Trouble in the Air

Millions of Americans Breathe Polluted Air
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Written by:
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Frontier Group

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Executive Summary

People across America regularly breathe unhealthy air that increases their risk of premature death, asthma attacks and other adverse health impacts.

In 2016, 73 million Americans experienced more than 100 days of degraded air quality with the potential to harm human health. That is equal to more than three months of the year in which smog and/or particulate pollution was above the level that the EPA has determined presents “little to no risk.” Millions more people in urban and rural areas experienced less frequent but still damaging levels of air pollution.

To safeguard public health, the nation needs to preserve and strengthen existing air quality protections at the federal and state level and move to reduce the future air pollution threats posed by global warming.

Burning fossil fuels such as coal, diesel, gasoline and natural gas creates air pollution in the form of smog, particulates and air toxics. Wildfires, wood stoves, agricultural dust and other sources create additional air pollution. There is no documented safe level of exposure to some of these pollutants.1

- Smog, or ground-level ozone, causes a host of respiratory problems, ranging from coughing, wheezing and throat irritation to asthma, increased risk of infection, and permanent damage to lung tissue.2

- Particulate pollution (PM$_{2.5}$) can cause similar respiratory harm and also trigger a range of cardiovascular problems, including heart attacks, strokes, congestive heart failure, and reduced blood supply to the heart.3 These problems can result in increased hospital admissions and premature deaths. Particulate pollution has also been shown to trigger premature birth, raise the risk of autism, stunt lung development in children, and increase the risk that they may develop asthma.4 Recent studies also implicate particulate pollution in an increased risk of dementia.5

- Levels of air pollution that meet current federal air quality standards can be harmful to health, especially with prolonged exposure. Researchers can detect negative health impacts, such as increased premature deaths, for people exposed to pollution at levels the EPA considers “good” or “moderate.”6 Current federal standards are less stringent than those recommended by the World Health Organization. They may also fail to reflect the impact of frequent exposure to moderate levels of pollution. For these reasons, the analysis in this report includes air pollution at or above the level the EPA labels “moderate” and indicates in yellow or worse in its Air Quality Index.

Millions of Americans live in urban and rural areas that experience frequent smog and/or particulate pollution.

- 56 metropolitan and micropolitan areas and four rural counties experienced more than 100 days on which smog and/or particulate pollution was “moderate” or higher – in other words, above the level that the EPA has
Table ES-1. Ten Most Populated Metropolitan Areas with More than 100 Days of Elevated Air Pollution in 2016

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Figure ES-1. Both Urban and Rural Areas Experienced Frequent Smog and/or Particular Pollutants in 2016
determined presents “little to no risk.” Seventy-three million Americans live in those places. (See Table ES-1.)

• Another 241 urban areas and 42 rural counties faced 31 to 100 days – a month or more – of smog and/or particulate pollution above the “little to no risk” level. Those places include large metropolitan areas such as Chicago, Miami and Hartford, and smaller communities such as Macon, Georgia; Yuma, Arizona; and Gettysburg, Pennsylvania. These places are home to 173 million Americans.

Smog pollution is a frequent health threat in some regions.

• 8 million people, living in 12 urban areas and two rural counties, were exposed to more than 100 days of elevated smog pollution in 2016. All of those places were located in inland California, where the wind carries pollution from urban centers, and hot, sunny days facilitate the reaction between nitrogen oxides (NOx) and volatile organic compounds (VOCs) that creates smog.

• Another 159 million residents of 208 areas breathed air with excess ozone pollution on 31 to 100 days in 2016. Those urban areas and rural counties were located in 38 different states, plus the District of Columbia.

Particulate pollution affected people living in a broad range of places in 2016.

• 21 million people, living in 21 urban and rural areas, were exposed to more than 100 days of elevated particulate pollution in 2016. These urban areas and rural counties were located in California, Georgia, Louisiana, Montana, New Jersey, North Carolina, Ohio, Pennsylvania and West Virginia.

• An additional 132 places, home to 154 million Americans, experienced 31 to 100 days of elevated particulate pollution. These areas include many of the nation’s largest metropolitan areas, and also much less populated areas where wintertime wood-burning for heat and summertime wildfires create extensive particulate pollution.

Global warming threatens to exacerbate the nation’s smog and particulate pollution problems. Higher temperatures will facilitate formation of smog and altered wind patterns may increase the number of days with stagnant air that prevents dilution of contaminants. Wildfires, which generate particulate pollution and smog precursors that can travel hundreds of miles, are predicted to become more frequent and intense.

To reduce the pollution that threatens the health of people across the country, and to avoid global warming-related increases in air pollution in the future, the nation should:

• Defend and build upon improvements in air quality achieved through rules implementing the Clean Air Act. Pollution reductions achieved under regulations of the Clean Air Act Amendments of 1990 helped prevent more than 160,000 early deaths, 130,000 non-fatal heart attacks, and 41,000 hospital admissions in 2010 alone. These benefits are in addition to those created by the original Clean Air Act. Maintaining the gains already achieved through implementation of the Clean Air Act and seeking greater emission reductions are crucial for ensuring that Americans can breathe cleaner air.

• Strengthen federal fuel economy standards for cars and light trucks. These standards are critical to the nation’s efforts to reduce global warming pollution from passenger vehicles.

• Continue to allow states to adopt stronger standards for pollution from vehicles to help reduce global warming emissions and health-threatening air pollution. The clean car standards pioneered by 13 states plus the District of Columbia have been highly effective in reducing pollution.

• Support policies at every level of government to reduce global warming pollution, including increasing the use of wind, solar and other clean energy, and placing state and regional limits on climate pollution.
Air pollution is a threat to public health. Ground-level ozone and particulate pollution, along with other toxic air pollutants, are the by-products of burning fossil fuels like gasoline, diesel, coal and natural gas. Wildfires, agricultural activity and volcanoes also contribute to air pollution. When inhaled, these air pollutants cause respiratory and cardiovascular damage.

Smog
Burning fossil fuels creates nitrogen oxides (NOx). Volatile organic compounds (VOCs) result from combustion or evaporation of gasoline, diesel and other petroleum fuels, from chemical solvents used in products such as cleaners or paints, and even from natural sources such as some plants.\textsuperscript{12}

When NOx and VOCs mix in the presence of sunlight, they form ozone – a powerfully reactive gas that is a principal component of smog. A natural layer of “good” ozone exists high in the atmosphere that protects us from exposure to ultraviolet radiation, but when pollutants create ozone near the ground it becomes a threat to public health. (As the impacts of global warming become more pronounced, smog pollution likely will become worse. See “Global Warming May Make Air Pollution Worse,” p. 19.)

Ground-level ozone quickly reacts with airway tissues and produces inflammation analogous to a sunburn on the inside of the lungs. This inflammation makes lung tissues less elastic, more sensitive to allergens, and more prone to infections.\textsuperscript{13}

Minor exposure to ozone can cause coughing, wheezing and throat irritation. Frequent exposure to ozone over time permanently damages lung tissues, decreases the ability to breathe normally, and exacerbates or even causes chronic diseases like asthma.\textsuperscript{14}

Children, adults who are active outdoors, and people with pre-existing respiratory system ailments suffer most from ozone’s effects. Children’s vulnerability to air pollution is the result of several factors: their lungs are not yet fully developed; they spend more time outside; they breathe more air than adults do, relative to their size; and they are more likely to have asthma.\textsuperscript{15} Asthma is a common reason that children are forced to miss school.\textsuperscript{16}

On days with elevated levels of ozone pollution:

- Hospitals admit increased numbers of patients for respiratory and cardiovascular disease.\textsuperscript{17} Scientists have estimated that on the most polluted summer days, smog pollution is responsible for up to half of all respiratory hospital admissions.\textsuperscript{18}
- More people visit hospital emergency rooms for asthma, pneumonia and upper respiratory infections.\textsuperscript{19}
- Children and adults suffer more asthma attacks, increased respiratory difficulty, and reduced lung function.\textsuperscript{20}
- More adults miss work and more children miss school due to illness.\textsuperscript{21}
Particulate matter consists of extremely small particles that can contain hundreds of toxic chemicals. Fine particles, those of 2.5 micrometers or less, present the greatest health risk because such small contaminants can be inhaled deeper into the lungs and even enter the bloodstream. Both short-term and long-term exposure to elevated levels of particulates can harm health.

Air pollution hangs over downtown Baltimore in this photo from early January 2016. A winter weather condition, known as an inversion, can trap pollution from cars, industrial activity and other combustion sources close to the ground. The markings on the image show how the pollution lifted during the day as the air warmed up. Credit: Maryland Department of the Environment

Particulates

Children are particularly at risk from exposure to particulate pollution. For example:

- A pregnant woman’s exposure to elevated levels of particulate pollution increases her risk of having her baby early. More than 15,000 pre-term births in the U.S. in 2010 were likely the result of particulate pollution.

- Exposure in utero to particulate pollution raises the risk that a child will have an autism spectrum disorder. The higher the mother’s exposure to particulate pollution, the higher the autism risk for her child.

- Particulate pollution may trigger changes in children’s brains that are early physical markers of Alzheimer’s disease.

- Children who are exposed to elevated levels of particulates may experience irreversible
damage as particulate pollution interferes with lung growth and development. Exposure to particulates may also cause children to be less able to fully inhale and more likely to develop asthma.

- Short-term increases in particulate pollution may raise the risk that children will develop respiratory infections, such as influenza. A study of people living in Utah’s Wasatch Front region, which includes Salt Lake City, found that more young children received medical care for lower-respiratory infections in the weeks following spikes in particulate pollution.

Older people are vulnerable to neurological damage from particulate pollution. Older women who live in areas with higher levels of particulate pollution are more likely to develop dementia. Another study that looked at both older men and women exposed to elevated ozone and particulate pollution found elevated Alzheimer’s disease risk.

### Air Toxics

Fossil fuel combustion releases toxic air contaminants such as benzene, formaldehyde and 1,3-butadiene that contribute to smog and particulate pollution, and that are also hazardous on their own. At sufficient levels of exposure, these pollutants can irritate airways and lungs, cause asthma, worsen asthma symptoms, and cause leukemia and other types of cancer.

Levels of air toxics are not included in the analysis presented in this report.

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### Outdoor Air Quality Influences Indoor Air Quality

Outdoor air quality influences the quality of air inside homes, workplaces, day cares, schools and other buildings, where Americans spend approximately 90 percent of their time. Ozone and particulate matter from outdoor air adds to air pollution from indoor sources, as do sulfur dioxide, nitrogen oxides and carbon monoxide. Polluted air can enter into buildings through ventilation systems, open windows and doors, and cracks and gaps in exterior walls.

Indoor activities and products add to air quality problems inside buildings. Smoking tobacco, burning wood and cooking can all degrade indoor air quality. For example, cooking with natural gas rather than electricity has been linked to respiratory harm in women. Common household chemicals used for cleaning, home maintenance or hobbies, as well as in cosmetics, can release organic compounds that create health threats. As a result, the concentration of organic gases may be as much as five times higher indoors than outdoors. Pesticides, products containing asbestos, and pressed-wood furniture that releases formaldehyde can add to indoor air pollution.

The share of total indoor air pollution that comes from outside sources varies greatly depending on the pollutant, the types and amount of activity taking place inside the building, the extent of ventilation that draws in outside air, and other factors. For example, well-sealed buildings that have air filtration systems contain less particulate pollution from outdoor sources.

Steps to reduce outdoor air pollution will help to improve indoor air quality, but additional measures are needed to address indoor-specific sources of air pollution.
Sources of Air Pollution

Burning gasoline, diesel, coal and other fossil fuels for transportation, electricity generation, industrial processes, heating and other purposes is a major source of the NOx and VOC emissions that create smog. Fossil fuel combustion, along with dust and fires, is a major contributor to particulate pollution, both by releasing particulates directly and by producing precursor chemicals that combine into particulates.

Nationally, on-road transportation – passenger vehicles, buses and trucks – is the biggest source of NOx emissions. Non-road vehicles – from airplanes and locomotives to construction and lawn equipment – are the next largest source. Together, these mobile sources account for more than half of NOx emissions. Pollution from electricity generation is the next largest source of NOx. (See Figure 1.)

Figure 1. Sources of Nitrogen Oxide Pollution in 2014

Agricultural activity, wildfires and dust from unpaved roads are some of the largest sources of particulate pollution nationally, adding to pollution from fossil fuel combustion. Fossil fuel combustion, however, is a major source of particulate pollution in the cities and suburban areas where most Americans live. A recent study of particulate pollution in Iowa found that pollution from gasoline and diesel engines added significantly to particulate pollution in urban areas.

Appendix B provides state-by-state data on the share of NOx, VOCs and particulate pollution that comes from electricity generation and mobile sources.
Degraded air quality affects residents of every state in the country. In the summer, ozone pollution is a widespread problem, while in the winter, many areas suffer from particulate pollution. Even a single day of elevated air pollution represents a threat to public health.

Air Pollution Indicators
Thousands of air quality monitors in both urban and rural areas across the nation sample air pollution levels multiple times each hour. Based on this information, the U.S. Environmental Protection Agency (EPA) identifies potentially harmful air quality conditions. To communicate potential health risks to the public, the EPA has designed an Air Quality Index (AQI) that classifies pollutant levels into different risk categories. (See Table 1.) The categories are:

- “Good” (green), which means air quality poses “little or no risk,” according to the EPA.45
- “Moderate” (yellow), a level at which air quality is deemed “acceptable.”
- “Unhealthy for sensitive groups” (orange), such as children, older adults, and people with heart or lung disease, who may experience health problems at this level of air pollution.
- “Unhealthy” (red), which means air is unhealthy for all people in the area, and health impacts may increase for sensitive people.
- “Very unhealthy” (purple), meaning health impacts will be more severe.
- “Hazardous” (maroon), which means air pollution is severe and presents a risk to the entire population.

The pollution categories within the AQI provide a tool for communicating relative risk. Different

Table 1. Air Quality Index Values and Colors

<table>
<thead>
<tr>
<th>Air Quality Category</th>
<th>Air Quality Index Values</th>
<th>Color</th>
<th>Ozone Readings (ppb)</th>
<th>PM$_{2.5}$ Readings ($\mu g/m^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0-50</td>
<td>Green</td>
<td>0-54</td>
<td>0-12</td>
</tr>
<tr>
<td>Moderate</td>
<td>51-100</td>
<td>Yellow</td>
<td>55-70</td>
<td>12.1-35.4</td>
</tr>
<tr>
<td>Unhealthy for Sensitive Groups</td>
<td>101-150</td>
<td>Orange</td>
<td>71-85</td>
<td>35.5-55.4</td>
</tr>
<tr>
<td>Unhealthy</td>
<td>151-200</td>
<td>Red</td>
<td>86-105</td>
<td>55.5-150.4</td>
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<td>Very Unhealthy</td>
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<td>Purple</td>
<td>106-200</td>
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</tr>
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<td>Hazardous</td>
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<td>201+</td>
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individuals may experience health impacts at lower or higher levels than the AQI suggests.

The AQI is linked to the National Ambient Air Quality Standards, which are periodically reviewed and adjusted based on the latest research on the links between pollution and public health. For example, currently the EPA has concluded that ozone levels above 70 parts per billion for eight hours or more are unhealthy for sensitive people, and when ozone exceeds that level, the EPA warns that children, older adults and people with lung disease should consider limiting their exposure. The EPA has concluded that sensitive people are at risk when levels of fine particulates (particulate matter of 2.5 microns or less) average 35 micrograms per cubic meter of air ($\mu g/m^3$) over 24 hours. (Table 1 presents AQI values and colors alongside ozone and particulate pollution thresholds.)

However, even “moderate” levels of air pollution can be harmful, particularly when people are exposed to them over a long period. A growing body of evidence suggests that current standards may not adequately account for the public health risks from air pollution.

The World Health Organization (WHO) recommends lower ozone and particulate pollution standards to protect public health. The WHO published air quality guidelines in 2006 that recommended an ozone pollution standard equal to 50 parts per billion over eight hours. In comparison, the current U.S. ozone standard is 70 parts per billion. The WHO recommended that particulates be limited to 25 $\mu g/m^3$ over 24 hours, more protective than the current U.S. standard of 35 $\mu g/m^3$. Above these levels, death rates increase.

The American Thoracic Society, the American Lung Association and other health associations support the same standard as the WHO.

Beyond that, it is not clear that there is a safe or “acceptable” level of short-term ozone or particulate exposure at all. Researchers can detect negative health impacts for people exposed to very low concentrations of pollution.

- Even when concentrations of smog are at levels considered by the EPA to be “good” or “moderate,” a 2006 study found that a modest increase in smog pollution results in more premature deaths.

- In a 2017 study, researchers examined more than 22 million deaths in the Medicare population from 2000 to 2012 and found that a 10-parts-per-billion rise in smog pollution increased the daily mortality rate by 0.5 percent, regardless of how low pollution levels had been initially. In the same population, a small (10 $\mu g/m^3$) increase in particulate pollution increased the daily death rate by 1.05 percent. The authors conclude that there is “no evidence of a threshold” below which smog or particulate pollution is safe.

- The World Health Organization in 2006 concluded that there is no documented safe level of exposure to particulate pollution.

In addition, averaging pollution data over eight hours for ozone and 24 hours for particulate pollution, as is the case for the AQI data used in this report, may mask short-term spikes in pollution that can damage health.

Finally, current standards may not reflect the long-term harm of air pollution. The EPA notes that repeated exposure to ozone pollution increases the risk of health impacts, especially in children. A study of air pollution in Stockholm, Sweden, found that a policy that limited driving – and thus air pollution – in the central city reduced asthma attacks in children in subsequent years. The authors suggest that curbing air pollution can have significant long-term benefits.

Separately, researchers at the Harvard School of Public Health have found that death rates for older Americans rise as air pollution increases – even when air pollution levels are below current national standards. The U.S. does not have an annual standard for smog, and the researchers suggest that the nation adopt one because of ozone’s long-term health impacts.

In short, there is strong evidence that U.S. air
pollution standards are inadequate to protect public health, that exposure to even “moderate” levels of pollution is a serious public health concern, and that any incremental reduction in air pollution is likely to produce public health benefits.

Threshold Used in This Analysis
This report estimates the number of days of degraded air quality experienced in 2016 by people living across the country, based on the number of days when air quality monitors reported an AQI of 51 or higher. This includes days that the EPA coded as moderate, unhealthy for sensitive groups, unhealthy, very unhealthy and hazardous. Air pollution data were grouped regionally, primarily by metropolitan and micropolitan areas. A relatively small number of rural counties also have air pollution monitors and were included.

In areas that contain more than one monitoring location, days in which half or more of the monitoring locations in the area reported an air quality problem were included in the tally of days with degraded air quality. People who live close to individual air pollution monitors may experience worse air pollution than indicated by this measure. However, counting every elevated reading from individual air pollution monitors runs the risk that a high reading from one or a handful of monitors may overstate the extent of the air pollution problem in a geographically dispersed metropolitan area.58

This report presents the number of days with elevated smog pollution and with elevated particulate pollution, which present different types of threats to health. It also presents the number of days with elevated smog and/or particulate pollution, a measure of how often residents have to breathe polluted air.

Table 2. Ten Most Populated Metropolitan Areas with More than 100 Days of Elevated Air Pollution in 2016

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Note: This count includes air pollution at or above the level the EPA labels “moderate” and indicates in yellow or worse in its Air Quality Index.
Number of Days with Smog or Particulate Pollution

In 2016, air pollution affected people across the nation. Seventy-three million Americans living in 56 metropolitan and micropolitan areas and four rural counties experienced more than 100 days of degraded air quality in 2016. That is equal to more than three months of the year in which smog and/or particulate pollution was above the level that the EPA has determined presents “little to no risk.” (See Table 2.)

Another 173 million Americans live in 241 urban areas and 42 rural counties that faced 31 to 100 days – a month or more – of elevated smog and/or particulate pollution. Those places include large metropolitan areas such as Chicago, Miami and Hartford. (See Table 3.) Pollution also affects smaller communities such as Macon, Georgia; Yuma, Arizona; and Gettysburg, Pennsylvania.

Number of Days with Smog Pollution

More than 8 million people, living in 12 urban areas and two rural counties, experienced more than 100 days of smog pollution in 2016. All of those places were located in inland California, such as in the Central Valley or Sierra Nevada foothills, where the wind carries pollution from coastal urban centers and hot, sunny days facilitate the reaction between extensive amounts of NOx and VOCs to create smog.

Residents of another 208 places breathed air with excess ozone pollution on 31 to 100 days in 2016. That means that for one to three months in 2016, those 159 million Americans were exposed to elevated smog pollution. Those rural counties and urban areas were located in 38 different states, plus the District of Columbia.

Number of Days with Particulate Pollution

Particulate pollution was a problem for 21 million people on more than 100 days in 21 areas in 2016. Those urban areas and rural counties were located in California, Georgia, Louisiana, Montana, New Jersey, North Carolina, Ohio, Pennsylvania and West Virginia. As with smog pollution in California, elevated particulate pollution occurs most often in inland regions. In Pennsylvania, the five cities with frequent particulate pollution are located west and northwest of Philadelphia, stretching from Harrisburg and Lancaster to the Allentown-Bethlehem-Easton area. (See Table 5.)

### Table 3. Ten Most Populated Metropolitan Areas with 31 to 100 Days of Elevated Air Pollution in 2016

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<td>20,275,179</td>
</tr>
<tr>
<td>Chicago-Naperville-Elgin, IL-IN-WI</td>
<td>84</td>
<td>9,546,326</td>
</tr>
<tr>
<td>Dallas-Fort Worth-Arlington, TX</td>
<td>72</td>
<td>7,253,424</td>
</tr>
<tr>
<td>Houston-The Woodlands-Sugar Land, TX</td>
<td>85</td>
<td>6,798,010</td>
</tr>
<tr>
<td>Washington-Arlington-Alexandria, DC-VA-MD-WV</td>
<td>84</td>
<td>6,150,681</td>
</tr>
<tr>
<td>Miami-Fort Lauderdale-West Palm Beach, FL</td>
<td>35</td>
<td>6,107,433</td>
</tr>
<tr>
<td>Boston-Cambridge-Newton, MA-NH</td>
<td>32</td>
<td>4,805,942</td>
</tr>
<tr>
<td>San Francisco-Oakland-Hayward, CA</td>
<td>41</td>
<td>4,699,077</td>
</tr>
<tr>
<td>Detroit-Warren-Dearborn, MI</td>
<td>97</td>
<td>4,305,869</td>
</tr>
<tr>
<td>Minneapolis-St. Paul-Bloomington, MN-WI</td>
<td>37</td>
<td>3,557,276</td>
</tr>
</tbody>
</table>

**Note:** This count includes air pollution at or above the level the EPA labels “moderate” and indicates in yellow or worse in its Air Quality Index.
Figure 2. Both Urban and Rural Areas Experienced Frequent Smog and/or Particulate Pollution in 2016

Table 4. Areas with More than 100 Days of Smog Pollution in 2016

<table>
<thead>
<tr>
<th>Urban Area or Rural County</th>
<th>Number of Days in 2016 in which Half or More Monitoring Locations Reported Elevated Ozone</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riverside-San Bernardino-Ontario, CA</td>
<td>155</td>
<td>4,523,653</td>
</tr>
<tr>
<td>Fresno, CA</td>
<td>140</td>
<td>979,534</td>
</tr>
<tr>
<td>Bakersfield, CA</td>
<td>159</td>
<td>885,086</td>
</tr>
<tr>
<td>Modesto, CA</td>
<td>102</td>
<td>541,353</td>
</tr>
<tr>
<td>Visalia-Porterville, CA</td>
<td>151</td>
<td>460,835</td>
</tr>
<tr>
<td>Merced, CA</td>
<td>116</td>
<td>268,878</td>
</tr>
<tr>
<td>Yuba City, CA</td>
<td>115</td>
<td>171,243</td>
</tr>
<tr>
<td>Madera, CA</td>
<td>131</td>
<td>154,966</td>
</tr>
<tr>
<td>Hanford-Corcoran, CA</td>
<td>146</td>
<td>149,797</td>
</tr>
<tr>
<td>Truckee-Grass Valley, CA</td>
<td>121</td>
<td>99,053</td>
</tr>
<tr>
<td>Red Bluff, CA</td>
<td>134</td>
<td>63,444</td>
</tr>
<tr>
<td>Sonora, CA</td>
<td>131</td>
<td>53,787</td>
</tr>
<tr>
<td>Calaveras County, CA</td>
<td>105</td>
<td>45,171</td>
</tr>
<tr>
<td>Mariposa County, CA</td>
<td>117</td>
<td>17,410</td>
</tr>
</tbody>
</table>

Note: This count includes air pollution at or above the level the EPA labels “moderate” and indicates in yellow or worse in its Air Quality Index.
An additional 132 places, home to 154 million Americans, experienced 31 to 100 days of elevated particulate pollution in 2016. These include many of the nation’s largest metropolitan areas, such as the New York, Los Angeles, and Chicago regions, where diesel trucks, industrial activity, and other combustion sources can produce particulate pollution and its precursors. Particulate pollution is also a recurring problem in a number of less populated areas where wintertime wood-burning for heat and summertime wildfires create extensive particulate pollution. (See Table 6.)

### Table 5. Ten Most Populated Metropolitan Areas with More Than 100 Days of Particulate Pollution in 2016

<table>
<thead>
<tr>
<th>Metropolitan Area</th>
<th>Number of Days in 2016 in which Half or More Monitoring Locations Reported Elevated PM$_{2.5}$</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlanta-Sandy Springs-Roswell, GA</td>
<td>103</td>
<td>5,795,723</td>
</tr>
<tr>
<td>Riverside-San Bernardino-Ontario, CA</td>
<td>145</td>
<td>4,523,653</td>
</tr>
<tr>
<td>Cleveland-Elyria, OH</td>
<td>105</td>
<td>2,060,065</td>
</tr>
<tr>
<td>Raleigh, NC</td>
<td>105</td>
<td>1,304,896</td>
</tr>
<tr>
<td>Fresno, CA</td>
<td>140</td>
<td>979,534</td>
</tr>
<tr>
<td>Bakersfield, CA</td>
<td>179</td>
<td>885,086</td>
</tr>
<tr>
<td>Baton Rouge, LA</td>
<td>125</td>
<td>835,596</td>
</tr>
<tr>
<td>Allentown-Bethlehem-Easton, PA-NJ</td>
<td>106</td>
<td>835,233</td>
</tr>
<tr>
<td>Stockton-Lodi, CA</td>
<td>201</td>
<td>734,294</td>
</tr>
<tr>
<td>Harrisburg-Carlisle, PA</td>
<td>112</td>
<td>568,008</td>
</tr>
</tbody>
</table>

*Note: This count includes particulate pollution at or above the level the EPA labels “moderate” and indicates in yellow or worse in its Air Quality Index.*

### Table 6. Rural Counties with 31 to 100 Days of Particulate Pollution in 2016

<table>
<thead>
<tr>
<th>Rural County</th>
<th>Number of Days in 2016 in which Half or More Monitoring Locations Reported Elevated PM$_{2.5}$</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aroostook County, ME</td>
<td>34</td>
<td>67,959</td>
</tr>
<tr>
<td>Oxford County, ME</td>
<td>47</td>
<td>57,217</td>
</tr>
<tr>
<td>Calaveras County, CA</td>
<td>38</td>
<td>45,171</td>
</tr>
<tr>
<td>Ravalli County, MT</td>
<td>73</td>
<td>42,088</td>
</tr>
<tr>
<td>Randolph County, IL</td>
<td>31</td>
<td>32,621</td>
</tr>
<tr>
<td>Swain County, NC</td>
<td>64</td>
<td>14,346</td>
</tr>
<tr>
<td>Shoshone County, ID</td>
<td>90</td>
<td>12,452</td>
</tr>
<tr>
<td>Benewah County, ID</td>
<td>51</td>
<td>9,092</td>
</tr>
<tr>
<td>Lemhi County, ID</td>
<td>40</td>
<td>7,723</td>
</tr>
<tr>
<td>Powder River County, MT</td>
<td>32</td>
<td>1,746</td>
</tr>
</tbody>
</table>

*Note: This count includes particulate pollution at or above the level the EPA labels “moderate” and indicates in yellow or worse in its Air Quality Index.*
Areas with High Pollution Levels or Hot Spots
Regional-level smog and particulate data can mask episodes of especially severe pollution or pollution hot spots where residents regularly breathe polluted air. Residents of these air pollution “hot spots” face greater health risks from the air they breathe.

Some Regions Suffer from Chronic and Severe Pollution
Some areas experience pollution that is both frequent and severe. For example, the Riverside-San Bernardino-Ontario metropolitan area, home to 4.5 million people east of Los Angeles, experienced 155 days in 2016 in which more than half the region’s air pollution monitoring locations reported smog above the level the EPA says presents “little to no risk.” On 50 of those days, at least one monitoring location in Riverside reported smog levels as “unhealthy” and on 13 days at least one location reported “very unhealthy” pollution. The EPA says that unhealthy (red-level) air pollution is unhealthy for everyone, not just sensitive groups, and very unhealthy (purple-level) pollution creates even more severe health impacts. Table 7 reproduces the list from Table 4 of all the places that experienced more than 100 days of smog pollution in 2016, and adds further detail about especially high pollution levels.

Other regions that suffer from particulate pollution that is both chronic and severe. Four metropolitan areas that had chronic particulate pollution (more than 50 days on which more than half of air pollution monitoring locations reported particulate pollution above the level the EPA says presents “little to no risk”) also had several days of severe pollution. Fairbanks, Alaska, which had 65 days of elevated particulate pollution experienced five days on which at least one monitor reported “red” level pollution. Yakima, Washington; Knoxville, Tennessee; and Salt Lake City, Utah, each had more than 50 days of particulate pollution and three days on which at least one monitor reported “red” level pollution.

Table 7. Pollution Severity in Areas with More than 100 Days of Smog Pollution in 2016

<table>
<thead>
<tr>
<th>Urban Area or Rural County</th>
<th>Number of Days in 2016 in which Half or More Monitoring Locations Reported Elevated Ozone</th>
<th>Number of Days in 2016 in which at Least One Monitoring Location Reported “Unhealthy” Ozone Pollution</th>
<th>Number of Days in 2016 in which at Least One Monitoring Location Reported “Very Unhealthy” Ozone Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bakersfield, CA</td>
<td>159</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Riverside-San Bernardino-Ontario, CA</td>
<td>155</td>
<td>50</td>
<td>13</td>
</tr>
<tr>
<td>Visalia-Porterville, CA</td>
<td>151</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>Hanford-Corcoran, CA</td>
<td>146</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Fresno, CA</td>
<td>140</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Red Bluff, CA</td>
<td>134</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Madera, CA</td>
<td>131</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Sonora, CA</td>
<td>131</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Truckee-Grass Valley, CA</td>
<td>121</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Mariposa County, CA</td>
<td>117</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Merced, CA</td>
<td>116</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Yuba City, CA</td>
<td>115</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Calaveras County, CA</td>
<td>105</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Modesto, CA</td>
<td>102</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>
Pollution Levels Vary within Regions

Pollution levels can vary significantly across a region.

Air quality in the Atlanta metropolitan area, for example, is monitored at 11 locations scattered across the metro area’s more than 8,000 square miles. Smog levels can vary across this immense region. For the region as a whole, smog levels were above the “little or no risk” threshold on 10 percent of days in 2016, meaning half or more of the region’s 11 monitors reported a problem on those days. However, smog levels were above levels that the EPA has identified as presenting “little or no risk” on approximately one-fourth of the days at two of the monitoring locations in the southeastern portion of the metro region. People who live close to those monitoring stations encountered worse air pollution than people who live elsewhere in the Atlanta area.
Global Warming May Make Air Pollution Worse

Air pollution may become a greater problem as climate change warms the planet, alters weather patterns, and triggers other shifts that will create more air pollution. 2017 was the third hottest year on record, according to the National Oceanic and Atmospheric Administration, behind 2016 and 2015, and the 41st consecutive year in which annual temperatures exceeded the 20th century average. Changes caused by global warming may worsen smog and particulate pollution. For example:

- Temperatures will rise, speeding up the chemical reactions that create smog. In addition, with higher temperatures throughout the year, people may experience more spring and fall days with unhealthy levels of ozone, in addition to the summer ozone problems that are common today.

- Changed wind patterns may increase the number of days with stagnant air, keeping pollution from being diluted. Decreased air circulation may already be worsening air quality by trapping pollution precursors and pollution near the ground. Multiple days of stagnant air can lead to especially high levels of pollution.

- Wildfires, already increasing in intensity and frequency due to drought and higher temperatures, create particulates and other air pollution that can travel for hundreds of miles. Higher temperatures could increase evaporative emissions of volatile organic compounds, precursors to ozone.

One study estimates global warming will increase the number of air-pollution-related premature deaths if no measures are implemented to counteract global warming’s impact on air quality. (Premature deaths are deaths that occur before the average age of death for a given population cohort.) The analysis, published in 2017, estimates that 1,130 Americans may die prematurely in the year 2030 from smog pollution made worse by global warming, and that the number of premature smog-related deaths could rise to 8,810 annually by the year 2100. The study also estimates that particulate pollution worsened by global warming could cause 6,900 premature deaths in 2030 and 19,400 premature deaths in the year 2100.

The U.S. Global Change Research Program has concluded that global warming will make it more difficult to control smog pollution, and that maintaining current pollution levels in a warmer world will require reduced emissions of the chemicals that form smog.

In many cases, the activities that cause air pollution also contribute to global warming. Efforts to reduce our reliance on fossil fuels, which contribute to global warming, have the potential to help reduce smog pollution as well.
Smoke from wildfires, which are projected to become more intense and more frequent in a warmer climate, can degrade air quality hundreds of miles away. Here, smoke from a fire in Northern California covers the width of the state and affects both the San Francisco Bay region and the Central Valley. Credit: NASA
Air pollution plagues metropolitan areas and rural counties across the country. Millions of Americans regularly breathe air that contains smog or particulate pollution, which creates a risk to public health, including the threat of respiratory, cardiovascular and developmental damage. Increasing evidence also suggests that routine exposure to relatively modest levels of air pollution increases mortality rates. Global warming-related increases in temperature and wildfires and changes in weather patterns will further exacerbate air pollution problems.

These threats to public health are unnecessary and can be addressed. Much air pollution and global warming is a result of our reliance on fossil fuels. The nation should move as quickly as possible to clean, renewable sources of energy to meet our energy needs without contributing to global warming. During the transition to clean energy, the nation should continue to limit pollution from burning fossil fuels.

Protect Progress Achieved under the Clean Air Act
At the national level, we should defend and build upon improvements in air quality achieved through rules developed to implement the Clean Air Act, which have reduced air pollution and improved public health across the nation since its enactment more than four decades ago. In 2010, air quality improvements made possible by regulations under the Clean Air Act Amendments of 1990 helped prevent more than 160,000 early deaths, 130,000 non-fatal heart attacks, and 41,000 hospital admissions. Better air quality enabled adults to go to work on an additional 13 million days and children to attend school on an additional 3.2 million days. These benefits are in addition to improvements stemming from the original Clean Air Act. Yet, as the elevated levels of smog and particulate pollution that continue to be experienced by Americans demonstrate, the problem of air pollution is far from solved. Maintaining the gains already achieved under implementation of the Clean Air Act and seeking greater regulatory protections are crucial for ensuring Americans can breathe cleaner air.

Ozone and particulate matter standards should be strengthened. Mounting evidence suggests that current standards fail to fully protect public health. In addition, the nation should adopt an annual limit for ozone pollution to help reduce harm from long-term exposure, an important concern as higher global temperatures are likely to increase the length of the annual ozone season.

State and local air quality regulators should set pollution permits for specific polluters at levels that will ensure a region’s residents are not breathing polluted air and should commit to strong and consistent enforcement of those permits to protect public health.

Reduce Pollution from Transportation
The EPA and the National Highway Traffic Safety Administration should not weaken federal fuel economy and global warming pollution standards that are critical to the nation’s efforts to combat air pollution.
to reduce global warming pollution from cars and light trucks. Unfortunately, the Trump administration has announced its intention to reconsider standards that, when fully phased in, would avoid emissions of 6 billion metric tons of global warming pollution over the lifetime of cars sold from 2012 to 2025. These standards should be implemented as planned and strengthened in the coming years to reduce future air pollution threats.

The EPA should respect the power of states to adopt stronger pollution standards for passenger vehicles, and to tighten those standards as needed to protect public health. Developed in response to the state’s widespread air pollution problems, California’s clean car standards help to reduce global warming emissions and health-threatening air pollution from cars and trucks. Federal law allows other states with air pollution problems to adopt these clean car standards instead of federal standards. Twelve other states, plus the District of Columbia, have done so. These standards have been highly effective in reducing pollution and are one reason cars, light trucks and other passenger vehicles today are 99 percent cleaner than vehicles sold in the 1960s. The federal government should not take away the ability of states to develop policies that have been so important in addressing pollution from passenger vehicles.

State and local governments should pursue policies to hasten the transition to zero-emission vehicles. Ten states – California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island and Vermont – already have electric vehicle sales requirements. Elected officials in other states should establish goals for sales of electric passenger vehicles.

Though air quality has greatly improved in the Los Angeles region thanks to the Clean Air Act and California’s policies to reduce pollution, including the clean car standard, air pollution remains a problem for the region’s millions of residents, as seen in this 2018 photo. Credit: Elizabeth Ridlington
and support the development of infrastructure needed to recharge those vehicles. State governments should allocate money from Volkswagen’s “Dieselgate” settlement to subsidize the purchase of electric school and transit buses, as well as charging infrastructure. Transit agencies and school districts should replace buses powered by fossil fuels with electric buses as they replace aging buses in their fleets. Policies to encourage electrification of heavy-duty trucks and nonroad equipment would help to further reduce air pollution and limit global warming pollution.

Policymakers should also act to address pollution from other forms of transportation. Pollution from medium- and heavy-duty vehicles, airplanes, locomotives and other mobile sources should also be reduced. Transportation is a major source of global warming pollution and transitioning to zero-carbon transportation is an essential part of addressing the public health threat presented by global warming.

Reduce Pollution from Electricity Generation

State leaders in the Northeast and Mid-Atlantic regions can continue to support and strengthen the Regional Greenhouse Gas Initiative (RGGI), an agreement among nine northeastern and mid-Atlantic states to limit carbon pollution from power plants. From the beginning of the program through 2016, carbon dioxide emissions from power plants in the RGGI states declined 40 percent. In addition to helping to reduce the future severity of global warming and its potential air quality impacts, the program has directly improved air quality in the region. From 2009 to 2014, improved air quality due to the program avoided up to 830 premature deaths, 390 non-fatal heart attacks, and 47,000 lost work days in the nine participating states, plus New Jersey, Pennsylvania, Virginia and Washington, D.C. RGGI could be strengthened in several ways. States should change policies that could undermine the effectiveness of the program, such as by retiring excess pollution permits that have built up over time. Additional states – including New Jersey and Virginia – should join the program to accelerate progress in cleaning up air pollution from power plants and show strong climate leadership by setting caps that are stringent enough to drive significant reductions in emissions.

State leaders in other regions should draw upon the model offered by the Regional Greenhouse Gas Initiative and create similar programs. Policies to increase the use of wind, solar and other clean energy and to improve energy efficiency help to reduce the need for electricity from coal and natural gas power plants that produce air pollution and add to global warming. Community leaders and policymakers should work to ensure the rapid deployment of renewable energy. Policymakers should also adopt policies to increase energy savings. Conserving energy and using it more efficiently can ease the transition from dirty fuels to clean, renewable energy. Policies to increase energy savings include zero net energy requirements for new buildings and statewide energy efficiency standards that require utilities to hit annual energy savings targets.
Methodology

Air pollution data for 2016 are from U.S. Environmental Protection Agency, Air Data, Pre-Generated Files, accessed at https://aqs.epa.gov/aqsweb/airdata/download_files.html, 15 February 2018. The relevant files are the daily summary data for ozone and daily summary data for PM$_{2.5}$ measured with FRM/FEM mass methods.

Those files include a daily EPA-calculated Air Quality Index (AQI) score from 0 to 500 for each monitoring station and for each pollutant. Per the EPA, an AQI score of 51 to 100 is moderate (yellow), 101 to 150 is unhealthy for sensitive groups (orange), a score of 151 to 200 is unhealthy (red), a score of 201 to 300 is very unhealthy (purple), and a score of 301 to 500 is hazardous (maroon). The method for each pollutant was as follows:

1. Identify the highest (worst) AQI score from each monitoring location for each day to obtain a single reading per location.
2. Count the number of those with an AQI above 50.
3. Divide that by the total number of monitoring locations that reported an AQI that day.
4. Tally the number of days on which half or more reporting locations in each CBSA or county reported an AQI above 50.


Appendix A.

Days with Elevated Smog, Particulates and Total Pollution, by Geographic Area, 2016

This count includes air pollution at or above the level the EPA labels “moderate” and indicates in yellow or worse in its Air Quality Index.

Air pollution data are listed by state. Results for urban areas are listed first, in alphabetical order, followed by results for rural counties that are not part of a metropolitan or micropolitan area. Many rural counties do not have an air pollution monitor and therefore do not appear here. Metropolitan and micropolitan areas that extend into more than one state are listed multiple times, once for each state.

Table A1. Days with Elevated Smog, Particulates and Total Pollution, by Geographic Area, 2016

<table>
<thead>
<tr>
<th>State</th>
<th>Metropolitan Area or Rural County</th>
<th>Number of Days in 2016 in which Half or More Monitoring Locations Reported Elevated</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ozone</td>
<td>PM$_{2.5}$</td>
</tr>
<tr>
<td>Alabama</td>
<td>Birmingham-Hoover, AL</td>
<td>43</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Columbus, GA-AL</td>
<td>38</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Daphne-Fairhope-Foley, AL</td>
<td>26</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Decatur, AL</td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Dothan, AL</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Florence-Muscle Shoals, AL</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Fort Payne, AL</td>
<td>42</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Gadsden, AL</td>
<td>46</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Huntsville, AL</td>
<td>48</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Mobile, AL</td>
<td>23</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Montgomery, AL</td>
<td>27</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Talladega-Sylacauga, AL</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Tuscaloosa, AL</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Clay County, AL</td>
<td>0</td>
<td>7</td>
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<tr>
<td></td>
<td>Sumter County, AL</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Alaska</td>
<td>Anchorage, AK</td>
<td>0</td>
<td>22</td>
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<tr>
<td></td>
<td>Fairbanks, AK</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Juneau, AK</td>
<td>0</td>
<td>50</td>
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<tr>
<td></td>
<td>Denali Borough, AK</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Arizona</td>
<td>Flagstaff, AZ</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Lake Havasu City-Kingman, AZ</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Nogales, AZ</td>
<td>0</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Payson, AZ</td>
<td>87</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Phoenix-Mesa-Scottsdale, AZ</td>
<td>83</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Prescott, AZ</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Show Low, AZ</td>
<td>65</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Sierra Vista-Douglas, AZ</td>
<td>70</td>
<td>1</td>
</tr>
<tr>
<td>State</td>
<td>Metropolitan Area or Rural County</td>
<td>Number of Days in 2016 in which Half or More Monitoring Locations Reported Elevated</td>
<td>Population</td>
</tr>
<tr>
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Appendix B.  
Sources of Pollutants that Contribute to Smog and Particulate Pollution, by State, 2014

Data are from the EPA’s 2014 National Emissions Inventory. “Mobile sources” include on- and off-road vehicles. “Industrial sources” include fuel combustion for industrial purposes, chemical and related product manufacturing, metals processing, and other industrial processes.

Table B1. Share of Nitrogen Oxides from Selected Emission Sources

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<th>State</th>
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### Table B2. Share of Volatile Organic Compounds from Selected Emission Sources

*Selected sources do not add up to 100 percent.*

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## Table B3. Share of PM$_{2.5}$ from Selected Emission Sources

*Selected sources do not add up to 100 percent.*

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Notes


5 M. Cacciottolo et al., “Particulate Air Pollutants, APOE Alleles and their Contributions to Cognitive Impairment in Older Women and


7 The map shows Census-designated metropolitan and micropolitan areas, plus rural counties that have an air pollution monitor. Note that Macon, Georgia, is mapped to Macon County. The towns of Bishop, CA; Rockland, ME; and Walterboro, SC, are not shown because they are not included in the Census Bureau shapefiles for mapping.


14 See note 2.


25 See note 23.


27 Raanan Raz et al., “Autism Spectrum Disorder and Particulate Matter Air Pollution before,
during, and after Pregnancy: A Nested Case-Control Analysis within the Nurses’ Health Study II Cohort,” *Environmental Health Perspectives*, 123: 264-270, dx.doi.org/10.1289/ehp.1408133, 1 March 2015.


30 U.S. Environmental Protection Agency, *The National Ambient Air Quality Standards for Particle Pollution: Particle Pollution and Health* (factsheet), no date.


32 See note 5.


36 Ibid.


42 Institute of Medicine, *Climate Change, the Indoor Environment, and Health* (Washington, DC: The National Academies Press, 2011), 83.

44 See note 40.


53 See note 49.


55 See note 47.


58 This methodology is different from the previous version of this report, in which a moderate (yellow) level air quality report or higher from a single monitoring location in a region triggered inclusion in the region’s annual count of days with unacceptable air quality.

59 See note 7.

60 Steven Wilson et al., U.S. Census, Patterns of Metropolitan and Micropolitan Population Change: 2000 to 2010, September 2012. The CBSA name in EPA’s air pollution data is “Atlanta-Sandy Springs-Roswell” and the CBSA name in the census data is “Atlanta-Sandy Springs-Marietta”


62 See note 8 and note 10.

63 See note 8.


65 See note 9.

66 See note 10.

67 Ibid.


69 See note 8.

70 Michelle L. Bell, Roger D. Peng and Francesca Dominici, “The Exposure-Response Curve for Ozone and Risk of Mortality and the Adequacy of Current Ozone Regulations,” Environmental Health Perspectives, 114(4): 532-6, doi:10.1289/ehp.8816, April 2006; see also note 52 and note 57.

71 See note 11.


75 Simon Mui, Natural Resources Defense Council, The World’s Biggest EV Program Was Just Adopted. Here’s Why, 28 September 2017, archived at https://web.archive.org/web/20180502193357/https://www.nrdc.org/experts/simon-mui/most-important-electric-vehicle-program-was-just-adopted, and National Conference of State Legislatures, State Efforts to Promote Hybrid and

76 States participating in the program are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont.


79 See note 45.