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COMMITTEE ON THE MEDICAL EFFECTS OF AIR POLLUTANTS

PAPER FOR INFORMATION: RECENT TRENDS IN OZONE CONCENTRATIONS ACROSS THE UNITED KINGDOM

1. The attached paper has been provided by Professor Dick Derwent from the Meteorological Office as background to the Committee's discussions on ozone.

COMEAP Secretariat
June 2002

RECENT TRENDS IN OZONE CONCENTRATIONS ACROSS THE UNITED KINGDOM

Summary

The ozone climate of the United Kingdom has changed significantly during the 1990s and COMEAP may wish to take into account these changes in their deliberations.

1. Maximum peak hourly mean ozone concentrations

The maximum peak hourly mean ozone concentrations at each of the rural monitoring sites have declined steadily during the 1990s. During the 1970s-1980s, peak hourly mean ozone concentrations in excess of 150 ppb were monitored in some years, particularly in the south and east of the United Kingdom. Such peaks are now a feature only of the historic record and are unlikely to be seen again in the future. If the decline observed during the 1990s continues into the 2000s then it is likely that exceedances of the 90 ppb level set as the Public Information Threshold by the Commission of the European Communities will also cease.

Figure 1.[1]

Peak hourly mean ozone concentrations in urban areas are somewhat lower than in the rural areas surrounding them and have shown the same steady declines during the 1990s. Exceedances of the 90 ppb Public Information Threshold at urban sites should cease during the 2000s.

2. 8-hour running mean ozone concentrations

The maximum 8-hour running mean ozone concentrations in each year have declined steadily during the 1990s at all rural sites from about 90-130 ppb to 60-80 ppb over the decade. There has also been a corresponding decrease in the number of days in which at least one 8-hour running mean ozone concentrations exceeded 50 ppb at all rural sites.

Figure 2.

At the least traffic-polluted urban sites, the number of 50 ppb 8-hour running mean exceedance days has been steadily rising to meet the exceedance levels found in the rural areas surrounding them. At the most traffic-polluted urban sites, the number of 50 ppb 8-hour exceedance days remains unchanged and in single figures.

Figure 3.

Figure 4.

[1] All figures can be made available by the Secretariat on request

It is likely that, if current trends continue, then the number of 50 ppb 8-hour exceedance days at all rural sites will decline to meet the EPAQS target of 10 occurrences per year with in the next 5-10 years. Exceedances of the EPAQS 8-hour target of 100 ppb are a matter of historic record and should not occur in the future.

Reducing maximum 8-hour running mean ozone concentrations below 50 ppb will require sustained action to reduce ozone precursor emissions both in the UK and in the rest of Europe which is certainly well beyond current policies and is probably beyond that considered technically feasible.

3. Mean monthly ozone concentrations

Monthly mean ozone concentrations have been steadily increasing in urban sites during the 1990s. The increases are usually observed during the autumn, winter and spring months with summer values remaining constant. The reduction in NO_x emissions brought about by motor vehicle three-way catalysts has undoubtedly reduced urban ozone destruction and this has been a major factor in the observed increase in monthly mean urban ozone concentrations. As a result the rural excess in ozone over the urban areas is declining markedly.

Figure 5.

There is another trend, however which has undoubtedly contributed to increasing mean monthly ozone concentrations in both urban and rural sites. This is the steadily increasing trend observed in the global ozone baseline concentrations in clean North Atlantic air as it enters the British Isles. Mean ozone concentrations have been rising at about +0.5 ppb per year during the 1990s in these clean air masses upwind og the United Kingdom. This cause of this increase has been attributed to the increasing global emissions of methane, carbon monoxide, organic compounds and oxides of nitrogen across the entire northern hemisphere and the importance of intercontinental transport of ozone.

Figure 6.

Ultimately, over the next few decades or so, the increasing trend in the ozone levels due to the increasing global ozone baseline may take over from the decreasing trend in regional ozone due to air pollution controls in Europe and monthly mean ozone concentrations may increase steadily under the influence of global warming.

Figure 7.

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