland, CA |
| Siskiyou | CA | |
| Sonoma | CA | San Jose-San Francisco-Oakland, CA |
| St. Lucie | FL | Port St. Lucie-Sebastian-Vero Beach, FL |
| Wakulla | FL | Tallahassee, FL |
| Honolulu | HI | Honolulu, HI |
| Butte | ID | |
| Kootenai | ID | Coeur d'Alene, ID |
| Palo Alto | IA | |
| Becker | MN | |
| Carlton | MN | Duluth, MN-WI |
| Lyon | MN | |
| Flathead | MT | |
| Yellowstone | MT | Billings, MT |
| Douglas | NE | Omaha-Council Bluffs-Fremont, NE-IA |
| Lancaster | NE | Lincoln, NE |
| Carson City | NV | Carson City, NV |
| Grant | NM | |
| Billings | ND | |
| Burke | ND | |
| Cass | ND | Fargo-Wahpeton, ND-MN |
| Dunn | ND | |
| Mckenzie | ND | |
| Mercer | ND | |
| Oliver | ND | |
| Columbia | OR | Portland-Vancouver-Beaverton, OR-WA |
| Jackson | SD | |
| Minnehaha | SD | Sioux Falls, SD |
| Brewster | TX | |
| Webb | TX | Laredo, TX |
| San Juan | UT | |
| Clallam | WA | |
| Ashland | WI | |

Note: (1) This list represents counties with no monitored ozone air pollution in unhealthful ranges using the Air Quality Index based on 2008 NAAQS.

# Health Effects of Ozone and Particle Pollution

New evidence shows that the **risks** from ozone and particle pollution **are greater than we thought.**

Ozone and particle pollution are the most widespread air pollutants—and among the most dangerous. Recent research has revealed new insights into how they can harm the body—including taking the lives of infants and altering the lungs of children. All in all, the evidence shows that the risks are greater than we once thought.

Recent findings provide more evidence about the health impacts of these pollutants:

- **Reducing air pollution has extended life expectancy.** Thanks to a drop in particle pollution between 1980 and 2000, life expectancy in 51 U.S. cities increased by 5 months on average, according to a recent analysis.[1]
- **The annual death toll from particle pollution may be even greater than previously understood.** The California Air Resources Board recently tripled the estimate of premature deaths in California from particle pollution to 18,000 annually.[2]
- **Long term exposure to air pollution—especially from highway traffic—harms women, even while in their 50s.** Exposure to particle pollution to appears to increase women's risk of lower lung function, developing chronic obstructive pulmonary disease (COPD), and dying prematurely.[3]
- **Busy highways are high risk zones.** Pollution from heavy highway traffic contributes to higher risks for heart attack, allergies, premature births and the death of infants around the time they are born.[4] New studies looking at the impact of traffic pollution even in cities with generally "cleaner" air expanded the concern over the health effects of chronic exposure to exhaust from heavy traffic.
- **Ozone pollution can shorten life, a conclusion confirmed by the latest scientific review by the National Research Council.[5]** New evidence appeared that some segments of the population may face higher risks from dying prematurely because of ozone pollution, including communities with high unemployment or high public transit use and Blacks.[6]
- **Truck drivers, dockworkers and railroad workers may face higher risk of death from lung cancer and COPD from breathing diesel emissions on the job.** Studies found that these workers who inhaled diesel exhaust on the job were much more likely to die from lung cancer, COPD and heart disease.[7]

Two types of air pollution dominate the problem in the U.S.—ozone and particle pollution. They aren't the only serious air pollutants: others include carbon monoxide, lead, nitrogen dioxide, and sulfur dioxide, as well as hundreds of toxic substances. However, ozone and particle pollution represent the most widespread.

## What Is Particle Pollution?

*Particle pollution* refers to a mix of very tiny solid and liquid particles that are in the air we breathe. But nothing about particle pollution is simple. First of all, the particles themselves are different sizes. Some are one-tenth the diameter of a strand of hair. Many are even tinier; some are so small they can only be seen with an electron microscope. Because of their size, you can't see the individual particles. You can only see the haze that forms when millions of particles blur the spread of sunlight. You may not be able to tell when you're breathing particle pollution. Yet it is so dangerous it can shorten your life.

The differences in size make a big difference in how they affect us. Our natural defenses help us to cough or sneeze larger particles out of our bodies. But those defenses don't keep out smaller particles, those that are smaller than 10 microns (or micrometers) in diameter, or about one-seventh the diameter of a single human hair. These particles get trapped in the lungs, while the smallest are so minute that they can pass through the lungs into the blood stream, just like the essential oxygen molecules we need to survive.

Researchers categorize particles according to size, grouping them as coarse, fine and ultrafine. Coarse particles fall between 2.5 microns and 10 microns in diameter and are called $PM_{10-2.5}$. Fine particles are 2.5 microns in diameter or smaller and are called $PM_{2.5}$. Ultrafine particles are smaller than 0.1 micron in diameter[8] and are small enough to pass through the lung tissue into the blood stream, circulating like the oxygen molecules themselves. No matter what the size, particles can be harmful to your health.

Because particles are formed in so many different ways, they can be composed of many different compounds. Although we often think of particles as solids, not all are. Some are completely liquid; some are solids suspended in liquids. As the U.S. Environmental Protection Agency puts it, particles are really "a mixture of mixtures." [9] The mixtures differ between the eastern and western United States and in different times of the year. For example, the Midwest, Southeast and Northeast states have more sulfate particles than the West in the summer, largely due to the high levels of sulfur dioxide emitted by large, coal-fired power plants. By contrast, nitrate particles from motor vehicle exhaust form a larger proportion of the unhealthful mix in the winter in the Northeast, Southern California, the Northwest, and North Central U.S.[10]

## Where Does Particle Pollution Come From?

Particle pollution is produced through two separate processes—mechanical and chemical.

Mechanical processes break down bigger bits into smaller bits with the material remaining essentially the same, only becoming smaller. Mechanical processes primarily create coarse particles.[11] Dust storms, construction and demolition, mining operations, and agriculture are among the activities that produce coarse particles.

By contrast, chemical processes in the atmosphere create most of the tiniest fine and ultrafine particles. Combustion sources burn fuels and emit gases. These gases can vaporize and then condense to become a particle of the same chemical compound. Or, they can react with other gases or particles in the atmosphere to form a particle of a different chemical compound. Particles formed by this latter process come from the reaction of elemental carbon (soot), heavy metals, sulfur dioxide ($SO_2$), nitrogen oxides ($NO_x$) and volatile organic compounds with water and other compounds in the atmosphere.[12] Burning fossil fuels in factories, power plants, steel mills, smelters, diesel- and gasoline-powered motor vehicles (cars and trucks) and equipment generate a large part of the raw materials for fine particles. So does burning wood in residential fireplaces and wood stoves or burning agricultural fields or forests.

## What Can Particles Do to Your Health?

Particle pollution can be very dangerous to breathe. Breathing particle pollution may trigger illness, hospitalization and premature death, risks showing up in new studies that validate earlier research.[13]

Good news came this year from researchers who looked at the impact of the drop in year-round levels of particle pollution between 1980 and 2000 in 51 US cities. Thanks to reductions in particle pollution people living in these cities had 5 months on average added to their life expectancy.[14] This study adds to the growing research that cleaning up air pollution improves life and health. Other researchers estimated that reductions in air pollution can be expected to produce rapid improvements in public health, with fewer deaths occurring within the first two years.[15]

Researchers these days are exploring possible differences in health effects of the three sizes of particles and particles from different sources, such as diesel particles from trucks and buses or sulfates from coal-fired power plants. So far, the evidence remains clear that all particles from all sources are dangerous.[16]

Particle pollution can damage the body in ways similar to cigarette smoking. A recent review of the research on how particles cause harm found that the body responds to particles in similar ways to its response to cigarette smoke. These findings help explain why particle pollution can cause heart attacks and strokes.[17]

### Short-Term Exposure Can Be Deadly

First and foremost, short-term exposure to particle pollution can kill. Peaks or spikes in particle pollution can last for hours to days. Deaths can occur on the very day that particle levels are high, or within one to two months afterward. Particle pollution does not just make people die a few days earlier than they might otherwise—these are deaths that would not have occurred if the air were cleaner.[18]

Researchers from Harvard University recently tripled the estimated risk of premature death following a review of the newer evidence from fine particle monitors ($PM_{2.5}$) in 27 US cities.[19] As mentioned earlier, scientists at the California Air Resources Board also tripled their estimate of the number of deaths occurring each year from particle pollution. They now put the range between 5,600 to 32,000 deaths a year in that state alone.[20]

Particle pollution also diminishes lung function, causes greater use of asthma medications and increased rates of school absenteeism, emergency room visits and hospital admissions. Other adverse effects can be coughing, wheezing, cardiac arrhythmias and heart attacks. According to the findings from some of the latest studies, short-term increases in particle pollution have been linked to:

- death from respiratory and cardiovascular causes, including strokes;[21, 22, 23, 24]
- increased mortality in infants and young children;[25]
- increased numbers of heart attacks, especially among the elderly and in people with heart conditions;[26]
- inflammation of lung tissue in young, healthy adults;[27]
- increased hospitalization for cardiovascular disease, including strokes and congestive heart failure;[28, 29, 30]
- increased emergency room visits for patients suffering from acute respiratory ailments;[31]
- increased hospitalization for asthma among children; and[32, 33, 34]
- increased severity of asthma attacks in children.[35]

Lifeguards in Galveston, Texas, provided evidence of the impact on healthy, active adults in a study published in 2008. Testing the breathing capacity of these outdoor workers several times a day, researchers found that many lifeguards had reduced lung volume at the end of the day when fine particle levels were high. This occurred even when the levels were well below the national standards. Because of this research, Galveston became the first city in the nation to install an air quality warning flag system on the beach.[36]

### Year-Round Exposure

Breathing high levels of particle pollution day in and day out also can be deadly, as landmark studies in the 1990s showed conclusively.[37] Chronic exposure to particle pollution can shorten life by one to three years.[38] Other impacts range from premature births to serious respiratory disorders, even when the particle levels are very low.

Year-round exposure to particle pollution has also been linked to:

- increased hospitalization for asthma attacks for children living near roads with heavy truck or trailer traffic;[39, 40]
- slowed lung function growth in children and teenagers;[41, 42]
- significant damage to the small airways of the lungs;[43]
- increased risk of dying from lung cancer[44]; and
- increased risk of death from cardiovascular disease.[45]

Alarmingly, the risks may be even greater than previously thought. Earlier studies of the long-term health risks of air pollution relied on estimates of the average exposure to people in the community. New evidence from studies published since 2005 suggests that those estimates may be far too low. California just completed a review of this research and tripled the estimate of the number of people killed each year by particle pollution: 18,000 premature deaths annually, with a range of 5,600 to 32,000 deaths.[46]

New research into the health risks of 65,000 women over age 50 found that those who lived in areas with higher levels of particle pollution faced a much greater risk of dying from heart disease than had been previously estimated. Even women who lived within the same city faced differing risks depending on the annual levels of pollution in their neighborhood.[47]

### Who Is at Risk?

Anyone living in an area with a high level of particle pollution is at risk (you can take a look at levels in your state in this report). People at the greatest risk from particle pollution exposure include those with lung disease such as asthma and chronic obstructive pulmonary disease (COPD), which includes chronic bronchitis and emphysema; people with sensitive airways, where exposure to particle pollution can cause wheezing, coughing and respiratory irritation; the elderly; people with heart disease; and children. New research points to ever-larger groups at higher risk, including diabetics, and most recently, women over 50.[48]

Researchers are identifying increased risk for workers whose jobs expose them to heavy diesel exhaust as a routine part of their job. The risk of dying from lung cancer and heart disease is markedly higher in truck drivers than in the general population in the U.S., according to a study by Harvard University researchers.[49] This study of over 50,000 members of the Teamsters Union employed from 1985 to 2000 looked at the cause of death of workers classified by job category. Truckers are exposed to traffic pollution and diesel engine emissions, while dockworkers are exposed to exhaust from forklifts and trucks in the shipyard. The study found that death rates for heart disease were 49 percent higher among truck drivers, and 32 percent higher among dockworkers than in the general U.S. population. Lung cancer death rates were 10 percent higher in both the drivers and the dockworkers. Railroad workers have also faced higher risks of death from lung cancer and COPD, according to two studies looking at historical data for those workers.[50]

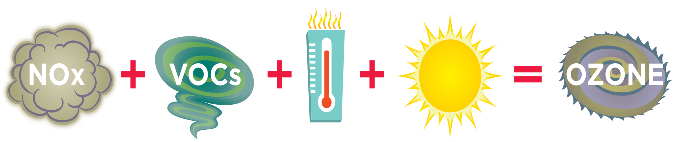
## What Is Ozone?

Ozone ($O_3$) is an extremely reactive gas molecule composed of three oxygen atoms. It is the primary ingredient of smog air pollution and is very harmful to breathe. Ozone attacks lung tissue by reacting chemically with it.

News about ozone can be confusing. Some days you hear that ozone levels are too high and other days that we need to prevent ozone depletion. Basically, the ozone layer found high in the upper atmosphere (the stratosphere) is beneficial because it shields us from much of the sun's ultraviolet radiation. However, ozone air pollution at ground level where we can breathe it (in the troposphere) is harmful. It causes serious health problems.

## Where Does Ozone Come From?

What you see coming out of the tailpipe on a car or a truck isn't ozone, but the raw ingredients for making ozone. Ozone is formed by chemical reactions in the atmosphere from two raw gases that do come out of tailpipes, smokestacks and many other sources. These essential raw ingredients for ozone are nitrogen oxides ($NO_x$) and hydrocarbons, also called volatile organic compounds (VOCs). They are produced primarily when fossil fuels like gasoline, oil or coal are burned or when some chemicals, like solvents, evaporate. When $NO_x$ and VOCs come in contact with both heat and sunlight, they combine and form ozone smog. $NO_x$ is emitted from power plants, motor vehicles and other sources of high-heat combustion. VOCs are emitted from motor vehicles, chemical plants, refineries, factories, gas stations, paint and other sources. The formula for ozone is simple, and like any formula, the ingredients must all be present and in the right proportions to make the final product.




You may have wondered why "ozone action day" warnings are sometimes followed by recommendations to avoid activities such as mowing your lawn or refilling your gas tank during daylight hours. Lawn mower exhaust and gasoline vapors are VOCs that could turn into ozone in the heat and sun. Take away the sunlight and ozone doesn't form, so refilling your gas tank after dark is better on high ozone days. Since we can't control sunlight and heat, we must reduce the chemical raw ingredients if we want to reduce ozone.

## Who is at risk from breathing ozone?

Five groups of people are especially vulnerable to the effects of breathing ozone:

- children and teens;
- anyone 65 and older;
- people who work or exercise outdoors;
- people with existing lung diseases, such as asthma and chronic obstructive pulmonary disease (also known as COPD, which includes emphysema and chronic bronchitis); and
- "responders" who are otherwise healthy but for some reason react more strongly to ozone.

The impact on your health can depend on many factors, however, not just whether you are part of one of these groups. For example, the risks would be greater if ozone levels are higher, if you are breathing faster because you're working outdoors or if you spend more time outdoors.

Again, the impact of even short-term exposure to ozone on healthy adults showed up in the Galveston lifeguard study in addition to the harmful effects of particle pollution; many lifeguards had greater obstruction in their airways when ozone levels were high.[51]

## How Ozone Pollution Harms Your Health

Scientists have studied the effects of ozone on health for decades. Hundreds of research studies have confirmed that ozone harms people at levels currently found in the United States. In the last few years, we've learned that it can also be deadly.

**Breathing ozone may shorten your life.** Strong evidence arrived late in 2004, when two large multi-city investigations documented that short-term exposure to ozone can shorten lives, building on numerous earlier studies. One of them looked at 95 cities across the United States over a 14-year period. That study compared the impact of ozone on death patterns during several days after the ozone measurements. Even on days when ozone levels were low, the researchers found that the risk of premature death increased with higher levels of ozone. They estimated that over 3,700 deaths annually could be attributed to a 10-parts-per-billion increase in ozone levels.[52] Another study, published the same week, looked at 23 European cities and found similar effects on mortality from short-term exposure to ozone.[53]

Confirmation came in the summer of 2005. Three groups of researchers working independently reviewed and analyzed the research around deaths associated with short-term exposures to ozone. The three teams—at Harvard, Johns Hopkins and New York University—used different approaches but all came to similar conclusions. All three studies reported a small but robust association between daily ozone levels and increased deaths.[54] Writing a commentary on these reviews, David Bates, MD, explained how these premature deaths could occur:

> "Ozone is capable of causing inflammation in the lung at lower concentrations than any other gas. Such an effect would be a hazard to anyone with heart failure and pulmonary congestion, and would worsen the function of anyone with advanced lung disease."[55]

In 2008 a committee of the National Research Council, a division of the National Academy of Sciences, reviewed the evidence again and concluded that "short-term exposure to ambient ozone is likely to contribute to premature deaths." They recommended that preventing early death be included in any future estimates of the benefits of reducing ozone.

**Other immediate risks from breathing high levels of ozone.** Many areas in the United States produce enough ground-level ozone during the summer months to cause health problems that can be felt right away. Immediate problems—in addition to increased risk of premature death—include:

- shortness of breath;
- chest pain when inhaling;
- wheezing and coughing;
- asthma attacks;
- increased susceptibility to respiratory infections;
- increased susceptibility to pulmonary inflammation; and
- increased need for people with lung diseases, like asthma or chronic obstructive pulmonary disease (COPD), to receive medical treatment and to go to the hospital.[57]

**Breathing ozone for longer periods can alter the lungs' ability to function.** Two studies published in 2005 explored ozone's ability to reduce the lung's ability to work efficiently, a term called "lung function." Each study looked at otherwise healthy groups who were exposed to ozone for long periods: outdoor postal workers in Taiwan and college freshmen who were lifelong residents of Los Angeles or the San Francisco Bay area. Both studies found that the long exposure to elevated ozone levels had decreased their lung function.[58]

**Other effects of long-term exposure to ozone.** Inhaling ozone may affect the heart as well as the lungs. One recent study linked exposures to high ozone levels for as little as one hour to a particular type of cardiac arrhythmia that itself increases the risk of premature death and stroke.[59] A French study found that exposure to elevated ozone levels for one to two days increased the risk of heart attacks for middle-aged adults without heart disease. [60]

Breathing other pollutants in the air may make your lungs more responsive to ozone—and breathing ozone may increase your body's response to other pollutants. For example, research warns that breathing sulfur dioxide and nitrogen oxide—two pollutants common in the eastern U.S.—can make the lungs react more strongly than to just breathing ozone alone. Breathing ozone may also increase the response to allergens in people with allergies.[61] A large study published in 2009 found that children were more likely to suffer from hay fever and respiratory allergies when ozone and $PM_{2.5}$ levels were high.[62]

## Focusing on Children's Health

Children may look like miniature adults, but they're not. Air pollution is especially dangerous to them because their lungs are growing and because they are so active.

Just like the arms and legs, the largest portion of a child's lungs will grow long after he or she is born. Eighty percent of their tiny air sacs develop after birth. Those sacs, called the alveoli, are where the life-sustaining transfer of oxygen to the blood takes place. The lungs and their alveoli aren't fully grown until children become adults.[63] In addition, the body's defenses that help adults fight off infections are still developing in young bodies.[64] Children have more respiratory infections than adults, which also seems to increase their susceptibility to air pollution.[65]

Furthermore, children don't behave like adults, which also affects their vulnerability. They are outside for longer periods and are usually more active when outdoors. Consequently, they inhale more polluted outdoor air than adults typically do.[66]

### Major Reviews Confirm Harm to Children

Two major analyses recently concluded that air pollution is especially harmful to children. They found that air pollution is so dangerous that it can even threaten children's lives.

The World Health Organization (WHO) published an in-depth look at the research on children's health and air pollution. Most importantly, the scientists concluded that particle pollution caused infant deaths. In addition, they found that air pollution caused a host of harmful effects in children, including:

- short-term and long-term decreased lung function rates and lower lung function levels, critical measures of how well the child will breathe throughout his or her life (due primarily to exposure to particle pollution and traffic-related pollution);
- worsening of asthma (from exposure to particle as well as ozone pollution);
- increased prevalence and incidence of cough and bronchitis (primarily from particle pollution); and
- increased risk of upper and lower respiratory infections.[67]

The American Academy of Pediatrics issued a statement on the dangers of outdoor air pollution on children's health, pointing out the special differences for children.[68] The Academy reported many of the health effects cited by the WHO study, but also focused on the sources common to many children. Both the WHO monograph and the Academy statement highlighted recent studies showing how children living near heavily traveled highways appear to be particularly harmed by traffic-related pollution. The Academy statement highlighted the specific concern over diesel school buses, citing a pilot study that showed children riding inside a school bus may be exposed to four times more diesel exhaust than if they were riding in a car.[69]

### Research on Prenatal Exposure to Air Pollution

Several studies published in 2005 found prenatal exposure to air pollution can harm children. A study of pregnant women in four Pennsylvania counties found an increased risk of preterm births linked to chronic exposure to high levels of air pollution during the last six weeks of pregnancy.[70]

A study of three low-income neighborhoods in New York City found that infants born to nonsmoking mothers faced a possible increased risk of cancer from living in areas with elevated urban area air pollutants.[71] A third study in the Czech Republic found evidence that the mother's exposure to air pollution may even alter the immune system of the fetus.[72]

## Air Pollution Linked to Increased Risk to Newborns and Infants

As the World Health Organization concluded, evidence shows that air pollution, especially particle pollution, increases the risk of infant death. A study looking at the infant deaths in the US from 1999 to 2002 confirmed the risk from particle pollution and found evidence that ozone may also increase the risk of sudden infant death syndrome, or SIDS.[73]

Researchers from Yale University looked at the records of over 350,000 babies born in Connecticut and Massachusetts with low birth weights to see if they could identify any relationships with outdoor air pollutants. The researchers concluded that air pollution may increase the risk of babies being born with low birth weight, even though almost all the air pollutants were at levels that were officially listed as safe by the Environmental Protection Agency.[74]

## Air Pollution Linked to Asthma Attacks, New Onset of Asthma

A 2003 study followed children with asthma by having their mothers track their symptoms on a daily basis. The study found that children with asthma were particularly vulnerable to ozone even at levels then officially considered safe.[75] An accompanying editorial warned, "Air pollution is one of the most under-appreciated contributors to asthma exacerbation."[76]

A recent study suggests that year-round exposure to ozone may be associated with an increased risk of the development of asthma. While more research is needed to confirm this finding, researchers tracking 3,500 students in Southern California found an increased onset of asthma in children who were taking part in three or more outdoor activities in communities with high levels of ozone.[77]

## Air Pollution Increases Risk of Underdeveloped Lungs

Another finding from the Southern California Children's Health study looked at the long-term effects of particle pollution on teenagers. Tracking 1,759 children between ages 10 and 18, researchers found that those who grew up in more polluted areas face the increased risk of having underdeveloped lungs, which may never recover to their full capacity. The average drop in lung function was 20 percent below what was expected for the child's age, similar to the impact of growing up in a home with parents who smoked.[78]

Community health studies are pointing to less obvious, but serious effects from year-round exposure to ozone, especially for children. Scientists followed 500 Yale University students and determined that living just four years in a region with high levels of ozone and related co-pollutants was associated with diminished lung function and frequent reports of respiratory symptoms.[79] A much larger study of 3,300 school children in Southern California found reduced lung function in girls with asthma and boys who spent more time outdoors in areas with high levels of ozone.[80]

## Cleaning Up Pollution Can Reduce Risk to Children

There is also real-world evidence that reducing air pollution can help protect children. Two new studies published in 2005 added more weight to the argument.

Changes in air pollution from the reunification of Germany proved a real-life laboratory. Both East and West Germany had different levels and sources of particles. Outdoor particle levels were much higher in East Germany, where they came from factories and homes. West Germany had higher concentrations of traffic-generated particles. After reunification, emissions from the factories and homes dropped, but traffic increased. A German study explored the impact on the lungs of six-year olds from both East and West Germany. Total lung capacity improved with the lower particle levels. However, for those children living near busy roads, the increased pollution from the increased traffic kept them from benefiting from the overall cleaner air.[81]

In Switzerland, particle pollution dropped during a period in the 1990s. Researchers there tracked 9,000 children over a nine-year period, following their respiratory symptoms. After taking other factors such as family characteristics and indoor air pollution into account, the researchers noted that during the years with less pollution, the children had fewer episodes of chronic cough, bronchitis, common cold, and conjunctivitis symptoms.[82]

In this country, the 1996 Olympics in Atlanta, Georgia remains one of the most interesting cases. Atlanta is a prime example of an urban area with a history of serious ozone problems. The determined efforts of the city to reduce traffic during the Olympics succeeded in not just reducing congestion, but in improving the health of children with asthma. Concerned with an expected traffic nightmare, the city brought in more buses, more subway cars, and encouraged ridesharing and telecommuting during the Summer Olympic Games. These measures created a prolonged period of low ozone pollution that resulted in significantly lower rates of childhood asthma events for children aged 1–16. The number of asthma acute care events (e.g., treatment and hospitalization) decreased 42 percent in the Georgia Medicaid claims files. Pediatric emergency departments also saw significant reductions, as did the Georgia Hospital Discharge Database and a health maintenance organization database. It is important to note researchers determined that weather was not the determining factor in the reduced ozone levels.[83]

## Disparities in the Impact of Air Pollution

The burden of air pollution is not evenly shared. Poorer people and some racial and ethnic groups are among those who often face higher exposure to pollutants and who may experience greater responses to such pollution. Many studies have explored the differences in harm from air pollution to racial or ethnic groups and people who are in a low socioeconomic position, have less education, or live nearer to major sources,[84] including a workshop the American Lung Association held in 2001 that focused on urban air pollution and health inequities.[85]

Many studies have looked at differences in the impact on premature death. Results have varied widely, particularly for effects between racial groups. Some studies have found no differences among races,[86] while others found greater responsiveness for Whites and Hispanics, but not Blacks/African-Americans,[87] or for Blacks/African-Americans but not other races or ethnic groups.[88] Other researchers have found greater risk for Blacks/African-Americans from air toxics, including those pollutants that also come from traffic sources.[89]

Socioeconomic position has been more consistently associated with greater harm from air pollution. Recent studies show evidence of that link. Low socioeconomic status consistently increased the risk of premature death from fine particle pollution among 13.2 million Medicare recipients studied in the largest examination of particle pollution mortality nationwide.[90] In the 2008 study that found greater risk for premature death for Blacks/African-Americans, researchers also found greater risk for people living in areas with higher unemployment or higher use of public transportation.[91] A 2008 study of Washington, DC found that while poor air quality and worsened asthma went hand-in-hand in areas where Medicaid enrollment was high, the highest Medicaid areas did not always have the strongest association of high air pollution and asthma attacks.[92] However, two other recent studies in France have found no association with lower income and asthma attacks.[93]

Scientists have speculated that there are three broad reasons why disparities may exist. First, groups may face greater exposure to pollution because of factors ranging from racism to class bias to housing market dynamics and land costs. For example, pollution sources may be located near disadvantaged communities, increasing exposure to harmful pollutants. Second, low social position may make some groups more susceptible to health threats because of factors related to their disadvantage. Lack of access to health care, grocery stores and good jobs, poorer job opportunities, dirtier workplaces or higher traffic exposure are among the factors that could handicap groups and increase the risk of harm. Finally, existing health conditions, behaviors, or traits may predispose some groups to greater risk. For example, diabetics are among the groups most at risk from air pollutants and the elderly, non-Hispanic Blacks, Mexican Americans and people living near a central city have higher incidence of diabetes.[94]

## Living Near Highways May Be Especially Dangerous

Being in heavy traffic, or living near a road may be even more dangerous than being in other places in a community. Several studies have found that the vehicle emissions coming directly from those highways may be higher than in the community as a whole, increasing the risk of harm to people who live or work near busy roads.

Children and teenagers are among the most vulnerable—though not the only ones at risk. A new European study found infants and young children exposed to air pollution from traffic faced a greater risk of wheezing.[95] In Southern California, a 2007 study found that air pollution may limit the capacity of the lungs in ten- to eighteen-year-olds who live within about one-third of a mile of a freeway. Changes such as that can reduce their capacity to breathe for the rest of their lives and increase their risk of developing serious lung diseases. Other recent research found that children who live near freeways had a higher risk of being diagnosed with asthma.[96, 97] However, children are not the only ones at risk. Studies have found increased risk of premature death from living near a major highway or an urban road.[98] Another study found an increase in risk of heart attacks from being in traffic, whether driving or taking public transportation.[99]

## How to Protect Yourself from Ozone and Particle Pollution

To minimize your exposure to ozone and particle pollution:

- Pay attention to forecasts for high air pollution days to know when to take precautions;
- Avoid exercising near high-traffic areas;
- Avoid exercising outdoors when pollution levels are high, or substitute an activity that requires less exertion;
- Do not let anyone smoke indoors and support measures to make all places smokefree; and
- Reduce the use of fireplaces and wood-burning stoves.

Bottom line: Help yourself and everyone else breathe easier. Support national, state and local efforts to clean up sources of pollution. Your life and the life of someone you love may depend on it.

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# Appendix: Description of Methodology

## Statistical Methodology: The Air Quality Data

### Data Sources

The data on air quality throughout the United States were obtained from the U.S. Environmental Protection Agency's Air Quality System (AQS), formerly called Aerometric Information Retrieval System (AIRS) database. The American Lung Association contracted with Dr. Allen S. Lefohn, A.S.L. & Associates, Helena, Montana, to characterize the hourly averaged ozone concentration information and the 24-hour averaged $PM_{2.5}$ concentration information for the 3-year period for 2005-2007 for each monitoring site.

Design values for the annual $PM_{2.5}$ concentrations by county were collected from data previously summarized by the U.S. Environmental Protection Agency (EPA) and were downloaded on September 12, 2008 from the EPA's website at www.epa.gov/airtrends/values.html.

### Ozone Data Analysis

The 2005, 2006, and 2007 AQS hourly ozone data were used to calculate the daily 8-hour maximum concentration for each ozone-monitoring site. The data were considered for a 3-year period for the same reason that the EPA uses 3 years of data to determine compliance with the ozone: to prevent a situation in any single year, where anomalies of weather or other factors create air pollution levels, which inaccurately reflect the normal conditions. The highest 8-hour daily maximum concentration in each county for 2005, 2006, and 2007, based on the EPA-defined ozone season, was identified.

On March 12, 2008, the EPA lowered the national ambient air quality standard for ozone to 0.075 ppm measured over 8-hours and adjusted the Air Quality Index to reflect the tighter standard. Using these results, A.S.L. & Associates prepared a table by county that summarized, for each of the 3 years, the number of days the ozone level was within the ranges identified by the EPA based on the EPA Air Quality Index:

| | |
|---|---|
| 0.000 – 0.059 ppm | Good (Green) |
| 0.060 – 0.075 ppm | Moderate (Yellow) |
| 0.076 – 0.095 ppm | Unhealthy for Sensitive Groups (Orange) |
| 0.096 – 0.115 ppm | Unhealthy (Red) |
| 0.116 – 0.374 ppm | Very Unhealthy (Purple) |
| >0.374 ppm | Hazardous (Maroon) |

The goal of this report was to identify the number of days that 8-hour daily maximum concentrations occurred within the defined ranges, not just those days that would fall under the requirements for attaining the national ambient air quality standards. Therefore, no data capture criteria were applied to eliminate monitoring sites or to require a number of valid days for the ozone season. All valid days of data within the ozone season were used in the analysis. However, for computing an 8-hour average, at least 75 percent of the hourly concentrations (i.e., 6-8 hours) had to be available for the 8-hour period. In addition, an 8-hour daily maximum average was identified if valid 8-hour averages were available for at least 75 percent of possible hours in the day (i.e., at least 18 of the possible 24 8-hour averages).

Following receipt of the above information, the American Lung Association identified the number of days each county, with at least one ozone monitor, experienced air quality designated as orange, red, or purple.

### Short-term Particle Pollution Data Analysis

A.S.L. & Associates identified the maximum daily 24-hour

AQS $PM_{2.5}$ concentration for each county in 2005, 2006, and 2007 with monitoring information. Using these results, A.S.L. & Associates prepared a table by county that summarized, for each of the 3 years, the number of days the maximum of the ***daily*** $PM_{2.5}$ concentration was within the ranges identified by the EPA based on the EPA Air Quality Index, adjusted by the American Lung Association as discussed below:

| | |
|---|---|
| from 0.0 Qg/m³ to 15.4 Qg/m³ | Good (Green) |
| from 15.5 Qg/m³ to 35.0 Qg/m³ | Moderate (Yellow) |
| from 35.1 Qg/m³ to 65.4 Qg/m³ | Unhealthy for Sensitive Groups (Orange) |
| from 65.5 Qg/m³ to 150.4 Qg/m³ | Unhealthy (Red) |
| from 150.5 Qg/m³ to 250.4 Qg/m³ | Very Unhealthy (Purple) |
| greater than or equal to 250.5 Qg/m³ | Hazardous (Maroon) |

On September 21, 2006, the EPA announced a revised 24-hour National Ambient Air Quality standard for $PM_{2.5}$, changing the standard to 35 µg/m³ from 65 µg/m³. As of December 2008, the EPA had not yet announced changes to the Air Quality Index based on the new standard. The Lung Association adjusted the level of the category "Unhealthy for Sensitive Groups" to include the new standard, making that category range from 35.1 µg/m³ to 65.4 µg/m³.

The goal of this report was to identify the number of days that the maximum in each county of the ***daily*** $PM_{2.5}$ concentration occurred within the defined ranges, not just those days that would fall under the requirements for attaining the national ambient air quality standards. Therefore, no data capture criteria were used to eliminate monitoring sites. Only 24-hour averaged PM data were used. Included in the analysis are data collected using only FRM and FEM methods, which reported 24-hour averaged data. As instructed by the Lung Association, A.S.L. & Associates included the exceptional and natural events that were identified in the database and identified for the Lung Association, including the dates and monitoring sites that experienced such events.

Following receipt of the above information, the American Lung Association identified the number of days each county, with at least one $PM_{2.5}$ monitor, experienced air quality designated as orange, red, purple or maroon.

## Description of County Grading System

### Ozone and short-term particle pollution (24-hour $PM_{2.5}$)

The grades for ozone and short-term particle pollution (24-hour $PM_{2.5}$) were based on a weighted average for each county. To determine the weighted average, the Lung Association followed these steps:

1. First, assigned weighting factors to each category of the Air Quality Index. The number of orange days experienced by each county received a factor of 1; red days a factor of 1.5; purple days a factor of 2; and maroon days a factor of 2.5. This allowed days where the air pollution levels were higher to receive greater weight.
2. Next, multiplied the total number of days within each category by their assigned factor, then summed all the categories to calculate a total.
3. Finally, divided the total by three to determine the weighted average, since the monitoring data were collected over a three-year period.

The weighted average determined each county's grades for ozone and 24-hour $PM_{2.5}$.

- All counties with a weighted average of zero (corresponding to no exceedances of the standard over the three-year period) were given a grade of "A."
- For ozone, an "F" grade was set to roughly correlate with the number of unhealthy air days that would place a county in nonattainment for the ozone standard.

- For short-term particle pollution, fewer unhealthy air days are required for an F than for nonattainment under the $PM_{2,5}$ standard. The national air quality standard is set to allow 2 percent of the days during the 3 years to exceed 35 µg/$m^3$ (called a "98th percentile" form) before violating the standard. That would be roughly 21 unhealthy days in 3 years. The grading used in this report would allow roughly only 1 percent of the days to be over 35 µg/$m^3$ (called a "99th percentile" form) of the $PM_{2.5}$. The American Lung Association supports using the tighter limits in a 99th percentile form as a more appropriate standard that is intended to protect the public from short-term spikes in pollution.

**Grading System**

| Grade | Weighted Average | Approximate Number of Allowable Orange/Red/Purple/Maroon days |
|---|---|---|
| A | 0.0 | None |
| B | 0.3 to 0.9 | 1 to 2 orange days with no red |
| C | 1.0 to 2.0 | 3 to 6 days over the standard: 3 to 5 orange with no more than 1 red OR 6 orange with no red |
| D | 2.1 to 3.2 | 7 to 9 days over the standard: 7 total (including up to 2 red) to 9 orange with no red |
| F | 3.3 or higher | 9 days or more over the standard: 10 orange days or 9 total including at least 1 or more red, purple or maroon |

Weighted averages allow comparisons to be drawn based on severity of air pollution. For example, if one county had 9 orange days and 0 red days, it would earn a weighted average of 3.0 and a D grade. However, another county which had only 8 orange days but also 2 red days, which signify days with more serious air pollution, would receive an F. That second county would have a weighted average of 3.7.

Note that this system differs significantly from the methodology EPA uses to determine violations of both the ozone standard and the 24-hour $PM_{2.5}$. EPA determines whether a county violates the standard based on the 4th maximum daily 8-hour ozone reading each year averaged over three years. Multiple days of unhealthy air beyond the highest four in each year are not considered. By contrast, the system used in this report recognizes when a community's air quality repeatedly results in unhealthy air throughout the three years. Consequently, some counties will receive grades of "F" in this report showing repeated instances of unhealthy air, while still meeting EPA's 1998 ozone standard.

Counties were ranked by weighted average. Metropolitan areas were ranked by the highest weighted average among the counties within a given Metropolitan Statistical Area as of 2007 as defined by the White House Office of Management and Budget (OMB). In 2003, the OMB published revised definitions for the nation's Metropolitan Statistical Areas. Therefore, comparisons between MSAs in the *State of the Air* reports from 2000 to 2003 and the *State of the Air* reports from 2004 and later should be made with caution.

## Year-round particle pollution (Annual $PM_{2.5}$)

Since no comparable Air Quality Index exists for year-round particle pollution (annual $PM_{2.5}$), the grading was based on the EPA's determination of violations of the national ambient air quality standard for annual $PM_{2.5}$ of 15 µg/$m^3$, as reported online and downloaded from the www.epa.gov/airtrends/values.html on September 12, 2008. Counties that the EPA listed as being in attainment of the standard were given grades of "Pass." Counties the EPA listed as being in nonattainment were given grades of "Fail." Where insufficient data existed for the EPA to determine attainment or nonattainment, those counties received a grade of "Incomplete." Counties were ranked by design value. Metropolitan areas were ranked by the highest design value among the counties within a given Metropolitan Statistical Area as of 2007 as defined by the OMB. The design value is the calculated concentration of a pollutant based on the form of the national ambient air quality standard, and is used by the EPA to determine whether or not the air quality in a county meets the standard.

The Lung Association received critical assistance from members of the National Association of Clean Air Administrators, formerly known as the State and Territorial Air Pollution Control Administrators and the Association of Local Air Pollution Control Administrators. With their assistance, all state and local agencies were provided the opportunity to review and comment on the data in draft tabular form. The Lung Association reviewed all discrepancies with the agencies and, if needed, with Dr. Lefohn at A.S.L. & Associates. Questions about the annual PM design values were referred to the EPA, which reviewed and had final decision on those determinations. The American Lung Association wishes to express its continued appreciation to the state and local air directors for their willingness to assist in ensuring that the characterized data used in this report are correct.

## Calculations of Populations-at-Risk

Presently county-specific measurements of the number of persons with chronic lung disease and other chronic conditions are not generally available. (The primary exception to this is asthma, as state-specific estimates for adult asthma are available through one national survey discussed below.) In order to assess the magnitude of lung disease and other chronic conditions at the state and county levels, we have employed a synthetic estimation technique originally developed by the U.S. Census Bureau. This method uses age-specific national estimates of self-reported lung disease and other conditions to project disease prevalence to the county level.

### Population Estimates

The U.S. Census Bureau estimated data on the total population of each county in the United States for 2007. The Census Bureau also estimated the age specific breakdown of the population by county.

### Prevalence Estimates

**Chronic Bronchitis, Emphysema, Pediatric Asthma and Diabetes.** In 2007, the National Health Interview Survey (NHIS) estimated the nationwide annual prevalence of diagnosed chronic bronchitis at 7.6 million; the nationwide lifetime prevalence of diagnosed emphysema was estimated at 3.7 million. The NHIS estimated the prevalence of diagnosed pediatric asthma (under age 18) to be over 6.7 million. The NHIS estimated the nationwide lifetime prevalence of diabetes at 17.3 million in 2007.

Due to the revision of the NHIS questionnaire, prevalence estimates from the *American Lung Association State of the Air 2000* cannot be compared to later publications. Estimates for chronic bronchitis and emphysema can be compared to the *State of the Air* reports for 2001 through 2008. Furthermore, estimates for chronic bronchitis and emphysema should not be combined as they represent different types of prevalence estimates.

Pediatric asthma prevalence estimates from this year's report can only be compared to those in the *State of the Air* reports since 2004 and not the *State of the Air* reports from 2000 through 2003 due to a change of the NHIS.

Local area prevalence of chronic bronchitis, emphysema, pediatric asthma and diabetes are estimated by applying age-specific national prevalence rates from the 2007 NHIS to age-specific county-level resident populations obtained from the U.S. Census Bureau web site. Prevalence estimates for chronic bronchitis, emphysema and diabetes are calculated for those 18-44, 45-64 and 65+. The prevalence estimate for pediatric asthma is calculated for those under age 18.

**Adult Asthma.** In 2007, the Behavioral Risk Factor Surveillance System (BRFSS) survey indicated that approximately 8.4% of adults residing in the United States reported currently having asthma. The information on adult asthma obtained from the Behavioral Risk Factor Surveillance System survey cannot be compared with pediatric asthma estimates that are derived from the NHIS.

The prevalence estimate for adult asthma is calculated for those 18-44, 45-64 and 65+. Local area prevalence of adult asthma is estimated by applying age-specific state prevalence rates from the 2007 BRFSS to age-specific county-level resident populations obtained from the U.S. Census Bureau web site.

**Cardiovascular Disease Estimates.** All cardiovascular disease estimates are based on the 2005 National Health and Nutrition Examination Survey and were obtained from the National Heart Lung and Blood Institute (NHBLI). According to their estimate, 79.8 million Americans suffer from one or more types of cardiovascular disease, including coronary heart disease, hypertension, stroke and heart failure. Local area prevalence of cardiovascular disease is estimated by applying age-specific prevalence rates for those 18-44, 45-64 and 65+, provided by NHLBI, to age-specific county-level resident populations obtained from the U.S. Census Bureau web site.

**Limitations of Estimates.** Since the statistics presented by the NHIS, BRFSS and NHANES are based on a sample, they will differ (due to random sampling variability) from figures that would be derived from a complete census or case registry of people in the U.S. with these diseases. The results are also subject to reporting, non-response and processing errors. These types of errors are kept to a minimum by methods built into the survey.

Additionally, a major limitation of both surveys is that the information collected represents self-reports of medically diagnosed conditions, which may underestimate disease prevalence since not all individuals with these conditions have been properly diagnosed. However, the NHIS is the best available source that depicts the magnitude of chronic disease on the national level and the BRFSS is the best available source for state-specific adult asthma information. The conditions covered in the survey may vary considerably in the accuracy and completeness with which they are reported.

Local estimates of chronic diseases are scaled in direct proportion to the base population of the county and its age distribution. No adjustments are made for other factors that may affect local prevalence (e.g. local prevalence of cigarette smokers or occupational exposures) since the health surveys that obtain such data are rarely conducted on the county level. Because the estimates do not account for geographic differences in the prevalence of chronic and acute diseases, the sum of the estimates for each of the counties in the United States may not exactly reflect the national estimate derived by the NHIS or state estimates derived by the BRFSS.

## REFERENCES

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Office of Management and Budget. Update of Statistical Areas Definitions and Guidance on Their Uses. OMB Bulletin 08-01 November 20, 2007.

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# State Table

## Notes for all state data tables

1. **Total Population** is based on 2007 US Census and represents the at-risk populations in counties with ozone or $PM_{2.5}$ pollution monitors; it does not represent the entire state's sensitive populations.
2. Those **18 & under** and **65 &** over are vulnerable to ozone and $PM_{2.5}$. They should not be used as population denominators for disease estimates.
3. **Pediatric asthma** estimates are for those under 18 years of age and represent the estimated number of people who had asthma in 2007 based on national rates (NHIS) applied to county population estimates (US Census).
4. **Adult asthma** estimates are for those 18 years and older and represent the estimated number of people who had asthma during 2007 based on state rates (BRFSS) applied to county population estimates (US Census).
5. **Chronic bronchitis** estimates are for adults 18 and over who had been diagnosed within 2007 based on national rates (NHIS) applied to county population estimates (US Census).
6. **Emphysema** estimates are for adults 18 and over who have been diagnosed within their lifetime based on national rates (NHIS) applied to county population estimates (US Census).
7. **CV disease** estimates are based on National Heart Lung and Blood Institute (NHLBI) estimates of cardiovascular disease applied to county population estimates (U.S. Census). CV disease includes coronary heart disease, hypertension, stroke and heart failure.
8. **Diabetes** estimates are for adults 18 and over who have been diagnosed within their lifetime based on national rates (NHIS) applied to county population estimates (US Census).
9. Adding across rows does not produce valid estimates. For example, because of differences in the surveys used to gather the information, adding pediatric and adult asthma does not produce an accurate estimate of total population with asthma. Adding emphysema and chronic bronchitis will double count people with both diseases.

# NEW YORK

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## AT-RISK GROUPS

| County | Total Population | Under 18 | 65 & Over | Lung Diseases: Pediatric Asthma | Adult Asthma | Chronic Bronchitis | Emphysema | CV Disease | Diabetes |
|---|---|---|---|---|---|---|---|---|---|
| ALBANY | 299,307 | 61,188 | 40,642 | 5,563 | 20,697 | 8,128 | 4,033 | 86,406 | 18,577 |
| BRONX | 1,373,659 | 387,025 | 144,266 | 35,184 | 85,167 | 32,337 | 14,905 | 332,814 | 70,239 |
| CHAUTAUQUA | 133,945 | 28,707 | 21,252 | 2,610 | 9,145 | 3,703 | 1,951 | 40,476 | 8,818 |
| CHEMUNG | 88,015 | 19,347 | 13,477 | 1,759 | 5,978 | 2,412 | 1,263 | 26,288 | 5,722 |
| DUTCHESS | 292,746 | 65,970 | 36,677 | 5,997 | 19,818 | 7,767 | 3,839 | 82,381 | 17,723 |
| ERIE | 913,338 | 199,858 | 141,471 | 18,169 | 62,178 | 25,168 | 13,259 | 275,031 | 59,961 |
| ESSEX | 38,119 | 7,158 | 6,350 | 651 | 2,691 | 1,093 | 580 | 11,986 | 2,615 |
| FRANKLIN | 50,449 | 9,485 | 6,677 | 862 | 3,550 | 1,379 | 668 | 14,502 | 3,099 |
| HAMILTON | 5,075 | 848 | 1,090 | 77 | 370 | 159 | 93 | 1,832 | 409 |
| HERKIMER | 62,558 | 13,312 | 10,068 | 1,210 | 4,289 | 1,745 | 929 | 19,164 | 4,186 |
| JEFFERSON | 117,201 | 28,862 | 13,365 | 2,624 | 7,587 | 2,877 | 1,321 | 29,574 | 6,227 |
| KINGS | 2,528,050 | 637,307 | 307,692 | 57,938 | 163,692 | 63,455 | 30,635 | 666,473 | 142,257 |
| MADISON | 69,829 | 14,743 | 9,110 | 1,340 | 4,801 | 1,882 | 931 | 19,973 | 4,294 |
| MONROE | 729,681 | 167,562 | 97,857 | 15,233 | 49,087 | 19,455 | 9,838 | 208,542 | 45,082 |
| NASSAU | 1,306,533 | 301,502 | 194,619 | 27,410 | 88,379 | 35,998 | 19,192 | 395,319 | 86,610 |
| NEW YORK | 1,620,867 | 273,423 | 204,078 | 24,857 | 116,001 | 44,125 | 20,423 | 455,080 | 96,056 |
| NIAGARA | 214,845 | 46,837 | 32,807 | 4,258 | 14,675 | 5,939 | 3,128 | 64,886 | 14,154 |
| ONEIDA | 232,304 | 49,945 | 36,989 | 4,541 | 15,827 | 6,403 | 3,370 | 69,964 | 15,234 |

| | | | | AT-RISK GROUPS | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Lung Diseases | | | | | |
| County | Total Population | Under 18 | 65 & Over | Pediatric Asthma | Adult Asthma | Chronic Bronchitis | Emphysema | CV Disease | Diabetes |
| ONONDAGA | 454,010 | 105,188 | 61,931 | 9,563 | 30,398 | 12,059 | 6,108 | 129,381 | 27,964 |
| ORANGE | 377,169 | 101,162 | 37,461 | 9,197 | 24,125 | 9,213 | 4,305 | 95,287 | 20,247 |
| OSWEGO | 121,454 | 27,445 | 14,338 | 2,495 | 8,209 | 3,184 | 1,540 | 33,445 | 7,159 |
| PUTNAM | 99,489 | 23,571 | 11,068 | 2,143 | 6,734 | 2,647 | 1,317 | 28,129 | 6,085 |
| QUEENS | 2,270,338 | 485,989 | 299,388 | 44,181 | 154,922 | 60,582 | 29,797 | 641,503 | 137,609 |
| RENSSELAER | 155,318 | 33,819 | 20,137 | 3,074 | 10,598 | 4,160 | 2,063 | 44,202 | 9,511 |
| RICHMOND | 481,613 | 114,171 | 57,621 | 10,379 | 32,127 | 12,538 | 6,142 | 132,437 | 28,439 |
| SARATOGA | 215,852 | 47,726 | 26,149 | 4,339 | 14,713 | 5,741 | 2,811 | 60,628 | 13,022 |
| SCHENECTADY | 150,818 | 34,541 | 23,143 | 3,140 | 10,126 | 4,098 | 2,159 | 44,786 | 9,762 |
| ST. LAWRENCE | 109,809 | 22,409 | 14,804 | 2,037 | 7,563 | 2,950 | 1,443 | 31,167 | 6,671 |
| STEUBEN | 96,874 | 21,801 | 14,898 | 1,982 | 6,551 | 2,656 | 1,404 | 29,065 | 6,343 |
| SUFFOLK | 1,453,229 | 358,691 | 185,431 | 32,609 | 95,965 | 38,051 | 19,260 | 407,911 | 88,295 |
| ULSTER | 181,860 | 37,615 | 24,747 | 3,420 | 12,630 | 5,010 | 2,538 | 53,734 | 11,629 |
| WAYNE | 91,291 | 21,797 | 12,121 | 1,982 | 6,112 | 2,444 | 1,258 | 26,404 | 5,741 |
| WESTCHESTER | 951,325 | 230,588 | 133,307 | 20,963 | 63,088 | 25,344 | 13,163 | 275,008 | 59,838 |
| **TOTALS** | **17,286,970** | **3,979,592** | **2,255,031** | **361,785** | **1,157,796** | **454,702** | **225,669** | **4,833,777** | **1,039,582** |

# NEW YORK

# NEW YORK


## American Lung Association in New York

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| | HIGH OZONE DAYS/2005–2007 | | | | | PARTICLE POLLUTION DAYS/2005–2007 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 24-Hour | | | | | Annual | |
| County | Orange | Red | Purple | Wgt. Avg | Grade | Orange | Red | Purple | Wgt. Avg | Grade | Design Value | Pass/ Fail |
| ALBANY | 11 | 0 | 0 | 3.7 | F | 7 | 0 | 0 | 2.3 | D | DNC | INC |
| BRONX | 12 | 2 | 0 | 5.0 | F | 31 | 0 | 0 | 10.3 | F | 15.5 | FAIL |
| CHAUTAUQUA | 48 | 1 | 0 | 16.5 | F | 3 | 0 | 0 | 1.0 | C | 9.7 | PASS |
| CHEMUNG | 2 | 0 | 0 | 0.7 | B | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| DUTCHESS | 15 | 0 | 0 | 5.0 | F | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| ERIE | 34 | 2 | 0 | 12.3 | F | 11 | 0 | 0 | 3.7 | F | 12.5 | PASS |
| ESSEX | 25 | 2 | 0 | 9.3 | F | 1 | 0 | 0 | 0.3 | B | 5.9 | PASS |
| FRANKLIN | 13 | 0 | 0 | 4.3 | F | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| HAMILTON | 4 | 0 | 0 | 1.3 | C | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| HERKIMER | 3 | 0 | 0 | 1.0 | C | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| JEFFERSON | 17 | 1 | 0 | 6.2 | F | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| KINGS | * | * | * | * | * | 8 | 0 | 0 | 2.7 | D | 14.0 | PASS |
| MADISON | 7 | 0 | 0 | 2.3 | D | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| MONROE | 19 | 0 | 0 | 6.3 | F | 4 | 0 | 0 | 1.3 | C | 10.6 | PASS |
| NASSAU | DNC | DNC | DNC | DNC | DNC | 5 | 0 | 0 | 1.7 | C | 11.4 | PASS |
| NEW YORK | * | * | * | * | * | 15 | 0 | 0 | 5.0 | F | 15.9 | FAIL |
| NIAGARA | 32 | 1 | 0 | 11.2 | F | 8 | 0 | 0 | 2.7 | D | 11.8 | PASS |
| ONEIDA | 3 | 0 | 0 | 1.0 | C | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| ONONDAGA | 14 | 0 | 0 | 4.7 | F | 1 | 0 | 0 | 0.3 | B | 9.9 | PASS |

| | HIGH OZONE DAYS/2005–2007 | | | | | PARTICLE POLLUTION DAYS/2005–2007 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 24-Hour | | | | | Annual | |
| County | Orange | Red | Purple | Wgt. Avg | Grade | Orange | Red | Purple | Wgt. Avg | Grade | Design Value | Pass/ Fail |
| ORANGE | 27 | 2 | 0 | 10.0 | F | 4 | 0 | 0 | 1.3 | C | 10.8 | PASS |
| OSWEGO | 15 | 0 | 0 | 5.0 | F | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| PUTNAM | 23 | 3 | 1 | 9.8 | F | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| QUEENS | 19 | 0 | 0 | 6.3 | F | 16 | 0 | 0 | 5.3 | F | 11.8 | PASS |
| RENSSELAER | 14 | 1 | 0 | 5.2 | F | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| RICHMOND | 33 | 7 | 0 | 14.5 | F | 6 | 0 | 0 | 2.0 | C | 13.2 | PASS |
| SARATOGA | 21 | 0 | 0 | 7.0 | F | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| SCHENECTADY | 6 | 0 | 0 | 2.0 | C | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| ST. LAWRENCE | DNC | DNC | DNC | DNC | DNC | 0 | 0 | 0 | 0.0 | A | 6.9 | PASS |
| STEUBEN | * | * | * | * | * | 3 | 0 | 0 | 1.0 | C | 8.7 | PASS |
| SUFFOLK | 34 | 9 | 1 | 16.5 | F | 3 | 0 | 0 | 1.0 | C | DNC | INC |
| ULSTER | 13 | 0 | 0 | 4.3 | F | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| WAYNE | 9 | 0 | 0 | 3.0 | D | DNC | DNC | DNC | DNC | DNC | DNC | DNC |
| WESTCHESTER | 29 | 7 | 0 | 13.2 | F | 4 | 0 | 0 | 1.3 | C | 11.7 | PASS |

Notes:
(1) The weighted average was derived by adding the three years of individual level data (2005-2007), multiplying the sums of each level by the assigned standard weights, i.e. 1=orange, 1.5=red, 2.0=purple and calculating the average. (2) Asterisk (*) indicates incomplete monitoring data for all three years. Therefore, those counties are excluded from the grade analysis or received an Incomplete. (3) DNC indicates that data on that particular pollutant is not collected in that county. (4) Grades are as follows: A=0.0, B=0.3-0.9, C=1.0-2.0, D=2.1-3.2, F=3.3+.

We will breathe easier when the air over every
American city is clean and pure.
We will breathe easier when the air in our public spaces,
workplaces and children's homes is free of secondhand smoke.
We will breathe easier when Americans are free from the addictive grip
of cigarettes and the debilitating effects of lung disease.
We will breathe easier when our nation's children no longer battle
airborne poisons or the fear of an asthma attack.
*Until then, we are fighting for air.*

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