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DOE's Site-Specific De-Inventory Reports

Sara Hogan, PhD
Office of Integrated Waste Management
US Department of Energy

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Disclaimer

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- To the extent discussions or recommendations in this presentation conflict with the provisions of the Standard Contract, the Standard Contract governs the obligations of the parties, and this presentation in no manner supersedes, overrides, or amends the Standard Contract.
- This presentation reflects technical work which could support future decision making by the U.S. Department of Energy (DOE or Department). No inferences should be drawn from this presentation regarding future actions by DOE, which are limited both by the terms of the Standard Contract and Congressional appropriations for the Department to fulfill its obligations under the Nuclear Waste Policy Act including licensing and construction of a spent nuclear fuel repository.

Contents

- Motivation for Reports
- History and Contents of Reports
- Plans for New Reports
- Snapshot of Three Reports
 - Connecticut Yankee
 - Humboldt Bay
 - Crystal River
- Technical Issues to be Addressed
- Contractor's Recommended Next Steps
- Unique Challenges



Planning for Spent Nuclear Fuel (SNF) Transport

- DOE-NE has been gathering data from nuclear power plant sites
 - *Nuclear Power Plant Infrastructure Evaluations for Removal of Spent Nuclear Fuel (2021)*:
 - Includes input from site personnel, local Tribes/States, U.S. Department of Transportation (DOT), Federal Railroad Administration (FRA), and other stakeholders
 - As this work matured, DOE-NE looked for the next steps in understanding the challenges with and planning for the removal of SNF and greater-than-Class-C low-level waste (GTCC)



Photo courtesy of Connecticut Yankee



Photo courtesy of Humboldt Bay



Photo courtesy of Crystal River

Initial Site-Specific De-Inventory Reports

- These reports are a first look at how an integrating contractor could recommend going about removing SNF and GTCC waste from these sites
- The reports represent one contractor's perspective and do not represent DOE's plans
 - Contractor used a Multi-Attribute Utility Analysis (MUA) as a framework for future identification of preferred mode/route alternatives
 - As DOE-NE continues to develop system analysis tools (START, NGSAM, etc.), these tools can also be integrated into the decision-making process



History of Site-Specific De-Inventory Reports

- Reports are a deeper dive into the activities needed to remove spent nuclear fuel (SNF) from specific sites
 - Team led by Orano is producing the reports
 - Reports build off of NPP site evaluations
- Work on reports began in 2015 and resulted in 6 reports being completed and released in 2017
 - Big Rock Point, Connecticut Yankee, Humboldt Bay, Kewaunee, Maine Yankee, Trojan
- Five reports in development expected to be released in 2023
 - Crystal River, La Crosse, Rancho Seco, Yankee Rowe, Zion
- Two reports beginning work in 2023

Content of Reports

- The reports have a consistent structure
 - Executive Summary
 - Introduction
 - Pertinent Site Information
 - Transportation Route Analysis
 - Participating Entities
 - Multi-Attribute Utility Analysis
 - Metrics related to transportation routes, modes, transload locations
 - Concept of Operations
 - Budget and Spending Plan
 - Safety and Security Plans and Procedures
 - Emergency Response and Preparedness
 - Recommended Next Steps

Initial Site-Specific De-Inventory Report for Big Rock Point
Report No.: RPT-3014537-002

**Initial Site-Specific De-Inventory Report for
Big Rock Point**

RPT-3014537-002

Prepared by: AREVA Federal Services LLC

REVISION LOG

Rev.	Date	Affected Pages	Revision Description
000	9/29/2015	N/A	Initial Issue
001	11/13/2015	All	Responding to DOE comments
002	5/10/2017	All	Entire document revised and reformatted to match format and content of more recent de-inventory reports submitted to client. In addition, the title was revised to Initial Site-Specific De-inventory Report for Big Rock Point.

Initial Site-Specific De-Inventory Report for Big Rock Point
May 10, 2017

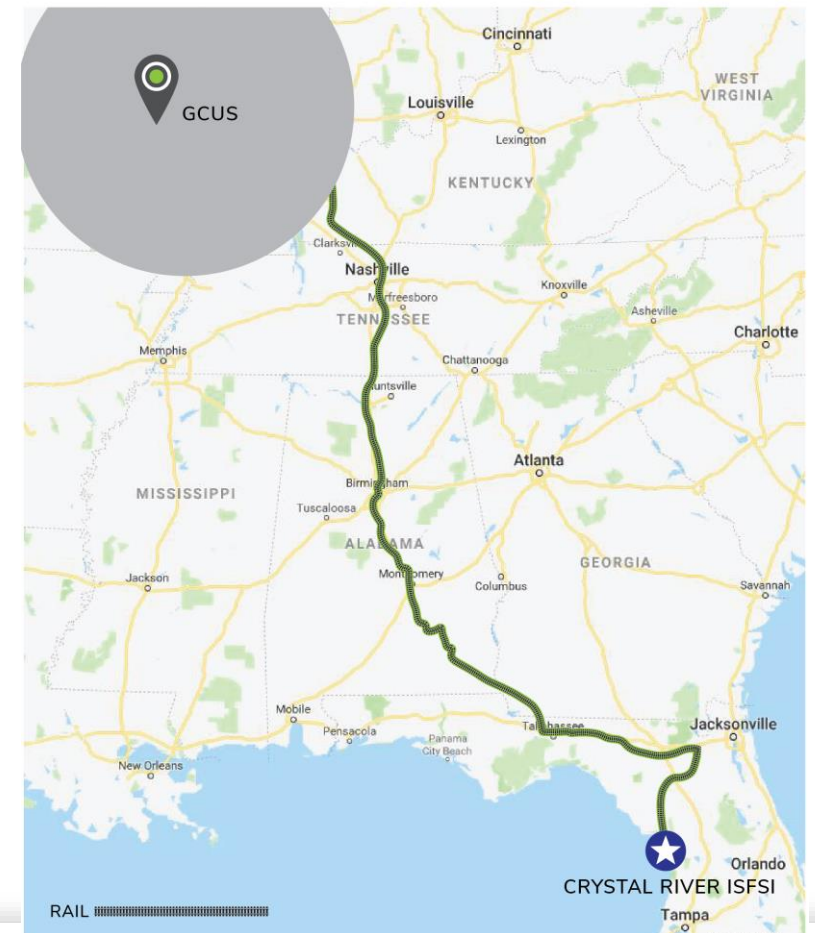
Pertinent Site Information

- The Pertinent Site Information section of a de-inventory report contains
 - **Description of the site/characteristics**
 - **Characteristics of the SNF and GTTC waste to be shipped**
 - **Description of the canisters/overpacks to be shipped**
- This information includes the overall site layout, site infrastructure, near-site transportation infrastructure, details on the dry storage systems deployed at a site, and transport equipment at a site
- SNF and GTCC waste data includes detailed information on specific assembly types, discharge dates, burnups, decay heats, often at the canister level
- Canister and overpack (transportation cask) data will typically identify any issues associated with transporting the SNF or GTCC waste that could require transportation Certificate of Compliance modifications, contain data on transportation cask weights and dimensions, and provide the sequence of operations for receiving, loading, and shipping a transportation cask

Transportation Route Analysis

- The Transportation Route Analysis section of a de-inventory report contains descriptions of the heavy haul truck routes, rail routes, and barge routes that are applicable at a site
- Transport from the site to the geographic center of the U.S. (GCUS) is assumed for the purposes of analysis
- Potential transload locations are also identified

CRYSTAL RIVER DE-INVENTORY
ROUTE 3

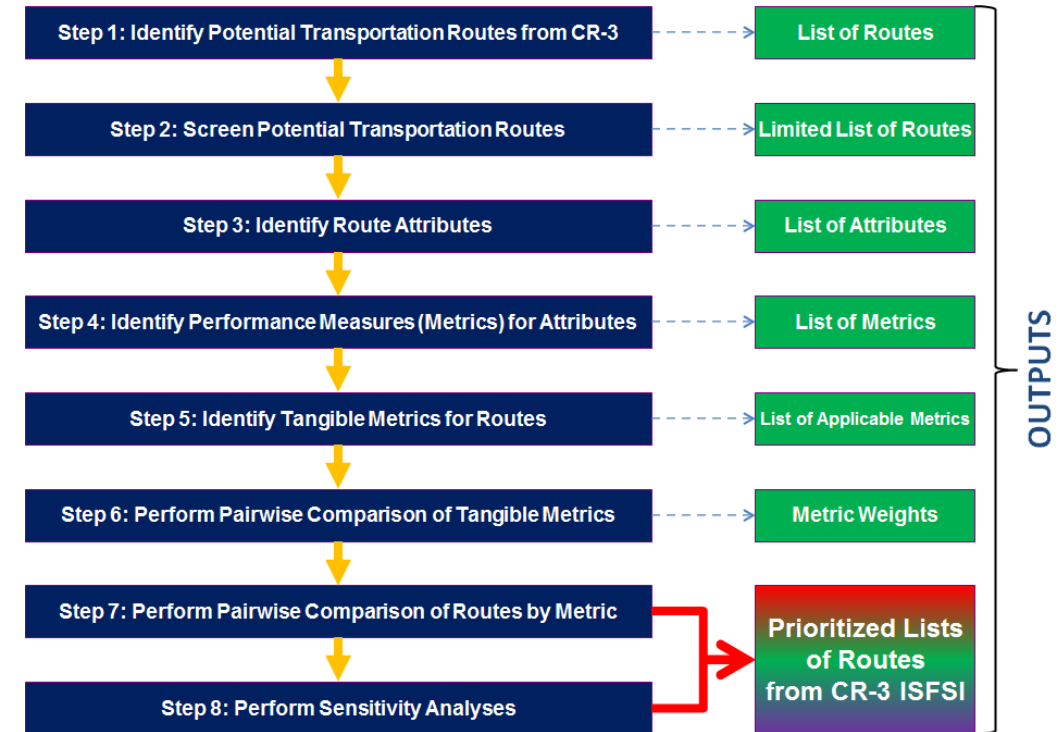


Participating Entities

- This section of a de-inventory report identifies entities that would be involved in transporting SNF and GTCC waste from a site
- Typical entities include Federal Agencies (e.g., U.S. Department of Transportation and U.S. Nuclear Regulatory Commission), local law enforcement agencies (LLEAs), and the U.S. Coast Guard
- Typical entities also include utility/site employees, subcontractors (crane suppliers, riggers, etc.), transportation cask suppliers, security personnel, communications personnel, and transportation emergency responders
- State officials also include, e.g., the Governor's Designee for Advance Notification of SNF Shipments, and State Department of Transportation and Emergency Management
- Railroad transportation contacts, barge operators, and heavy haul service providers also included

Multi-Attribute Utility Analysis (MUA)

- Often, there are several transportation modes and there may be several transportation routes available at a site
- Routes and modes can have both positive and negative aspects
 - Shorter length or fewer crane lifts might be desirable, higher costs might be undesirable
- The MUA provides a structured way to compare these modes and routes by identifying route attributes and associated metrics, performing a pairwise comparison of the metrics, and performing a pairwise comparison of the routes using the metrics
 - The pairwise comparison of the metrics provides a relative ranking of the metrics
 - The pairwise comparison of the routes provides a relative ranking of the routes
- Sensitivity analyses are also performed



MUA (continued)

- Attributes are associated with cost, environmental impact, institutional considerations, permitting, resource requirements, safety, schedule, security vulnerability, and waste generation
- There are over 30 metrics evaluated. Some specific metrics include
 - On-site rental equipment costs
 - Infrastructure improvement costs
 - Transport costs
 - Route characteristics (e.g., terrain, grade, tunnels, etc.)
 - Number of Tribal lands crossed
 - Number of permits
 - Availability of specialty equipment (e.g., transfer cask)
 - Population along the route
 - Number of crane lifts
 - Transit duration
 - Ease of access to transload location
 - Number of police stations along route
 - Amount of radioactive and non-radioactive produced

Concept of Operations

- The Concept of Operations section describes what activities are required to remove SNF and GTCC waste from a site
- Typically the activities are divided into groups:
 - Mobilization
 - Operational readiness
 - Site operations
 - Transport operations
 - Demobilization
- The section will also include information on resource requirements and staffing, lists of ancillary equipment, sequence of operations/schedule, ALARA planning, and quality assurance requirements

Budget and Spending Plan

- The Budget and Spending Plan section of the report contains the overall cost and schedule estimate for removing SNF and GTCC waste from a site
- The following items are not included in the costs
 - Costs of transportation casks, impact limiters, transportation cask ancillary equipment, rail rolling stock
- The following items are included in the costs
 - Fees and permits, campaign operation management, equipment for loading operations, in-transit security, on-site operations
- Transportation cask shipping costs are included but only to where a short line meets the Class I railroad
 - For estimating the overall schedule, transport to the GCUS is assumed
- Additional costs to support de-inventory activities are also discussed – transportation costs from Class I railroad to GCUS, emergency response center operational costs, railcar maintenance costs, cask maintenance costs

Security Plan and Procedures

- The Security Plan and Procedures section discusses strategies and procedures to ensure the safety and the security of the material, employees, and the public during loading, transloading activities, and movement associated with the transportation of the SNF and GTCC waste from a site to the GCUS
- Provisions for heavy haul truck, railroad, and barge security is discussed
- Section also discusses the development of various security and communication plans and protocols

Emergency Response Plan and Preparedness

- The Emergency Response Plan and Preparedness section provides general guidance for an emergency response plan and contains site-specific considerations to be considered in the development of a plan

Recommended Next Steps

- The Recommended Next Steps section provides recommendations to support the future de-inventorying of a site
- These recommendations typically are concentrated in the areas of issues associated with the SNF inventory and the need for transportation CoC modifications, onsite infrastructure and equipment needs, and near-site transportation infrastructure
- Because each site is unique, the recommended next steps will be site-specific
 - Removing SNF from some sites is likely to be more logistically simple than from other sites
 - For example, a site that requires a heavy haul truck to rail transload will be different than a site with direct rail access which will be different than a site where barge transport is used
 - If a site has SNF stored in non-transportable canisters, then the challenges are likely to be more significant than a site where no or minor transportation CoC modifications are required

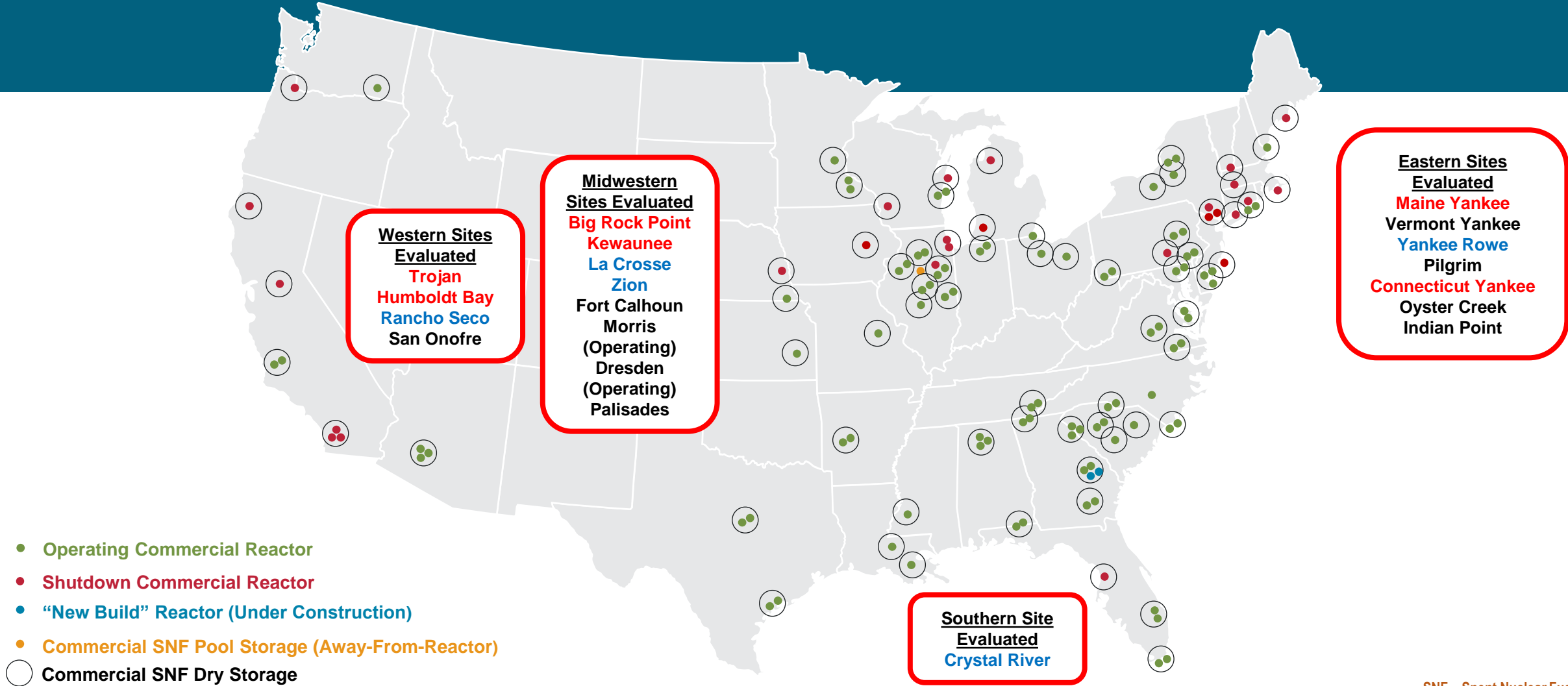
Plans for New Reports (FY2023)

- Five close to completion reports are expected to be released in the near future
- Two additional reports will be started in 2023
 - San Onofre and Vermont Yankee
- Other site specific de-inventory reports will be added as funding is available

Scope and Limitations of these Reports

- Contractor Team
 - AREVA Federal Services (now Orano Federal Services)
 - Teamed with MHF
 - Teamed with NAC for Connecticut Yankee, Maine Yankee, and Kewaunee
- Ground rules for reports
 - AREVA did not talk with nuclear power plant site personnel, State or Tribal stakeholders, or rail carriers
 - AREVA used information provided in DOE materials (*Nuclear Power Plant Site Infrastructure Evaluations*, etc.)
 - AREVA relied on staff/corporate experience
- These reports only focus on technical and logistical considerations

Locations of Commercial SNF



SNF – Spent Nuclear Fuel
 Updated October 2022

Note: Symbols do not reflect precise locations

Connecticut Yankee (CY) Background

- Located on the eastern shore of the Connecticut River near Haddam Neck
 - 25 miles southeast of Hartford
- Site inventory includes 43 casks
 - NAC-MPC storage systems
 - 40 SNF
 - 3 GTCC



Photo courtesy of Connecticut Yankee



CY operations estimated to take ~60 weeks, cost \$17M

Likely transport package: NAC-STC

- ~255,000 lbs. loaded
- maximum diameter of 128"

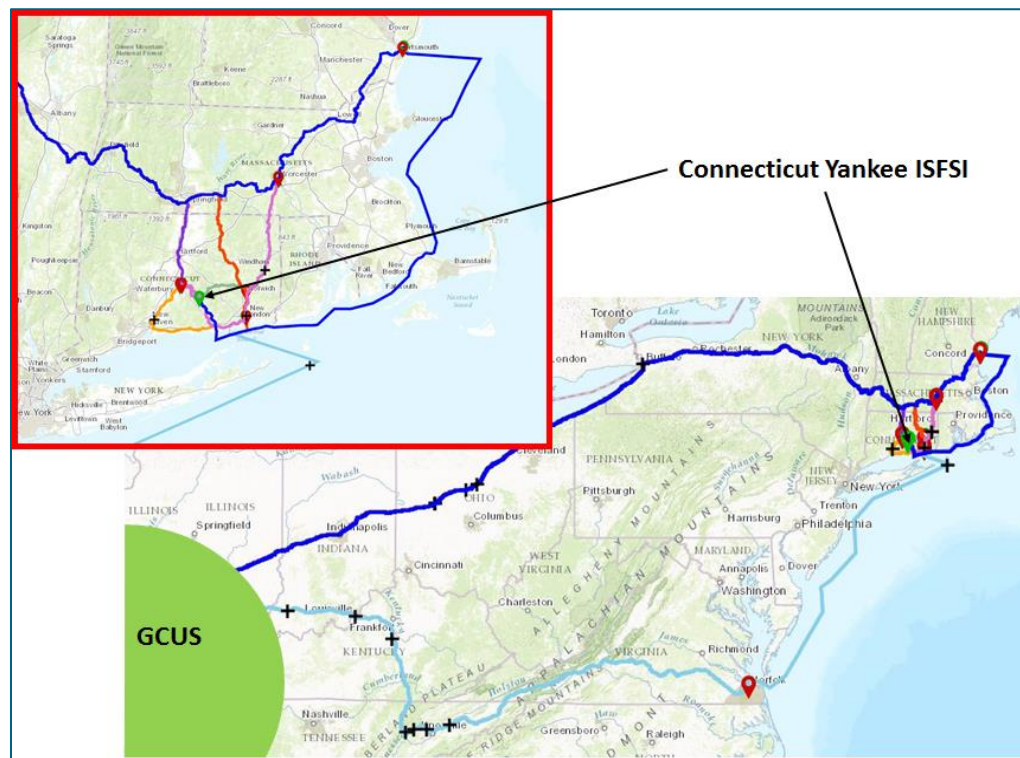
Contractor's recommended route/mode:

- Heavy-haul truck 13 miles to rail in Portland, CT, local rail to Worcester, MA, CSXT to destination/interchange

9 mini-campaigns of 4-5 casks each

~26 days for 5 casks to get from ISFSI to rail

Round-trip takes ~6 weeks



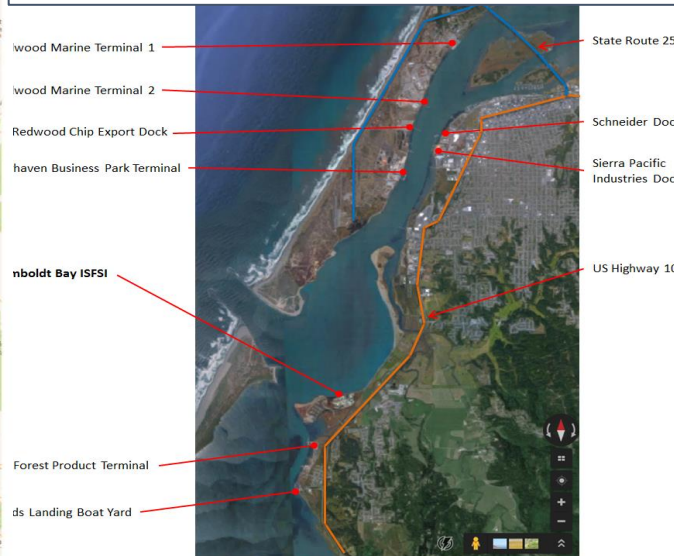
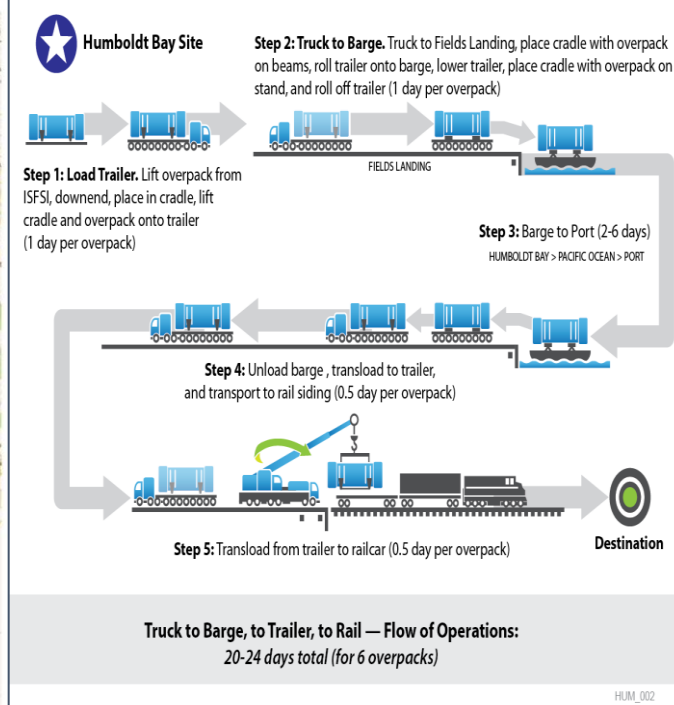
Example routes are provided for illustrative purposes only and do not reflect any routing decisions by DOE



Humboldt Bay (HB) Background

- Located on the shore of Humboldt Bay, near Eureka, California
 - ~260 miles north of San Francisco, CA
- Site inventory includes 6 casks
 - HI-STAR HB storage systems
 - 5 SNF
 - 1 GTCC





HB operations estimated to take ~5 weeks, cost ~\$2.7M

Likely transport package: HI-STAR HB

~187,000 lbs loaded
maximum diameter of 128"

Contractor's recommended route/mode:

Heavy-haul truck 2 miles to Fields Landing, barge to Concord, CA, UP or BNSF rail to destination/interchange

1 campaign of 6 casks
Transportation takes ~20-24 days

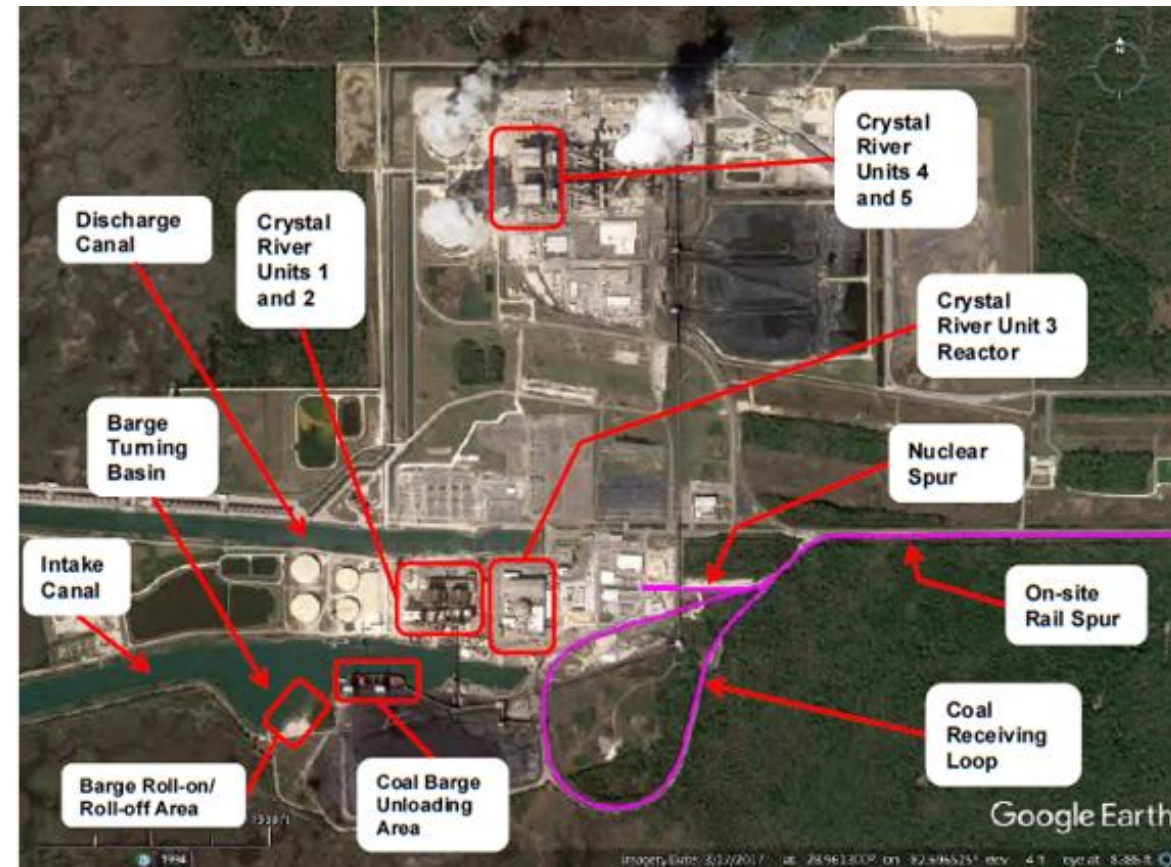
Example routes are provided for illustrative purposes only and do not reflect any routing decisions by DOE

Crystal River Background

- Located on the Gulf Coast, 70 miles north of Tampa
- Site inventory includes 44 casks
 - Standard NUHOMS dry storage systems
 - 39 SNF
 - 5 GTCC (estimated)

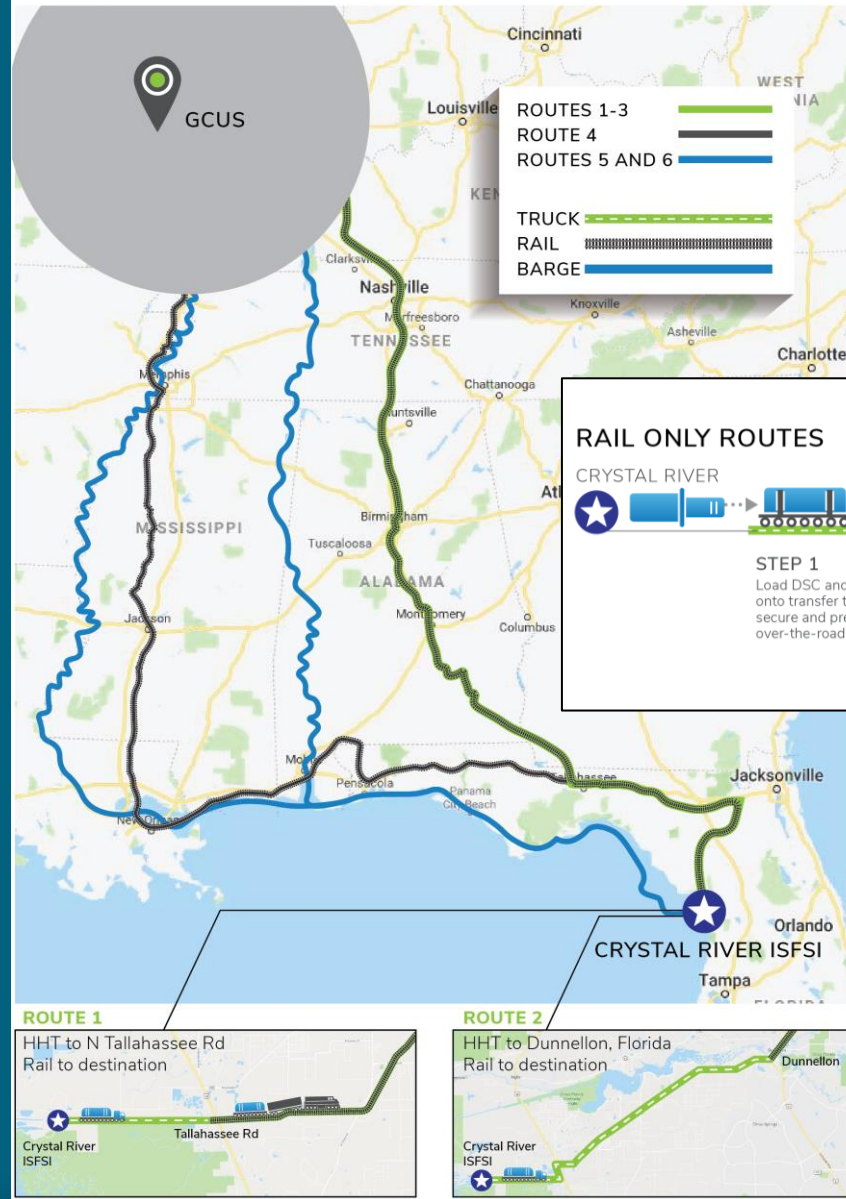


Photo courtesy of Crystal River

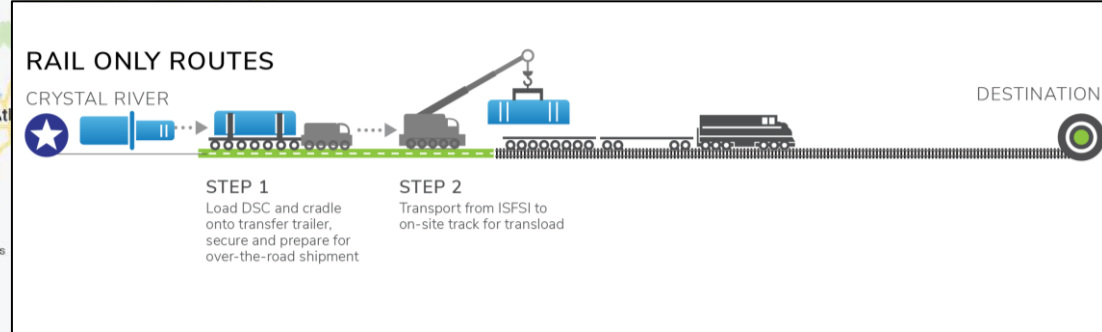


Crystal River operations estimated to take ~39 weeks , cost \$14.3M

- **Likely transport package: MP197HB**
 - ~304,000 lbs. loaded
 - maximum diameter of 126"
- Contractor's recommended route/mode:
 - Load onsite at Crystal River, local rail (Florida Northern Railroad) to Newberry, FL, CSXT to destination/interchange
- **9 mini-campaigns of 5 casks each**
- **Round-trip takes from ISFSI to GCUS~24 days**



Example routes are provided for illustrative purposes only and do not reflect any routing decisions by DOE



Technical Issues to be Addressed

- Each report includes a section on “Recommended Next Steps”
- Based on data from DOE Nuclear Power Plant Site Evaluation Report, Orano’s, MHF’s, and NAC’s experience, etc.
 - NAC and ORANO experience at sites that use NAC and ORANO storage systems
 - Additional data obtained from sites as requested by Orano
 - *Nuclear Power Plant Infrastructure Evaluations for Removal of Spent Nuclear Fuel* leveraged earlier work of DOE’s former Office of Civilian Radioactive Waste Management in Facility Interface Capability Assessment (FICA) Reports, Near-Site Transportation Infrastructure (NSTI) Reports, Services Planning Documents (SPDs), and Facility Interface Data Sheets (FIDS)

Contractor's recommended next steps applicable to many sites

- Verify dry storage canister contents allowed by transportation Certificate of Compliance (CoC)
 - Monitor status of 5-year renewal intervals
 - Verify any storage canister changes made through the 10 CFR 72.48 process have propagated to the transportation CoC
- Establish detailed equipment needs for transportation
 - Transportation casks, transfer casks, impact limiters, spacers, cradles, personnel barriers, etc.
 - Additional equipment as needed - mobile cranes, rigging equipment, etc.



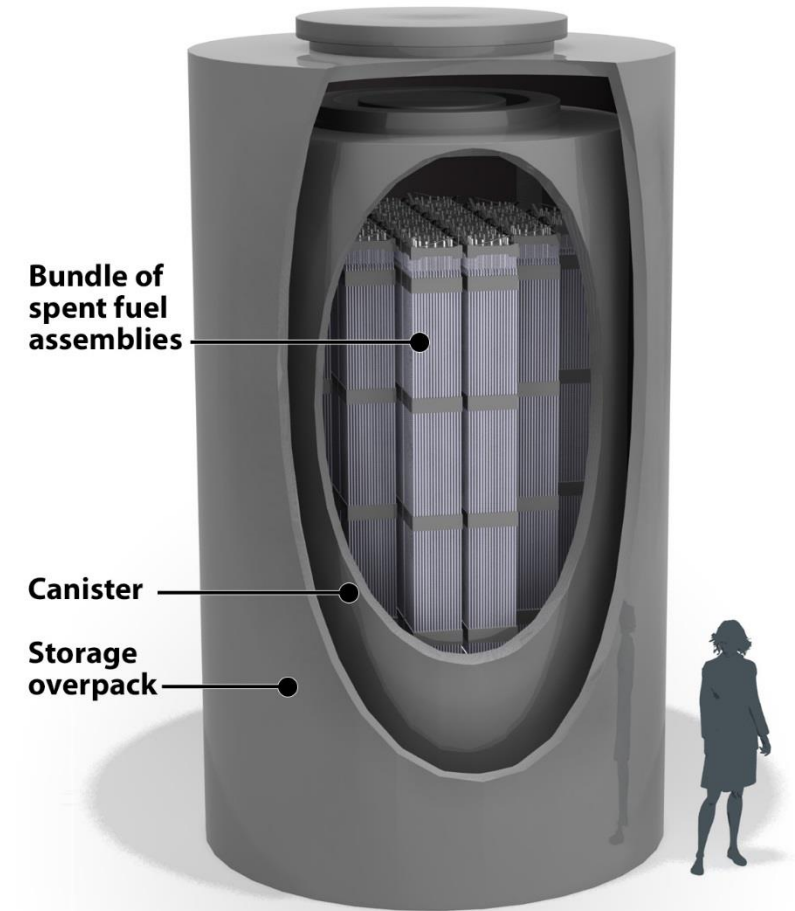
Contractor's recommended next steps applicable to many sites continued

- Establish electrical power requirements for performing operations and verify availability at the site
- Establish/re-establish on-site and near-site infrastructure
- Conduct route clearances and permitting for heavy-haul routes
 - If barge used, dredging may be required, which may require permits



Unique Challenges

- Big Rock Point:
 - Update TS125 transportation CoC to allow for fabrication (-85 to -96) and to allow for GTCC waste, **OR**
 - Modify transportation CoC for another transportation cask to allow transport of W74 canisters



ORNL 2015-G00467/aas

Unique Challenges continued

- Humboldt Bay:

- Identified that revision of transportation CoC for HI-STAR HB would be required to allow transport of SNF with lower enrichments and GTCC waste
 - Revision completed
- Potential issues associated with fuel channel thickness and lid bolts with reduced effective thread length
- Clarification on need to perform vacuum drying, helium backfill, or leak-testing of GTCC waste containing cask prior to transportation
- Using existing vertical cask transporter (shared with Diablo Canyon)



Photo from Holtec International

How will the information in a site-specific de-inventory report be used for future transportation planning?

- **Information in the de-inventory reports is being used to identify common challenges across sites, and to identify unique challenges at individual sites**
 - Data needs from de-inventory reports are being fed back to Nuclear Power Plant Site Evaluations
- **Information can inform future transportation planning**
 - Reports have identified SNF issues that in some cases have already been addressed by transportation cask vendors
 - Multi-Attribute Utility Analysis (MUA) provides a structured method for evaluating and comparing potential transload locations
 - Data contained in reports are being used in system modeling

Lessons Learned

- **What are the key lessons learned from preparing the site-specific de-inventory reports that can benefit operators of waste storage sites?**
 - Reports have highlighted the importance of preserving transportation infrastructure to enable removal of SNF
 - Transportation CoC changes may be required to transport SNF from some sites
 - In some cases, these transportation CoC changes will be driven by the 72.48 process, and will need to be considered in SNF storage at Federal or private Interim Storage Sites
 - Virtual meetings with sites now being used to verify and clarify information
- **Have these lessons learned been shared with the nuclear utilities?**
 - First 6 reports have been widely shared with nuclear utilities and transportation cask vendors, typically through participating in conferences
 - Five upcoming reports will be posted publicly

Summary

- Initial Site-Specific De-Inventory Reports build on nuclear power plant site evaluation work DOE has conducted
- Provide proposed next steps, activities, interfaces, schedules, and estimated costs for removing fuel from the sites
- Some sites have unique challenges
- No “showstopper” technical issues identified among the six sites studied



Questions?

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