Industrial Nuclear Company, Inc.
Outer Package, Raw Material Shipping Container
Model OP-RMSC

A Presentation to the
US Nuclear Regulatory Commission

December 4, 2019

INDUSTRIAL NUCLEAR CO., INC

Agenda

- *Introduction*
- *Description of OP-RMSC Package*
- *Materials of Construction*
- *Payload Description*
- *Certification Test Plan*
- *Schedule*
- *Summary*

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Description of OP-RMSC Package

- ***Enclosed, Right Circular Cylinder***
  - ***18” OD x 22-1/4” High Sch 10S Pipe***
- ***Stainless Steel Construction***
- ***Single Payload***
  - ***Raw Material Shipping Container (RMSC)***
- ***Gross Weight: Approximately 650 lb***

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OP-RMSC 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 minimal impact mitigation***
- ***Shielding***
  - ***Provided by RMSC payload***
  - ***Tungsten gamma shields***

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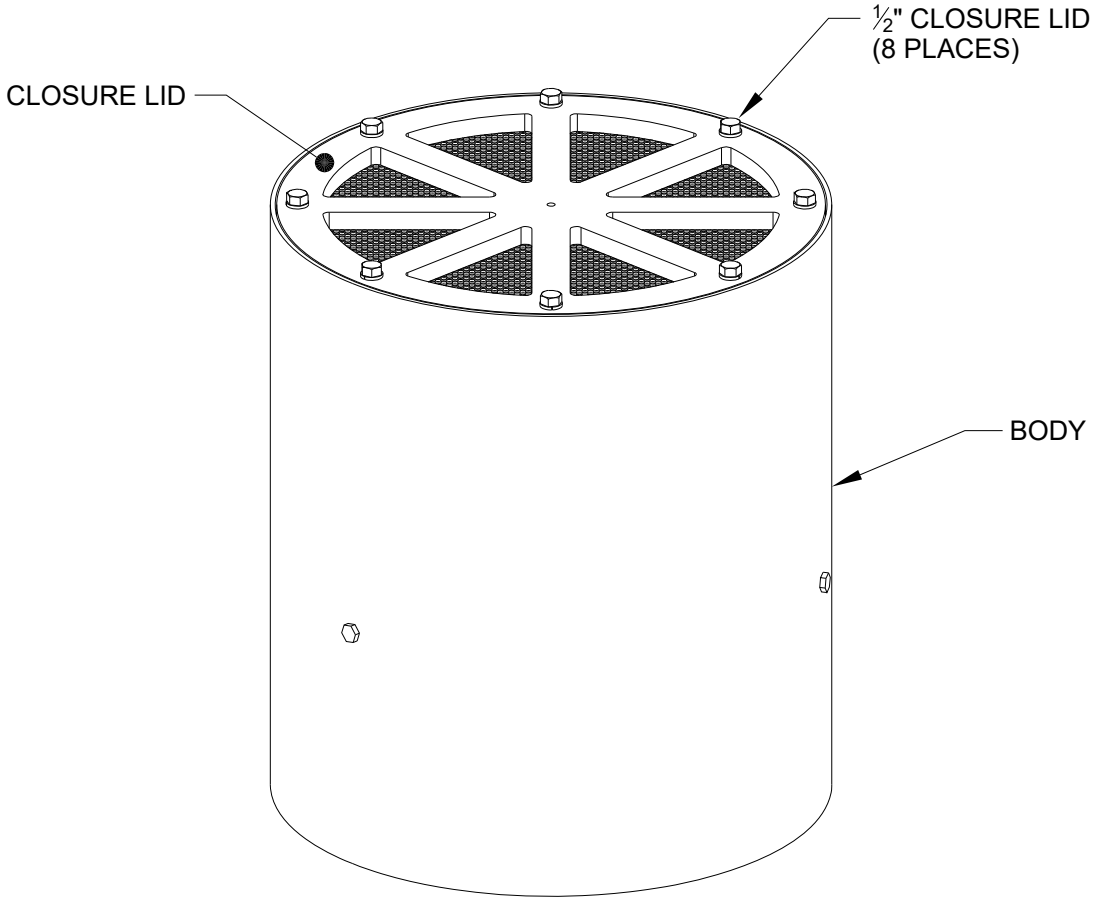
Description of OP-RMSC Package (con't)



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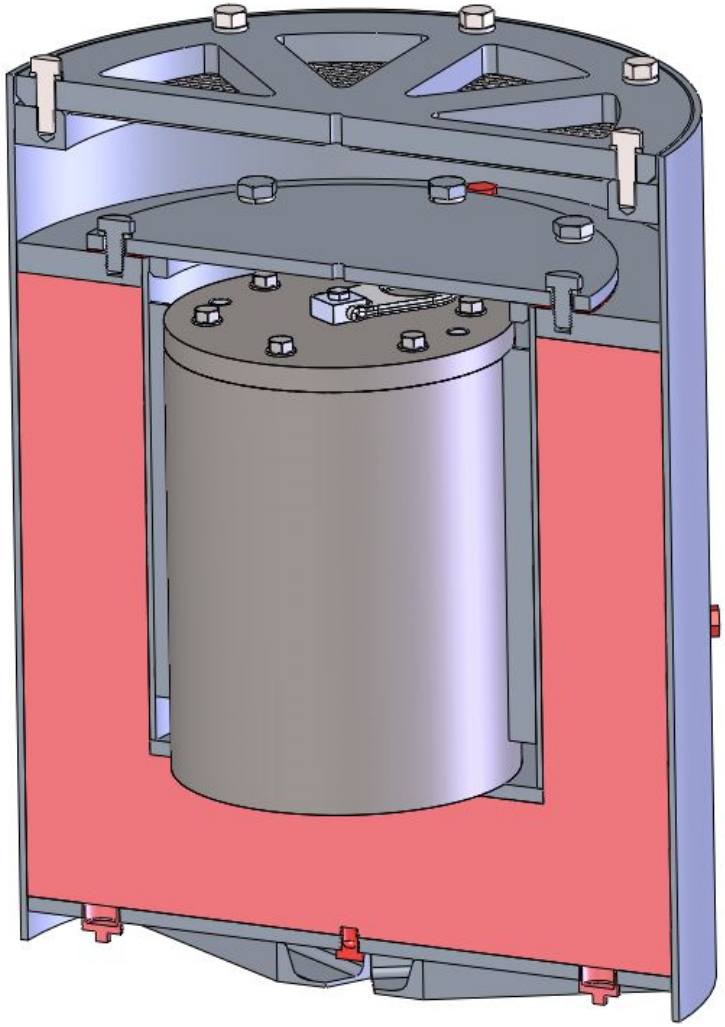
Description of OP-RMSC Package (con't)
RMSC Payload



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Description of RMSC Payload

- *Enclosed, Right Circular Cylinder*
  - *8-5/8” OD x 11-3/8” High Sch 10S Pipe*
- *Welded Stainless Steel Construction*
- *Bolted Stainless Steel Closure Lid*
- *Gross Weight: Approximately 380 lb*

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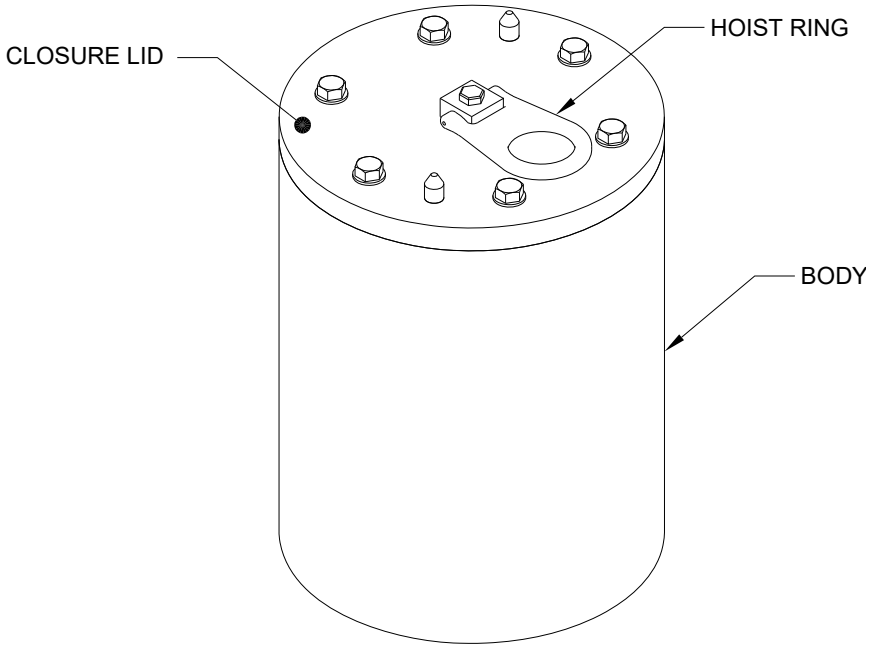
Description of RMSC Payload (con't)



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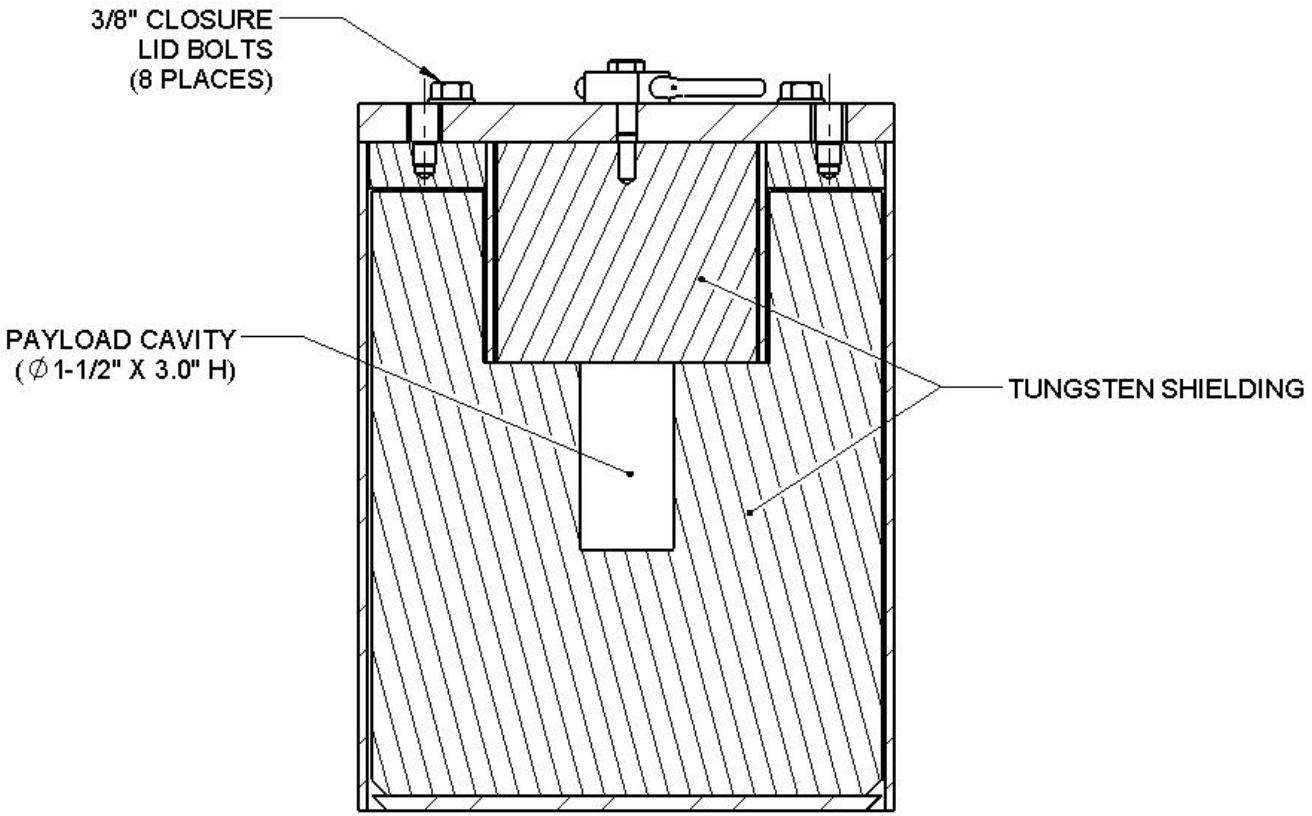
Description of RMSC Payload (con't)



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RMSC Materials of Construction

- ***Structural:***
  - ***Type 304 or 304L stainless steel plate, bar, and pipe***
  - ***ASTM A320 L7 or L43 Alloy Steel Closure Lid Bolts***
  - ***All welded construction encasing body gamma shield***
  - ***Bolted closure lid securing cavity gamma shield***
- ***Gamma Shielding: Tungsten Heavy Metal***

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RMSC Contents

- ***Contents:***
  - ***Licensed as Special Form***
  - ***Iridium 192 (Ir–192) capsules***
  - ***Selenium 75 (Se–75) capsules***
  - ***Cobalt 60 (Co–60) capsules***
  - ***Cesium 137 (Cs–137) capsules***
- ***Radioactive Contents Limits (to be verified):***
  - ***Ir-192: 16,000 Ci***
  - ***Se-75: 16,000 Ci***
  - ***Co-60: 3 Ci***
  - ***Cs-137: 16,000 Ci***
  - ***Comply with 10 CFR §71.47(a) radiation levels***
- ***Decay Heat Limit: 115 watts***
  - ***Surface temperature limit of 50 °C (122 °F) per 10 CFR §71.43(g)***

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OP-RMSC Certification Test Plan

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

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OP-RMSC 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 OP-RMSC package*
  - *Use of actual radioactive source capsules in RMSC payload*
  - *Post–test readings versus pre–test readings*
- *Normal speed filming of free drops planned*
- *Tests*
  - *Free Drops*
  - *Puncture Drops*

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OP-RMSC Certification Test Plan (con't)

- ***Structural evaluations:***
  - ***NCT compression and free drop, HAC free & puncture drops, by test***
    - ***Total of one NCT free drop***
    - ***Total of three HAC free and three puncture drops***
  - ***All other NCT and HAC load cases by analysis***
- ***Thermal NCT & HAC evaluations by analysis***

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OP-RMSC 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:***
    - ***Side***
    - ***CG–over–Top corner***
  - ***Puncture tests will be performed at ambient temperature***

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OP-RMSC Certification Test Plan (con't)

- One NCT, 4–ft free drop
- Three HAC 30–ft free drops
  - One focused on impact
  - Two focused on deformation
- Three puncture drops
  - Tentatively the same free drop orientations
  - Final orientations to be determined based on observed free drop damage

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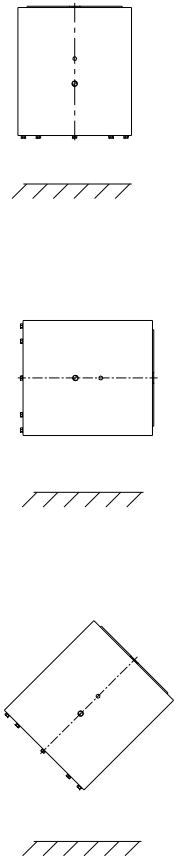
OP-RMSC Certification Test Plan (con't)

Free Drop Test	Purpose
Vertical, Top Down (cold); NCT & HAC	Max impact to dislodge RMSC payload, gamma shields, source capsules
Side (hot)	Impact to damage RMSC payload, gamma shields
Top Down, CG–over–Corner (hot)	Max deformation to attempt to damage closure, RMSC payload



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OP-RMSC Certification Test Plan (con't)

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

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OP-RMSC Certification Test Plan (con't)

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

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Schedule

- *CTU fabrication completion – 4th Quarter 2019*
- *Certification testing – 1st Quarter 2020*
- *Submittal of application to NRC for Type B(U)–96 certification – Late 1st or Early 2nd Quarter 2020*
- *Planning on approximately 5 months to first round RAIs*

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OP-RMSC Package

- ***Summary***

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