Nuclear Fuels Storage and Transportation Planning Project – Transportation System Development Overview

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Western Interstate Energy Board
South Lake Tahoe, California
October 2014
Outline

NFST Transportation **Operational** Activities
- Shutdown Sites Report
- UNF ST&DARDS

NFST Transportation **Hardware** Activities
- AAR S-2043 Compliant Railcar Development

Linking it All Together
Historically, the development of a transportation system has been divided into three primary elements

- **Institutional**
  - Relationships that must be established with stakeholders to move the transportation process forward
    - States, Tribes and Local Officials
    - First Responders
    - Industry
    - Carriers, etc.

- **Operational**
  - Day-to-day activities that will take place to operate the transportation system

- **Hardware**
  - All physical items that must be used in order to operate the transportation system
    - Casks
    - Railcars
    - Heavy-haul trailers, etc.
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Operational Activities are Ramping Up with Focus on the Shutdown Sites

- Development of the Stakeholder Tool for Assessing Radioactive Transportation (START)
  - Development of START is considered an Operational activity, though support for use of START by Stakeholders is considered an Institutional Activity
  - START Version 1.1 released 9/30/2014
  - Training provided at AD Hoc 180(c) meeting in Atlanta last week

- Review of Recommendations by NAS to determine ownership and progress
- Shutdown Sites Report continues to develop
- UNF ST&DARDS Development
  - Specific to transportation
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Current Status of Shutdown Sites

Activities

- Latest Shutdown Sites Report (SSR) released on August 30, 2014

- In-Process of being posted on DOE-NE website

- NFST has visited 10 Shutdown Sites
  - SRG representatives, a Tribal representative, and a Federal Railroad Administration (FRA) representative participated in 7 of the shutdown site visits
  - Kewaunee site visit completed 09/09-09/11/2014
Locations of 12 Shutdown Reactor Sites

Nine Storage System Types and Eight Different Transportation Cask Designs at Shutdown Sites

- Trojan - UNF 34; GTCC 0
- Humboldt Bay - UNF 5; GTCC 1
- Rancho Seco - UNF 21; GTCC 1
- La Crosse - UNF 5; GTCC 0
- Zion - UNF 61; GTCC 4
- Big Rock Point - UNF 7; GTCC 1
- Yankee Rowe - UNF 15; GTCC 1
- Maine Yankee - UNF 60; GTCC 4
- San Onofre - UNF 137; GTCC 5 (Estimated)
- Crystal River - UNF 42; GTCC 2 (Estimated)

Key
UNF – used nuclear fuel canisters
GTCC – canisters of greater than class C waste
Trojan

- Portland and Western Railroad passes through the Trojan site
  - Portland and Western interchanges with BNSF and UP near Portland, Oregon
- Rail is Track Class 2 in vicinity of site
- Rail spur to site removed
- Smaller spur installed for waste shipments during decommissioning but has been removed
- Onsite barge slip
Trojan Site Layout
Trojan Transportation Infrastructure

Portland and Western Railroad Outside Trojan Site

Junction of Portland and Western Railroad and Trojan Onsite Rail Spur

Trojan Onsite Rail Spur Bed

Remnants of Onsite Rail Spur at Trojan Site
Trojan Barge Slip

- Trojan barge slip used to remove steam generators (450 tons each), pressurizer (125 tons), and reactor pressure vessel (1000 tons) during decommissioning.
Trojan Access Road and Barge Slip

Trojan Barge Slip Access Road

Trojan Barge Slip
Humboldt Bay has not been served by rail since 1998

- Was served by Northwestern Pacific Railroad
- Northwestern Pacific open to Windsor, California, about 220 miles south of Humboldt Bay

No onsite barge access
Potential Humboldt Bay Heavy Haul Routes

- Nearest rail access located in Redding, California
- During decommissioning, Humboldt Bay has used several truck routes
  - U.S. Highway 101 south to California State Route 20 to Interstate 5
  - U.S. Highway 101 north to U.S. Highway 199 to Interstate 5
  - U.S. Highway 101 north to California State Route 299 to Interstate 5
- Distance to these locations range from 160-260 miles
- Other locations are possible
  - Coos Bay, Oregon – 220 miles
  - San Francisco Bay Area – 290 miles

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Humboldt Bay Potential Heavy Haul Routes

- Grants Pass, Oregon
- US 101 to US 199
- US 101 to SR 299
- Humboldt Bay ISFSI
- US 101 to SR 36
- US 101 to SR 20
- Central Oregon and Pacific Railroad
- Union Pacific Railroad
- Redding, California
- Red Bluff, California
- Williams, California
- Marysville, California
Humboldt Bay Barge Access

- Humboldt Bay has no onsite barge access
- Fields Landing Terminal, located 2 miles south of Humboldt Bay, was used to offload 10 engines and generators that were installed at the Humboldt Bay Generating Station
  - Engines – 680,000 lb. each
  - Generators – 150,000 lb. each
- Heavy haul trucks used to transport engines and generators from Fields Landing to Humboldt Bay
Engine and Generator Transport to Humboldt Bay Site

- Loading Engine Onto Barge at Schneider Dock
- Engine Arriving at Fields Landing Terminal
- Unloading Engine at Fields Landing Terminal
- Engine Arriving at Humboldt Bay Site
Engine and Generator Heavy Haul Route to Humboldt Bay Site
Rancho Seco

- Onsite rail spur connects to Union Pacific Ione Industrial Lead
- Ione Industrial Lead connects to Union Pacific mainline in Galt, California
  - Mainline connects Stockton and Sacramento
- Ione Industrial Lead is Track Class 2
  - 158 ton weight limit
  - 6-axle locomotives prohibited
  - Transport of UNF and GTCC would require route clearance
- UP mainline is Track Class 5
- Rail spur used during decommissioning but is not being maintained
  - Rail spur was used to transport four reactor coolant pumps (50 tons each), the pressurizer (150 tons), and two steam generators (550 tons each)
  - The two steam generators were too large to ship in their intact state due to rail route clearances and were cut into four 225-ton segments
- During decommissioning, heavy haul truck to barge transport was used to transport 520-ton generator to Surry for re-use
Union Pacific Mainline and Ione Industrial Lead Near Rancho Seco Site
Rancho Seco Site Layout
Rancho Seco Rail Infrastructure

Rancho Seco Rail Spur

Remnants of Rancho Seco Onsite Rail Infrastructure
Rancho Seco Grade Crossing, Junction, and Split Rail Derailer

CA-104 and Rancho Seco Rail Spur Grade Crossing

Junction of Rancho Seco Rail Spur and Ione Industrial Lead

Split Rail Derailer on Rancho Seco Rail Spur
Onsite rail spur connects to BNSF mainline
- Spur is 0.8 miles long
- Spur is Track Class 1

BNSF mainline is Track Class 4

Rail spur was reactivated in 2000 to support decommissioning of San Onofre Unit 1

The NFST Team has not yet visited San Onofre, so knowledge of this site is more limited than for the other western shutdown sites
San Onofre

Interstate 5

On-Site Rail Spur

San Onofre ISFSI

BNSF Railroad

San Onofre-2 and -3
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- **NFST Transportation Hardware Activities**
  - AAR S-2043 Compliant Railcar Development

- **Linking it All Together**
UNF-ST&DARDS is an integrating (storage, transportation, and disposal) foundational resource with broad applicability.

- A comprehensive system for analysis of the used nuclear fuel (UNF) from the time it is discharged from the reactor to the time it is disposed of in a geologic repository.

- Unified Database (UDB)
  - The DOE Office of Nuclear Energy resource for UNF management and disposition.

- Characterizes the input to the waste management system
  - Assess and address issues regarding transportability of loaded casks and high burnup fuel.
Comparison to 10 CFR 71 dose rate limits for both NCT and HAC

- **Maximum Normal Conditions of Transport (NCT) dose rate** at 2 m from the cask radial surface as a function of time (10 CFR 71.47(b) dose rate limit: 10 mrem/h)

- **Maximum Hypothetical Accident Conditions (HAC) dose rate** at 1 m from the cask radial surface as a function of time (10 CFR 71.51(a)(2) dose rate limit: 1,000 mrem/h)
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Hardware Activities are Currently Focused on Long-Lead Time Items

- Initial planning for the procurement or leasing of casks, cask ancillary equipment, and railcar fleet
  - Determination of certification status for each of the canister types used at the shutdown sites
  - Initial determination of cask and railcar fleets needed to de-inventory each shutdown site

- AAR S-2043 Compliant railcar Development
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Railcars necessary for Large-Scale Transport

- Specialized railcars are needed to support the transportation system
  - Association of American Railroads (AAR) Standard S-2043 provides the performance specification for these cars
  - Without new railcars, the U.S. has no capability to move the very massive rail-sized casks on a large-scale basis

- DOE has made agreements with the Union Pacific and BNSF railroad companies, which state, “All cars supplied by the Government Shipper ... will comply with AAR Construction Standards…”

- A consist carrying spent nuclear fuel and/or high-level waste must have buffer cars, cask cars, and an escort car.

- The entire consist must comply with S-2043.
Developing S-2043 compliant railcars is a long and detailed process

- Development of S-2043 compliant railcars will take a minimum of 7-8 years
  - The design process includes extensive finite element analysis modeling activities
  - The testing process is very involved
  - Initial modeling and testing may have to be repeated if the modeling and testing results do not match

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Duration (estimate):
- Year 1: Initiate procurement
- Year 2: Design cars
- Year 3: Manufacture prototype
- Year 4: Test cars and document
- Year 5 to 8: AAR approval review
The primary purpose of S-2043 is to ensure that derailments will not occur.

- To this end, the specification calls for top-of-the-line, highly reliable components:
  - Electronically Controlled Pneumatic (ECP) brakes
  - On-board System Performance Monitoring, including real-time monitoring of hunting, rocking, bearing temperature, vertical acceleration, lateral acceleration, and longitudinal acceleration.
  - Trucks with Specialized Suspensions
  - Anticipate that All Components will be Commercially Available

- Very detailed analyses must be performed prior to a prototype car being built for testing:
  - Structural Analysis
  - Nonstructural Static Analysis
  - Dynamic Analysis
The testing process is comprehensive

- Testing consists of two distinct testing regimes
  - Single car testing
  - Consist testing
    - Consist testing must be done with at least one cask car, one buffer car and one escort car
- The tests are comprehensive and will take several years to complete
- Analysis results must be compared to data measurements taken during testing
Approval is two-stage process

- Conditional approval may be granted by the AAR after all required reports have been submitted.
- Follow-up single-car testing is required at 50,000 miles or five years, whichever comes first.
- Upon satisfactory operation of the railcar(s) for 100,000 service miles a report detailing the service must be submitted to the AAR.
- Based upon this report and the proposed remediation plan for any issues identified by the report, the AAR Equipment Engineering Committee may grant full approval of the car design.
Significant Progress toward Railcar Development was Made in FY 2014

- Issued AAR S-2043: Use and History report
- Issued AAR S-2043 Cask Railcar Systems Requirements Document

Request for Information and Sources Sought Notice (RFI/SSN) posted in FedConnect (DE-SOL-0006863)

- Included draft Statement of Work (SOW)
- Requested information about companies that may be interested in responding to a Request for Proposals (RFP)
- Requested additional information that may be helpful in developing an RFP
- Five Responses Received
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Key NFST Transportation Linkages

NTP

180(c)

Institutional Routing

START

Operational Shutdown Sites Information UNF ST&DARDS

Hardware

Casks Railcars

Cask Ancillary Equipment
Contact Information

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