HOW TO TRANSPORT A CASK WHICH HAS BEEN LOADED AND THEN STORED FOR SEVERAL DECADES

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ABSTRACT

One option for the storage of spent fuel which is not reprocessed immediately is the use of dual purpose casks suitable for transport *and* storage. Similarly, high level waste or residues can also be stored in dual purpose casks before an appropriate repository has been commissioned.

Some authorities license the storage facility with the conditions that the package design is approved according to the IAEA Regulations for the Safe Transport of Radioactive Material (TS-R-1).

Whilst the storage facility needs to be licensed for a middle term (potentially several decades), package design approvals for transport are issued with a limited period of validity (typically 3 to 5 years).

One issue is then the maintenance of the package design approval for transport. What happens if after a certain period of time the approval cannot be renewed / prolonged (or re-issued if there was no need for a transport approval during the storage period), either because of a revision in the Transport Regulations or because of a new safety review? Is it possible to synchronize the expiration dates of the transport approval (short term) and of the storage facility license (middle term)?

Several options have been considered by the Waste and Spent Fuel Transport Industry Working Group within the World Nuclear Transport Institute (WNTI). These options are:

- To issue package design approvals for transport with a longer validity for dual purpose casks than for "standard" package designs, and to synchronize the expiration of the transport approval with the validity of the storage facility license;
- To stabilize the Transport Regulations for the dual purpose packages;
- To revise the Transport Regulations in order to allow dual purpose casks prepared for transport not later than a given date under a certain edition of the Regulations to continue in transport, whatever is the later edition of the Regulations;
- To separate the storage license and the package design approval for transport, and at least to avoid requiring maintenance of the transport approval along the life of the storage facility, and then to license the final transport through a new package design approval or through the special arrangement procedure.

The paper discusses these options in detail.

0. INTRODUCTION

After having been burnt in a reactor, the fuel assemblies can be managed following different routes. They can be reprocessed in order to recycle valuable materials such as uranium and plutonium and to optimize the volume and the residues. This option has been implemented for several decades in countries such as France, Japan and the Netherlands. They can also be stored for an interim period, in pools or in casks, pending the decision for a definitive option for the management of the spent fuel. This is the current practice in countries such as Switzerland and the United States of America (USA).

Another option for the storage of spent fuel which is not immediately reprocessed is the use of dual purpose casks suitable for transport *and* storage. This is what is done today in Belgium and in Germany. In the same manner, high level waste or residues can also be stored in dual purpose casks before an appropriate repository has been commissioned.

Some authorities license the facility where the dual purpose casks are stored with the conditions that the package design is approved according to the IAEA Regulations for the Safe Transport of Radioactive Material (TS-R-1).

Whilst the storage facility needs to be licensed for a middle term (potentially several decades), package design approvals for transport are issued with a limited period of validity (typically 3 to 5 years).

One issue is then the maintenance of the package design approval for transport. What happens if after a certain period of time the approval cannot be renewed / prolonged (or re-issued if there was no need for a transport approval during the storage period), either because of a revision in the Transport Regulations or because of a new safety review? Is it possible to synchronize the expiration dates of the transport approval (short term) and of the storage facility license (middle term)?

In 2008, the World Nuclear Transport Institute (WNTI) decided to set-up a working group of specialists and interested parties to promote the development of the safe and efficient transport of radioactive waste and spent fuel. In broad terms, the aims of the group can be expressed as:

- identifying issues with the potential to adversely affect the safety or efficiency of radioactive waste and spent fuel transports,
- using the knowledge and experience of its members to obtain a full understanding of these issues, and to develop an industry position,
- disseminating the results to shippers and regulators.

The WNTI Waste and Spent Fuel Transport Industry Working Group has considered the issue of the maintenance of the package design approval for transport during the storage period. It identified several options to solve this problem: their description, viability, pros and cons are discussed thoroughly hereafter. The means to transport - at the end of the storage period – a cask which has been loaded then stored during several decades was also addressed by the Working Group and are discussed here as well.

1. TO MAINTAIN PACKAGE DESIGN APPROVALS

The first option is to transport a cask after several decades of storage by maintaining the package design approval for transport during the several-decade storage period.

This is the basis of the German policy on this issue. In this country, package design approvals (for transport) for dual purpose casks are issued with a period of validity typically of five years, which is longer than other "standard" approvals (typically three years). For dual-purpose casks which effectively are not transported, this validity period is extended to 10 years, and potentially – in the near future – to 20 years, with the conditions of periodic confirmation of compliance of the package design with the new editions of the Regulations.

This approach is fully compatible with the transitional arrangements which are set forth in the IAEA Transport Regulations. In its 1996 Edition, and its following editions as well, it is stated that "packagings manufactured to a package design approved by the competent authority under the provisions of the 1985 or 1985 (As Amended 1990) <*and following*> Editions of these Regulations may continue to be used (…)" (providing some limited conditions are met). There is no end of life or end of use date imposed.

This approach imposes a periodic review of the package design with a potential question mark (and associated uncertainties) about the method of assessments which could be implemented by the competent authorities in a few decades regarding safety analysis report prepared today or even yesterday. However and most importantly, it allows a full approval of the package design to be permanently available.

2. TO ISSUE PACKAGE DESIGN APPROVALS WITH A LONG VALIDITY

The second option to make easier the transport of a cask at the end of the storage period is by issuing a package design approval for transport with a validity similar to that of the facility licence for storage. Ideally, this should allow the end of the validity of the package design approval for transport to synchronize with the facility licence for storage.

This could be done in the framework of the current IAEA Transport Regulations, under a unilateral decision of the competent authorities facing this issue, as there is no restriction in the Regulations regarding the length of the validity of the package design approval. It could also be done after a revision of the Regulations, in order to develop requirements for a new type of package: dual-purpose packages for transport and storage of spent fuel or high level waste.

It must be recognized that this option would probably be considered by many competent authorities as contrary to their general approach of the enforcement of the Regulations, and more precisely as opposed to the practice consisting in periodically reviewing the package design approvals and the technical basis which underpins the approvals.

3. TO STABILIZE THE TRANSPORT REGULATIONS FOR DUAL PURPOSE PACKAGES

The third option to facilitate the transport of a cask after several decades of storage is to definitively stabilize the IAEA Transport Regulations and, subsequently, to stop the periodic review and revision of these Regulations.

This could be done at least for the dual purpose packages through a revision of the IAEA Transport Regulations in order to develop requirements for a new type of package (dual-purpose packages for transport and storage of spent fuel and high level waste).

This third option could be considered as suffering from a significant flaw: it is against the general approach implemented by the IAEA to periodically review its Regulations. And this general approach comes from resolutions of the Board of Governors and from the General Conference. But in fact, this general principle is applicable to the current Regulations. If provisions dedicated to such dual-purpose packages are added to the current Regulations, then they could be considered as different Regulations, and the applicability of the principle of the periodic review and revision should be questioned.

4. TO ALLOW DUAL PURPOSE CASKS TO CONTINUE IN TRANSPORT

The fourth option is more radical: to revise the IAEA Transport Regulations in order to allow dual purpose casks prepared for transport not later than a given date under a certain edition of the Regulations to continue in transport, whatever is the later edition of the Regulations.

This should be an extension of the transitional arrangements which exist for packages not requiring competent authority approval of design (para. 815 of the 2009 Edition of the IAEA Transport Regulations) to all types of packages, or at least to the dual purpose casks. A draft text could be:

> "… packages prepared for transport not later than DATE under the YEAR editions of the Regulations may continue in transport …".

WNTI made such a proposal in the framework of the review / revision cycle which started in 2009. This proposal was not received positively by the competent authorities, though the need to continue to address the issue of the transport of a cask which has been loaded then stored for an extended period of time was widely recognised.

5. TO SEPARATE THE STORAGE LICENSE AND THE PACKAGE DESIGN APPROVAL

A fifth option was considered: to separate the storage license and the package design approval for transport, or at least to avoid requiring maintenance of the transport approval along the life of the storage facility, and then to license the final transport through a new package design approval or through the special arrangement procedure.

Some authorities responsible for storage facilities require that, as a condition of the storage license, a transport package design approval for transport is permanently valid. This is very

demanding, particularly at the time of the renewal of the approval for transport, as some delay cannot be prevented, nor avoided as authorities competent for transport may have a different agenda.

This fifth option alleviates the problem of the maintenance of the package design approval for transport during the storage period. For instance, now, the Swiss competent authorities require that the package design is approved (only) when loading the cask.

However, this does not allow transportation after several decades. To solve this problem, one of the four above options must be considered.

6. HOW TO TRANSPORT AFTER SEVERAL DECADES?

After having discussed the several options which may exist for keeping the package design approval for transport valid during the storage period, the critical questions is: how to transport a cask without difficulty which has been loaded and then stored safely for several decades?

> **6.0** At first, it is necessary to evaluate the condition of the package (i.e. the packaging and its contents). The condition of the package should be assessed through the results of the inspection programme implemented during the storage period, and completed – if necessary – by a specific programme applied before the shipment. The extent of both programmes should be agreed with the competent authority.

Then, several cases have to be considered, and each of them has to be discussed.

> **6.1** If the package design approval for transport is still valid, there is no administrative problem. The "only" issue to consider is to demonstrate that the package (the packaging and its contents: fuel assemblies or high level waste) still complies with the requirements of the package design approval for transport. This has to be done through the inspection discussed in paragraph 6.0.

> **6.2** If the package design approval for transport is no longer valid, then the inspection programme discussed in paragraph 6.0, completed as much as necessary by a testing and maintenance programme, should give assurance about the physical condition of the casks and to give confidence about the general safety of the package which was stored.

Then, if needed, it should be possible to transport the cask, either:

- through an updating of the safety assessment demonstrating the compliance of the package design with the Regulations applicable at the time of transport,

or

- with minor modifications of the cask if needed and sufficient, and subsequent updating of the safety assessment demonstrating the compliance of the package design with the Regulations applicable at the time of transport,

or

- through the special arrangement procedure (as a package design approval for transport was granted at the beginning of the storage period, the transport can probably be

performed with the appropriate level of safety when implementing reasonable additional provisions)

It is worth noting that, for packages which are used for the transport of spent fuel, the main requirements have not been changed for the last four decades. It can be expected that this regulatory stability will be maintained in the future. Therefore, what is considered as safe today will probably still be considered as safe in the next decades.

6.3. A different alternative is to store the fuel assemblies in a sealed storage canister and a concrete module or a metallic overpack, which are options implemented and / or considered in USA and Switzerland. When it is necessary, the sealed canister (including the fuel) can be transported in a transport packaging, complying with the applicable transport Regulations.

7. CONCLUSION

Storage of spent fuel in dual purpose casks designed to meet the requirements for both transport and storage is an option widely used for the management of spent fuel which is not reprocessed. It allows one to delay the decision about the final destination of the fuel assemblies: reprocessing or disposal.

However, the transport of these casks after an extended period of storage is not a trivial issue. Administrative issues arise because of the different time scales for which the approvals for storage and transport are valid: long for storage and relatively short for transport. Several options to deal with this issue have been identified and discussed in the paper. On this basis, a number of actions to assure a safe transport at the end of the storage period have also been identified.

Beyond the administrative issues, one technical issue is the ageing of the package, i.e. the radioactive contents and, probably less significantly, the cask. As the period for storage will probably extend beyond the original plan, this subject has received more and more notice, nationally and internationally. For instance, it was one of the topic of the “Spent fuel storage and transportation licensing conference and workshop” organized by the US Nuclear Regulatory Commission (NRC) by the end of June 2010 and also of the “International conference on management of spent fuel from nuclear power reactors” organized by the International Atomic Energy Agency (IAEA) in early June 2010. The need to further consider this issue was a common outcome of both conferences.

The IAEA is also considering setting up a group to study the issues involved in the long term storage of spent fuel in dual-purpose casks and its subsequent transport, possibly based on a holistic approach. It would be an opportunity to address the safety demonstration for dual use casks in terms of both extended periods of storage and also having good prospects to meet transport requirements at the end of the storage period. This could be part of the IAEA “International Project on Safety Assessment Driven Radioactive Waste Management Solutions” (SADRWMS).

The IAEA TRANsport Safety Standards Committee (TRANSSC) will also consider whether it is relevant to put on its agenda the evaluation of the need for new or revised transport safety

standards needed to address the unique challenges posed by long term storage of spent fuel and high level waste and the incidental transport for further processing or disposal.

Indubitably, WNTI will endeavour to keep being a significant voice on this issue and to bring its contribution and expertise.