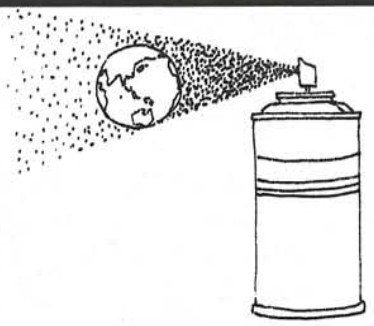
BACK BOX

In search of spray-can gases



If a chlorine atom meets an ozone molecule high up in the stratosphere, it may turn the ozone into ordinary oxygen. If large numbers of these meetings keep occurring, the eventual outcome could be a dangerous weakening of the ozone barrier that protects us from the sun's biologically harmful ultraviolet radiation.

Normally one wouldn't expect to find chlorine atoms in the stratosphere. But modern technology is changing that, and the source that has been most studied so far is the humble spray-can. The chlorine is contained in compounds that blow out the fly spray, deodorant, paint, or whatever when we press the plunger.

These propellant compounds, known as fluorocarbons and containing carbon, fluorine, and chlorine, are normally very stable. But they drift upwards in the atmosphere, and apparently break up in the stratosphere under the influence of ultraviolet radiation. One of the products is chlorine atoms.

Scientists in America and Europe have been measuring fluorocarbon concentrations in the atmosphere for some time. Their readings agree closely with predictions based on the amounts of the compounds produced. Measurements in the stratosphere show a falling concentration with increasing height, which indicates that the compounds are breaking up as expected.

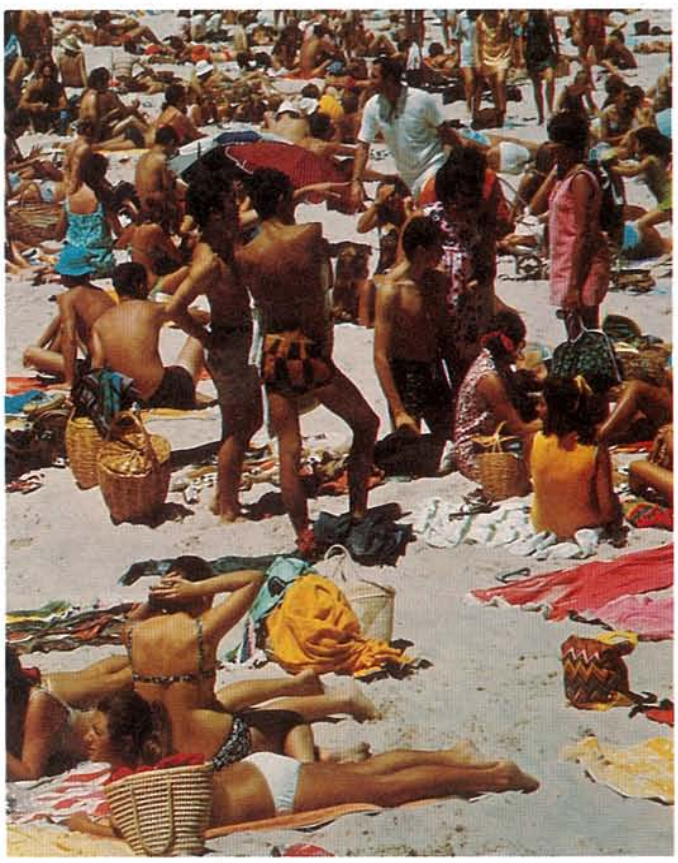
Scientists in many countries, including Australia, regularly measure ozone concentrations in the stratosphere. So far they haven't found any evidence that the fluorocarbons are causing any reduction, but ozone concentrations fluctuate naturally, and a small man-made change would take some time to detect. A team at Harvard University, Boston, calculated recently that if the growth in fluorocarbon propellant output continues at about 10% a year, stratospheric ozone could decrease by 10% in the next 20 years.

The CSIRO Division of Atmospheric Physics at Aspendale, Melbourne, is about to begin measuring fluorocarbon concentrations in air samples collected over Australia and the surrounding sea. Dr Paul Fraser will analyse the samples, gathered in the Division's carbon dioxide measuring program run by Dr Graeme Pearman and Dr John Garratt (see *Ecos* 1). Aeroplanes collect air at altitudes ranging up to 12 km, which at some times of the year is just into the stratosphere. The scientists hope to use balloons to obtain higher stratospheric samples —at altitudes up to 28 km.

As well as testing for fluorocarbons, the scientists will analyse the air samples for another possible source of chlorine atoms, carbon tetrachloride. American and English scientists have found this compound in the stratosphere, and also the lower atmosphere, in concentrations similar to those measured for fluorocarbons. Like the fluorocarbons, it breaks up in the presence of strong ultraviolet radiation.

Mr Ian Galbally of the Division of Atmospheric Physics has calculated the amounts likely to find their way to various levels in the atmosphere from industrial emissions. His predictions agree closely with the measurements. He concludes from this that all the carbon tetrachloride in the atmosphere has probably been put there by Man's activities.

Carbon tetrachloride has many uses, including removing grease from metals, dry cleaning, and fumigation. It seems that it must now join supersonic jet exhausts and spray-can propellants as a possible destroyer of the ozone that protects us from the sun's most harmful rays. Whether any of these will have a damaging effect remains to be seen.



A decrease in upper-atmosphere ozone would let through more of the ultraviolet radiation that causes sunburn and skin cancer.

Unshielding the sun—human effects. A. K. Ahmed. *Environment*, 1975, **17**, 6–14.

Ozone comes down to earth. *Ecos* No. 2, 1974, 12–18.