JAPAN AND ATOMIC CO-OPERATION

Japan, which is host country for the Ninth Regular Session of the Agency General Conference, has an important programme of nuclear power development to meet future needs. In addition, Japan is active in other applications of atomic energy and is building up a domestic nuclear engineering industry. Japan has profited by the Agency as a channel of international cooperation, and was a party to the first bilateral agreement in which the responsibility for administering safeguards against the diversion of materials to military purposes, was transferred to the Agency. Japan has also lent support to Agency programmes by gifts, training courses, research, and the loan of experts.

In 1961, the Japan Atomic Energy Commission (AEC) formulated the "Long-Range Programme for Development and Utilization of Atomic Energy", on the basis of the economic prospects of nuclear power generation, and the conditions necessary to meet the ever-increasing domestic energy demands. According to this programme, in the light of power reactor development trends overseas, it is expected that nuclear power costs will compete with those of oilburning stations by 1970. On this basis, total nuclear power generating capacity of 1000 MW(e) will be attained by 1970, and 7000 - 9 500 MW(e) by 1980.

As a prelude to the above programme the Japan Atomic Power Company (JAPCO) began construction in 1959 of a graphite-moderated gas-cooled nuclear power station (Improved Calder Hall type) of 165 MW(e) gross capacity. This is now progressing smoothly, and reached criticality in May 1965; it is expected to supply commercial power by the end of this year.

The second nuclear power station will be built by the same company on the coast of the Japan Sea, with a light water-moderated reactor of 250 - 300 MW(e) capacity. The construction plan is currently being pushed forward for completion in 1970. Thereafter three private utility comapnies - Tokyo, Kansai and Chubu Electric Companies - are doing preparatory work for the construction of three nuclear power stations each of about 300 MW(e), for completion about 1970. If these plans are carried out to schedule, the goal of 1000 MW(e) of nuclear capacity, set in the Long-Range Programme, will be exceeded.

However, the unit power costs of JAPCO's first commercial reactor are likely to be higher than was originally estimated, and unit power costs of the succeeding nuclear stations will not immediately become competitive with those of oil-fired power stations.

With the intention of promoting nuclear power generation during the research and development stage, the AEC made specific investigations of such problems as construction of a fuel reprocessing plant and the repurchase of plutonium contained in spent fuel. Five nuclear power stations will be in operation by 1970 and the annual discharge of spent fuel - of enriched and natural uranium - is estimated at 100 tons in 1970, and 200 tons in 1975. To rrovide for domestic reprocessing of spent fuel as a part of

nuclear development policy, the AEC has investigated the construction of a plant with a capacity of 0.7 tons per day, for completion in 1970. The Atomic Fuel Corporation (AFC) placed orders with a British company in the financial year 1963 for the preliminary design of the plant, and the AFC will shortly set to work on detailed designs. The construction cost is estimated at about 10000 million yen. In the meantime, fundamental research and development work on reprocessing has been carried out jointly by the Japan Atomic Energy Research Institute (JAERI) and the AFC.

Another important application is nuclear ship propulsion. Research on this subject has been conducted since 1957 by the Ship Research Institute of the Ministry of Transport, the Nuclear Ship Research Association, and the private industries concerned. After long discussion about the construction of a nuclear ship, the AEC decided in 1962 to build an oceanographic survey and crew training ship of about 6000 tons gross. The Japan Nuclear Ship Development Agency (JNSDA) was established in August 1963 as the executive organization, financed jointly by Government and industry. In conformity with the AEC "Nuclear Ship Development Programme" which had been worked out previously, the JNSDA is required to complete the preliminary design in the financial year 1963, place construction orders in 1964, complete construction in 1968 and sail the vessel for experimental navigation in the succeeding two years. Following the preliminary design of the ship, the Agency fixed the main characteristics of the vessel in 1963, the reactor adopted being of the indirect cycle light water type.

RESEARCH REACTOR

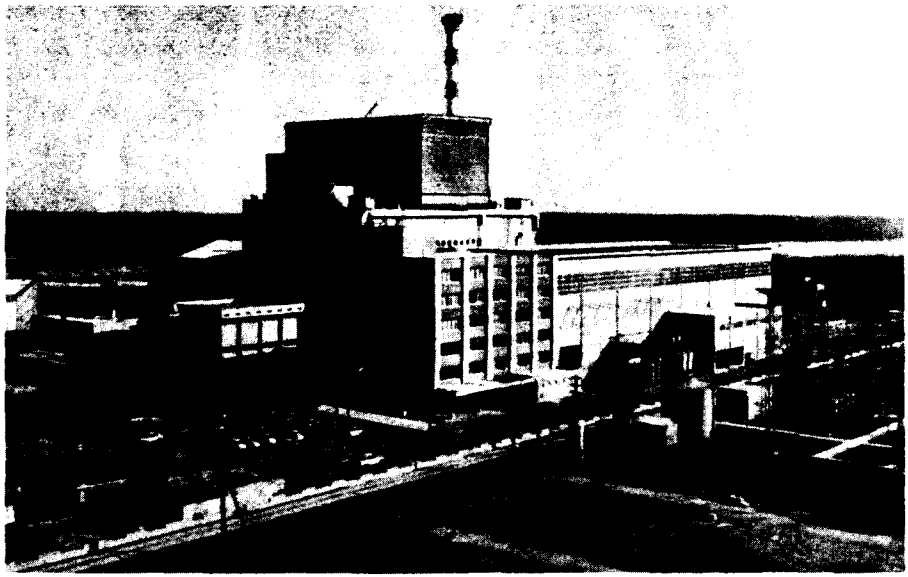
REACTOR	*TYPE*	*OUTPUT*	*PURPOSE*	*LOCATION*	*START UP*
1. JAERI's JRR-1	Enriched U light water (water-boiler type)	50 Kwt	Basic research, training	Tokai-mura	Aug. 1957
2. JAERI's JRR-2	Enriched U heavy water (CP-5 type)	10 Mwt	Basic research, material testing, engineering testing	Tokai-mura	Oct. 1960 (20% Fuel) Apr. 1962 (90%)
3. JAERI's JRR-3 (First Japan-made reactor)	Natural U heavy water	10 Mwt	Isotope production, engineering testing	Tokai-mura	Sept. 1962
4. JAERI's JRR-4	Enriched U light water (swimming-pool type)	1 Mwt (max. 3 Mwt)	Shielding study	Tokai-mura	Jan. 1965
5. JAERI's JMTR	Enriched U light water (tank type)	50 Mwt	Irradiation testing of fuel materials	Oharai-machi	Mar. 1968 scheduled

REACTOR	TYPE	OUTPUT	PURPOSE	LOCATION	START UP
6. Goto Ikuei-kai Reactor	U-Zr Hydride alloy (TRIGA-2)	100 Kwt	Training, research	Kawasaki-City Kanagawa Pref.	Jan. 1963
7. Hitachi Reactor	Enriched U light water (swimming-pool type)	100 Kwt	Training research	Kawasaki-City Kanagawa Pref.	Dec. 1962
8. Toshiba Reactor	Enriched U light water (swimming-pool type)	30 Kwt (max. 100 Kwt)	Training, research	Kawasaki-City Kanagawa Pref.	Mar. 1962
9. St. Paul Univ. Reactor	U-Zr Hydride alloy (TRIGA-2)	100 Kwt	Training, Research	Yokosuka-City Kanagawa Pref.	Dec. 1961
10. Kinki Univ. Reactor	Enriched U light water (UTR type)	0.1 wt	Training	Fuse-City Osaka	Nov. 1961
11. Kyoto Univ. Reactor	Enriched U light water (water-tank type with pool)	1 Mwt	Academic study training (used jointly by all univ., colleges)	Kumatori-machi Osaka	Jun. 1964
POWER REACTOR					
12. JAERI's JPDR	Enriched U light water (BWR type)	12.5 Mwe	Research on power reactor	Tokai-mura	Aug. 1963
13. JAPCO Power Reactor	Natural U graphite (Calder Hall type)	166 Mwe	Commercial power generation	Tokai-mura	May 1965

APPLICATIONS OF RADIATION

Radiation is being utilized widely in such fields as agriculture, medical treatment and industry.

Agricultural applications include tracing the movement and absorption of fertilizer in the soil, surveying water leakage from irrigation dams, and studying insect extermination effect on crops. The Institute of Radiation Breeding of the Ministry of Agriculture and Forestry at Omiya-machi, Ibaraki Prefecture, has installed a gamma field of 200 metres in diameter. Plant breeding experiments with irradiation are being conducted in this gamma field with cobalt-60 as the radiation source. The Institute has had some success in plant breeding. The gamma field is available to universities and other research institutes as well as to establishments of the Ministry.



Japan's first commercial nuclear power station at Tokai Mura, which went critical in May 1965. (Photo: Japan AEC)

Research on the preservation of foodstuffs by irradiation was started in the financial year 1963, and the Japan Research Association for Foodstuffs Irradiation (made up of researchers of national institutes, universities, etc.,) was established in February 1964 for exchange of information, organisation of research and discussions on irradiation of foodstuffs.

The National Institute of Radiological Sciences (NIRS). universities and national research institutes are now conducting surveys and studies on prevention, diagnosis and treatment of injuries caused byradiation. The Institute has installed for this purpose such equipment as the 31 MeV betraton, medical linear accelerator, whole-body counter, Van de Graaff accelerator, and a 30 000 curie cobalt-60 irradiation plant.

In industry, radiation is used widely for non-destructive testing and gauging. Its use in production process control for the paper and steel industries, has proved very beneficial. Universities, national institutes and private research institutes have recently been carrying out fundamental studies in the chemical field, using radiation.

The Takasaki Research Establishment of the Japan Atomic Energy Research Institute will conduct a pilot-plant-scale experiment applying the results obtained by universities and industry. It will test styrene graft polymerization on cellulose, ethylene polymerization, and the moulding of plastics by radiation, in the first instance. Although the utilization of radiation in the chemical industry is only in the early stage, it is expected to bring about great benefits with the progress of research and development,

and the Takasaki Establishment will play an important role in the application of radiation chemistry.

Japan relies at present on imports for a large part of her radioisotope needs. In the near future, full-scale production of isotopes by the Japan Atomic Energy Research Institute's reactor, JRR-3, will sufficiently provide for domestic demands.

JAPAN AND INTERNATIONAL COOPERATION

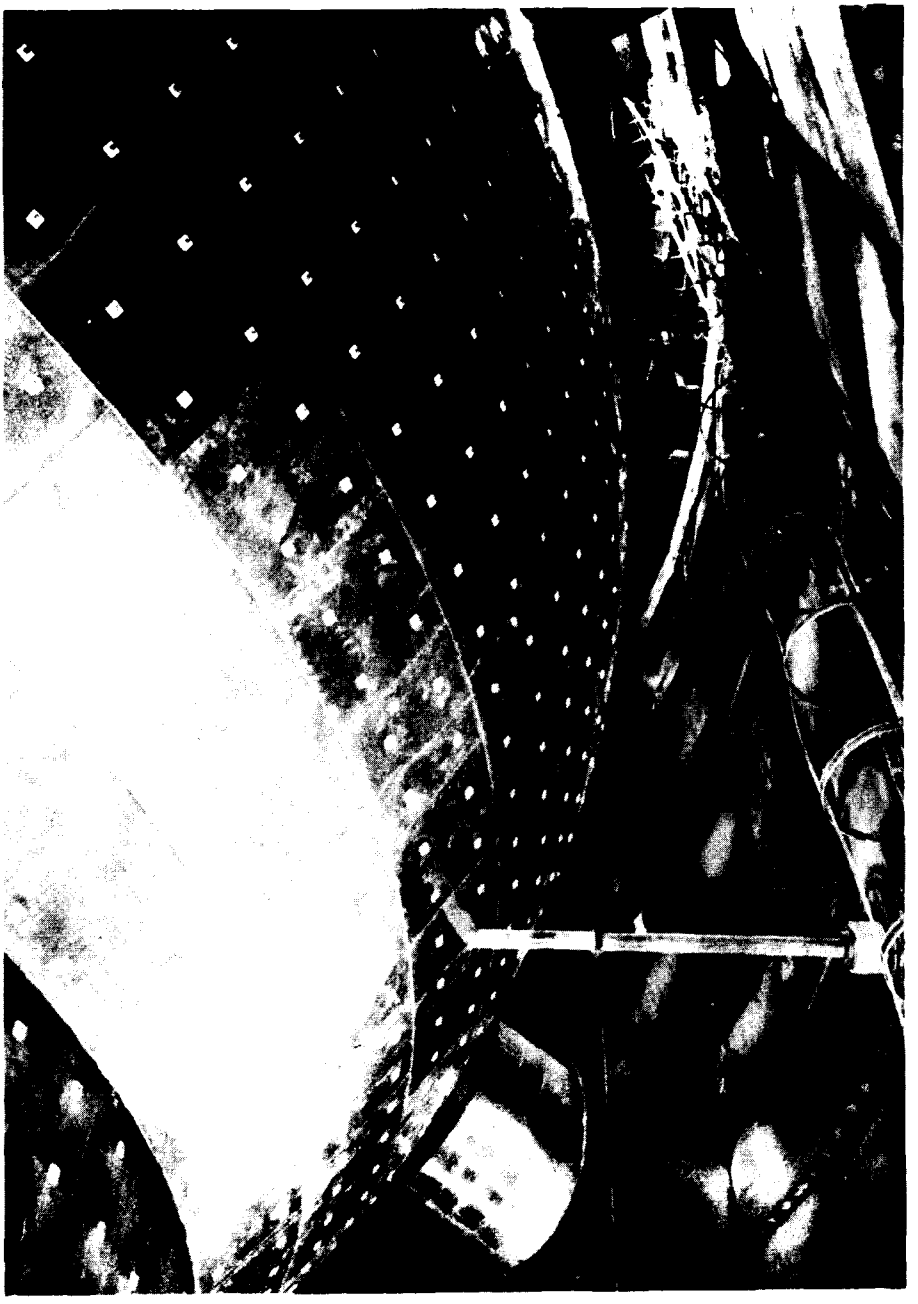
Japan concluded three agreements for cooperation in the peaceful uses of atomic energy, with the United States of America, the United Kingdom and Canada respectively. Each of these agreements prescribes that safeguards shall be applied to the materials transferred from the other country in order to prevent diversion to military use; under the first two, safeguards also apply to equipment and installations. In each case, it had always been expected that the responsibility for administering safeguards would be transferred to the Agency. In view of the provisions of the Atomic Energy Basic Law which restricts the applications for atomic energy to peacuful uses, and in view of the Japanese desire to reinforce these provisions, safeguards responsibility under the Japan-United States agreement was transferred to the Agency in 1963 - the first such case in the world. Since then, the IAEA safeguards system has been extended to large power reactors as well as research reactors; power reactors are subject to safeguards under the Japan-United Kingdom agreement, and this responsibility too has been scheduled for transfer to IAEA. From the point of view of a country accepting IAEA inspection under bilateral arrangements, not merely of research reactors but of power reactors, this is an epoch-making case. In addition, Japan has been negotiating with Canada for the transfer of safeguards responsibility to the Agency under this bilateral agreement. These moves and efforts on the part of Japan will, it is hoped, contribute to the development and acceptance of an effective IAEA safeguards system.

Japan has contributed directly to IAEA programmes in a number of ways, including donations of equipment. The Government of Japan has decided to donate a mass spectrometer to the Agency to promote the IAEA/FAO co-ordinated research programme - the research project on Rice and Maize Fertilization. In February 1965, Japan distributed 1600 capsules, for use in research reactors for experimental irradiations. They were sent to Thailand, Pakistan, the Philippines and Taiwan, by arrangement with the Agency. The capsules are made in five dimensions, of polyethylene and aluminium.

An important contribution to the development of East Asian countries is the provision of training. Japan has already accepted a total of 139 trainees from abroad. They include the following:

Seventy trainees holding IAEA fellowships, mainly accepted by the Japan Atomic Energy Research Institute, the National Institute of Radiological Sciences and other national institutes;

Twenty-six participants in the radioisotope training course (of four weeks' duration) held in 1958 under the co-sponsorship of IAEA and UNESCO;



Pressure vessel of the Tokai Mura reactor (Photo: Japan AEC)

Sixteen participants in a radioisotope training course (four weeks) co-sponsored in 1962 by IAEA and UNESCO;

Fifteen participants in the IAEA long-term training course on the application of radioisotopes in engineering, chemistry, biology and agriculture (eighteen weeks' duration) held in 1964;

Four fellows from Asian countries, endowed by Japanese Government scholarships.

In addition, nine reactor operators came to Japan from Pakistan in April 1965 under the Colombo Plan. They will use the experience gained at the Japan Atomic Energy Research Institute for the research reactor which is being constructed in Pakistan.

Japan also helps neighbouring countries by the loan of experts; three such experts have been to South-East Asia under the IAEA Technical Assistance Programme: one to the Philippines and other countries to assist in the IAEA/Food and Agriculture Organization co-ordinated programme of research into rice cultivation by means of radioisotopes, and the others to Thailand to help engineers there with the operation of a reactor and the handling of reactor equipment. This cooperation was highly appreciated by the Asian countries concerned, and the Japanese Government desires to promote further such cooperation with foreign countries.

A significant step in regional cooperation was the Conference of Countries in Asia and the Pacific for the Promotion of Peaceful Uses of Atomic Energy. This was held under the auspices of the Government of Japan in March, 1963, in Tokyo. The conference was designed to give the participants the opportunity of discussing common problems in the administrative as well as the technical aspects of research and development in the

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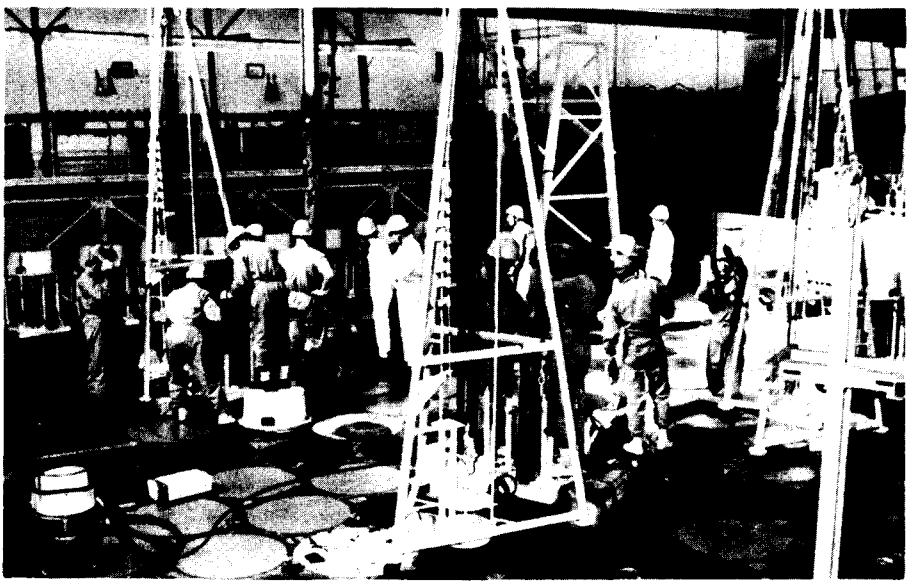
First fuel loading at Tokai Mura power station (Photo: Japan AEC)



peaceful uses of atomic energy, and of exploring methods of overcoming difficulties through international cooperation. It was attended by 33 participants from 14 countries, comprising Afghanistan, Australia, Ceylon, the Republic of China, India, Indonesia, Iran, Japan, Korea, New Zealand, Pakistan, the Philippines, Thailand and Viet Nam.There were also observers from the Economic Commission for Asia and the Far East, the IAEA, the International Labour Office, the Food and Agriculture Organization and the World Health Organisation, as well as from Canada, France, the Federal Republic of Germany, Italy, the United Kingdom and the United States. The conference decided to request the Agency to promote regional activities in Asia and the Pacific, and to study the possibility of establishing a regional office for the purpose. It also expressed a general desire to hold similar meetings from time to time under Agency auspices. The conference resulted in a much better mutual understanding between the participating countries.

Japan has played an important part in carrying out research contracts awarded by the Agency; from 1958 to 1964, 22 contracts were given to Japanese scientists. The subjects have been mostly in the fields of radioisotope applications in agriculture, radiation protection and radiation biology.

Thus Japan's relations with the Agency are many-sided. In carrying out her own atomic energy development, she has taken advantage of the facilities offered by the Agency, and, on the other hand, has lent valuable support to Agency programmes at a number of points.