Current Status and Future Challenges of Nuclear Materials Transportation in Japan

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Foreword

It is my great honor to be given this opportunity to speak in this plenary session. I would like to speak about the current status and the future challenge of nuclear materials transportation in Japan.

Thirty-four years ago fresh nuclear fuel was transported from the United States of America to Japan and 26 years ago spent fuel was shipped off to the United Kingdom for the first time. Today, Japan is in the third position of the nuclear power generation countries in the world, with its capacity of 33,240 MW of 41 units. Nuclear power accounts for 30 % of the total power generated in Japan. The national nuclear power development plan aims at a goal of 72,500 MW in the year 2010. Up to now nuclear fuel and materials have been satisfactorily transported, in inland and abroad, and we have never experienced any accident in nuclear materials transportation.

Uranium is a precious resource. To effectively utilize and assure stable supply of uranium, we have been striving to complete the nuclear fuel cycle in our country. Since the current position of light water reactors is expected to continue in the future, plutonium, which is a precious resource generated in the light water reactors, will be utilized for light water reactors together with the recovered uranium. At the same time, plutonium will be utilized for fast breeder reactors at better efficiency.

To accomplish recycling of uranium resources in Japan, we are now promoting the construction of a private reprocessing facility at Rokkasho-mura, Aomori Prefecture.

At this Rokkasho-mura, a uranium enrichment facility is now in operation to assure stable supply of enriched uranium, and a facility for burying low-level wastes from nuclear power plants is under construction.

It is our basic principle to reprocess spent fuel for recycling. However, in the transient stage until the completion of the future nuclear fuel cycle wherein plutonium is used in fast breeder reactors, it will be necessary to have a more flexible strategy; putting spent fuel in temporary storage and reprocessing spent fuel at a slower rate.

Nuclear power generation and nuclear fuel cycle must be promoted in a closely connected manner. The nuclear fuel transport is the "arteries" of the nuclear power industry. The demand for energy in Japan would be met by the nuclear power generation in future as well as at present. In order to assure a smooth development of nuclear power generation, it is essential to circulate nuclear fuel, like the "blood," smoothly from the front end to the back end of the nuclear fuel cycle through its elements (facilities) by means of transportation.

On the other hand, although the power plants and fuel cycle facilities themselves are separated from the public to a considerable distance by establishing control areas, the transportation has a possibility of access to the general public since the transportation is carried out on public roads by vehicles. Accordingly, it is essential to secure public acceptance, by means of safety regulation, safety evaluation and safety measures. Especially, safety assurance of transportation is important in Japan since it is densely populated. To this end, there is a necessity for Japan of conducting many R & D activities on safe transportation.

With such a background, the research and development activities in Japan on nuclear materials transportation have been quite active and extensive, aiming to assure safe transportation and to sophisticate and rationalize technologies for future. At this symposium a total of 68 papers will be presented by Japan.

Current Status

1. Safety Regulations

Regulations relating to nuclear fuel transport in Japan are governed by the Law for Regulation of Reactors, the Maritime Safety Law and the Aviation Law. The technical standards are based on IAEA's Regulations for the Safe Transport of Radioactive Material (S. S. No. 6). The 1985 edition of the Regulations was incorporated into the laws and regulations of Japan, and the new laws and regulations were put into effect on and after January 1, 1991.

2. Overview of Nuclear Materials Transport

(1) Transportation to Rokkasho Nuclear Fuel Cycle Facilities

1) Transportation to commercial uranium enrichment facility

With regard to the balance between the demand and supply of uranium enrichment, Japan is currently receiving enrichment services from the United States firms and Eurodif Corp.

To meet the subsequent new demand, enriched uranium equivalent to this demand will be produced domestically from a standpoint of establishing an independent nuclear fuel cycle. As a part of this effort, a commercial uranium enrichment facility with a final enrichment capacity of 1,500 tons SWU/year is in operation at Rokkasho-mura, Aomori Prefecture.

As for transportation in relation to this facility, the natural uranium which is imported from foreign countries will be shipped by container ships and then shipped to the enrichment facility by vehicle. Also, the product of enriched uranium will be shipped to fabrication facilities.

2) Transportation to private reprocessing plants

Reprocessing of spent nuclear fuel is currently made by Power Reactor and Nuclear Fuel Development Corporation (PNC) and by overseas reprocessing plants under the reprocessing commission agreements with British Nuclear Fuels plc (BNFL) and Compagnie Générale des Matiéres Nucléaires (COGEMA). Also spent fuel totalling about 3,150 tons are now in storage in the water pools of nuclear power plants and the Tokai Reprocessing Plant. Up to now the Tokai Reprocessing Plant has processed spent fuel of 630 tons in total. On the other hand, a private reprocessing plant is to be constructed at Rokkasho-mura, Aomori Prefecture, which is expected to start operation in 1999, with a reprocessing capacity of 800 ton U/year.

As for the transportation relating to this, spent fuel is to be shipped from the exclusive-use port or the nearest port of each power plant site to the reprocessing plant.

3) Transportation to low-level radioactive waste burial facility

Low-level radioactive wastes produced from power plants are stored in the storage houses constructed at each site. The total number of low-level radioactive waste drums stored at nuclear power plants throughout the nation is approximately 780,000. Each power plant has dealt with an increasing number of radioactive waste by expanding the storage houses. However, to realize burial of these low-level radioactive waste, a plan is being implemented to construct a low-level radioactive waste burial facility at Rokkasho-mura, Aomori Prefecture.

As for the transportation to this facility, radioactive wastes are to be transported by sea from the exclusive-use port or the nearest public port of each power plant site to Mutsu Ogawara Port near the low-level radioactive waste burial facility and then transported by vehicles to the burial facility.

The actual transportation is planned to be started in coming December with a carrier ship called Seiei-maru.

A tour for this symposium participants is scheduled in the end of this week.

4) Transportation of returned waste

Radioactive wastes which are generated by reprocessing in foreign countries will be returned to Japan and stored within the site of a private waste management facility at Rokkasho-mura, Aomori Prefecture. The actual transportation will be started in 1995.

(2) Transportation relating to the utilization of plutonium

The Power Reactor and Nuclear Fuel Development Corporation is aiming at the first criticality of a prototype fast breeder reactor "Monju" in the spring next year. The supply of plutonium for its fuel must be assured. The first transportation of the uranium and plutonium mixed oxide fuel for the initial loading was made on land in the beginning of last July. The plutonium recovered by the Tokai Reprocessing Plant is not sufficient to meet the need for "Monju." Hence PNC is promoting a program for transporting plutonium recovered by overseas reprocessing.

PNC will transport about one ton (mass of fissile material) of plutonium dioxide powder from France to Japan for reloading "Monju." A dedicated carrier ship which meets the standards set by the Ministry of Transport will be used for this transportation. The actual transportation will be made in this autumn. It is not an exaggeration to say that the success or failure of this transportation will tell whether the nuclear fuel recycling program can be made smoothly.

Future Challenges

1. R & D Tasks in Future

(1) Development of Cask Made of Ductile Cast Iron

In Japan, ductile cast iron has been accepted as a material for the main body of the at-site dry storage cask.

Ductile cast iron is expected to be used for transport casks in future as well as for storage cask. The private sector will conduct research and development relating to it, and the Government will formulate the requirements/criteria of such casks. Moreover, the results of the specialist meetings at IAEA are expected to be incorporated in the transport regulations.

(2) Development of Basket Materials

Borated stainless steel and aluminum will be effective for the basket of a transport cask as a means of criticality control to increase the contents of the cask. The development of such materials will be conducted for the fuel basket.

(3) Improvement of Containment Analysis Method

Containment of the cask is the most important function of the cask. It is desirable to rationalize the containment analysis method in terms of the interrelationship of ① inventory of the content, ② permissible leakage rate, and ③ leakage rate of the cask. To this end, an ISO committee has been preparing the standard and we are looking forward to seeing the final draft.

(4) Research for Introduction of Burnup Credit

In the criticality safety design of transport casks, it is a common practice to use the composition of fresh fuel even for spent fuel transport casks. Since the burnup of fuel has been rising in recent years, it is desirable to conduct verification tests that allow criticality safety design with burnup credit.

2. Future Outlook

The Government's research efforts on nuclear fuel transportation are intended to secure the public safety, and to form a foundation which makes it possible to supply each element of the nuclear fuel cycle with a sufficient amount of nuclear fuel to achieve the energy security. Many direct and indirect research and development efforts are required to assure the public safety and the energy security at the same time.

The private sectors will strive to design, manufacture and improve casks to meet the transport demands. Naturally, a variety of relevant research and development efforts will be made. In addition to them, advancement of quality management system and quality assurance at manufactures and R & D will be extremely important to the private sectors striving to secure the safety.

With regard to international cooperation, Japan will actively participate in and cooperate with the activities of the SAGSTRAM and the respective technical committees of IAEA. Japan will be maintaining and promoting cooperative relationships at various levels with the U. S. A. and European countries.

This is the first meeting of PATRAM held in Asia, and some papers from Asian countries will be presented. And a few people are contributing to chair, co-chair the session. I believe it is important for Asian nations, taking this meeting as a momentum, to establish an active and close cooperative relationship in the world's nuclear transportation field. Thank you.

PACKAGING TECHNOLOGY

Session 1:

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