Shielded Payload Containers Will Enhance the Safety and Efficiency of DOE's Remote Handled Transuranic Waste Operations

Roger Nelson, US DOE/CBFO
Sean White, URS Washington Division

WM2008
February 27, 2008

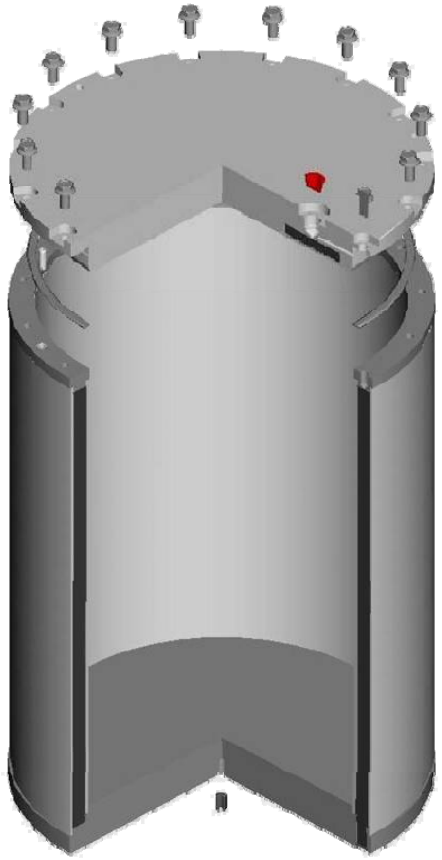
URS
Washington Division

Shielded Containers - Approach

- Candidate waste streams to be characterized and certified under WIPP's existing WAP/WAC as RH TRU waste (prior to shielding)
- New Mexico C&C Agreement and the requirements of the LWA for RH TRU waste will continue to be met
- All waste received in shielded containers (and in RH-72Bs/10-160Bs) will count against RH waste volume capacities:
  - Table IV.A.1 of the Hazardous Waste Facility Permit
  - 730 RH canisters ~ 5900 shielded containers (max)
- RH-72B/10-160B shipments and canister disposal operations will continue

Shielded Containers - Approach (Continued)

- External dimensions = 55-gal drum, internal capacity for a standard 30-gallon drum
- Transport in 3-pack configuration in HalfPACT under current design and licensing bases:
  - 7,600 lb max payload
  - 30 watts max decay heat
  - 325 max Fissile Gram Equivalent (FGE) Pu
- Handling, storage, and emplacement in 3-pack configuration
- Incorporate into existing CH TRU waste handling infrastructure



URS
Washington Division

Timeline

2007				2008				2009			
Q-1	Q-2	Q-3	Q-4	Q-1	Q-2	Q-3	Q-4	Q-1	Q-2	Q-3	Q-4

Engineering and testing

Stakeholder meeting 11/29/07

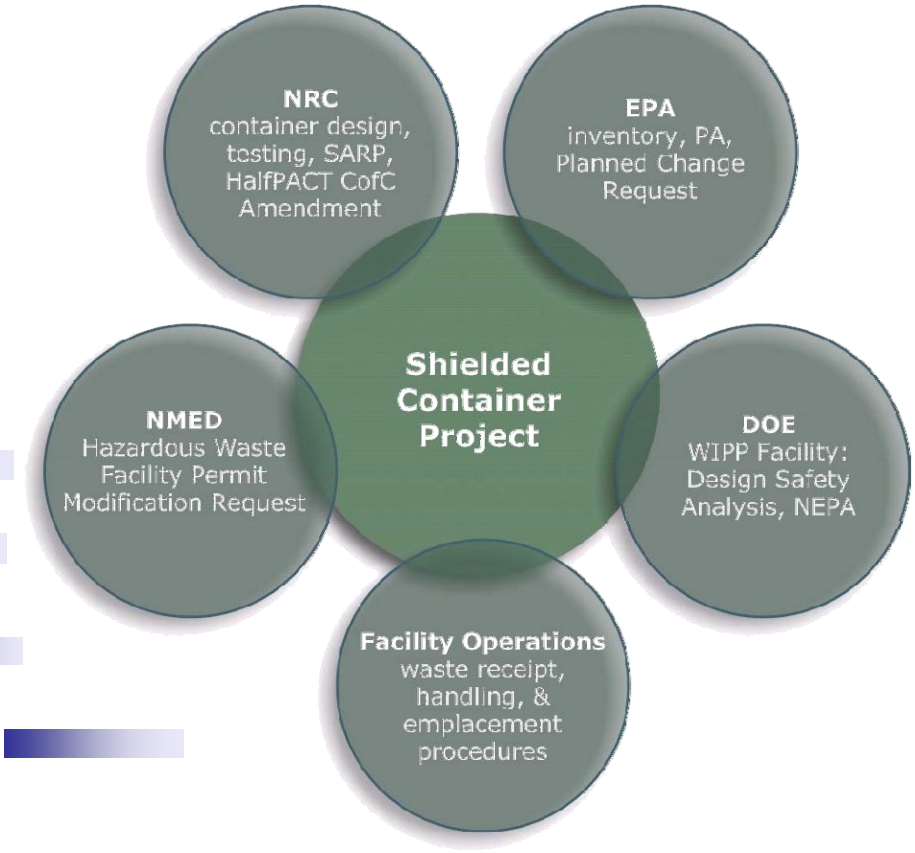
EPA Planned Change Request

NRC HalfPACT SAR

WIPP DSA Review

NEPA Review of Facility Waste Handling

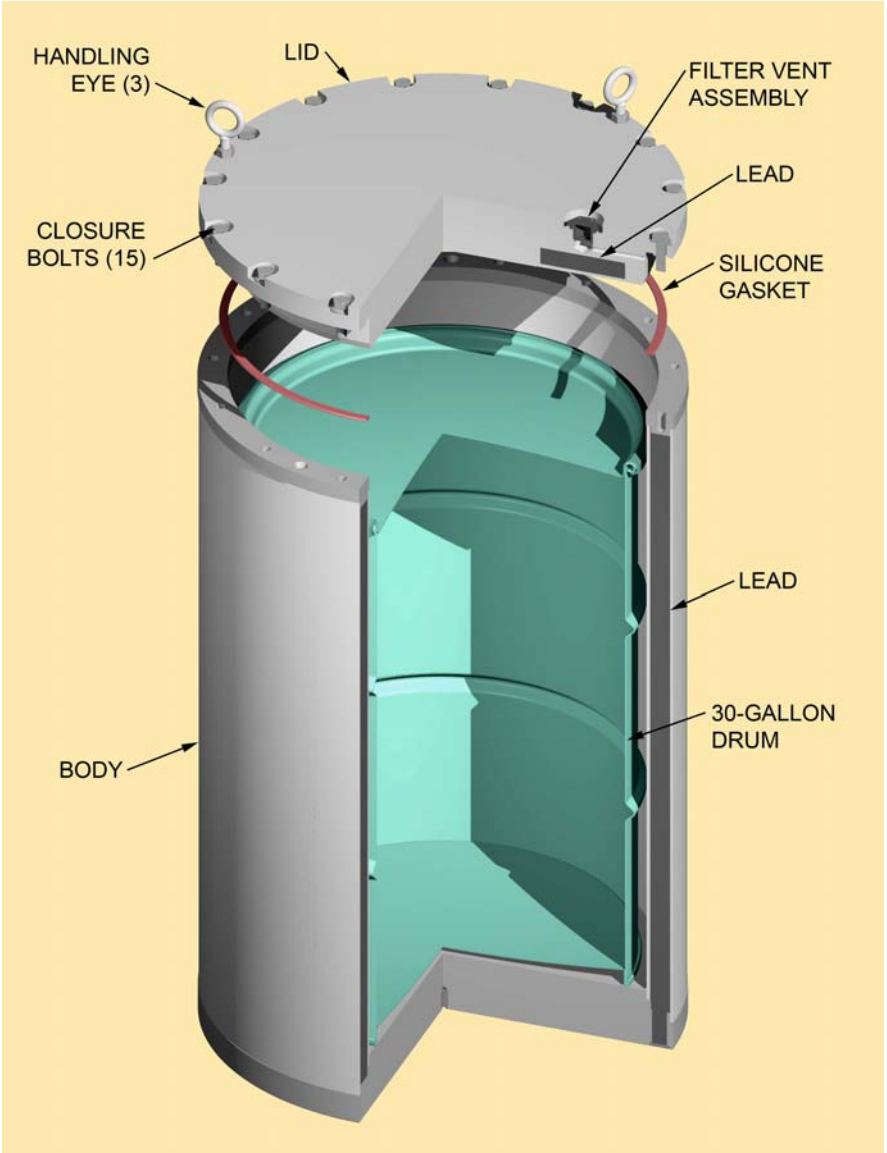
NMED Permit Modification Request



URS
Washington Division

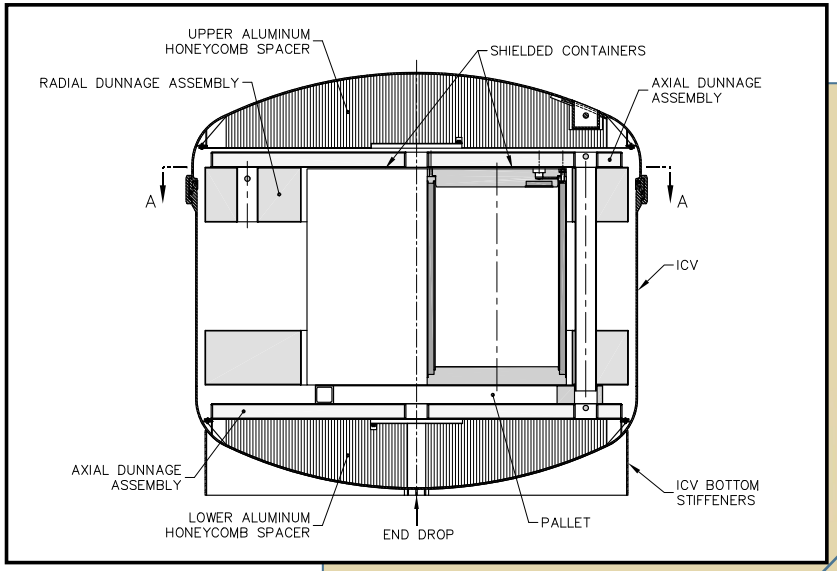
Shielded Container

- Nominal 55-gallon exterior size
- 1” lead and ~5/16” steel thickness in side; 3” steel lid and base
- ASTM A516, Grade 70, carbon steel lid, base, and flange normalized to fine grain practice, and ASTM A1011, Grade 45, carbon steel shells
- 15, 1/2” Grade 8 closure bolts
- Silicone rubber gasket
- Filtered vent port w/ lead shield plug
- Empty weight 1,730 pounds nominal



URS
Washington Division

Shipping Configuration



URS
Washington Division

3 Shielded Containers on a Pallet

URS
Washington Division

Axial Shock Absorber

URS
Washington Division

Radial Shock Absorber

Container Testing

DOT Type 7A Certification – Shielded Container

4 ft. drop test onto unyielding surface in worst case orientation w/ inner 30 gallon container maximally loaded:

- Design robustness
- Payload confinement
- Shielding effectiveness

NRC Hypothetical Accident Conditions – Payload Assembly

30 ft. drop onto unyielding surface in worst case orientations, HalfPACT inner containment vessel (ICV) with three shielded containers with inner 30 gallon containers maximally loaded:

- Overall design robustness
- Payload confinement
- Shielding effectiveness
- HalfPACT ICV Integrity

7A Drop Test Orientations

URS
Washington Division

Video clip of DOT-7A Drop Test

DOT 7A Drop Test Results

URS
Washington Division

7A Drop Test Results (cont.)

URS
Washington Division

HAC End Drop Test

URS
Washington Division

HAC Side Drop Test

URS
Washington Division

Video clip of NRC HAC Drop Test

URS
Washington Division

End Drop Test Results

- Pre- and post-drop position of SCAs and radial shock absorber within ICV
- 6.5 inch crush of bottom end axial dunnage and aluminum honeycomb spacer equates to an impact of approximately 60 g for SCAs
- SCAs see a very “soft landing” compared to the HalfPACT itself, which experiences approximately 400 g in bottom end drop

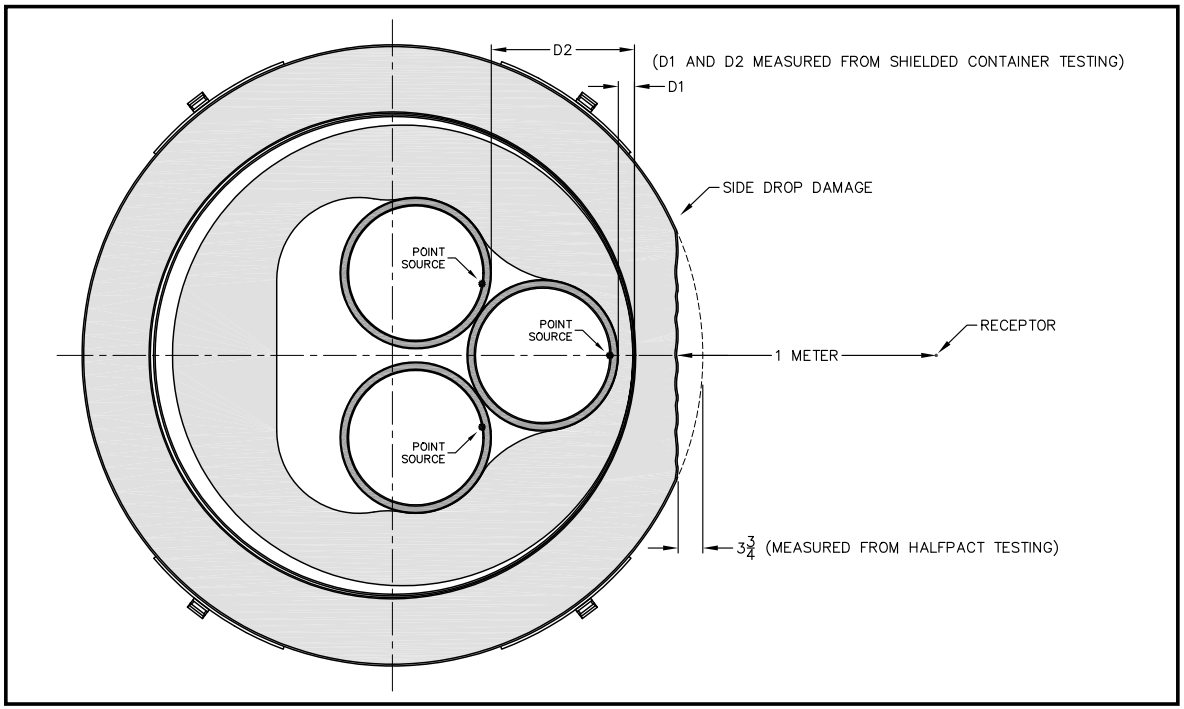
Side Drop Test Results

- Pre- and post-drop position of SCAs and radial shock absorber within ICV
- 4.5 inch crush of radial shock absorber equates to a lateral impact between 80 and 160 g for SCAs
- SCAs see a “softer landing” compared to the HalfPACT itself, which experiences a crush of 3.75 inches in side drop, equating to between 100 and 200 g

URS
Washington Division

Thermal, Shielding and Criticality Evaluations

- SAR analyses utilize NRC previously approved analytic methods and assumptions
  - ***30 watt payload decay heat limit results in no change to HalfPACT normal or accident condition temperatures***
  - ***PU-238 FGE is set at 200 per SCA (same as for 55-gallon drums) and remains at a max of 325 per HalfPACT***
  - ***Radionuclide activity limits are set such that even if reconfigured into a point source, accident condition limit of 1 R at 1 meter is still satisfied***



URS
Washington Division

Transportation Certification Status

Certification of design to the requirements of DOT 7A Type A is underway:

- Free drop by tests
- Post-drop gamma scan
- All other load cases by analysis

HalfPACT SAR, Rev. 6 and CH-TRAMPAC, Rev. 4 submitted to obtain NRC authorization to ship shielded containers in the HalfPACT:

- Free drop by tests
- Post-drop gamma scan
- All other load cases by analysis (e.g., thermal)

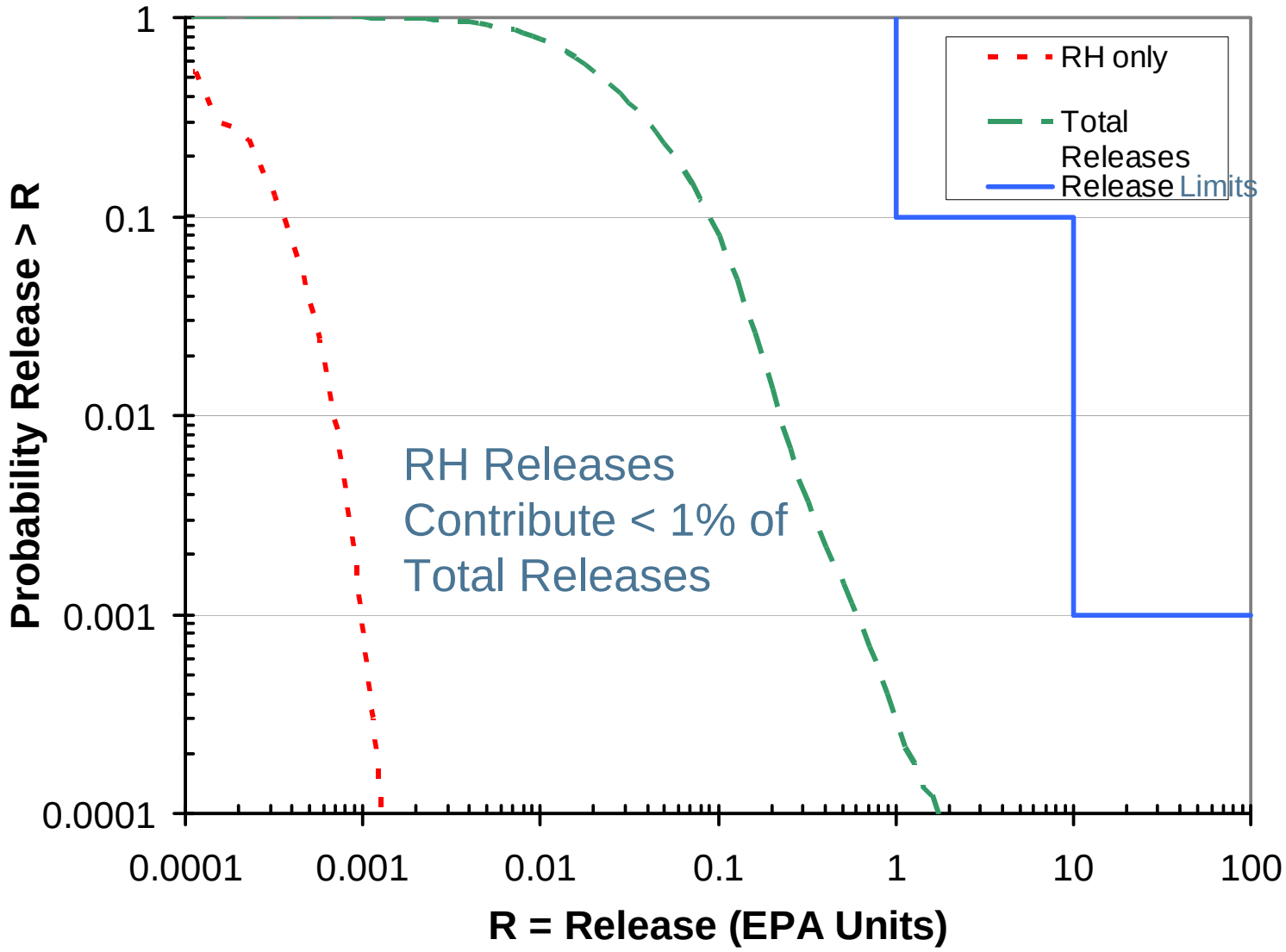
Operations Overview

- Shielded containers will be managed as any other contact-handled waste (generator site loading through final WIPP disposal)
- Receipt of 3-pack assemblies – no breaking apart or reassembly
- Management, including storage, in the WIPP CH-bay
- Use of existing infrastructure and equipment:
  - Lifting fixtures
  - Fork lifts
  - Facility pallets

URS
Washington Division

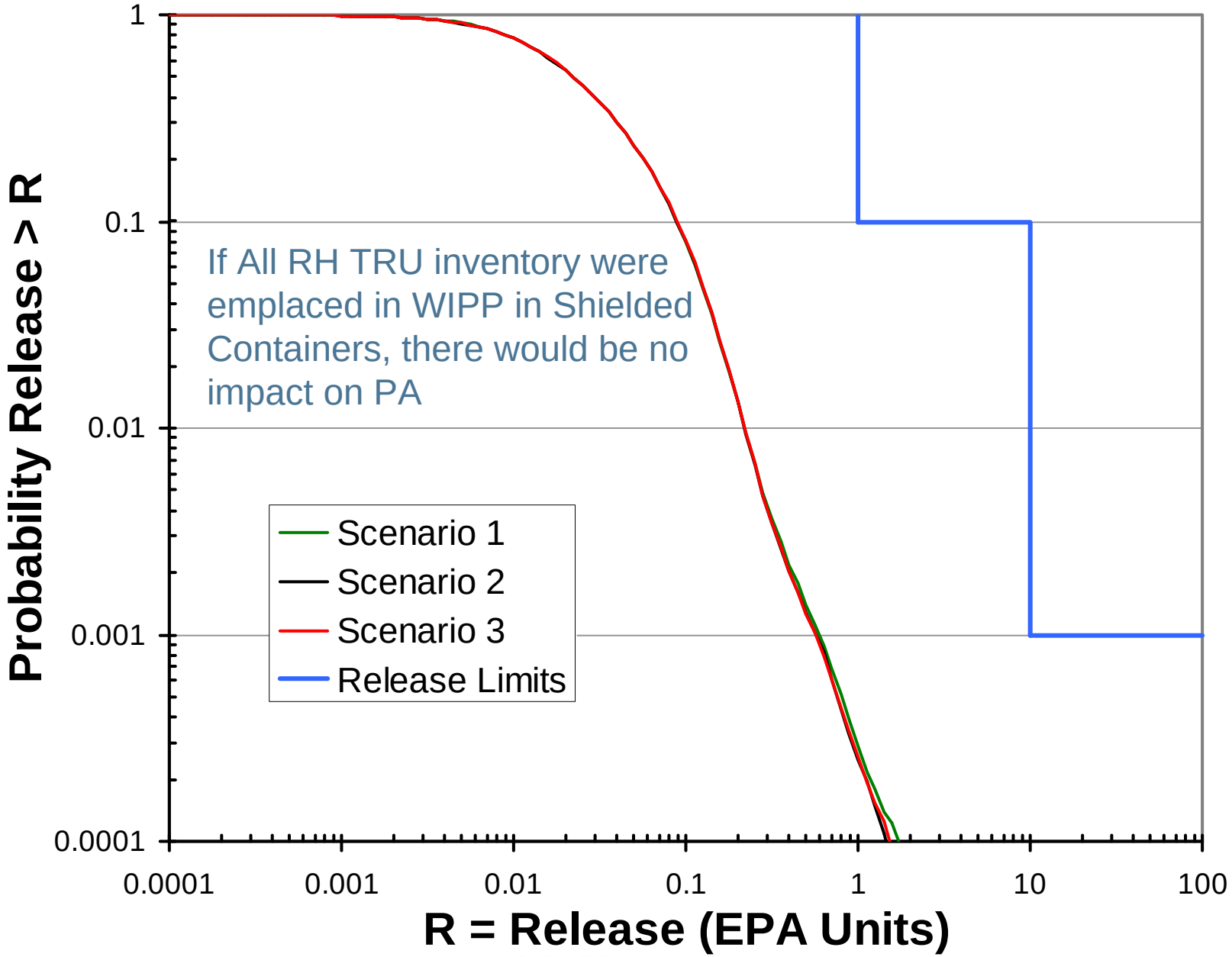
URS
Washington Division

WIPP Long-term Repository Performance is Insensitive to RH Inventory



URS
Washington Division

No Impact to Repository Performance



URS
Washington Division

Candidate Waste Stream Selection

- Activity of Cs^{137} dominates RH inventory (in some cases Am^{241} or Co^{60})
- Dose ~200 mrem/hr for ~ 2-3 Ci Cs^{137} in 30-gallon drum inside SCA (<0.12 Ci of Co^{60})
- Microshield modeling → candidate waste streams
- Other benefits include higher FGE, PECi, Wattage per shipment (e.g., each HalfPACT with 325 FGE limit) compared to one RH-72B with same limit
- Every RH shipment from INL to WIPP to date ~108 would have been able to be shipped in shielded containers (34)

URS
Washington Division

Cost/Benefit Considerations

RH shipping comparison for typical 100 m^3 waste stream	Containers	RH-72B Shipments
Direct-load RH canisters	112	112
55-gallon drums in canisters	476	159
30-gallon drums in canisters	909	303
Shielded Containers*	909	101*

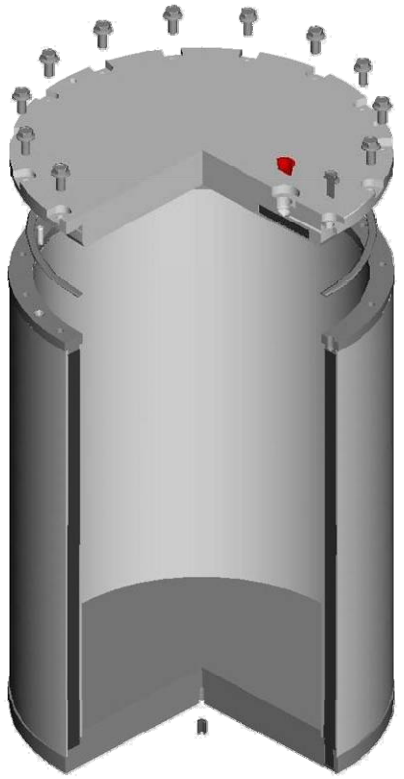
*** Shipped in HalfPACT**

- **Cost/benefit break-even SCA cost ~$9000/unit**
- **Engineering estimate ~$5000/unit (bulk quantities)**
- **Use of lead from DOE's Material Recycle program could drop price even more**
- **Cost avoidance of RH-72B and canister insertion inefficiency**

URS
Washington Division

Shielded Container Conclusions

- Shielded containers are robust and safe alternatives to shipping RH-TRU waste in the 72-B cask
- Testing shows that radial and axial dunnage assemblies (with honeycomb end spacers):
  - preserve the shielding capabilities of the shielded containers in the HAC, and
  - protect the HalfPACT ICV during nominal use
- Shielded containers have no discernible impact on long-term repository performance.
- Shielded containers in HalfPACT can increase waste volume/shipment by 63% (vs 55gal drums in RH72B) to 200% (vs 30gal drums)



URS
Washington Division