

of detailed regulations which might hamper future development. Much attention had been devoted to the problems peculiar to different types of marine reactors. It seemed clear that optimum shielding designs had not yet been found. It had also been agreed that a nuclear ship must be able to manoeuvre at least as well as a conventional ship and a reactor type which could ensure safe manoeuvrability with a minimum of auxiliary equipment was particularly desirable. Enough was not yet known about the forces acting upon a ship in bad weather, and hence about the effects of sea movements on marine reactors.

Mr. Whiteside said that the conclusions of the symposium might be summarized as follows:

Nuclear ships could be built with a sufficiently high standard of safety to make the risks involved acceptable;

It was unlikely that any nuclear merchant ship built within the next few years would be economically competitive with its conventional counterparts;

Nuclear merchant ships should nevertheless be built with a view to gaining the experience which would make it possible to build better ones;

Much of the experience required could only be obtained under sea-going conditions;

Any rules and regulations laid down at the present stage of development must be flexible and must not be such as to hinder further development;

Much had still to be done, particularly in regard to waste disposal, shielding, exposure levels, internationally acceptable construction standards and the effects of sea motion upon nuclear ships.

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## ATOMIC ASSISTANCE IN 1961

More than 100 experts provided by the International Atomic Energy Agency will be working in different parts of the world this year, assisting the Agency's Member States in building up their national programs of peaceful atomic development. Some of the experts are already in the field. A number of these countries will also receive from the Agency a wide variety of nuclear equipment.

This program of technical assistance is financed from two sources - the Agency's General Fund which is made up of voluntary contributions from its Member States and funds made available to the Agency under the United Nations Expanded Program of Technical Assistance (EPTA). For the part of the program to be financed out of the Agency's own funds, the Agency's Board of Governors has authorized a total expenditure of \$513 100, subject to the availability of funds, i. e. adequate voluntary contributions to the General Fund.

The total allocation of EPTA funds to the Agency for the two-year period 1961-62 is \$1 393 600 (of which approximately half is available in 1961), and is meant not only for the provision of experts and equipment but also for training fellowships and regional projects.

The countries which will receive Agency assistance in the form of experts and equipment this year are: Afghanistan, Argentina, Austria, Brazil, Burma, Ceylon, Chile, the Republic of China, Denmark, Greece, Guatemala, Iceland, Indonesia, Iran, Iraq, Israel, Japan, the Republic of Korea, the Republic of Mali, Mexico, Morocco, Pakistan, the Philippines, Senegal, the Sudan, Thailand, Tunisia, Turkey, the United Arab Republic, Vietnam and Yugoslavia.

The assistance is being given in response to specific requests from the Member States, and the fields in which it is needed vary from one country to another. Most branches of nuclear science and technology are covered by the program, but some of the requirements appear fairly common. The largest need seems to be for expert advice in the applications of radioisotopes in agriculture and medicine, which is understandable in the light of the basic and most urgent needs of underdeveloped economies. There is also a widespread demand for specialists in radiobiology; studies in this field are useful not only because of their relevance to agricultural and medical research but also because they are essential in devising adequate methods for radiation protection. A number of experts will be needed to formulate health physics regulations, to train personnel in radiation monitoring and dosimetry or to establish radiation protection services.

Several Member States are interested in the exploitation of indigenous reserves of nuclear raw materials and have asked for experts to assist them in prospecting or in the more advanced stages of actual production. The importance of radiochemistry is also recognized and several specialists in that field will be needed this year. Other subjects in which expert advice or practical assistance is needed include electronics, nuclear engineering, metallurgy, reactor design, and nuclear and other branches of physics.

Some details of the individual projects of technical assistance are given in the following country-wise analysis.

## **Afghanistan, Argentina, Austria, Brazil**

Afghanistan will receive \$15 000 worth of equipment to support the work of an Agency expert who will be sent to help in establishing a nuclear physics laboratory in the University of Kabul.

Argentina will be provided with the services of nine experts, two of whom are already in the field, and equipment valued at \$41 500. Two of the experts will be concerned with a program for the exploitation of the country's reserves of nuclear raw materials. Production of uranium metal has already begun in Argentina and it is now intended to develop it on an industrial scale. There will be one specialist in the medical applications of radioisotopes, and another to assist the local authorities in applying isotope techniques to studies on the nutrition and breeding of farm animals.

Austria will have the services of a biochemist.

Brazil will have nine experts from the Agency, two of whom will be continuing their work begun earlier. Two of the experts to be sent this year will work at the radioisotope laboratory of the National Cancer Hospital at Rio de Janeiro. Equipment to the value of about \$35 000 will also be provided, some of which is meant for a program of research on soil-plant relations at the School of Agriculture of the University of São Paulo.

## **Burma, Ceylon, Chile, China, Denmark**

There will be three Agency experts in Burma, for isotope applications in agriculture, prospecting for nuclear materials, and uranium mineralogy. Some equipment for isotope applications will also be sent.

A survey of thorium and uranium bearing minerals, which is already under way in Ceylon, is now to be extended to the whole of the country except the north-west coastal belt where the chances of their occurrence are small. The Agency will provide two experts for this project, a geologist and an electronics technician. A radiochemist will also be working in Ceylon, and a radiation physicist is expected to start his work there soon.

Chile will have an expert in nuclear energy administration.

The services of three experts have been allocated to the Republic of China, one in nuclear instrumentation, one in radiation protection and the third in reactor physics. The provision of some equipment has been approved for a radiation protection service.

An expert in non-ferrous metallurgy has been serving in Denmark.

## **Greece, Guatemala, Iceland, Indonesia, Iran**

An Agency expert will help in a research program in neutron physics to be conducted in the physics laboratory of the Greek Nuclear Research Center. Greece will also receive the services of an expert in the medical applications of radioisotopes - a field in which much progress has already been made at the Alexandra

Hospital in Athens. An Agency expert has helped in this program and acted as adviser to two other hospitals where plans have been made for starting work with isotopes. The expert whose services will be available this year will help in setting up routine diagnostic and therapeutic services at these two hospitals, apart from training personnel and advising other centers of work. Altogether, provision exists for seven Agency experts for Greece this year, the other five working in the fields of radiobiology, health physics, reactor utilization, and radiochemistry.

An expert in medical physics will be assigned to Guatemala.

An Agency expert will help in establishing a program of medical applications of isotopes in the hospital of the University of Iceland. The country will also receive the services of a hydrologist. A variety of counting, monitoring, handling and shielding equipment, at an estimated cost of \$10 600, will be provided.

Two experts, already assigned to Indonesia, are continuing their work in health physics and nuclear geology.

Five Agency experts will be working in Iran, three of whom have already been assigned. One of the two new experts will be a health physicist and the other an electronics engineer.

## **Iraq, Israel, Japan, Korea**

A health physicist and an entomologist will be sent to Iraq. Another expert will help in the agricultural uses of radioisotopes. A specialist in the applications of isotopes in medicine was assigned to Iraq earlier.

An expert in the design of nuclear reactors will be sent to Israel in connection with the Israeli Government's plans to use nuclear energy as a source of power. There will be two other Agency experts in that country, one a nuclear chemist and the other a specialist in the operation of a "hot" laboratory. Israel will also get equipment for a mobile radiation monitoring station.

The services of a reactor physicist will be made available to Japan.

Four experts will be working in Korea, in the fields of geology, health physics, nuclear instrumentation and reactor control, and agricultural applications of isotopes. Two of them have already been assigned. Some equipment will be supplied for a radiation protection service.

## **Mali, Mexico, Morocco, Pakistan**

A specialist in the medical uses of isotopes will be sent to the Republic of Mali.

Mexico will receive the services of seven experts. Three of them will help in prospecting for radioactive minerals, in the development of ore deposits, and in the production of uranium metal. A plant for the processing of uranium ores to extract concentrates is

being planned and a further plant for the production of uranium metal on a semi-industrial scale is under consideration. One of the experts will advise on the design and construction of nuclear electronic equipment, while another will advise on problems of radiation dosimetry.

Morocco will be provided with the services of an expert in the agricultural applications of isotopes as well as some necessary equipment. Isotopes are to be used in measuring the distribution of soil water and the Agency expert will calibrate the equipment needed for this work and assist in drawing up a research program. Morocco will also get a planning consultant.

Four experts will be sent to Pakistan, in addition to one who is already there. In eastern Pakistan, an Agency specialist in the agricultural uses of isotopes will initiate investigations into such problems as plant nutrition, plant genetics and pest control. Equipment, worth \$12 000, will also be provided for this work.

### **Philippines, Senegal, Sudan, Thailand**

A variety of equipment, at a total cost of \$31 900, will be sent to the Philippines for radiation protection services, for the use of isotopes in medical research and for applying isotope techniques to agriculture and biology. In addition to one who has already taken up his assignment, six experts will be provided in the fields of health physics, use of radioisotopes in medicine, industrial and agricultural applications of isotopes, and irradiation techniques.

Senegal will be provided with some equipment and the services of three experts, one a planning consultant and the other two specialists in the medical and agricultural application of isotopes.

Copper ore deposits in the Sudan have been found to contain uranium and the Sudan Government has been trying to determine the content and the distribution of uranium in the ore body. The Agency will send a spe-

cialist in the analysis of nuclear raw materials to install the necessary analytical and testing equipment, which will be supplied by the Agency, and to train laboratory staff in its use. A specialist in radiation monitoring together with some equipment will also be sent.

Thailand will receive \$15 000 worth of equipment and the services of two new experts; five experts were assigned last year. The fields in which assistance is being given include health physics, isotope applications and prospecting for raw materials.

### **Tunisia, Turkey, U.A.R., Vietnam, Yugoslavia**

Tunisia will have three experts, two in the medical and a third in the industrial applications of radioisotopes. A specialist in agricultural applications was assigned earlier.

Six experts, apart from two already assigned, will be in Turkey which will also receive equipment to the value of nearly \$31 950. Some of the equipment will be for a radiochemistry laboratory at Istanbul University and some for a nuclear physics laboratory at Ankara University.

Three specialists in isotope applications, and one each in nuclear raw materials, radiation monitoring and health physics, will be serving in the United Arab Republic.

An expert in the agricultural applications of radioisotopes will advise the authorities in Vietnam on applying isotope techniques to the utilization of rubber trees.

Five Agency experts will be working in Yugoslavia. One of them will advise on the agricultural applications of radioisotopes and another on the toxicology of radioactive materials. Three others, who are already in the field, are concerned with problems of radioteletherapy, biochemistry and medical uses of isotopes.