

# Asthma and Outdoor Air Quality

Four of the five most ozone-polluted counties in the U.S. are within California.

— American Lung Association <sup>43</sup>

“After moving from Florida to the San Joaquin Valley, it didn’t take long for me to realize how the change in air quality was affecting my six-year-old asthmatic son. While in Florida it had been nearly four years since he had experienced any asthma symptoms but within a month of living in Merced my son had to be rushed to the emergency room with the worst asthma attack he had ever had.”

— Alicia Bohlke, Merced/Mariposa County Asthma Coalition



**OUTDOOR AIR POLLUTION** is a serious problem in most urban areas as well as in many rural areas of the United States. Nearly all Californians (about 99 percent) live in areas that fail to meet the state’s health-based ozone and/or particulate matter standards.<sup>1</sup> However, the problem affects low-income and minority communities disproportionately because these groups tend to live in the areas where air pollution is worst. Air pollution can have long-term effects on our health and can contribute to the development of asthma, respiratory tract infections, and lung cancer.

Each year premature deaths, hospital admissions, respiratory illnesses, and school and work absences caused by the effects of ozone and fine particulate matter (PM<sub>2.5</sub>) at levels above federal air-quality standards in the San Joaquin Valley and South Coast Air Basin (including Los Angeles, San Bernardino, Riverside, and Orange Counties) cost California an estimated \$28 billion. Despite gains in air quality in the past decade, the associated costs remain high, and many vulnerable populations are not adequately protected. This is especially true for children, whose developing lungs are more sensitive to the harmful effects of outdoor air pollution than those of adults.

## What Are the Major Outdoor Air Pollutants Affecting Asthma and Where Do They Come From?

Every year millions of pounds of dangerous chemicals, gases, and particles are released into the air by vehicles, power plants, and industrial and agricultural activities. These include the following:

### Ozone (O<sub>3</sub>)

Ozone, a colorless and odorless gas, is the chief component of urban smog. Ambient O<sub>3</sub> is formed by the reaction of sunlight with nitrogen oxides and hydrocarbons, both of which are emitted by motor vehicles and industrial sources.

**Health impacts:** ozone causes airway inflammation and damages lung tissues, which can lead to breathing problems including coughing, wheezing, and chest pain.<sup>3</sup> Ozone can also increase the immune response to allergens in some individuals.<sup>4</sup>

### Particulate matter (PM)

PM is a heterogeneous mixture of small solid or liquid particles that can be inhaled. Fine particles (PM<sub>2.5</sub>) are generated by combustion processes, including diesel-powered engines, power generation, and wood burning. Larger particles (PM<sub>10</sub>) come from dust produced by construction, mining, and agricultural activities. Particles can also include dirt, soot, smoke, and even liquid droplets (aerosols) emitted from factory smokestacks and other sources. In California, wildfires cause high levels of particulates in affected areas.<sup>5</sup>

**Health impacts:** when particulate matter is inhaled, it causes lung damage and breathing problems and can trigger asthma.<sup>3</sup>

### Nitrogen dioxide (NO<sub>2</sub>)

NO<sub>2</sub> is a brownish acidic gas that reacts with other gases to form ozone. Fuel emissions from cars, trucks, and power plants are sources of NO<sub>2</sub>.

**Health impacts:** NO<sub>2</sub> irritates the lungs, causing bronchitis and pneumonia.<sup>6</sup>

### Sulfur dioxide (SO<sub>2</sub>)

Point sources such as power plants produce SO<sub>2</sub> or acid sulfate particles. SO<sub>2</sub> is formed by burning sulfur-containing fuels such as coal and oil. Steel mills and paper mills also create SO<sub>2</sub> pollution.

**Health impacts:** exposure causes breathing problems and lung damage, especially for those with asthma, bronchitis, and emphysema.<sup>7</sup>

## What Role Does Air Pollution Play in Worsening Childhood Asthma?

Children are more likely than adults to be affected by outdoor air pollutants since they spend more time outdoors and have higher respiration rates. They also tend to breathe more through their mouths than through their noses, so fewer particles are filtered out as air enters their lungs.<sup>8</sup>

Scientific studies conducted in California and throughout the U.S., as well as in other countries, have found strong relation-

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ships between four outdoor air pollutants—NO<sub>2</sub>, PM, O<sub>3</sub>, and SO<sub>2</sub>—and the following asthma-related outcomes in young children and adolescents:<sup>3,6-8</sup>

- Reduced lung function and increased inflammation. Outdoor pollutants such as O<sub>3</sub>,<sup>9</sup> PM<sub>2.5</sub>,<sup>10-12</sup> PM<sub>10</sub>,<sup>12</sup> NO<sub>2</sub>,<sup>10,11,13</sup> and SO<sub>2</sub> are known to exacerbate asthma by causing inflammation in the airways and decreasing lung function.
- Increase in symptoms like wheezing and coughing. Several outdoor pollutants have been shown to increase asthma symptoms in children (O<sub>3</sub>,<sup>9,14-16</sup> PM<sub>2.5</sub>,<sup>12,15,17</sup> PM<sub>10</sub>,<sup>9,12,16,17</sup> NO<sub>2</sub>,<sup>9,10,13,15,16,18,19</sup> and SO<sub>2</sub><sup>9,13,16</sup>).
- Increased hospitalization and Emergency Department (ED) visits. Outdoor air pollutants such as O<sub>3</sub>,<sup>20-24</sup> PM<sub>2.5</sub>,<sup>25</sup> PM<sub>10</sub>,<sup>26-28</sup> NO<sub>2</sub>,<sup>29-31</sup> and SO<sub>2</sub><sup>31</sup> can also trigger severe asthma attacks, resulting in ED visits and hospitalization.
- Increased medication use for asthma, such as quick-relief inhalers. Exposure to O<sub>3</sub>,<sup>14,32</sup> PM<sub>2.5</sub>,<sup>33</sup> PM<sub>10</sub>,<sup>33-35</sup> NO<sub>2</sub>,<sup>18,19</sup> and SO<sub>2</sub><sup>36</sup> can exacerbate asthma and increase inhaler use among children.
- Missed school days. O<sub>3</sub>,<sup>37</sup> PM<sub>2.5</sub>,<sup>10</sup> PM<sub>10</sub>,<sup>38</sup> NO<sub>2</sub>,<sup>10</sup> and SO<sub>2</sub><sup>39</sup> are related to school absences in children with asthma.

## Is Outdoor Air Pollution a Cause of Asthma?

In addition to exacerbating asthma, outdoor air pollution has now been implicated in the development of new asthma cases. The Children's Health Study, a long-term study of more than 3,000 children in 12 southern California communities, found that traffic-related pollutants contribute to the

onset of asthma. In addition the study found that children playing three or more team sports in high ozone areas have an increased risk for developing asthma.

## What Can Be Done About Outdoor Air Pollution?

Community Action to Fight Asthma (CAFA) is a network of asthma coalitions in California working to shape local, regional, and state policies to reduce the environmental triggers of asthma for school-aged children where they live, learn, and play. A few examples of local and state policies related to outdoor air pollution are listed below:

- Promote siting of schools, playgrounds, athletic fields, and subsidized housing away from major outdoor air-pollutant sources such as high-traffic roads and freeways.
- Institutionalize and enforce diesel emissions-reduction policies and procedures.
- Reduce exposure to harmful particulate matter through the adoption of wood-burning ordinances.
- Reduce pollution at the ports, on truck routes, and in communities across the state.
- Replace the worst polluting school buses to reduce children's exposure to diesel exhaust.

Please visit our website at [www.rampasthma.org](http://www.rampasthma.org) to learn more about Community Action to Fight Asthma, connect with local coalitions, locate asthma resources across California, and sign up for our e-newsletter.

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