Ready to Move: HBURC Shipment Project

Information Sharing Meeting

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U.S. DEPARTMENT of ENERGY | Office of Nuclear Energy

Spent Fuel and High-Level Waste Disposition

Outline

- Overview of U.S. Department of Energy, Office of Nuclear Energy (DOE-NE) High Burnup Research Cask (HBURC) Project
  - Background
  - Shipment Basics
  - Research at INL
  - State and Tribal Ad Hoc Working Group
  - Schedule
- Spent Nuclear Fuel Center for Applied Research
- Discussion and Questions

Photo courtesy of Dominion Energy

Intro: Office of Spent Fuel & High-Level Waste Disposition

The mission of the Office of Spent Fuel & High-Level Waste Disposition is to develop and implement a plan for the safe and secure long-term management of the Nation's spent nuclear fuel and high-level radioactive waste

Office Activities:

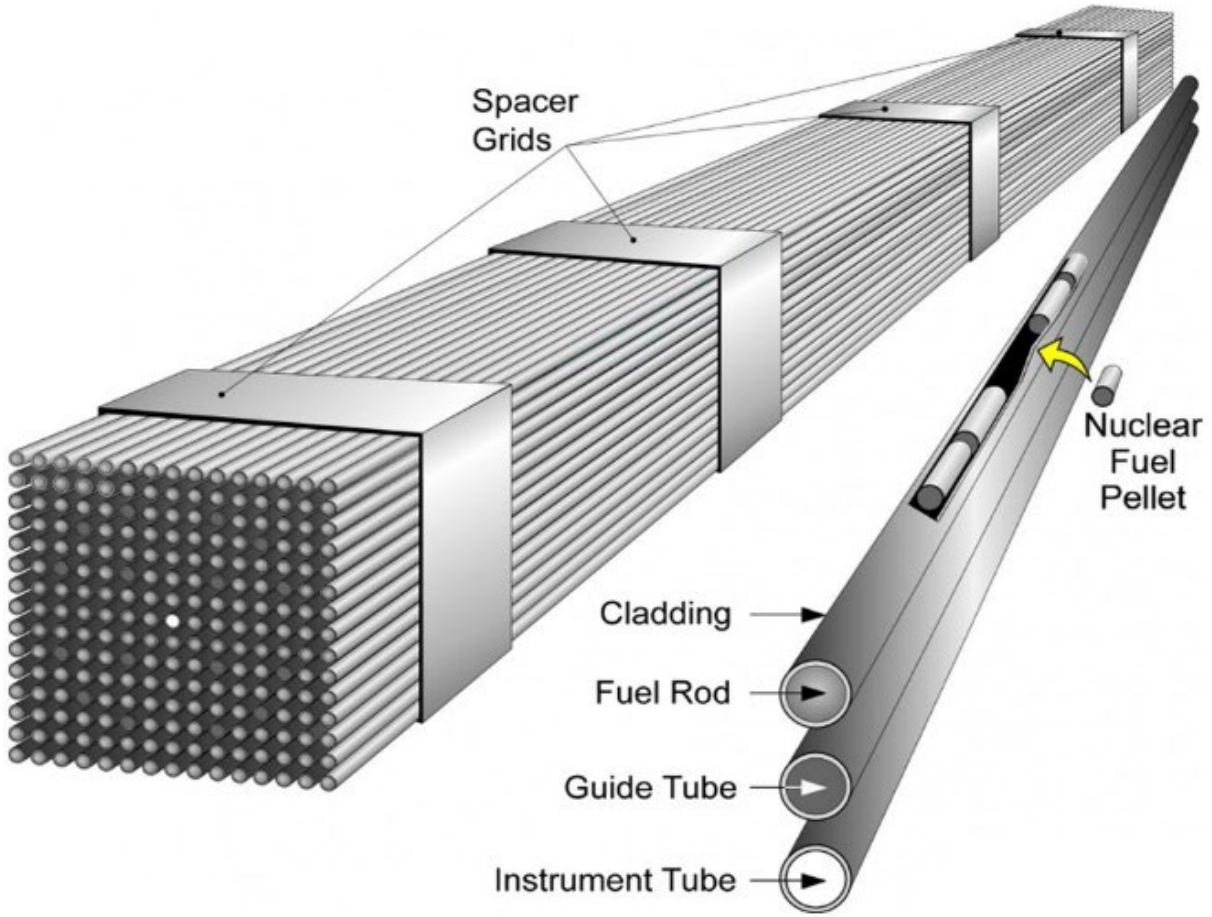
- Storage & Disposal Facility Siting through a Collaboration-Based Siting Process
- Disposal Research & Development
- Storage & Transportation for Spent Nuclear Fuel and High-level Radioactive Waste
- Spent Nuclear Fuel Storage & Transportation Research & Development

What is DOE's High Burnup Research Cask (HBURC) Project?

- Research project started in 2013 as a collaboration between DOE and the Electric Power Research Institute (EPRI)
- High burnup spent nuclear fuel (SNF) stays in reactors longer to produce electricity
- Monitoring characteristics of high burnup SNF in one dry cask at the North Anna Power Station near Mineral, Virginia
- Project will provide data to support safe storage of SNF for DOE's future Federal consolidated storage facility(s), and for the majority of currently operating U.S. nuclear power plants

Spent Nuclear Fuel Characteristics

- 32 pressurized water reactor high burnup SNF assemblies
- SNF assemblies in the cask have four different cladding types
  - Zircaloy-4, low-tin Zircaloy-4, Zirlo®, M5®
- At the time of shipment, the SNF will have been in dry storage, collecting data for about 10 years



Cask Characteristics

- The cask is a TN-32B model cask certified by the U.S. Nuclear Regulatory Commission (NRC) for storage and transportation of SNF.
- Made of steel and lead and provides containment and shielding to protect the public.
- Specialized lid allows temperature measurements with thermocouples.
- TN-32B and hardware for shipment (its “shipping weight”) is 361,855 pounds (181 tons).

Transporting the High Burnup Research Cask

Why?

- SNF will remain in dry storage systems in the U.S. for many decades before final disposal.
- DOE will continue to collect data on SNF inside the HBURC, including opening the cask to remove fuel rods for examination.
- Specialized science facilities such as those at Idaho National Laboratory (INL) are needed to open the cask and examine fuel rods; nuclear power plants do not have these facilities.

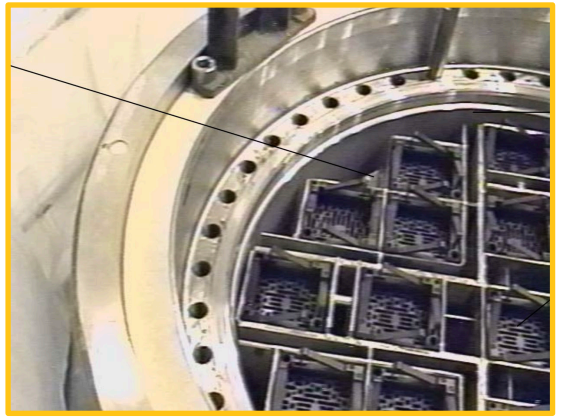
Benefits?

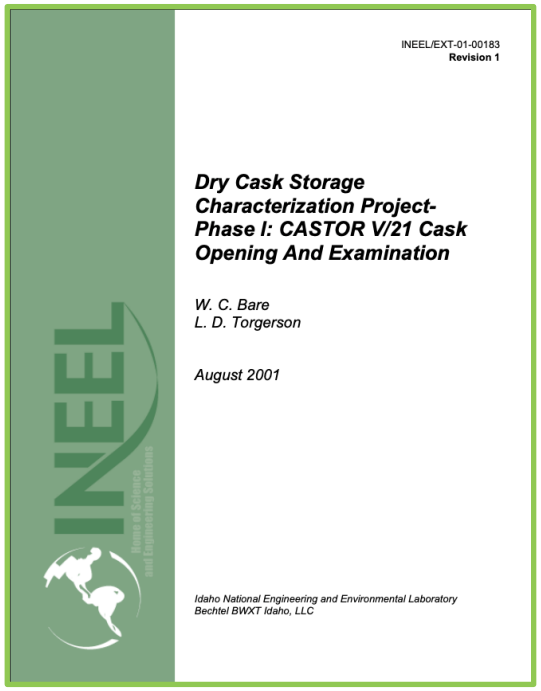
- Providing valuable data needed for licensing activities for current and future storage of commercial SNF
- Demonstrating ability to safely ship SNF; have not transported commercial SNF cross-country by rail since 2003
- Building public trust and confidence
- Demonstrating the safety and security of DOE's new Atlas railcar consist
- Opportunity to build capacity for future DOE shipments of SNF to a Federal storage facility or repository, when available

HBURC at INL: Ensuring the Future of SNF Storage

Goal: Enhance understanding of High Burnup (HBU) spent nuclear fuel (SNF) in dry storage.

How: HBURC will be opened and SNF will be examined.





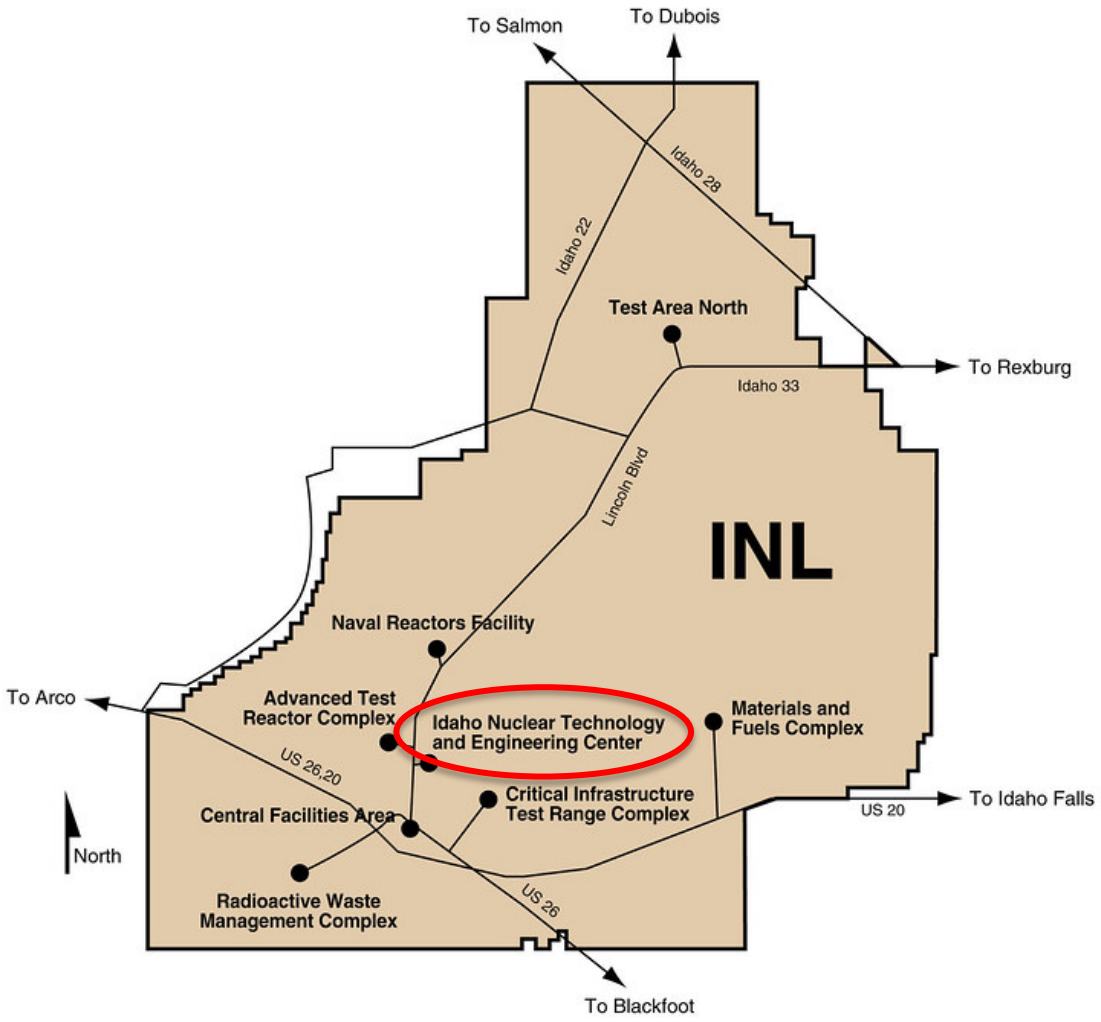
Existing SNF Data supporting dry storage obtained from tests at INL* in 1999 and 2000

Why INL? World-class researchers and facilities enable safe handling and post irradiation examination of SNF.

Expected Outcome: Provides data to validate models, ensure safety, and inform future decisions of long-term storage of HBU SNF.

* INL was previously known as Idaho National Engineering and Environmental Laboratory (INEEL)

Where the HBURC Would Be Stored at INL - INTEC

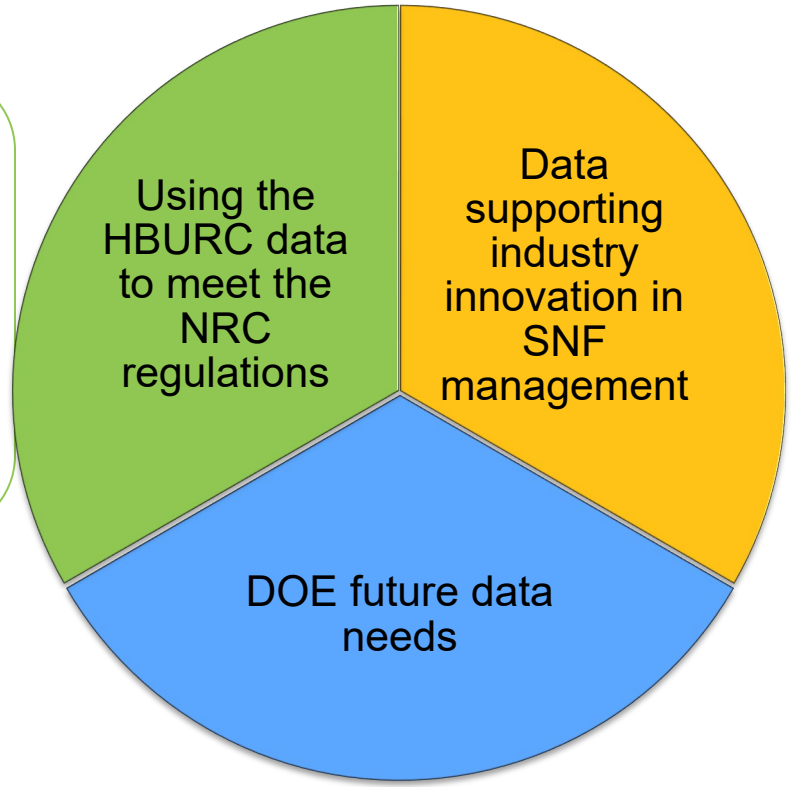


Where the HBURC Would Be Stored at INL – CPP-2707

HBURC Research Supports the Nuclear Industry and Ensures Safe Long-term Management of SNF for DOE

- 53 Nuclear Power Plants in 28 states are relying on the collection of data from the SNF within the HBURC to support licensing of extended storage

- Collect initial discharge data from loading and initial period of storage
- Collect greater than 10-year storage data
- Compare discharge and time in storage data



- Increasing operational design space for SNF management

- Long-term SNF management

Transporting the High Burnup Research Cask

How?

- The size and weight of the cask – more than 180 tons – means that freight rail is the best mode to transport the cask from Virginia to INL
- DOE has designed, tested, and obtained approval for specialty railcars (Atlas) for transporting SNF by rail
- Armed escorts will travel on the train in a rail escort vehicle (REV)

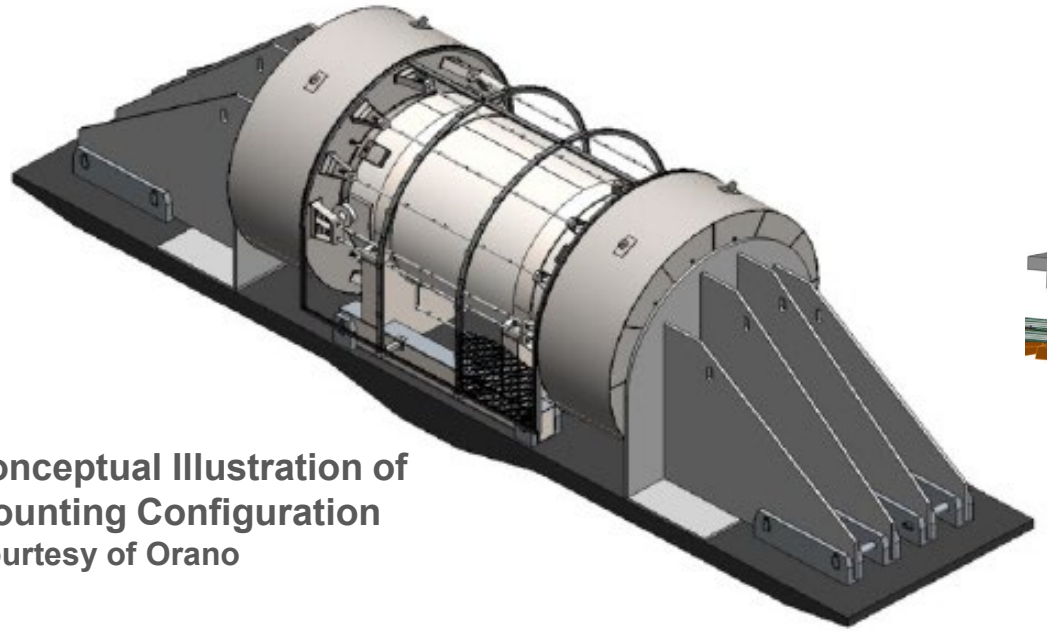
When?

- Spring 2027 – "Dry-run" rail shipments with an empty TN-32B cask from Virginia to INL and back to test procedures and inform emergency responders (provide opportunities to view train consist)
- Fall 2027 – SNF shipment

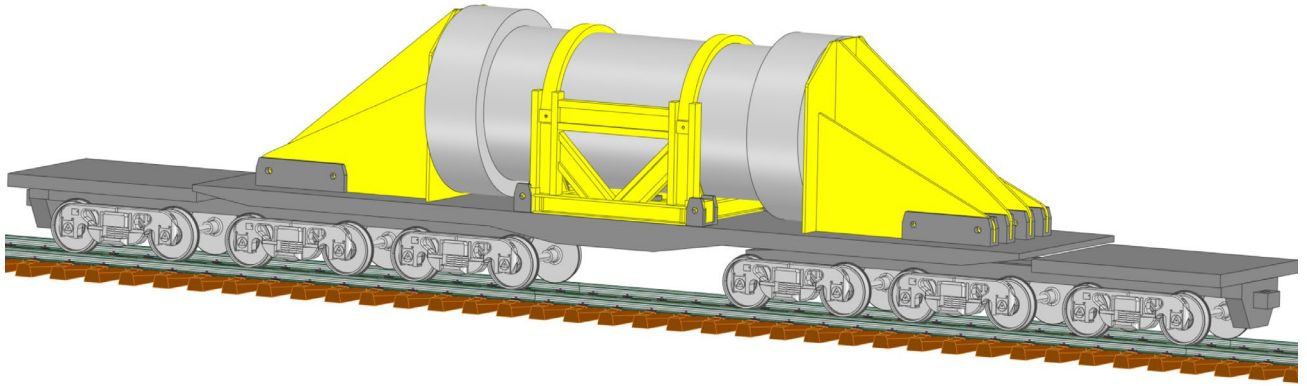
DOE's Atlas railcar

Rail Escort Vehicle

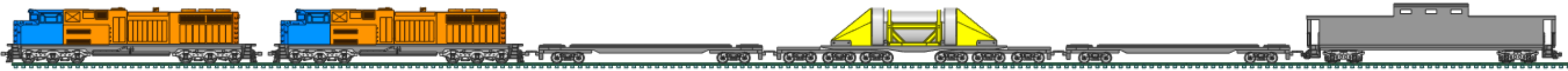
Shipment Basics: What Will the Train Look Like?



Conceptual Illustration of Mounting Configuration
Courtesy of Orano



Conceptual Illustration of a Cask on Atlas Railcar



Conceptual Illustration of Atlas Rail Consist

Map of Potential Rail Routes

Coordination with Tribal, State, and Federal Partners

CSG ERC

Western Interstate Energy Board

CSG MIDWEST

SOUTHERN STATES ENERGY BOARD
Transcending Boundaries

TRMTC

NAVAL REACTORS

FRA

PHMSA

CYBERSECURITY & INFRASTRUCTURE SECURITY AGENCY
CISA

FEDERAL BUREAU OF INVESTIGATION
WEAPONS OF MASS DESTRUCTION DIRECTORATE

DEPARTMENT OF ENERGY
UNITED STATES OF AMERICA

UNITED STATES NUCLEAR REGULATORY COMMISSION

Transportation Emergency Preparedness Program (TEPP)

- Component of an overall comprehensive emergency management system and required component of coordination in DOE Order 460.2B, "*Departmental Materials Transportation Management*."
- TEPP training offered for HBURC shipment; coordination between DOE-NE and DOE-EM.
- Mission is to "ensure that Federal, State, Tribal, and local responders have access to the plans, training, and technical assistance necessary to safely, efficiently, and effectively respond to transportation accidents involving DOE-owned radioactive materials."
- Includes multiple tools to help communities understand their current response capacity and develop additional emergency response capabilities.
- Learn more at www.teppinfo.com

Photo credit: TEPP/DOE

Similarities and Differences with Other DOE Shipments

- Similarities to Waste Isolation Pilot Plant (WIPP) shipments:
  - Offering TEPP training to jurisdictions along the potential transport routes
  - Use of TRANSCOM tracking; advance notification to States and Tribes
- Differences from other DOE radioactive material shipments:
  - Single cask shipment under Atomic Energy Act and DOE Order 460.2B – Departmental Materials Transportation Management
  - Rail shipment vs. road shipments – rail carriers determine routes in accordance with DOT regulations, fewer option for detours
  - Armed escorts on the train instead of local law enforcement
- HBURC can develop lessons learned and apply to future shipments of SNF from nuclear power plants under the Nuclear Waste Policy Act
- Will follow successful model of DOE's Chalk River shipments to Savannah River Site from 2017 - 2020

A WIPP Truck Shipment. Source: WIPP/DOE


Trains carrying West Valley SNF. Source: DOE

HBURC Shipment Ad Hoc Working Group (AHWG)

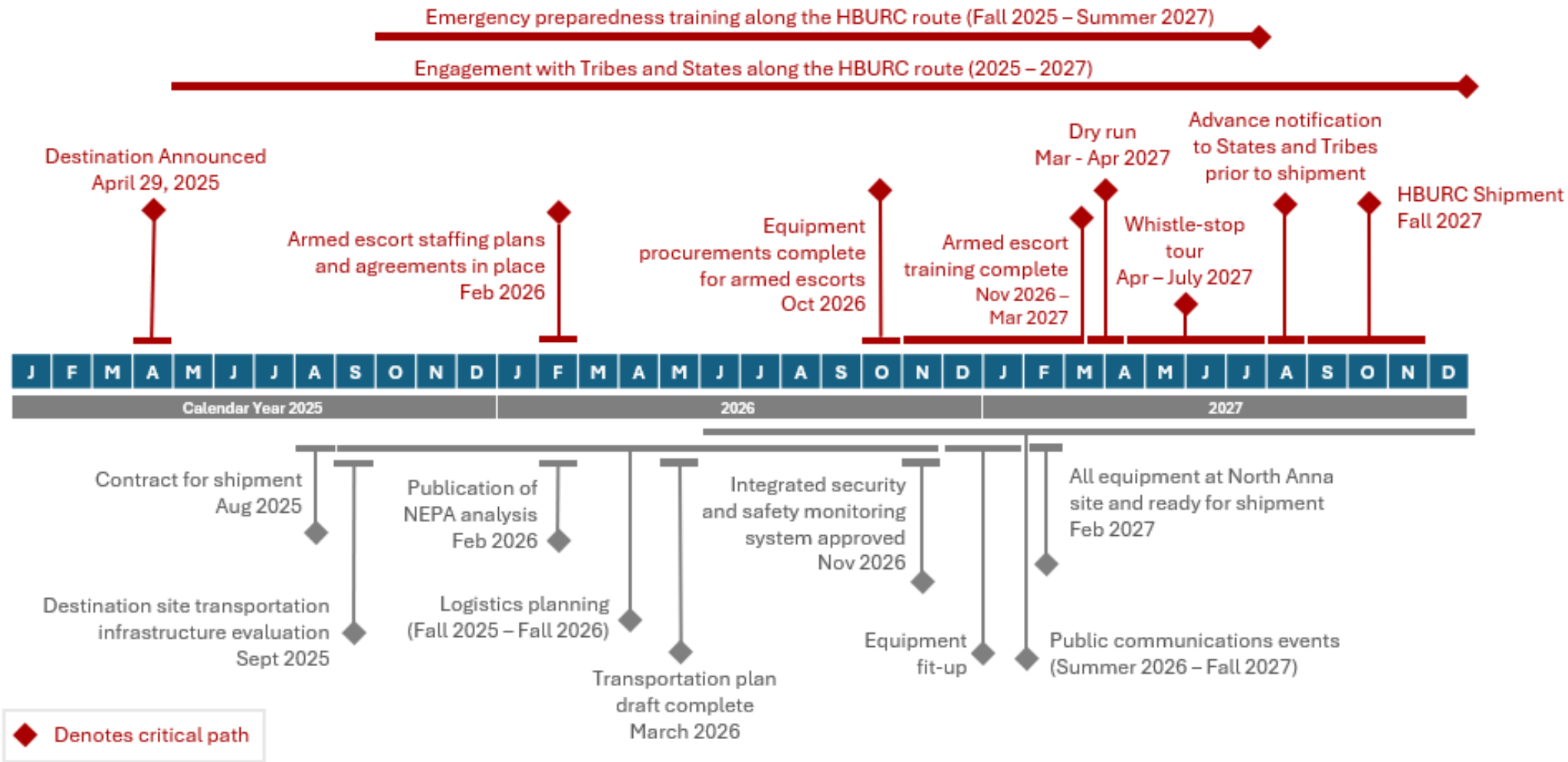
- Established through National Transportation Stakeholders Forum (NTSF)
- Open to Tribal and State entities at origin and destination sites and along route, and Federal partners
- AHWG Goals and Purpose
  1. Facilitate dialogue between Federal staff from DOE (DOE-NE & DOE-EM), Tribal and State governments along the transportation route, Federal Railroad Administration (FRA), and other Federal agencies, as applicable;
  2. Coordinate training plans, technical assistance needs, transportation plans, and public communication resources for the shipment
  3. Build capacity, gather lessons learned in real time, and develop a common understanding of how future DOE rail shipments of SNF could operate
  4. Review lessons learned post-shipment and/or questions to resolve in advance of commencing future DOE shipping campaigns.

Emphasizing and Demonstrating Safety and Security

- The HBURC shipment is centered on safety and security.
- Features include:
  - NRC-certified cask
  - Certified Atlas railcar consist
  - Real-time monitoring with Integrated Safety and Security Monitoring System (ISSMS)
  - REV with armed escorts
  - Extensive operations planning

- Emergency planning, coordination, technical assistance along route
- Rail carrier/FRA/State safety inspections
- Coordination and communication among shipment-critical parties
- A recovery plan in the unlikely event of a transportation incident

Planned Schedule: HBURC Shipment Timeline



Applied Research for SNF Storage & Transportation

- DOE is making plans to deploy a Spent Nuclear Fuel Center for Applied Research (SNF Center).

Mission:	Coordinate efforts in developing innovative technologies and solutions, conduct research that helps support and maintain regulatory compliance, and ensure public confidence in the storage and transportation of commercial and DOE-managed SNF and high-level radioactive waste (HLW).

Reduce DOE's contractual and technical liabilities.

Leverage U.S. and international research and operational experience.

Furnish data and methods to support extended storage and transportation.

SNF Center

Up to approximately 180,000 tons of SNF from the current light-water reactor fleet equates to up to 94 million fuel rods. Many variables. Different cladding types, different enrichments, different burnups.

Need statistically significant data to be able to make informed technical decisions related to SNF and HLW management

Exploring collaborations with Germany, Belgium, Switzerland, and Japan

- Countries with similar SNF and HLW forms

Consolidate all Research & Development into a systematic approach

- Coordinated technical expertise, assets, and a global support network

Location may follow the HBURC and move to the Federal CSF

Partners to the SNF Center

- The SNF Center will operate based on a hub-and-spoke model
  - Hub = physical and intellectual location
  - Spokes = principal partners, associates, and other participants
- Accountable to the DOE-NE Deputy Assistant Secretary for Spent Fuel & HLW Disposition
- Industry Partners
- International Partners

Summary: Key HBURC Shipment & Project Activities

- May 2025: Establish HBURC Shipment AHWG, begin outreach and engagement
- Summer/Fall 2025: Shipment coordination and planning with States and Tribes along route
- Fall 2025: Establish Center for Applied Research
- Fall 2025 – Spring 2027: Emergency management training
- Spring 2027: Shipment Dry Run
- Summer 2027: Whistle Stop Tour
- Fall 2027: HBURC Shipment
- Winter 2027-Spring 2028: Post-shipment summary and lessons learned
- 2027 – 2030s: HBURC fuel examination and data collection

Learn More about the HBURC Shipment Project

Visit our webpage at:
https://curie.pnnl.gov/HBURC-Transport

- Background information
- Updates on the project
- Contact information
- Sign-up link for email updates

Questions?