
OZONE HARMFUL TO HUMANS, PLANTS AND VEGETATION

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What is Ozone?

Colourless and odourless, ozone (O₃) is an extremely reactive gas molecule composed of three oxygen atoms. Ozone forms in chemical reactions in the upper atmosphere when nitrogen oxides (NO_x) and volatile organic compounds (VOCs), come into contact with both sunlight and heat.

Sources of Ozone

Ozone is present in two areas of the atmosphere and plays two roles. Ozone formed naturally in the atmosphere (the “good” ozone) protects life from the sun's damaging ultraviolet rays. At ground level, however, ozone acts as an invisible air pollutant that is harmful to humans, animals, plants and man-made materials.

Ground-level ozone is one of the main ingredients of smog. It is created when gases such as nitrogen oxides (NO_x) react with volatile organic compounds (VOCs) in combination with sunlight and heat. This is why smog is more of a problem on hot summer days. Nitrogen oxides are produced by burning fossil fuels such as coal, oil, gas, and diesel in motor vehicles, industries, power plants and homes. VOCs include carbon-containing gases that are created when gasoline and solvents are burned. Studies show that every major Canadian urban centre has levels of ground-level ozone that are high enough to pose health risks. Ontario is disproportionately affected because of its geographical location, downwind of the major U.S. sources of pollutants.

Ozone levels typically rise between May and September due to a combination of higher temperatures, more sunlight, and stagnant air masses, leading to significant areas of the province having unhealthy levels of the gas.

Due to the transboundary nature of the gas, up to 90 per cent of smog-causing air pollutants come from sources outside of the province on elevated ozone days. As a result, 19 of 20 monitored sites in Ontario cannot currently meet the Canada-Wide Standards for ozone.

Effects on Health and the Environment

Studies show a wide variety of effects caused from ozone exposure. Short-term exposure can result in eyes nose and throat irritation, coughing and headaches.

Exposure to high levels can result in reduced lung function. Ozone is a major contributor to asthma and it can worsen the existing symptoms of asthma. The American Lung Association has identified the following immediate problems attributed to ozone:

- shortness of breath
- chest pain when inhaling deeply
- wheezing and coughing
- increased susceptibility to respiratory infections
- inflammation of the lungs and airways
- increased risk of asthma attacks

- increased need for medical treatment and hospital admission for people with lung diseases, like asthma or chronic obstructive pulmonary disease (COPD).

Children, the elderly and people with respiratory and heart problems, asthma and lung disease are at the highest risk. Also at risk are healthy adults exercising and working outdoors for long periods of time. Exposure to ozone can lead to increased hospital admissions and even premature death.

In June 2008, the Ontario Medical Association (OMA) estimated that air pollution is a contributing factor in almost 9,500 premature deaths annually in Ontario. In a 2005 report, the OMA also blamed air pollution for nearly 17,000 hospital admissions and almost 60,000 emergency rooms visits. MOE, in its 2005 report on transboundary air pollution, estimated health costs at \$6.6 billion.

Effects on Vegetation

Ozone is toxic to plants and causes crop loss each year in Ontario, including noticeable leaf damage in many crops, garden plants and trees. The 2005 *Transboundary Air Pollution in Ontario* report indicated that air pollution costs Ontario's economy \$3 billion each year in environmental damages.

United States Environmental Protection Agency reports have shown that ozone has the following effects on plant life:

- interfering with the ability of sensitive plants to produce and store food, making them more susceptible to certain diseases, insects, other pollutants, competition and harsh weather;
- damaging the leaves of trees and other plants, negatively impacting the appearance of urban vegetation, national parks, and recreation areas; and
- reducing crop yields and forest growth, potentially impacting species diversity in ecosystems.

Because these impacts directly affect plant life, the economy also suffers in both the agricultural and forestry sectors. Additional costs to the Ontario's economy include damage to buildings and infrastructure.