Depletion of The Ozone Layer: Radiation Hazard to Eyes

Fact sheet

What is ozone?
Ozone is a form of oxygen in which three oxygen atoms join together to form a molecule of ozone (03). It is formed by the action of sunlight on molecules of ordinary oxygen in the stratosphere. Thus, it is mainly scattered in a "layer" at altitudes between about 10 and 30 km above the earth's surface. Some ozone can also be formed close to the earth's surface by the action of sunlight on, for example, car exhaust fumes.

Why is the ozone layer important?
As well as emitting visible light, the sun also emits short-wavelength ultraviolet radiation. The ozone layer absorbs the shorter, more hazardous, ultraviolet wavelengths and hence prevents them from reaching the earth's surface. This short-wavelength ultraviolet radiation can affect human health by causing skin cancer and affecting the immune system. It also contributes to various types of damage to the eyes (e.g. photokeratitis or snow blindness, and various opacities on and within the eyes, including pingueculae, pterygia and cataract)

What is happening to the ozone layer?
The ozone layer is being damaged by various man-made chemicals (eg chloro-fluorocarbons, or CFCs), which find their way from the earth's surface up to the stratosphere and break down the ozone molecules.

Is anything being done to stop this happening?
A large number of nations have signed the 1987 Montreal Protocol and its later amendments, which restrict the production of these damaging chemicals. However, because these chemicals survive a long time in the atmosphere, some loss of ozone will persist for at least another 50 years. Worries remain too, that some nations may still continue to produce these chemicals.

Do we know whether or not there has already been a loss in atmospheric ozone?
Yes. Measurements made from satellites, rockets and the ground all show that at certain times of the year, the ozone layer thins by 50% over the South Pole. Fortunately, losses over Britain and other non-polar regions are very much smaller (about 4% per decade since 1979).

Does this mean that much more short-wavelength ultraviolet radiation is reaching the ground?
Yes, at the South Pole. Currently, little evidence shows that ultraviolet levels

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have increased in Europe and other non-polar regions, although the situation is being carefully monitored to make sure that this does not occur.

When do I need to protect my eyes against short-wavelength ultraviolet radiation from the sun?

At present, the risks to the eyes are not substantially greater than they have been in the past. Amounts of potentially damaging solar ultraviolet have always been greatest at around local noon in mid-summer. They increase as we move towards the equator or to higher altitudes. Sand and snow tend to reflect substantial amounts of ultraviolet and hence increase damage risks. Protection is certainly needed then, during skiing or other activities on snow at high altitudes (particularly during summer) or on beaches, especially when these are near the equator.

How can I protect my eyes?

Wearing a broad-brimmed hat considerably reduces the amount of light striking the eyes when walking or standing. Ordinary clear plastic or high-index glass lenses provide considerable protection against short-wavelength ultraviolet radiation. Sunglasses provide still better protection, although it is important to check that these are made to meet the British Standard for sunglasses (BS EN 1836:1997 or BS 2724:1987): category 2 (20% transmittance) gives good protection. Protection against ambient ultraviolet coming from the side or reflected from below is also desirable, and with some modern small sized frames, care must be taken to check that they also protect from above.

Do I still need protection when the sky is cloudy?

Many types of cloud have only a small effect on the amounts of ultraviolet reaching the ground. lt is, then, prudent to continue to protect the eyes from ambient ultraviolet in high-risk environments even when the sky is cloudy.

Do I need to wear sunglasses in Britain whenever it is sunny?

While under most circumstances this is not necessary from the point of view of ocular health when only relatively brief periods of exposure are involved, those spending many hours outside, particularly in summer in highly reflecting environments such as white sand beaches, should certainly wear them. Sunglasses can improve ocular comfort for everyone in bright sunny conditions.

Are the risks likely to get worse in the future?

Scientists hope that the signing of the Montreal Protocol will stop the

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decrease in the ozone layer and make sure that we remain reasonably protected against short-wavelength ultraviolet sunlight. However, it is very difficult to predict exactly what will happen and a very careful worldwide watch is being kept on levels of both ozone and ultraviolet so that any worsening of the problem can rapidly be identified.

If I have exposed my eyes to too much short wavelength ultraviolet radiation, how will I know?

A few hours after the exposure your eyes will redden and water. They may feel "gritty" and you may be more comfortable in a darkened room. Fortunately, this photokeratitis will subside within one or two days. The possibility of long-term effects cannot be excluded, however, so that it is worthwhile protecting your eyes when at risk in the future.