Industrial Nuclear Company, Inc.
Multi-Payload Shipping Container
Model MPSC

A Presentation to the
US Nuclear Regulatory Commission

November 17, 2015

INDUSTRIAL NUCLEAR CO., INC

Agenda

- *Introduction*
- *Description of MPSC Package*
- *Materials of Construction*
- *Payload Descriptions*
- *Certification Test Plan*
- *Schedule*
- *Summary*

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Description of MPSC Package

- ***Enclosed, Right Circular Cylinder***
  - ***22” OD x 25” High***
- ***Stainless Steel Construction***
- ***Two Payloads***
  - ***Ten-Hole Source Changer (THSC)***
  - ***Raw Material Shipping Container (RMSC)***
- ***Gross Weight:***
  - ***Approximately 680 lb w/ THSC payload***
  - ***Approximately 745 lb w/ RMSC payload***

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MPSC Materials of Construction

- ***Structural:***
  - ***Type 304 stainless steel plate, bar, and pipe***
  - ***ASTM A320 L7 or L43 Alloy Steel Closure Lid Bolts***
    - ***Outer Lid***
    - ***Inner Lid***
  - ***Body - All welded construction***
  - ***Polyurethane foam for impact mitigation***
- ***Gamma Shielding***
  - ***Provided by THSC and RMSC payloads***
  - ***Cast depleted uranium (DU)***

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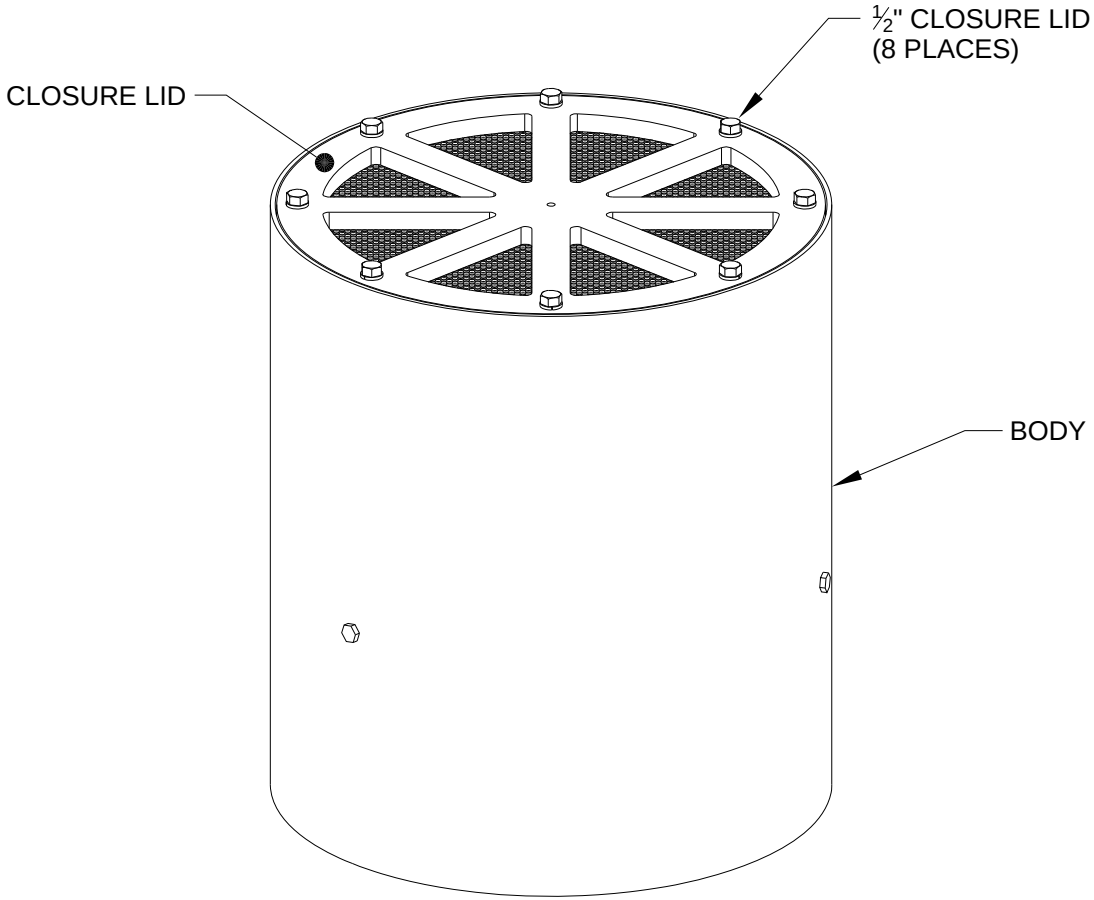
Description of MPSC Package (con't)



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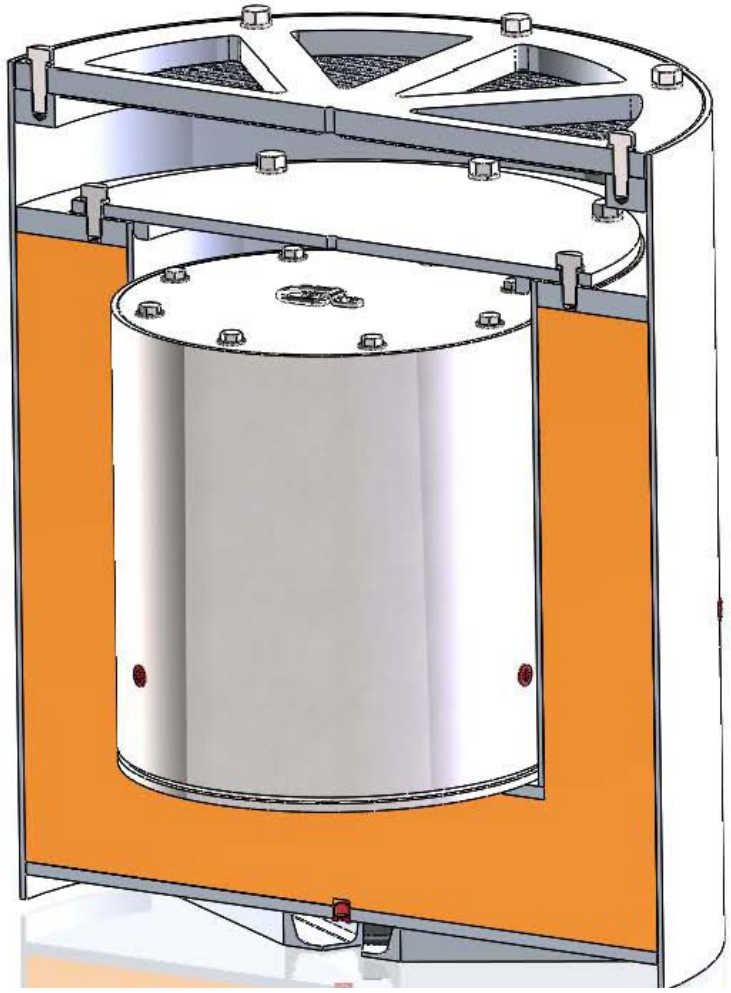
Description of MPSC Package (con't)
THSC Payload



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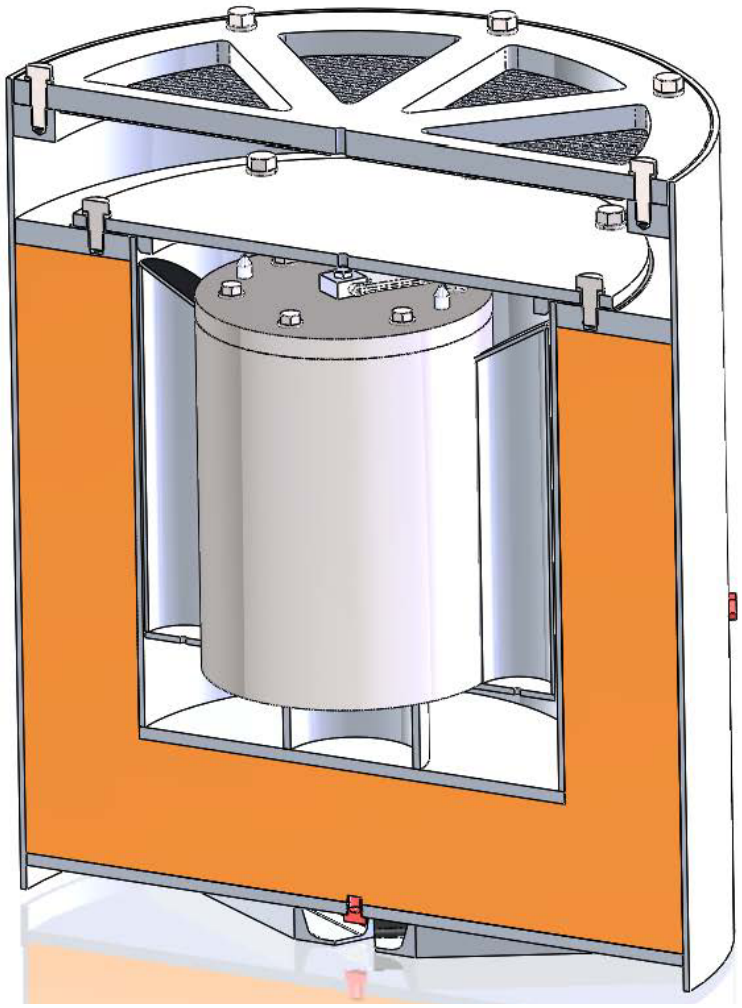
Description of MPSC Package (con't)
RMSC Payload



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Description of THSC Payload

- *Enclosed, Right Circular Cylinder*
  - *12-3/4” OD x 13-1/2” High*
- *Welded Stainless Steel Construction*
- *DU Gamma Shield*
- *Titanium Source Tubes/Hub*
- *Gross Weight: Approximately 327 lb*

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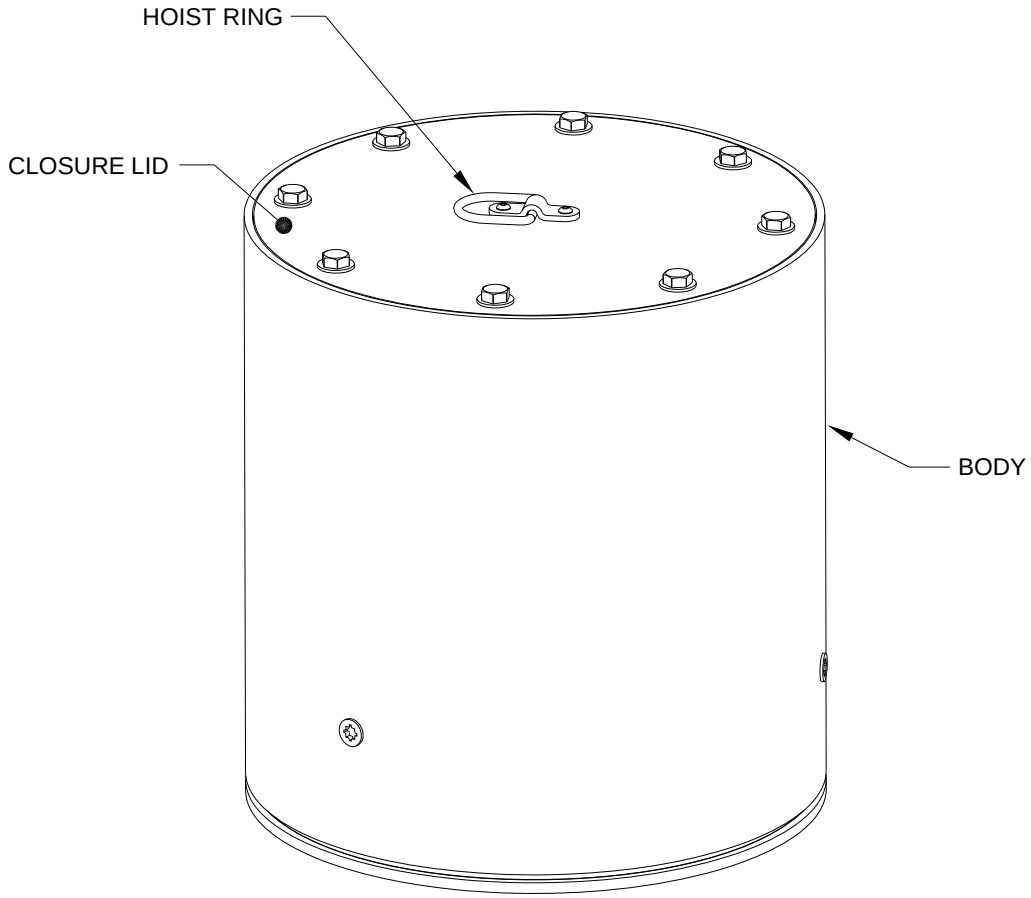
Description of THSC Payload (con't)



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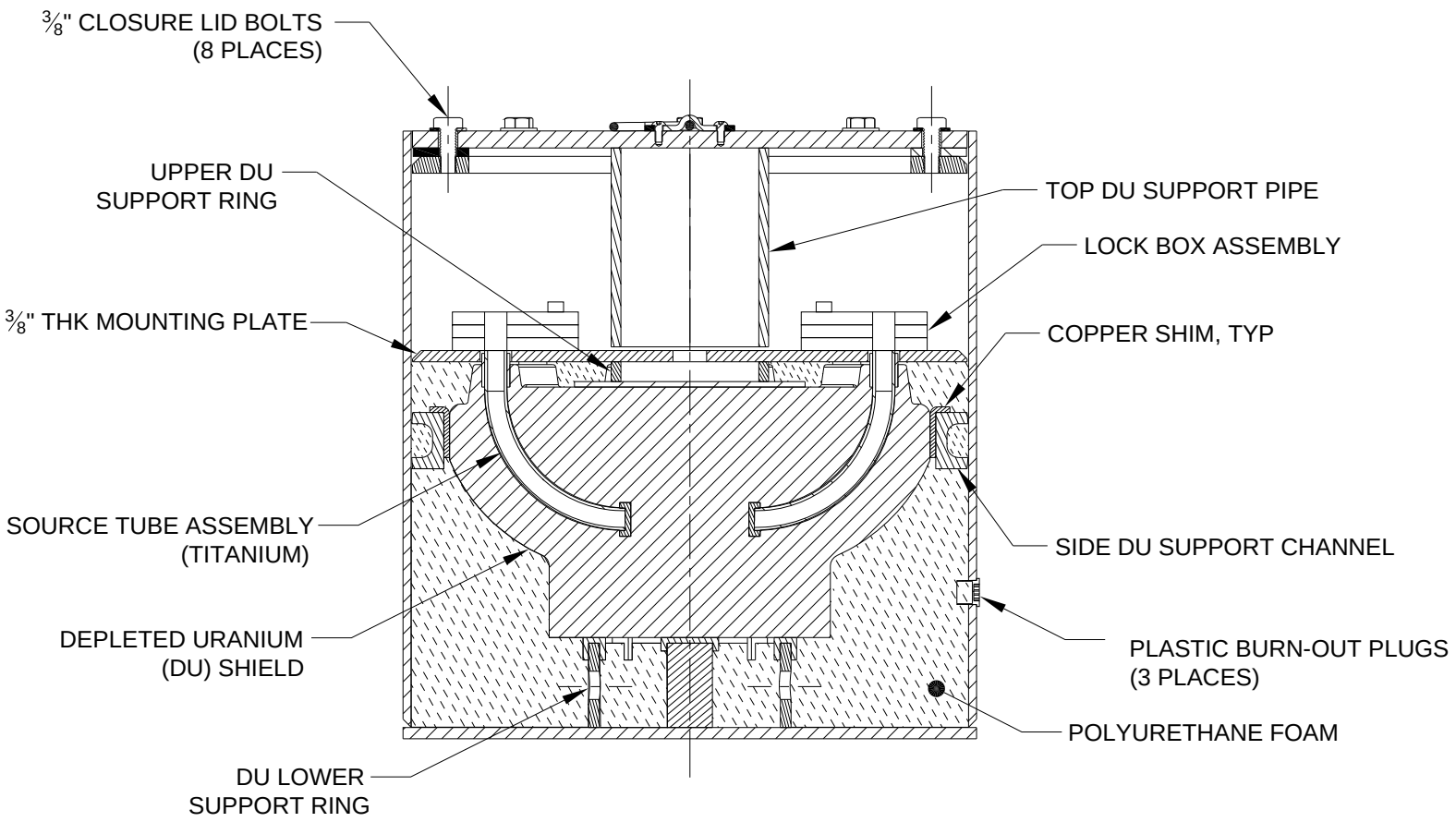
Description of THSC Payload (con't)



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THSC Materials of Construction

- ***Structural:***
  - ***Type 304 stainless steel plate, bar, and pipe***
  - ***ASTM A320 L7 or L43 Alloy Steel Closure Lid Bolts***
  - ***All welded construction encasing gamma shields***
  - ***Copper shims between DU and stainless steel contact points***
  - ***Polyurethane foam for impact mitigation***
  - ***0.50” OD x 0.056” wall titanium source tubes***
  - ***Titanium hub***
- ***Gamma Shielding***
  - ***Cast depleted uranium (DU)***
- ***All materials have been previously used in currently NRC licensed source changers and radiation cameras***

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THSC Contents

- **Contents**
  - *Iridium 192 (Ir–192) capsules*
  - *Selenium 75 (Se–75) capsules*
  - *Licensed as Special Form*
- **Contents limits**
  - *1,500 Ci total limit*
  - *Maximum 150 Ci per capsule*
  - *Maximum of 10 capsules per package*
- **Decay Heat Limit: 11 watts**

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Description of RMSC Payload

- *Enclosed, Right Circular Cylinder*
  - *8-5/8” OD x 11-3/8” High*
- *Welded Stainless Steel Construction*
- *DU Gamma Shield*
- *Gross Weight: Approximately 367 lb*

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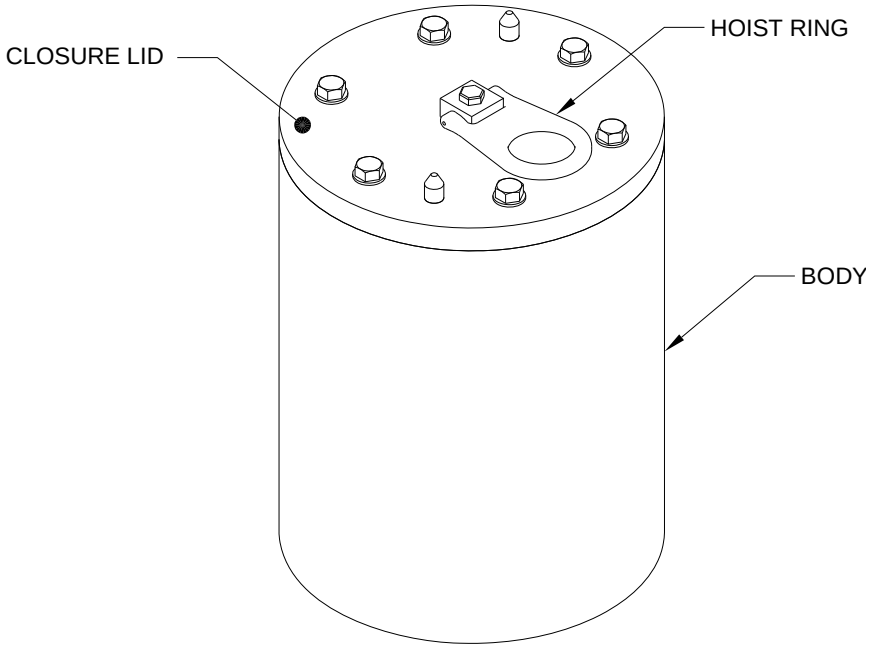
Description of RMSC Payload (con't)



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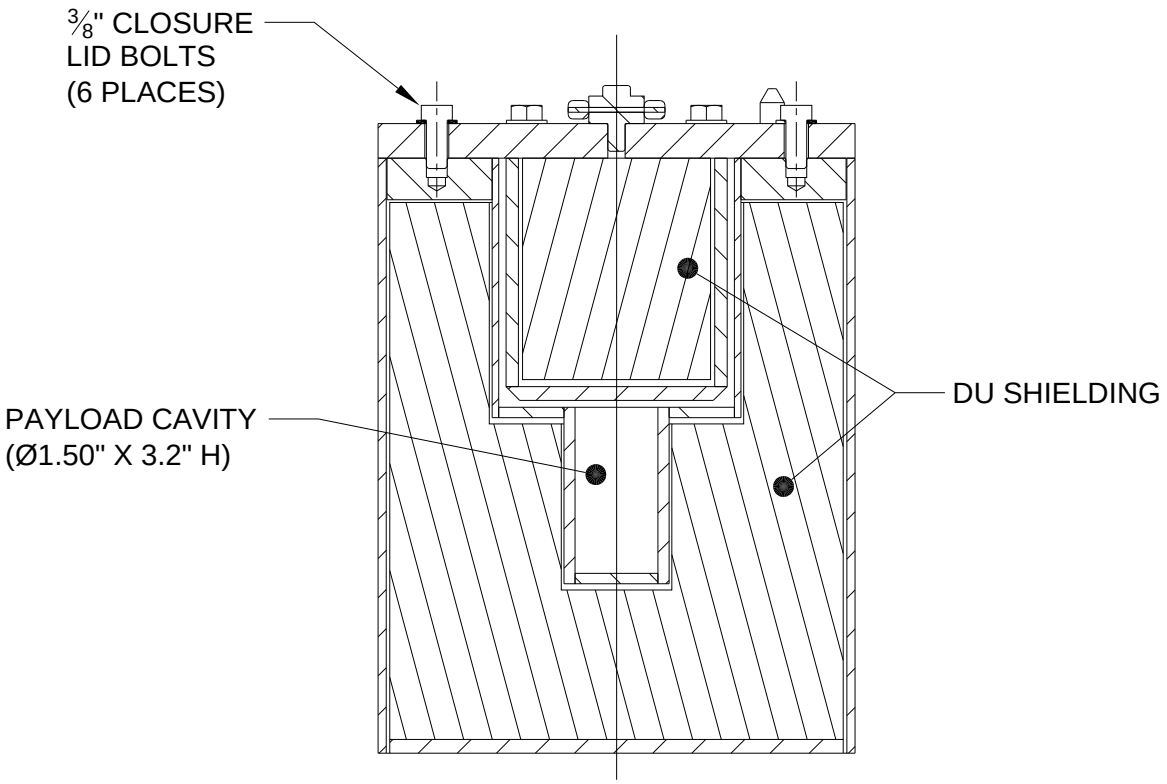
Description of RMSC Payload (con't)



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RMSC Materials of Construction

- ***Structural:***
  - ***Type 304 stainless steel plate, bar, and pipe***
  - ***ASTM A320 L7 or L43 Alloy Steel Closure Lid Bolts***
  - ***All welded construction encasing gamma shields***
  - ***Copper shims between DU and stainless steel***
  - ***Polyurethane foam for impact mitigation***
- ***Gamma Shielding***
  - ***Cast DU***

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RMSC Contents

- **Contents**
  - *Iridium 192 (Ir–192) capsules*
  - *Selenium 75 (Se–75) capsules*
  - *Licensed as Special Form*
- **Radioactive Contents Limit: 12,000 Ci**
- **Decay Heat Limit: 85 watts**

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MPSC Certification Test Plan

- ***Objectives***
  - ***To demonstrate that, after a worst–case sequence of free and puncture drops, no degradation in shielding capability of payload packages occurs***
  - ***To demonstrate retention of special form capsules within the gamma shields***

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MPSC Certification Test Plan (con't)

- *Full–scale, prototypic CTUs*
- *Demonstration basis: radiation dose rates comply with 10 CFR 71 radiation limits after full series of free and puncture drops*
  - *No shielding credit for outer MPSC package*
  - *Use of actual radioactive source capsules in THSC and RMSC payloads*
  - *Post–test readings versus pre–test readings*
- *Normal speed filming of free drops planned*
- *Tests*
  - *Free Drops*
  - *Puncture Drops*

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MPSC Certification Test Plan (con't)

- ***Structural evaluations:***
  - ***NCT free drops, and HAC free & puncture drops, by test***
    - ***Total of two NCT free drops***
    - ***Total of five HAC free and four puncture drops***
  - ***All other NCT and HAC load cases by analysis***
- ***Thermal NCT & HAC evaluations by analysis***

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MPSC Certification Test Plan (con't)

- ***Initial conditions***
  - ***For high-impact free drops, temperature will be cold (-20 °F):***
    - ***Top down orientation***
  - ***For maximum deformation free drops, temperature will be NCT hot condition:***
    - ***CG–over–corner***
    - ***Side***
  - ***Puncture tests will be performed at ambient temperature***

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MPSC Certification Test Plan (con't)

- *Two NCT, 4–ft free drops*
- *Four HAC 30–ft free drops*
  - *Two focused on impact*
  - *Two focused on deformation*
- *Four puncture drops*
  - *Tentatively the same free drop orientations*
  - *Final orientations to be determined based on observed free drop damage*
- *Thermal Evaluation of Most Damaged CTU(s)*

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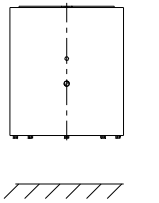
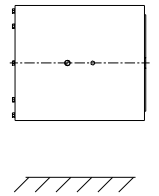
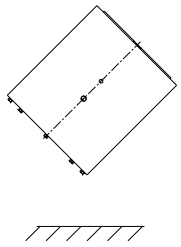
MPSC Certification Test Plan (con't)

Free Drop Test	Purpose
Vertical, Top Down (cold); NCT & HAC THSC & RMSC Payloads	Max impact to dislodge gamma shields, source capsules
Side (hot) RMSC Payload	Impact to damage gamma shields, enclosure
Top Down, CG–over–Corner (hot) THSC & RMSC Payloads	Max deformation to attempt to damage lock block assemblies, damage gamma shields







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MPSC Certification Test Plan (con't)

- **Data collection**
  - **Temperature of polyurethane foam**
  - **Normal speed film**
- **Measurements (pre– and post–test)**
  - **Crush distance, puncture damage**
  - **Radiation Dose Rates**
  - **Photographs**

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MPSC Certification Test Plan (con't)

- ***Acceptance Criteria***
  - ***Radiation dose rates comply with 10 CFR §71.51(a)(2):***
    - ***THSC payload***
    - ***RMSC payload***
  - ***No dislodgement of source capsules in THSC payload***
  - ***No loss of gamma shielding in RMSC payload***
- ***Discussion***

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Schedule

- *CTU fabrication completion – 1st Quarter 2016*
- *Certification testing – 2nd Quarter 2016*
- *Submittal of application to NRC for Type B(U)–96 certification – 3rd Quarter 2016*
- *Planning on approximately 5 months to first round RAIs*

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MPSC Package

- ***Summary***

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