



## Excerpts from US EPA's "Smog – Who Does It Hurt? What You Need to Know About Ozone and Your Health"

July 1999 EPA-452/K-99-001

Ozone is an odorless, colorless gas composed of three atoms of oxygen. Ozone occurs both in the Earth's upper atmosphere and at ground level. Ozone can be good or bad, depending on where it is found:

**Good Ozone.** Ozone occurs naturally in the Earth's upper atmosphere - 10 to 30 miles above the Earth's surface - where it forms a protective layer that shields us from the sun's harmful ultraviolet rays. Human-made chemicals are gradually destroying this "good" ozone. An area where ozone has been most significantly depleted - for example, over the North or South pole - is sometimes called a "hole in the ozone."

**Bad Ozone.** In the Earth's lower atmosphere, near ground level, ozone is formed when pollutants emitted by cars, power plants, industrial boilers, refineries, chemical plants, and other sources react chemically in the presence of sunlight.

Most people only have to worry about ozone exposure when ground-level concentrations reach high levels. In many U.S. communities, this can happen frequently during the summer months. In general, as ground-level ozone concentrations increase, more and more people experience health effects, the effects become more serious, and more people are admitted to the hospital for respiratory problems. When ozone levels are very high, *everyone* should be concerned about ozone exposure. Scientists have found that about one out of every three people in the United States is at a higher risk of experiencing ozone-related health effects. If you are a member of a "sensitive group," you should pay special attention to ozone levels in your area.

**Ozone can irritate the respiratory system.** When this happens, you might start coughing, feel an irritation in your throat, and/or experience an uncomfortable sensation in your chest. These symptoms can last for a few hours after ozone exposure and may even become painful



**Ozone can reduce lung function.** When scientists refer to "lung function," they mean the volume of air that you draw in when you take a full breath and the speed at which you are able to blow it out. Ozone can make it more difficult for you to breathe as deeply and vigorously as you normally would. When this happens, you may notice that breathing starts to feel uncomfortable. If you are exercising or working outdoors, you may notice that you are taking more rapid and shallow breaths than normal. Reduced lung function can be a particular problem for outdoor workers, competitive athletes, and other people who exercise outdoors.

**Ozone can aggravate asthma.** When ozone levels are high, more asthmatics have asthma attacks that require a doctor's attention or the use of additional medication. One reason this happens is that ozone makes people more sensitive to allergens, which are the most common triggers for asthma attacks. (Allergens come from dust mites, cockroaches, pets, fungus, and pollen.) Also, asthmatics are more severely affected by the reduced lung function and irritation that ozone causes in the respiratory system.



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**Ozone can inflame and damage the lining of the lung.** Some scientists have compared ozone's effect on the lining of the lung to the effect of sunburn on the skin. Ozone damages the cells that line the air spaces in the lung. Within a few days, the damaged cells are replaced and the old cells are shed - much in the way that skin peels after a sunburn. If this kind of damage occurs repeatedly, the lung may change permanently in a way that could cause long-term health effects and a lower quality of life.

**Scientists suspect that ozone may have other effects on people's health.** Ozone may aggravate chronic lung diseases, such as emphysema and bronchitis. Also, studies in animals suggest that ozone may reduce the immune system's ability to fight off bacterial infections in the respiratory system. Most of these effects are considered to be short-term effects because they eventually cease once the individual is no longer exposed to elevated levels of ozone. However, scientists are concerned that repeated short-term damage from ozone exposure may permanently injure the lung. For example, repeated ozone impacts on the developing lungs of children may lead to reduced lung function as adults. Also, ozone exposure may speed up the decline in lung function that occurs as a natural result of the aging process. Research is underway to help us better understand the possible long-term effects of ozone exposure.

### **Who is most at risk from ozone?**

Four groups of people, described below, are particularly sensitive to ozone. These groups become sensitive to ozone when they are active outdoors, because physical activity (such as jogging or outdoor work) causes people to breathe faster and more deeply. During activity, ozone penetrates deeper into the parts of the lungs that are more vulnerable to injury. Sensitive groups include:

**Children.** Active children are the group at highest risk from ozone exposure. Such children often spend a large part of their summer vacation outdoors, engaged in vigorous activities either in their neighborhood or at summer camp. Children are also more likely to have asthma or other respiratory illnesses. Asthma is the most common chronic disease for children and may be aggravated by ozone exposure.



**Adults who are active outdoors.** Healthy adults of all ages who exercise or work vigorously outdoors are considered a "sensitive group" because they have a higher level of exposure to ozone than people who are less active outdoors.



**People with respiratory diseases,** such as asthma. There is no evidence that ozone causes asthma or other chronic respiratory disease, but these diseases do make the lungs more vulnerable to the effects of ozone. Thus, individuals with these conditions will generally experience the effects of ozone earlier and at lower levels than less sensitive individuals.

**People with unusual susceptibility to ozone.** Scientists don't yet know why, but some healthy people are simply more sensitive to ozone than others. These individuals may experience more health effects from ozone exposure than the average person. Scientists have studied other groups to find out whether they are at increased risk from ozone. So far there is little evidence to suggest that either the elderly or people with heart disease have heightened sensitivity to ozone. However, like other adults, elderly people will be at higher risk from ozone exposure if they suffer from respiratory disease, are active outdoors, or are unusually susceptible to ozone as described above.

### **How can I tell if I am being affected by ozone?**

Often, people exposed to ozone experience recognizable symptoms, including coughing, irritation in the airways, rapid or shallow breathing, and discomfort when breathing or general discomfort in the chest. People with asthma may experience asthma attacks. When ozone levels are higher than normal, any of these symptoms



may indicate that you should minimize the time spent outdoors, or at least reduce your activity level, to protect your health until ozone levels decline.

Ozone damage also can occur without any noticeable signs. Sometimes there are no symptoms, or sometimes they are too subtle to notice. People who live in areas where ozone levels are frequently high may find that their initial symptoms of ozone exposure go away over time-particularly when exposure to high ozone levels continues for several days. This does not mean that they have developed resistance to ozone. In fact, scientists have found that ozone continues to cause lung damage even when the symptoms have disappeared. The best way to protect your health is to find out when ozone levels are elevated in your area and take simple precautions to minimize exposure even when you don't feel obvious symptoms

### **What can I do to avoid unhealthy exposure to ozone?**

If you are a parent, keep in mind that your children are likely to be at higher risk, particularly if they are active outdoors. You may therefore want to pay special attention to the guidance for sensitive groups. In general, when ozone levels are elevated, your chances of being affected by ozone increase the longer you are active outdoors and the more strenuous the activity you engage in. Scientific studies show that:

- At ozone levels above 0.12 ppm, heavy outdoor exertion for short periods of time (1 to 3 hours) can increase your risk of experiencing respiratory symptoms and reduced lung function.
- At ozone levels between 0.08 and 0.12 ppm, even moderate outdoor exertion for longer periods of time (4 to 8 hours) can increase your risk of experiencing ozone-related effects.

EPA recommends limiting outdoor activities as ozone levels rise to unhealthy levels. You can limit the amount of time you are active outdoors or your activity level. For example, if you're involved in an activity that requires heavy exertion, such as running or heavy manual labor, you can reduce the time you spend on this activity or substitute another activity that requires less exertion (e.g., go for a walk rather than a jog). In addition, you can plan outdoor activities when ozone levels are lower, usually in the early morning or evening.

### **What does exertion have to do with ozone-related health effects?**

Exercise and outdoor activities can play an important role in maintaining good health. Physical exertion helps build up strength in the heart and lungs. But exerting yourself outdoors can actually increase your chances of experiencing health effects when ozone concentrations are at unhealthy levels. Why is this true? Think of it this way: Exertion generally causes you to breathe harder and faster. When this happens, more ozone is taken into your lungs, and ozone reaches tissues that are susceptible to injury. Research has shown that respiratory effects are observed at lower ozone concentrations if either the level or duration of exertion is increased. This is why EPA recommends decreasing the level or duration of exertion to avoid ozone health effects.

Examples of typical daily activities that involve **moderate exertion** include climbing stairs, light jogging, easy cycling, playing tennis or baseball, and stacking firewood. Outdoor occupational activities such as simple construction work, pushing a wheelbarrow with a load, using a sledgehammer, or digging in your garden, would also involve moderate exertion.



Activities that involve **heavy exertion** include vigorous running or cycling, playing basketball or soccer, chopping wood, and heavy manual labor. Because fitness levels vary widely among individuals, what is moderate exertion for one person may be heavy exertion for another. No matter how fit you are, cutting back on the level or duration of exertion when ozone levels are high will help protect you from ozone's harmful effects.