

# *INL Spent Fuel Management*

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Business Sensitive

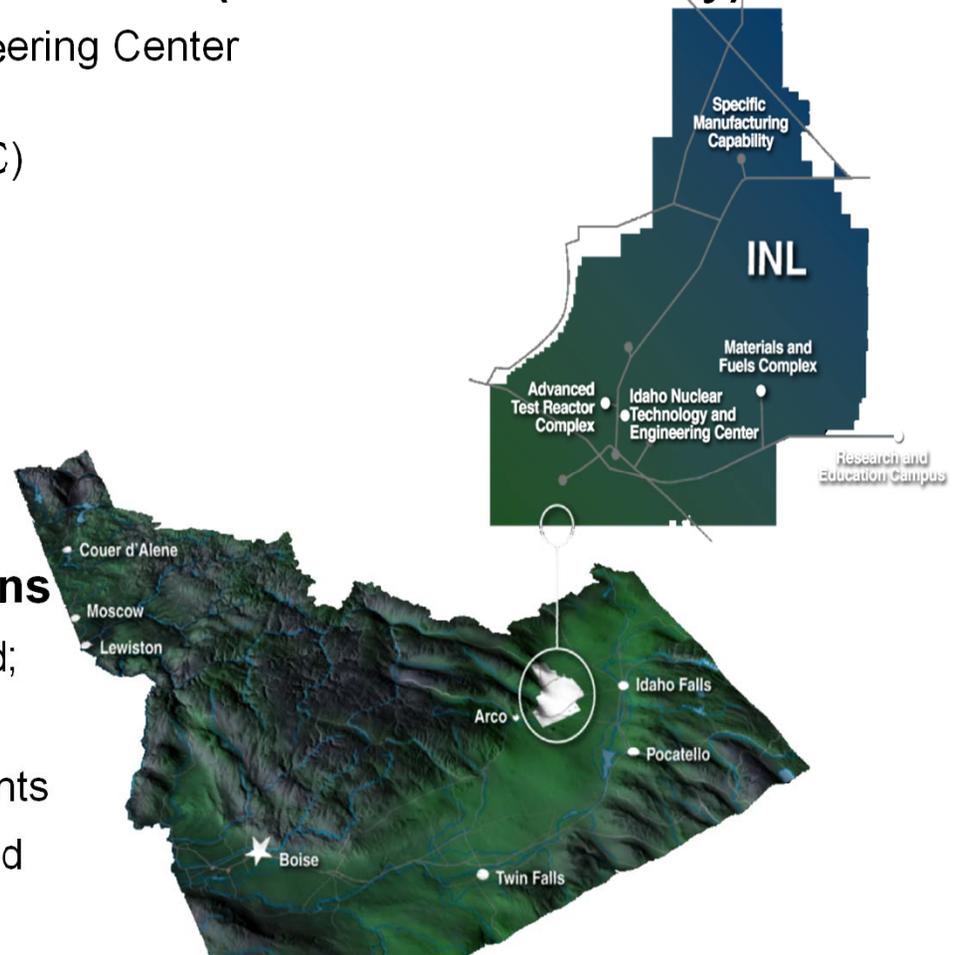
# Idaho Spent Nuclear Fuel

- **Idaho has approximately 290 MTHM of SNF (11% of DOE inventory)**

- Idaho Nuclear Technology and Engineering Center  
DOE-regulated storage facilities
- Nuclear Regulatory Commission (NRC)  
licensed Independent Spent Fuel  
Storage Installations at INTEC  
and Ft. St. Vrain, CO
- Advanced Test Reactor canal
- Materials and Fuels Complex  
DOE-regulated storage facilities

- **Inventory includes variety of fuel types in different configurations**

- 2lb-1/2 ton specimens; Al, SS, Zr clad;  
sodium-bonded, epoxy-bonded,  
Be and carbon matrix fuels;  
Intact & damaged & various enrichments
- Storage in vaults, dry casks, pools, and  
in ground storage systems



## ***Regulatory Drivers***

- **1995 Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Record of Decision – All activities in the current baseline were analyzed in the 1995 EIS.**
- **1995 Idaho Settlement Agreement –**
  - All SNF in dry storage by 2023 – If not met, SNF receipts in Idaho stop.
  - All SNF out of Idaho by 1/1/2035 - \$60K/day fine if not met.
  - DRR/FRR receipts are permitted, if the SNF is listed in SA amendment.
  - SRS/ID Exchange permitted if calendar year cask received from SRS are equal to casks sent from Idaho and total number received by Idaho does not exceed total sent.
- **Colorado Agreement –**
  - All SNF out of Colorado by 1/1/2035 - \$15K/day fine if not met.

## ***Path Forward for SNF Management***

- **Inventory is expected to grow slightly**
  - Domestic and Foreign Research Reactor (D/FRR) receipts will continue
  - ATR will continue to generate SNF – DOE-NE
  - Some fuel may be received and stored for research
- **Idaho will continue to safely manage SNF in existing facilities**
  - Authorization basis through 2035 (continuous surveillance and maintenance)
  - Ft. St. Vrain (CO) and TMI NRC regulated facilities continue operation
  - License renewal for TMI ISFSI will be submitted in 2019
  - Storage of fuels for research will continue
- **Focus on aging management**
  - Life-cycle extension studies define refurbishment to maintain facilities and infrastructure
- **Some management alternatives are under investigation**
  - Increase cask pad storage or modular storage
  - Identify technical needs and fund R&D to ensure safe extended storage

## ***INL SNF Management May Change as a Result of Responses to Recommendations to BRC and Idaho's LINE Commission***

- **Leadership in Nuclear Energy (LINE) Commission**
  - *“make recommendations to the Idaho Governor on policies and actions the State of Idaho can take to support and enhance the long-term viability and mission of the INL and the broader nuclear industry in the state”*
  - Draft report requests comment on recommendations
    - Conduct a Used Fuel Storage Demonstration
    - Pilot a US Regional Interim Storage Facility.
- **DOE “Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste” (BRC Response)**
  - Strategy recommends consideration of transport and storage of government owned used nuclear fuel and high level waste at a proposed interim storage facility

## ***Questions Remain***

- **Will the disposition path for Idaho's SNF and HLW be the same as commercial fuel?**
- **Will DOE-EM disposition all the DOE owned fuel at Idaho?**
- **Will HLW and SNF have the same disposition path?**
- **Will an interim storage facility accept INL's DOE-owned SNF and HLW?**
- **Should Idaho construct a packaging facility in the near term that will allow transport to the interim storage facility identified in the new DOE strategy?**

# *Background slides*



## ***Characteristics of DOE SNF***

- **Fuel forms**
  - Rod array, element, plate array, annulus, blocks, pins
- **Fissile radionuclides**
  - U-233, U-235, Pu based fuels
- **Fissile enrichments**
  - Ranges from depleted Uranium to 93%
- **Cladding types**
  - Aluminum, Stainless Steel, Zircalloy, Hastelloy, Inconel, Nichrome
- **Fuel compounds**
  - Alloy, oxide, carbide, nitride, hydride, metal, silicide

## ***Characteristics of DOE SNF cont.***

- **Matrices**
  - Aluminum, graphite, ceramic, and stainless steel
- **Condition**
  - Intact, cropped, corroded, disassembled
- **Dimensions**
  - 0.06 inch to several inches wide
  - 4 inches to nearly 15 feet long
- **Burnups**
  - From less than 1,000 to over 500,000 MWd/MTHM
  - 0.1% to over 70% of original fissile material

## ***Currently SNF Storage Configurations***

### **CPP-666 – SNF Wet Storage Basins**

- 79,000 ft<sup>2</sup> facility constructed in 1984 includes truck receiving area, cask receiving and decon., unloading pools, 6 interconnected storage pools, transfer canal and supporting functions.
- Basins and canal are stainless steel-lined concrete with leak detection system. 4 basins are 31 ‘ deep and 2 are 41’.
- Shares safety significant systems with adjacent RH-TRU packaging hot cell.
- SNF is stored in lidded racks. Water chemistry is tightly controlled.
- All ICP-assigned SNF has been retrieved and transferred to dry storage.
- NE-assigned ATR SNF will be received through 2012.
- EBR-II SNF (sodium-bonded) will be retrieved and transferred to MFC for electrometallurgical processing.
- Naval Nuclear Propulsion Program SNF is being returned to Naval Reactors Facility under MOA.
- Authorization basis assumes operation through 2035. Continuous routine S&M is required; upgrade to ventilation system suggested.

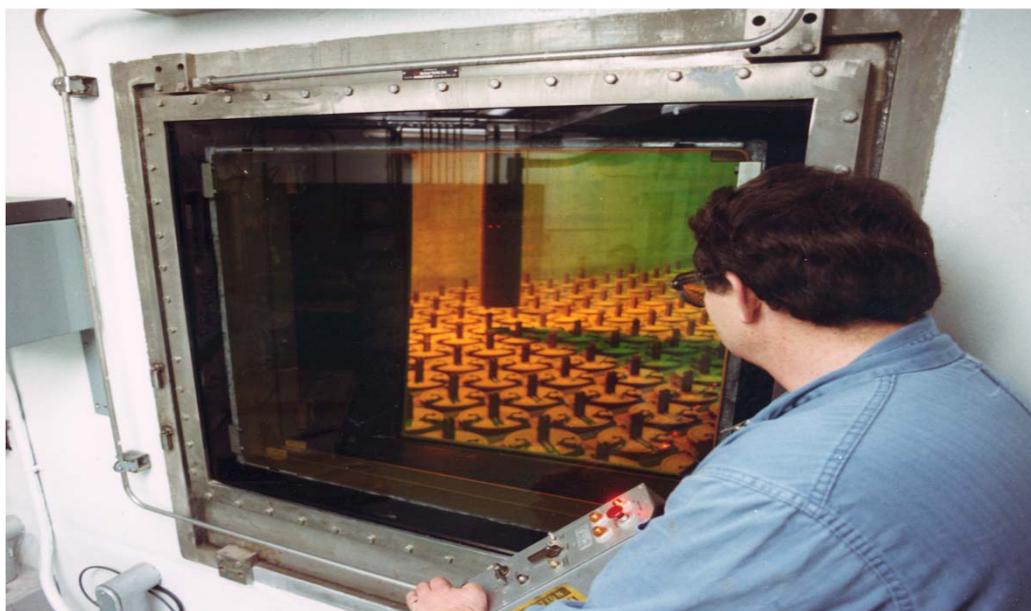
***CPP-666  
Fuel Storage***



## ***CPP-603 – Irradiated Fuel Storage Facility***

- **Dry storage area was completed in 1974. It was designed to receive Ft. St. Vrain SNF and shares structure with older, closed and grouted fuel basin.**
- **Authorization basis assumes operation through 2035.**
- **SNF is remotely handled and stored in 18” diameter canisters in contact with ambient air.**
- **Only intact SNF can be received; compromised SNF must be canned (these cans are not welded).**
- **Mechanical systems need to be upgraded to maintain min. safe storage and to support retrieval of SNF.**
- **Roof has been re-coated.**

## ***CPP-603 Storage Array***



## ***CPP-749 – Underground Storage Vaults***

- **3 types of vaults constructed between 1971 and 1985 each consisting of carbon steel pipes with shielding lids. 21 vaults are 12 ¾”, 197 vaults are 30” in diameter.**
- **Authorization basis assumes operation through 2035. Routine S&M and corrosion monitoring is required.**
- **Some vaults are not usable because these vaults are located in an area where water from fire-water system leaks has collected (perched water) in the past. Perched water management is an element of the CERCLA Record of Decision for INTEC.**

## ***CPP-2707 Cask Pad and Rail Car***

- **Cask pad was constructed in 2003 with a design life of 40 years (2043) but the authorization basis assumes operations only through 2035.**
- **Pad has space for 20 cask storage positions; 6 are in use.**
- **SNF stored in the casks came from Test Area North fuel examination facility and includes epoxied fuel.**
- **Rail car holds 2 rail casks from West Valley containing SNF of commercial origin.**

# Underground Vaults and Cask Pad



## ***NRC Licensed Independent Spent Fuel Storage Installations (ISFSI)***

- **ICP holds 3 NRC licenses:**
  - ISFSI Fort Saint Vrain (FSV),
  - Three Mile Island (TMI)
  - Idaho Spent Fuel Facility (ISFF, not constructed).
- **Ft. St. Vrain ISFSI is located in CO and was designed for carbon matrix SNF. A 20-yr license renewal is complete.**
- **S&M is defined by the NRC license.**



## ***Three Mile Island ISFSI***

- **The TMI ISFSI (NRC regulated) is located within the INTEC facility.**
- **TMI is a set of 30 horizontal storage modules.**
- **NRC license must be renewed by 2019.**
- **S&M defined by license.**



## ***Advanced Test Reactor Canal Storage***

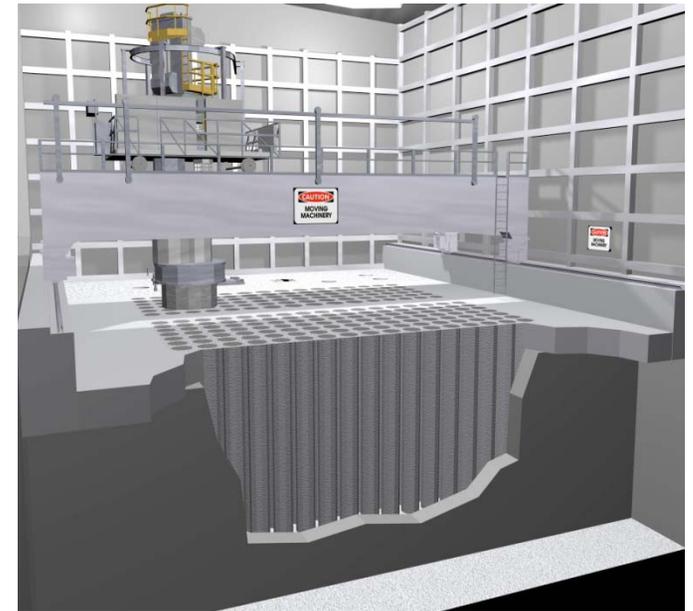
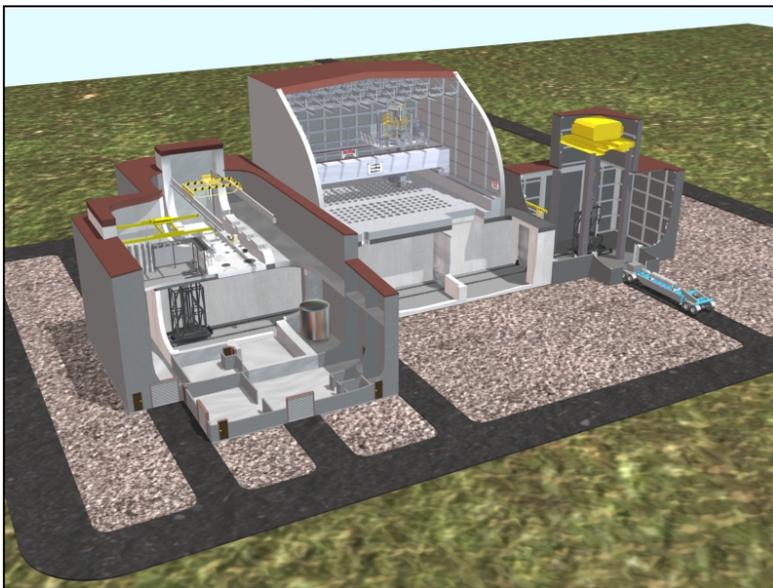
- **SNF removed from the Advanced Test Reactor (ATR) is stored in the reactor canal.**
- **ATR SNF is transferred to CPP-666 for longer-term storage.**
- **ATR SNF is the largest population of SNF managed in Idaho and can be processed in H-canyon.**

## ***Materials and Fuels Complex SNF/HLW Storage***

- **Sodium-bonded SNF from the Experimental Breeder Reactor-II is stored in dry, in-ground shielded steel cylinders in the Radioactive Scrap and Waste Facility.**
- **Sodium-bonded SNF from the Hanford Fast Flux Test Facility is stored in the Hot Fuel Examination Facility shielded hot cell.**
- **These SNF will be treated in the electrometallurgical treatment process in the Fuel Conditioning Facility.**
- **The uranium product, ceramic HLW form and metal HLW form from electrometallurgical treatment are stored in in-ground shielded steel cylinders in the Radioactive Scrap and Waste Facility.**



# Idaho Spent Fuel Facility Concept



## ***SNF Characterization, Packaging, Packaged Storage and Load-out***

- **The current ISFF design is licensed by NRC. It has not been constructed.**
- **Its mission is to receive Idaho SNF; examine/characterize SNF, as necessary for repository, interim storage or process facility acceptance; package SNF in standard canisters; store enough packaged SNF to prevent transport system impacts; and load packaged SNF into truck casks for transport off site.**
- **The facility may be redesigned to:**
  - Provide additional unpackaged SNF storage.
  - Accommodate SNF not currently assigned to Idaho (Oak Ridge HIFR).
  - Provide additional packaged storage.
  - Provide load-out to truck and rail transport systems.