THE R66 CASK, A LEAD-SHIELDED TYPE B CASK DEVELOPMENT OF A NEW CONTAINMENT CONCEPT

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SUMMARY

The R66 cask was designed and manufactured for CEA (French Atomic Energy Commission) by ROBATEL, using a new patented containment concept jointly developed by ROBATEL and CEA. The R66 cask and its containment concept are presented in this paper.

INTRODUCTION

Lead-shielded casks have been developed and manufactured by ROBATEL since 1954. Application of national and international regulations and evolution over the last 40 years of regulations and transportation needs have led to constant developments. ROBATEL most recent development to date is the joint invention with CEA (French Atomic Energy Commission) of a new containment concept designed to meet the new directives issued by IPSN (French Regulatory Commission) and related to testing of the containment function. The first application of this new containment concept is the R66 cask.

THE R66 CASK

The R66 cask is a 16 ton lead-shielded type B transportation cask. General characteristics of the R66 cask and its contents are provided below. The R66 cask is the first cask using the new containment concept presented in this paper.

The R66 cask is designed for transportation of solid irradiated wastes composed of different materials in various proportions. These wastes can be contaminated by all radionuclides and can contain fissile materials. The R66 cask was designed to meet IAEA regulatory transportation requirements. It was designed using proven and reliable techniques based on ROBATEL's experience with casks design and fabrication.

The R66 cask is a cylindrical packaging, composed, from the inside out, of : an inner containment composed of four separate cylindrical cavities, a lead shell providing gamma shielding, a layer of PNT7 compound providing thermal protection and neutron shielding, and a cylindrical outer liner. The space between lead shell and inner containment is filled with PNT7 compound to provide additional neutron shielding.

Each containment inner cavity is provided with individual shielded plugs and the containment is closed by a bolted closure lid.

At the bottom, a shock absorber is integrated in the cask body. A removable impact limiter is provided at the top.

R66 CASK CONTAINMENT CONCEPT

The containment concept developed by ROBATEL and CEA was used in the R66 cask design. It is described below.

The R66 containment system is composed of the following components : (1) the four individual cavities with their common welded upper flange, (2) the bolted closure lid, and (3) three closure lid seals.

The new containment concept is based on the following features : (1) use of three closure lid seals to ensure cask containment and allow for easy testing of the containment seal after each loading operation, (2) each of the four cylindrical containment cavities is jacketed on its outer surface by a copper liner; pipings connect the space in-between each cavity and its copper liner with a gas inlet located in the cask upper flange.

The features described above make it possible to meet the new directives issued by IPSN and related to assessment of the containment function as follows :

- The containment function is tested after each loading operation using the helium spectrometry technique. Testing is performed by injection of helium in-between the inner seal and the containment seal and helium spectrometry testing of the cavity between the containment seal and the outer seal is performed.

- The containment system is submitted to a global test during periodic maintenance operations using the helium spectrometry technique. Testing is performed by injection of helium in the gas inlet connected with the outer surfaces of the cavities constituting the containment. The outside surface of the containment is thereby completely immersed in a helium atmosphere, and helium spectrometry testing of the containment is performed through a hole in a special lid put in place of the closure lid for testing purpose.

- Use of the helium spectrometry technique is thereby made possible for containment assessment during all regulatory tests. The advantages of this technique is that it is easy to put in practice, it requires a very short testing time, and the sensitivity is much higher than other existing techniques (like the pressure rise method). It makes therefore possible to assess much higher leak criteria.

CONCLUSIONS

Evolution of national and international regulations in the field of transportation of nuclear materials have led over the years to numerous developments in type B cask design and fabrication. France's most recent evolution is related to the application of regulatory requirements for testing of the containment function. A new containment concept developed by ROBATEL and CEA was tested and validated during fabrication and reception testing of the first R66 cask.