

### DEVIL IN THE DIESEL

Lorries belch out what may be the most carcinogenic chemical ever discovered.

A compound discovered in the exhaust fumes of diesel engines may be the most strongly carcinogenic ever analysed, say Japanese researchers. They warn that a major source of the chemical is heavily loaded diesel engines, and that it could be partly responsible for the large number of lung cancer cases in cities.

The compound, 3-nitrobenzanthrone, produced the highest score ever reported in an Ames test, a standard measure of the cancer-causing potential of toxic chemicals. "I personally believe that the recent increase in the number of lung cancer patients in vehicle-congested areas is closely linked with respirable carcinogens such as 3-nitrobenzanthrone," says Hitomi Suzuki, a chemist at Kyoto University who led the study. Test emissions from truck engines and the air above central Tokyo both contained the compound.

3-Nitrobenzanthrone is a nitrated polycyclic aromatic hydrocarbon (nitro-PAH). It is produced during reactions between ketones—by-products of burning fuel— and airborne nitrogen oxides that take place on the surface of hydrocarbon particles in diesel exhaust.

The researchers used the Ames test to measure the number of mutations the compound caused in the DNA of standard strains of bacteria. In a test with a strain of *Salmonella typhimurium*, 3-nitrobenzanthrone recorded more than 6 million mutations per nanomole. This compared to a score of 4.8 million for its nearest rival, 1,8-dinitropyrene, which is also found in diesel exhaust and had until now been the most powerful known mutagen.

In a further experiment, the researchers found that the compound caused "considerable chromosomal aberrations" in the blood cells of mice, suggesting that it is likely to have similar effects on other mammals, including humans. Suzuki and colleagues from the National Institute of Public Health in Tokyo and the Kyoto Pharmaceutical University report their findings in the October issue of *Environmental Science and Technology* (vol 31, p 2772).

The two mutagens are found only in minute quantities. Each makes up no more than a few parts per million of the particulates in diesel exhaust. Nonetheless, the authors conclude that they are so toxic, that "it is easily understandable that they would contribute considerably to the ~ total mutagenic activity of diesel exhaust particle extracts".

Tiny combustion particles, many of them from diesel exhausts, have been estimated to cause 10 000 deaths in Britain and 60 000 in the US each year ("Dying from too much dust", *New Scientist*, 12 March 1994, p 12). Tony Seaton of the Aberdeen Royal Infirmary, a leading adviser on air pollution and health to the British government, says: "PAHs are known carcinogens and nitroPAHs are probably the worst. This one seems to be new to us."

The Japanese study also provides clues about how to reduce the threat from 3-nitrobenzanthrone and other nitroPAHs. It reveals a "remarkable increase" in emissions when engines are working under heavy load. This may show "the potential danger of engines overloading", Suzuki says.

He calls for stronger regulations to limit the loads that diesel trucks can carry. In addition, nitro-PAHs are created faster in smoggy air with high levels of nitrogen oxides and ozone.