

HI-STAR 240

New Type B(U) Transportation Package

Pre-Application Presentation to NRC

June 28, 2021

Holtec Information for Public Release



Presentation Agenda

- Introduction
- General Overview
- Design Overview
- Package Contents to be Authorized
- Acceptance Criteria and Overview of Safety Analysis Approach
 - ✓ Structural Safety Overview
 - ✓ Thermal Safety Overview
 - ✓ Containment Safety Overview
 - ✓ Shielding Safety Overview
- Summary and Proposed Licensing Schedule

Introduction

- Holtec is preparing to submit a license application for the new HI-STAR 240 Transportation Package.
- The HI-STAR 240 package design incorporates containment boundary and shielding design elements and concepts derived from the HI-STAR ATB 1T but with key enhancements.
- HI-STAR 240 Package impact limiting component design concept is an enhanced version of the HI-STAR ATB 1T's.
- Lesson Learned from HI-STAR ATB 1T have been incorporated as appropriate.
- HI-STAR 240 is not a pressure vessel. HI-STAR 240 design pressure is less than 15 psig (100 kPa), the pressure specified by ASME Code for classification as a pressure vessel.
- The Safety Analysis Report, SAR, on the HI-STAR 240 follows essentially the same basic format as Holtec's SAR on the HI-STAR ATB 1T.

General Overview

■ General Content

- ✔ Non-Fuel Waste (NFW) in the form of power reactor-related waste in a solid form (up to 10,000 lbs).
- ✔ No secondary packaging is required to meet safety functions and any that is used is solely for operational convenience.
- ✔ Dunnage is allowed (secondary packaging may serve as dunnage).

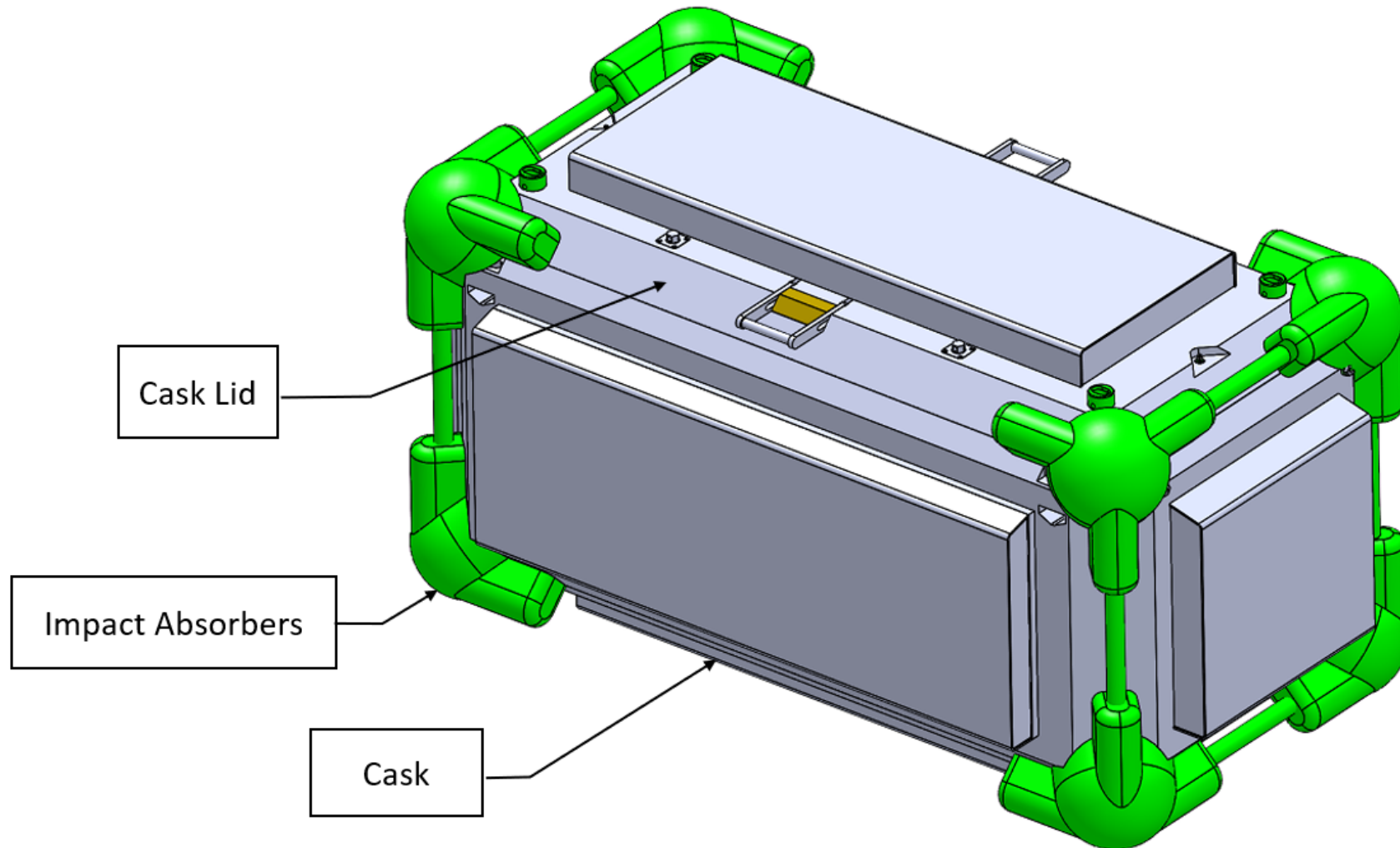
■ Principal Package Performance

- ✔ Low design heat load (1.75 kW), low pressures and temperatures.
- ✔ Leakage Rate Acceptance Criteria based on Containment Analysis.
- ✔ ALARA: Shielding materials, system operating procedures and quick-actuating cask closure lid locking system promotes ALARA.

■ Corrosion and Radiolysis Mitigation

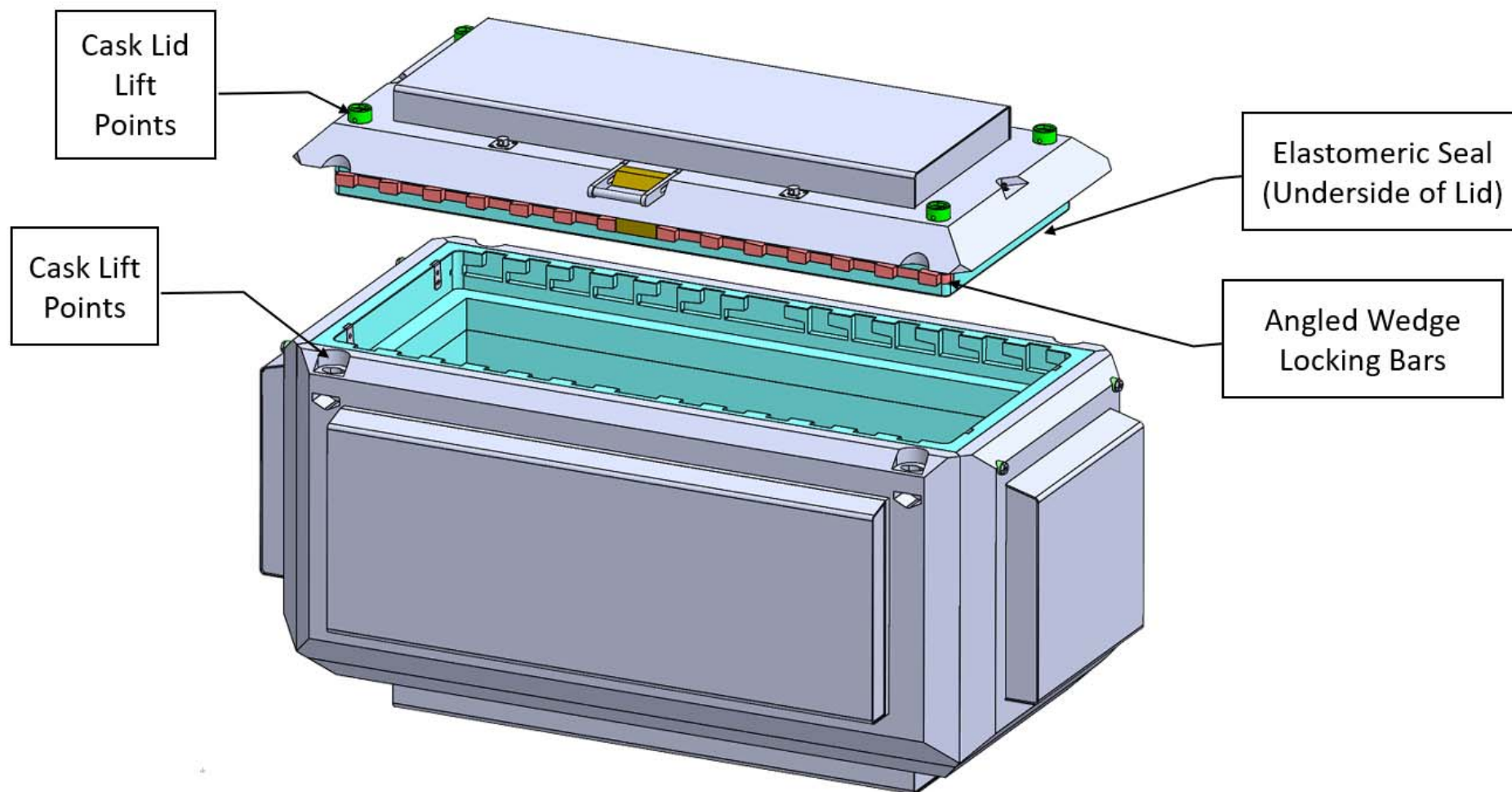
- ✔ Designed to be submerged in pool for loading.
- ✔ Moisture content is procedurally limited (same as ATB-1T)

Design Overview – Shipping Configuration



Empty Cask Weight: 80,000 lbs
Package Gross Weight 90,000 lbs
Exterior Dimensions: Approx. 6' x 6' x 11'

Design Overview - Cask and Lid



Interior Dimensions: Approx. 36" x 36" x 95"

Package Contents to be Authorized

- Non-Fuel Waste (NFW) Description
 - ✔ Segmented power reactor related waste in solid form
- Additional Characterization
 - ✔ Activated non-dispersible solids with surface contamination
 - ✔ Surface contamination consists of fixed and non-fixed surface contamination

Structural Safety Overview

Acceptance Criteria

- General Criteria: Type B(U) Provisions of 10CFR71
- Containment Integrity:
 - NCT: Level A stress intensity limits of ASME B&PV Code Division 1 Subsection NB (same as HI-STAR 180, 190, 180D and ATB 1T) for all normal condition loads.
 - HAC: Level D stress intensity limits of ASME B&PV Code Division 1 Subsection NB (same as HI-STAR 180, 190, 180D and ATB 1T) for all HAC events
- Closure Lid Seal Joint:
 - NCT and HAC: joint maintains required leaktightness as set in the Safety Analysis Report
- Shielding Components: Remain functional after impactive events
- Cask Crushable Attachments: Sufficient energy absorption to protect containment boundary and shielding components.

Structural Safety Overview

Safety Analysis Approach

- LS-DYNA
 - All structural components modeled as true stress-strain materials based on ASME Code minimum properties
- 10CFR71.71 and 10CFR71.73 Dynamic Analysis
 - 0.3-meter drop (governing orientations based on 9-meter drop causing the most damage)
 - 9-meter drop (bottom down, top down, side drop on small surface, CG over corner (CGOC) bottom down, CGOC top down, CG over short edge (CGOE) bottom down, CGOE top down)
 - 1-meter puncture on cask large surface wall.
- Static Analysis
 - Lifting, immersion, component stability, fire accident, fatigue, fracture etc. addressed in SAR with separate supporting report.

Structural Safety Overview

Benchmarking Based on HI-STAR ATB 1T

- HI-STAR 240 has similarities to the HI-STAR ATB 1T package viz. rectangular package, custom (unconventional) impact absorbers, mechanical closure along with use of elastomeric seals
- The HI-STAR ATB 1T physical testing and corresponding benchmarking in LS-DYNA provides, with a high-level of confidence, that the numerical analysis code LS-DYNA is capable of accurately predicting the dynamic response of the high energy impact events even in the absence of conventional impact limiters.
- Material benchmarking effort, carried in support of HI-STAR ATB 1T, will also be relevant to HI-STAR 240 package.

Thermal Safety Overview

Acceptance Criteria

- General Criteria
 - Type B(U) Provisions of 10CFR71
- Package Effectiveness
 - Package Component Temperature Limits as specified in the SAR.
- Closure Lid Seal Joint
 - Temperature of seal shall remain below the manufacturer's recommended temperature limits under all conditions of transport.
- Impact Limiting Components
 - Sufficient energy absorption to protect containment boundary and shielding components

Thermal Safety Overview

Safety Analysis Approach

- 3-Dimensional thermal models developed
 - ANSYS-Fluent CFD Code
- Methodology consistent with that adopted in HI-STAR ATB-1T application
 - Heat rejected from the cask under passive conditions (i.e. no wind) by natural convection and radiation.
- Analyzed Conditions
 - NCT – Cask in Horizontal Orientation
 - Cask in Shade
 - Fire Condition Evaluation

Containment Safety Overview

Acceptance Criteria

- 10CFR71 NCT and HAC Allowable Release Rates

Safety Analysis Approach

- ANSI N14.5, “American National Standard for Radioactive Materials Leakage Tests on Packages for Shipment”, 2014
- NCT: Analysis based on ^{60}Co source term from releasable surface contamination
 - 15% of surface contamination is considered releasable.
- HAC: Non-fixed surface contamination is limited to an activity of less than or equal to 1A_2 (based on 10.8 Ci, ^{60}Co) thus assuring 10CFR71.51(a)(2) accident release limits are not exceeded.
 - 100% of surface contamination is considered releasable.

Shielding Safety Overview

Acceptance Criteria

- Normal Conditions of Transport: 10 CFR 71.47
- Hypothetical Accident Conditions: 10CFR 71.51

Safety Analysis Approach

- MCNP shielding calculations (dose rates)

Summary and Licensing Schedule

- Design details, materials and safety analyses approaches are essentially identical to those for HI-STAR family of casks or based on proven practice and/or techniques which supports an efficient licensing process.
- Planned Submittal July 2021.

Questions and Discussion