STATUS OF JAPANESE WASTE MANAGEMENT PROGRAM

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ABSTRACT

Radioactive waste management policy in Japan is prescribed in the Long-Term Program for Development and Utilization of Nuclear Energy, revised in June 1982. According to the Long-Term Program, responsibility for implementation of the management is divided and distributed between the government and industry who generates the wastes. Much efforts have been done and doing for diminishing the generating amount and the volume to be isolated after treatment. Emphasis is put on the long-term management of the wastes.

GENERAL

In Japan, the government and industries have great efforts to develop the nuclear power generation based upon the consensus that the nuclear energy is essential to fulfil its energy demand.

Now, nuclear power generation capacity in Japan has grown up to 17 GWe and the share of nuclear electric power supply becomes more than 20% in 1982, while the capacity shares 12% of total power generation capacity. It is expected that the nuclear power generation capacity will double in '90's introducing another 19 GWe which are either under construction or in planning stage. Therefore, establishing the management system becomes a growing concern as an integral part of nuclear program.

Because of small and unfavorable conditions of land, large population density, and nervous public sense against nuclear, Japan has to take much care of environmental protection since early stage in nuclear development. The Atomic Energy Commission and the Nuclear Safety Commission created in 1978 have emphasized that appropriate management of radioactive wastes is an inevitable issue in the planning of development and utilization of nuclear energy.

In 1979, the Atomic Energy Commission established one advisory committee on radioactive waste management, and the Nuclear Safety Commission also created one advisory committee on safe technology of radioactive wastes. The mission of both committees is to promote and advance the reviews on policy, strategy, research and development, demonstration, regulation. and implementation.

LOW-LEVEL RADIOACTIVE WASTES

Treatment

By now, low-level wastes arisen from daily operation and maintenance at various nuclear installations including nuclear power stations have been stored inside of each site boundary after treatment for volume reduction. The stored amount is estimated as shown Fig. 1.

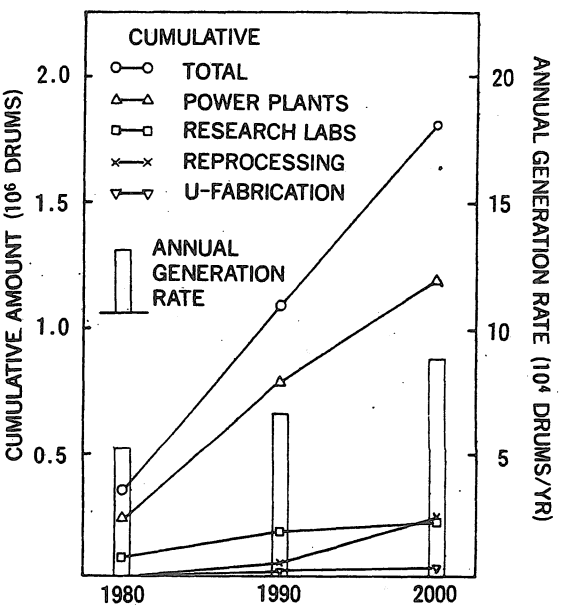

Fig. 1 LLW GENERATION AND ACCUMULATION

TABLE I. LLW TREATMENT TECHNOLOGIES IN JAPAN

		In Operation/Under Construction	R & D
Nuclear Power Stations	BWR	1. Holdup Decay Tank, Charcoal Delay Bed, HEPA Filter, 2. Filter (Precoat, Non-precoat, Magnetic, Cartridge), Crud Separator by Centrifuge, Evaporator, Reverse Osmosis, Electrodialysis, Ion-Exchange Demineralizer, Carbon Bed, Solidification by Cement, Bitumen, Plastics, Drying and Pelletizing 3. Incineration, Compaction 4. Compaction, Decontamination 5. Solidification by Plastics	2. Advanced Filter (Non-precoat Hollow Type) Micro-wave, Evaporator, Electro Dialysis, Reverse Osmosis, Advance Cementing, Modified Pelletizing, Decomposition of Organic Materials in Water by Chemical/Photo Oxidation, Fluidized Bed Calcination 3. Fluidized Bed Incinerator, High Temperature Slugging Incinerator 4. Super Compaction, Plazma Melting, Ash Melting by Induction/Micro-wave Heating, High Temperature Slugging Incinerator 5. Acid Degestion, Wet Oxidation, Incineration
	PWR	1. Holdup Decay Tank, HEPA Filter 2. Filter (Precoat, Non-precoat, Cartridge) Reverse Osmosis, Ion-Exchange Demineralizer Boron Recovery by Ion-Exchange Resin Solidification by Cement, Bitumen 3. Incinerator	1. Membrance (Gaseous Diffusion) 2. Advanced Filter (Non-precoat Hollow Fiber) Advanced Cementing, Modified Pelletizing Fluidized Bed Calcination 3. Fluidized Bed Incineration 5. Wet Oxidation
Other Installations		1. Cryogenic Separation of Xe, Kr, Iodine Removal by Ag-Zeolitre, HEPA Filter 2. Precipitation, Evaporator, Carbon Bed Solidification by Bitumen, Cement 3. Incinerator 4. Compaction	2. Solidification by Plastics 3. Acid Digestion 4. Ash Melting by Induction Heating, Electro-slugging Pyrolysis 5. Acid Digestion

1. gaseous effluent 2. liquid waste 3. combustible waste 4. incombustible waste 5. ion-exchange resin

The gaseous effluent and part of liquid wastes which are discharged into the eivironment in accordance with the relevant regulations and the principle to keep the environmental release as low as reasonably achievable, have so far posed no considerable problem

A part of the wastes under site storage, for example, evaporator concentrate is already conditioned with cement or bitumen into 200 l drums. Recently, nuclear operators are installing more effective volume reduction facilities and solidification units suitable for manufacturing packages to be stored, transported, and finally disposed of either into the sea or in land depending on their characteristics (Table I).

In the other hand, significant efforts have been made to diminish the waste generating amount by improving older processes, re-examining operation procedures, etc. With these efforts, the accumulation rate of conditioned wastes - object of final disposal or isolation - is estimated to diminish distinctively compared with the past.

Disposal

Based upon the Policy, the nuclear operators have to treat their wastes and also responsible in principle for their long term management. In other words, the private sector has to isolate their conditioned wastes from biosphere, after the stage when the technical prospect of long-term storage and disposal would have been determined through experimental verifications and so on, conducted by the government. The waste having rather lower radioactivity content and non-TRU waste would be dumped into the deep ocean.

On the other hand, the waste unsuitable for sea dumping in the framework of the London Dumping Convention would be isolated on land, and the low-level solid waste preferable to be kept in retrievable manner would be stored in engineered facilities.

Sea Disposal

Up to a few years ago, Japan had an intention to carry out the sea dumping prior to land isolation. Various preparatory work has been done for design of dumping ship, development and demonstration of unloading gear for dumping of the packages, confirmation of accuracy of navigation aids, quality control of the packages and so on. Japan had already ratified the London Dumping Convention in 1980 and taken part in the Multilateral Consultation and Surveillance Mechanism for Sea Dumping of Radioactive Wastes in OECD/NEA in 1981, with an intention of dumping low-level solid wastes under the same international framework as followed by some European countries.

The sea dumping program of Japan is to carry out an experimental operation of limited amount of radioactivities at a cadidate site in the Northwestern Pacific Ocean in advance of full scale operation. A comprehensive environmental safety assessment of the operation carried out by the government. Since 1977, further oceanographical surveys at the candidate site, and the various demonstration tests on the packages concerning their integrity at the sea bottom

have been conducted to make the safety of the sea disposal all the more confirmed. Therefore, the scientific consideration on sea dumping by the expert group to be set up at the coming Consultative Meeting of the Contracting Parties to the London Dumping Convention is one of the most important milestones which Japan should clear successfully so as to obtain more common understanding on the safety of sea disposal at international level.

From a view point of implementation, the government set forth the regulation concerning the sea dumping in 1979 and the industries created the Radioactive Waste Management Center (RWMC) to be a sole organization for execution of the waste isolation not only into the sea but also on land under guidance of the government.

Land Disposal

As for the land disposal, the Japan Atomic Energy Research Institute (JAERI), RWMC, and several governmental and public organizations are taking their share of relevant experiments and research activities necessary for establishing safe and practical disposal methods and system. In parallel, various surveys for candidate sites are also being carried out throughout the country by the industries.

The Atomic Energy Commission and the governments are examining a concept to store the low-level solid wastes in engineered facilities installed outside of the nuclear installation sites in which the waste are arisen. The concept suggested by the industries would be one option approaching to the land disposal. Such storage would be effective as a measure to improve the economy and efficiency of management by means of aggregating the wastes in many sites to a central facility, and also to appeal to the public with demonstrating safety and effectiveness of management at specific site conditions, which is necessary for the land disposal. In this context, the government has formalized and published the basic idea of the Away-from-Reactor Site storage last year, with a view to stimulating both the public and local interests necessary to promote the siting.

Concerning the land disposal itself, it seems to be necessary to establish a conceivable methodology for evaluating the safety from the result of comprehensive research and tests, and, then, trial disposal will be carried out to demonstrate a series of disposal technologies prior to the routine disposal. In addition to this, the waste which is regarded as posing no problem from a view point of hazard due to radioactive decay during long-term storage shall be properly disposed of in accordance with the rational measures for disposing of de minimis waste.

Future Task

Now, the nuclear business is required to make the overall prospect of the back-end of radioactive waste management clear as far as possible. The wastes arisen from small-scale installations, in which nuclear fuel material is used, shall be jointly treated, and in order to properly cope with the execution of routine disposal, studies on arrangement of standards, establishing of a definitive execution system for routine disposal and providing appropriate domestic regulations shall be conducted as well as technical examinations. These are pointed out as future tasks in the Long Term Program. The Nuclear Safety Commission has been re-examining the research and development program on safe technology of land isolation as well as sea dumping both in regulatory aspect, and, in its report described the program up to 1988 (Table II), announced that emphases be put on development of methodology for safety assessment of land isolation and standards and guidlines of packages to be isolated on land.

TABLE II. Research Program on Safe Technology for Waste Management (1984 - 1988)

1. Sea Disposal
   (1) Standardization of Packages
   (2) Accumlation of Oceanographical Knowledge
   (3) Ocean Environmental Monitoring
2. Land Disposal
   (1) Standardization for Execution
   (2) Development of Methodology for Safety Assessment

HIGH-LVEL RADIOACTIVE WASTES

Since the outset of nuclear energy development, Japan has made it a basic policy to promote reprocessing from view point of energy resources security. High-level liquid waste arisen from the reprocessing plant are now stored in tanks. The waste is to be solidified into stable form and then transferred to a provisional storage. The solidification and provisional storage would be carried out by the reprocessing plant operator, and the government shall prove the technology. Also, the government shall bear the responsibility for disposal or equivalent alternatives. However, in principle, the waste generators shall bear the necessary cost for management to be done by the government. The high-level waste will be finally disposed of into geological formations.

Treatment

Technologies for solidification and storage have been developed by the Power Reactor and Nuclear Fuel Development Corporation (PNC), and the pilot plant for vitrification is under design state and expected to start its operation by around 1990 for proving the technologies as shown in Fig. 2.

Disposal

Another research and development are underway for geological disposal and matters relevant to the disposal with aim of establishing the disposal technologies in early of next century (Fig. 3). Investigation and research on potential geological formations and artificial barriers have been made, and in 1984 a comprehensive review on the result is planned before proceed to the next phase to investigate the promising sites.

Apart from the above-mentioned development, following developments are being carried out by JAERI and PNC for evaluating the safety, new solidification matrix, and new management concepts such as group separation and transmutation, etc.

On the other hand, with regard to the reprocessing wastes including TRU waste, etc. from overseas reprocessing of Japanese spent fuels, specifications of the wastes would be submitted in near future. Necessary tests for examination of the specifications have been continued, and research and development on treatment and disposal of TRU waste have to be intensified with reference to the results on high-level waste. Under close co-operation in organization concerned, studies of the specifications, arrangement of the domestic reception system are under progress among other things.

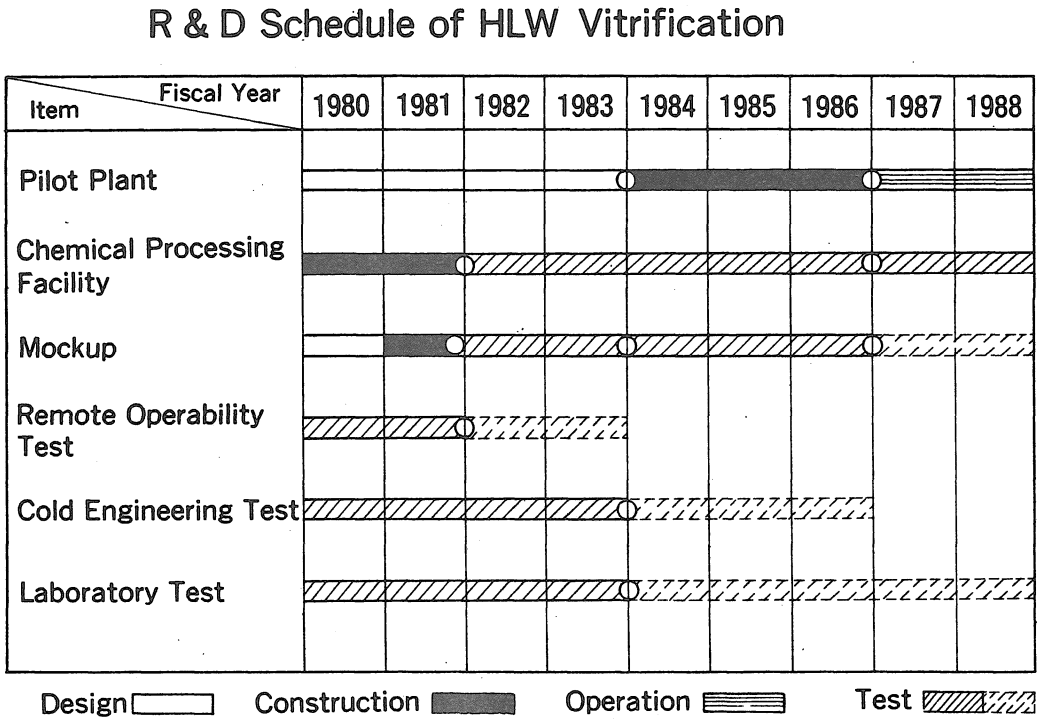

Fig. 2 R & D SCHEDULE OF HLW VITRIFICATION

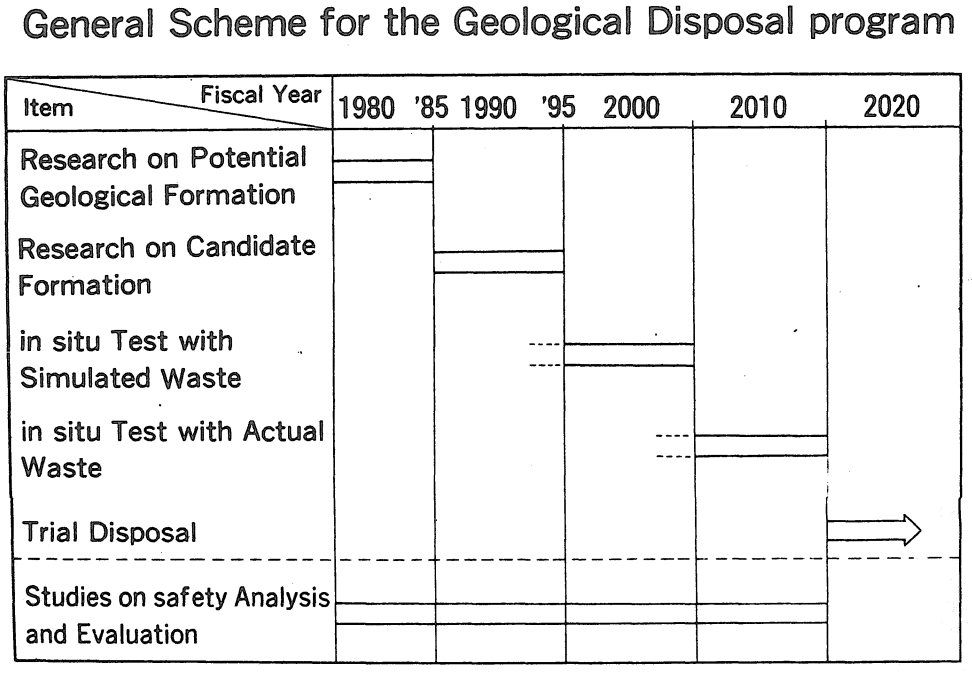

Fig. 3 GENERAL SCHEME FOR THE GEOLOGICAL DISPOSAL