within one to two per cent. In special cases it can be better - according to the radionuclide concerned. The IAEA can guarantee its values, so that if the receiving laboratory obtains a result which is more than one to two per cent in error, its methods are in need of improvement.

The purposes of the receiving laboratories in using these samples vary. A physics laboratory, for example, may be interested in methods of absolute measurement, and will use its sample accordingly. A medical laboratory, on the other hand, will be interested primarily in the response of its counting equipment to a sample of known radioactive strength; such a laboratory will use the sample as a means of calibrating its instruments.

The Agency is in a unique position to carry out work in this field of measurement and calibration on an international basis. Its plans include provision for making absolute measurements of radioactive samples at the request of Member States, development of improved apparatus for calibrating electron-capture nuclides, and development of other new research methods and techniques.

A study of calibration of slow and fast neutron fluxes in reactors is planned, with a view to providing standard foils for neutron dosimetry; these foils are threshold detectors, each of them being activated by a given minimum neutron flux.

In order to assist calibration of chemical dosimeters and cavity ionization chambers, IAEA may also undertake absolute measurement of gamma doses from cobalt-60.

Future plans envisage a number of useful possible activities, but the programme is being kept flexible and will be adapted to the requirements of Member States, with the emphasis always on nuclides of immediate practical significance.

MEMBERS AND ASSOCIATES OF THE AGENCY

Nearly eight years have elapsed since the IAEA draft Statute was submitted to the conference of 81 nations which was convened at the United Nations headquarters in 1956. Since then the membership has grown steadily, and the Agency has also established affiliations with a large number and variety of other organizations - a reflection of the numerous fields in which atomic energy has become significant.

At the conclusion of the conference in October 1956, representatives of 70 States signed the Statute, and 10 more did so within 90 days. These accessions had to be ratified and, by the end of 1957, 59 States had done so and become Members. Others followed from year to year, Iraq becoming the 70th Member State in March 1959 and Uruguay the 80th in January 1963; several more have still to do so. Thanks to the emergence of new independent States, new applications continue; the seventh General Conference in 1963 approved those of Algeria, Cameroun, Gabon, the Ivory Coast and Nigeria. Subject to the completion of formalities (already finalized by Algeria, the Ivory Coast and Gabon), this brings the membership to 88.

The Agency quickly established links with other members of the United Nations family. The first was with the United Nations itself under whose aegis the Agency was established. Because of the particular significance of atomic energy and the possibility of diverting it to non-peaceful uses, the IAEA - unlike the specialized agencies of the United Nations - is directly linked by its Statute to the General Assembly of the United Nations, and may also report to the Security Council as the organ bearing the main responsibility for the maintenance of international peace and security. In other respects IAEA resembles the specialized agencies, and like them reports to the Economic and Social Council of the United Nations each year on its work of interest to that body.

Shortly after the Agency was set up it concluded a series of agreements to spell out its co-operation with various specialized agencies: namely the International Labour Organisation, Food and Agriculture Organization, United Nations Educational, Scientific and Cultural Organization, World Health Organization, International Civil Aviation Organization, World Meteorological Organization and the Inter-Governmental Maritime Consultative Organization. Agreements were also made with certain regional intergovernmental bodies dealing with the peaceful uses of atomic energy: namely the European Nuclear Energy Agency (of the Organisation for Economic Co-operation and Development) and the Inter-American Nuclear Energy Commission (of the Organization of American States). The Agency is

also negotiating an agreement with the Commission for Technical Co-operation in Africa.

In addition the Agency has granted consultative status to nineteen non-governmental organizations, and is considering applications from a number of others. The nineteen are as follows:

European Atomic Forum
European Confederation of Agriculture
International Air Transport Association
International Cargo Handling Co-ordination Association
International Chamber of Commerce
International Commission on Radiological Protection
International Committee on Radiological Units and Measurements
International Confederation of Free Trade Unions
International Co-operative Alliance
International Council of Scientific Unions
International Federation of Christian Trade Unions
International Federation of Documentation
International Federation of Industrial Producers of Electricity for Own Consumption
International Organization for Standardization
International Union of Inland Navigation
International Union of Producers and Distributors of Electrical Energy
Japan Industrial Forum
World Federation of United Nations Associations
World Power Conference

NEUTRON EFFECTS ON LIVING THINGS

Scientific interest in neutrons and protons - two fundamental particles of the atomic nucleus - has grown in recent years as the technology of peaceful uses of atomic energy has progressed. Such interest also has increased because both protons and neutrons are encountered in outer space. However, only recently has a thorough study of the biological effects of neutrons and protons become possible, as a result of progress in making physical measurements of the radiation dose absorbed in biological systems (of plants and animals, for example). Reports of work in that field were presented in December 1962, when IAEA sponsored at Harwell Laboratory in the United Kingdom the first international symposium on detection dosimetry (measurement) and standardization of neutron radiation sources.

The Harwell meeting was followed in October 1963 at Brookhaven National Laboratory, Long Island, New York, by the first scientific meeting sponsored by IAEA in the U.S. Entitled "Biological Effects of Neutron Irradiations", the Symposium continued the review of problems of measuring radiation absorption in living things and provided in addition for several reports dealing with the effects of radiation on living organisms - plant, animal and human - and with delayed consequences of exposure to radiation, such as: change in life span; tumour incidence; and fertility. Eighteen countries were represented.

Although much has been learned about X-ray and gamma-ray effects, comparatively little is known about the biological effects of neutrons, and therefore many of the Symposium papers reviewed the various aspects of neutron experimentation. Similarly, since there is increasing interest in the biological effects of protons, papers were given on that related subject.

Measurement Problems

The principal topic discussed at the Symposium was methodology for comparing absorption in tissue of different types of radiation. There seemed to be general agreement among the participants that the approach most commonly used in recent years, namely Relative Biological Effectiveness (RBE), can hardly be considered adequate by itself as a method. The term RBE has been defined as the ratio of a "standard" dose of X-radiation to the dose of test radiation required to produce an equivalent biological effect. The standard dose is the amount of energy absorbed by a given volume of plant or animal cells from the incoming X-rays. The test dose is the amount of energy absorbed from incoming neutrons. For example, if a test dose of one rad* of neutrons produces the same biological effect on the cells in question as a standard dose of three rads of X-rays, the RBE of the neutrons is three.

* *rad: unit of the amount of energy absorbed by material exposed to radiation.*