

Ozone half of the
largest urban areas in



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Ozone
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March 16, 1997
Triatomic oxygen, O₃, is most commonly known as ozone. It has a resonance structure, and can be drawn in two different ways: O=O-O-O=O. It is a bluish, explosive gas at room temperature, and has a boiling point of -119°C. It has a melting point of -193°C, and is a blue liquid.

Its critical temperature and pressure are -12.1°C and 53.8 atm, respectively. It has a pleasant odor in concentrations of less than 2 ppm, and is irritating and injurious in higher concentrations. The density of ozone gas is 2.144 g/L, and the density of ozone as a liquid is 1.614 g/mL. It is extremely unstable, and solutions containing ozone explode upon warming. It is found in varying proportions on Earth, but it is about 0.05 ppm at sea level. Ozone absorbs harmful ultraviolet radiation in the upper atmosphere, and protects humans from skin cancer. But ozone is also the main ingredient of smog, and causes serious health effects and forest and crop damage in the lower atmosphere. Ozone is formed through the chemical reaction of volatile organic compounds and nitrogen dioxide, in the atmosphere, in the presence of sunlight.

This reaction is called a photochemical reaction, because sunlight is required. The product is known as smog. The notorious brownish color of smog is due to nitrogen dioxide of the mixture. Increased temperature stimulates the reaction, which is why ozone conditions are worse in the summer. It is an oxidant, meaning it takes electrons away from other molecules, and disrupts key structures in cells by starting chain reactions.

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Ozone is a serious national problem. Half of the largest urban areas in the United States exceed the ozone standards.

The worst regions in the US include California and the Texas Gulf coast, and the northeast and the Chicago-Milwaukee area during the summer. The ozone condition varies from year to year, as the temperature and weather fluctuate. This fluctuation also occurs throughout the day, as emissions from morning traffic builds up, the levels rise. Ozone emissions come from many things, such as automobiles, gas stations, powerplants, dry cleaners, paint shops, chemical manufacturing plants, oil refineries, and other businesses that release volatile organic compounds. The health effects of ozone are chest pain, coughing, wheezing, lung and nasal congestion, labored breathing, sore throat, nausea, rapid breathing, and eye and nose irritation. The symptoms occur when the levels of ozone are only slightly higher than the legal standard.

Living in San Diego during my elementary school year, I personally felt the effects of ozone; the tightness of the chest, wheezing, and labored breathing on certain hot, humid days. Days would be labeled “smog days”, and children wouldn't be able to play outside during recess, the air was so polluted. Heavy exercise can drive ozone deeper into the respiratory system, and interferes with lung operation, and children growing up in smog-polluted areas have been found to have lost 10-15% of their lung capacity. Ozone severely damages crops, forests, and man-made materials.

The crops affected are ones such as soybeans, peanuts, corn, and wheat, and more extensively to tomatoes, beans, snapbeans. Cash losses of these crops

are estimated at several billion dollars a year. Evidence points towards the fact that ozone is severely damaging forest in the eastern United States, and ozone is responsible for the reduced growth rate of commercial yellow pines in the southeast U. S. Organisms such as lichens, and ecosystem processes such as nutrient cycling, are also affected. Ozone can also damage materials, such as causing cracking of plastics and rubber, and decomposition and fading of fibers and dyes. Ozone has been in the news a lot in the past decade or so.

Not only the effects of ozone as smog in the lower atmosphere, but ozone depletion in the upper atmosphere. It seems rather ironic that something we have such an abundance of that it becomes a problem, should also present the problem that we are lacking in it. However, the focus of my research was primarily on smog and the effects of the lower atmosphere. The health problems presented, the money lost on crops, and forests, have made ozone quite a prevalent issue, mainly because it affects everyone, all over the planet.

This invisible gas has and will continue to be a source of intense interest for scientists in the coming years. Contributing pollutants such as automobiles, power plants, and other things I mentioned previously have led to controversy over these items. Huge amounts of money have been put into research for decreasing the amount of ozone produced. For instance, Los Angeles installed a