

# ROYAL METEOROLOGICAL SOCIETY: AUSTRALIAN BRANCH MEETING

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## Ambient Air Monitoring in Victoria

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Mr Munro, Principal Air Quality Officer, Technical Services, Victorian Environment Protection Authority (EPA), opened his address to the Society by outlining the need for monitoring air quality. The most important effect of air pollution was undoubtedly on human health, in a variety of ways, but significant economic losses could also arise, e.g. losses in foodstuff production due to retardation of plant growth, increased costs of building maintenance and so on. Last, but not least in many people's eyes, was the aesthetic degradation caused with noticeable visibility reductions, for instance, even on days that were not rated as dangerous on other accounts.

He then listed the many pollutants that had to be coped with in Victoria:  $O_3$  (not discharged to any significant extent, but generated photochemically in the atmosphere), CO (80 to 90 per cent from automobile exhausts),  $NO + NO_2$  (the former mainly from combustion processes, and not of great importance in itself, except insofar as it was generally further oxidised - largely photochemically - to give  $NO_2$ ),  $SO_2$  (not at present important in Melbourne, because of low sulphur content in the fuels used here, but likely to increase in future due to more use of coal and high-S crude oil), hydrocarbons (both from exhausts and from fuel handling and processing facilities), particulates (classified as primary, from mainly industrial sources, and secondary, generated by atmospheric reactions, mainly photochemical and associated with smog), Pb (largely from exhausts, but some from smelters), also industrial chemicals (such as vinyl chloride) and mineral fibres (such as asbestos).

With each of these, there can be a wide variation of concentration in both space and time - an extreme and obvious example being pollutants generated by road traffic. It has therefore been found necessary all over the world to set up a range of so-called Air Quality Standards, Goals and/or Criteria - mostly time-dependent. For instance, the principal sufferers, such as USA and Japan, have already introduced legal standards for all major emissions. On a global basis, World Health Organisation expert committees have produced a number of recommendations on long-term goals for pollutant concentrations. At the moment Victoria has no standards, but is working towards their introduction in the near future.

The factors involved are very difficult to evaluate, of necessity being based on complex and costly medical studies, to assess the pollutants' effects on human health for various exposure times at various concentrations. Such standards as have resulted set out maximum permissible concentrations, as time averages over periods of an hour and up, which are not to be exceeded more than a laid-down number of times per annum.

In assessing where we stand in relation to all this, there is no alternative to continuous monitoring of most of the pollutants concerned. Even so, large errors inevitably arise, e.g. in air sampling procedures, conditioning of air samples for analysis, and calibration of instruments at the very low concentration levels normally involved - not to mention in the representativeness of monitoring sites.

Large uncertainties also arise in interpretation, especially in marginal situations. For example, if a chosen standard lays down that 10 pphm of a certain pollutant should not be exceeded more than, say, once a year, what should be the response to a finding that up to 10.5 pphm occurs, say, several times a year? This clearly calls for concern, but not for alarm - which would more likely arise at levels of around 15 to 20 pphm.

Monitoring tends to be of two basic kinds: (i) airshed average or trend (via long-term measurements, within a populated region but well-removed from major local sources, and often at isolated sites), to permit assessment of the effects of changing industrial and population patterns, and of the efficiency of control measures where these apply; (ii) local source (via shorter-term measurements of, for instance, CO and/or Pb along roads, dust fallout near quarries, etc.), to assess the contribution of each source to both local and regional problems, and again to evaluate any control measures introduced.

Six basic sets of equipment were acquired in 1973, just after EPA was set up. Three such sets were installed in mobile vans, two to be used around Melbourne and the other by the Latrobe Valley Water and Sewerage Board (LVWSB). These vans tend to be moved on after a year or less at any one site, so that a bird's eye view of the overall problem is rapidly obtained, although trend-spotting is difficult.

The oldest fixed station is at the Science Museum, where it not only operates continuously but is also on display for educational purposes. Others have recently started at Camberwell, Footscray, and the EPA headquarters in Parliament Place - essentially sampling Melbourne's Central Business District (CBD). In the next two years, three more vans and two fixed stations will be set up - including sites at South Caulfield, Alphington and Frankston.

The ultimate aim is a central station to cover the CBD, and two rings at 5 to 10 km and 15 to 20 km radius; also stations in larger provincial cities, such as Geelong, where elevated levels of  $O_3$ ,  $SO_2$  and particulates have already been found - possibly having drifted from Melbourne rather than being emitted locally. The Latrobe valley is already being monitored to some extent by the LVWSB and the State Electricity Commission.

As well as pollutant levels, each station at present measures windspeed and direction, air temperature and humidity, and visibility. Apart from problems of commissioning, of operation and of maintenance, the acquisition of suitable sites, affording a representative exposure, has proved very difficult. Railway land is ideal in many respects, but has problems with diesel fumes and  $O_3$  owing to high-tension brush-discharge. Security is a very important requirement.

Results obtained so far show that Melbourne does have photochemical smog, although not as badly as in Los Angeles or Tokyo. Our particulate levels are also not too good, but  $SO_2$  and CO are only a problem locally, e.g. the latter near busy streets and intersections. The CBD emits significant hydrocarbons, which as the air moves along tend to generate  $O_3$ , the maximum level of which occurs some distance away. Although high  $O_3$  levels are generally found in the suburbs rather than the city, this could also arise from possible local sources, or from the reducing effect of high NO concentrations in the city itself.

In order to understand the situation better, several studies have been undertaken, one jointly with the University of Melbourne on the urban meteorology of Melbourne, and another on the causes of haze, by tracking polluted air masses generated in the CBD during the morning rush, both as to where they go and what happens to the  $O_3$  and precursors, etc., in them.

For some years now the EPA has supplied the media with a daily Air Quality Bulletin. The public seemed uninterested in the detailed makeup of pollution, so a simple index was established (somewhat analogous to the meteorological index of human comfort). This involves suitably weighting the measured figures for all pollutants, for 8 to 9 am and 2 to 3 pm, then adding those for the four most significant pollutants on the occasion - whatever they might be. The resulting overall pollution figures are then classified into one of five categories - Clean, Light, Significant, Heavy, or Severe. Crude and ambiguous as such an index is, it has been well accepted and any improvements in it will need to be slowly and carefully introduced.

A lengthy discussion followed, one point of particular interest to members being the likelihood, on the one hand, of increased future involvement of the Bureau of Meteorology in this kind of work, and on the other, the increasing employment of meteorologists by the EPA and other concerned bodies.

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