

WHO and WMO collaborate in global air pollution monitoring*

The worldwide spread of air pollution led both the World Health Organization and the World Meteorological Organization (WMO) to initiate air monitoring programmes in the early 1970s. Together, these programmes now constitute the main air monitoring component of the Global Environmental Monitoring System (GEMS) of the United Nations Environment Programme (UNEP). In addition to cooperating in GEMS, the two programmes complement each other in providing data on pollution in urban and industrial areas (so-called impact areas) and on background levels of pollution that can serve as a basis for environmental management activities.

For many years air pollution was considered to be almost entirely a local problem associated with industrial activities and urban living patterns. More recently it has taken on a worldwide character following the discovery that pollutants were being transmitted all over the globe through the atmosphere. The situation has been aggravated by the growth of populations and the increase in polluting industries in some developing countries whose ability to control air pollution is often inadequate.

It has been established that there exist several different levels of air pollution corresponding to different scales of turbulent diffusion. Scientists speak of local, urban, regional, continental and global scales. One illustration of the existence of different levels of pollution is the construction of high discharge stacks, which is effective in controlling local and urban pollution—the impact level—but much less effective at regional and more extensive (background) levels. Similarly, environmentally conscious land-use planning is valuable on the regional scale but of little interest on the local and urban scales. In the long term, an increase in

background pollution on the global scale will produce changes in climate and so will influence conditions and patterns of life too.

The WHO project is active in the industrial and urban areas. Its main concern is the protection of people's health, particularly in cities. The WMO programme concentrates on background air pollution measurements, its main interest being the potential for long-term global and regional changes in air pollution concentrations and their effect on climate. Both are worldwide in scope, however, and their aims converge since both are designed to monitor, in a comparable way, the levels of air pollutants in the principal human and natural environments, to assemble information that has a bearing on the assessment and improvement of air quality, and to collaborate with Member countries in efforts to produce the necessary skills and facilities to deal with national and international air pollution problems.

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The WHO Air Quality Monitoring Project

The project began in 1973, and until 1975 operated on a pilot scale with 14 countries participating; today there are 42 countries. During the early years air monitoring procedures were established and tested and, with a view to harmonizing measurement and sampling methods, a manual¹ was published that described different commonly used methods for measuring the five major air pollutants—suspended particulate matter (SPM), smoke and sulfur dioxide, carbon monoxide, the nitrogen oxides, and ozone. The project is carried out in cooperation with national agencies and laboratories responsible for operating the monitoring stations and reporting the data, which are stored and processed by the WHO Collaborating Centre on Environmental Pollution Control in the United States Environmental Protection Agency, Washington, DC, USA. Biennial reports are published by WHO.

Other WHO Collaborating Centres in Nagpur (India), Tokyo (Japan), London (England), and Moscow (USSR) assist in the monitoring project. The Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS) in Lima (Peru) acts as the coordinating centre for the project in Latin America.

Thus far, only SPM, smoke and sulfur dioxide data have been assembled. Starting in 1978, nitrogen dioxide and carbon monoxide will be added from traffic-related stations. Lead analysis of SPM will also be carried out on filters from selected stations.

Assistance has been given to countries wishing to begin air monitoring in some large cities. New monitoring stations in 12 cities (see Table 1) are being equipped with instruments by WHO using funds from UNEP. For SPM, the high-volume sampler with flow controller is supplied, and for sulfur dioxide a gas bubbler device with temperature control and all-weather housing. Assistance also takes the form of training personnel.

The distribution of the cities reporting data to the WHO projects is presented in Figure 1. The monitoring stations either belong to local or national networks or have been set up with WHO assistance. The data are obtained using a number of different but acceptable methods. To overcome difficulties in interpreting sets of data produced by these different methods, a number of "comparison" stations are being set up in different cities around the world.

A comparison station is a station belonging to a national or local network where a set of air monitoring equipment provided by WHO can be run in parallel with the locally used equipment on two or three days each month. The parallel measurements

Table 1. List of comparison stations and new monitoring stations with number of sets of air monitoring equipment provided by WHO

Comparison stations		New monitoring stations	
City	No. of sets	City	No. of sets
Toronto	1	Bangkok	3
Chicago	1	Kuala Lumpur	2
Lima	1	Djakarta	2
Santiago	1	Nairobi	2
Sao Paulo	1	Accra	3
Calcutta	1	Lagos	2
Cairo	1	Dakar	2
Teheran	1	Suva	1
Brussels	1	Iligan	
Warsaw	1	(Philippines)	2
Zurich	1	Lahore	2
Tokyo	1	Baghdad	3
Sydney	1	Lisbon	2
Manila	1		
	14		26

for sulfur dioxide and SPM will be analysed separately, thus providing information on how different sets of data can be compared. Table 1 gives the cities where comparison stations are being set up; most of the stations began operation late in 1977.

The WMO Background Air Pollution Monitoring Network (BAPMoN)

The WMO network includes three types of monitoring stations, regional, continental and baseline, which represent respectively about 75%, 15% and 10% of the network density. Regional stations are located sufficiently far away from built-up areas to avoid being dominated by fluctuations in pollution from local sources. Continental stations are mostly located above the surface boundary layer; they are representative for areas from 1 to 10×10^6 km. Measurements made at baseline stations should reflect the lowest concentration to be expected over large areas of the earth. As such, they monitor real long-term tropospheric air pollution levels resulting from the highest degree of atmospheric mixing. The sites for these stations should be in an area where no significant changes in land-use practices are anticipated for at least 50 years within a radius of 100 km, such as a small isolated island or a mountain above the tree-line.

At the regional stations, the "minimum" programme is carried out. It includes sampling of wet

¹ WORLD HEALTH ORGANIZATION. *Selected methods of measuring air pollutants*. Geneva, 1976 (WHO Offset Publication No. 24).



Fig. 1. WHO/UNEP air monitoring project sites.

precipitation and the observation of atmospheric turbidity. Daily turbidity measurements are made under clear sky conditions. Analysis of precipitation on a monthly or shorter-term basis is carried out for a large variety of chemical constituents as well as for electrical conductivity, pH and acidity. Any concentration changes in elements involved in the chemistry of cloud formation are of great interest. Recently it was decided to add the measurement of suspended particulate matter to the minimum programme, using high-volume air samplers.

Continental stations may be described as regional stations with expanded programmes that include, as far as possible, the monitoring of gaseous air constituents such as carbon dioxide, ozone, sulfur dioxide and nitrogen oxides. Baseline stations can be considered as research projects, usually with some scientific staff in full-time attendance. An example is the baseline station at Mauna Loa (Hawaii) where, in addition to the expanded programme, fluorocarbons, carbon monoxide, isotopes in air and precipitation, total and surface ozone, and condensation nuclei are measured. All the BAPMoN stations also measure a variety of meteorological parameters.

The WMO programme is implemented through the national meteorological services. The data are reported on a monthly basis, according to existing

coding and reporting practices, to the United States National Climatic Center, Asheville, NC. They are subsequently processed and stored in a data bank located at the North Carolina office of the United States Environmental Protection Agency, a WMO Collaborating Centre on Background Air Pollution Data. Other central facilities such as CO₂ and chemical reference centres help in attaining a high degree of standardization.

At present there are about 82 regional, 9 continental and 11 baseline stations, but some have not yet reached full operation. About 35 countries are participating in the WMO air monitoring programme and a further 30 countries will begin active participation in 1978. It is expected that the network stations will finally number between 150 and 200.

WHO-WMO cooperation

The WHO and WMO air monitoring programmes cooperate within the framework of the Global Environmental Monitoring System (GEMS) of the United Nations Environment Programme. The role of GEMS is not to assume or duplicate existing monitoring efforts but to coordinate these activities and to stimulate the formation of the necessary linkages of national and regional monitoring networks.

WHO and WMO both seek to foster cooperation on the national level between the agencies concerned in operating air monitoring networks in impact areas and between them and the national meteorological service, and to ensure that information relating to site selection and air quality data interpretation is used correctly and in conjunction with meteorological data.

The two Organizations jointly convened a consultation on the design of air monitoring programmes which resulted in the publication of a guideline document on the subject.²

The two programmes complement each other in various ways. The WHO project makes measurements on the micro or urban scale (10–20 km) while the WMO's measurements are on the macro scale comprising the continental (500–3000 km) and the baseline (over 3000 km) scales. Thus WHO is interested mainly in short-term variations in relatively high pollution levels and WMO is concerned with long-term variations of relatively low levels. However the two programmes have many points in common. Both have attained global coverage with the largest possible number of countries participating, both use uniform reporting formats and com-

puterized data storage facilities, both conduct inter-laboratory comparison studies, and both provide documentation on technical aspects of air pollution monitoring. Both organize various types of training courses and provide fellowships. In the regional training courses, lecturers are exchanged to provide cross-fertilization.

The two projects thus provide an international framework for the harmonization of methodology and the stimulation of air monitoring activities. Both now possess a well-defined structure while remaining flexible and able to adapt to future needs. These needs may relate, for example, to closer coordination of available air pollution data with environmental information obtained from monitoring programmes in other media such as water and food, and possibly also to more detailed studies of the effects of air pollution on environmental components such as lakes, seas and forests. Such evaluations are expected to be made towards the end of the 1970s.

² WORLD HEALTH ORGANIZATION & WORLD METEOROLOGICAL ORGANIZATION, *Air monitoring programme design for urban and industrial areas*. Geneva, 1976 (WHO Offset Publication No. 33).

Periodontal disease

Periodontal disease is one of the most widespread diseases of mankind. Gingivitis affects over 80% of young children and almost the entire adult population have experienced gingivitis, periodontitis, or both. Research and clinical evidence indicate that the damage caused to the supporting structures of the teeth by periodontal disease in early adult life is irreparable, while in middle age it destroys a large part of the natural dentition and deprives many people of all their teeth long before old age. The total effects of periodontal disease on the general health of populations cannot yet be assessed.

People have come to accept this unfortunate state of affairs as inevitable. However, research into the etiology, prevention, and treatment of periodontal diseases has provided a sound basis for control. If public awareness of present-day knowledge were increased, the prevalence of the disease and the severity of its sequelae could be considerably reduced. The generally accepted principle that prevention is better than cure is particularly apt, because periodontal disease is one of the few chronic diseases for which evidence is available on effective methods of prevention.

From: WHO Technical Report Series, No. 621, 1978 (*Epidemiology, etiology, and prevention of periodontal diseases*: report of a WHO Scientific Group), pp. 7-8.