Preliminary Evaluation of Removing SNF from Shutdown Sites – Fort Calhoun Site Visit

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This is a technical presentation that does not take into account contractual limitations under the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (10 CFR Part 961). Under the provisions of the Standard Contract, DOE does not consider spent fuel in canisters to be an acceptable waste form, absent a mutually agreed to contract amendment.

This presentation reflects research and development efforts to explore technical concepts which could support future decision making by DOE. No inferences should be drawn from this presentation regarding future actions by DOE.
The purpose of the shutdown sites evaluation is to support planning for removing spent nuclear fuel (SNF) and greater-than-Class C low-level radioactive waste (GTCC waste) from shutdown nuclear power plant sites by collecting and documenting information related to:

- Site inventory
- Site conditions
- Near-site transportation infrastructure and experience

Identify gaps in information needed to ship SNF and GTCC waste from the shutdown sites

Based on the available information, identify options for transporting SNF and GTCC waste from the shutdown sites.
There will be 583 total canisters (546 SNF, 37 GTCC waste) at 14 shutdown sites

There are 11 dry storage systems in use at the shutdown sites; 9 transportation cask models would be used to remove SNF and GTCC waste from the sites.
General Types of Storage Systems Deployed at Shutdown Sites

Vertical Concrete Casks (VCCs) Deployed at 9 Sites

- Vertical Concrete Casks at Maine Yankee

Horizontal Storage Modules (HSMs) Deployed at 5 Sites

- Horizontal Storage Modules at Rancho Seco

Underground Storage Modules at Humboldt Bay

- HI-SPORT
- UMAX

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Transportation Cask Models That Would Be Used to Ship SNF and GTCC Waste from Shutdown Sites Have a Wide Range of Weights and Dimensions

HI-STAR HB
128" dia.
230.8" long
187,000 lb.

MP197HB
126" dia.
271.25" long
304,000 lb.

NAC-UMS UTC
124" dia.
273.3" long
255,000 lb.

NAC-STC
128" dia.
273.7" long
255,000 lb.

HI-STAR 100
128" dia.
307.5" long
280,000 lb.

MP187
126.75" dia.
308.0" long
271,000 lb.

NAC MAGNATRAN
128" dia.
322.0" long
312,000 lb.

TS125
143.5” dia.
342.4” long
285,000 lb.

HI-STAR 190
128” dia.
362.06” long
421,000 lb.

Humboldt Bay
Kewaunee, Crystal River, San Onofre, and Fort Calhoun
Yankee Rowe, Connecticut Yankee, and La Crosse
Yankee, and La Crosse
Trojan and Vermont Yankee
Rancho Seco and San Onofre
Zion and Kewaunee
Big Rock Point
San Onofre
Sources of Information Used in Evaluation

- Documents and databases
  - GC-859 Nuclear Fuel Data Survey

- Independent Spent Fuel Storage Installation (ISFSI) site managers

- Heavy equipment, lifting, rigging, and transporting companies with experience at the shutdown sites

- Shutdown site visits
  - Tribal, Federal Railroad Administration (FRA), State, and State Regional Group (SRG) representatives participate in shutdown site visits and have provided valuable contributions to the evaluations

- Railroads serving the sites

- Google Earth
On-site Conditions at Shutdown Sites

■ On-Site Transportation Features
  • On-Site Rail
  • On-Site Roads for Heavy Haul Trucks
  • Barge Access

■ On-Site Equipment to Support Transportation Operations
  • Transfer Casks
  • Cranes and Rigging

■ On-Site Staging Areas for Transport Vehicles, Equipment, and Operations Support

On-site Rail Spur at La Crosse
Trojan Transfer Station
Big Rock Point Horizontal Transfer System

Photo courtesy of Trojan
Photo courtesy of Big Rock Point
Near-Site Transportation Infrastructure and Experience

- Evaluate transportation mode options for the shutdown sites
- **Near-Site Rail Access**
  - Condition and capacity of near-site rail infrastructure
  - Potential transload locations
  - Site experience with rail shipments
- **Local Roads and Highways**
  - Distance to potential rail transload locations (rail spurs or sidings)
  - Characteristics and condition of roads and associated infrastructure that would be used by heavy haul vehicles
  - Site experience with heavy haul shipments
- **Barge Access**
  - Characteristics of onsite or nearby docks/slips/shorelines
  - Site experience with barge shipments

- Junction of Onsite Rail Spur and Union Pacific Railroad at Zion
- Rail Grade Crossing at East Portal of Hoosac Tunnel Near Yankee Rowe
- Low Overhead Bridge Near Big Rock Point
- Railroad Grade Crossing at East Portal of Hoosac Tunnel Near Yankee Rowe
Potential Transload Locations Near Shutdown Sites

Portland Railhead Near Connecticut Yankee

Potential Kewaunee Transload Location Near Bellevue, Wisconsin

Petoskey Transload Location Near Big Rock Point

Gaylord Transload Location Near Big Rock Point
Potential Barge Locations

Barge Dock at Maine Yankee

Location of Barge Area in Coolant Discharge Canal at Connecticut Yankee

Barge Slip at Trojan

Barge Area at Crystal River
Site Experience Shipping Large Components Key to Understanding How SNF Might Be Moved

- Turbine Component Unloading at Crystal River
- Reactor Pressure Vessel Shipping at Maine Yankee
- Reactor Pressure Vessel Shipping at La Crosse
- Steam Generator Shipping Near Kewaunee
Case Study – Fort Calhoun Site Visit

- Fort Calhoun site visit – May 15-19, 2017
- Met with Fort Calhoun staff (Omaha Public Power District, OPPD) and the Union Pacific Railroad
- Participants in site visit included
  - Federal Railroad Administration
  - Pahrump Paiute Tribe
  - Prairie Island Indian Community
  - Nebraska State Patrol
  - Nebraska Department of Health and Human Services
  - Iowa DOT Office of Rail Transportation
  - Iowa DOT Office of Motor Vehicle Enforcement
  - CSG-Midwest
Fort Calhoun has loaded 10 dry storage canisters containing 320 SNF assemblies into AREVA TN Standardized NUHOMS systems
- 32PT canisters
- Campaigns in 2006 (4 canisters) and 2009 (6 canisters)

Fort Calhoun will expand ISFSI to accommodate SNF currently in pool
- 944 assemblies
- Have damaged fuel and high burnup fuel
- Have not decided whether to stay with AREVA TN or switch to Holtec or NAC
- 30 additional dry storage canisters if stay with AREVA TN and 32PT canisters

Total of 40 SNF canisters and 1-2 GTCC canisters at conclusion of loadings (estimated)
Fort Calhoun ISFSI
Fort Calhoun Served by Cargill Rail Spur and Union Pacific Railroad
Track at Entrance to Cargill Spur

Looking South

Looking North

Derailer at Entrance to Spur
Cargill Railyard and 7.5-8 Degree Curve

Cargill Railyard

7.5-8 Degree Curve
Measuring Curvature of Track
Cargill Rail Spur Onsite at Fort Calhoun

Cargill Rail Spur Looking Southeast

Cargill Rail Spur Looking Northwest
Cargill Rail Spur – 136 lb. rail, Concrete Ties, Pandrol Clips
Cargill Spur Still Active Down to Fort Calhoun Site
Rail Spur Used to Run Onsite

Cargill Rail Spur

Former Onsite Rail Spur
Fort Calhoun Barge Receiving Area

Missouri River

Barge Receiving Area
Fort Calhoun has received horizontal storage modules (HSMs) by rail on Cargill Spur.

HSMs transloaded onsite and moved down haul road to ISFSI.
HSM Transload and Transport to ISFSI Pad

Photos courtesy of Fort Calhoun
Installation of HSMs on ISFSI Pad

Photos courtesy of Fort Calhoun
Cargill Rail Spur, HSM Transload Location, and ISFSI
Current Condition of Transload Location and Haul Road
In 2006, two steam generators, the pressurizer, the reactor vessel head, low pressure turbines, and the main output transformer were replaced.

All equipment was shipped via barge except for main output transformer (shipped by rail).

During construction of the plant, major components were also shipped by barge.
Aerial View of Barge Area
Barge Transport on Missouri River and Arrival

Photos courtesy of Fort Calhoun
Barge Arrival and Offloading

Photos courtesy of Fort Calhoun
Reactor Vessel and Steam Generators Shipped by Barge During Construction

Photos courtesy of Fort Calhoun
## Summary of Transportation Mode Options Identified for Shutdown Sites

<table>
<thead>
<tr>
<th>Reactor Site</th>
<th>Transportation Mode Options</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine Yankee</td>
<td>Direct rail, Barge to rail</td>
<td>The condition of the onsite rail spur and Central Maine and Quebec Railroad would need to be verified.</td>
</tr>
<tr>
<td>Yankee Rowe</td>
<td>Heavy haul truck to rail</td>
<td>Potential rail transload location at east portal of the Hoosac Tunnel (7.5 miles from site).</td>
</tr>
<tr>
<td>Connecticut Yankee</td>
<td>Barge to rail, Heavy haul truck to rail</td>
<td>Depth of barge canal uncertain and may require dredging to accommodate barges. Potential rail transload location at Portland rail spur (12 miles from site).</td>
</tr>
<tr>
<td>Humboldt Bay</td>
<td>Heavy haul truck to rail, Heavy haul truck to barge to rail</td>
<td>Potential rail transload locations located 160 to 280 miles from site. The condition of the Fields Landing Terminal barge transload location would need to be verified.</td>
</tr>
<tr>
<td>Big Rock Point</td>
<td>Heavy haul truck to rail, Barge to rail</td>
<td>Potential rail transload locations in Petoskey, Michigan (13 miles from site) and Gaylord, Michigan (52 miles from site). The rail infrastructure at these locations would need to be evaluated.</td>
</tr>
<tr>
<td>Rancho Seco</td>
<td>Direct rail</td>
<td>The rail spur is not being maintained. Weight restrictions on the Ione Industrial Lead would require route clearance by the railroad.</td>
</tr>
<tr>
<td>Trojan</td>
<td>Direct rail, Barge to rail</td>
<td>The onsite rail spur was removed. Barge used to ship reactor pressure vessel and steam generators.</td>
</tr>
<tr>
<td>La Crosse</td>
<td>Direct rail, Barge to rail</td>
<td>The onsite rail spur was used to ship reactor pressure vessel.</td>
</tr>
<tr>
<td>Zion</td>
<td>Direct Rail, Barge to rail</td>
<td>The onsite rail spur was recently refurbished to support decommissioning.</td>
</tr>
<tr>
<td>Crystal River</td>
<td>Direct rail, Barge to rail</td>
<td>Extensive onsite rail system. Potential onsite barge area.</td>
</tr>
<tr>
<td>Kewaunee</td>
<td>Heavy haul truck to rail, Heavy haul truck to barge to rail</td>
<td>Potential rail transload locations in Bellevue, Luxemburg, Denmark, and Manitowoc. Potential barge transload location in city of Kewaunee.</td>
</tr>
<tr>
<td>San Onofre</td>
<td>Direct rail, Heavy haul truck to barge to rail</td>
<td>Onsite rail spur recently refurbished to support reactor decommissioning shipments.</td>
</tr>
<tr>
<td>Vermont Yankee</td>
<td>Direct rail</td>
<td>Onsite rail spur will be reactivated to support decommissioning.</td>
</tr>
<tr>
<td>Fort Calhoun</td>
<td>Direct Rail, Barge to rail</td>
<td>Onsite rail spur could be reinstalled or onsite transload performed. Barge used to ship steam generators, pressurizer, reactor vessel head</td>
</tr>
</tbody>
</table>
Current Status – Shutdown Sites Evaluation

- Latest version of shutdown sites report (SSR) completed on September 30, 2016
  - Posted on DOE-NE website (http://energy.gov/ne/downloads/preliminary-evaluation-removing-used-nuclear-fuel-shutdown-sites)
- SSR will be updated and submitted at the end of FY2017
- Items for update include
  - Addition of Fort Calhoun to the SSR
    - Shut down in October 2016
  - Add additional SNF discharge data
  - Add additional information on storage systems in use at shutdown sites
  - Add additional information on the local transportation infrastructure and transload locations around the shutdown sites
  - Evaluations of additional sites as they shut down, such as Palisades, Pilgrim, Three Mile Island, Indian Point, Clinton, Quad Cities, Oyster Creek, and Diablo Canyon