

Canada's National Occupational  
Health & Safety Resource

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## Inquiries Service

The Inquiries Service at CCOHS answers questions on the health or safety concerns people have about the work they do.

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### What are the main health hazards associated with breathing in ozone?

Even very low concentrations of ozone can be harmful to the upper respiratory tract and the lungs. The severity of injury depends on both by the concentration of ozone and the duration of exposure. Severe and permanent lung injury or death could result from even a very short-term exposure to relatively low concentrations.

Exposure to extremely low concentrations of ozone initially increases the reactivity of the airways to other inhaled substances (bronchial hyperresponsiveness) and causes an inflammatory response in the respiratory tissue. Exposure to ozone during exercise or work increases susceptibility to this effect. Increased bronchial responsiveness has been observed following 7-hour exposures to 0.08, 0.1 or 0.12 ppm (with moderate exercise), or a 1-hour exposure to 0.35 ppm. This response occurs almost immediately following exposure to ozone and persists for at least 18 hours.

Other symptoms observed following acute exposures to 0.25-0.75 ppm include cough, shortness of breath, tightness of the chest, a feeling of an inability to breathe (dyspnea), dry throat, wheezing, headache and nausea.

More severe symptoms have been seen following exposure to higher concentrations (greater than 1 ppm) and have included reduced lung function, extreme fatigue, dizziness, inability to sleep and to concentrate and a bluish discoloration of the skin (cyanosis). Intermittent exposure to 9 ppm for 3-14 days has produced inflammation of the bronchi and lungs.

An acute occupational exposure to approximately 11 ppm for 15 minutes caused severe respiratory irritation and almost caused unconsciousness. A 30-minute exposure to 50 ppm is considered potentially lethal.

Animal studies indicate that ozone can also cause a potentially fatal accumulation of fluid in the lungs (pulmonary edema). Symptoms of pulmonary edema, such as shortness of breath, may not appear for 24 hours after exposure and are aggravated by physical exertion.

The severity respiratory responses to ozone becomes reduced following repeated daily exposures. This "functional adaptation" to the effects of ozone may persist for several days after exposure stops. Decreases in respiratory function do not appear to be more pronounced in cigarette smokers or people with pre-existing lung disorders.



### **What happens when ozone comes into contact with my skin?**

There is no information available. Ozone gas can probably cause skin irritation due to its oxidizing ability, but only at concentrations capable of causing severe respiratory injury.



### **Can ozone hurt my eyes?**

Ozone concentrations greater than 2 ppm can be irritating to the eyes within minutes. No definite effects on vision were noted in volunteers exposed for 3 or 6 hours to 0.2-0.5 ppm, although some increase in side vision (peripheral) and a slight reduction in visual sharpness (acuity) was noted during dark adaptation tests.



### **What happens if ozone is accidentally swallowed (enters the digestive system)?**

Ingestion is not an applicable route of exposure for gases.



### **What are the long term health effects of exposure to ozone?**

A small number of studies examining the potential effects of long-term occupational exposures to ozone have reported headache, irritation of the nose and throat, chest constriction and lung congestion in exposed workers. Human population studies indicate that people living in communities with high background ozone levels have experienced a greater decrease in lung function over 5 years than people living in communities with lower background levels.

These studies suggest that long-term exposures to ozone may result in impaired lung function. These reports are consistent with animal studies which also indicate that long-term exposure to ozone can impair lung function and cause structural changes to the lungs.

Based on animal evidence, exposure to ozone may increase susceptibility to bacterial infections of the respiratory system.



### **Will ozone cause cancer?**

There is no human information available. Animal studies are inconclusive.



### **Will ozone cause any problems with my reproductive system?**

There is no human information available. No effects were observed in one animal study.



### Will ozone cause effects on the fetus/unborn baby?

There is no human information available. No conclusions can be drawn from the available animal studies because effects were either seen in the presence of maternal toxicity or maternal toxicity was not evaluated.



### Will ozone act in a synergistic manner with other materials (will its effects be more than the sum of the effects from the exposure to each chemical alone)?

Ozone exposures may influence clearance of other hazardous substances from the lung. Individuals with asthma were reported to be sensitized to the effects of other irritants when pre-exposed to 0.12 ppm ozone for 1 hour. Animal studies have shown that rats exposed to ozone prior to an exposure to asbestos had significantly more asbestos in their lungs one month later than animals not exposed to ozone. No synergism has been observed between ozone and either nitrogen dioxide or sulphuric acid in terms of impaired respiratory function.



### Is there potential for ozone to build-up or accumulate in my body?

Ozone is absorbed in both the upper and lower respiratory tract. It is a potent oxidant that reacts with protein and lipids, particularly within biological membranes. A small amount of inhaled ozone is absorbed into the blood. The extreme reactivity of ozone limits its ability to accumulate.



Document last updated on January 15, 1998

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