LANS 380-B: Type B Shielded Package for Sources

AREVA Federal Services LLC

under contract to

Los Alamos National Security, LLC

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Agenda

- Introductions
- Meeting objectives
- Technical discussions and NRC staff feedback
- Planned Project schedule
- Discussion

Introductions

- **AREVA Federal Services LLC (AFS)**
  - **Ron Burnham, LANS 380-B Project Manager**
  - **Tom Criddle, LANS 380-B Project Engineer**
  - **Phil Noss, AFS Licensing Manager**
- **NNSA Global Threat Reduction Initiative, NA-21**
  - **Frank Cocina**
  - **Temeka Taplin, Federal Project Manager**
- **NNSA Office of Packaging and Transportation, NA-00-40**
  - **Kathy Schwendenman**
- **Los Alamos National Laboratory**
  - **John Zarling, OSRP Program Manager**
  - **Darin Westley, OSRP Project Manager**
  - **Blair Menna, Project Engineer, Northern Nuclear Services**

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Meeting Objectives

- Description of the LANS 380-B Packaging
- Description of the payload
- Licensing Approach
- Preliminary Analysis Results
- Planned Project Schedule
- NRC Staff feedback

LANS 380-B Packaging - General

- **The LANS 380-B is a leak-tight, lead shielded transport cask.**
- **Will be used to safely transport disused radioactive sealed sources to facilitate recovery and management efforts for global threat reduction.**
- **Sources are located within medical, industrial, or research devices.**
- **No reliance will be placed on source device integrity.**
- **Sources are gamma- or beta-producing, non-fissile.**
- **A principal design driver is total conveyance weight.**
  - **Gross weight of conveyance < 120,000 lb**
  - **Gross weight of package approximately 66,000 lb**
  - **Maximum payload weight including dunnage approximately 12,000 lb**

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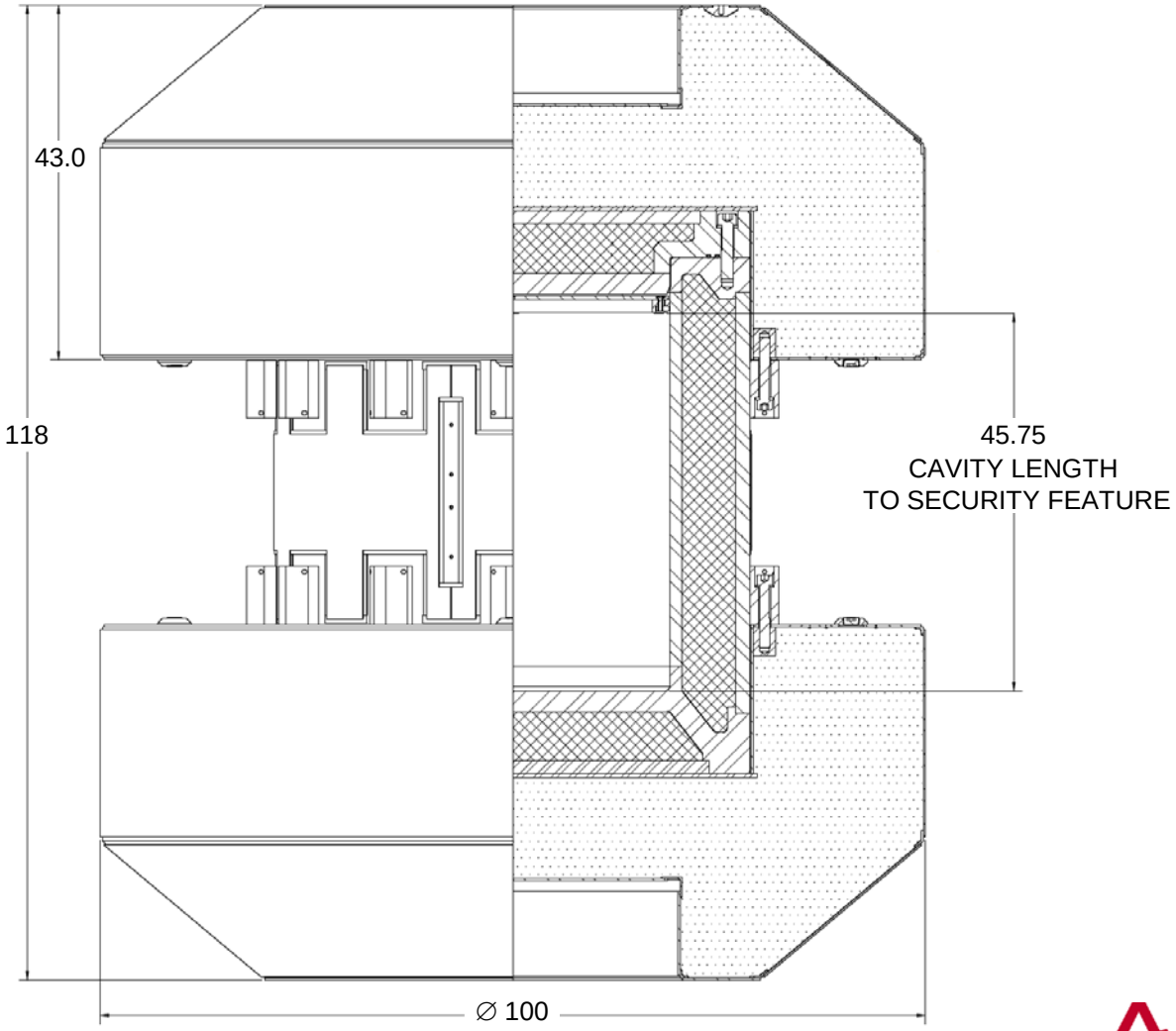
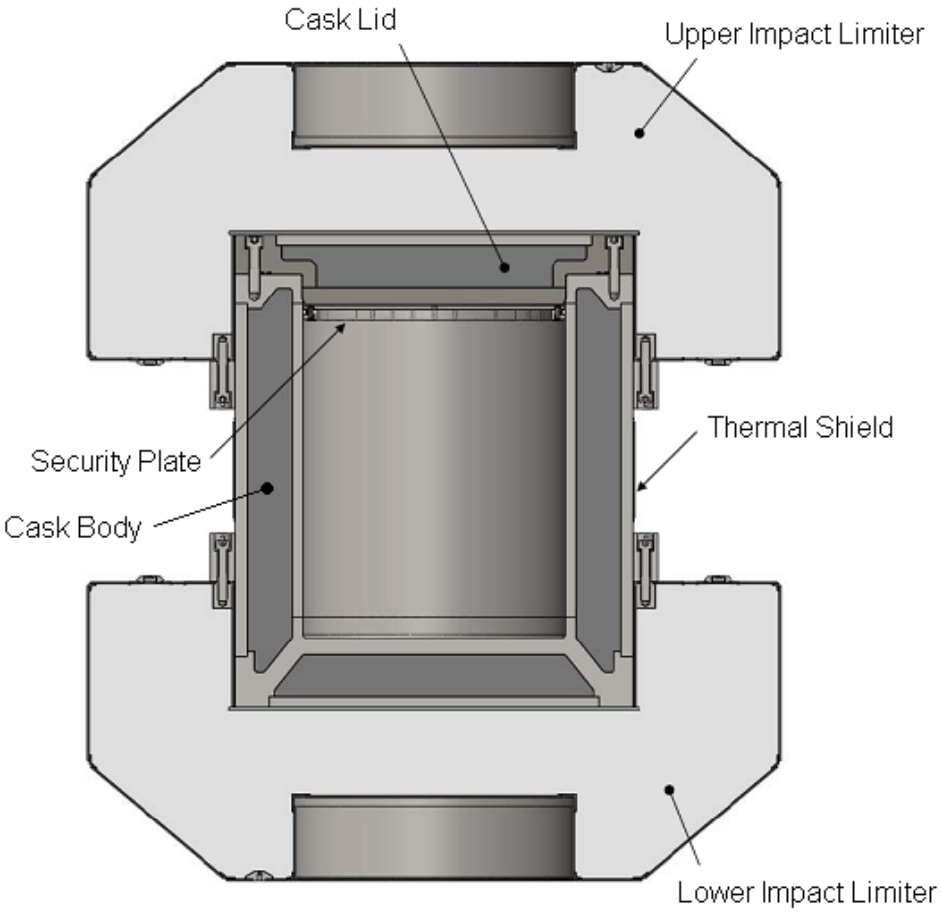
LANS 380-B Packaging Description

- **Overall height, 118 inches**
- **Overall diameter, 100 inches at impact limiters**
- **Cask outer diameter, 57½ inches**
- **Thin gauge thermal shield covers area between impact limiters and lugs**



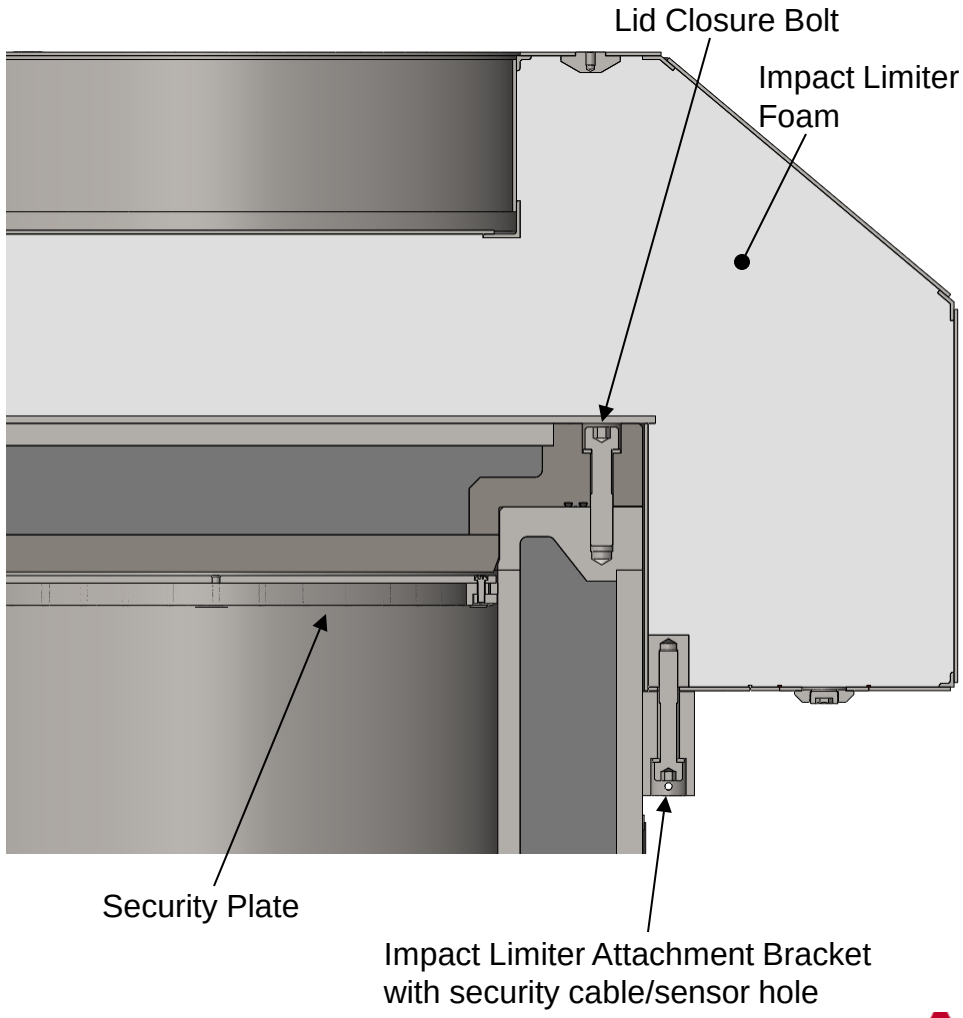
LANS 380-B Packaging Description

- **Lead shielded cask with leak-tight containment boundary**
- **Bolted closure lid**
- **Cavity dimensions**
  - **Inner diameter 38.0 inches**
  - **Minimum opening 37.0 inches**
  - **Height to lid 48.13 inches**
  - **Height to security plate mounting hardware 45.75 inches**
- **Component thicknesses**
  - **1 ¾ inch outer shell**
  - **1 ½ inch inner shell**
  - **2 ½ inch cavity end plates**
  - **1 ½ inch outer cover plates**
  - **6 inch minimum shielding**
- **Material: Type 304 austenitic stainless steel and lead**

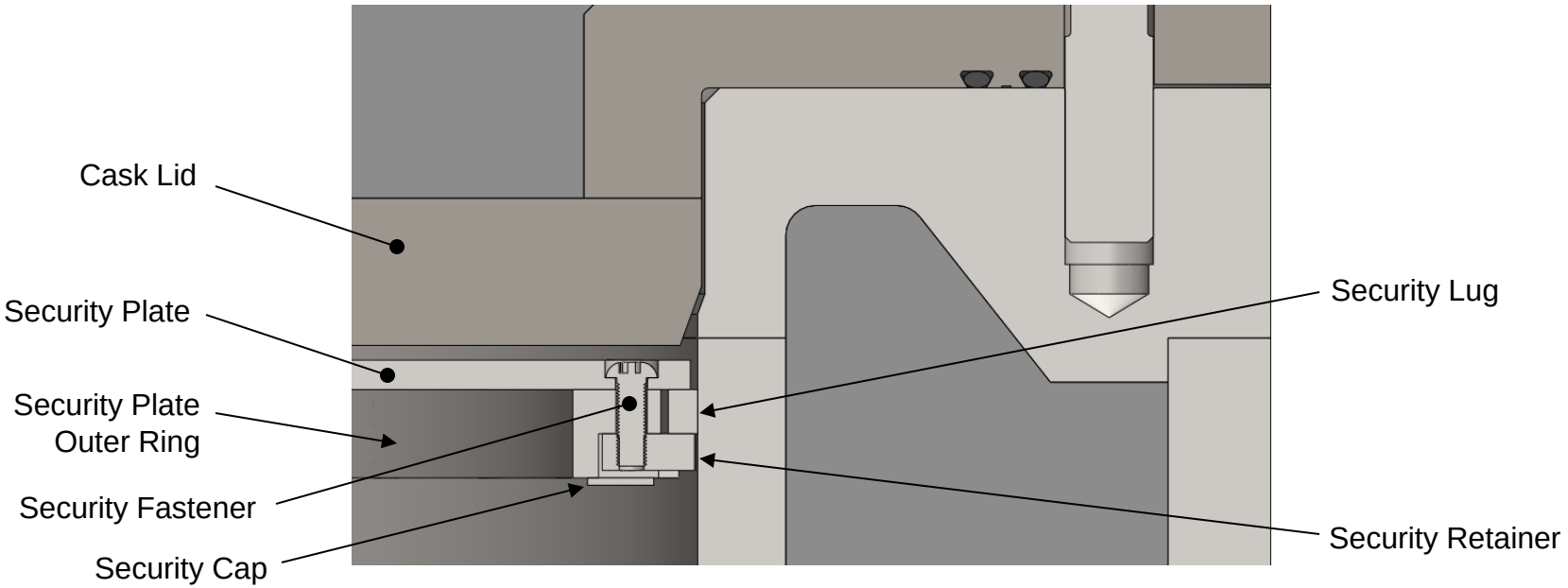


LANS 380-B Packaging Description

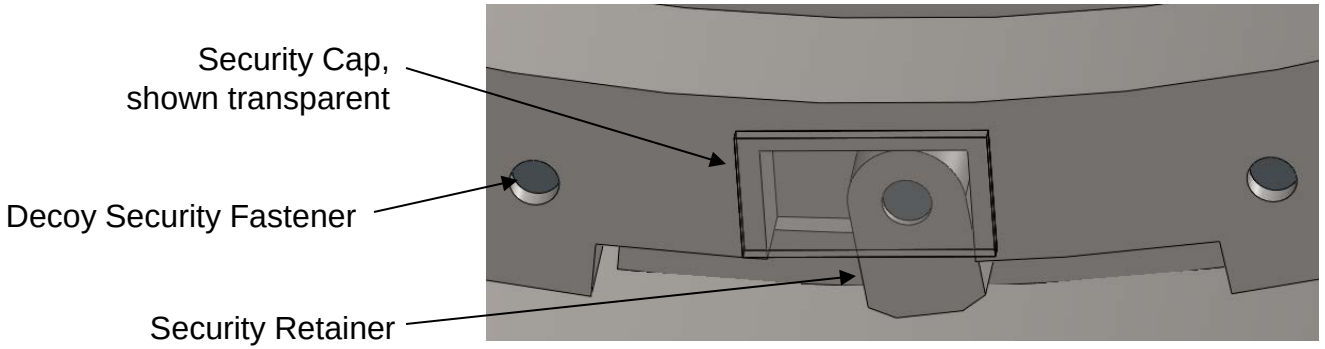
- **Thick section lid flange with lead shielding material and outer cover plate.**
- **36, 1-1/2 inch diameter closure bolts & washers made from ASTM A564 Type 630, Condition H1100**
- **Internal security plate**
  - **½ inch thick type 304**
  - **1 ½ inch thick outer ring for mounting and shielding exclusion zone**
- **Impact limiter lugs have ½ inch holes for security cables/sensors**



LANS 380-B Packaging Description



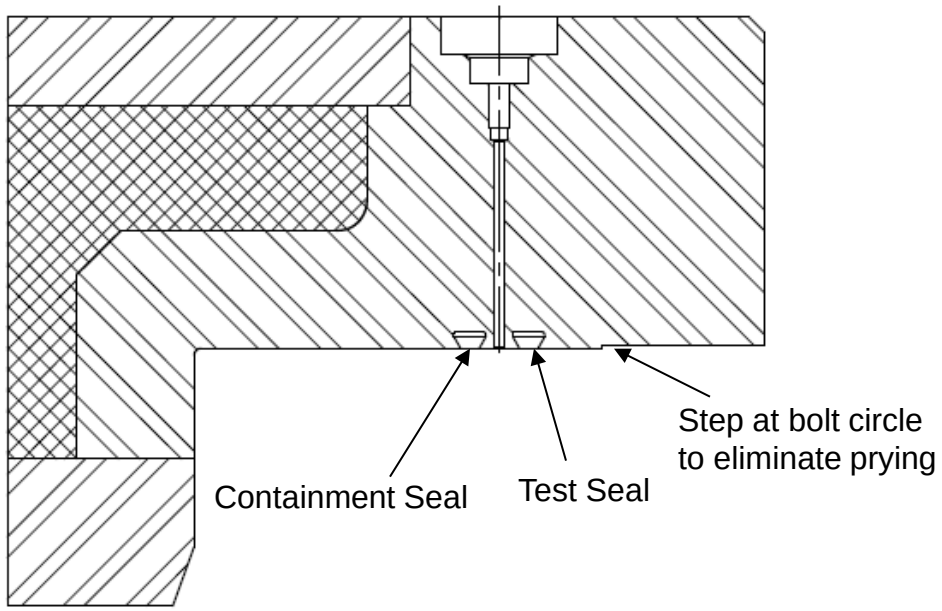
Security Plate



Security Plate Attachment Hardware

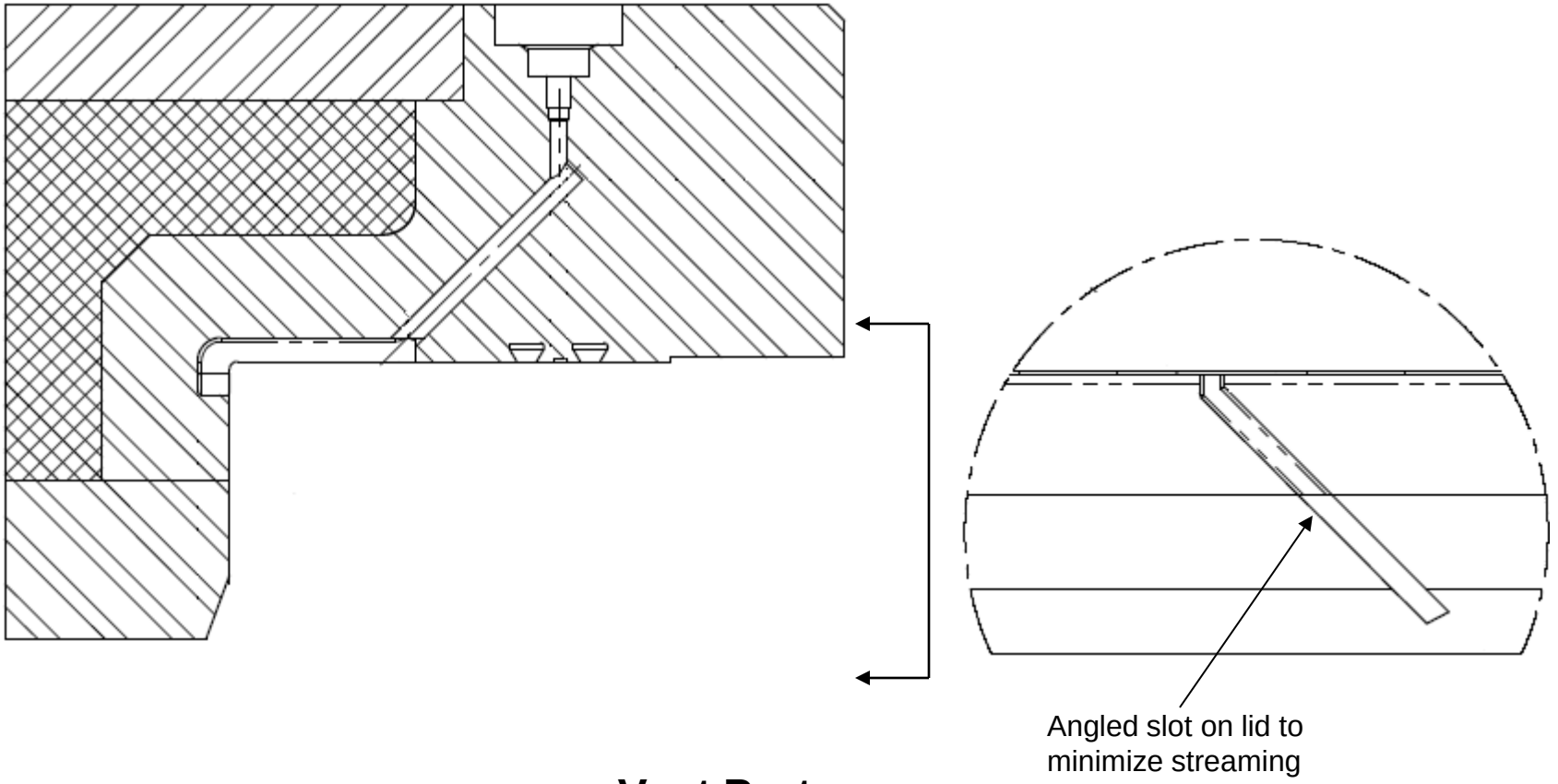
LANS 380-B Packaging Description

- **Containment seal and test seal ⅜-inch diameter butyl rubber on flange face**
- **Seal material made from Rainier Rubber R-0405-70**
- **Bolt circle step to relieve bolt prying**
- **Vent port and seal test port located inboard of bolt circle, with brass covers, brass port plugs, and sealing washers using same butyl elastomer**



Seal Test Port

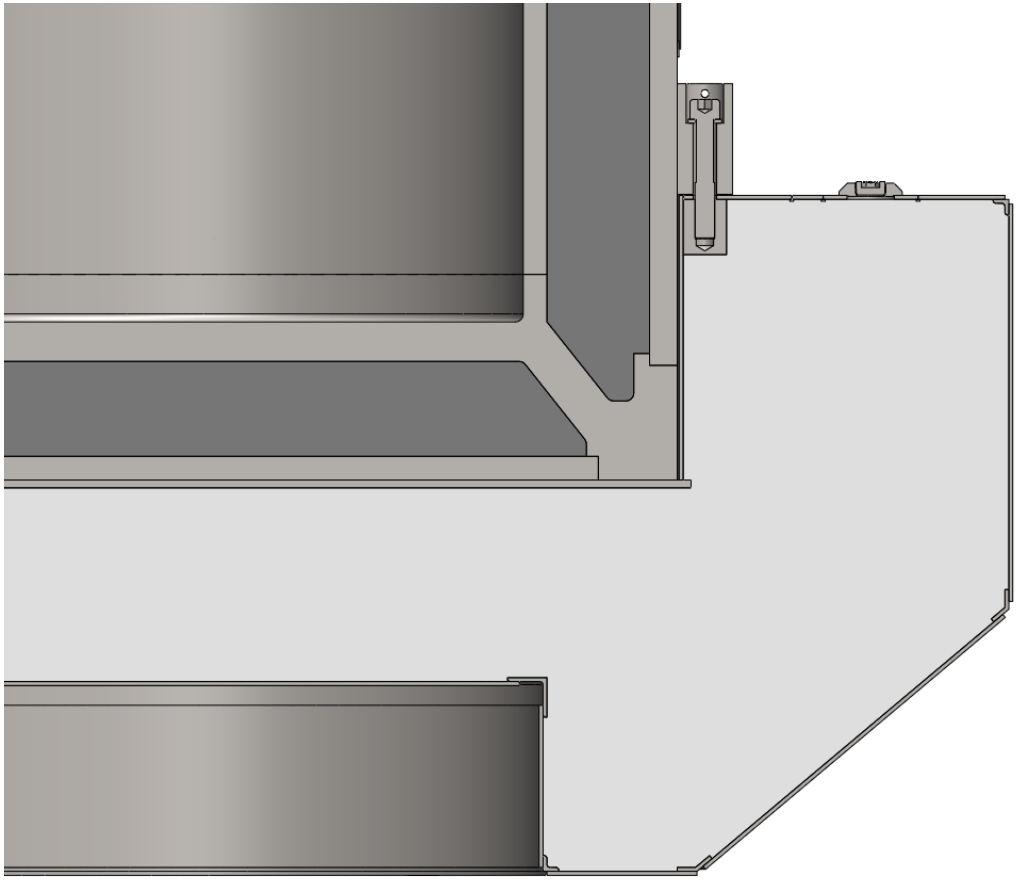
LANS 380-B Packaging Description



Vent Port

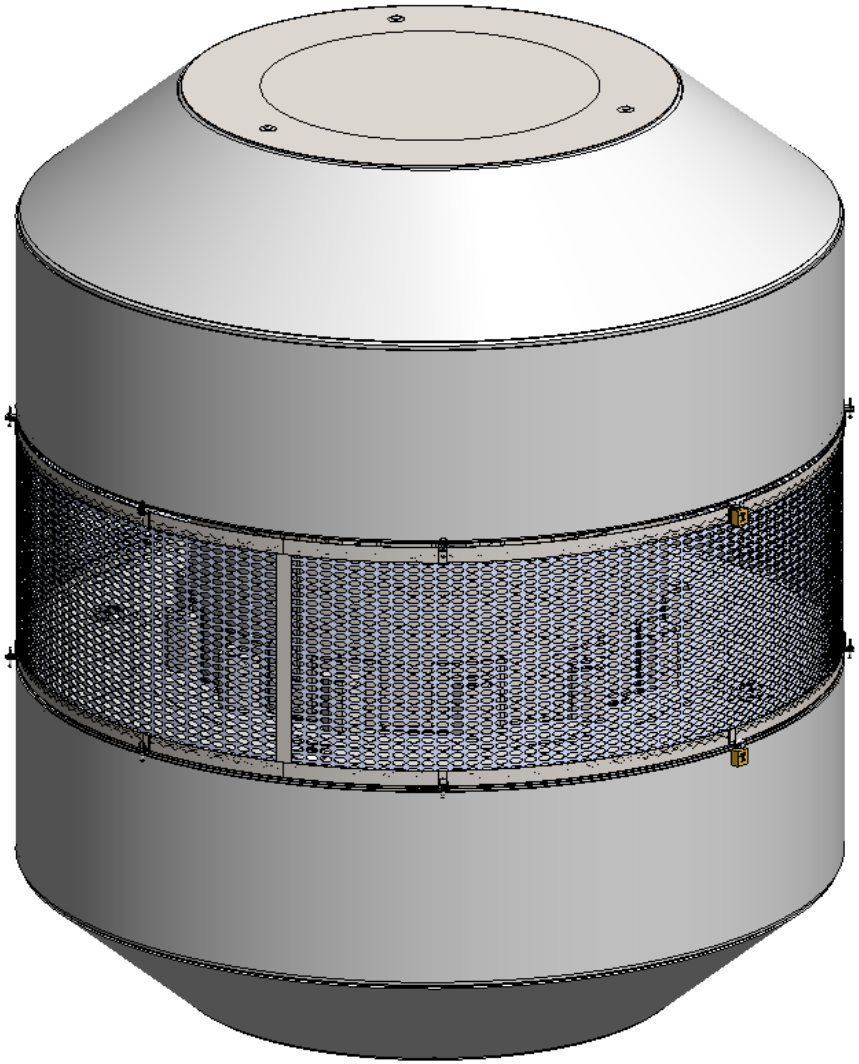
LANS 380-B Packaging Description

- **Base forging or casting with lead shielding material and outer cover plate**
- **Complete joint penetration welds to inner and outer shells**



LANS 380-B Packaging Description

- Impact limiters protect from direct impact and provide fire protection
- Polyurethane foam, approx. 16 lb/ft^3
- IL shell is ¼ inch thick
- 12, 1 ¼ inch diameter impact limiter attachment bolts, made from ASTM A564 Type 630, Condition H1100 & washers
- Personnel barrier between limiters at limiter OD



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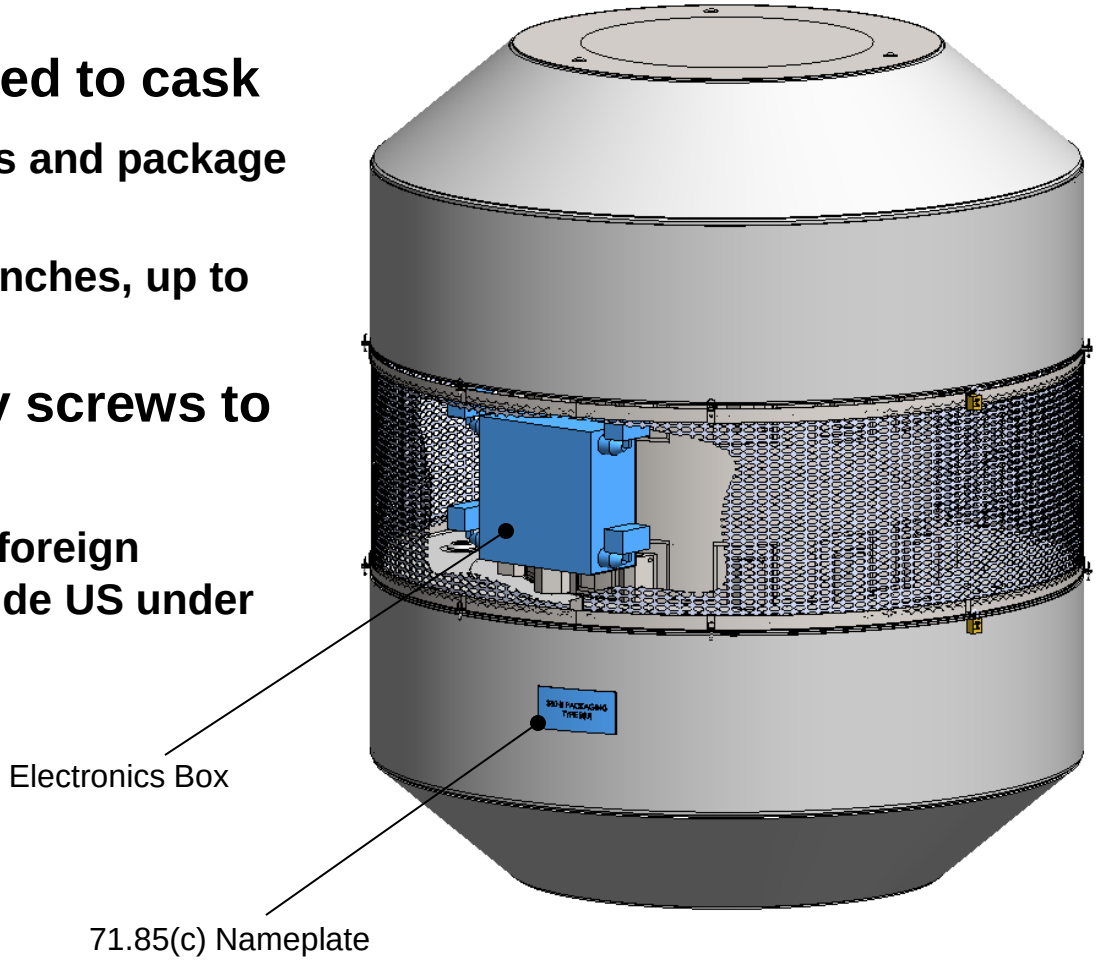
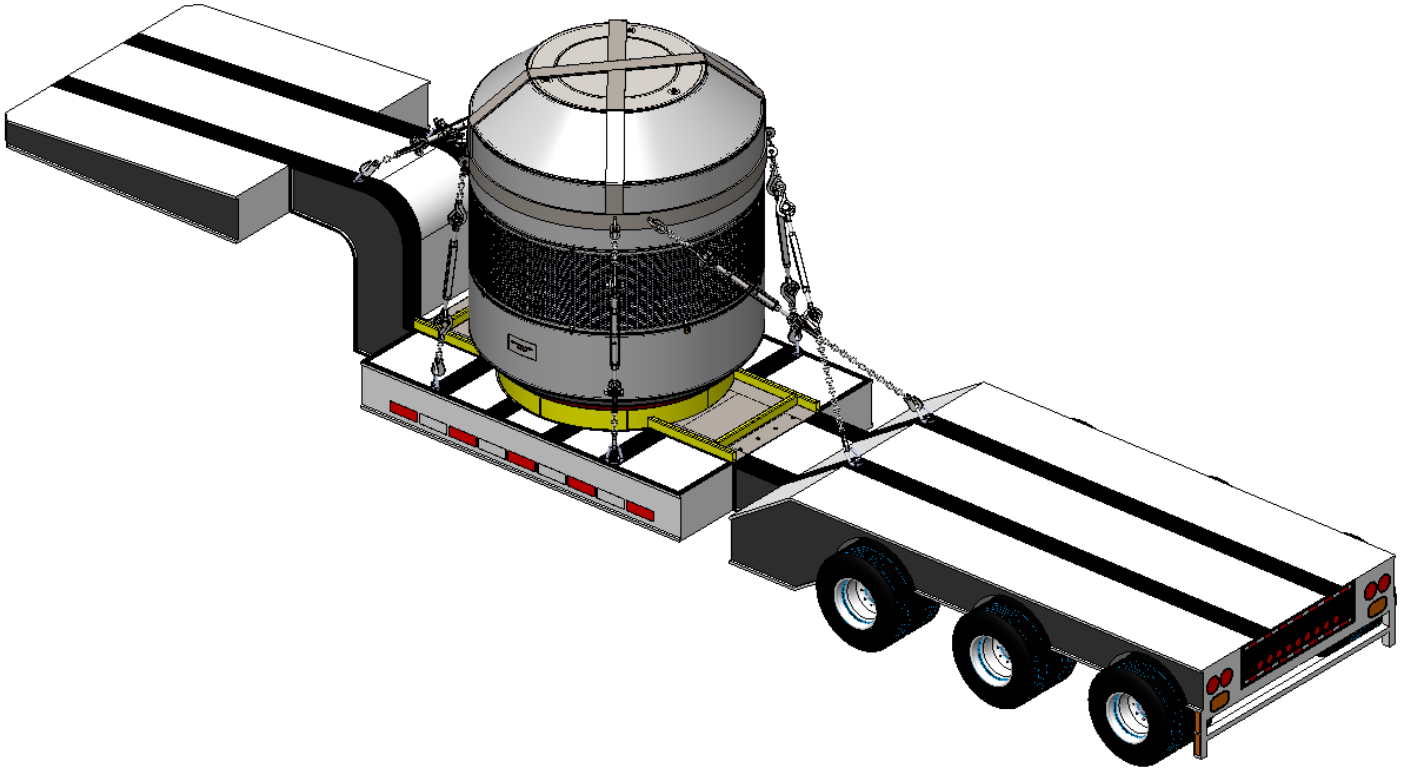
LANS 380-B Packaging Description

- **Electronics box attached to cask**
  - **Used for security cables and package tracking**
  - **Approximately 20 x 20 inches, up to 250 lb**
- **Nameplate attached by screws to impact limiter OD**
  - **Permits changeover to foreign nameplate for use outside US under foreign certificate**



LANS 380-B Packaging Description

- **Tie-downs go over top of upper impact limiter, anchored to conveyance.**



Package on Trailer

Package Design Summary

- **Type B(U)-96**
- **Heavy lead shielding.**
- **Leaktight containment (<1.0 × 10^{-7} std-cc/sec, air) for both NCT and HAC.**
- **For transport by truck, rail, ship, and air.**
- **Weight (approximate):**
  - **120,000 lb total conveyance maximum (highway truck case)**
  - **66,000 lb licensed maximum weight**
  - **12,000 lb payload + dunnage**

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Payloads

- Payloads will consist of radioactive sources contained in shielded medical, industrial, or research devices.
- Devices consist of a source exposure mechanism and a thick shield.
- Shielding is typically lead, may be DU or tungsten.
- Maximum dimensions are 36 inches in diameter and 44.5 inches long.
- Maximum decay heat is 205W.
- Maximum weight is 10,000 lb.
- Source nuclides: Co-60, Cs-137, Sr-90, Ra-226, Ir-192.
  - Governing activity is 7,500 Ci of Co-60
- Devices will be blocked within the cask with dunnage.

Payloads

- **The 380-B cask does not rely on the payload device for shielding or containment.**
  - **The shielding analysis assumes a point source in any location within the package**
- **Consequently, the 380-B package can be used for devices where the integrity of the device shielding or exposure mechanism is not known or is suspect.**
- **There is no need to consider the integrity of the device shielding or of the mechanism when considering the effects of free drop or puncture.**
- **The 380-B can transport any device that meets the isotopic, activity, wattage, size, and weight limits.**

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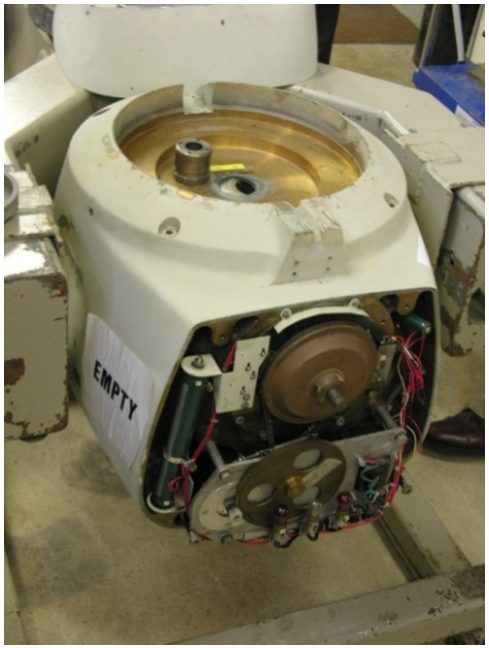
Payloads



Licensing Strategy

- Safety demonstration primarily by analysis.
- Impact limiter performance will be demonstrated by half-scale test of prototypic design, including prototypic attachments.
- Test cask will be an equivalent weight dummy.
- Active accelerometers will be used.
- LS-DYNA calculations used to determine worst-case orientations and behavior at other foam temperatures.
- Test plan to be developed in 2013.
  - Test plan will be discussed with NRC Staff prior to test.
  - NRC Staff will be invited to observe test.
- SAR will be written in terms of both Part 71 and TS-R-1.

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Licensing Strategy

- **Test protocols will satisfy both 10 CFR 71 and IAEA TS-R-1**
  - **-40 ºF cold free drop requirement of TS-R-1 will be addressed.**
  - **The order of puncture will be considered and if necessary, extra puncture drops will be peformed to satisfy both regulations.**
- **Structural analysis**
  - **General stress criteria per Reg. Guide 7.6.**
  - **Load combinations per Reg. Guide 7.8.**
  - **Stress analysis using conservative bound impact acceleration from test.**
  - **Elastic stress in seal area.**
  - **Lead slump analysis.**
  - **Bolting analysis per guidance of NUREG/CR-6007.**
  - **Cask shell immersion buckling analysis per ASME B&PV Code Case N-284-2.**

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Licensing Strategy

- **Thermal by analysis**
  - **Heat source 205 W.**
  - **Decay heat will be applied to cask inner surfaces. Temperature of source or device will not be calculated.**
  - **Half- or quarter- symmetry model using SINDA/FLUINT® analysis software.**
  - **Thermal model will include worst-case HAC free drop and puncture damage to impact limiters.**
- **Shielding analysis**
  - **MCNP model developed using a bounding point source of 7,500 Ci Co-60**
  - **No credit taken for shielding of the source by the device.**
  - **Source is assumed to escape the device shield and be located anywhere in payload cavity for NCT and HAC.**
  - **Streaming in lower corners and in lid closure area will be considered.**

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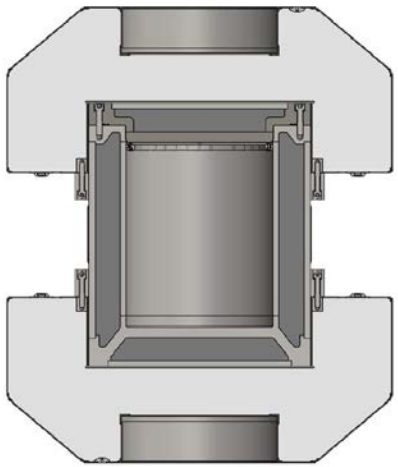
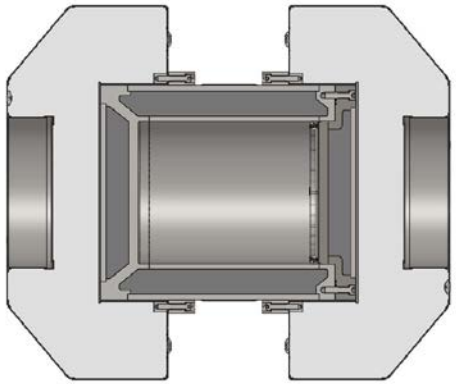
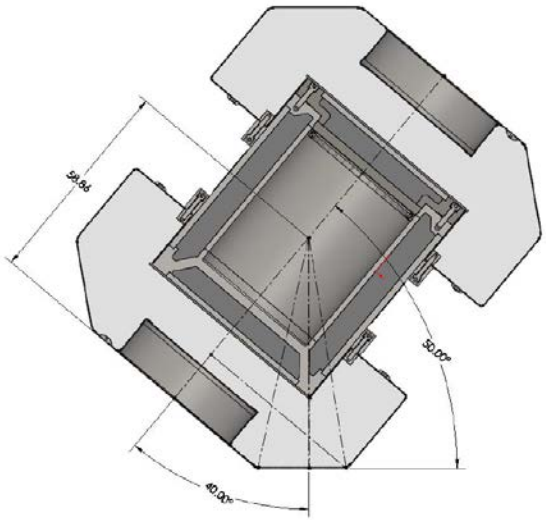
Preliminary Analysis Results

- **Preliminary structural results:**
  - **Bottom end drop <100g**
  - **Side drop <100g**
  - **Center of Gravity over Corner drop <80g**
  - **Max foam strain <90% (CG over Corner, on corner)**







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Preliminary Analysis Results

- **Preliminary shielding results:**
- **Source is assumed outside of device, located nearest to dose location.**
  - **Package side (at personnel barrier), 93.0 mrem/hr < 200**
  - **Top impact limiter, 135 mrem/hr < 200**
  - **Bottom impact limiter, 59.7 mrem/hr < 200**
  - **2 meters from conveyance side, 6.8 mrem/hr < 10**

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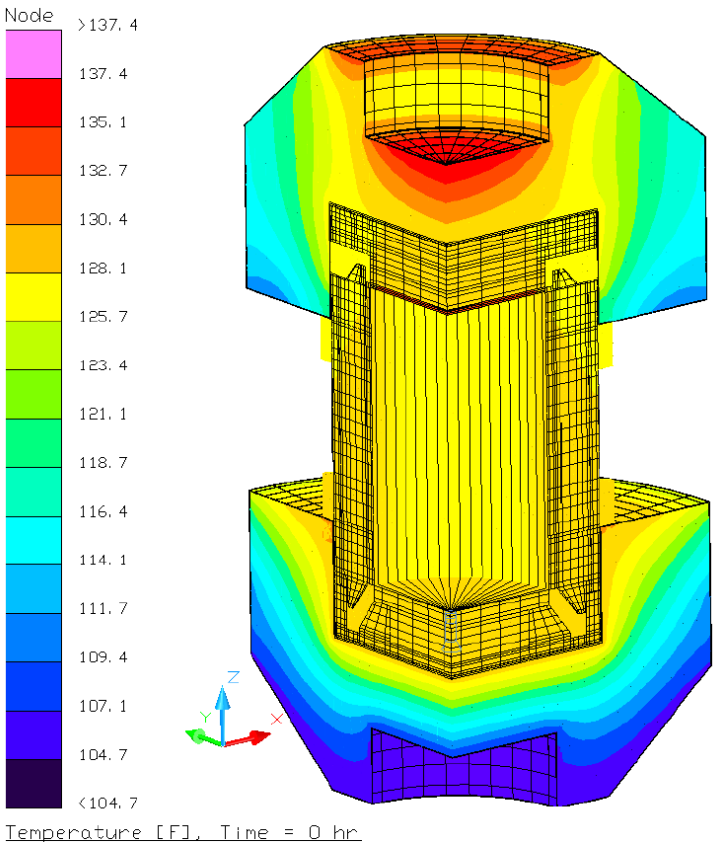
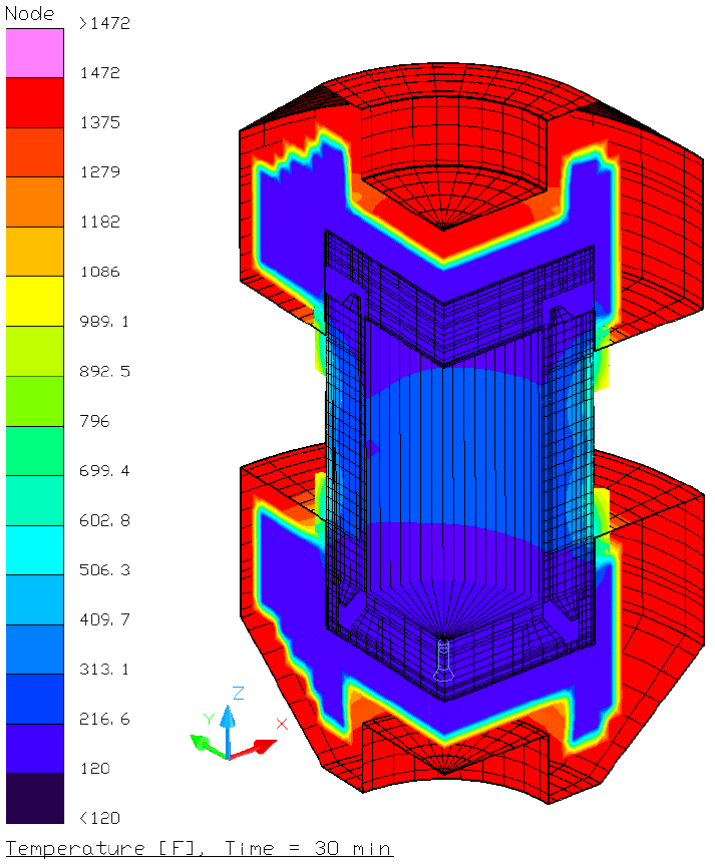
Preliminary Analysis Results

- **Preliminary thermal results:**
  - **NCT hot with solar, containment elastomer seal temperature ~128 ºF (Long term limit is 250 ºF)**
  - **HAC maximum seal temperature (~2.3 hrs after fire start) ~245 ºF (Short term limit is 8 hours at 400 ºF)**
  - **HAC maximum lead temperature 460 ºF (Lead melts at 620 ºF)**
  - **HAC result includes conservatively estimated free drop damage on the impact limiter**

Preliminary Analysis Results



NCT Hot with Solar



HAC with Drop Damage

Planned Project Schedule
(Calendar Year Basis)

- Test plan review meeting with NRC staff – 1st Quarter 2014
- Half scale certification tests – 3rd Quarter 2014
- NNSA application review – approx. 1st Quarter 2015
- Licensing application submittal to NRC – approx. 3rd Quarter 2015
- RAIs – by approx. 1st Quarter 2016
- CoC – by approx. mid 2016

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Conclusion

- **NRC Staff Comments and Suggestions**