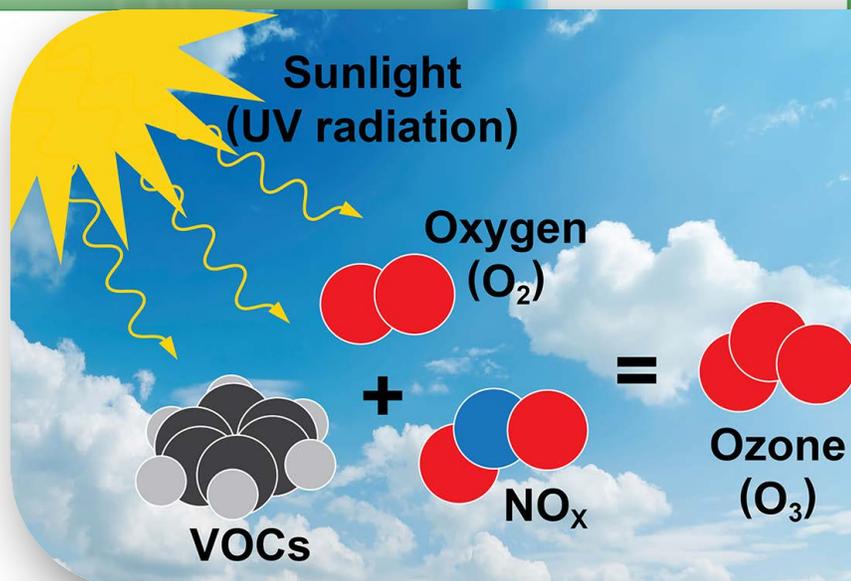


## Ozone

### General

Ozone ( $O_3$ ) is a highly reactive form of oxygen, and at normal ambient concentrations is colorless and odorless. At very high concentrations,  $O_3$  is a blue, unstable gas with a pungent odor.

Unlike the other criteria pollutants,  $O_3$  is not emitted directly into the air by specific sources. It is formed in the presence of sunlight through chemical reactions of oxygen with nitrogen oxides ( $NO_x$ ) and volatile organic compounds (VOCs). Some of the more common sources of  $NO_x$  and VOCs include: gasoline vapors, chemical solvents and cleaning fluids.



$O_3$  is formed in two locations of our atmosphere. Stratospheric  $O_3$  (also known as smog) is formed at ground level. Stratospheric  $O_3$  is produced at high altitudes and provides a protective layer around the earth by absorbing most of the sun's harmful ultraviolet radiation. These two should not be confused. Ground level  $O_3$  is a pollutant, while stratospheric  $O_3$  is a necessary component of the atmosphere. Essentially,  $O_3$  is good up high - bad nearby.

Ground level  $O_3$  occurs naturally from non-manmade sources in very low concentrations. Even though  $O_3$  production is a daily occurrence, peak  $O_3$  levels typically occur from May to August when the reactants are stimulated by increased sunlight. Typical conditions needed for high  $O_3$  concentrations include:

- weekdays when traffic and industrial activity is prevalent
- the time is between 11 a.m. and 5 p.m. when the sun is high
- winds are light or calm
- little or no cloud cover is present.

A high concentration of ground level  $O_3$  is mostly an urban problem; however, both  $O_3$  and the  $O_3$ -forming VOCs and  $NO_x$  can be transported long distances under certain weather conditions.

### Effects

$O_3$  affects both public health and public welfare.  $O_3$  may cause health problems because it may damage lung tissue, reduce lung function and sensitize the lungs to other irritants. It also severely irritates the mucous membranes of the nose and throat, causing coughing and increased infection of the lungs. It has been estimated that 90 percent of inhaled  $O_3$  is never exhaled. Its effects are more severe in individuals with chronic lung disease, asthma or diseases of the heart and circulatory system, and can affect these individuals at lower concentrations.

O<sub>3</sub> damage can result from prolonged exposure to low concentrations or from exposure to higher concentrations for a shorter period of time. Short-term exposure to O<sub>3</sub> in the range of 0.15 to 0.25 parts per million (ppm) may impair mechanical functions of the lung and may induce respiratory and related symptoms in highly susceptible individuals. Exposure to O<sub>3</sub> for several hours at relatively low concentrations has been found to significantly reduce lung function in normal, healthy people as well, particularly during exercise. This decrease in lung function generally is accompanied by symptoms such as chest pain, coughing, sneezing, nausea, headache and pulmonary congestion. Results from animal studies indicate that repeated exposures to high levels of O<sub>3</sub> for several months or more can produce permanent structural damage in the lungs.

Ground level O<sub>3</sub> affects plants more than humans. It interferes with the production and storage of starches in plants, resulting in leaf injury or reductions in growth and yield of plants. Some plants such as soybeans, alfalfa, oats, corn, beans, clover, shrubs and deciduous trees are especially sensitive to O<sub>3</sub> and show damage at low concentrations. The deterioration of nylon and other synthetic materials, as well as degradation of rubber, metal, and paint, is also associated with O<sub>3</sub>.

## Standards

The national 8-hour primary and secondary ambient air quality standard for ozone is 0.070 ppm. These standards are met when the average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.070 ppm using the most recent 3 years of collected data at any one ozone monitoring site.

The primary standards are designed to protect public health, including the health of sensitive populations such as asthmatics, children and the elderly. The secondary standards are designed to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation and buildings.