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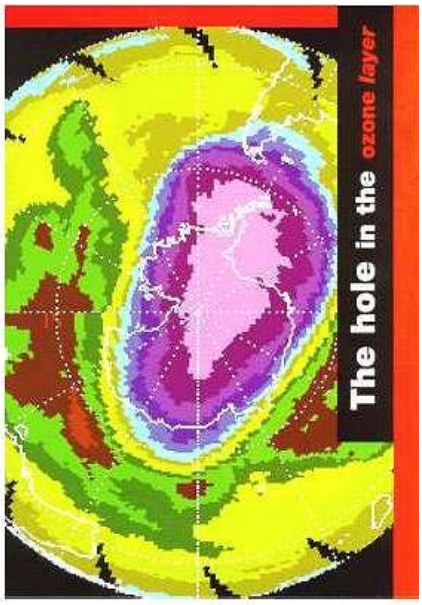
The Ozone hole



Discovery of the hole in the ozone layer showed that human activity can have major, and often unexpected impacts on the planet. The destruction of ozone in the stratosphere high above the planet's surface has been brought about as the result of the widespread use of chemicals which under normal conditions are chemically inert and harmless.

Ozone occurs at all levels in the atmosphere, but most of it is found in the stratosphere, between about 10-20 kilometres above the Earth's surface. Even there it occurs in minute concentrations, but it plays a very important role. Ozone absorbs harmful ultraviolet radiation which is produced by the Sun. Ultraviolet radiation can damage cells of living things - plants, animals and people. Whereas small doses result in nothing worse than sunburn, larger amounts may cause cataracts or skin cancer, and can affect the growth of plants.

The breakdown of ozone has been caused by complex chemical reactions involving chlorine and bromine. Although small amounts of these elements occur naturally in the stratosphere - for instance chlorine is produced by volcanic eruptions - the major breakdown of ozone over the last twenty years has been caused by man-made chemicals. Large amounts of gases called CFCs and Halons were produced this century for use in everyday appliances like fridges, aerosol spray cans, and fire extinguishers. At ground level, these compounds are chemically non-reactive. However they are carried on wind systems up into the high atmosphere, where the ozone layer is. Up here, CFCs and Halons can be broken up by the intense sunlight, releasing chlorine and bromine atoms.

The hole in the ozone layer is formed over the Antarctic continent each spring. During the dark Antarctic winter, the atmosphere becomes colder than anywhere else on Earth. Strong winds enclose the cold air above the Antarctic, allowing ice clouds to form. The ice crystals provide the sites where chlorine and bromine react with ozone when sunlight returns in the spring, and results in the ozone hole. In early summer, the ozone hole mixes with the rest of the stratosphere. Over the past years, the concentrations of chlorine and bromine in the atmosphere have been steadily increasing, and more ozone has been destroyed.

The story of the ozone hole illustrates the complexity of the behaviour of the atmosphere and the ways in

which we can change it. Ozone itself is a useful protective layer high above our heads, but in the cities is an irritating pollutant. The CFCs have other effects too. As well as contributing to the breakdown of ozone, CFCs are also very effective 'greenhouse gases', contributing to a gradual warming of the atmosphere. However, the possible change in climate resulting from increases in various greenhouse gases might make the stratosphere colder, not warmer. Even if we were able to reduce CFC and Halon emissions effectively, these lower temperatures could mean that ozone destruction would continue. Time will tell.

Governments of many countries agreed in 1987 to the Montreal Protocol in an effort to reduce the amount of CFCs and Halons being produced, and so protect the ozone layer. Since then, this agreement has been strengthened; more countries have signed it, and more substances included for control. As a result, the amount of chlorine and bromine in the atmosphere seems to be decreasing. With less chlorine and bromine in the atmosphere the ozone hole should become smaller, and eventually close up, but it is likely to take 20-30 years for this to happen.

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