NNSA Support for Cesium Irradiator Replacement and Secure Transportation and Disposition

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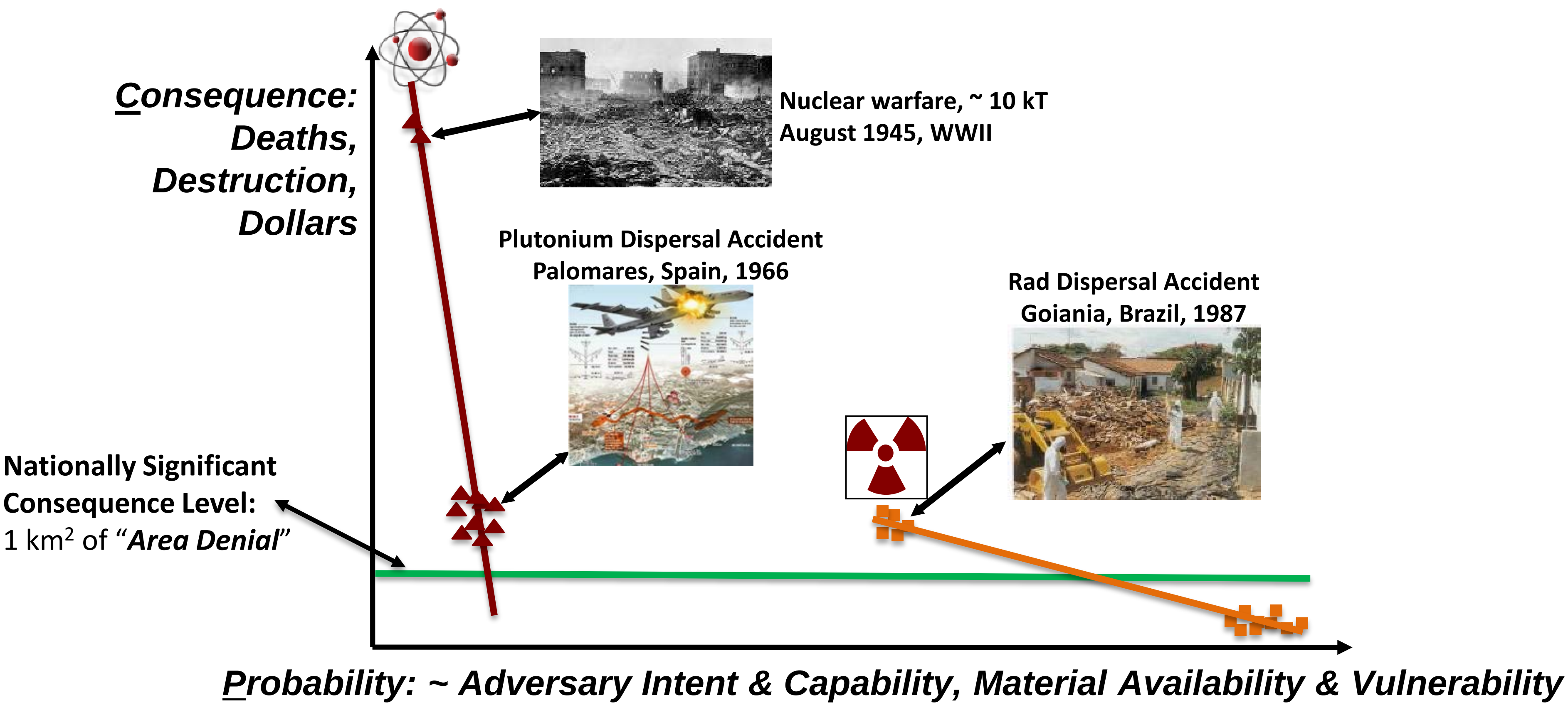
Outline

- The risk of radiological terrorism
- The Office of Radiological Security
- Cesium Irradiator Replacement
- Impacts of the FY19 NDAA
- Secure transportation of radioactive sources
  - Motivation
  - 435B
  - 380B

Nuclear vs. Rad Terrorism Risk

Risk = <u>C</u>onsequence X <u>P</u>robability.

Accidents and other events are used to understand Consequence.
Terrorist Probability is hard to quantify.



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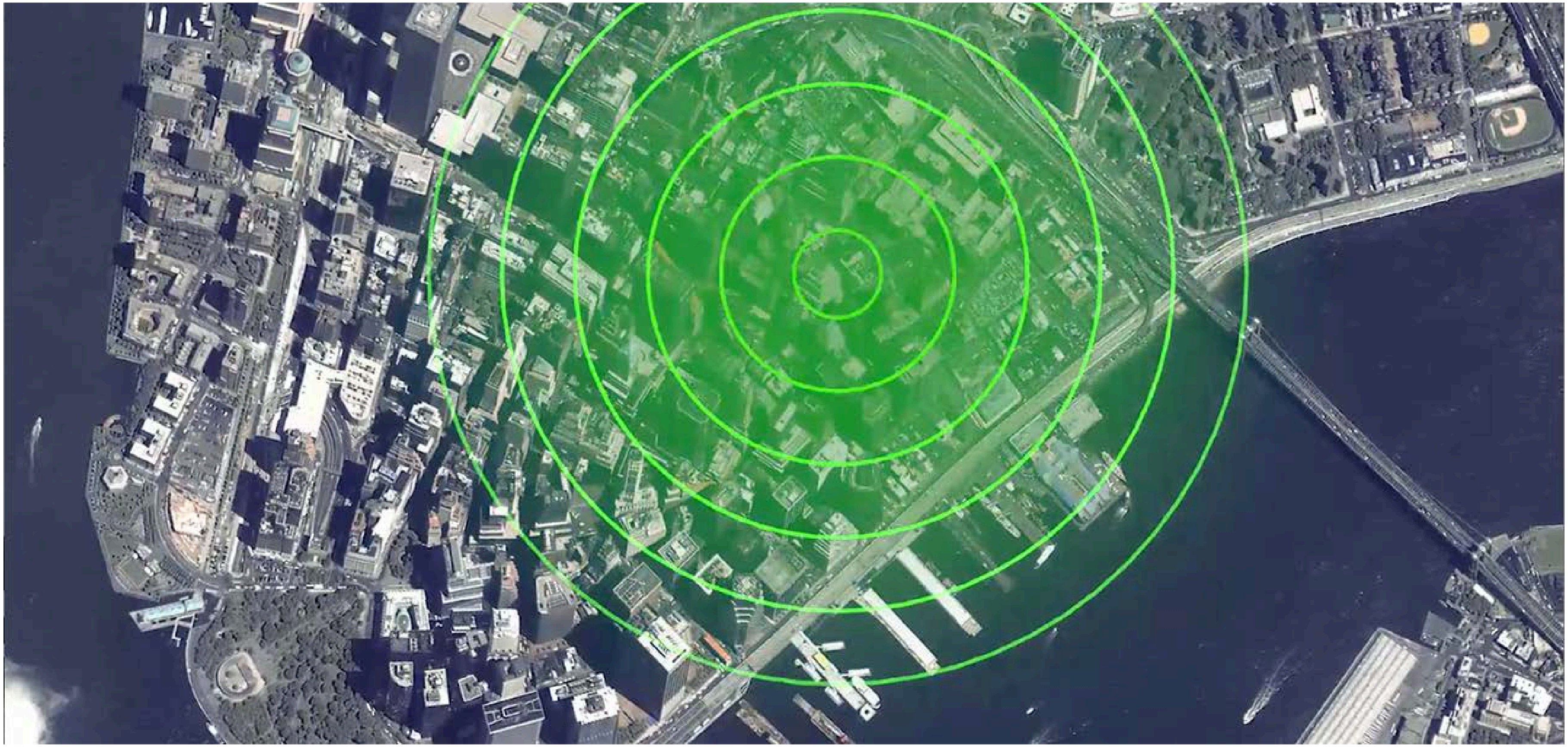
Consequences of Radiological Terrorism



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Enhance global security by preventing high-activity radioactive materials from being used in acts of terrorism.

ORS Strategies

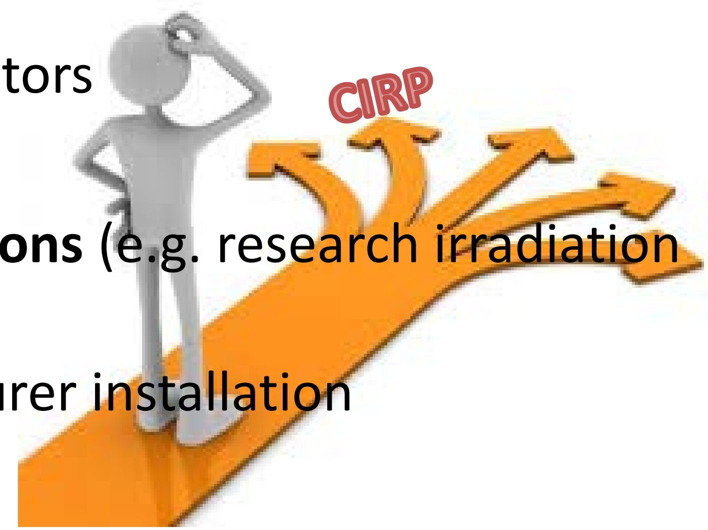
PROTECT	REMOVE	REDUCE
Protect radioactive sources used for vital medical, research, and commercial purposes.	**Remove** and dispose of disused radioactive sources.	**Reduce** the global reliance on high-activity radioactive sources by promoting the adoption and development of non-radioisotopic alternative technologies.

Cesium Irradiator Replacement Project

- Incentives for replacement with X-ray
- Removal of disused Cs-137
- Permanent risk and cost reduction
- Reduced or eliminated security requirements
- Consistent throughput
- Some x-ray devices have additional capabilities

Irradiator Replacement Considerations

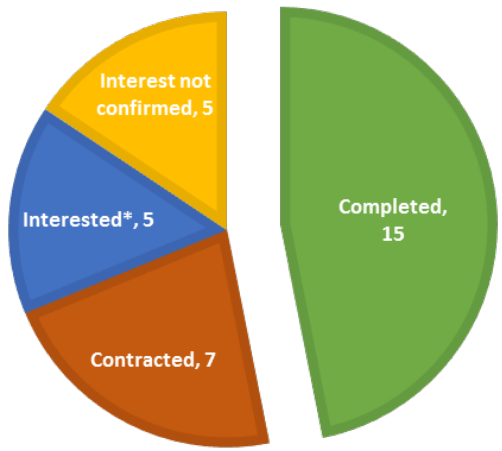
- **Cost** – device purchase, infrastructure requirements, operating costs, radioactive material disposition
- **Reliability** – operational reliability & maintenance requirements, device throughput & site needs
- **User preference**
- **Information gaps** among users & administrators
- **Research standards & operating protocols**
- **Technology differences for certain applications** (e.g. research irradiation or cancer treatment capabilities)
- **Timeline** – financing, disposition, manufacturer installation



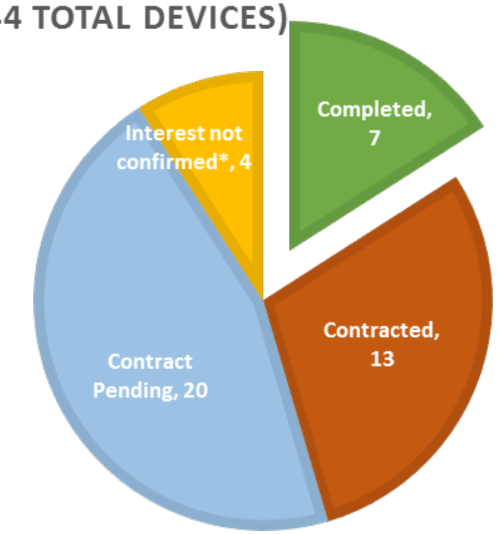
The U.S. Trend in Cs-137 Irradiator Replacement

- ~60% blood irradiators, 40% research irradiators
- University of California - 90% of irradiators expected to be replaced/removed
- New York City - 75% of irradiators expected to be replaced/removed
- Atlanta - 66% of irradiators expected to be replaced/removed
- American Red Cross - 100% of irradiators expected to be replaced/removed
- Blood Banks, Hospitals, Academia, Corporations

NYC STATUS (32 TOTAL DEVICES)



UNIVERSITY OF CALIFORNIA STATUS (44 TOTAL DEVICES)



U.S. Replacement by the Numbers	
Replacements completed	82
Future replacements contracted or pledged	110
Percent of US irradiators replaced, contracted, or pledged	20%

Congressional Support for Permanent Risk Reduction

- The FY19 National Defense Authorization Act sets the goal of eliminating cesium blood irradiators in the US by the end of 2027
- This is a *voluntary* effort for owners of *blood* irradiation devices
- Our ability to meet the 2027 goal is dependent on continued funding and volunteers
- The Authorization Act supports the established CIRP incentive structure and process

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NNSA Secure Transportation: Background

- Many Type B packages were designed several decades ago and do not meet new international standards. In a January 2004 rulemaking, NRC adopted revised regulations to harmonize with the 1996 edition of the IAEA regulations.
- Packages that meet IAEA regulations only fit a small number of devices (<10%) and are expensive to use due to limited availability.
- Type B packages did not have to meet the new design standards until October 1, 2008. After this date, many of the existing Type B packages could no longer be used.
- In the United States, the Department of Transportation (DoT) issued special permits to companies for continued issue of DoT Specification 20WC and 6M containers.
- Because industry needs Type B packages to ship new devices, it was believed that industry would develop new packages that would meet the new design standards.

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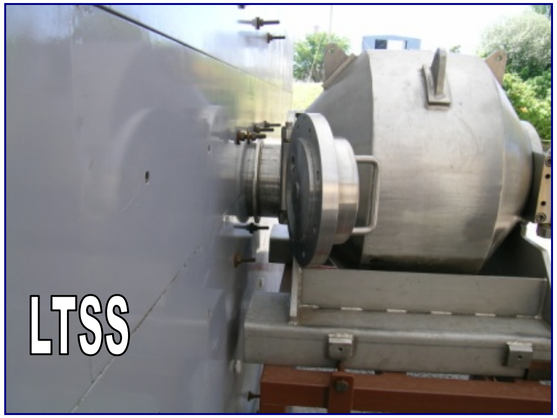
Background Continued

- By 2009 it was clear industry was not developing these packages in a timely manner therefore DOE began investigating a solution.
- Most ORS recoveries (~80%) involving Type B quantities of Cs-137 or Co-60 were completed using the expired DoT Specification 20WC containers.
- Type B packages that meet the new standards are expensive to lease or buy and are available only in limited quantities or they do not have a cavity size large enough for the majority of devices recovered by ORS.

Development of a New Package

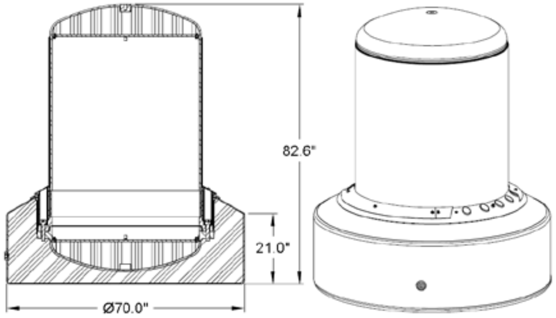
435-B Goal:

- To design, construct, and certify a new Type B package that meets the current standards and is transportable in a standard box truck.
- To develop a Type B package to transport the IAEA Long Term Storage Shield (LTSS).
  - LTSS was originally used by the IAEA to consolidate high activity sources into a secure shield assembly for storage after a removal using the mobile hot cell.
  - LTSS will be used in conjunction with the 435-B to transport sources from storage locations to country of origin.
- Concept evolved to include capability to ship other devices due to problems with domestic Type B packages.



Issues:

- Briefed the NRC on the 435-B package design. This was a preliminary technical review, but a number of programmatic issues were raised:
  - The package will not have shielding so the shielding will come from either the devices or, in cases where the mobile hot cell is used, from the LTSS.
  - NRC suggested ORS consider including a list of specific models of devices with design drawings and analysis specific to each device's shielding, configuration and dimensions or design an entirely new package with its own shielding. Assembling this data is time consuming and costly.



435-B USA/9355/B(U)-96

- External construction based on previously certified container
- Design Summary
  - Leak tight – NCT and HAC
  - Transport by truck, rail, ship, air
  - External dimensions 83 in H x 70 in OD
  - Internal Cavity 43.5 in ID x 60 in H
  - Empty weight 4,940 lbs, Total weight 10,100 lbs

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435-B Device Payload

Model Name/Type	Maximum Activity Ci	Nominal Weight lbs	Sealed Source Device Registry
Group 1 Devices			
Gammator 50B, B, B34, G-50-B	420	1,800	NR-0880-D-802-S
Gammator M34	1,920	1,850	NR-0880-D-806-S
Gammator M38	3,840	2,250	NR-0880-D-806-S
Gammacell 1000 (GC-1000) Models A through D Elite A through D, Type I and Type II	3,840	2,800	NR-0880-D-808-S, NR-1307-D-102-S
Gammacell 3000 (GC-3000) Elan A through C, Type I and Type II	3,048	3,300	NR-1307-D-102-S
Group 3 Devices			
Gammacell-40 (GC-40 Exactor)	2,250	2,650	NR-1307-D-101-S

Content Type	Maximum Weight lbs
Dunnage	≤ 500
Group 1-Shielded Device	≤ 3,500
Group 3-Shielded Device	≤ 3,500

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435-B LTSS Payload

Nuclide	Maximum Activity Ci
60Co	12,970
137Cs	14,000
90Sr	1,000
241Am	1,000
241AmBe	7
192Ir	200
75Se	80

Nuclide	Maximum Mass grams of Pu
238Pu	75 g Pu
239Pu	15 g Pu
239PuBe	15 g Pu

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380-B Technical Considerations

Revised Solution:

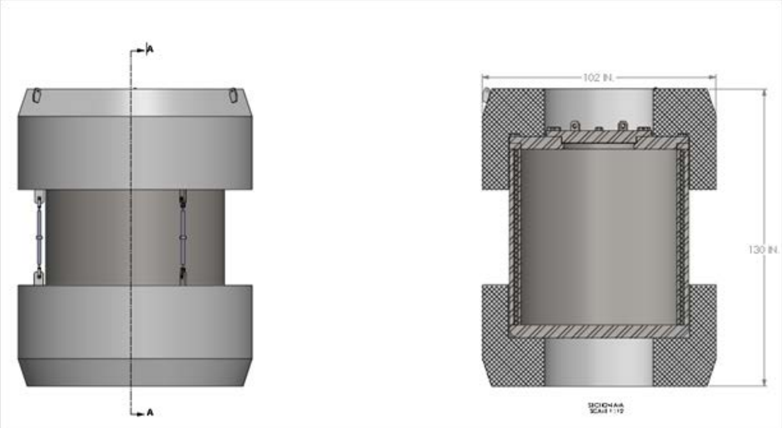
- Design, construct and certify a new Type B package 380-B that meets current regulatory standards, doesn't take credit for device shielding, has enhanced security features, and has a life span of at least 40 years.

Strategy

- To design a shield Type B package that is safe and secure in a timely manner at the lowest cost to the tax payer.
  - A study that would examine factors such as physical size, weight , curies and the type and number of sources to be registered over the next 40 years. This would ensure the shielded Type B package is able to transport as many devices from as many sites as possible with minimum number of certification modification.

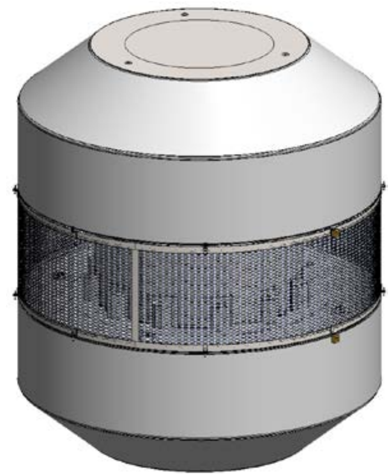
Initial Design Parameters

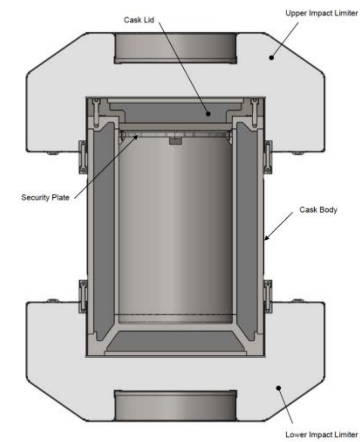
- The package should be able to transport a maximum of 33,000 Curies of Cobalt-60 and 40,000 Curies of Cesium-137
- Payload of 8,250 lbs
- Inner cavity dimensions of at least 46" diameter and height of 64".
- The container system (truck, trailer, and container) shall adhere to 23 CFR PART 658—Truck Size and Weight, Route Designations-Length, Width and Weight where applicable.
- Security system to be designed as an integral whole and incorporated into various components of the transportation system

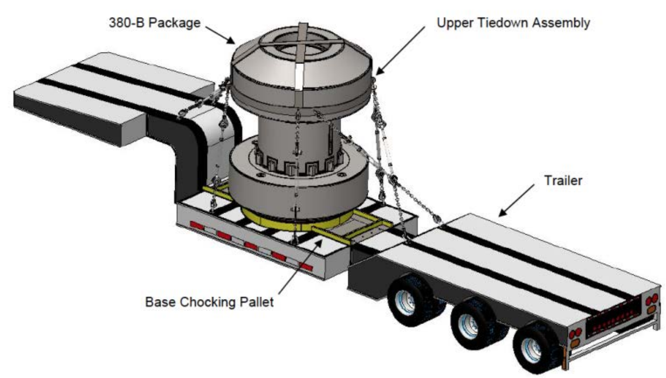


380-B USA/9370/B(U)-96

- Design parameters:
  - Co, Cs, Sr, Ir, Ra, Am, Pu and Depleted Uranium
    - Maximum decay heat is 205W
    - Governing activity for Co-60 is 7,700 Ci
    - Design activity of Cs-137 is 40,600 Ci
- Leak tight – NCT and HAC
- Transport by truck, rail, ship, air
- External dimensions 118 in H x 100 in OD
- Internal Cavity 45.75 in H x 38 in ID
- Empty weight 55,000
- Maximum payload weight including dunnage approximately 67,000 lbs







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Questions?

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