



HI-STAR ATB 1T TYPE B(U) TRANSPORTATION PACKAGE

New Application for Design Approval

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**Pre-Application Presentation to NRC
(Holtec Non-Proprietary)**

**May 20, 2015
Holtec International**

Presentation Agenda

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

Introduction

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- Holtec is preparing to submit a license application for the new HI-STAR ATB 1T Transportation Package.
- The HI-STAR ATB 1T package design incorporates containment boundary and shielding design elements and concepts derived from HI-STAR packages previously licensed by the USNRC.
- HI-STAR ATB 1T Package has no impact limiters.
- HI-STAR ATB 1T is not a pressure vessel. HI-STAR ATB 1T 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 on the HI-STAR ATB 1T follows essentially the same basic format as Holtec's latest SARs (e.g. HI-STAR 180, HI-STAR 180D).
- USNRC staff's feedback is highly encouraged during this presentation.

Design Overview General Content and Performance

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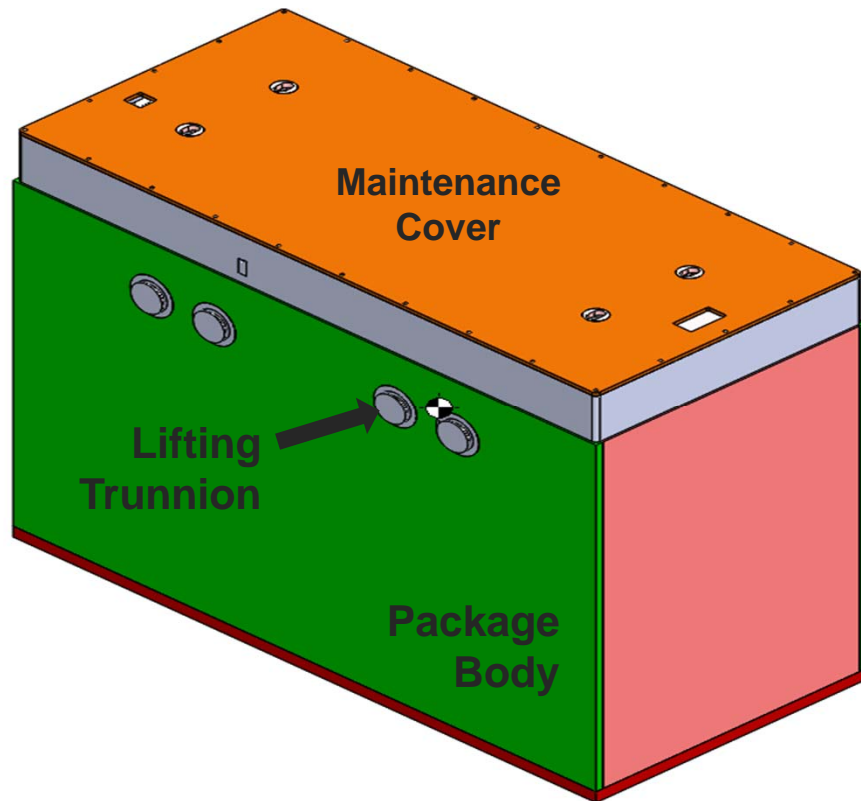
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- General Content
 - Non-Fuel Waste (NFW) in the form of power reactor-related waste in a solid form. Up to 12 Mt (13.2 US Tons)
 - BFA-Tanks (Secondary Packaging Container)
 - BFA-Cassettes (Secondary Packaging Basket)
- Principal Package Performance
 - Low design heat load (2 kW), low pressures and temperatures
 - Leakage Rate Acceptance Criteria based on Containment Analysis
 - ALARA: Shielding materials, system operating procedures and remotely actuated cask closure lid locking system promotes ALARA
- Corrosion and Radiolysis Mitigation
 - HI-STAR ATB 1T cask is not submerged in pool for loading
 - Only the BFA-Cassettes are submerged in the pool for loading
 - BFA-Tanks and BFA-Cassettes are coated to enhance corrosion protection
 - Moisture content is limited mainly for radiolysis purposes.

Design Overview (Cont'd) Package

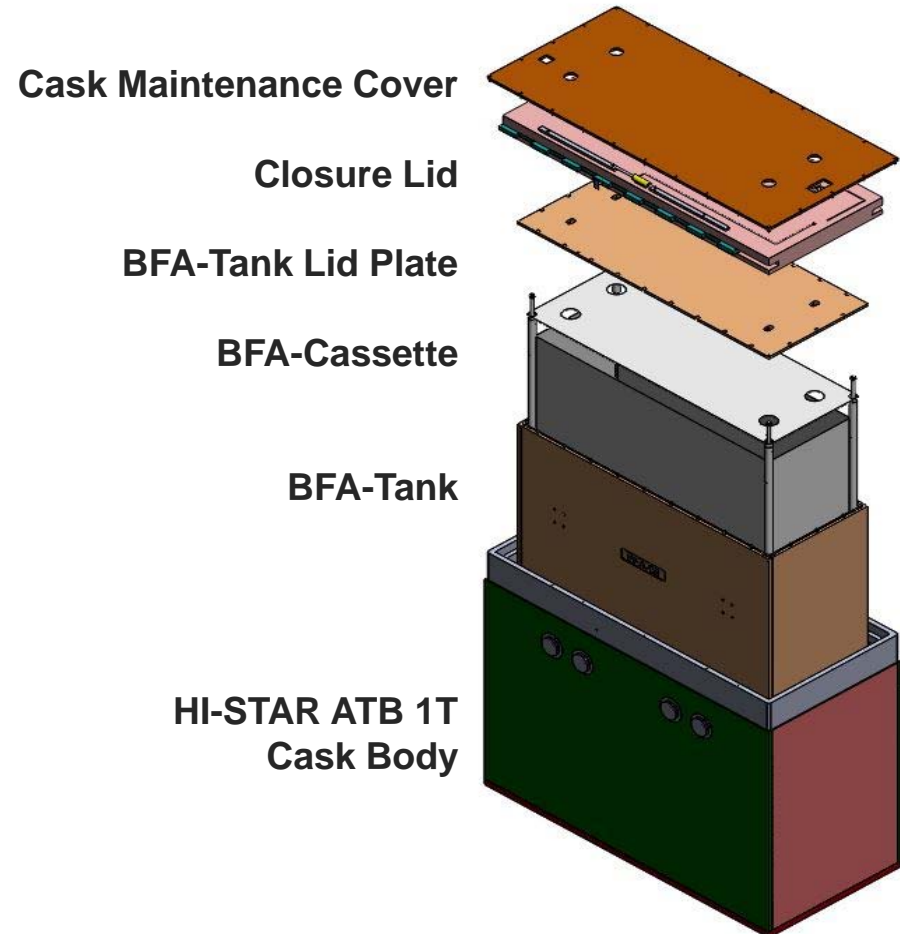
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Package Gross Weight:
116 Mt (128 US Tons)

Approximate Exterior Dimensions
L: 3.7 m, W: 1.8 m, H: 2.9 m



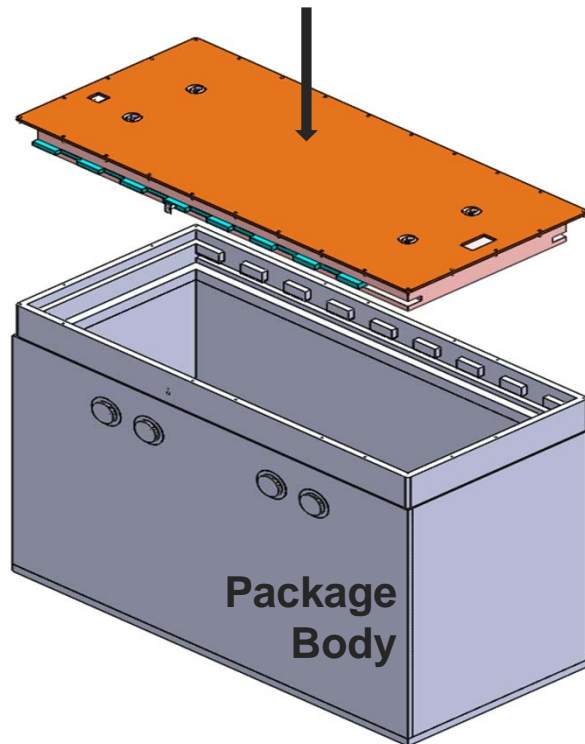
Exploded View of Transport Package
with Secondary Packaging

Design Overview (Cont'd) Package Closure Lid

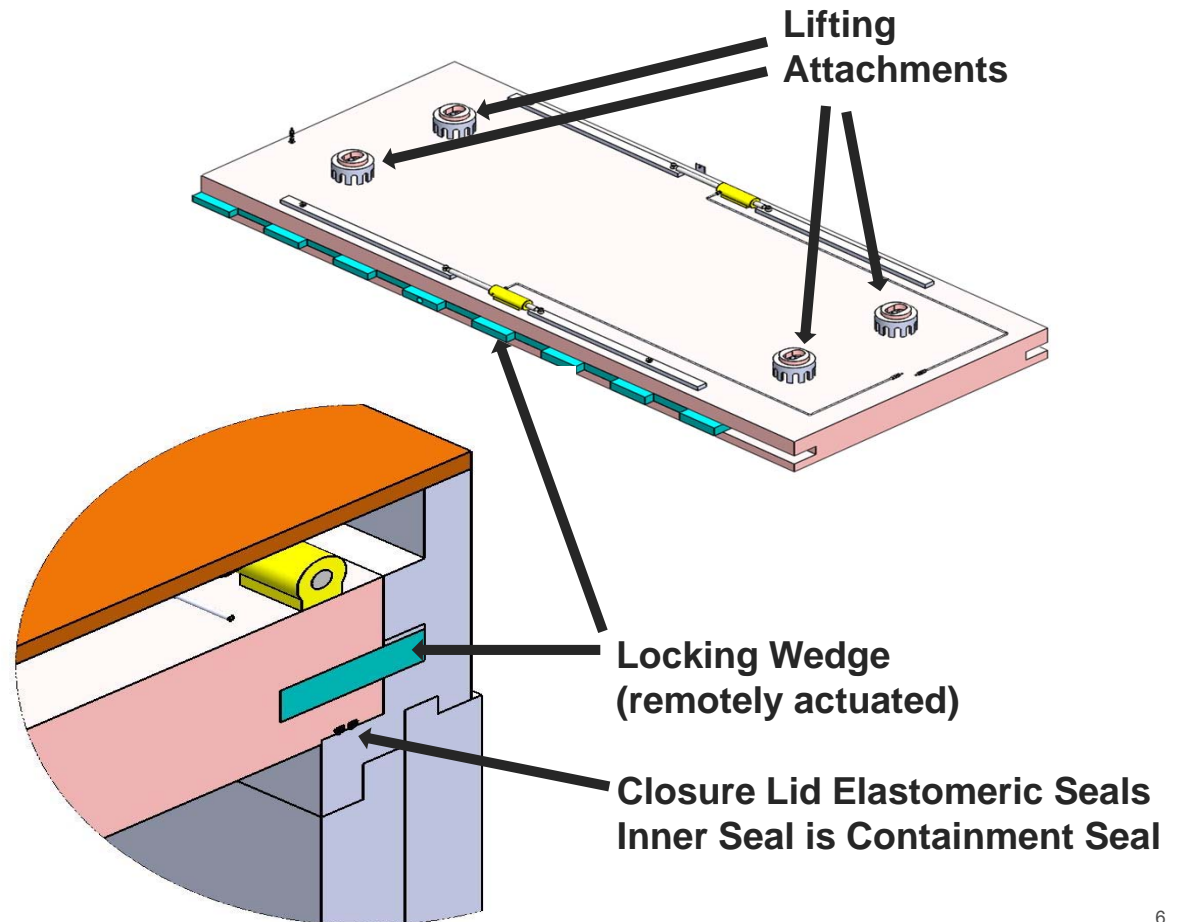
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Maintenance Cover
over Closure Lid



Closure Lid
(Without Maintenance Cover)

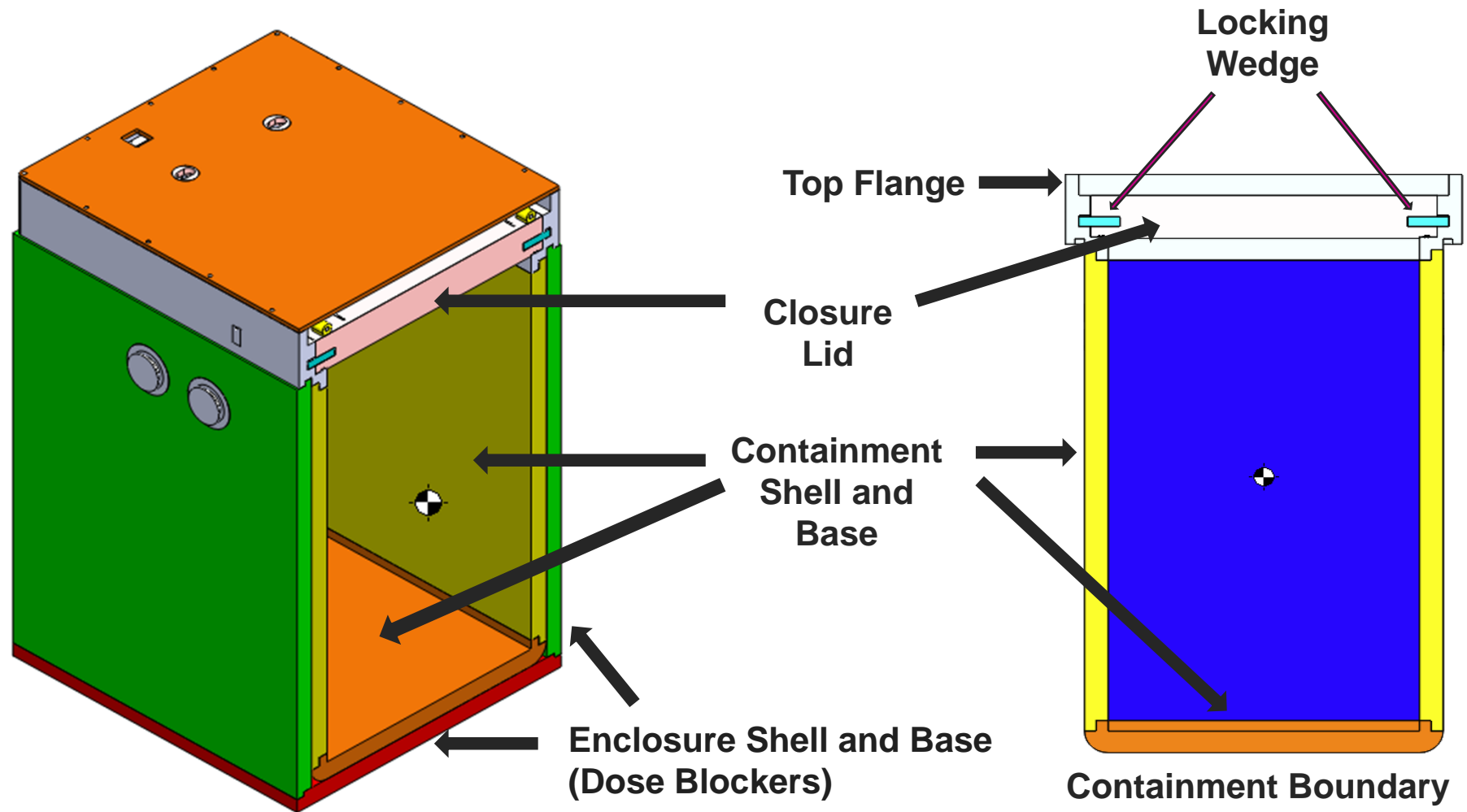


Design Overview (Cont'd)

Containment Boundary and Dose Blockers

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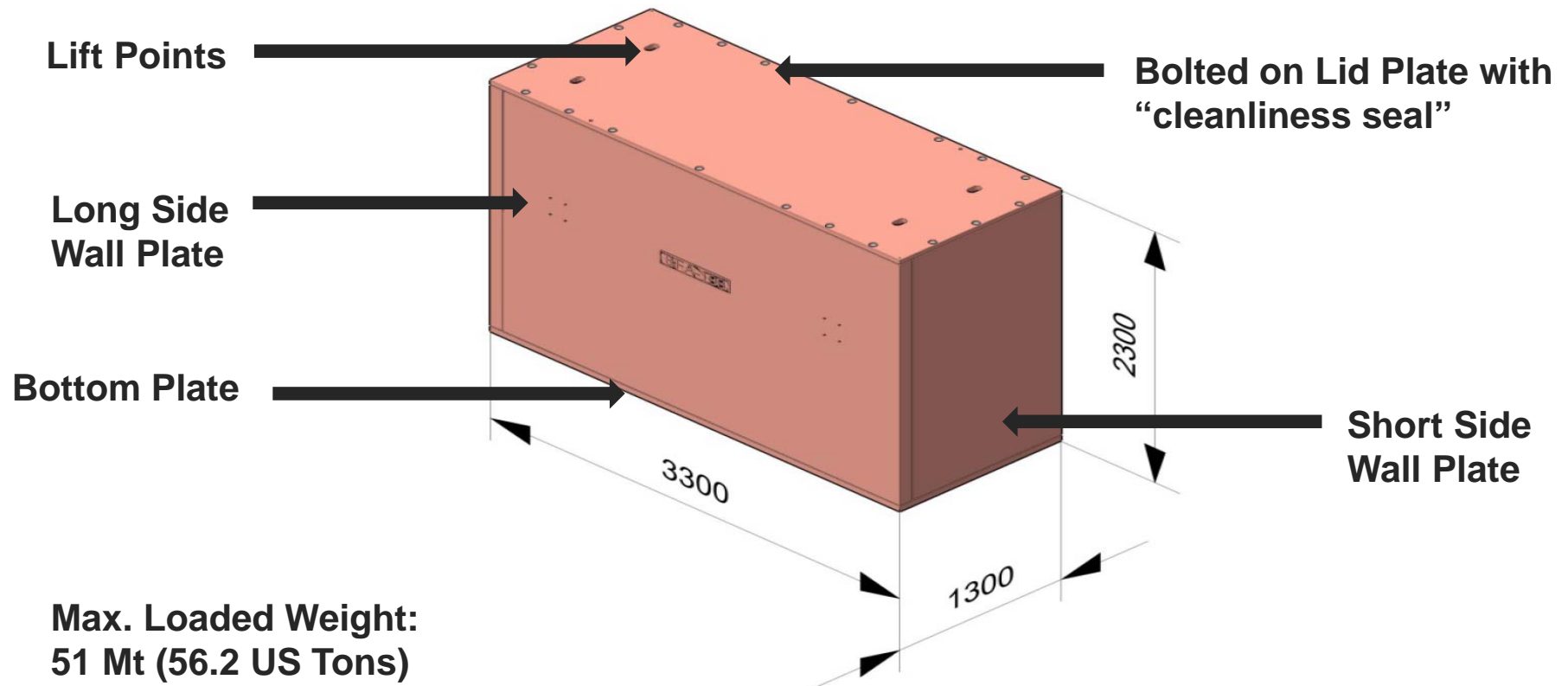
Design Overview (Cont'd)

BFA-Tanks

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Typical BFA-Tank is shown. Five BFA-Tanks (Type A through Type E) of same exterior dimensions but varying wall thickness. BFA-Tanks fit snugly into HI-STAR ATB 1T cask. All BFA-Tank walls are classified as dose blockers except for Type E.



Note: Dimensions in millimeters

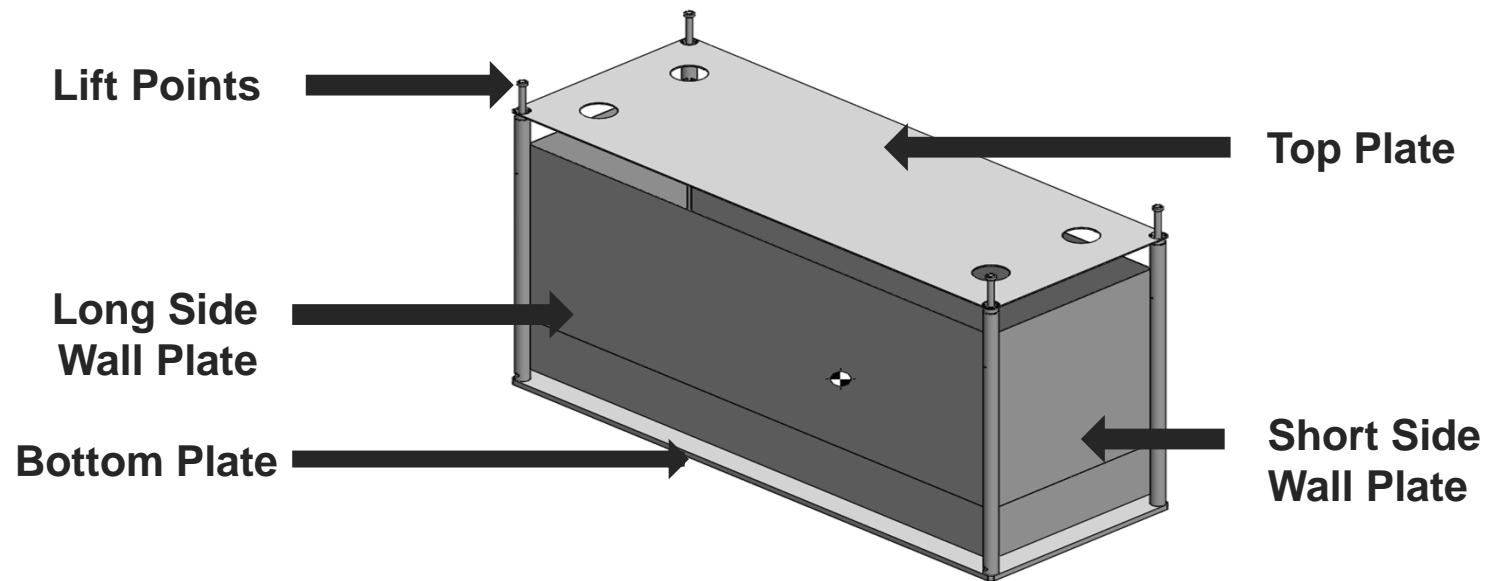
Design Overview (Cont'd)

BFA-Cassettes

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Typical BFA-Cassette Shown. Five types of BFA-Cassettes of same exterior dimensions but varying top and bottom plate wall thickness. BFA Cassettes fit snugly into BFA-Tanks. Only top and bottom plates are classified as dose blockers except for Type E. The BFA-Cassette is the only component that is submerged in the spent fuel pool.



Max. Loaded Weight:
18 Mt (19.8 US Tons)

Package Contents to be Authorized General Specifications

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- Non-Fuel Waste (NFW) Description
 - Segmented power reactor related waste in solid form
 - Top Guides/Core Grids, Core Shrouds, Core Shroud Heads etc.
 - Chips from segmentation process in secondary containers
 - Additional Characterization
 - Activated non-dispersible solids with surface contamination
 - Non-dispersible means:
 - structurally robust when subjected to transportation and loading related forces.
 - No fines made of the bulk material (no particles less than about 100 μm in size).
 - Surface contamination consists of fixed and non-fixed surface contamination

Package Contents to be Authorized General Specifications



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- Payload Activity Limits (All Sources)
 - Maximum Permissible Activity: $3.6E+15$ Bq ^{60}Co
 - 1 year minimum cooling time accounts for source terms from short lived radionuclides (e.g. ^{59}Fe , ^{58}Co , and ^{54}Mn)
 - Maximum Permissible Specific Activity based on BFA-Tank type (GBq/Kg ^{60}Co):

Type A	Type B	Type C	Type D	Type E
1400	180	23	3	0.4

- Payload Activity Limits (Surface Contamination)
 - Maximum Permissible Non-Fixed Activity: $1A_2$ (10.8 Ci, ^{60}Co)
 - Assures compliance with 10CFR71.51(a)(2) which sets hypothetical accident release limits to $10A_2$ krypton-85 in 1 week and $1A_2$ of all other radionuclides in 1 week. Note: Krypton-85 is not applicable to the intended non-fuel waste.
 - Maximum Permissible Fixed Activity: No specific limit.

Acceptance Criteria and Overview of Safety Analysis Approach



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- Structural Acceptance Criteria for the Cask
 - **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 and 180D) for all normal condition loads, except for 0.3 meter drop event.
 - Level C stress intensity limits shall apply for the 0.3 meter drop
 - HAC: Average thru-thickness strain levels in the containment system shall not attain values that would adversely affect the package in such a way that it would fail to meet the applicable requirements of 10CFR71.51
 - A thru-wall breach of the containment boundary shall not occur

Acceptance Criteria and Overview of Safety Analysis Approach



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- Structural Acceptance Criteria for the Cask (cont'd)
 - **Closure Lid Seal Joint:**
 - NCT: joint maintains leaktightness
 - HAC: joint remains effective however loss of leaktightness is acceptable
 - **Shielding Components:** Remain functional after impactive events

Acceptance Criteria and Overview of Safety Analysis Approach



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- **Structural Acceptance Criteria for Secondary Packaging**
 - **Shielding Components of BFA-Tanks (Types A, B, C and D)**
 - NCT: Dose Blocker parts remain in place and functional
 - HAC: Dose Blocker parts may separate at weld locations but remain functional with limited credible movement.
 - **Shielding Components of BFA-Cassettes (Types A, B, C and D)**
 - NCT: Dose Blocker parts remain functional with limited credible movement
 - HAC: Dose Blocker parts not credited for shielding therefore no structural acceptance criteria.
 - **Shielding Components of BFA-Tank (Type E)**
 - No dose blocker parts therefore no structural acceptance criteria.
 - **Shielding Components of BFA-Cassette (Type E)**
 - No dose blocker parts therefore no structural acceptance criteria.

Acceptance Criteria and Overview of Safety Analysis Approach



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- Structural 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 (orientation 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 etc. addressed in SAR with separate supporting report.

Acceptance Criteria and Overview of Safety Analysis Approach



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- Thermal Acceptance Criteria
 - Type B(U) Provisions of 10CFR71
 - Package Component Temperature Limits as specified in the SAR
 - Closure Lid Seal Joint:
 - NCT: Joint maintains leaktightness (elastomeric seal does not exceed temperature limit)
 - HAC: Joint remains effective (metal to metal contact). Possible loss of elastomeric seal function and leaktightness under fire accident condition is acceptable
 - Normal and Accident Design pressures as specified in the SAR

Acceptance Criteria and Overview of Safety Analysis Approach



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- Thermal Safety Analysis Approach
 - ANSYS-Fluent CFD Code
 - 3 dimensional modeling
 - Heat applied as a volumetric uniform heat source within the BFA-Tank
 - Analyzed Conditions
 - NCT – Cask in Horizontal Orientation (no effect from mesh personnel barrier)
 - Includes determination of maximum moisture content
 - Fire Condition Evaluation

Acceptance Criteria and Overview of Safety Analysis Approach



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- Containment Acceptance Criteria
 - 10CFR71 NCT and HAC Allowable Release Rates
- Containment Safety Analysis Approach
 - Consulted References
 - **ANSI N14.5**, “American National Standard for Radioactive Materials Leakage Tests on Packages for Shipment”, 1997
 - **NUREG/CR-6487**, “Containment Analysis for Type B Packages Used to Transport Various Contents”, 1996
 - **NUREG-1609**, “Standard Review Plan for Transportation Packages for Radioactive Material”, 1999
 - **NUREG-1617**, “Standard Review Plan for Transportation Packages for Spent Nuclear Fuel”, 2000

Acceptance Criteria and Overview of Safety Analysis Approach



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- Containment Safety Analysis Approach (cont'd)
 - NCT: Analysis based on ^{60}Co source term from releasable surface contamination
 - Non-fuel waste is non-dispersible (i.e. structurally-robust); thus no fines released into cask cavity space.
 - 15% of the non-fixed contamination is considered releasable.
 - Fixed contamination is not 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 the non-fixed contamination is considered releasable.
 - Fixed contamination is not considered releasable.

Acceptance Criteria and Overview of Safety Analysis Approach

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- Shielding Acceptance Criteria
 - Normal Conditions of Transport: 10 CFR 71.47
 - Hypothetical Accident Conditions: 10CFR 71.51
- Shielding Safety Analysis Approach
 - MCNP shielding calculations (dose rates)
 - Isotopic specific activities
 - Wide variety source region geometries
 - NCT: Shielding credit for 50, 100, 150 and 200 mm thick steel from combination of BFA-Tank and BFA-Cassettes wall thicknesses.
 - HAC: Shielding credit for BFA-Tank wall thickness only.
 - No credit for Type E BFA-Tank or BFA-Cassette under any condition.

Acceptance Criteria and Overview of Safety Analysis Approach

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- Criticality Acceptance Criteria
 - Excepted from Fissile Material Classification per 10CFR71.15
- Criticality Safety Analysis Approach
 - No criticality analysis since fissile exempt

HI-STAR ATB 1T – Proposed Licensing Schedule

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- 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.
- Submittal Target: September 2015