

Health Risks of Ozone Pollution

Ozone is one of the nation’s least well-controlled air pollutants.

Ozone (O₃) is a gas molecule made up of three oxygen atoms. Sometimes called “smog,” ozone pollution forms in the atmosphere when gases that come out of tailpipes, smokestacks, oil and gas extraction and other sources react in the presence of sunlight. The gases that react to form ozone are volatile organic compounds and nitrogen oxides.¹ Ozone levels typically rise between May and October when higher temperatures, increased sunlight, and stagnant atmospheric conditions transform air pollutants into ozone. Rising temperatures from climate change will make it harder to reduce ozone.

When a person inhales ozone pollution, it reacts chemically (“oxidizes”) with the body’s internal tissues, causing inflammation, like a “sunburn” of the lung. Ozone acts as a powerful respiratory irritant at the levels frequently found across the nation, especially during the summer months.

Millions of people are vulnerable to the health threats from ozone pollution. Five groups of people are especially vulnerable to the effects of breathing ozone:²

- children and teens;
- anyone 65 and older;
- people with existing lung diseases, such as asthma and COPD;
- people with cardiovascular disease; and
- people—even healthy adults—who work or exercise outdoors.

Independent scientists and U. S. Environmental Protection Agency (EPA) concluded that ozone pollution posed multiple, serious threats to health. The EPA engaged a panel of expert scientists, the Clean Air Scientific Advisory Committee, and the public in a four-year process to help them assess all available research. Their findings, published in 2013, are highlighted in the box below, along with a few of the hundreds of studies they cited.

Ozone Pollution Poses Serious Health Threats

- ✓ Causes respiratory harm (e.g. worsened asthma, worsened chronic obstructive pulmonary disease [also known as COPD, which includes emphysema and chronic bronchitis])³
- ✓ Likely to cause early death⁴
- ✓ Likely to cause cardiovascular harm (e.g. heart attacks, strokes, heart disease, congestive heart failure)⁵
- ✓ May cause harm to the central nervous system⁶
- ✓ May cause reproductive and developmental harm⁷

Based on these findings, EPA strengthened the national standards for ozone in 2015, although the [American Lung Association and health and medical allies](#) called for stronger limits than EPA adopted. In a 2017 scientific paper, researchers found further evidence in a nationwide study that older adults faced a higher risk of premature death even when levels of ozone pollution remained well below the current national standard.⁸

¹ U.S. Environmental Protection Agency. *Integrated Science Assessment of Ozone and Related Photochemical Oxidants (Final Report)*. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/076F, 2013.

² U.S. EPA, 2013.

³ Mar TF, Koenig JQ. Relationship between visits to emergency departments for asthma and ozone exposure in greater Seattle, Washington. *Ann Allergy Asthma Immunol*. 2009; 103:474-9. Villeneuve PJ, Chen L, Rowe BH, Coates F. Outdoor air pollution and emergency department visits for asthma among children and adults: A case-crossover study in northern Alberta, Canada. *Environ Health Global Access Sci Source*. 2007; 6:40.

⁴ Bell ML, Dominici F, Samet JM. A meta-analysis of time-series studies of ozone and mortality with comparison to the National Morbidity, Mortality, and Air Pollution Study. *Epidemiology*. 2005; 16:436-45. Levy JI, Chermerynski SM, Sarnat JA. Ozone exposure and mortality: An empiric Bayes metaregression analysis. *Epidemiology*. 2005; 16:458-468. Ito K, De Leon SF, Lippmann M. Associations between ozone and daily mortality: Analysis and meta-analysis. *Epidemiology*. 2005; 16:446-29.

⁵ Ruidavets J-B, Cournot M, Cassadou S, Giroux M, Meybeck M, Ferrières J. Ozone air pollution is associated with acute myocardial infarction. *Circulation*. 2005; 111:563-569.

⁶ Chen JC, Schwartz J. Neurobehavioral effects of ambient air pollution and cognitive performance in US adults. *Neurotoxicology*. 2009; 30:231-9.

⁷ Salam MT, Millstein J, Li YE, et al. Birth outcomes and prenatal exposure to ozone, carbon monoxide, and particulate matter: Results from the Children’s Health Study. *Environ Health Perspect*. 2005; 113:1638-44.

⁸ Di Q, Dai L, Wang Y, Zanobetti A, Choirat C, Schwartz JD, Dominici F. Association of Short-Term Exposure to Air Pollution with Mortality in Older Adults. *JAMA*. 2017. 318: 2446-2456.