Transport System for Low Level Radioactive Wastes in Japan

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INTRODUCTION

Low level radioactive wastes (LLW) arising from domestic nuclear power stations have been loaded into drums and temporarily stored at the power station site, and the cumulative number of stored drums now reaches about 500,000.

A burial facility for the final disposal of such LLW is now being constructed in Rokkasho-Mura, Aomori Prefecture by Japan Nuclear Fuel Limited (JNFL) and the facility will commence operation in December 1992. Nuclear Fuel Transport Co., Ltd.(NFT) will assume the responsibility for LLW transport from power stations through to the burial facility.

For the time being, LLW to be transported will be mixture of liquid wastes/sludge and cement/asphalt and these will be solidified uniformly in the drums of standard size.
Transport volume is expected to be 25,000 drums per year.
As all of the nuclear power stations are located along coast lines in Japan, the transport will be mainly by sea, then to be followed by short land transport.

Mass LLW transport is the first attempt in Japan. Therefore, the latest technology from the viewpoint of equipment and operation will be adapted as far as possible to make the complete preparation for the transport and to enhance safety and confidence.

SUMMARY OF TRANSPORT SYSTEM

LLW Transport will be carried out with sea transport and land transport connected in series as follows. First of all, the drums stored in storage facilities of power stations, will be loaded into a transport packaging, which is a closure-type special container (8 drums each) following inspection necessary for burial disposal. Trucks loaded with 2 packages respectively will move to a reactor port on the site internal roads. Packages will be loaded by the ship's crane onto the LLW transport ship "SEIEI-MARU" moored on the quay. An

inspector's attendance is necessary at the time of loading because LLW are legally regarded as dangerous articles. The locations of power stations decide the navigation route of this ship. The vessel will arrive at Mutsu-Ogawara Port which is a public port in Rokkasho-Mura after 2 to 4 day voyage via the Sea of Japan or the Pacific Ocean.

A bridge crane located on the quay will be used to unload packages at the said Mutsu-Ogawara Port, and 2 packages will be loaded onto a LLW dedicated-truck at a time. The radiation level will be measured by the gate monitor positioned beside the crane and the land transport will begin after this measurement. Trucks which left the quay will drive on a short public road and then on the site internal road of JNFL to the burial facility. The distance between the quay and the burial facility is approximately 9 km (Fig. 2)

The outline of LLW transport system is showed in Fig. 3. After packages are received in the burial facility, drums are taken out from packagings, while emptied packagings will be transferred into the packagings storage facility to carry out inspection, cleaning, small repair and temporary store. Emptied packagings are returned back to each power station on the totally reverse route. The timing of such return is scheduled to be more than 6 months ahead of the next transport.

CHARACTERISTIC OF FACILITIES AND EQUIPMENT FOR TRANSPORT

(1) LLW Transport Ship 「Seiei-Maru」

Seiei-Maru is a special type of container ship dedicated solely to LLW transport and was built by Mitsubishi Heavy Industries, LTD. in September 1991. Deadweight capacity is set at 3,000 tons taking into account the size of nuclear power station ports.

This ship has seven holds and can carry 384 transport packagings (3,072 drums) at the maximum. Seiei-Maru has a structure reflecting the maximum safety in accordance with 「Standards for Equipment Structure」 issued by Japanese Ministry of Transport.

Major characteristics of this ship include a double-hull structure and a double-bottom structure which provide anti-sinking quality against collision and stranding, concrete shielding which protect crews from radiation exposure (not greater than 1m Sv/year), special navigation equipment for a safer voyage, an automated on-board crane which provides efficient loading and unloading operations at the power station ports.

(2) Transport Packaging

LLW packaging is a special container which can carry eight drums. This packaging is smaller than general containers, and the size was decided for the sake of easy operation in storage facilities of power stations.

This packaging meets the requirements for IP-2 as stipulated in IAEA transport regulations. For example, the packaging can endure a drop test from a height of 1.2m. A small transmitter is attached to each packaging and the registration No. can read automatically (data carrier system). The total number of packagings of 3,000 was decided as a result of simulation study, and these packagings are under manufacture at a maker in

Rokkasho-Mura.

(3) Quay Crane

A bridge crane with the lifting capacity of 25 tons is located on the quay of Mutsu-Ogawara port in order to load/ packagings continuously. This crane moves on the rail (width:16m) built along the quay, and loading at any position. When the crane will not be used, the crane can be moved to a parking area via the curved rail. From the viewpoint of reduction of radiation expose, the operation of the crane is automated (same as the on-board crane of Seiei-Maru). Namely, the crane is operated automatically in accordance with the program put in memory in advance. Therefore, crane operators just make a few small adjustments manually while monitoring loading/unloading works on TV at a distance.

(4) Transport Vehicle

Large trucks with a loading capacity of 11 ton will be exclusively used for land transport, and each truck carries 2 packages (each weight 5 tons) at a time. The number of trucks is 12, and the trucks will shuttle between the quay of Mutsu-Ogawara port and LLW burial site leaving every several minutes. Characteristics of the trucks are as follows. First, the trucks do not have the carrier bed in order to reduce their own weight. Second, a steel shielding plate is attached in order to reduce radiation exposure. Third, tie-down/ untying operations can be remotely managed in driving seats of the trucks. In addition, the brake systems have anti-lock brake systems and anti-spin regulators in order to prevent slips on snowy roads in winter.

(5) Gate-Monitor

When the vehicles loaded with radioactive materials run on public roads, it is necessary to measure the radiation dose-rate around the vehicles in advance and confirm that the level is less than the criteria (Surface of vehicles: less than 2m Sv/h, 1m from vehicles: 0.1m Sv/h). The gate monitor is an equipment to automatically measure the radiation dose-rate of vehicles.

The vehicles enter the gate-shaped space and the radiation dose-rate on the surface of vehicles and at 1m from vehicles at 22 points is confirmed in a short time.

(6) Transport Packagings Storage Facility

Emptied transport packagings will be returned back to each power station in preparation for the next LLW transport. Prior to the said return, some operations such as inspection, cleaning, and small repair (if necessary) have to be done beforehand. This storage facility is being built in LLW burial site and will receive about 40 empty packagings a day. This facility consists of the indoor inspection area, the indoor storage area, and the outdoor storage area. The maximum number of empty packagings which can be temporarily stored is 1500.

Transport plan and management

Prior to the actual transport we have to establish an annual transport plan. We ask each power station for their requests/comments on the quantity and the timing of the transport and so on, and need to elaborate a most rationalised shipment schedule of "Saiei-Maru" in line with said requests/comments.

Under such circumstance, we have developed a computerized planning system, which can provide

immediately a suitable shipment schedule by inputting various data such as requests and restriction of each power station. We believe that this computerized planning system could work effectively when the shipment schedule has to be changed suddenly due to unexpected reasons such as bad weather.

In the case of LLW transport, we need strict management from various viewpoints like legal procedures, data control, safety operation and so on.

Consequently, a computerized overall management system has been also developed in order to support various management tasks.
This management system has several functions such as preparation of the various reports for packages, automatic crane operation programme, distribution of the packagings, radiation monitoring, automatic plotting of navigation, etc. It would remarkably contribute to improve the safety and reliance of the transport operations.

The computer can be accessed both from the head office (Tokyo) and Rakkasho transport office for input and output operations.

Closing Remark

In order to promote unclear power generation, it is inevitably essential to establish the most reliable transport system for radioactive wastes.

To this date, NFT, has been in charge of the transportation of spent fuels to be delivered to TOKAI reprocessing plant in Ibaraki-pref.
It is our vital wish to accomplish future transport of low level wastes successfully with our every effort.

And furthermore, in the near future NFT will be responsible for the transportation of spent fuels to Japanese commercial reprocessing plant in Rokkasho-Mura as well as the land transport of vitrified residues to be returned from Europe.

Fig 1. Locations of Power Plants and Rokkasho Fuel Cycle Facilities

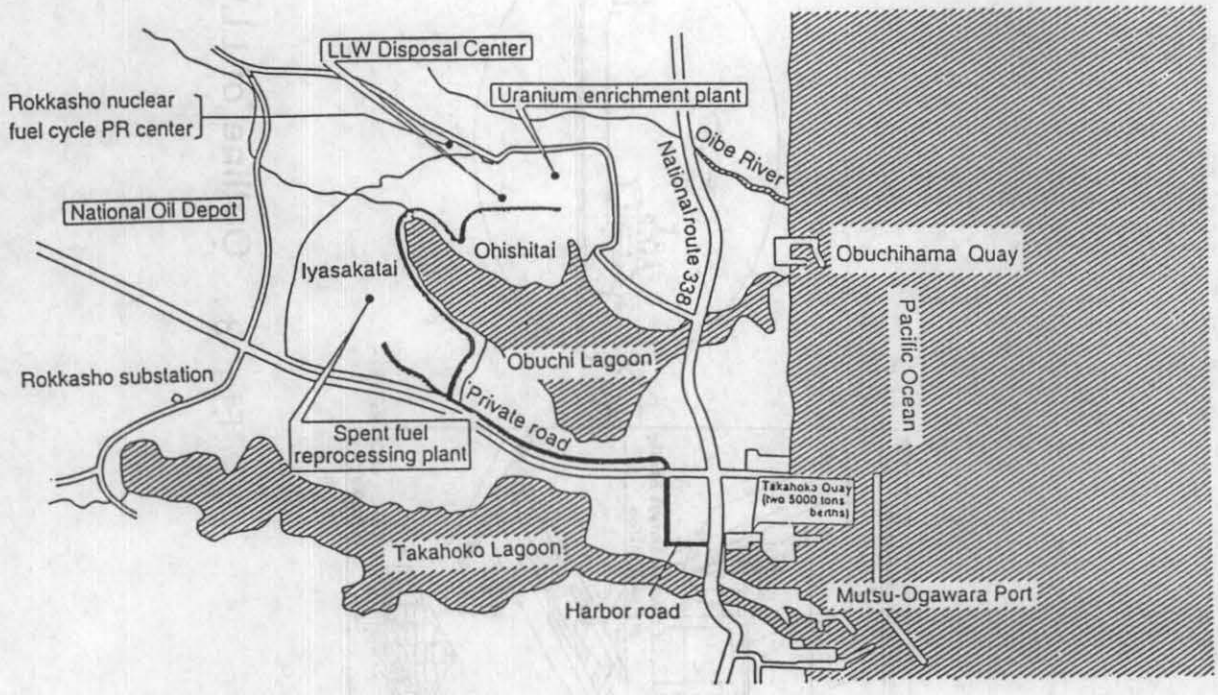

Fig 2. Transport Route Map

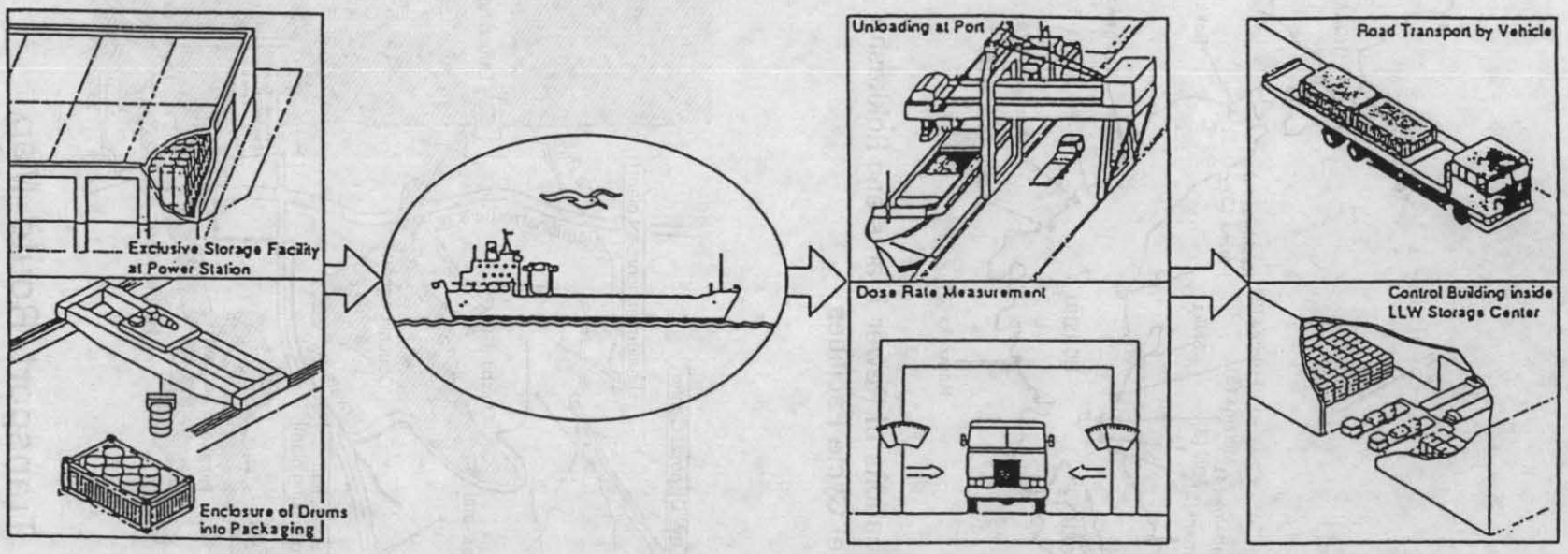

Fig 3. Outline of LLW Transport System