

FUEL CYCLE INDUSTRIALIZATION PROGRAM PREPARED BY
N-FUEL RESEARCH COMMITTEE, ANRE

The Nuclear Fuel Research Committee of the Agency of Natural Resources and Energy, of MITI (Chairman: Prof. Y. Mishima, University of Tokyo) has prepared an "Interim Report on the Results of Study on the Nuclear Fuel Cycle," which sets out in precise terms the methods that should be followed in establishing Japan's nuclear fuel cycle, through to the year 2000. The following proposals are made: (1) About one-third of the additional uranium that will be needed should be procured by independent development by Japan; (2) Enough enriched uranium to meet one year's needs should be stockpiled by 1983; (3) Efforts should be made to implement the Nuclear Fuel Park conception; (4) Japan should participate actively in international joint projects of nuclear fuel cycle.

In July 1977 the same committee completed a "Comprehensive Promotion Program of Nuclear Fuel Projects," but the present study amounts to a detailed overall revision of the previous program, to meet the new situation resulting from the scaling-down of Japan's nuclear power development plan, and the changes due to the new U.S. nuclear non-proliferation policy, and other matters.

According to the revised study, 394,000 tons of natural uranium and 156,000 tons SWU of enriched uranium will be needed for the development of nuclear power plants with a total capacity of 150,000 MW, by the year 2000. It is also estimated that radioactive wastes emanating from nuclear power plants of this capacity will total 3,920,000 drums of low-level and 14,300 drums of high-level radioactive wastes. The total funds needs for the establishment of the nuclear fuel cycle will amount to about ¥200 billion (estimated at 1975 figures).

The outline of the proposed Nuclear Fuel Cycle Industrialization Program will be presented later. First, the basic policies on which the Program is based are set out as follows:

In order for Japan to secure an international position as "a nuclear developed country," involving the establishment of an independent nuclear fuel cycle, it is necessary to achieve the sound development in every branch of industry relating to the nuclear fuel cycle, as seen from the coordination of both energy and industrial policies.

In planning for the various projects of each industry concerned with the nuclear fuel cycle, the following steps will be necessary: (1) The provision of legal requirements for each of the projects of the enterprises concerned; (2) To secure the funds needed for research and development in industrialization; (3) Studies on how to establish each related industrial system.

Internationally, it will be necessary to energetically deal with the following problems: (1) To provide economic cooperation, by means of investments and loans, with natural resources possessing countries for the development of resources; (2) To study the feasibility of undertaking international uranium

enrichment projects, in partnership with natural resources countries; (3) To join the proposed "Nuclear Fuel Bank;" (4) To implement the plan for international plutonium management and control.

- Outline of Plans for Developing Nuclear Fuel Cycle -

Promotion of Japan's Own Development of Nuclear Fuel by a Central Company of Industrial Circles

To undertake uranium ore development independently involves greater risks than simply purchasing uranium ore or extending loans, etc.; but once prospecting and exploitation of uranium ore deposits have proved successful, it will be a great contribution to securing stable uranium supplies.

It is necessary for Japan to promote uranium prospecting and development vigorously, aiming at securing one-third of future uranium needs.

There is a great difference between what is needed by way of investment in uranium ore prospecting and recent trends of investments by Japan's private companies. It is necessary therefore for the Japanese Government to take active steps to meet the need. Private enterprises have urgent need to consolidate their funds and technology, and embark together on such a great project, because the funds of each company are limited for investment in such projects.

In promoting the prospecting and exploiting of uranium ore deposits, the electric power companies, non-ferrous metals mining companies, trading companies and others should cooperate with the circles concerned and consolidate both funds and technology, and should also ask the Government to subsidize such ventures.

Specifically, the help of the Uranium Resource Committee should be sought (See January issue of AIJ p. 45); One central uranium prospecting and exploiting corporation should be established in overseas uranium resources country, for the present aimed at prospective projects in Canada and Australia, etc. Each central corporation should take care of the whole of each area in a uranium resources country; e.g. Canada or Australia as a whole.

Such central corporations should play the principal role in developing uranium ore deposits, both in prospecting and exploitation, and do everything possible to achieve Japan's independent supply.

Promotion of Uranium Stockpiling

Japan depends on overseas countries for supplies of nuclear materials, as well as for conversion, enrichment and many other operations. Very recently, on account of moves towards regulation the export of such materials, reflecting changes in the nuclear policies of nuclear resources countries, nuclear supplies from abroad have become extremely uncertain.

In order to ensure stable supplies of electrical power from the stable operation of nuclear power plants, it is necessary to stockpile surplus enriched uranium to meet any emergency, enough to meet Japan's needs for up to one year.

Stockpiling should be done by cooperation among electric power companies, commencing from fiscal 1979, with the stockpiling target to be completed by the end of fiscal 1983.

Construction of Domestic Uranium Enrichment Plant

It is extremely important that a uranium enrichment plant should be built in Japan, which should be speeded up, to achieve the following purposes: To ensure stable supplies of enriched uranium; to make it possible to improve enrichment technology; to give Japan bargaining powers on future uranium enrichment services; to ensure nuclear safeguards with independent uranium enrichment technology; to be sure of having a stockpile of enriched uranium for the future; to help in the export of related machinery and instruments, etc.

To achieve these ends, it is urgent that Japan's own uranium enrichment system be established; and in the transitory period between a demonstration plant and a commercial plant, a cooperative system will be needed among Governmental authorities and private enterprise, and considerable cooperation will be needed from private organizations to procure the necessary funds.

It will be necessary to complete plans for manufacturing centrifugal machinery according to the time-table for the construction of Japan's own uranium enrichment plant.

Promotion of Construction of a Nuclear Fuel Park

In the promotion of nuclear power development, it is essential that the back-end of the industry, including reprocessing, plutonium fabrication, waste treatment and disposal, etc., be fully established. To meet these needs, the construction of a "Nuclear Fuel Park" should be speeded up, in which such plants and facilities for reprocessing, storing spent fuel, plutonium fabrication, plutonium storage, high-level waste management and others are all located.

Among the facilities in a nuclear fuel park, an industrial company operating a reprocessing plant and its ancillary factories is to be set up within fiscal 1978, in which the electric power companies are principal promoters.

It is essential that the chemical and heavy electrical machinery manufacturing companies should participate in such a venture. The establishment of the main operating body for plutonium fabrication facilities, and the management and operating system of the whole nuclear fuel park must be expedited. A consultative body composed of Governmental and private member organizations must also be set up as soon as possible to carry out longterm planning and overall adjustments. With the object of selecting a site and taking the necessary steps on environmental problems, the principal non-Governmental promoter of the enterprise should be selected as soon as possible to carry out urgent negotiations with the local community.

The Central Government will have to conduct prior environmental surveys to confirm the suitability of the site. In selecting a site, what is extremely important is winning public acceptance. Therefore, the strategy for winning public acceptance from the local people calls for public relation campaigns, negotiations, acquisition of sites, and decisions to be completed as soon as possible. To enable this to be done, the Central Government should take every possible step to expedite the selection of a site for the fuel park, first by working out a basic plan, then speeding up a Governmental decision on the site, and taking the necessary measures in the interest of the local people by applying the provisions of the "Three Laws relating to Power Sources Development," etc., as fully as possible.

The domestic manufacture of all the necessary equipment for the nuclear fuel cycle must be put in hand, taking into account the fact that recent international circumstances make the transfer of sensitive reprocessing technology difficult, as well as to ensure the reliability of machinery and instruments. For this purpose the process know-how must be acquired from the PNC reprocessing plant, and for the development of a chopping machine, a leaching machine, etc., sufficient demonstration tests must be conducted, all of which will cost a very considerable sum, and require a period of 5 to 7 years. Well-planned and efficient research and development must therefore be undertaken. For this, it is important that the following points be made clear: viz., the principal body to conduct research, the research system and the research program. The tasks of the Governmental authorities must be clarified and the necessary system established, and for the private sector, strong subsidy measures will be needed.

As it will take as long as seven years to complete the reprocessing plant of the nuclear fuel park, from start of construction to commercial operation, enormous funds will be needed, and the Government will need to assist as regards taxation and financing.

From the point of view of safety, the protection of nuclear substances, plutonium management, guidelines for inspection of the site, and standards for design, etc., must all be provided for.

Promotion of Pu Use and Cooperation in International Movement for Nuclear Non-proliferation

In order to ensure the compatibility of plutonium use and nuclear non-proliferation, a policy that actively complies with international requirements must be implemented.

To meet this need, a practical scheme for the international control of plutonium is to be established, and research and development are to be promoted for nuclear non-proliferation, including coprocessing.

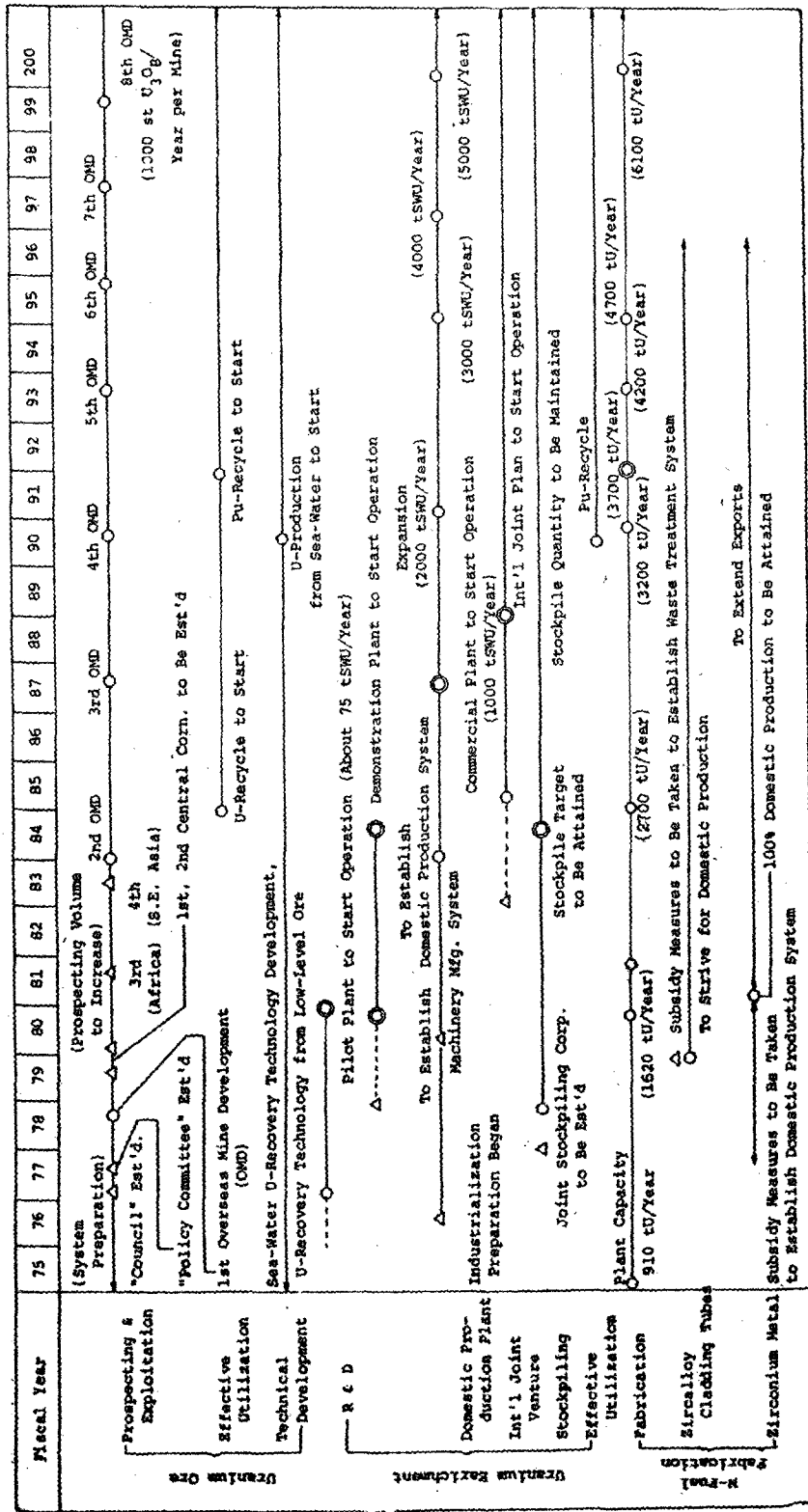
In preparation for the period in and after 1990, for the practical plutonium recycling in thermal neutron reactors, demonstration tests on the use of plutonium in LWR will have to be conducted.

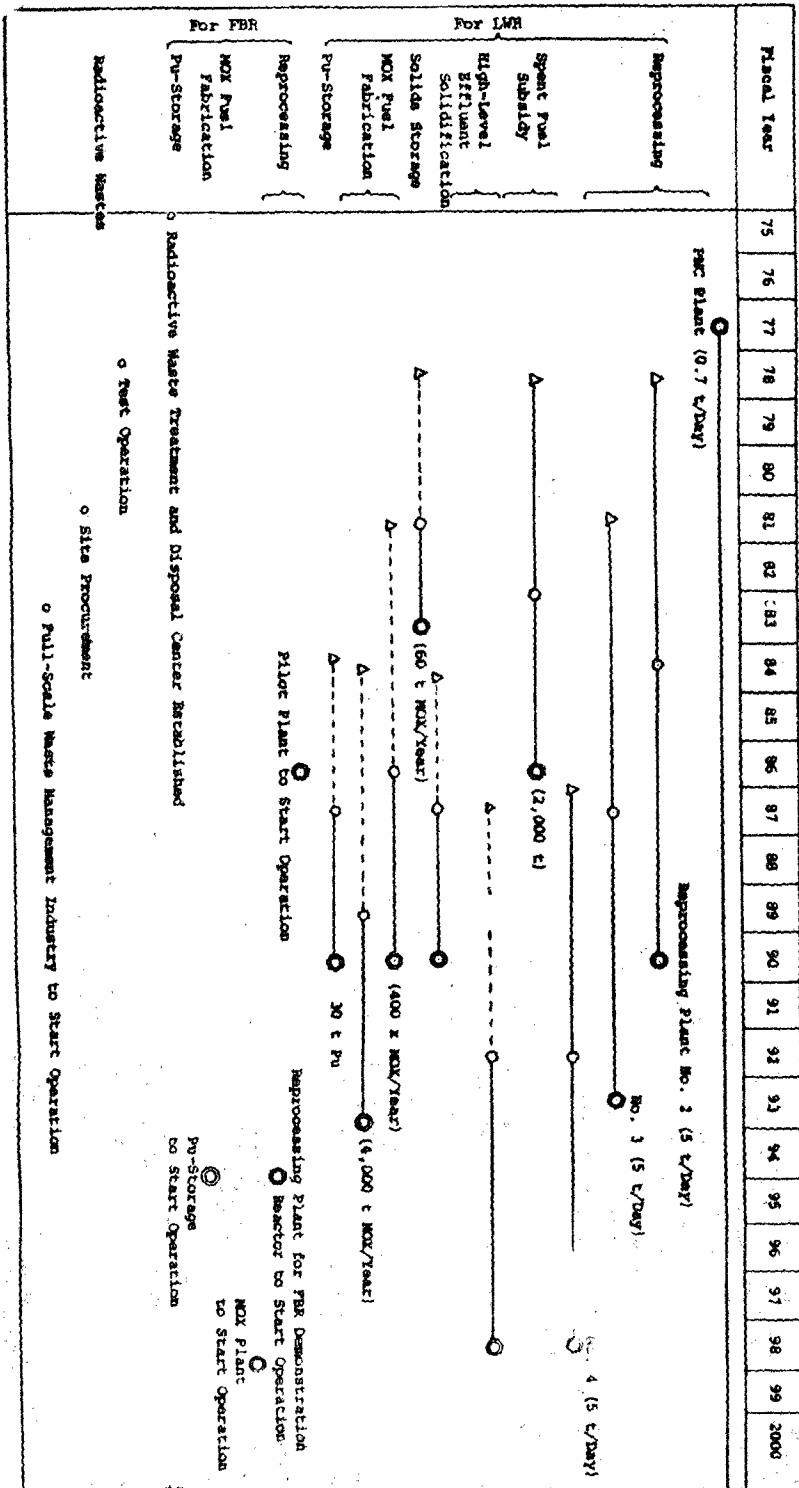
Establishment of Measures for Management of Radioactive Wastes

Concerning low-level radioactive wastes, the technique of volume reduction and the concentration of wastes should be developed, and efforts made to reduce the amount of wastes discharged. At the same time, efforts must be made to establish a joint system for the treatment of low-level radioactive wastes discharged from nuclear fuel fabrication plants, and to establish a practical method of final disposal of low-level radioactive wastes; the experimental undertaking and investigation and research on ocean dumping and local disposal of the low-level radioactive wastes are to be carried out, and safety demonstration tests on site storage of the wastes are needed. Meanwhile, the establishment of an organization responsible for carrying out the treatment and disposal of low-level wastes is urgently needed, and the education and training of engineers and technicians to work on low-level waste treatment and disposal must proceed at once. The acquisition of sites for waste storage and disposal must be expedited, and the Government must formulate necessary standards of various kinds for waste treatment and disposal.

For the treatment and disposal of high-level radioactive wastes, it is necessary that research and development on final disposal techniques for vitrification, solidification and geologic disposal and other factors be expedited. It is also important for industrial feasibility studies to go on seeking the management methods, organizations responsible for high-level waste treatment and disposal, how to proceed with research and development on final storage of high-level wastes, conditions of sites for high-level waste storage and disposal, etc., all of which must be suitable to Japan's natural and social conditions.

Comprehensive Industrialization Plan





NUCLEAR FUELS DEMAND AND SUPPLY

Items		Fiscal Year						
		1980	1985	1990	1995	2000		
Installed Nuclear Capacity		MW	15,500	33,000	60,000	100,000	150,000	
Natural Uranium	Demand (Annual) (Cumulative)		st U ₃ O ₈	3,300	10,000	17,300	25,500	32,800
	Supply (Ann.)	Long-Term contract		8,700	9,000	4,200	1,000	-
		Overseas development Recycled		1,100 0	1,800 300	3,800 2,100	5,800 6,300	6,700 10,500
Enriched Uranium	Demand (Ann.) (Cum.)		t SWU	1,600	3,800	6,600	10,000	13,700
	Sup. (Ann.)	Imports		11,700	25,300	51,200	94,400	156,000
		Joint venture		3,500	6,600	5,500	5,500	5,500
Domestic productions Recycled		0 0	0 30	1,000 1,000	1,000 2,400	2,000 4,400		
Fabrication	Demand (Ann.) (Cum.)		t U	480	1,050	2,130	3,240	4,350
	Sup. (Ann.)	Domestic productions		3,200	7,600	15,900	30,300	49,500
Reprocessing	Demand (Ann.) (Cum.)		t U	730	1,700	2,500	3,750	4,890
	Sup. (Ann.)	Overseas contracts Domestic productions		280	450	1,100	2,140	3,200
Wastes	Low-level	Cement (Ann.)	thousand drums (200 l drum)	280	450	1,100	2,140	3,200
		Solidification (Cum.)		1,000	3,000	7,200	15,400	29,000
		With efforts (Ann.) for reduction (Cum.)		230	260	890	-	-
	High-level	(Ann.)	m ³	120	200	660	2,400	3,600
		(Cum.)		-	-	530	930	2,610
				-	-	960	4,010	14,340