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PAT-1 SAR Addendum Update

Paul Mann

Defense Programs Packaging Manager; NNSA

David Miller

Transportation and Environmental Safety Manager; SNL

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

VTC Purpose

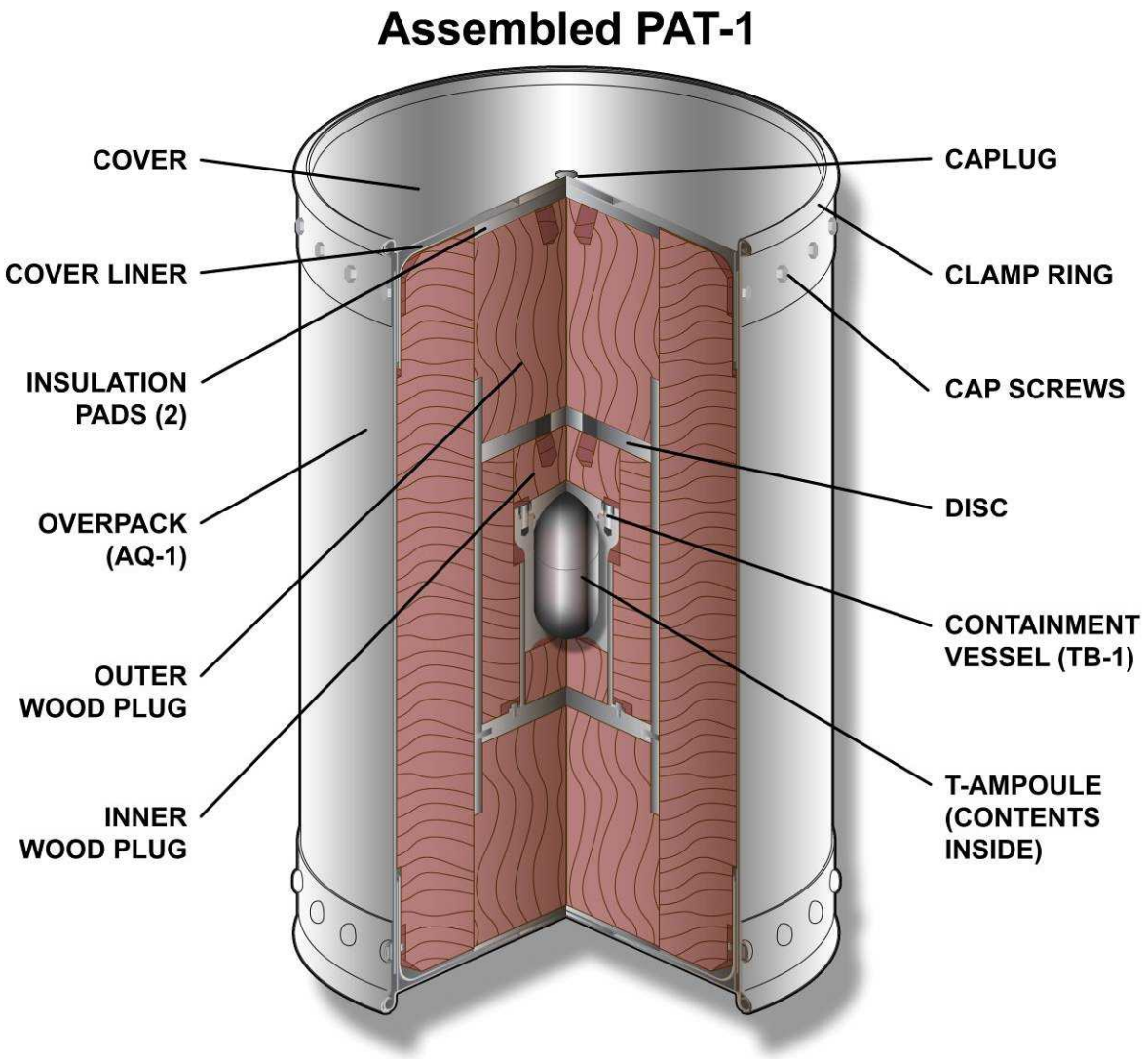
- Have completed analysis to add Pu metal to the PAT-1
- Learned much regarding structural analysis and response
- Structural analysis will be main focus of VTC – would like your thoughts on the approach
- We will show analysis incorporates conservative assumptions
- Confident we are safe and proposed metal contents within regulatory requirements

DOE Program Needs Air Transport of Pu Metals Addendum

- Existing SAR certification for PuO_2
- New program needs for Pu metal
- Support of critical security programs
- Material exchanges for experiments
- Plutonium metal return

Goal: Develop capability for air shipment of Pu metal under US and international regulations.

PAT-1 Air Transportable Package



Current PAT-1 Package with PC-1

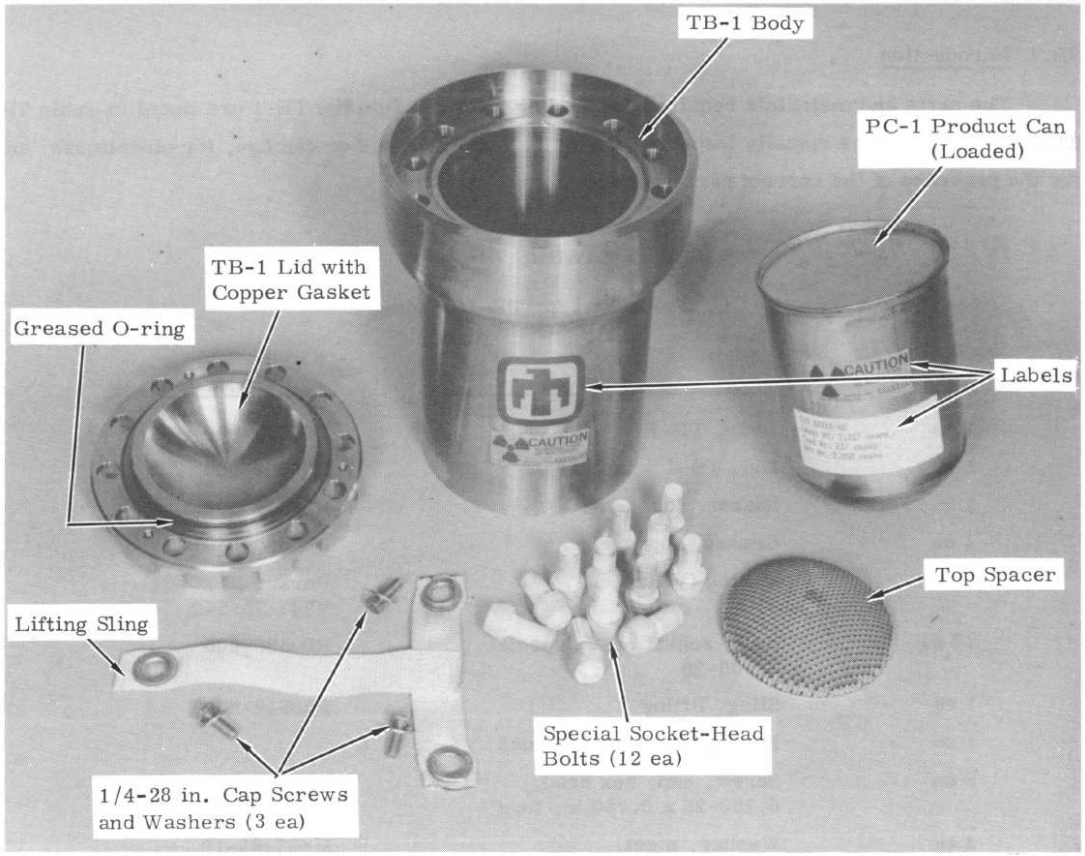


Figure 7B-1. Parts for Loading PC-1 Product Can

Current CoC Authorized Contents

- Existing package certified (1978) by the NRC for shipping PuO_2.
- Type and form of material – PuO_2 and daughter products (solid form), may be mixed with UO_2 and daughter products (solid form).
- Maximum quantity per package – 2 kg total radioactive material, lesser amounts (200 g) authorized as described in CoC.
- Maximum decay heat load of contents may not exceed 25 watts.

Prior NRC Meetings

- Pre-application Meeting – May 23, 2006 - NRC
  - NNSA and SNL briefed NRC of need for PAT-1 to transport metals.
- NRC Fact Finding Meeting – September 25, 2006 - SNL
  - NRC reviewed PAT-1 certification documents.
- First PAT-1 Meeting – June 13, 2007 - NRC
  - Described need for addendum, authorized contents, hardware description, structural criterion, eutectic, shielding and criticality analyses.
  - Changing the nature of material contents led to proposed new work activities.
  - Actions from NRC meeting
    - TB-1 bolt analysis.
    - Detailed shielding and criticality calculations.
    - Full body of analysis to determine decelerations.
- Second PAT-1 Meeting – July 2008 - VTC
  - TB-1 leakage rate test same as SAR.
  - Single containment evaluation was concurred to be not required.
- All actions have been completed and questions satisfactorily addressed.

NNSA PAT-1 Certification Strategy

- New plutonium metal contents has one containment boundary (TB-1) under all transport conditions.
- TB-1 leak rate test per current SAR.
- Eutectics prevention with titanium barrier.
- Structural analysis to use tearing parameter as failure criteria.

Proposed Contents

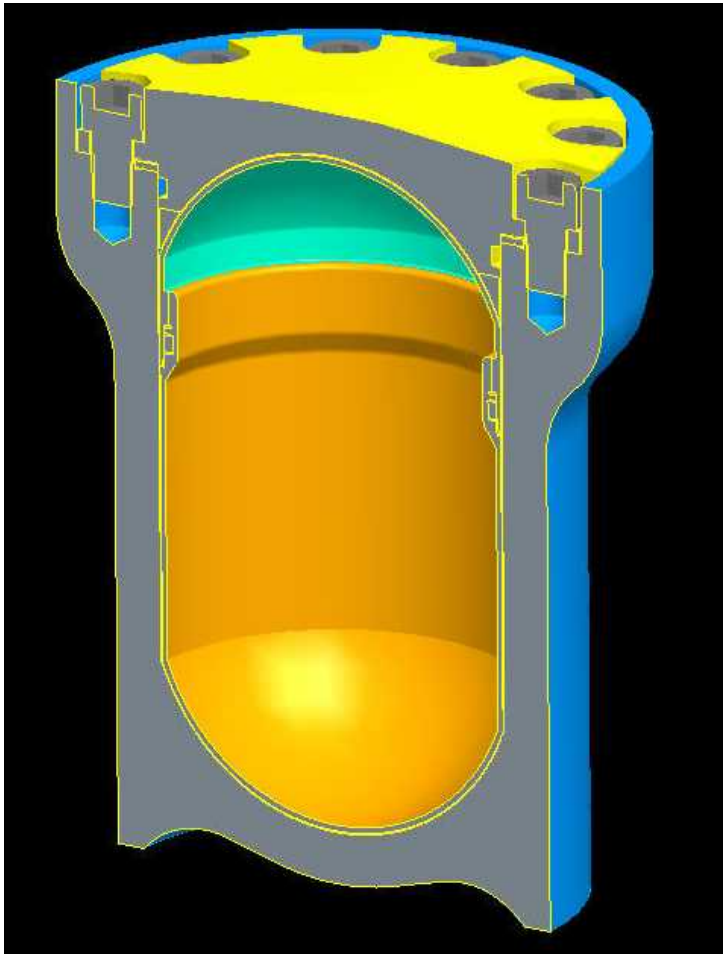
- Adding plutonium metal
  - <20 Ci PuO_2 as approved contents
  - 831 gram maximum plutonium metal content
- Various content configurations
  - Hollow cylinders
  - A variety of shapes that are bounded by a solid cylinder in titanium containers.
  - Composite (PuBe) samples bounded by a solid cylinder.

TB-1 Containment Vessel

(Shown with T-Ampoule)

ATTRIBUTES:

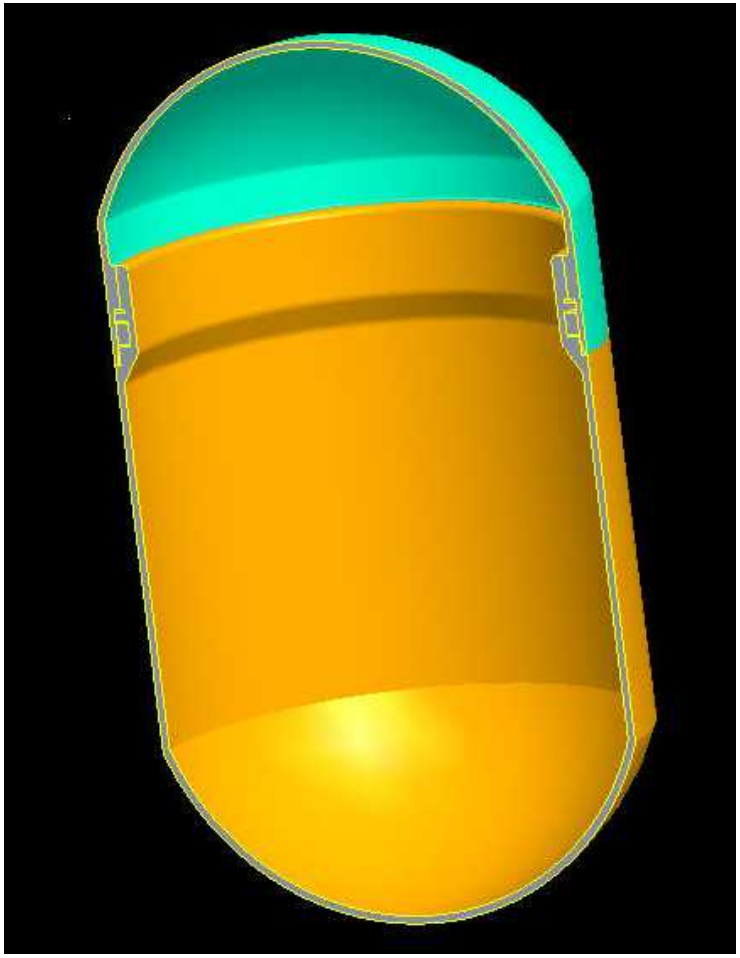
- TB-1 design unchanged
- PH13-8Mo stainless steel
- 12 fasteners
- Copper gasket and O-ring
- 25 watts decay heat
- 4.6 lbs (2.1 kg) content weight
- 41.6 lbs (18.9 kg) maximum gross weight
- Maximum 1080˚F (582˚C) during air accident fire test



T-Ampoule

ATTRIBUTES:

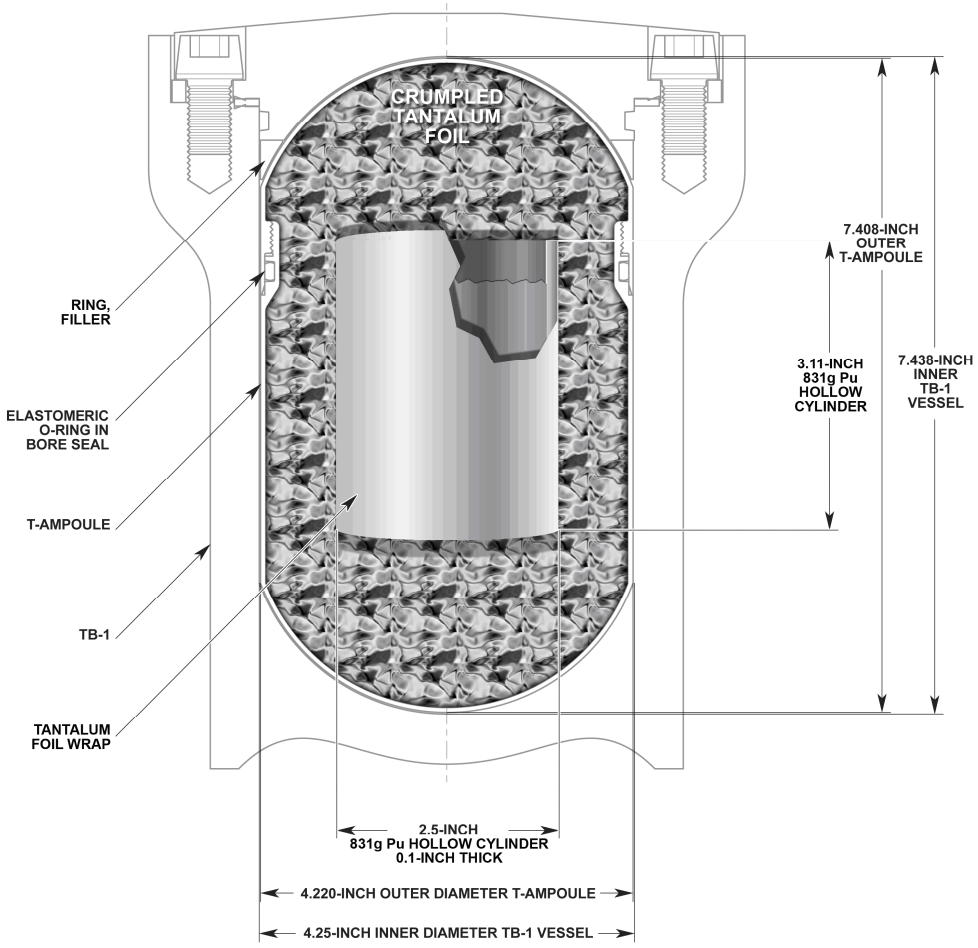
- Eutectic prevention barrier
- Titanium alloy (Ti-6Al-4V)
- 2-piece construction
- Machined from solid bar stock
- No welding processes
- Threaded closure bore seal w/ elastomeric O-ring
- Minimum 0.060” wall thickness
- Contents include Pu metal, sample containers
- Maximum gross weight of 4.6 lbs (2.1 kg)
- Analysis concludes that T-ampoule maintains integrity under regulatory conditions.



Electro-Refined Plutonium Cylinder

ATTRIBUTES:

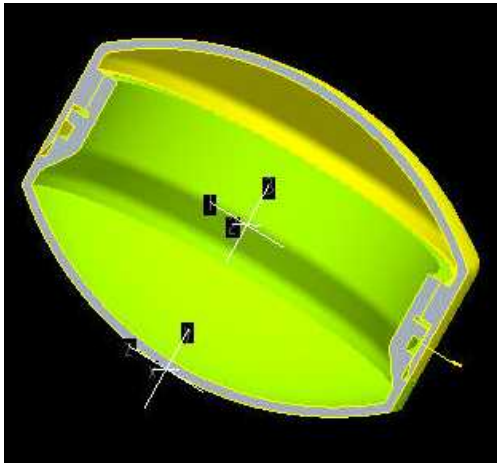
- Hollow Pu cylindrical shape allows softer deformable configuration to mitigate impact stresses
- Allowable Pu mass ranges from 731 and 831 grams
- Tantalum foil is used to wrap cylinder and crushed tantalum foil supports Pu metal cylinder



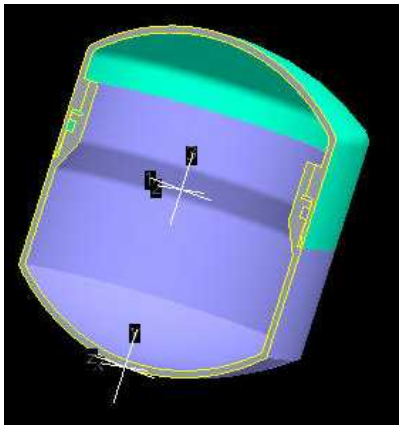
Sample Containers (SC)

ATTRIBUTES:

- Titanium alloy (Ti-6Al-4V)
- 2-Piece construction
- Machined from solid bar stock
- No welding processes
- Threaded closure w/ elastomeric O-ring
- Minimum 0.060” wall thickness
- Convenience container for single or multiple samples
- Samples placed in tantalum foil
- Titanium flat legs and bowl end supports (Inner Cradle) serve as a position control component

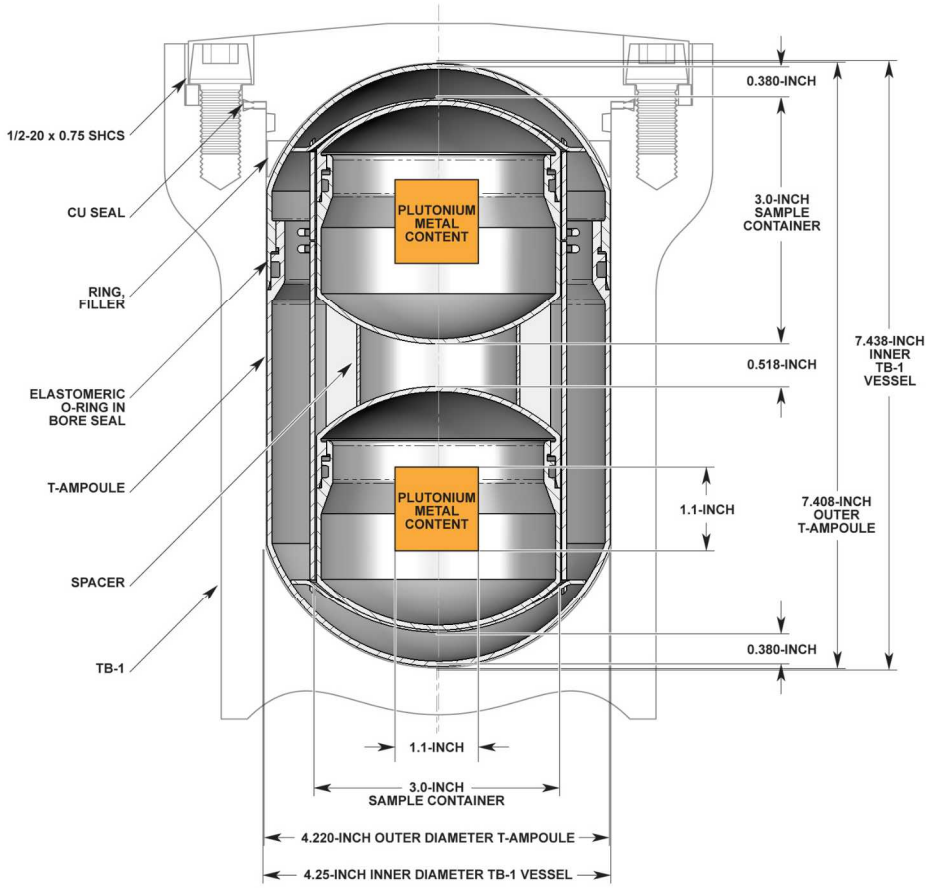


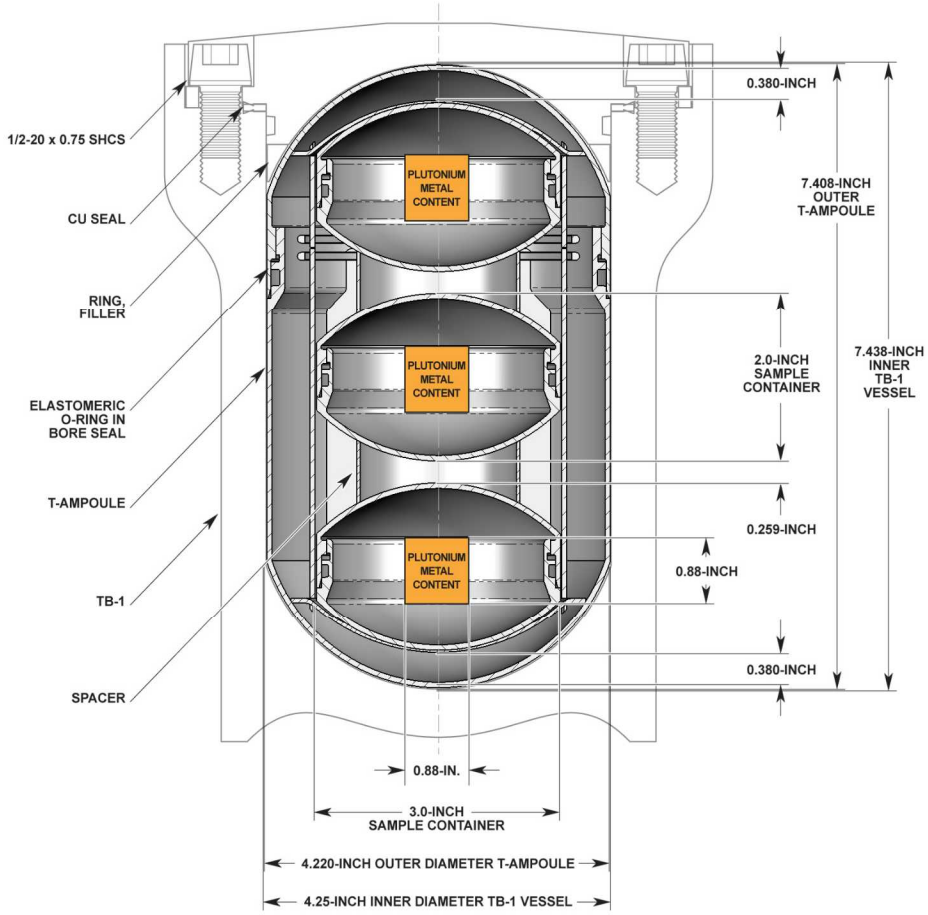
SAMPLE CONTAINER SC-1



SAMPLE CONTAINER SC-2

Sample Container Configurations





TB-1 design is unchanged and provides the containment boundary.

Certification Overview

- Eutectics evaluation
  - Selected titanium material for eutectic barrier
- Thermal analysis
  - Maintained 25 watt decay heat load
- Criticality and Shielding
  - K_{eff} <0.72
  - Calculated dose rates well below regulatory limits
- Leak Rate Testing
  - No change in the current SAR approach
  - TB-1 leak testing procedure unchanged
  - Utilize approved SAR procedures
- Structural Analysis was successfully completed

PAT-1 Structural Analyses

- Conducted TB-1 bolt analysis and found loads much lower than bolt preload
- Performed full package analyses to determine TB-1 loading (deformations compared favorably with certification test results)
- Analyzed all T-Ampoule components and demonstrated T-Ampoule integrity
- In worst cases TB-1 has minimal local internal deformations from impacts of decelerating contents; majority of body is elastic
- All requirements of certification were met

Status - PAT-1 Pu Metal Addendum

- The PAT-1 is currently certified by the NRC for 2 kg PuO_2
- Addendum covers new contents of 831 g Pu metal
- Meets criticality/shielding requirements
- Leak testing requirements remain unchanged
- A new T-Ampoule eutectic barrier, internal containers and support structures have been added to the design
- Analysis demonstrates package meets regulatory requirements
- SAR Addendum will be submitted to NRC September 2009

Summary

- SAR in combination with SAR Addendum will demonstrate PAT-1 with plutonium metal contents meets regulatory requirements
- We would appreciate NRC's input on NNSA's planned tearing parameter criteria strategy as soon as possible