

Official Monitoring of the Quality Assurance in the Manufacturing of Spent Fuel and High-Level Waste Transport and Storage Casks

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0. Abstract

As for the transport and the interim storage of spent fuel and high-level waste an increasing number of casks are manufactured according to the German design approval certificate. The system of quality assurance is based on the liability of the licensees and manufacturers themselves, and is supplemented by a comprehensive official monitoring.

The Federal Institute for Materials Research and Testing (BAM) bear full responsibility for the surveillance of the quality assurance in the manufacturing of these packagings. Basis of this process is the German regulation TRV 006 (Technical Rules Traffic). It defines requirements for the production and testing to ensure that the series sample conforms to the authorised design. The main steps of the official supervision are:

- Examination of the manufacturers' qualification including his sub – suppliers,
- Qualification of materials and specific fabrication processes,
- Examination of the specific quality assurance program adapted to the scope of production,
- Approval of master documents such as specifications and manufacturing- and test plans,
- Technical inspections during the manufacturing of components and final tests before commissioning,
- Assessment of non-conformities,
- Final verification of the documentation for correctness and completeness and issuing an acceptance certificate for the packagings.

As consulted experts of BAM, employees of TÜV Rheinland Industrial Service are entrusted with performing a large field of the official surveillance.

Details of the surveillance system as well as examples and experience with a huge number of suppliers will be presented.

1. Introduction

The production of transport and storage casks is performed on the basis of the design approval certificate of the Federal Office for Radiation Protection (BfS). The approved design is entirely described by drawings and parts lists as well as applicable specifications.

The Technical Rule concerning measures for quality assurance and quality control regarding packagings for the transport of radioactive materials (TRV 006) defines the production requirements.

The Federal Institute for Materials Research and Testing (BAM) assume full responsibility for the surveillance of the quality assurance in the manufacturing of these packagings.

Casks for storage of spent fuel or high-level waste kept in a German intermediate storage facility become part of this facility. In conjunction with the design approval certificate the surveillance of quality assurance according to TRV 006 is a precondition for the certificate of conformity.

The essential elements of quality assurance are

- the manufacturer's quality management system and
- a quality assurance program adapted to the scope of production.

The manufacturer takes full responsibility for the quality assurance as well as the assembly of packages in accordance with the approval.

The extent of external supervision depends on the safety importance of the components.

This is divided into 3 classification levels:

Class 1: Components that have a direct influence on integrity / leak tightness of casks, subcriticality, and shielding.

- first qualification and monitoring of the manufacturer as well as the sub-suppliers by BAM in relation to the QM system and the manufacturing processes on the basis of specifications,
- manufacture and documentation on the basis of manufacturing and test plans (MTPs),
- checking and approval of all relevant documents by BAM,
- Non-conformity reports have to be accepted by BAM (and BfS for sub-criticality/shielding).

Class 2: Components that have an indirect influence on integrity / leak tightness of casks, subcriticality, and shielding

- As class 1 components, but without monitoring by BAM (except non-conformities).

Class 3: All other components

- Self-regulation by manufacturer.

Employees of TÜV Rheinland as consulted experts of BAM (T1) are entrusted with the supervision of the measures applied in production.

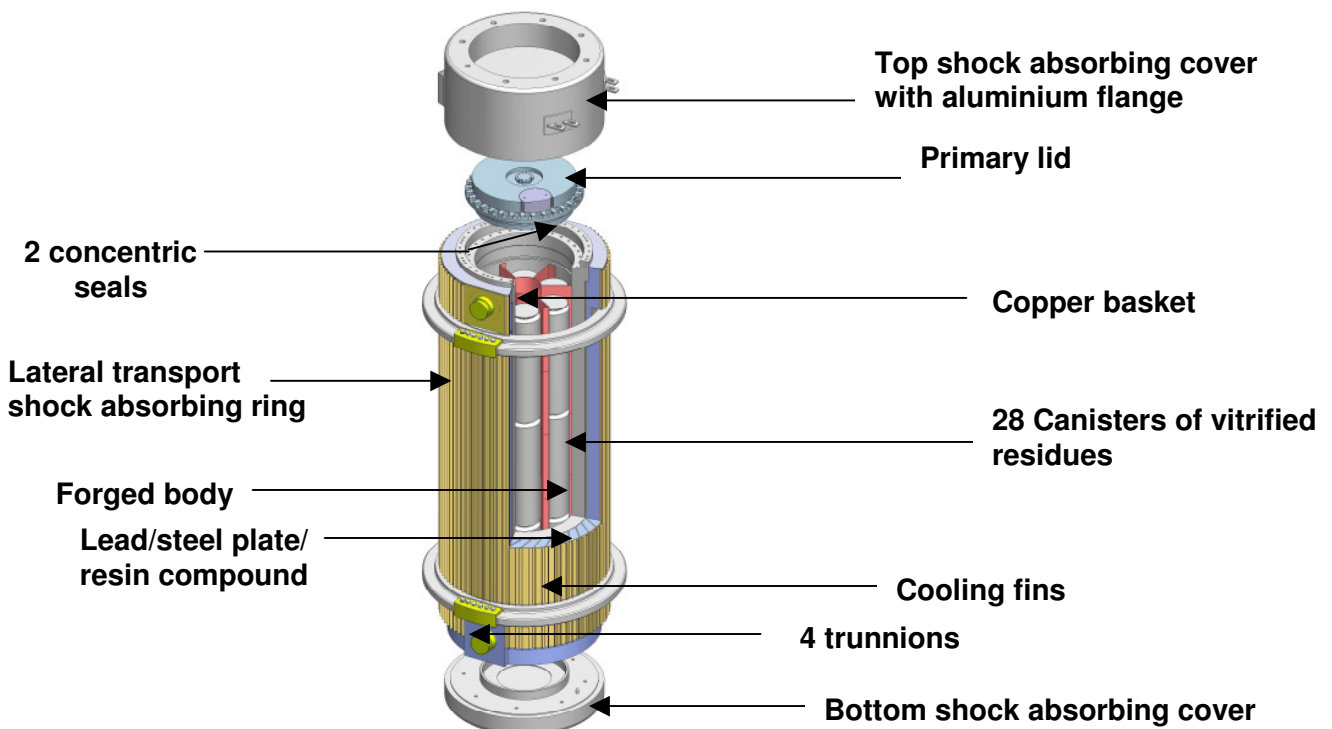
The main tasks in this connection are:

- Verification and certification of the manufacturer's qualification for cask components of class 1.
- Examination and approval of the manufacturing- and test specifications of the licensee.
- Examination and approval of the quality plans and drawings as well as the manufacturing- and test specifications of the component manufacturers.
- Surveillance of the manufacturing within the framework of quality plans, executed by special inspectors (T1 authority's authorized inspection representative) respectively approval and assignment of local independent inspectors (T2 authorities named local inspection representative).
- Assessment of non-conformities in cooperation with the competent authorities.
- Final check of the manufacturing documentation for the casks and certification that the realisation compiles with the design.

In the following we report on the adaptation of this quality control in the case of manufacturing packagings with German approval in a foreign country. The Transport- und Storage Cask TN 85 is a good example for this situation. The licensee is the French company TN International.

The cask manufacturing started in 2004. In September 2007 the first cask was approved.

2. Description of the cask



The transport and storage cask TN85 is intended for the transport of high level waste from the French reprocessing plant to a German interim storage facility and the following interim storage there.

The cask consists of a thick-walled cylindrical body with a welded on bottom, both made of forged steel. The cask is closed, depending on the transport configuration, by a primary lid respectively a primary lid plus secondary lid and the dedicated closing lids, bolting, and gaskets. Aluminium profiles are attached to the cask surface to house the additional gamma shielding (lead, steel) as well as the neutron shielding (resin). The cask is fitted with cooling fins for the heat removal and two pairs of trunnions for handling. A copper basket contained in the cavity can take 28 HLW canisters.

The transport cask is equipped with a shock absorbing system (lid- and bottom shock absorbers and two lateral impact limiters between the trunnions).

For the interim storage the cask is completed by extra lateral neutron absorbing rings and a protective cover.

The manufacturing of the cask components as well as their assembly was done on behalf of the licensee TN International all over Europe.

During the independent supervision the consulted experts of BAM (T1) laid emphasis on the class 1 components.

- Forged bodies from a French manufacturer
- Bottoms and lids forged by an Italian manufacturer
- Trunnion from a Czech manufacturer
- Screws from a French manufacturer
- Metal gaskets by a French manufacturer
- Body-bottom welding performed by a French manufacturer
- Assembling of the cask components including the pouring of resin by one Belgium and one French manufacturer.

3. Verification of the manufacturer's qualification

TRV 006 requires of the manufacturer to apply a quality assurance system that is adjusted to the requirements of packages for radioactive materials. Certified quality management systems according to ISO 9001 are now the general rule. A specific quality assurance program for the manufacture and testing of the product is still required depending on the production scope of the manufacturer – complete packages or only components of them.

The qualification of manufacturers of packages and components of classification level 1 is monitored by BAM in the form of audits. A period of 2 years has been defined by BAM for the supervision of the manufacturer's qualification.

These audits focus on the quality management system and the general conditions at the manufacturers, especially on:

- Human resources and infrastructure,
- Product realization,
- Measurement, analysis and improvement.

The audits were held jointly by TNI and T1 on the basis of bilaterally accepted programs. The basis of this consent was an agreement assuring the independence of the auditing parties.

In the case of products that are particularly complex for technical reasons, and highly relevant to the safety of packages, the manufacturer must provide evidence that the production process is safely under control.

Examples for the qualification of manufacturing techniques under the supervision of T1 are:

1. Forging of the cask body on the basis of the requirements of the material specification as well as additional requirements regarding the homogeneity of the mechanical characteristics and additional assays regarding the sub-zero toughness behaviour,
2. The qualification of the body-bottom welding on the basis of a standard ASME examination of procedures with additional assays concerning residual welding stress and dynamic fracture toughness.
3. Qualification of the resin pouring by test pouring under realistic conditions (aluminium profiles).

4. Preliminary examination of quality documents of the component manufacturing (class 1 and 2) as well as of the cask assembly

The basis of the manufacturing are the manufacturing and test sequence plans with exact definition of the manufacturing sequence, the appropriate specifications (drawings, manufacturing- and test procedures) as well as participation in the tests and check points for the manufacturer, licensee, and consulted experts of BAM.

The preliminary examination of all documents was performed by T1 in terms of approval compliant manufacturing. As for the project TN85 more than 700 quality documents of TNI and their manufacturers were examined and released prior to the start of manufacturing.

5. Build-up of an independent manufacturing surveillance (components class 1 and cask assembly)

For this purpose a Europe wide net of independent inspectors (T2) was created to act on behalf of the consulted experts of BAM (T1).

Prerequisites for the personal nomination and assignment of T2 inspectors are:

- Membership in an accredited surveillance organisation,
- Proven qualification and professional experience of the inspectors,
- Individual instruction
- Clearly defined field of action
- Duty to inform T1 in case of quality problems.

For the project TN85 the number of 30 T2 inspectors were approved and assigned.

6. Surveillance of the actual manufacturing process

The surveillance activities are laid down in the applicable manufacturing- and test sequence plans. As a general rule the participation of T1/T2 is mandatory because 3.2 test certificates have to be issued according to EN 10204.

In carrying out their duties the independent inspectors T1/T2 act as independent surveillance party that have to certify the manufacturer's results for the acceptance of the tests. The licensee informs the T1 about the dates of the tests by notification.

T1 decides, inter alia, on his own participation in the tests or the assignment of T2, depending on the specific quality situation or safety relevance of the tested components.

Therefore a number of notifications have to be dealt with every day.

Main areas for the surveillance are:

- Material acceptance tests
- Non-destructive tests
- Dimensional checks
- Compliance with process parameters
- Assembling tests like leak tests, and overload tests et al.

In order to get an approval compliant cask, the requirements of the material specification with regard to independent inspection attendance have to be fulfilled by all means.

7. Dealing with non-conformities and changes

Dependent on the influence on the approved design non-conformities/changes are classified in 3 categories.

Type 1: Undesigned lasting non-conformities with the design (parts list, concept drawing, material specification)

The licensee has to provide evidence by giving an adequate report (FTD A1) that the non-conformities are not safety relevant and therefore tolerable. If necessary, repair measures and corrective actions to avoid recurrence, have to be proposed, to be approved, and to be proven after execution.

The acceptance has to be obtained from BAM T1 and, if necessary, from other authorities within the framework of the approval under the transport law as well as the license under the atomic law.

Type 2: Non-conformities within the framework of the manufacturing and test sequence plans without lasting non-conformities with the approved design (for example change of manufacturing sequence or of an intermediate size)

The licensee proves, in an adequate report (FTD A2), that the approved design is not affected and obtains the acceptance from T1.

Type 3: Planned changes of a design approved under the transport law, need the acceptance of the authorities.

The licensee applies for that by FTD A3 at the German authorities.

8. Final inspection and verification of the manufacturing documentation

The detailed manufacturing documentation comprises the verification proving that class 1 and 2 components have been manufactured and assembled in conformity with the design.

The verification of the class 3 components can be provided by the manufacturer through a collective certificate.

T1 examines the documented evidence of conformity of each individual component as well as their assembling certification and, with his acceptance certificate, he confirms the conformity with the design approved under the transport law, taking into consideration the approved changes and the tolerated non-conformities.

After successful verification the identification plate of the cask will be stamped with BAM/T1 and the date of the next periodic inspection.

The acceptance certificate of the consulted expert of BAM (T1) forms, at the same time, the basis of the certificate of conformity under the atomic law by BAM.

9. Summary

The manufacturing of the transport- and storage cask TN85 of the licensee TN International is a concrete example showing the good use made of the German rules and regulations TRV 006 for the surveillance of the manufacturing of type B packagings for the transport of radioactive material. The increasing globalization of manufacturing requires, more than ever, a centralized independent regulatory surveillance, as under the given responsibility of BAM, ensuring the design conformity of the packagings. The net of quality assuring surveillance created for this purpose, in addition to the quality assurance of the licensee has proven to be worthwhile.

On September 27, 2007, the design conformity of the first cask of the TN85 series was certified and stamped.

On October 2, 2007, BAM certified the conformity of the cask for the license under the atomic law, as basis for the emplacement in a German interim storage facility.