

WMO AND ATOMIC ENERGY

(This article has been supplied at our request by the Secretariat of the World Meteorological Organization)

One of the purposes of the World Meteorological Organization laid down in its Convention is to encourage research and training in meteorology and to assist in co-ordinating the international aspects of such research and training. At first sight, the connection between meteorology and atomic energy for either research or training purposes may appear vague and ill-defined but, in reality, there is a broad common field and each discipline can make a notable contribution to the progress of the other.

The international aspects of most of the technical questions handled by WMO are dealt with by one of its eight technical commissions (composed of experts nominated by Member countries) or by special panels or working groups of experts established by the Executive Committee or by the technical commissions themselves. Nearly all the experts, recruited from various countries, are prominent meteorologists. The success of this system depends entirely on the goodwill and co-operation of the Member countries and the national meteorological services, and one of its significant results is that the services of practically all the world's foremost meteorologists are made available to the Organization in one capacity or another.

WMO Panel on Atomic Energy

The growing interest of WMO in atomic energy was reflected in the decision of the Executive Committee in 1956 to establish a panel of experts to study the meteorological aspects of this new sphere of activity. The initial tasks of the panel were to ensure that the new techniques arising from developments in nuclear physics were wherever possible used to assist the science of meteorology and to provide advice and assistance to both WMO Members and other international organizations in this field.

One of the major achievements of the panel, which has held two meetings since its inception, has been the preparation of a technical note treating fully the various meteorological problems resulting from the applications of the peaceful uses of atomic energy. This technical note is now almost complete and will be available shortly. Other valuable work includes the compilation of periodic bibliographies dealing with the meteorological aspects of atomic energy and the maintenance of close collaboration with other interested international organizations, especially with IAEA.

Over the past four years, steady progress has also been made both in adapting nuclear techniques to meteorological uses and in providing advice and assistance. The five-member panel has now been

reconstituted with more clearly specified responsibilities as a result of the increased understanding of the role of the Organization in guiding this work at the international level which has been gained during these years. The new terms of reference of the panel give a good idea of the scope of its work as well as an indication of some of the developments which may result from their studies. They may be summarized briefly as follows:

- (a) To work out a program on the application of atomic physics in meteorology, including the use of radioactive isotopes for the measurement of various elements, and for the provision of assistance to the Members of WMO;
- (b) To prepare technical notes and lists of references on all meteorological aspects of the peaceful uses of atomic energy;
- (c) To study the work of other international bodies active in this field with a view to making recommendations on WMO's participation in the working out of projects in which there are significant meteorological aspects;
- (d) To study the problems of the standardization of instruments and methods of observation for the collection of radioactivity data together with meteorological data.

It may thus be seen that the WMO panel has a heavy program of work which should produce results of interest not only to meteorologists but also to other scientists whose disciplines affect or are affected by meteorological considerations.

In explanation of these terms of reference it should be mentioned that the interest of WMO in the peaceful uses of atomic energy can be viewed from two separate standpoints. Firstly, what help can the meteorologist give in ensuring the safe and effective utilization of atomic energy and, secondly, how can developments in atomic energy be adapted to serve the cause of meteorological progress?

Help from the Meteorologist

One of the most important problems of the day is to ascertain the movement of both natural and artificially-injected radioactive substances in the atmosphere. In recent years, this problem has largely centered round the need to measure the atmospheric pollution caused by nuclear explosions in order to assess the potential danger to life of all kinds. Since

the movement of radioactive substances in the atmosphere is essentially dependent upon meteorological factors, including the winds at various levels, vertical movements in the atmosphere, rainfall and the stratosphere-tropospheric interchange, the advice of the meteorologist on the physical processes controlling these factors is evidently vital. Much time and thought are now being devoted to the study of large-scale air mass movements, turbulent diffusion and the other meteorological processes on which the transport and gradual fall-out of radioactive debris depend. The safe location of nuclear plants and the disposal of radioactive waste are related problems in which WMO has also taken a very active interest and the importance of effective meteorological advice on these problems can hardly be over-estimated.

Another aspect of the help which WMO as an organization can provide is intimately connected with its structure. This help concerns the collection and analysis of radioactive material in the biosphere. For a variety of purposes, including weather forecasting, the countries of the world maintain in their respective territories extensive networks of meteorological stations making observations at regular intervals. At present, more than 9 000 land stations and ships participate in this work and an intricate system of telecommunications operates day and night to ensure the timely collection and distribution of the resulting vast quantity of data on the weather throughout the world. The sites of the stations, the instruments used, the methods of observation, the transmission times and other arrangements for diffusing the data are controlled by regulations or recommended practices laid down in WMO publications. It is against this background of WMO's normal activities that the possible participation of the Organization in any system for the collection and analysis of radioactive material in the biosphere should be viewed.

It will be clear that WMO has at its disposal a considerable amount of information on the most suitable exposure for instruments which measure or sample atmospheric properties. It is assumed that, as for meteorological parameters, representative samples of atmospheric radioactivity will be required and for that reason WMO is prepared to assist in the arrangements for developing a network of measuring stations. Moreover, WMO and its Members can provide information on the distribution of amounts, types and intensities of precipitation, which is an important factor.

It is also highly probable that on all occasions when the radioactivity of the atmosphere and of rain is being measured, there will be a requirement for the corresponding values of meteorological elements. This consideration emphasizes the advantage to be derived from taking radioactive samples at locations which are near to meteorological observing stations.

New Techniques Assist Meteorology

The second aspect of WMO's role in atomic energy is the application of nuclear techniques to the solution

of meteorological problems. To some extent, the two roles of WMO in this field are complementary. For example, in seeking to provide data on the movement of radioactive substances in the atmosphere much valuable information on hemispherical air movements is also obtained. The problem of the general circulation of the atmosphere is receiving the closest attention at present and it is possible to use radioactive particles as "tracers" of these large-scale displacements of air in the upper atmosphere. The International Geophysical Year meteorological program was primarily directed towards improving our knowledge of the general circulation and it is widely believed that a better understanding of its behavior might result in revolutionary progress in weather forecasting.

Advances in nuclear physics have also opened up great possibilities for the use of radioactive isotopes in making meteorological and hydrometeorological measurements. A good deal of work has already been done in constructing new instruments based on recent techniques and a large measure of success has been achieved. One of the most widely used principles is that of the attenuation of gamma rays when traversing a medium. The application of this principle to the measurement of soil moisture, evaporation, water movement, the water equivalent of snow cover, water levels and deposits at the bottom of water basins has introduced a new standard of accuracy into these traditionally difficult measurements. The use of neutrons for obtaining soil moisture measurements is also becoming more widespread.

WMO has an important part to play in standardizing the instruments and methods deriving from these new techniques and in ensuring their adaptation to meteorological problems in the widest and most beneficial manner.

Collaboration with International Organizations

If WMO is to provide the best possible assistance to other bodies and at the same time secure the maximum benefit for meteorology, the closest collaboration with other international organizations active in this field is obviously essential. In general terms it may be stated that these objectives have been attained through the working arrangements which WMO has with IAEA, FAO, UNESCO, the International Council of Scientific Unions and the International Union of Geodesy and Geophysics.

Mutually beneficial collaboration has also been maintained between WMO and the United Nations Scientific Committee on the Effects of Atomic Radiation. Early in 1960, at the request of this Committee, WMO conducted a discussion on atmospheric transport and the removal of radioactive debris from nuclear tests. A number of well-known experts were invited by WMO to take part in this discussion and the papers presented were recognized to be a unique and authoritative source of information on the meteorological aspects of fall-out. These contributions will be issued as a WMO Technical Note.

Naturally WMO's closest collaboration in the atomic energy field has been with the International Atomic Energy Agency. From its inception in 1957, the Agency has sought the views of WMO on all matters of common interest and, in August 1959, an agreement between the two bodies officially came into force. A spirit of friendly co-operation has, at all times, characterized the joint activities of these organizations.

The agreement between IAEA and WMO provides for representation of one at appropriate meetings of the other body and, in conformity with this provision, the Agency was represented at the last meeting of the WMO panel as well as at meetings of higher WMO bodies. Similarly, WMO has taken part in various IAEA meetings, at the last of which the question of the collection and analysis of radioactive materials in the biosphere was discussed. In November 1959 WMO took part in a scientific conference on the disposal of radioactive wastes held under the joint sponsorship of IAEA and UNESCO. Various possibilities including the use of oceans, glaciers and the soil for the disposal of these wastes were studied and the problems and consequences of each method were fully discussed.

More recently, the co-operation of WMO was sought by IAEA in connection with the initiation of a program to determine the world-wide distribution of hydrogen and oxygen isotopes in water. This project, which concerns the investigation of the distribution of hydrogen and oxygen isotopes in rain, in rivers, in groundwater and in oceans is a very important line of research in two large groups of problems which are intimately connected with the circulation of water in nature. One is the proposed use of continental water sources for technical and agricultural production and the other is the disposal of radioactive wastes on land and in the sea. The combination of the results of isotopic studies of water with the results of meteorological, geological, hydrological and oceanographical research will provide quantitative information on the circulation of water in nature.

The IAEA study will include the collection of water samples, isotopic analysis and the preparation and provision of international standards of tritium water. WMO has been requested to invite meteorological stations to collect and send monthly water samples to certain specialized laboratories for analysis. A proposed list of about 120 stations throughout the world which will be invited to collect samples has been drawn up and full WMO support will be given to the IAEA project.

JOAQUIM DA COSTA RIBEIRO



The death occurred in Rio de Janeiro on 29 July 1960 of Professor Joaquim da Costa Ribeiro, the distinguished Brazilian scientist who was the first Director of IAEA's Division of Exchange and Training. He was 54.

Before joining the Agency, Professor Costa Ribeiro was Head of the Department of Physics, Faculty of Sciences, Federal University, Rio de Janeiro, and had previously held several other senior positions in academic and administrative spheres. He had been President of the Atomic Energy Commission of the Brazilian Research Council and a member of the United Nations Advisory Committee for Peaceful Uses of Atomic Energy.

Professor Costa Ribeiro directed IAEA's Division of Exchange and Training from 15 February 1958 to 15 November 1959 - a period during which the Agency planned, initiated and established its operational programs, and it was largely due to his untiring effort and able handling that the training and fellowship program rapidly developed into one of the most important and fruitful of the Agency's activities.