DISPOSAL OF FUEL ASSEMBLY CHANNELS FROM BWR'S AND OTHER CORE COMPONENTS

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ABSTRACT

The disassembly of "Fuel Assembly Channels" from BWR's under water is fairly problematic and time consuming.

To take a different route, GNS has developed, built and loaded a ductile cast-iron cask to transport and store 66 fuel assembly channels.

After storage of these casks, the further conditioning for final disposal shall follow in a "hot cell" which is currently under construction.

INTRODUCTION

The waste material generated in nuclear power plants in addition to normal solid or liquid controlled area waste also includes such waste which is produced in the reactor core or the near-core area through the activation of metallic parts by neutron flux.

These items often remain in the reactor core for many cycles, and must be replaced if their mechanical function or technical application is no longer guaranteed. This concerns the following parts in the first place:

- Fuel assembly channels and channel attachments from BWR's;
- Control assemblies from BWR's and PWR's;
- Instrumentation lances from BWR's and PWR's;
- Absorber assemblies from PWR's.

The core components consist mainly of stainless steel or zirconium alloys, and partly include compounds containing boron, or even nuclear fuel in the case of neutron flux instrumentation lances.

When removed, core components are stored in the fuel pool. The specific activity of this waste material is very high as a rule, so that considerable shielding measures must be taken for the handling and conditioning of these items. As special spaces are not provided for this when designing the power plant, stripping and packing of the components nowadays is generally performed in the fuel storage pool under water. These stripping and packing operations under water of course are fairly problematic and time-consuming, and an optimized volume reduction and utilization of the necessary shielding casks cannot be achieved. Further, other working operations are permanently to be carried out in the fuel pool area (e.g. handling of fuel assemblies, repairs, etc.), which means that the "time window" available for conditioning generally is fairly small. Faced with these many problems, GNS has been led to take a different route for the disposal of core components.

A suitable cask has been developed and built for the housing and interim storage of unstripped core components. The aim is after building a so-called "hot cell' to effect conditioning of this unit in an optimum way in channels. This is presented below, and the planned cellular concept is also introduced.

CASK MOSAIK 80 T

The MOSAIK 80 T cask has been developed for the loading of core components. This cask for shipping and storage largely corresponds in its design characteristics to type MOSAIK II casks as used in Germany for waste conditioning. However, the new type of cask is considerably larger, and is characterized by a wall thickness of 290 mm for respecting by the applicable dose limit values during transport. Figure 1 is a schematic representation of the cask and its main design data.

Leak-tight containment is obtained by a lid, which is protected against mechanical impacts from the outside during handling by a protective plate.

To permit the fuel assembly channels requiring disposal to be adequately housed, the cask was fitted with a basket suitable to take 66 of these channels. Figure 2 is a cross-section of the basket.

It should be noted that design modifications on the basket make it comparatively easy to also store other components in the cask, such as absorber assemblies or instrumentation lances. Administrative measures during loading of the basket further permit the storage of even higher-activity items without any problems.

At the present time, 3 units of these MOSAIK 80 T casks have been built, and loaded with a total of 198 fuel assembly channels.

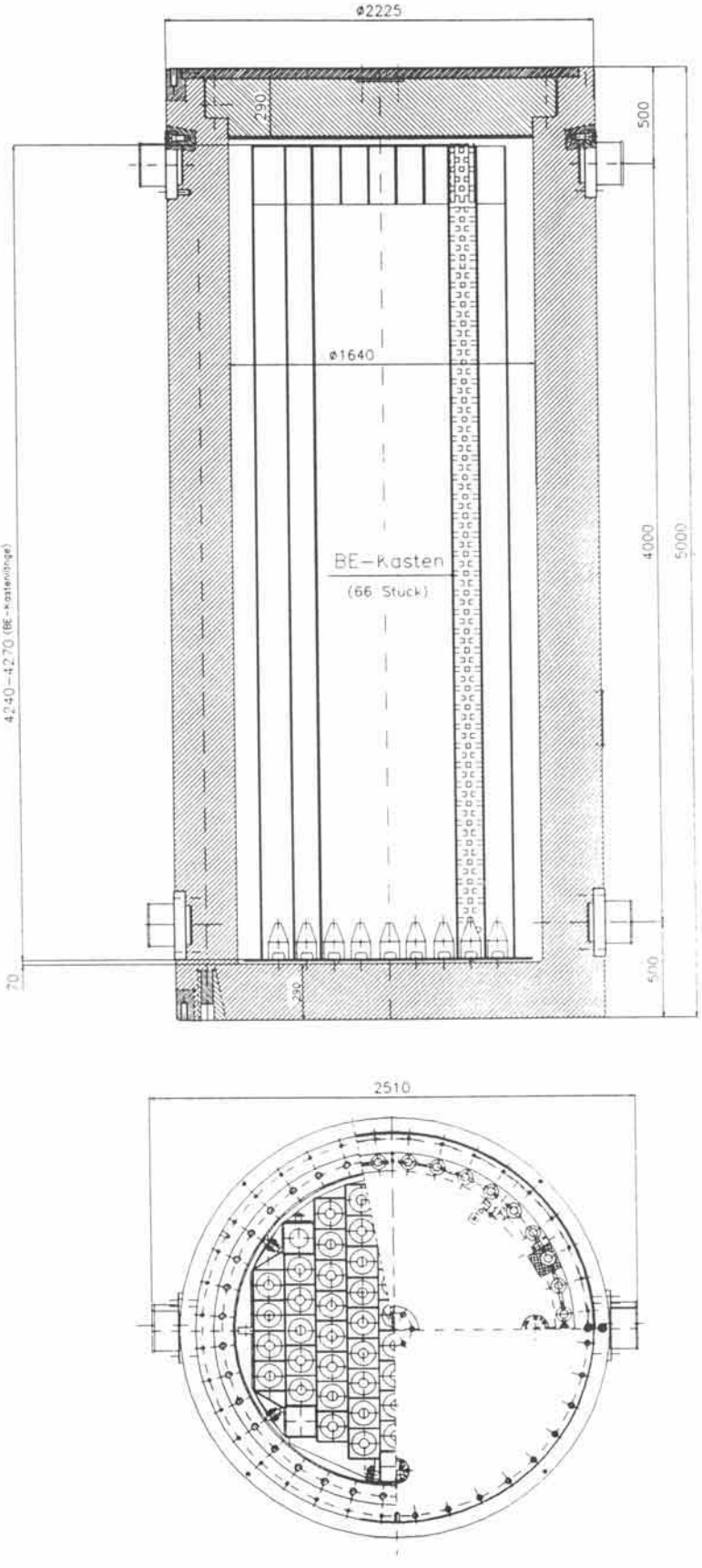
LOADING OF THE CASK IN THE NUCLEAR POWER STATION

As the casks in question can be compared to casks used for the shipping of spent fuel assemblies concerning their weight and handling, the loading of these casks can likewise be compared to the handling of fuel assemblies. For this reason, only the main points of the handling sequences required for loading will here be outlined in a summary:

- Arrival of empty cask;
- Entry into power station;
- Introduction of cask into fuel storage pool;
- Loading of cask;
- Closing of cask under water;
- Lifting of cask from pool;
- Draining and drying of cask;
- Exit of cask;
- Storage of cask in interim storage area.

PLANNING OF A CONDITIONING CELL

With the packaging and storage of the fuel assembly channels, an interim step is reached. The further conditioning for final disposal shall follow in a "hot cell".



Transportmass
Transportmasse ca. 87000 kg
(mit Stoßdämpfer)
(with Schokabsorber)

Behälter beladen ca. 78000 kg
Cask loaded

Behälter–Leermasse ca. 73000 kg
Cask empty

Fig. 1. MOSAIK-80T/66.

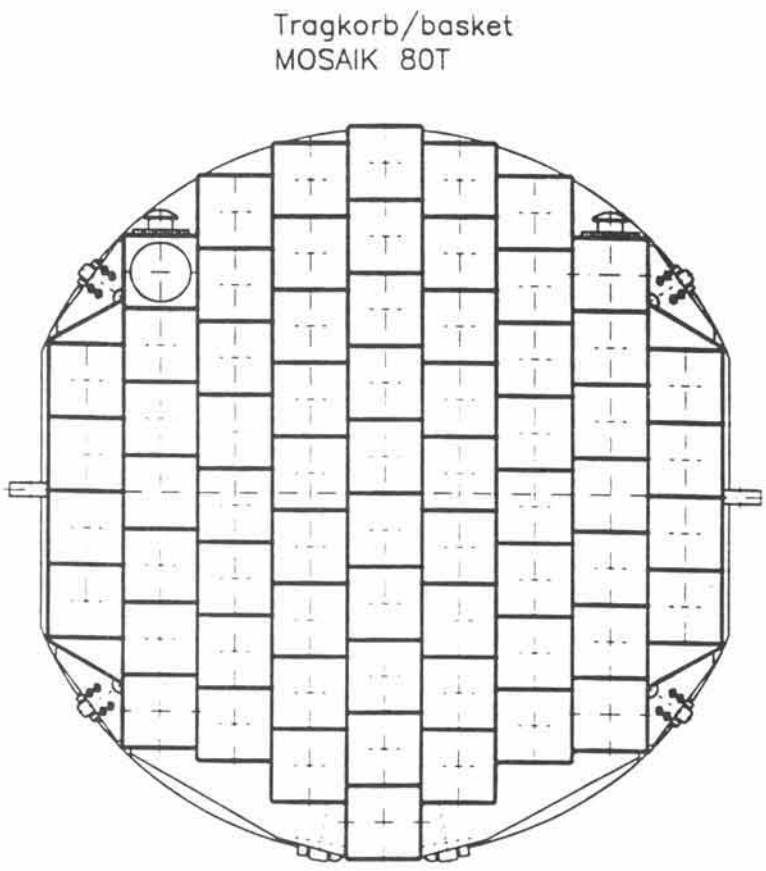


Fig. 2. Cross section-MOSAIK 8O/T basket.

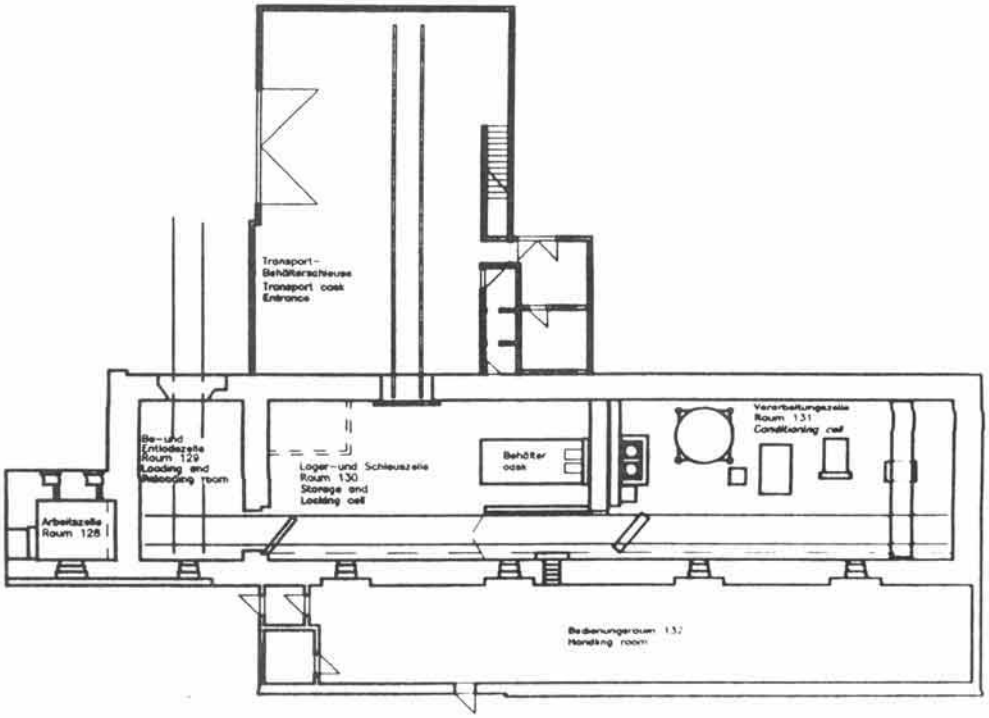


Fig. 3. Hot cell concept.

At the moment it is planned to use the existing building facilities at the nuclear research center Karlsruhe and to perform the feasible modification by refitting with the necessary equipment.

The conditioning cell can be divided into the following parts:

- Loading and unloading cell;
- Storage and locking cell;
- Conditioning cell;
- Handling room.

A schematic representation of the conditioning cell is shown in Fig. 3.

To unload heavy transport and shielding casks up to 100 t, a locking cell is provided. In this room the incoming casks will be loaded on to a rail vehicle. With this vehicle, the casks will be transported into the storage and locking cell and can be locked on the conditioning cell.

After locking and sealing the cask on the conditioning cell, the lock will be opened and the cask lid can be removed with a special removing equipment.

With a power manipulator inside the conditioning cell, the cask will be reloaded into the cell in a next step. After closing the cask with the lid the cask can be removed and conditioning can start.

Inside the cell, all the necessary equipment to perform optimized conditioning is available.

The main equipment consists of the following:

- mechanical cutting;
- thermal cutting;
- compactor;
- cask handling equipment.

At the moment, the execution of the different tools is not yet fixed.

SUMMARY

With the cask system MOSAIK 80 T for the transport and storage of core components, a first step has been taken to make a safe and quick waste management with core components.

The next step is the optimized conditioning of these parts in a "hot cell", taking into account:

- safe handling;
- low waste volume;
- health physics aspects.