DUAL/MULTI PURPOSE CANISTERS AND THE REPROCESSING OPTION

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SUMMARY

The DOE's multipurpose canister (MPC) concept is a versatile concept, that has been created in order to help DOE perform its legal duty of taking over the spent fuel from nuclear power plants. Although this program has been brought to a stop by the US Congress, it set a powerful trend among utilities in favor of dual purpose canistered systems for transport and storage of spent fuel in the USA. Simultaneously, several vendors do market canister based systems akin to the MPC. The present paper reviews the basis of the concept then shows how it may well be expanded to more options, in the USA and internationally, than strictly direct disposal in the USA by DOE.

INTRODUCTION

When the US DOE introduced the multipurpose canister (MPC) concept, it had three major goals:

- providing at reactor dry storage of spent fuel assemblies in order to remove the fuel from cooling pools, when a given nuclear power plant would be close to losing full core reserve,
- implementing a standardized transport system to carry the fuel to a repository or interim storage facility,
- using the canister as the containment for final disposal, presumably in a geological repository.

Although the original plans of DOE have now somewhat changed, their attractiveness with regard to the first two purposes has made it into a sort of reference and validation for canistered dual purpose systems, such as the NUHOMS® system of Transnuclear West. This system was in fact the first, wherefrom the MPC was conceptualized. It is the most widely used storage system in the USA.
Dual purpose systems make possible both interim storage of spent nuclear fuel and its safe transportation on public networks.

After describing the main features of a MPC system, the present paper will show that this concept needs not be limited to its original purposes and can also open up other avenues in the USA and elsewhere.

THE MPC CONCEPT

The American concepts of dual purpose canister or that of multipurpose canister have been initially oriented towards direct disposal of spent fuel. It has several advantages:

- standardization of a limited family of canisters for at reactor interim storage until the fuel can be taken over by DOE,
- reusable overpacks for transport to repository or to MRS (monitored retrievable storage) when these facilities become available,
- possible use for long term repository (final disposal), provided applicable specifications are finalized and can be met.

Interim storage:

The storage design relies on the implementation of the following items:

- a cylindrical canister made of medium thickness steel plates (25 mm), rolled and welded, that contain a fuel basket. This basket supports the spent fuel assemblies and transfers decay heat to the outer shell. It ensures criticality control under all conditions,
- a welded-on shielded plug that provides the interim storage containment. Automatic welding is a preferred mode of welding in order to limit defects and operator exposure,
- a shielded transfer container that allows handling the canister in and from the pool.
- a reinforced concrete ventilated structure (such as the NUHOMS® Horizontal shielding module-HSM) that provides shielding, physical protection, cooling by natural convection of air around the canister. This structure is made of precast reinforced concrete that constitutes a temporary structure that poses no difficulty for later dismantling,
- a set of ancillary equipment such as trailer, hydraulic jacks, vacuum drying and leak testing systems in order to effect canister preparation and transfer.

The design basis is similar to a certain extent to that of a nuclear facility augmented by specifics of an interim storage installation.

Transport:

The canister is transported inside an overpack that is to be licensed for transport, such as NUHOMS® MP 187 (see figure 1). The overpack provides shielding, mechanical protection and containment with respect to the transport regulatory accident conditions.

It can be transported like any licensed packaging for radioactive materials, within the framework of the applicable transport regulations. The preferred mode is railway transportation, because of the overweight character of a road transport.

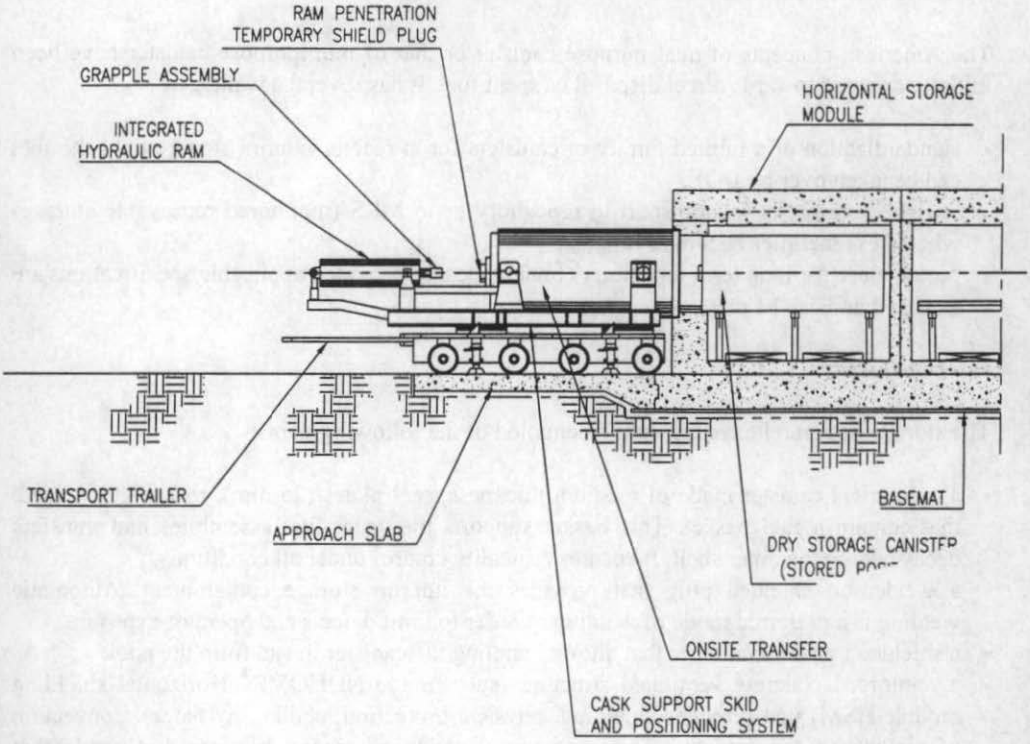

Figure 1: NUHOMS® System Components, Structures and Transfer Equipment

Long term repository:

After sufficient cooling in interim storage, the canisters can be backfilled with a medium, still to be defined, in order to be transferred into a long term repository. The precise specifications and their significance in terms of design of the canister are not yet known.

Although the U.S. Congress cancelled funding to the MPC project, several companies continued gone on working on dual purpose canister (DPC) systems. The trend has been to stay close to handling and thermal characteristics of the original DOE specification, while improving payload, initial enrichment, costs, and operation.

BEYOND THE MPC CONCEPT

The MPC concept can also provide the US operators with more options than they might have considered initially. It also offers opportunities for utilities outside the USA.

The Transnuclear and Transnucléaire dual purpose casks already allow the utilities that adopt them to decide at any time to contract with a reprocessor, COGEMA or BNFL and deliver their spent fuel for reprocessing at La Hague or Sellafield in these same casks (see references and figure 2). This is a precious option for a utility that is not sure whether there will be a centralized interim storage facility, or something equivalent in its country, available at a time when shipping the fuel away from reactor becomes necessary. It is also an advantage from public acceptance point of view, since several possibilities exist to clear the reactor site if needed.
Furthermore, once the fuel has reached its MRS and has been stored there in a dual purpose cask for several years, prices of uranium or the pressure of the greenhouse effect on energy policies may, at a later time, enhance further the advantages of reprocessing, that can then be taken up as an option.

As for dual purpose casks, one can and should take this in consideration when designing MPC or DPC systems: One key to successful development of such systems is retaining as many options as possible. This is all the more true as in many instances, MPC/DPC solutions may well be an answer to utilities needs in many different countries.

Consider the venture once initiated with the Mescalero Apache tribe or the current one underway with the Goshute Indians: would not it be an enhancement of the concept to show that whatever the difficulties ahead, extra solutions would be at hand to ship the fuel away? These could be recycling the valuable fissile materials or bringing the fuel to an international storage site if ever such a development takes place .

In short, the idea is to offer extra value to the utilities by offering extra options. Therefore the MPC or the DPC can be improved by taking into account the possibility of reprocessing plants or of international storage sites, and could be renamed a MOC (multi option canister).

What considerations should one evaluate in the MOC specifications? Without going into details, one should be prepared to answer the following kind of questions:

- There must be an agreement with the reprocessor or the storage facility on how one can ascertain the identity and the status of the canistered spent fuel with respect to fuel acceptance:
  Ways to do that may include devices for sampling the atmosphere inside the canister to check for damaged fuel with or without breaching containment, setting maximum temperature and cladding creep damage criteria for the spent fuel to protect against fuel failure, defining and testing adequate precautions upon canister reopening at the reprocessors, implementing administrative procedures to trace the fuel assemblies, defining solutions for damaged fuel.

- Handling of transport overpack and of canister: One must make sure that the constraints stemming from inland transport to reprocessors (size and weight) or to storage site, the lifting capacities and handling systems are taken into account. For instance, the railway gauge in Europe is quite smaller than US one.

- In addition, it would be wise to start validation discussions with several Competent Authorities at an early stage in order to integrate timely their recommendations into the licensing process.

- Canister reopening procedures:
  Attention should be devoted to adequate tools (arc torch, mechanical can opener...), to the medium, dry unloading or wet unloading, and to the necessary subcriticality precautions. The approach may stem from procedures worked out to solve at reactor recovery from operational difficulties. One should also take into account that the storage pools of the reprocessing plants are not boronated for criticality control.

Clearly, the above questions can find adequate answers without putting a severe additional constraint on the design.

CONCLUSION

When considering the way to dispose of spent fuel while waiting for DOE to perform its duty of taking over the fuel, it is well worth preparing for as many possibilities as possible. The gap from DPC or MPC to MOC is not a wide one, and may well prove a wise and reasonably priced insurance against future storage set backs and a practical access to fruitful opportunities. Furthermore a MOC approach may extend significantly international application of the concept.

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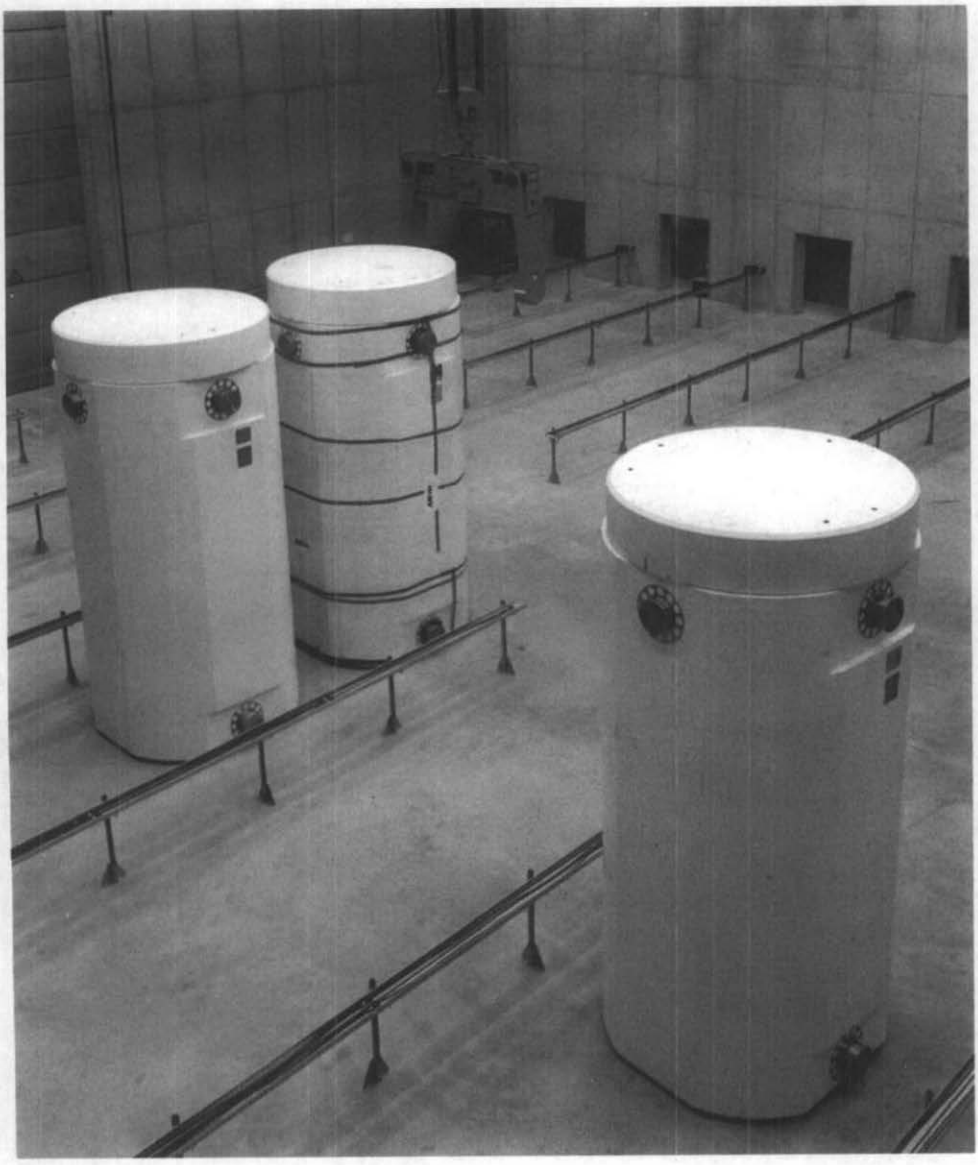

Figure 2: TN 24 D dual purpose casks in the Doel (Belgium) interim storage building

SESSION 5.3

Materials Behavior