WATER WISDOM

Ways of making the wisest use of fresh water resources, of adding to them by desalination and of preventing their pollution have been widely discussed in recent months at international meetings. At the "Water for Peace" conference in USA details were given of the Agency's efforts. Before this the second European Symposium on Fresh Water from the Sea had been held in Athens and more recently a symposium organized by the Agency and the Food and Agriculture Organization investigated the needs of agriculture.

At the American conference altogether five papers were submitted from the IAEA explaining how nuclear techniques are being used to help solve water problems. In addition the Director General, Dr. Sigvard Eklund, took part in special sessions.

In an expert session on Water-Supply Technology chaired by Prof. Ivan Zheludev, Deputy Director General for Technical Operations, he said that additional ways of providing more water for arid areas must be developed. "Desalting", he continued, "is one method of providing more water and transportation of natural water over long distances is another; both require large quantities of energy which can be supplied by nuclear power."

In a survey paper prepared for publication in the proceedings of the Conference, Professor Zheludev discussed the varied, and perhaps to some people surprising, ways of using nuclear methods to help with both immediate and long-term questions. He pointed out that demands for fresh water will continue to expand rapidly as a result of increasing populations, improved living standards, progressive industrialization and intensive irrigation.

The work of the IAEA came under three general headings. The first was the application of isotope techniques in hydrology, the second was the use of nuclear power for water desalination and the transport of water, and the third was the effort devoted to ensuring that atomic energy did not pollute or reduce natural water resources.

Isotopes from the atmosphere, some created by thermonuclear tests, could yield important information about the history and movement of water. Artificial isotopes could be used to establish water movement and nuclear instruments

In research to find whether the old practice of allowing land to lie fallow each year is effective in conserving water measurements are being taken in Turkey using radioactive sources linked with instruments.

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could measure sediments, snow content, soil moisture and underground deposits. IAEA's current programme included grants for work in hydrology to Brazil, Ecuador, India, Iran, Israel, Nigeria and Romania. There were also 19 research contracts under way in 14 countries. Other services were organization of symposia, panel meetings and working groups, together with publication of results and data; fellowships and training courses, including one just completed in Turkey; and technical advice plus analytical services for field investigations. During the past year the Agency had collaborated closely with the Food and Agriculture Organization in Jamaica, Jordan, Nigeria and Spain and had performed analytical work in connection with national investigations in Austria, Czechoslovakia, Greece, Kuwait, Mexico, Saudi Arabia, Spain and Thailand.

Professor Zheludev described the promising role that desalting of saline water could play in helping to meet a part of future municipal, industrial and, later, irrigation requirements. It might also call for transfer of water sometimes over great distances and to varying heights. Development of nuclear technology for the purpose would require a great deal of international co-operation. The

Agency had set itself to serve as the international focal point; to provide assistance and advice to its Member States; to provide co-ordination services for those States; and to stimulate practical work. It was expected that the demand for assistance would increase, and a survey had indicated that for several years the Agency would be asked to provide five to ten fellowships a year.

Although pollution of surface or ground water by radioactivity represented only a very small facet of pollution problems, it attracted much public attention and sometimes had to meet disproportionately exacting standards of control. Professor Zheludev thought that the nuclear industry could well be taken as a model in safety and pollution control. The Agency had a responsibility in promoting international safety. For this reason it carried out and supported research, disseminated information, published reference manuals and provided advice on environmental aspects of radioactive release into the ground, air or surface waters. It also provided an ad hoc technical advisory service, in collaboration with other organizations to give free practical advice to Member States.

WAYS TO HELP THE FARMER

Efficient use of available water resources could increase food crops by as much as fifty per cent in some parts of the world, according to a recent FAO report. Ways of finding out how to achieve better use, as well as the possibilities of increasing supplies through desalination, were discussed at the joint IAEA/FAO symposium in Istanbul, the title of which was "The Use of Isotope and Radiation Techniques in Soil Physics and Irrigation Studies". In spite of the fact that events in the Middle East prevented some scientists from attending, the total of 84 from 20 countries was higher than originally expected.

In an opening speech, Ibrahim Deriner, Secretary General of the Turkish Atomic Energy Commission, pointed out that nearly a third of Turkey's arable land, amounting to about 20 million acres, was left fallow every year. If it could be kept in regular annual production there could be an increased production of about two million tons of grain. The use of isotopes for research in land irrigation problems would be of great help to countries suffering, like Turkey, from a dearth and irregularity of rainfall.

Maurice Fried, Director of the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture, emphasised that the close co-operation of FAO and the Agency in this work was unique among the United Nations organizations. A single joint programme on the use of isotopes and radiation in agriculture and food was being carried out, particularly on projects of importance to developing countries. Current emphasis lay in finding methods for the most efficient use of fertilisers, achieving more efficient use of water in arid areas, utilising the unique possibility of measuring soil moisture with the use of neutrons, and encouraging other research work in which isotopic measurements played a leading role. Referring to the unprecedented urgency of finding more food to meet the population explosion, he said that fortunately rapid advances were being made through the application of modern science and

technology. Amongst the important contributions of nuclear science to the welfare of mankind were the valuable tools provided by radioisotopes and ionizing radiation for research on basic biological processes and the technical factors involved in agricultural production.

In considering the use of desalted water for agricultural purposes, one great question, which will take a considerable time to resolve, is how to make it economic for farmers. This, and the contribution which may be made by advances in nuclear power, formed the subject of a special discussion, which was initiated by reviews from scientists of IAEA and FAO.

Dr. D.B. Brice (IAEA) made a survey of ways in which fresh water could be obtained from the sea or brackish water, of developments in nuclear reactors and of the factors involved in adapting nuclear power for desalting purposes. There were advantages in considering plants which could generate electric power as well as producing fresh water. Power reactors of the present type could be used for the double purpose, the water being supplied for municipal and industrial purposes as well as possibly for very special agricultural production involving fruit and vegetables of high value. For general agricultural purposes very low costs would have to be the aim and very large units with very low fuel charges could provide the answer. They would have to be accompanied by improvements in distillation and agricultural technology. There was promise in the development of advanced converter and breeder reactors, in which more nuclear fuel could be produced than was consumed and on which future economic nuclear power production was likely to depend. Studies had been carried out, with a view to a possible dual-purpose nuclear pilot plant, at Borg El-Arab (United Arab Republic). There had also been a study in USA on the feasibility of using breeder reactors for the single purpose of desalting water.

As far as cost was concerned, Dr. Brice recalled that ten years ago this stood in USA at a minimum of $1.00 per cubic metre. For some of the larger plants (4000 to 6000 cubic metres a day) built within the last few years it had become about $0.25 per cubic metre. For very large plants with capacities of the order of 400000 cubic metres a day operated in conjunction with power generation, estimates were as low as $0.06 per cubic metre. Larger plants, such as one being considered in a joint IAEA/Mexico/US study, might with improved technology produce water costing less than $0.03 per cubic metre.

It had been estimated that if nuclear desalters were used to produce irrigation water for one tenth of the world's need for new food supplies in the next ten years, the growth rate would exceed that for electrical power reactors. Unfortunately there were still many problems to be solved. The hard facts were that the price foreseen by the late 1980's for a plant with a daily output of 3.8 million cubic metres, or a billion gallons a day, could be 2.6 to 3.9 cents per cubic metre.

Professor M.A. Hagood (FAO) said that water not fully utilized at present was becoming limited and in most cases would be expensive to develop and deliver. This condition was creating competition for its future use and for water

which had traditionally been used for agriculture. Justification for the cost of irrigation water would depend on a country's need for developing its soil and water resources for food, for international trade, and for the effect on other industries assessed against all factors. Agricultural practices changed when water prices became high. The indication from many studies was that $0.10 per thousand gallons ($0.026 per cubic metre) was an upper limit of acceptable costs for developing irrigation water at present economic levels.

His conclusion was that for most places in the foreseeable future it would be better to make fuller utilization of presently available water at costs much less than to convert salt water.

From the statements by Brice and Hagood it became clear that the main subject of the symposium was of much greater immediate importance than desalination, i.e. the use of isotope and radiation techniques in soil physics and irrigation studies. A number of reports dealt with equipment for the purpose, followed by much discussion of soil moisture studies. Some of them dealt with ways of drawing up a water budget to assess the quantities of water which reach and leave, in one way or another, areas where plants are affected. The possibilities of studying water content and movement either on the spot or in laboratories received appreciable attention. Capacity of soil to retain water was another subject, bringing with it the question of whether leaving parts of land lying fallow, in order to increase the amount of water conserved, was in fact more economical than continuous use. Prevention of losses through evaporation and the relation between soil, water and plants were also discussed.

INDONESIA ACCEPTS SAFEGUARDS

Indonesia became, on 19 June this year, the 27th country to accept Agency safeguards control of nuclear activities. An agreement, also signed by USA and the Agency, transferred the application of controls designed to prevent diversion to military purposes of material and equipment involved in collaborative work between the two countries.

Taking part in the signing ceremony shown in this photograph are (left to right) Miss Laili Roesad, Indonesian Ambassador to Austria and Resident Representative to the Agency; Dr. Sigvard Eklund, Director General; and Ambassador Henry D. Smyth, United States Representative to the Agency.