nuclear energy and the environment

The world has awakened to the urgent need to protect the environment, to conserve resources of land, air and water as nearly as possible in their natural states for the benefit of mankind. Nuclear energy, as an alternative source of electric power, and nuclear techniques in the sciences can contribute to the attainment of these goals.

Speaking a few weeks ago at the General Assembly of the United Nations Dr. Sigvard Eklund, Director General of the IAEA, recalled that the Fourth International Conference on the Peaceful Uses of Atomic Energy, held in Geneva this year, had discussed *inter alia* various environmental implications of the growth in the use of nuclear power worldwide. "All of us who wish to see man's heritage preserved for the benefit of future generations must welcome the growing concern about preservation of the environment," he said. "It is disquieting, however, that amongst some of us, and particularly amongst some of the young people, this concern has taken an anti-scientific and anti-technological turn.

"It is obvious that what we need to overcome the ills of industrial society, aggravated by a rapidly-exploding world population, is an even greater application of the scientific mind and the scientific method — of the professionally specialized and rational application of the human intellect. That some re-direction of scientific effort is needed towards conservation rather than unstinted growth I do not doubt."

Commentators on the Geneva Conference have noted that concern over environmental problems associated with the use of nuclear energy was a recurrent theme of discussions inside and outside the meeting rooms. In their opening speeches Dr. Glenn T. Seaborg, immediate past-Chairman of the United States Atomic Energy Commission, termed it "ironic" and Dr. Eklund "a paradox" that nuclear energy should be under attack from those who urged protection of the environment when it did offer the promise of higher living standards combined with the potential to lessen environmental pollution.

"No nation," said Dr. Eklund in New York, "is prepared to forego the benefits that cheap and plentiful electrical power bring to the well-being of its citizens and the progress of its economy. The question we must answer is 'what is the best way of meeting this rapidly-growing demand with a minimum of impact on the environment?'

"The Fourth Geneva Conference returned a clear answer which was perhaps best summed-up in the concluding message from the representative of the Secretary-General, U Thant," said Dr. Eklund. "In pointing out that the Fourth Geneva Conference was, in a sense, a preparatory meeting for the Stockholm Conference on the Human Environment in June 1972, he said that the Geneva Conference had 'emphasized the contribution which nuclear power can make to providing man with clean energy, with a minimum disturbance to the environment'."

For years past the IAEA has taken an active role in promoting research into ways of measuring the impact on the environment of the introduction of nuclear energy and nuclear techniques; and in attempting to ensure that safe conditions are established and maintained for workers in the nuclear industries and for the public at large. The enviable safety record of the nuclear industry has often been cited, and it has been claimed that the methods adopted for the study of environmental contamination by radioactive substances could well serve as an example to other industries.

Encouragement to research

The IAEA is authorized under its Statute "to encourage and assist research on, and the development and practical application of, atomic energy for peaceful uses throughout the world." The Agency's programme and budget for 1972 accordingly provides for the placing of research contracts with universities, colleges, agricultural, medical and industrial laboratories and research centres, and other institutions in Member States, on questions of direct interest to the Agency's work.

Each year Member States are informed by circular letter of the subjects in which research contracts may be placed during the coming twelve-month. The broad subject groups of research in which the Agency is particularly interested are reviewed by the IAEA Scientific Advisory Committee; allocation of funds to each subject group is made by the IAEA Board of Governors. Financial support by the Agency for any particular project is provided normally by a lump-sum cost-sharing contract; the contractor is usually expected to bear part of the cost of the project and, in any case, to continue to make normal contributions in the form of overhead and other expenses. The amounts awarded by the Agency are rarely large — at present, the average is somewhat less than $4000 a year per contract. Contracts are normally awarded for a period of one year, renewable up to a total project period of three years, although in very exceptional cases it is sometimes possible to extend the total project period.

Full details of the programme may be had on enquiry from the Research Contract Section, Department of Research and Isotopes, at IAEA headquarters in Vienna. The formal submission of research project proposals should preferably be within the first half of the year.

There are three main subject areas in which it has been decided research contracts may be awarded by the Agency during 1972: nuclear

technology, including studies relating to nuclear power and reactors and waste management, physics and chemistry; radioisotope and radiation applications, in agriculture, food technology, industry, medicine, and hydrology; and the protection of man and his environment. Specifically, under the sub-heading of studies in waste management research contracts may be awarded during the coming year for work in the determination of basic chemical, physical and biological information to assist in establishing the behaviour of and the limits for radioactive waste discharged to the sea and to inland freshwater lakes ; analyses of geologic and oceanographic data of the sea with reference to the behaviour of radioactive waste discharged to the sea and to inland freshwater lakes; studies to determine the migration and dispersion of radionuclides from the storage of radioactive waste under various conditions in the terrestrial environment, and so on. Under the second main subject heading, radioisotopes and radiation applications, research contracts may be awarded for the study of the use of nuclear techniques in environmental control, and in other areas.

The third main subject heading is of most interest here. Under the sub-heading "radiation biology," contracts may be awarded for research directed toward the protection of man and his environment from the biological effects of ionizing radiation, or to promote its beneficial applications, with emphasis on:

* factors determining radiation sensitivity of biological systems to provide the basis for improvement of radiation protection, as well as the diagnosis and therapy of radiation injury;
* studies of the effects of ionizing radiation alone and with other environmental factors on living systems;
* production and selection of beneficial mutant micro-organisms by use of nuclear techniques;
* use of radiation for sterilization of biomedical products and biological tissues as well as for the preparation of vaccines;
* and studies directed toward the enhancement of the effectiveness of radiation therapy.

Studies may also be made in dosimetry, and in health physics and radiation protection (including studies in the assessment of airborne contamination, and methods of monitoring environmental radioactive contamination with emphasis on rapid methods of analysis applicable to biological and other environmental samples). The last main section of this listing deals with environmental research, in which contracts may be awarded for studies in:

* the uptake of radioactive substances through the food chain;
* the physical and chemical behaviour in the atmosphere, surface waters and ground of those radionuclides which are important in relation to radioactive waste disposal, as well as the biological movement of these radionuclides through the food chain;
* the sampling of the sea for the distribution of radionuclides ;
* effects of long-term exposure of biota to low levels of radioactive waste ;
* the evaluation of integral waste management programmes in regard to their total effect on man and his environment;
* and the physical and ecological effects of thermal discharges from power reactors to the aquatic environment.

This listing illustrates strikingly the very wide range of nuclear activities which relate directly or indirectly to the preservation of the environment. Even so, it is incomplete. In some subject areas — such as the studies relating to the distribution of radionuclides in the sea — the IAEA itself has an active research programme, undertaken by research workers at the laboratory operated jointly by the Agency, the Government of the Principality of Monaco and the Oceanographic Institute there.

Looking forward to Stockholm

The Agency expects to take an active part in the United Nations Conference on the Human Environment, to be held in Stockholm in June 1972, and has submitted papers to be presented there. In co-operation with the World Health Organization, the IAEA plans to publish early in 1972 a booklet on the environmental aspects of nuclear power programmes, for distribution to a non-specialist audience — including, for example, utility engineers and economists —, summarizing material presented at the 1970 New York Symposium on Environmental Aspects of Nuclear Power Stations. This booklet will, it is hoped, place problems in the use of nuclear energy in their correct perspective, comparing radiation exposures from nuclear energy programmes with other natural and man-made radiation exposures. It will give authoritative information of a sort which could be used to refute unfounded criticisms of the use of nuclear techniques and of nuclear power programmes of the sort which have become common during the last few years.

In addition, it is hoped that the end-April issue of the Bulletin (Vol.14 No.2) will include a series of articles on nuclear energy and the environment, including a keynote article asking "Why the controversy?" Like the booklet described in the preceding paragraph, it is intended that this issue of the Bulletin should be freely available and that copies should, in particular, be available for distribution at the Stockholm conference.

(1) A research worker of the Isotope Division of the Australian Atomic Energy Commission transfers remotely a phial containing radioactive gold-198 to a shielded tank where it is mixed with sand, during a silt tracing test carried out in Botany Bay, New South Wales. Photo: AAEC

(2) A plunger used to break the small phial containing the gold is removed from the tank. The sand in the tank is later released. Photo: AAEC