HI-STAR 180

Meeting with NRC
October 24, 2006

Holtec International

Agenda

- Introduction
- Double Lid System
- Moderator Exclusion
- Burnup Credit
- Summary

Introduction

- In a meeting on May 25, Holtec presented to the NRC the design of a new transportation cask, designated HI-STAR 180.
- In a meeting on August 4, 2006, discussions focused on
  - Benchmarking of codes for impact limiter qualification
  - Analytical modeling of the containment sealing
  - Structural acceptance criteria
  - Water exclusion for Criticality Control under Accident Conditions
- Current Meeting focuses on Moderator Exclusion

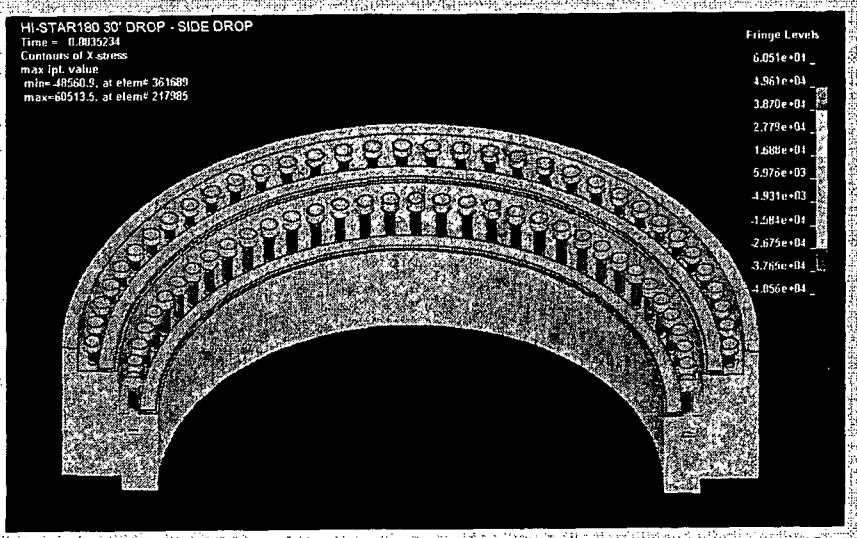
HI-STAR 180 Double Lid System

- For future qualification as storage cask, the double lid system will enable monitoring of the leak tightness of the cask
- Each lid uses two metallic seals, for a total of four barriers against leakage
- Either lid may perform the containment boundary function with final qualification by leak testing to leak tight criteria per ANSI N14.5
- The double lid system provides redundant closure to prevent water intrusion during accident condition (moderator exclusion)

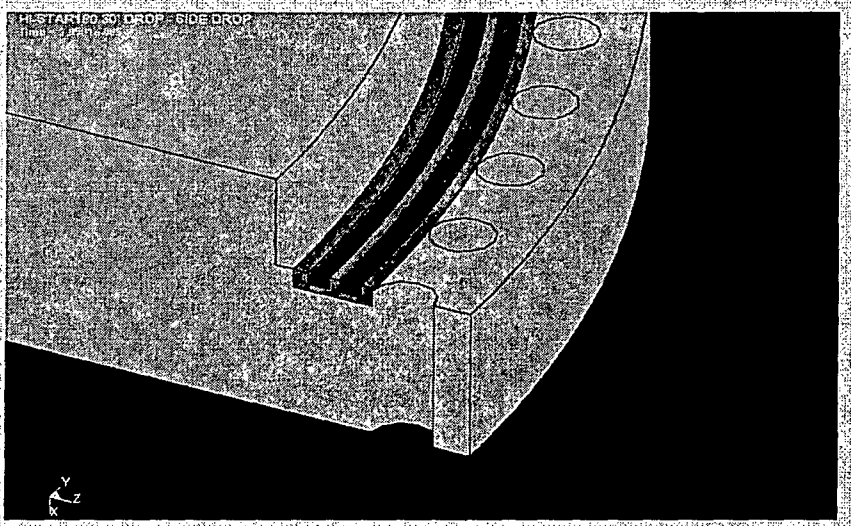
HI-STAR 180 Double Lid System (cont'd)

- Analysis based performance qualification of the sealing system, i.e., lids, bolts and seals

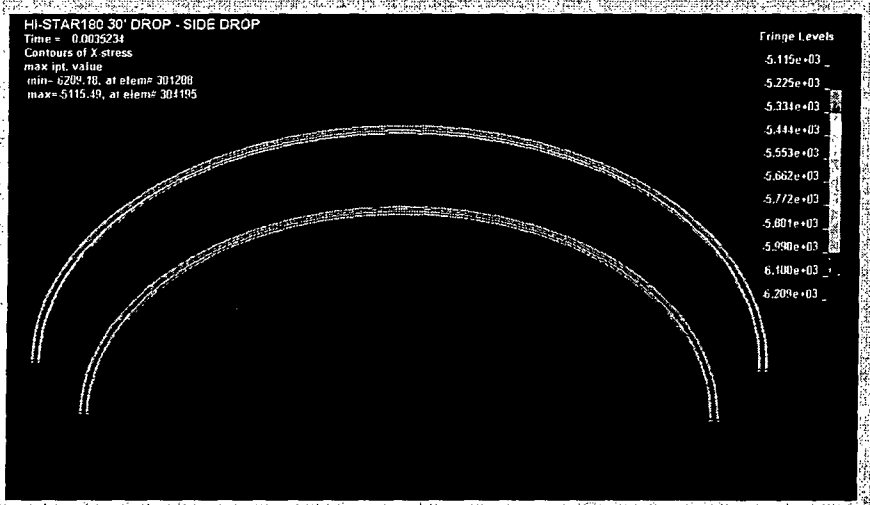
Stresses in the Lid Bolts and the Top Forging after Preloading



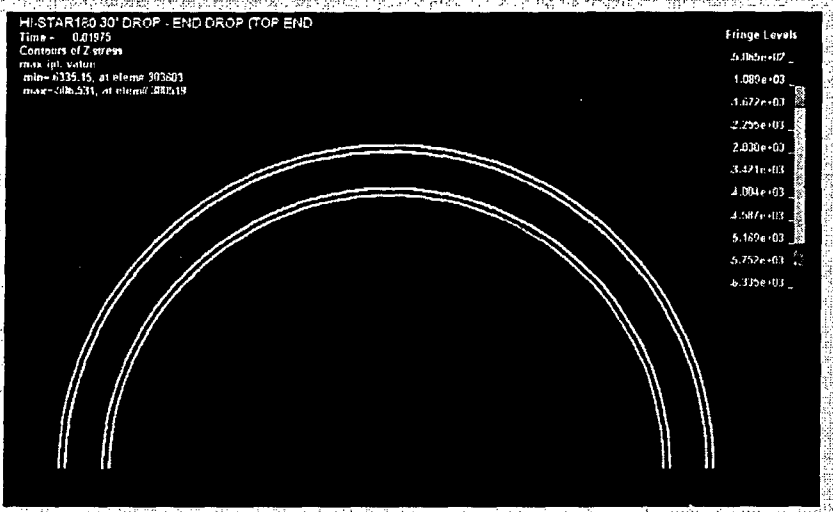
Primary Lid and Seal Model



Seal Compressive Stress After Preloading Lid Bolts



Minimum Seal Compressive Stress in the Governing Top End Drop Event



Moderator Exclusion

- Cask is designed for High Burnup Fuel, i.e. fuel with burnups >45 GWd/mtU
- Concern for High Burnup Fuel is Fuel Integrity under Accident Conditions
  - Fuel damage under accident conditions potentially affects criticality under assumed water intrusion during the accident
- Moderator Exclusion ensures subcriticality under accident condition, independent of the structural condition of the fuel

Moderator Exclusion (cont'd)

- ISG-19 : Moderator Exclusion under Hypothetical Accident Conditions and Demonstrating Subcriticality of Spent Fuel under the Requirements of 10 CFR 71.55(e)
  - Structural evaluation to determine reconfigured fuel geometries
    - Insufficient material property information for high burnup fuel to allow this type of evaluation.
  - No water inleakage under accident conditions
    - Physical testing of the water exclusion boundary.
    - Bolt Closure System Test as Part of Impact Limiter Testing
    - Physical test of scaled bolt closure system to provide added assurance of moderator exclusion under accident conditions.

Moderator Exclusion (cont'd)

- As discussed in the Meeting on August 4, Holtec proposes an analytical qualification of the system under drop accident conditions
  - Impact Limiter
  - Bolt Closure
  - Seal systems
- The intent of ISG-19 is met through analysis and special design features
  - Bolt closure is evaluated in the impact limiter analysis, using sophisticated state-of-the-art 3-dimensional transient models
  - The redundant non-containment boundary lid is qualified as special design feature by leak testing to water tight criteria,. This provides the "added assurance of moderator exclusion"

Burnup Credit

- 32 Assembly Basket
  - Fresh Fuel
  - UO_2 and MOX assemblies
- 37 Assembly Basket
  - Burnup Credit for UO_2 assemblies
    - Actinide Only
  - Limited Number of fresh MOX or low burned UO_2 assemblies

Summary

- Double Lid system with four seals provides redundant closure
- Seals remain under compression and thus prevent water intrusion and release of radionuclides under all credible conditions
- Design and analyses meet the intent of ISG-19
- No physical testing required