Department of Energy Owned
Spent Nuclear Fuel Integration

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Spent Nuclear Fuel (SNF) Mission/Vision

Environmental Management (EM) SNF Overview
  - Hanford
  - Idaho National Laboratory (INL)
  - Savannah River Site (SRS)

Future Direction
  - Administration’s Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste
  - SNF Working Group

Summary/Conclusion
• Safe and secure operations in a cost-effective manner

• Protect human health and the environment

• Work with all stakeholders to comply with legal agreements

• Collaborate with international community to support U.S. non-proliferation objectives

• Achieve SNF management
DOE EM Spent Nuclear Fuel Overview

Idaho National Laboratory (~265 MTHM)
- INTEC Fuel Storage Facility
- Drying, Packaging, Shipping Capability
- *Settlement Agreement requires dry storage of all SNF by 2023 and removal of all SNF from Idaho by 1/1/2035

Fort St. Vrain (~15 MTHM)
- Interim Spent Fuel Storage Installation (ISFSI)
- Packaging, Shipping Capability
- *Settlement Agreement requires removal of all SNF from Colorado by 1/1/2035

Savannah River Site (~30 MTHM)
- L-Basin Facility
- Drying, Packaging, Shipping Capability
- **FRR Program ends 2019 **DRR Program expected to continue through 2035

Hanford Site (~2,130 MTHM)
- 200 Area Interim Storage Area and Canister Storage Building
- *Settlement Agreement requires dry storage of all SNF by 2023 and removal of all SNF from Idaho by 1/1/2035

Repository / Interim Storage

For Illustrative purposes only.
• DOE production reactors (majority of inventory)
• Core debris from the Three-Mile Island Reactor
• Commercial power demonstration projects
  – Shippingport Atomic Power Station, Shippingport, Pennsylvania
  – Peach Bottom Atomic Power Station, Peach Bottom Township, Pennsylvania
  – Fort Saint Vrain Generating Station, Platteville, Colorado
• Foreign Research Reactors (FRR) – 41 countries
• Domestic Research Reactors (DRR)
  – Includes DOE labs, Universities, and other Government agencies
Hanford Site, Washington

- ~87% by weight, 14% by volume of DOE inventory
- All SNF has been moved from wet to dry storage
- SNF is safely stored in ~400 Multi-canister Overpacks and other dry casks
- Safely stored awaiting disposition
Idaho National Laboratory, Idaho

- ~12% by weight, 53% by volume of total DOE inventory (includes Ft. St. Vrain)
- Diverse inventory of SNF
  - Includes sodium-bonded, graphite based, and SNF from Three Mile Island (in an Nuclear Regulatory Commission-licensed facility)
- Advanced Test Reactor continues to generate SNF
- Idaho Settlement Agreement
  - SNF in dry storage by 2023
  - SNF out of Idaho by January 1, 2035
INTEC SNF Facilities

Spent Nuclear Fuel Facilities
- CPP-603 IFSF
- CPP-666 FAST
- CPP-749 SNF underground storage area
- CPP-1774 TMI
- CPP-2707 cask pad
- WV rail casks

Idaho Nuclear Technology and Engineering Center
Fort St. Vrain, Colorado
• Continue to receive FRR (until 2019) and DRR
  - Non-aluminum clad fuel (primarily TRIGA fuel)
  - Currently all shipments into Idaho are suspended until treatment of remaining sodium bearing liquid waste is completed (missed Settlement Agreement milestone)
Addressing Idaho SNF Issues

• EM consolidated SNF from 11 storage sites across INL to Idaho Nuclear Technology Engineering Center from 1997 - 2005

• All EM SNF in dry storage as of 2010

• Closed 5 of 6 wet storage pools

• EM working with Navy and NE
  – Removal of EBR II SNF (NE) from wet to dry storage by 2020
  – Move 1,000 ATR (NE) elements from wet to dry storage
  – Remove all Navy fuel from wet (CPP-666) to dry storage by 2018
# Wet to Dry Storage at Idaho

<table>
<thead>
<tr>
<th>SNF Wet Storage Facility</th>
<th>Date Emptyed</th>
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<tbody>
<tr>
<td>TRA-660, ARMF/CFRMF Canal*</td>
<td>10/28/1997</td>
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<tr>
<td>CPP-603, Basins*</td>
<td>04/28/2000</td>
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<tr>
<td>TRA-603, MTR Canal &amp; Plug Storage*</td>
<td>09/24/2002</td>
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<tr>
<td>TAN-607, Basin*</td>
<td>09/29/2002</td>
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<td>PBF-620, Pool*</td>
<td>09/15/2003</td>
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<tr>
<td>CPP-666, Basins (EM-managed SNF)</td>
<td>06/06/2010</td>
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(* Closed)
Making SNF ‘Road Ready’ at Idaho

• Under the Idaho Settlement Agreement, DOE is required to remove all SNF from Idaho by Jan. 1, 2035

• DOE is performing initial planning to make the SNF stored at INL ‘road ready’ to meet the Settlement Agreement milestone

• Plans include packaging variety of DOE-managed SNF into standardized canisters for future management
Making SNF ‘Road Ready’ at Idaho

Standardized DOE SNF Canister

- Lifting Ring
- Optional Plug
- Boding Ring
- Impact Plate
- Shallow Dished Head
- Skirt

Nominal Outside Diameters:
- 18 in. and 24 in.

Wall Thickness:
- 3/8 in. for 18 in. canister
- 1/2 in. for 24 in. canister

Maximum Weight with Fuel:
- 5,000 to 10,000 lbs.

External Lengths:
- Short Canister: 118.11 in.
- Long Canister: 179.92 in.

Material:
- Canister Body: SS316 L
Savannah River Site, South Carolina

- ~1% by weight, 31% by volume of DOE inventory
- All SNF in wet storage (L-Basin)
  - Implementing Augmented Monitoring & Condition Assessment Program in addition to existing maintenance activities
- Continue to receive FRR (until 2019) and DRR
  - Aluminum-clad SNF only
  - Includes High Flux Isotope Reactor (HFIR) Fuel – temporarily suspended due to storage capacity

Wet storage at L- Basin

HFIR Fuel (Office of Science)
• In March 2013, DOE decided to process limited quantity of aluminum-clad fuel (including HFIR) & target residues

  ─ Generates extra storage capacity (especially for HFIR fuel)
  ─ Economic benefits (converts separated HEU to LEU for commercial use with proceeds back to Federal Government)
  ─ Non-proliferation benefits
Foreign Research Reactor Spent Fuel Acceptance Program

- Supports the U.S. non-proliferation policy under global threat reduction initiative
- Program initiated in 1996 w/41 countries
- ~ 9,800 SNF Assemblies Received
- Aluminum-clad fuel to SRS (majority of shipments)
- Non-aluminum-clad fuel to INL (primarily TRIGA fuel)
- Program ends in 2019
  - SNF shipments expected in the next 3 years from Canada, Japan, Finland, Australia, etc.
• The mission of the United States DRR Infrastructure Program (RRI) is to provide fresh nuclear reactor fuel to U.S. Universities at no, or low, cost to the university.

• The title of the fuel remains with the United States government and when universities are finished with the fuel, it is returned to DOE (at DOE/INL or DOE/SRS)

• The Program is funded and managed by the Office of Nuclear Energy

• Supports 24 U.S. Universities
Future Direction

• Administration’s *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste*, January 2013, endorsed the key principles of the Blue Ribbon Commission’s recommendations
  – Pilot-scale interim storage facility
  – Consolidated interim storage facility
  – Geologic repository
• Legislation needed for full implementation
  - Strong basis exists to find that a Defense HLW Repository is required
  - Would provide valuable experience to reduce the cost and time for a future repository
DOE complex-wide coordination of SNF issues by establishing an internal DOE working group in 2014

- Collaboration between
  - Office of Environmental Management
  - Office of Science, Nuclear Energy, Naval Reactors, and NNSA (Materials, Management, and Minimization)
  - DOE field sites that manage DOE SNF
SNF Working Group

• SNF working group objectives include:
  - Develop complex-wide strategies for storage, retrieval, packaging, transportation, technology development, processing, and/or disposal
  - Integrate and leverage DOE SNF management and disposition activities across the complex
  - Support DOE efforts to develop waste acceptance criteria for a future repository
  - Support non-proliferation goals
  - Re-establish National SNF Program and maintain updated complex-wide database of DOE’s SNF

• Working Group has met 4 times since the initial meeting in 2014
• Facilitate cooperative issue resolution throughout DOE
Summary/Conclusion

• EM is safely and effectively managing the legacy SNF with minimal impacts to DOE on near-term SNF management

  – Processing limited amount of spent fuel (at Savannah River Site and Idaho)
  – EM has realized significant benefits by consolidating SNF storage from multiple sites across INL to INTEC
  – EM has made significant progress in transferring SNF from wet to dry storage

• SNF Working Group is an effective means for enhancing integration of SNF programs across the complex
Questions