BACK BOX

Ozone and bushfire smoke

Photochemical smogs occur in cities when nitrogen oxides and hydrocarbons, mostly from car exhausts, react together under the stimulus of ultraviolet radiation from the sun. Scientists from CSIRO have recently found that similar reactions can take place when the sun shines on smoke from bushfires or from controlled burning in forests.

The main product of the reactions is ozone, a form of oxygen so poisonous that concentrations as low as 6 parts per million can kill rats in 4 hours. Fortunately the ozone build-up in smoke is restricted to the tops of plumes.

The discovery of photochemical ozone production in smoke was made by Mr Tony Evans, Mr Nicholas King, Mr David Packham, and Mr Edwin Stephens during research on pollution from controlled burning. Mr Evans, of the Division of Applied Organic Chemistry in Melbourne, is now making a detailed study of the causes of the ozone build-up.

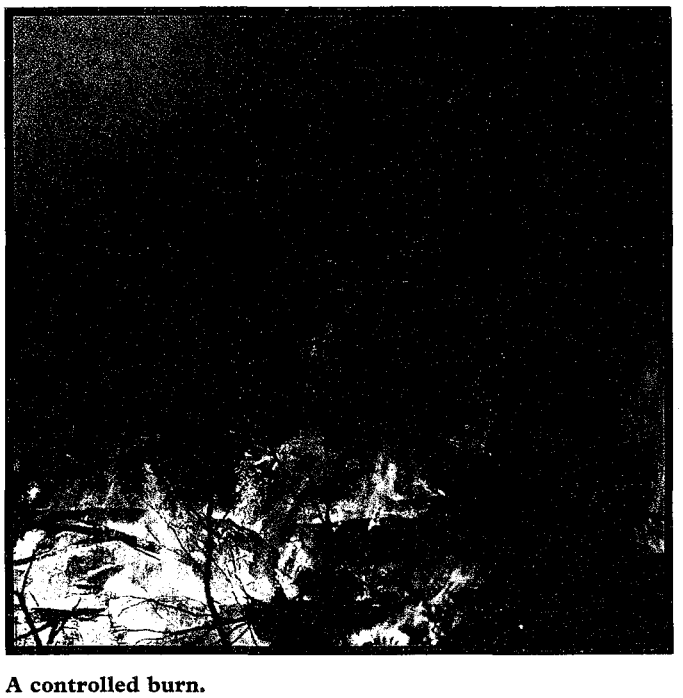
To find out what's in the smoke, Mr Evans flies a small aircraft through it. A monitor on board records ozone concentrations. Carbon dioxide, nitrogen oxides, and hydrocarbons are measured either in flight or in samples of smoky air brought to the ground. Ozone levels as high as 0·2 p.p.m. have been recorded at plume tops; this compares with a maximum of about 0·03 p.p.m. in unpolluted air, and is similar to levels recorded during the worst photochemical smogs in Sydney and Melbourne.

Mr Evans has also measured ultraviolet radiation at various levels in a plume, and found that very little penetrates through the smoke. For example, at lower levels, where smoke has reduced the visible radiation by half, the ultraviolet intensity is less than one-tenth of that in clear sunlight. It seems that measurable ozone production is restricted to the top of a plume because the smoke stops most of the ultraviolet radiation from reaching lower levels.

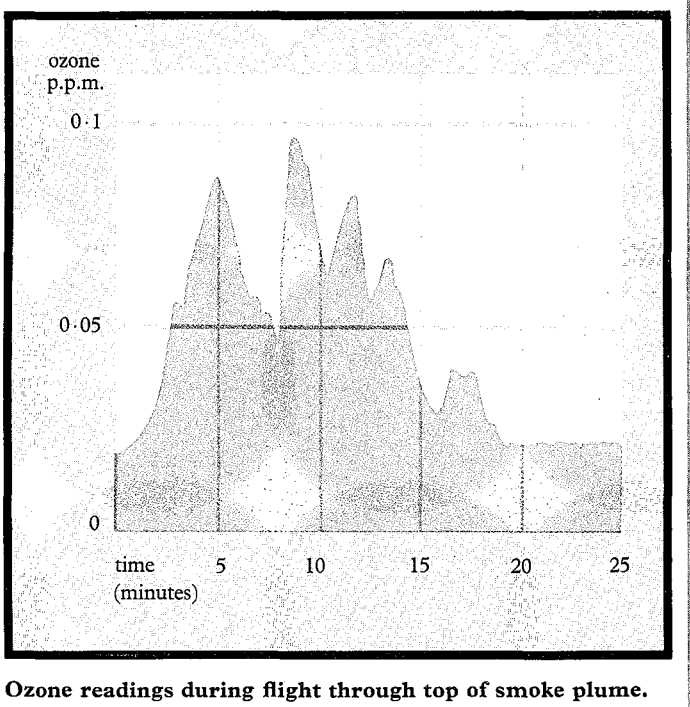
Mr Evans will soon begin laboratory experiments aimed at sorting out the roles of various smoke constituents in ozone formation. Particles, for example, may either contribute to production of the gas or consume it. The eucalypt oils that boil off when gum trees burn and the more common hydrocarbon combustion products ethylene and propylene may have different roles.

One interesting feature of the smoke examined is that it has a much lower concentration of nitrogen oxides than city atmospheres polluted by car exhausts have. Mr Evans is planning experiments to see if nitrogen oxides added to smoke give rise to higher ozone concentrations.

Ozone measurements in smoke from forest fires. L. F. Evans, N. K. King, D. R. Packham, and E. T. Stephens. *Environmental Science and Technology*, 1974, 8, 75–6.



A controlled burn.



Ozone readings during flight through top of smoke plume.