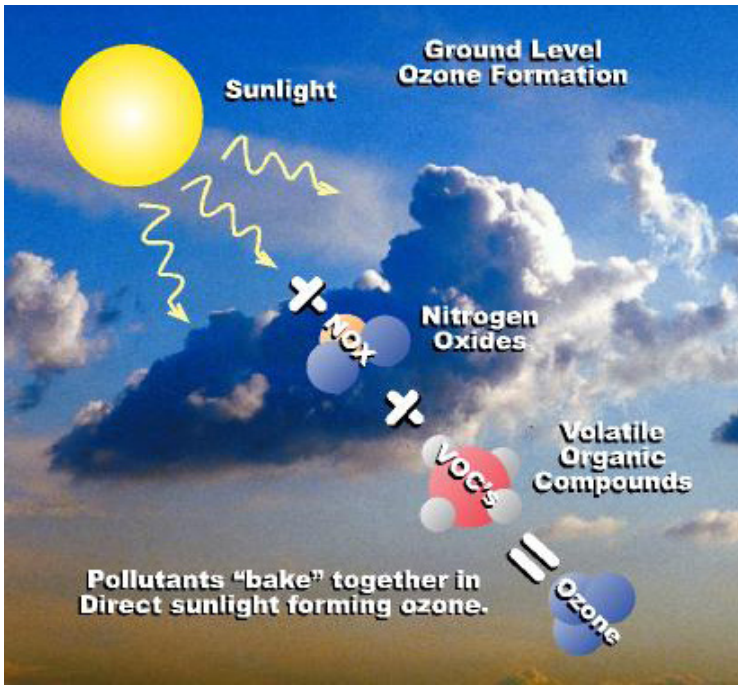
AIR

April 2016

Ozone

General

Ozone (O3) is a highly reactive form of oxygen, and at normal ambient concentrations it is colorless and odorless. At very high concentrations, O3 is a blue, unstable gas with a pungent odor. Unlike the other criteria pollutants, O3 is not emitted directly into the air by specific sources. It is formed in the presence of sunlight through chemical reactions of oxygen in the air with nitrogen oxides (NOx) and volatile organic compounds (VOCs). There are many sources of these pollutants. Some of the more common sources include: gasoline vapors, chemical solvents, and cleaning fluids. O3 is formed in two locations of our atmosphere.



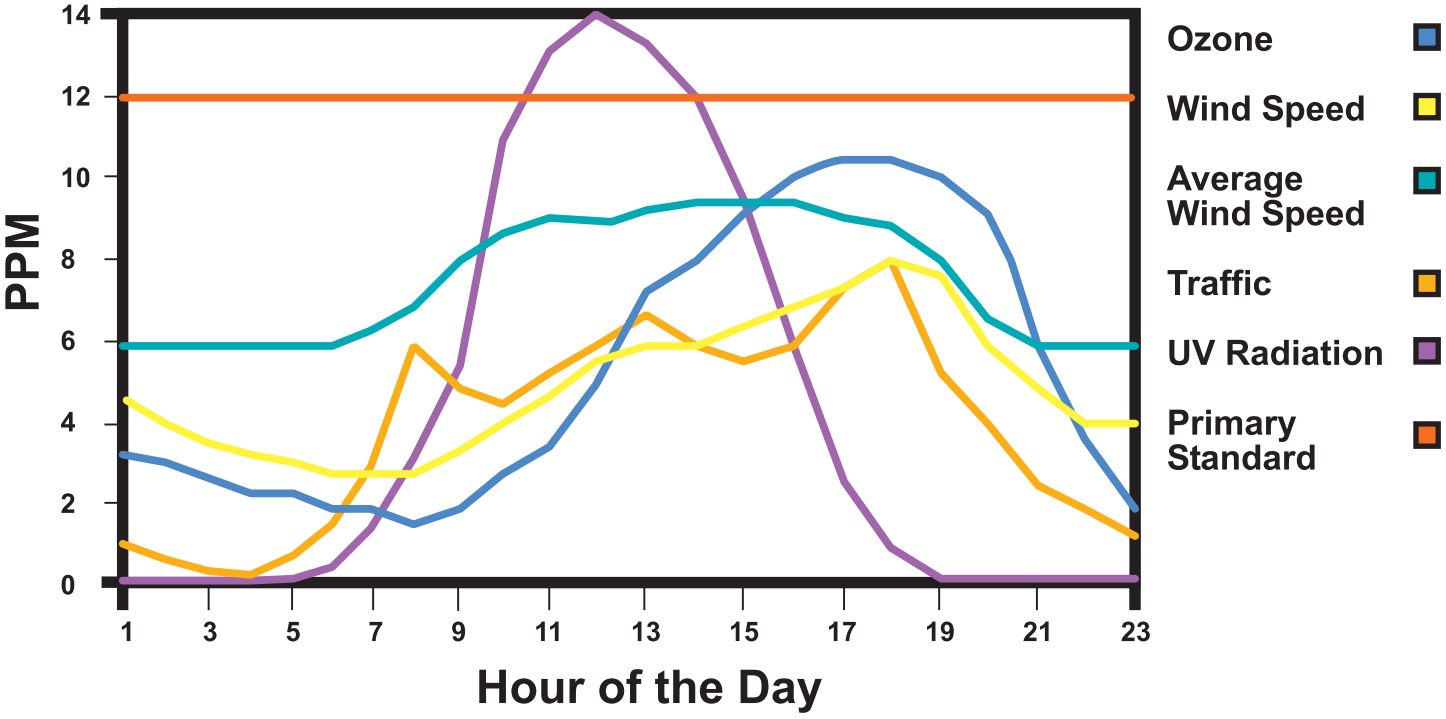
Substratospheric O3 is formed at ground level and is also known as "smog." Stratospheric O3 is produced at high altitudes and provides a protective layer around the earth. These two should not be confused. Ground level O3 is a pollutant, but stratospheric O3 is a necessary component of the atmosphere. Essentially, O3 is "good up high - bad nearby." Ground level O3 does occur naturally from non-manmade sources, although this results in very low concentrations. Even though O3 production is a year-round occurrence, peak O3 levels typically occur from May to August when the reactions are stimulated by sunlight and temperature. Figure 1 illustrates the typical events occurring on a day when high O3 concentrations are experienced. Other traits of a potentially high O3 day include these items: a weekday when traffic is prevalent, a time between 11 a.m. and 5 p.m. when the sun is high, temperature is in the 80s and 90s (°F), wind is low or calm, and little or no cloud cover is present. A high concentration of ground level O3 is mostly an urban problem; however, both O3 and the O3-forming VOCs and NOx can be transported long distances under certain weather conditions.

Effects

Ozone affects both health and welfare. O3 may cause health problems because it can 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% of inhaled O3 is never exhaled. Its effects are more severe and are experienced at lower concentrations in individuals with chronic lung disease, asthma, or diseases of the heart and circulatory system. Ozone 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 O3 in the range of 0.15 to 0.25 ppm may impair mechanical functions of the lung and may induce respiratory and related symptoms in highly susceptible individuals. Exposure to O3 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 including chest pain, coughing, sneezing, nausea, headache, and pulmonary congestion. Results from animal studies indicate that repeated exposures to high levels of O3 for several months or more can produce permanent structural damage in the lungs. Ground level O3 interferes with the production and storage of starches in plants, which results 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 O3 and show damage at low levels. The deterioration of nylon and other synthetics, as well as degradation of rubber, metal, and paint, is associated with O3.

Figure 2- Typical Day with High Ozone



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. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

This publication is issued by the Oklahoma Department of Environmental Quality authorized by Scott Thompson, Executive Director. Copies have been prepared at a cost of $0.1004 each. Copies have been deposited with the Publications Clearinghouse of the Oklahoma Department of Libraries. (\fact sheets\air\Ozone) 4/27/16