

## DOMESTIC TRANSPORT FOR NUCLEAR FUEL CYCLE IN JAPAN

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### SUMMARY

Recycling of nuclear fuel is the basic policy of Japan. Domestic transport of nuclear materials is assigned to the exclusively dedicated firm, Nuclear Fuel Transport Company(NFT) which plays a central role in the transport of spent fuel, VHLW, UF<sub>6</sub> and LLW.

In Japan, nuclear power plants and fuel cycle facilities are all located on the sea coast or close thereto, therefore, nuclear transport is mostly carried out by sea.

Domestic transport of spent fuel has been carried out since 1978 from nuclear power plants to the Tokai Reprocessing Plant. The amount of spent fuel transported by the end of March 1997 is approximately 900 tons. In the near future spent fuel will be transported to Rokkasho Reprocessing Plant of Japan Nuclear Fuel Limited(JNFL), which is under construction in Aomori Prefecture.

Terminal overland transport of VHLW started in 1995, receiving it from La Hague Reprocessing Plant of COGEMA, France. It will continue routinely in the future.

NFT started domestic transport of UF<sub>6</sub> in 1996, receiving it from overseas in 48Y cylinders and transferring it overland to the Rokkasho Enrichment Plant. It will also continue routinely in the future.

Transport of LLW has been carried out since 1992 and as of March 1997, approximately 90,000 LLW drums were moved from nuclear power plants to the Rokkasho LLW Disposal Center.

The transport has been performed mostly in orderly manner and demonstrated the safety of nuclear fuel cycle transport. With further reliance both from the consignors and local residents it is hoped that the transport will contribute to the fuel cycle activities.

### INTRODUCTION

In Japan, research and development of nuclear energy have been carried out in various fields of application on the basic policy of recycling of nuclear fuel materials. In June 1971 Japan's first reprocessing plant of the Power Reactor and Nuclear Fuel Development Corporation(PNC) commenced its construction in Tokai-mura, Ibaraki Prefecture and went into commission in January 1981.

Uranium enrichment started in 1982 at PNC's Pilot Plant in Ningyotoge, Okayama Prefecture. However, uranium enrichment has been totally depended on overseas, mostly on USA and Canada. Reprocessing of spent fuel also has been assigned to the overseas reprocessing plants

of BNFL and COGEMA because PNC's Tokai Reprocessing Plant can treat only a part of spent fuel generated in Japan.

To cope with such situations construction of nuclear fuel cycle facilities of uranium enrichment, spent fuel reprocessing and LLW disposal was decided by Japanese utilities in April 1984, and in April 1985, the site was selected at Rokkasho-mura, Aomori Prefecture

At first Uranium Enrichment Plant was commissioned in March 1992, followed by start-up of LLW Disposal Center in December 1992. The Reprocessing Plant is planned to receive spent fuel in March 1998 and to start operation in 2003.

Domestic transport for nuclear fuel cycle will be described in the following.

## TRANSPORT OF LLW

Assigned by electric utilities, NFT started the transport of LLW in December 1992 from nuclear power plants to the LLW Disposal Center of JNFL.

The system for LLW transport consists of followings:

- At a nuclear power plant, LLW drums are confirmed to comply with disposal requirements and then they are packaged in the dedicated containers, eight for each, and transferred to the on-site private port or near-by public port.
- LLW containers are loaded into the dedicated LLW transport ship "Sei-ei Maru" by means of on-board crane.
- The ship transport the LLW containers to Mutsu-Ogawara port(MO port)
- At the MO port, LLW containers are unloaded from the ship by a 25-ton wharf crane and loaded onto LLW transport trucks, two for each, and radiation level around the vehicle is checked by means of an automatic radiation measurement equipment.
- LLW containers are transferred by way of private road to LLW Disposal Center, which is located approximately nine kilometers away from the wharf and delivered to JNFL.
- LLW drums are unloaded from the containers, conformed again for compliance with disposal requirements and buried in a concrete pit.

The system for LLW transport is illustrated in figure 1.

Number of drums transported from nuclear power plants to LLW Disposal Center amounts to approximately 90,000 by March 1997 as shown in Figure 2.

## TRANSPORT OF SPENT FUEL

Assigned by electric utilities, NFT started in January 1977 to transport spent fuel(SF) from nuclear power plants to Tokai Reprocessing Plant of PNC.

The system for SF transport consists of followings:

- At a nuclear power plant, SF is loaded into dedicated casks, 7 PWR or 17 BWR fuel assemblies for each cask.  
After the casks have been confirmed to comply with the regulatory requirements, they are transferred to the on-site private port or near-by public port.
- SF casks are loaded into the dedicated SF transport ship "Hinoura Maru" by means of a wharf crane.
- The ship transport the SF casks to the private port of Japan Atomic Power Company(JAPC) located in Tokai-mura.

- At the port, SF casks are unloaded from the ship by a wharf crane and loaded onto SF transport truck-trailor. After assuring safety of casks they are transported in a fleet to the Tokai Reprocessing Plant through the premises of JAPC and Japan Atomic Energy Research Institute.

The system for SF transport is illustrated in figure 3.

SF transported from nuclear power plants to the Tokai Reprocessing Plant was approximately 860 tons as of March 1997 as shown in Figure 4.

#### TRANSPORT OF VHLW

Assigned by JNFL, NFT started to transport vitrified high level wastes(VHLW) from MO port to JNFL's Waste Management Facility in April 1995.

The system for VHLW transport consists of followings.

- At the reprocessing plant overseas VHLW is contained in a canister in a form of glass and loaded in a dedicated cask, 20 or 28 canisters for each cask. After the casks have been confirmed to comply with the regulatory requirements, they are transported to Japan(MO port) by a PNTL ship.
- Having arrived at MO port, VHLW casks are unloaded from the ship by means of a 150-ton wharf crane to a dedicated vehicle. After they are confirmed to comply with the regulatory requirements, they are transported via JNFL's private road to the Waste Management Facility, which is located approximately nine kilometers away from the port.  
Method of transport is basically same as that of SF. The system for VHLW transport is illustrated in figure 5.

Between April 1995 and March 1996, 68 VHLW canisters have been transported from overseas to JNFL.

#### TRANSPORT OF NATURAL UF<sub>6</sub>

Assigned by JNFL, NFT started to transport natural UF<sub>6</sub> from MO port to JNFL's Enrichment Plant in September 1996.

The system for UF<sub>6</sub> transport consists of followings.

- At the overseas conversion plant natural UF<sub>6</sub> is contained in a 48Y cylinders mounted on a improved skid.  
After they have been confirmed to comply with the regulatory requirements, they are transported to Japan(MO port) by a chartered ship.
- Having arrived at MO port, 48Y cylinders mounted on a improved skid are unloaded from the ship by means of a 25-ton wharf crane to a trailor, one cylinder for each trailor.  
After they are confirmed to comply with the regulatory requirements, they are transported via JNFL's private road to the Uranium Enrichment Facility, which is located approximately nine kilometers away from the port.  
48Y cylinders are delivered to JNFL and the skids are returned and stored at a warehouse

for further use.

Between September 1995 and July 1996, 150 units of 48Y cylinders have been transported from MO port to JNFL.

## CONCLUSION

Domestic transport for nuclear fuel cycle has been carried out in Japan since 1977. Spent fuel has been transported to PNC's Tokai Reprocessing Plant since 1977, LLW to JNFL Disposal Center since 1992, VHLW to JNFL Waste Management Facility since 1995 and natural UF<sub>6</sub> from MO port to JNFL Enrichment Plant since 1996. Thanks to close cooperation from transport enterprises and local public there has been no noticeable incidents and the safety for nuclear transport has been demonstrated. The nuclear transport has indeed contributed to all facets of activities in nuclear fuel cycle.

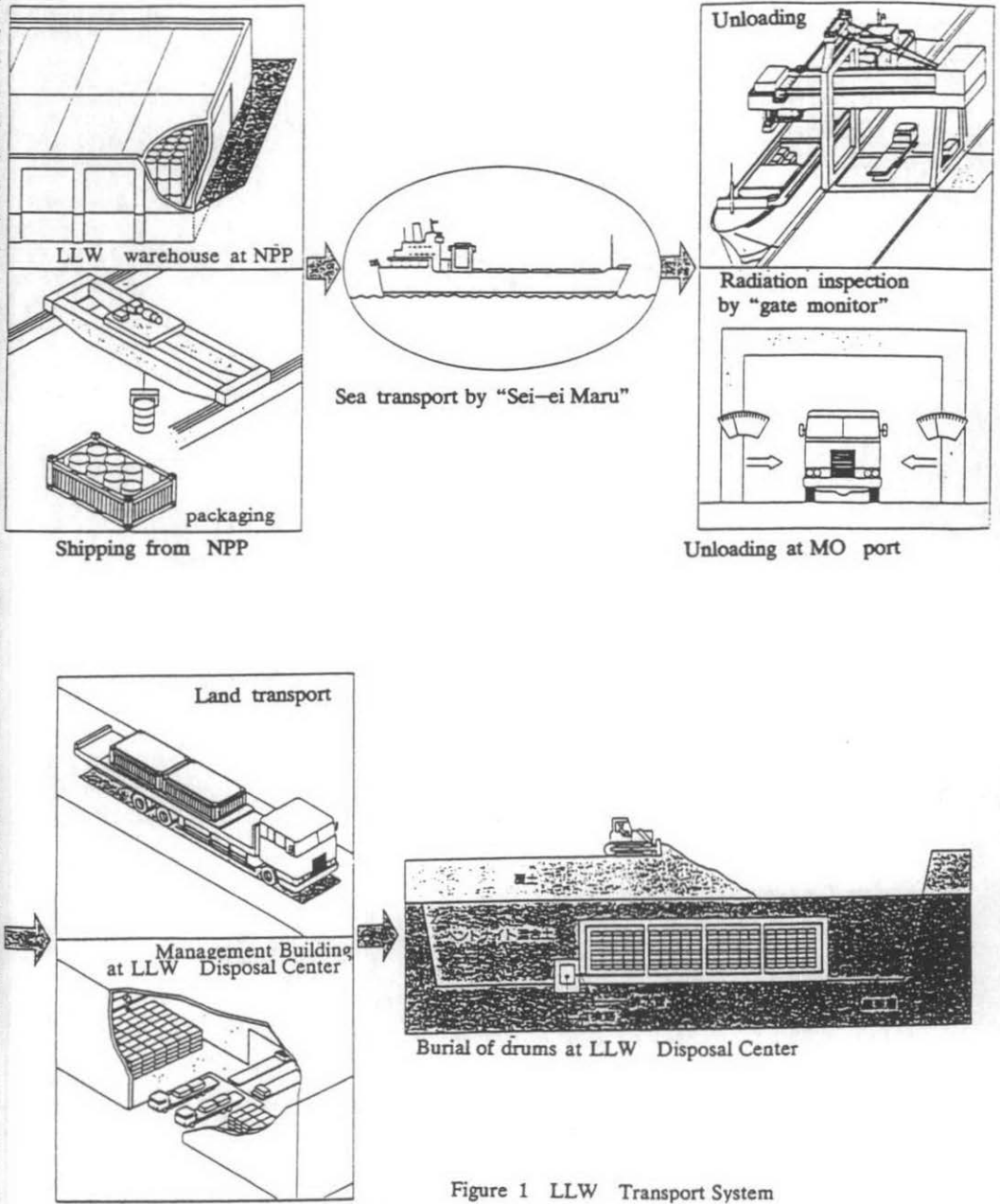


Figure 1 LLW Transport System

Land transport to LLW Disposal Center

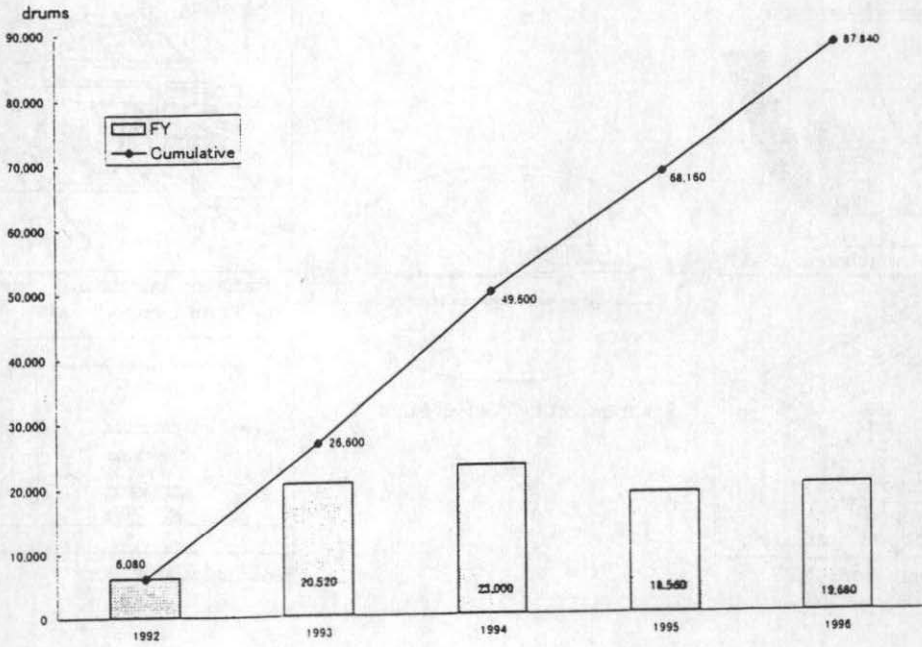


Figure 2 Transport Record of LLW

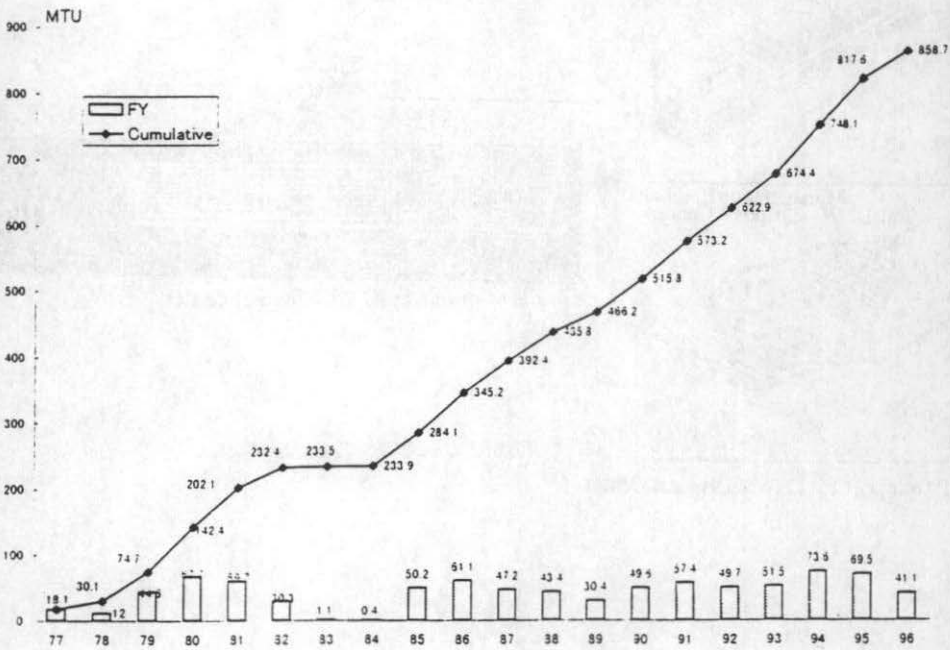


Figure 4 Transport Record of SF

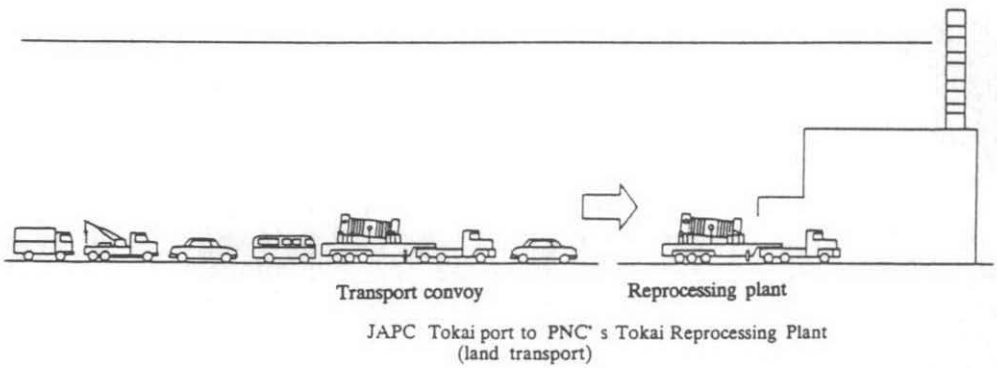
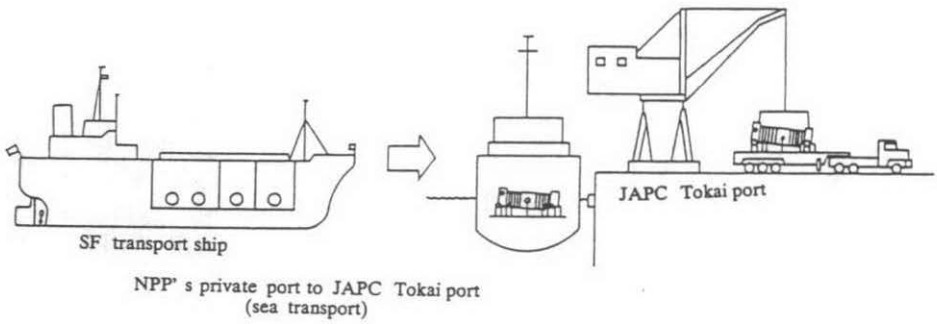
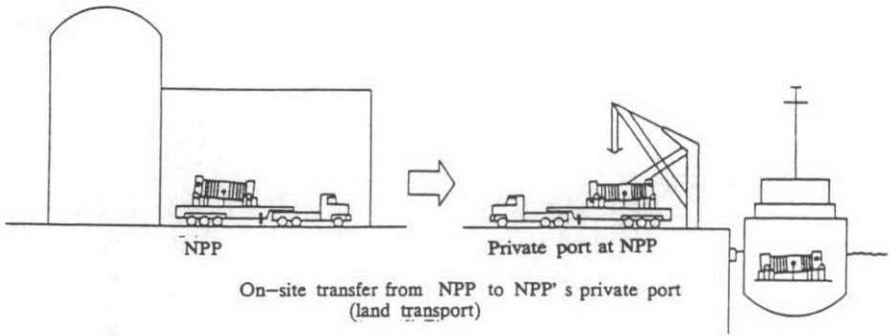


Figure 3 SF Transport System



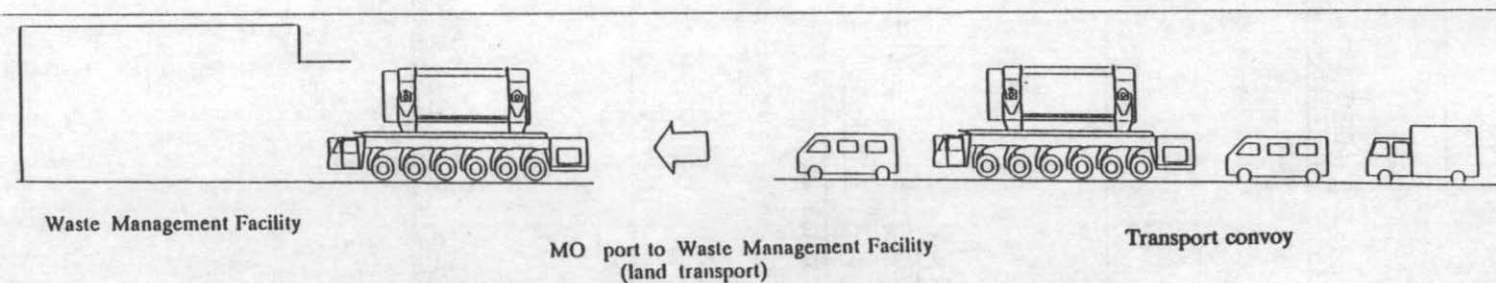
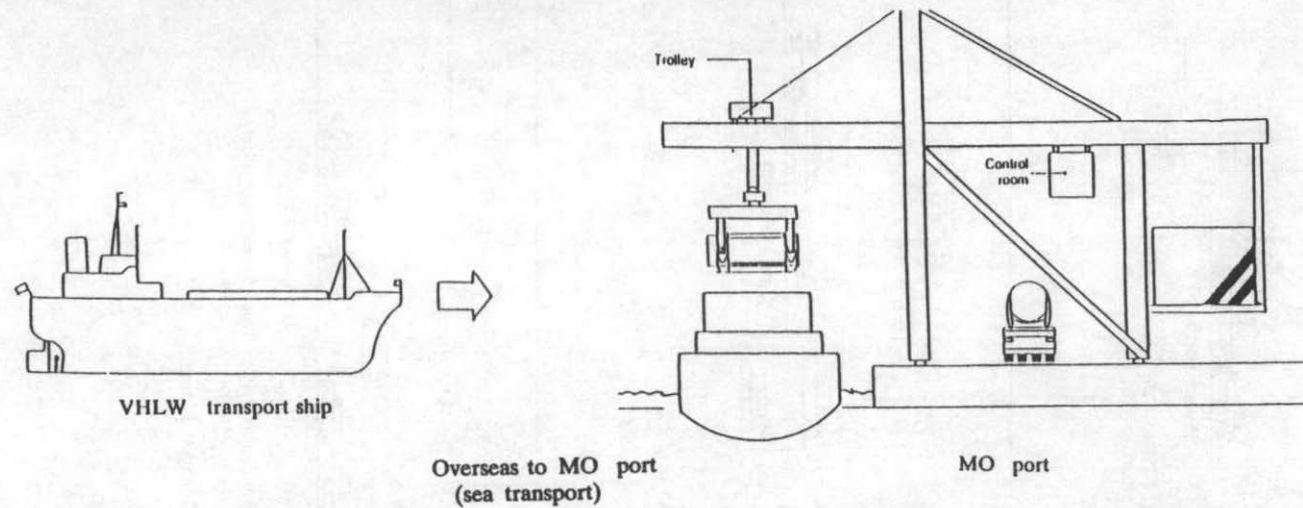


Figure 5 VHLW Transport system