COOPERATION FOR PACKAGE SAFETY IN VHLW TRANSPORTS FROM FRANCE TO JAPAN

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SUMMARY

This paper deals with the regulatory aspects related to the return of Vitrified High Level Waste (VHLW) from France to Japan resulting from the implementation of the spent fuel reprocessing contracts. Explanations are given on the differences in regulatory requirements and operational practices between Japan and France for a type B packaging specially developed for the transport of these vitrified wastes. It shows how a close cooperation has been established to resolve the various licensing and operational issues at the satisfaction of the Competent Authorities of the two countries.

INTRODUCTION

It is necessary to cooperate between France and Japan in the international transport of a nuclear material package, because of existing differences in domestic laws and regulations. Licensing systems for both countries and mutual cooperation for international transport between France and Japan is described for the case of Vitrified High Level Wastes (VHLW) which has already been carried out every year since 1995.

The contracts signed between COGEMA and its foreign customers for the reprocessing of their spent fuel call for the return of the corresponding waste to the countries of origin of this spent fuel.

The fission products contain 99% of the total radioactivity of the various waste separated from re-usable materials during reprocessing. These high level wastes, also called residues, are incorporated in a glass matrix which is poured in stainless steel canisters. These canisters are stainless steel cylinders, 1.34 m high and 0.43 m in diameter, each containing 150 litres, or 400 kg of glass. In this small volume, the waste resulting from the reprocessing of 1.3 t of uranium has been concentrated. At the La Hague reprocessing plant, the glass canisters are kept in air cooled pits, and a similar facility has been constructed at Rokkasho-Mura to provide means for their interim storage.

TRANSPORT OF VHLW FROM FRANCE TO JAPAN

Comparison of licensing systems for a nuclear material transport between France and Japan is shown in Table 1. In Japan, a generic packaging type approval, an individual packaging registration and a package confirmation are performed by the competent authority. Since the designer of VHLW packaging is Transnucléaire and owner is COGEMA, and also because a prior-to-shipment inspection must be carried out in France, a mutual cooperation is necessary to obtain Japanese competent authority approval of design, packaging and package.

The procedures for licensing are as follows (Figure 1).

① Design of package
② Fabrication of packaging
③ Preparation of package
④ Shipment

The French organizations plan the schedule for prior-to-shipment inspection with Japanese counterparts and provides Japan with data on VHLW and the package. France also carries out periodic inspections of the packagings and provides Japan with the inspection data so as to apply for the packaging approval for further use.

ACTIVITIES IN FRANCE

Being aware that the transports of vitrified residues had to be performed according to the terms of the reprocessing contracts, Transnucléaire started the design of a new cask, specially optimized for this content. Within a total weight of around 113 tons, this cask can transport either 28 or 20 glass canisters, according to their heat power.

A full set of regulatory testing has been performed on a 1/3 scale model of the cask at the Transnucléaire test facility situated in the CEA-Moronvilliers center and the Safety Analysis Report (SAR) of the cask has been submitted to the French Competent Authority.

A Type B(U)F license has been granted in France to this cask model, but instead of being directly validated in Japan, specific rules require, as explained below, that a second SAR be prepared in Japan.

To allow the loading of vitrified waste in TN 28 VT casks, a special facility had to be constructed at La Hague. It includes a receiving area in which the canisters are transferred from the storage building, using a shuttle cask with a capacity of 7 canisters. This shuttle casks has been designed to reproduce the layout of one level of canisters in the TN 28 VT transport cask.

The canisters can be unloaded and automatically transferred to a shielded inspection cell where the various checks take place. A separate area is devoted to the preparation of the cask before loading and to the associated geometric and operational checks.

Several years ago, the specifications of the glass produced by COGEMA have been approved by the French Safety Authorities and the Japanese authorities judged that the results they had studied in the specification were proper.

After the glass canisters have been checked in the inspection cell and all the associated documentation attesting ot the compliance of the product to the agreed specification in the presence of Japanese representatives, the cask is docked under the loading cell and leaktightness between the cask cavity and the cell is established with inflatable seals. The canisters can then be lowered into the basket where their geometry allows to stack them on 4 levels. Loading operations take place in a dry atmosphere and are remote controlled, except for a few manual operations such as tightening down the lid bolts. This guarantees a very low dose uptake to the operators.

After loading, the cask is submitted to the various prior-to-shipment checks prescribed by the IAEA and by the specific Japanese regulations, as explained below.

ACTIVITIES IN JAPAN

PACKAGE DESIGN APPROVAL

At first, France delivers the certificate of B(U)F package design approval as the country of origin of the design, and then it is also necessary to acquire the certificate of package design approval in Japan.
Based on the initial SAR drawn-up by Transnucléaire, a Safety Analysis Report (SAR) has been prepared by NFT, in cooperation with Transnuclear Ltd, Tokyo, according to an STA guideline and has been examined by STA. Therefore, it was necessary that Transnucléaire Paris provided Transnuclear Ltd, Tokyo with data on the design of the package before the application of package design approval and during examination by STA.
In order to gather still more information for SAR examination, STA performed regulatory tests on full scale packagings to confirm the safety of the package design: drop test, fire test and immersion test. An immersion test at a depth of 200 m was carried out according to the IAEA Regulations 1996 edition, although it is not prescribed in the IAEA Regulations 1985 edition. Moreover, STA performed drop tests on canisters for VHLW by simulating those fabricated by COGEMA to get data on leaktightness after drop. Based on the data obtained, STA evaluated and issued certification of package design approval.
As a result, STA judged that it was necessary to get data on VHLW dose rate. Therefore, certificate of package design approval was issued under condition that dose rate is measured around the package and the result evaluated before prior-to-shipment inspection.

FABRICATION OF PACKAGING

A qualified supplier has been selected in France to manufacture a first series of 4 casks needed for the transport of glass-containing canisters to Japan.
Japanese Competent Authority inspects packagings during fabrication to confirm that they are fabricated to the approved design even if packagings are fabricated in a country outside of

Japan. When the inspection data are reviewed and accepted, certificates of packaging approval are issued after manufacture is completed and the packagings are then available for use.
As assigned by COGEMA, the owner of the packagings, Transnucléaire prepares inspection procedures for the packagings and performs the manufacturing follow-up. It is necessary that items and the schedule for STA inspection are determined, based on the information supplied by the French organizations. STA prescribes that packagings shall be inspected according to the procedures shown in Table 2, and the inspection results shall be submitted to STA. Through witness inspection or review of records of the inspections, STA confirms that the packagings have been fabricated in conformity with the approved design.

Certificates of packaging approval must be renewed and application shall be made more than 30 days before the end of validity of the certificates. Periodic inspection of packagings shall be carried out at regular intervals so that STA confirms they maintain their performances. Therefore, it is necessary that periodic inspections are carried out and inspection records are provided to Japan when the packagings are maintained in France.

PREPARATION OF PACKAGE

STA will witness the inspection before shipment at COGEMA facility to check that the package satisfies the technical criteria. Inspection procedures are shown in Table 3. The inspections include, from loading of canisters to shipment as follows:

① Visual inspection
② Lifting test
③ Weight check
④ Surface contamination check
⑤ Dose rate check
⑥ Temperature measurement
⑦ Leak test
⑧ Pressure measurement
⑨ Inspection of content

Therefore, it is necessary to adjust the inspection schedule between France and Japan to carry out these inspections.
Dose rate around the package was measured according to the conditions of the certificate of package design approval. The result was evaluated and the safety analysis on the package was validated.

CONCLUSION

National rules governing the transport of radioactive materials are all established on the common basis provided by the IAEA Regulations. However, substantial differences exist between several countries in some aspects of the rules and in their practical application. The return of vitrified residues from France to Japan has given the opportunity of a large scale co-ordination between the various actors involved: Competent Authorities, cask designers, sea

and land transport operators. Several shipments have already been performed, implementing all multinationally applicable rules and under the strict supervision of the Competent Authorities involved.

Table 1: Comparison of regulatory system between France and Japan

ITEM	FRANCE	JAPAN
1. DESIGN APPROVAL	SAR is examined by the Competent Authority.	STA technical advisory group is organized. SAR, explained by applicant, is examined.
2. PACKAGING APPROVAL	① Individual packaging approval is not necessary and applicant guarantees that packagings are fabricated in conformity with the design. ② Competent Authority checks quality assurance before and during fabrication and reserves the right to perform inspections during packaging fabrication.	① STA witnesses inspections of all packagings and registers each packaging individually. ② Periodic Inspection is scheduled and approved
3. CONFIRMATION OF PACKAGE	Competent Authority confirms that the package complies with the IAEA Regulations.	STA witnesses inspection before shipment and confirms the safety of package.

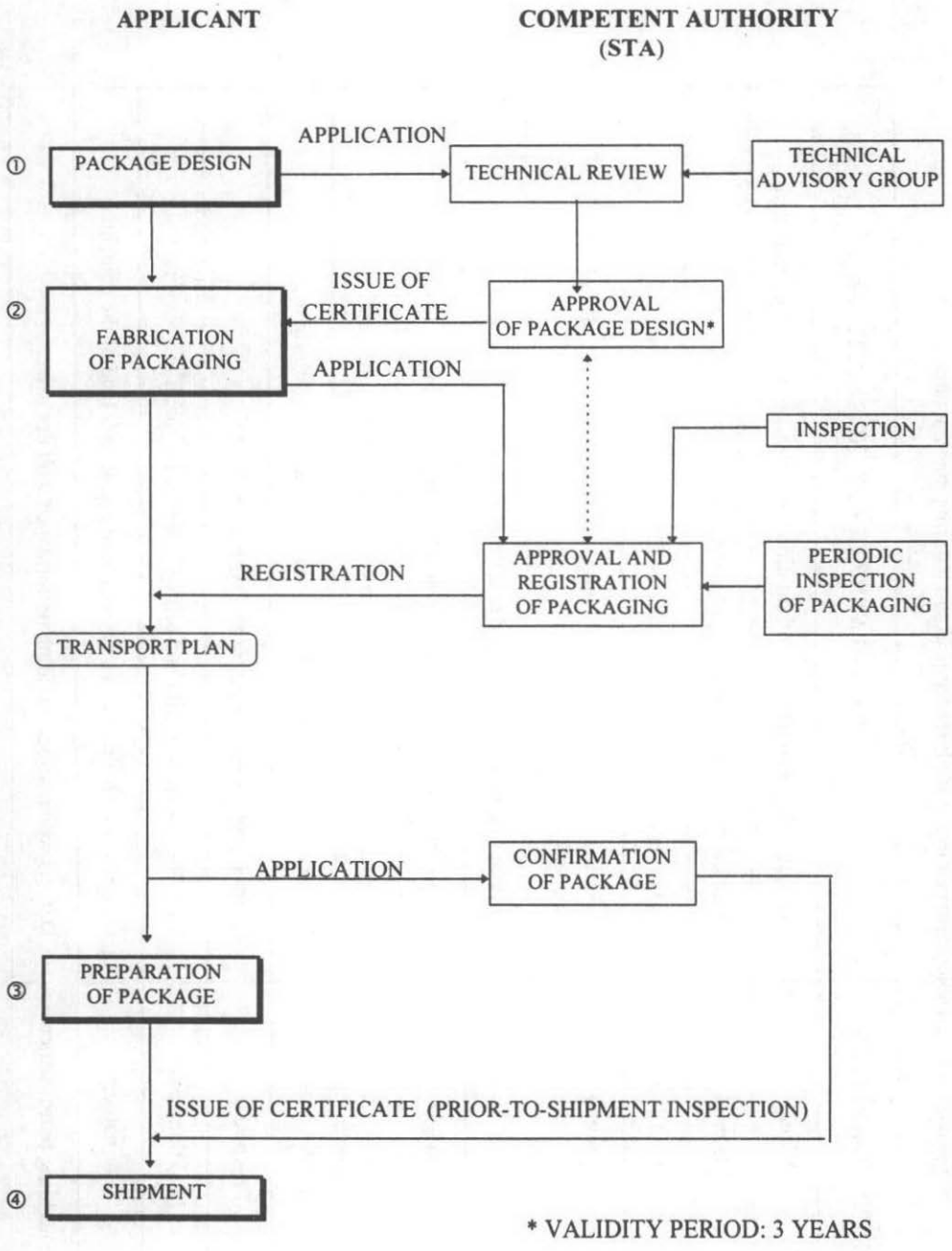

Figure 1: Japanese regulatory system

Table 2: Inspection procedures for packaging during manufacture

INSPECTION ITEM	METHOD AND ACCEPTANCE CRITERIA
Visual	Flaws, cracks, anomaly of configuration are not accepted on any component
Material	Traceability of all materials is guaranteed through q.a. Program
Dimension	All components are within tolerances specified in detail drawings
Welding	Qualified methods and operators are used - checks by x ray, ultrasonic and dye penetrant
Lifting load	Trunnions shall endure the load of 2 times the package weight
Weight	Weight of each component is measured and the total weight verified
Operation	Valves and safety devices are checked already fitted on the cask
Handling test	Lifting and tilting of cask shall be performed without problems
Pressure test	Internal pressure test is performed with air in cavity
Leaktightness	Each leaktightness for lid and orifice is 1.33×10^{-3} pa.m^3/s
Thermal test	Performed with electric heaters representing the heat load of the content
Shielding performance	Defects which affect shielding performance shall not exist

Table 3: Procedure of prior-to- shipment inspection

INSPECTION ITEM	INSPECTION METHOD	ACCEPTANCE CRITERIA
1. Visual inspection	Visual observation	The surface condition and the configuration of the packaging shall have no anomaly
2. Lifting test	During handling operations	Smooth handling
3. Weight check	Calculation by summing up the weight of cask and content	The result shall not exceed 113.5 tons
4. Surface contamination check	Inspection by smear test method	α emitters : $\leq$ 0.4 bq/cm2 others : $\leq$ 4 bq/cm2
5. Dose rate check	Measurement by survey meters	$\leq$ 2 msv/hr (surface), $\leq$ 0.1msv/hr (at 1m)
6. Temperature measurement	Measurement by thermocouple	$\leq$ 85°c at surface of the cask
7. Leak test	Measurement of leak rates by pressure rise method	Eachleak rate (lid sealing flange,orifice) shall not exceed 1.33×10^{-3} pa.m^3/s.
8. Pressure measurement	The initial pressure of the neutral gas introduced into the packaging is measured	The initial pressure shall not exceed the specified level
9. Inspection of content	① Visual appearance ② Weight of a canister ③ Glass chemical composition ④ Heat generation ⑤ Radioactivity these items are confirmed by cogema data sheets	① no anomalies ② $\leq$ 550 kg (average : 500 kg) ③ as per accepted specification ④ $\leq$ 41 kw (28 canisters), $\leq$ 1.46 kw (per canister) $\leq$ 40 kw (20 canisters), $\leq$ 2 kw (per canister) ⑤ To satisfy the formura specified in design approval certificate