

HI-STAR 180
TYPE B(U) TRANSPORTATION PACKAGE
LICENSE APPLICATION

Presentation to the USNRC
By
Luis Hinojosa
Holtec International

January 21, 2009

Agenda

- Introduction
- Overview of Package Contents and Performance Requirements
- Packaging Design Overview
- Metamic-HT Qualification
- Structural Evaluation
- Thermal Evaluation
- Shielding Evaluation
- Criticality Evaluation

January 21, 2009

2

Introduction

- The HI-STAR 180 is engineered to meet 10CFR71 Type B(U) safety standards and provisions.
- The SAR on the HI-STAR 180 Package:
 - is prepared in format suggested in Reg. Guide 7.9
 - is prepared in accordance with USNRC guidance in NUREG 1617 and applicable ISGs.
 - thoroughly addresses NRC OTIs (June 2008)
 - incorporates information needed to resolve recently answered RAIs to HI-STAR-60 Package (Docket 71-9336).

January 21, 2009

3

Overview of Package Contents and Performance Requirements

- High Burnup PWR Fuel
 - Up to 66 GWd/mtU for UO₂
 - Up to 61.5 GWd/mtU for MOX
- Minimum Cooling Time
 - 4 Years for F-37
 - 3 Years for F-32
- Heat Load up to 32 kW

January 21, 2009

4

Comparison to HI-STAR 100 Packaging

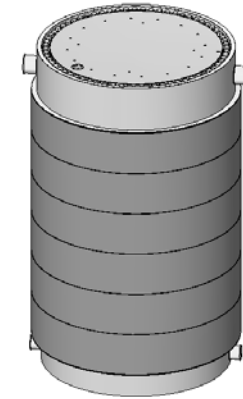
- Similarities
 - o Containment boundary construction and materials
 - o Impact limiter construction and materials
 - o Metamic-HT (a borated aluminum MMC) controls criticality
 - o Gamma and neutron supplementary shielding materials (holtite, lead and steels)
- Main Difference
 - o No secondary packaging (i.e. fuel canister or Holtec MPC)
- Major Improvements
 - o Double closure lid system and ANSI N14.5 leaktight containment boundary
 - o Hypothetical accident resistant basket (100% Metamic-HT)
 - o Fuel impact attenuation features devised to limit G-loads on containment boundary
 - o Shielding and heat transfer optimization
 - o Body extensive shielding made of a cryogenic material

January 21, 2009

5

Major Packaging Features

- Containment Boundary
- Double Lid Closure System
- Fuel Basket
- Basket Shims
- Shielding
- Trunnions
- Impact Limiters



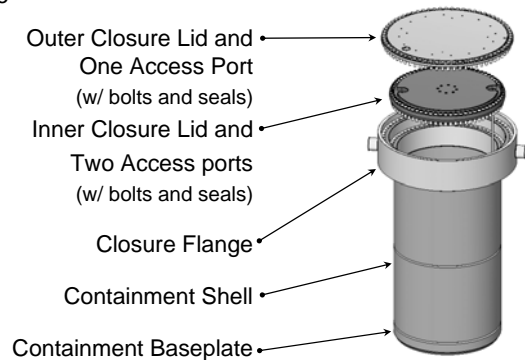
HI-STAR 180 Cask

January 21, 2009

6

Containment Boundary

- All containment system steels have high fracture toughness at very low temperatures
- ASME B&PV Code, Section III, Subsection NB for Design and Manufacture

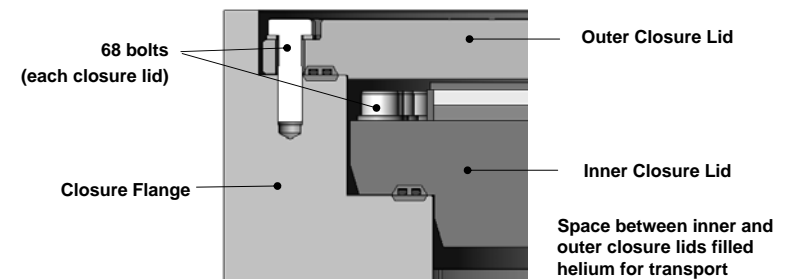


January 21, 2009

7

Double Lid Closure System

- Metal to metal contact joints provide maximum protection against leakage under impulsive loading
- ANSI N14.5 leaktight double lid closure system ensures moderator exclusion

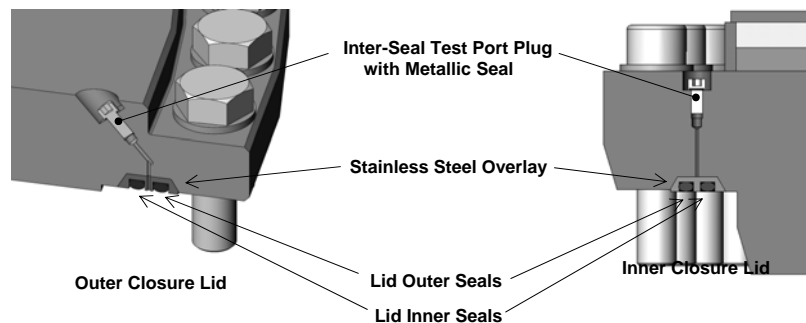


January 21, 2009

8

Seal and Test Port Details

- Each closure lid is equipped with two independent metallic seals
- All seals are silver clad stainless or nickel alloy and equipped with nickel alloy springs for long-term trouble free service.



January 21, 2009

9

Moderator Exclusion - 10 CFR 71.55(e)

- HI-STAR 180 application requests approval based on moderator exclusion for transportation of high burnup fuel (HBF); the approach meets the intent of ISG-19
 - Robust cask design and a double lid closure system with four barriers against leakage
 - The double lid closure system addresses the additional assurance recommended in ISG-19
 - The leakage rate criterion for each closure lid or penetration gasketed joint is “leaktight” per ANSI N14.5
 - Structural analyses confirm containment integrity under accident conditions

January 21, 2009

10

Moderator Exclusion - 10 CFR 71.55(e) (continued)

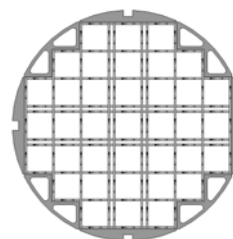
- As defense in depth, criticality assessment of credible reconfigured fuel geometries assuming water inleakage are performed

January 21, 2009

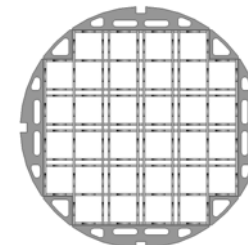
11

Fuel Basket and Basket Shim Assembly

- Thick Metamic-HT basket plate construction provides high conductivity and high bending resistance
- High creep resistant 2000 series aluminum alloy basket shims surround the basket to provide conformal contact with the containment shell



F-37 Fuel Basket



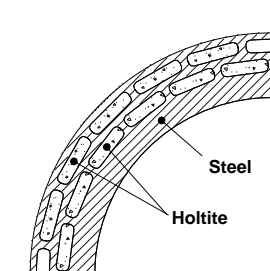
F-32 Fuel Basket

January 21, 2009

12

Monolithic Shield Cylinder

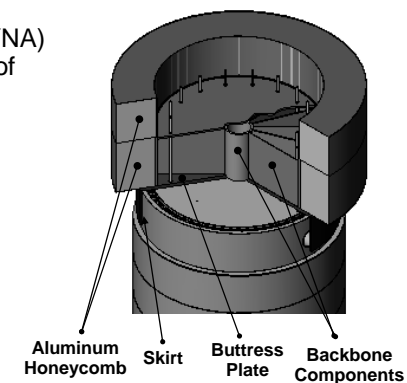
- The containment system is heavily shielded with a monolithic shield cylinder
 - Cryogenic ASME Code steel casting
 - Precision machined multi-piece construction improves on established shrink fit fabrication practice
 - Neutron shielding provided by overlapping Holtite filled pockets
 - Shrink fit installation strengthens the containment shell and improves heat transfer



Monolithic Shield Cylinder
Cross section

Impact Limiters

- Limit cask loads to 85 g (LS-DYNA) under any potential orientation of drop
- Axial connections to cask
- Provide additional rigidity to the Closure Flange lip
- Engage cask to resist rotation.
- Contain Holtite for added neutron shielding



Top Impact Limiter Shown