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Integrated Waste Management
Office of Spent Fuel and Waste Disposition
Nuclear Energy

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

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Disclaimer

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.

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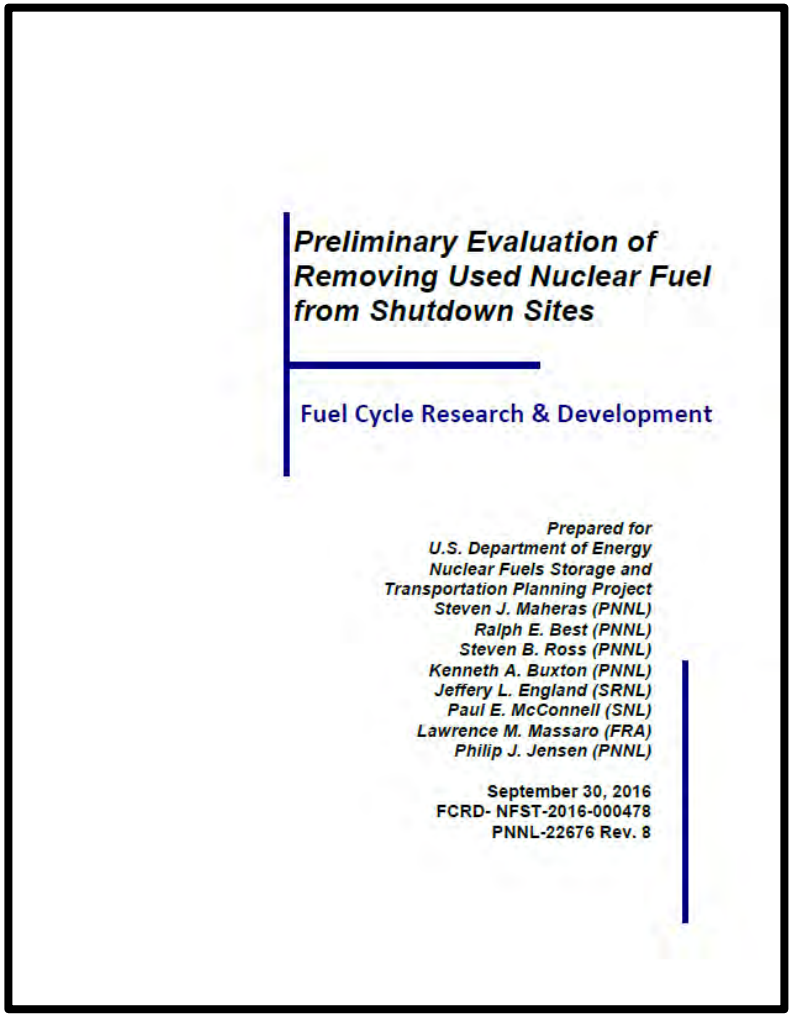
Shutdown Sites Evaluation

- **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**



Preliminary Evaluation of Removing Used Nuclear Fuel from Shutdown Sites

Fuel Cycle Research & Development

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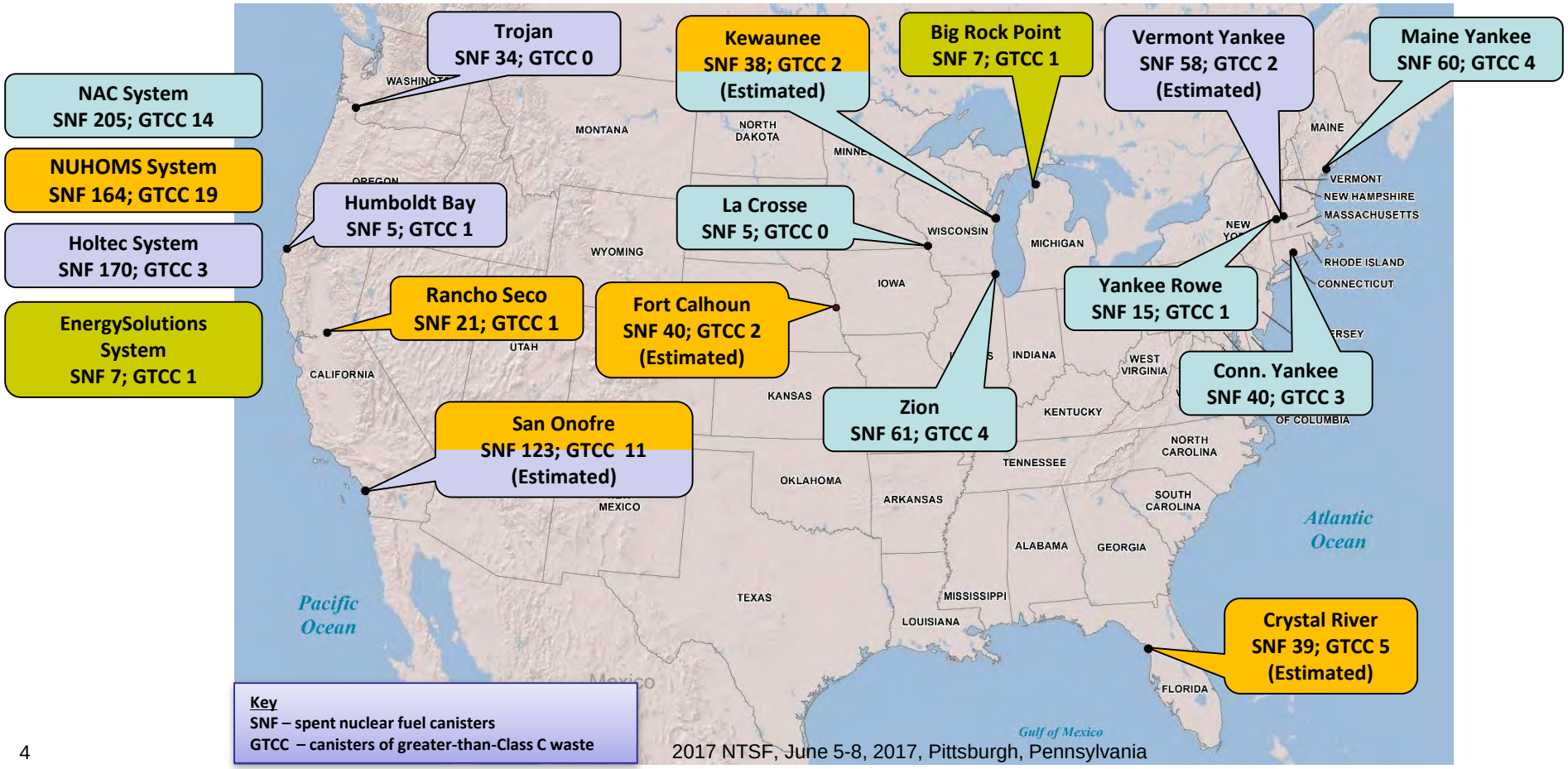
Locations of Shutdown Nuclear Power Plant Sites

- 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



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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-STORM UMAX Underground Storage Modules

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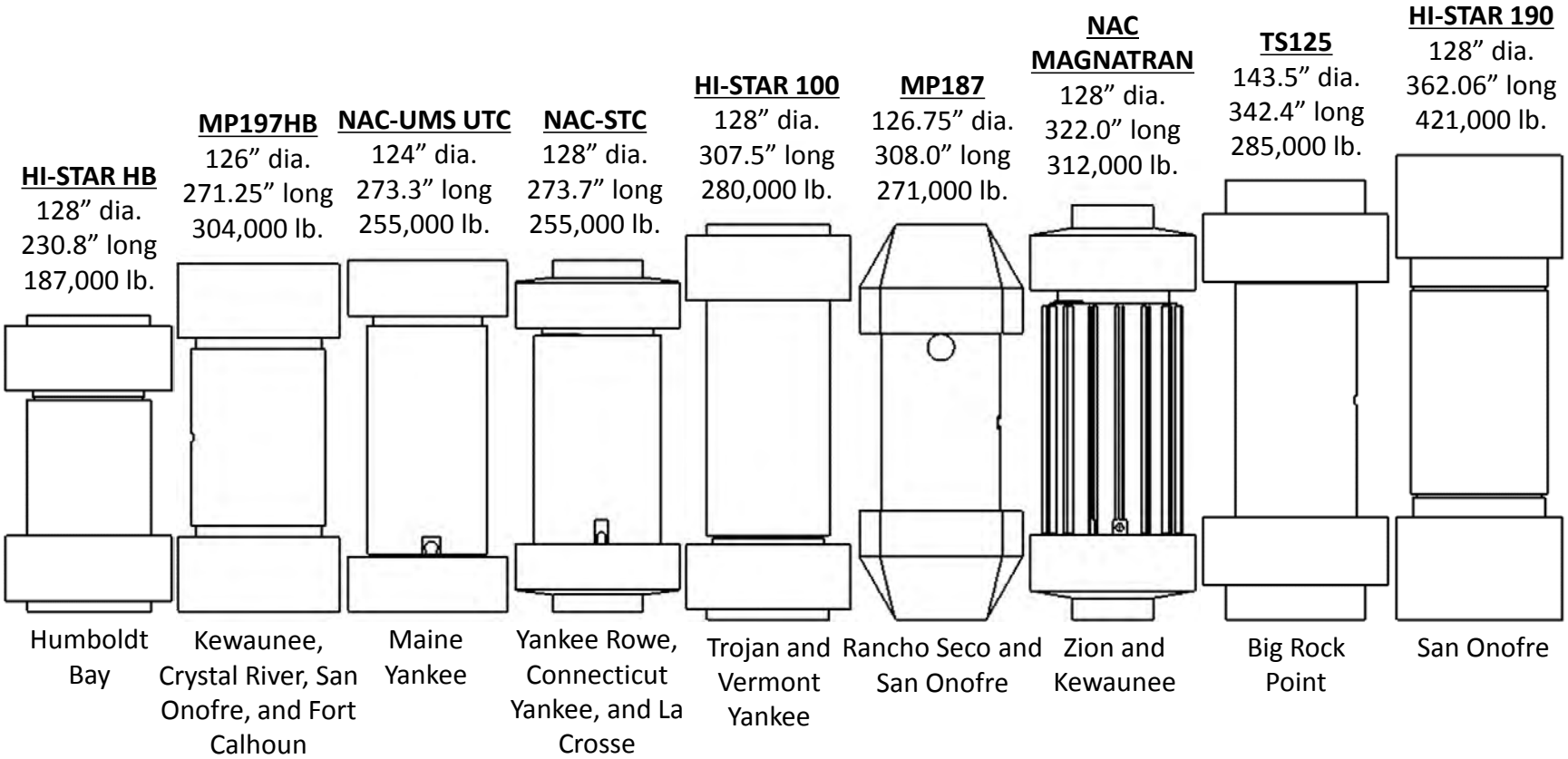
Transportation Cask Models That Would Be Used to Ship SNF and GTCC Waste from Shutdown Sites Have a Wide Range of Weights and Dimensions



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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**

MP187 Transportation Cask Heavy Haul to Rancho Seco

Photo courtesy of Rancho Seco

Big Rock Point Reactor Pressure Vessel Heavy Haul

Photo courtesy of Barnhart Crane & Rigging

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Onsite 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**

Photo courtesy of La Crosse

Onsite Rail Spur at La Crosse

Photo courtesy of Trojan

Trojan Transfer Station

Photo courtesy of Big Rock Point

Big Rock Point Horizontal Transfer System

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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

Low Overhead Bridge Near Big Rock Point

Railroad Grade Crossing at East Portal of Hoosac Tunnel Near Yankee Rowe

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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

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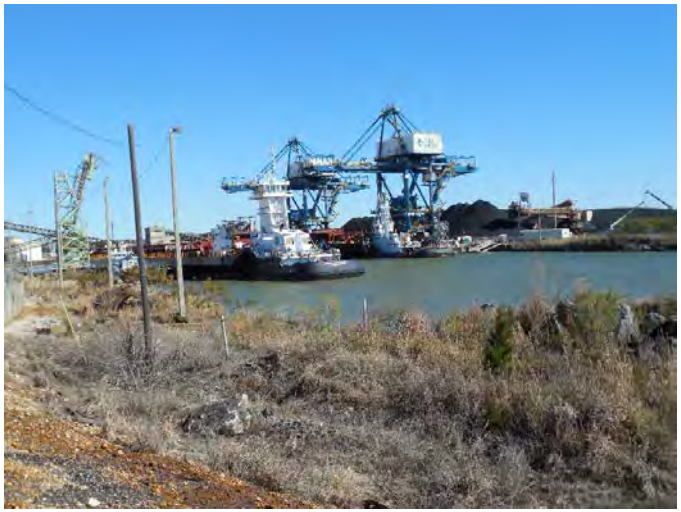
Potential Barge Locations

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



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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

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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

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Fort Calhoun SNF Storage

- **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

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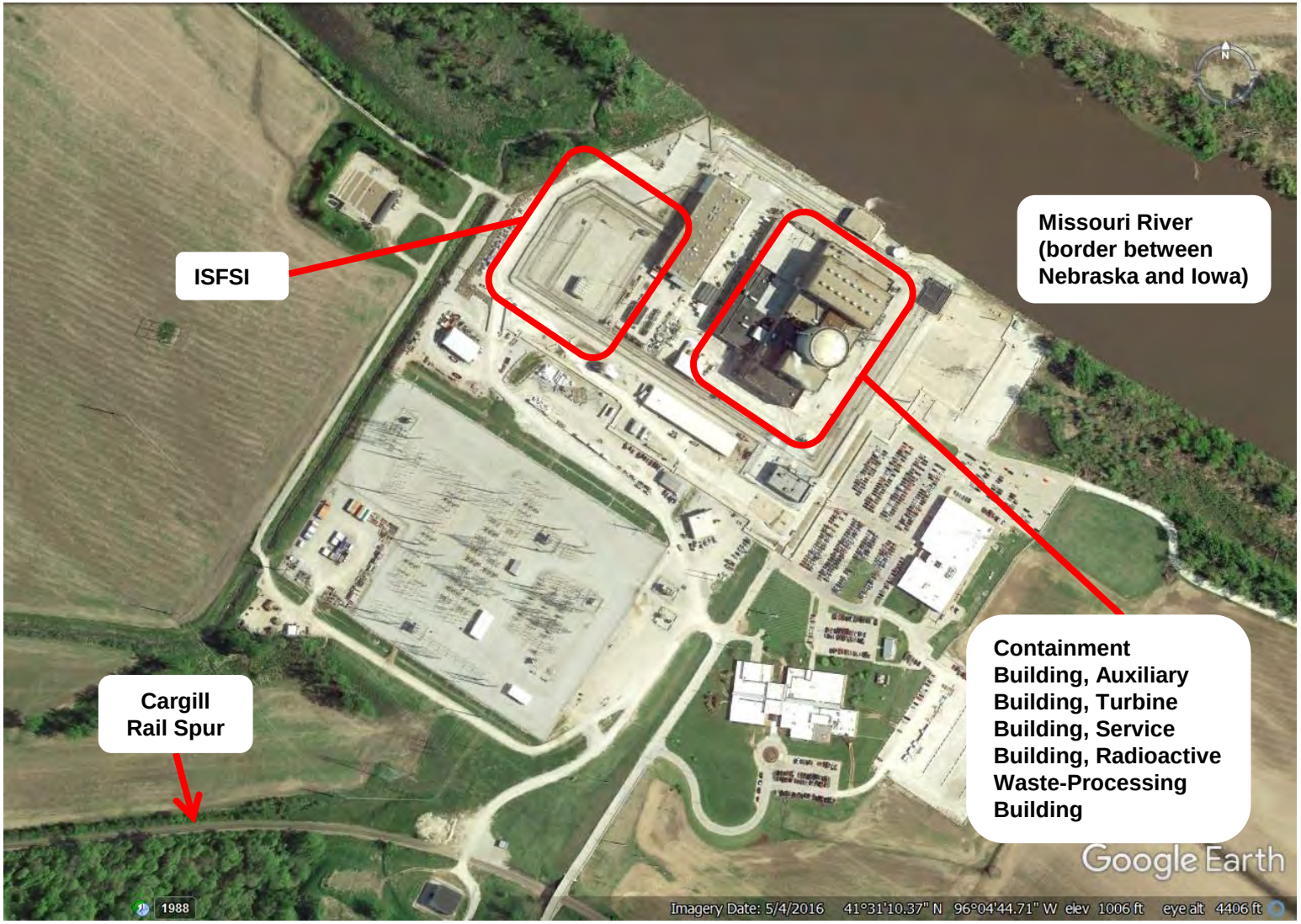
Fort Calhoun Site Layout



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Fort Calhoun ISFSI

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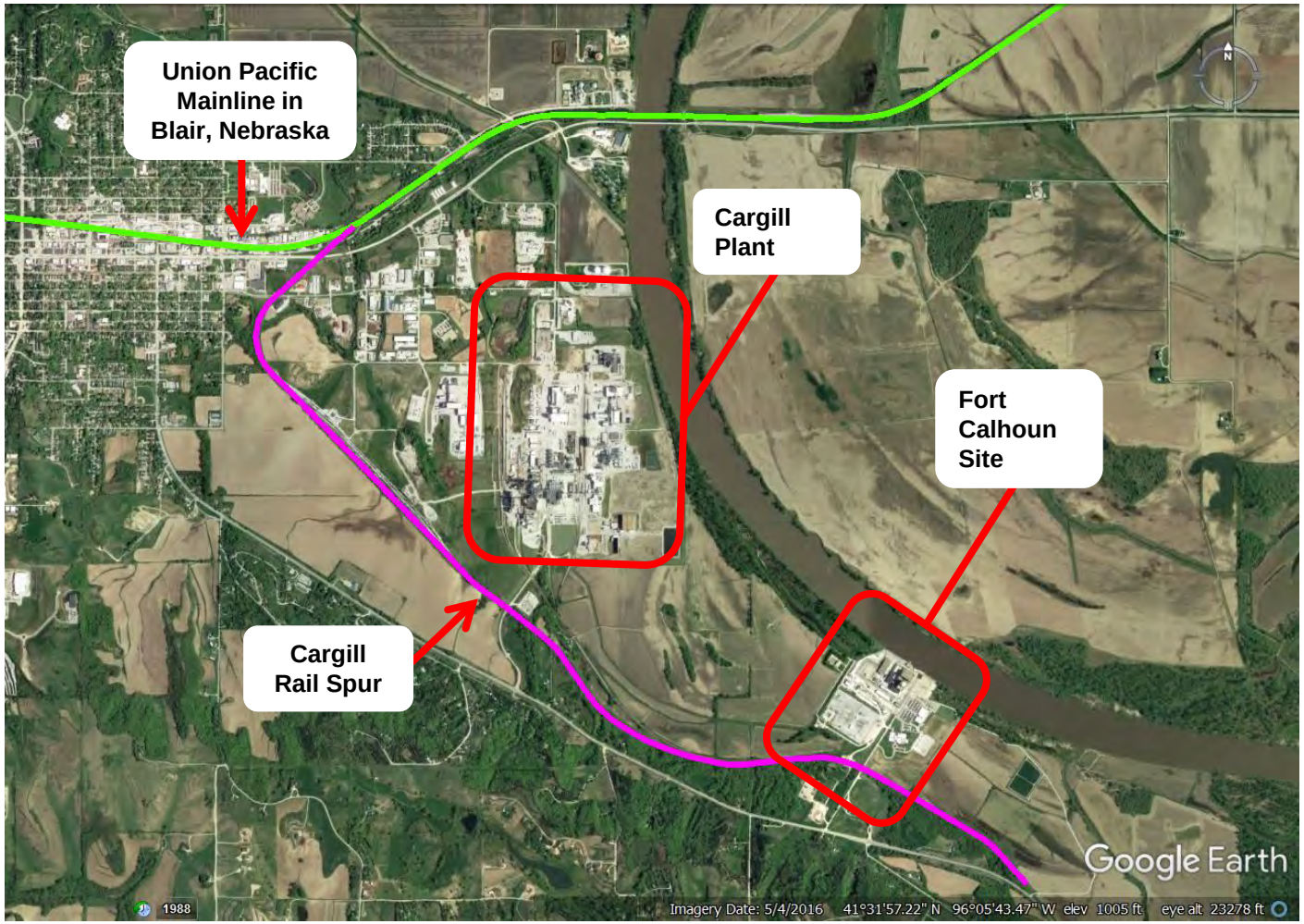
Fort Calhoun Served by Cargill Rail Spur and Union Pacific Railroad



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Track at Junction of Cargill Spur and Union Pacific Railroad

Looking South

Looking North

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Track at Entrance to Cargill Spur

Looking South

Looking North

Derailer at Entrance to Spur

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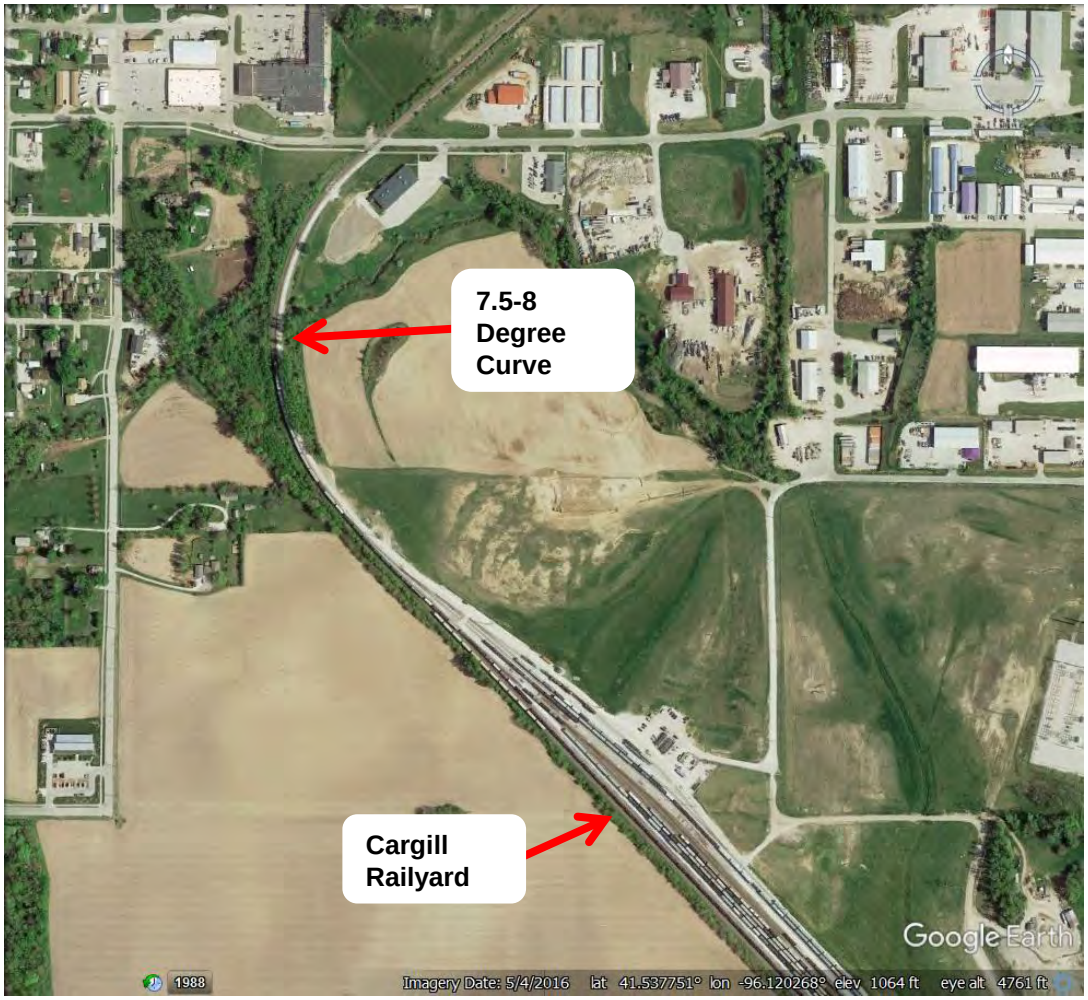
Cargill Railyard and 7.5-8 Degree Curve



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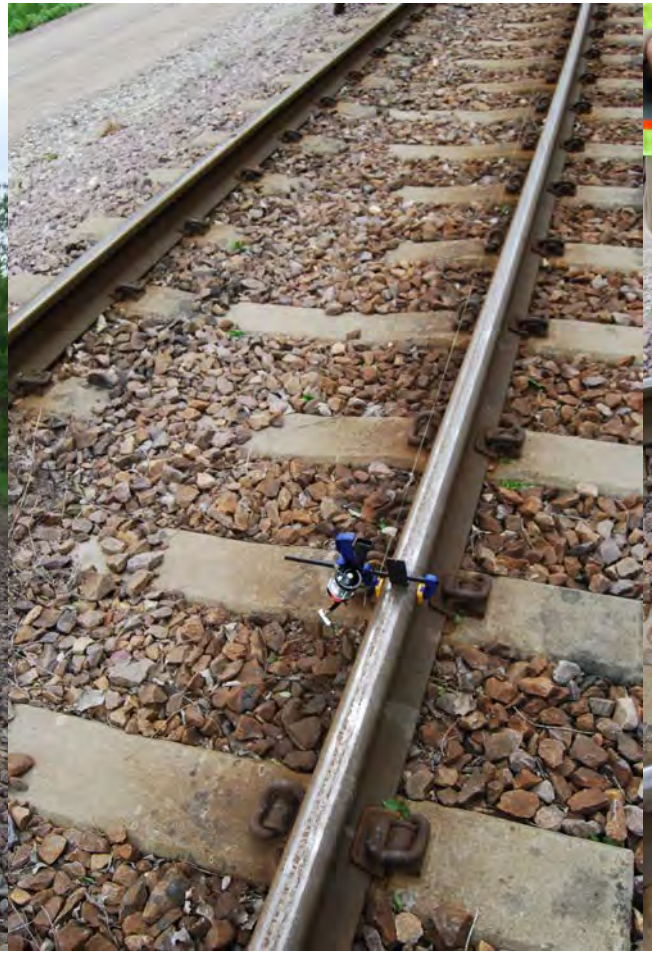
Measuring Curvature of Track



Derailer and Greaser on Cargill Spur

Derailer and Greaser

Closeup of Greaser Activators

Cargill Rail Spur Onsite at Fort Calhoun

Cargill Rail Spur
Looking Southeast

Cargill Rail Spur
Looking Northwest

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Cargill Rail Spur – 136 lb. rail, Concrete Ties, Pandrol Clips

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Cargill Spur Still Active Down to Fort Calhoun Site

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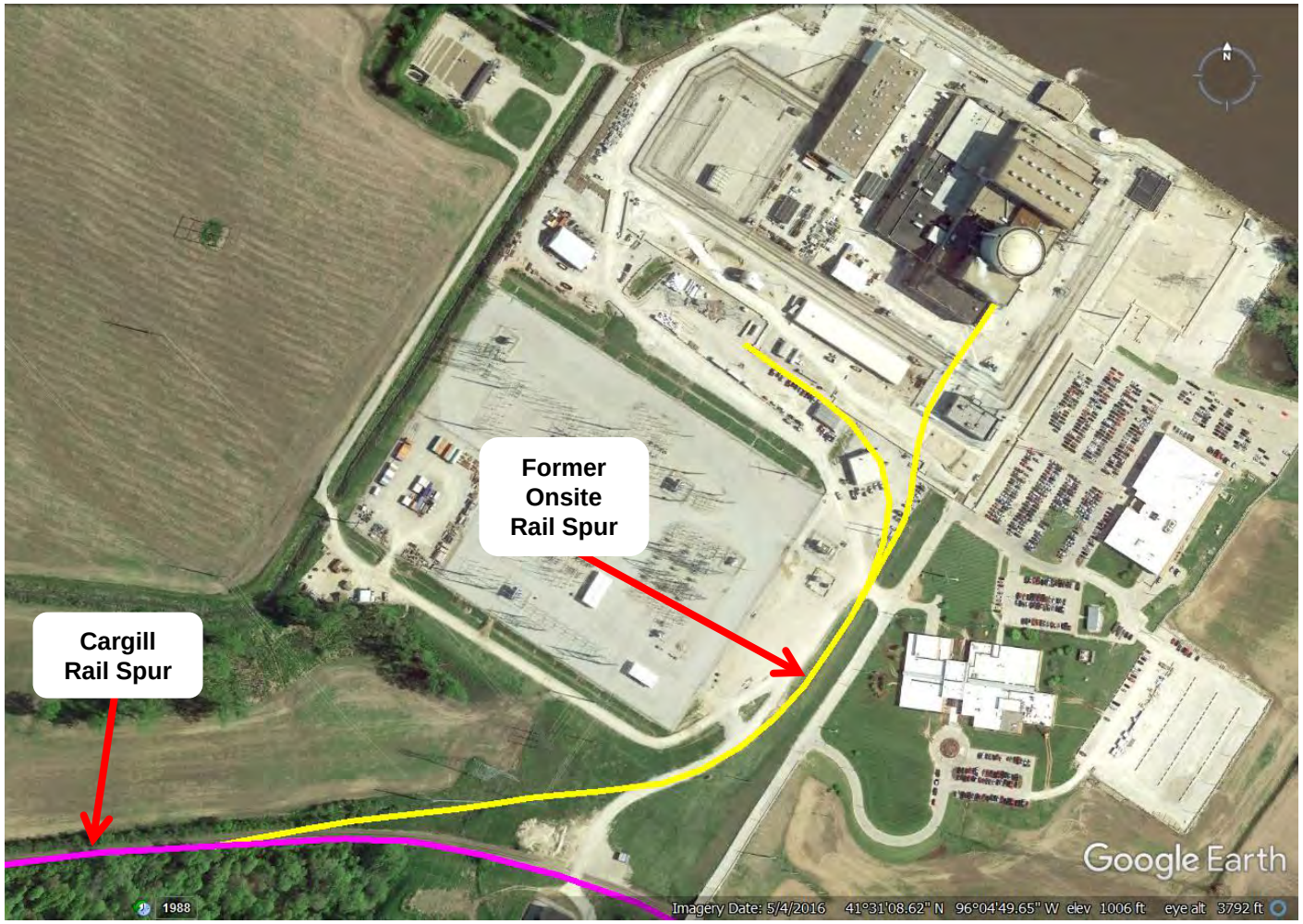
Rail Spur Used to Run Onsite



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Fort Calhoun Barge Receiving Area

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Site Transportation Experience – Rail

- **Fort Calhoun has received horizontal storage modules (HSMs) by rail on Cargill Spur**
- **HSMs transloaded onsite and moved down haul road to ISFSI**

Photos courtesy of Fort Calhoun

HSM Transload and Transport to ISFSI Pad

Photos courtesy of Fort Calhoun

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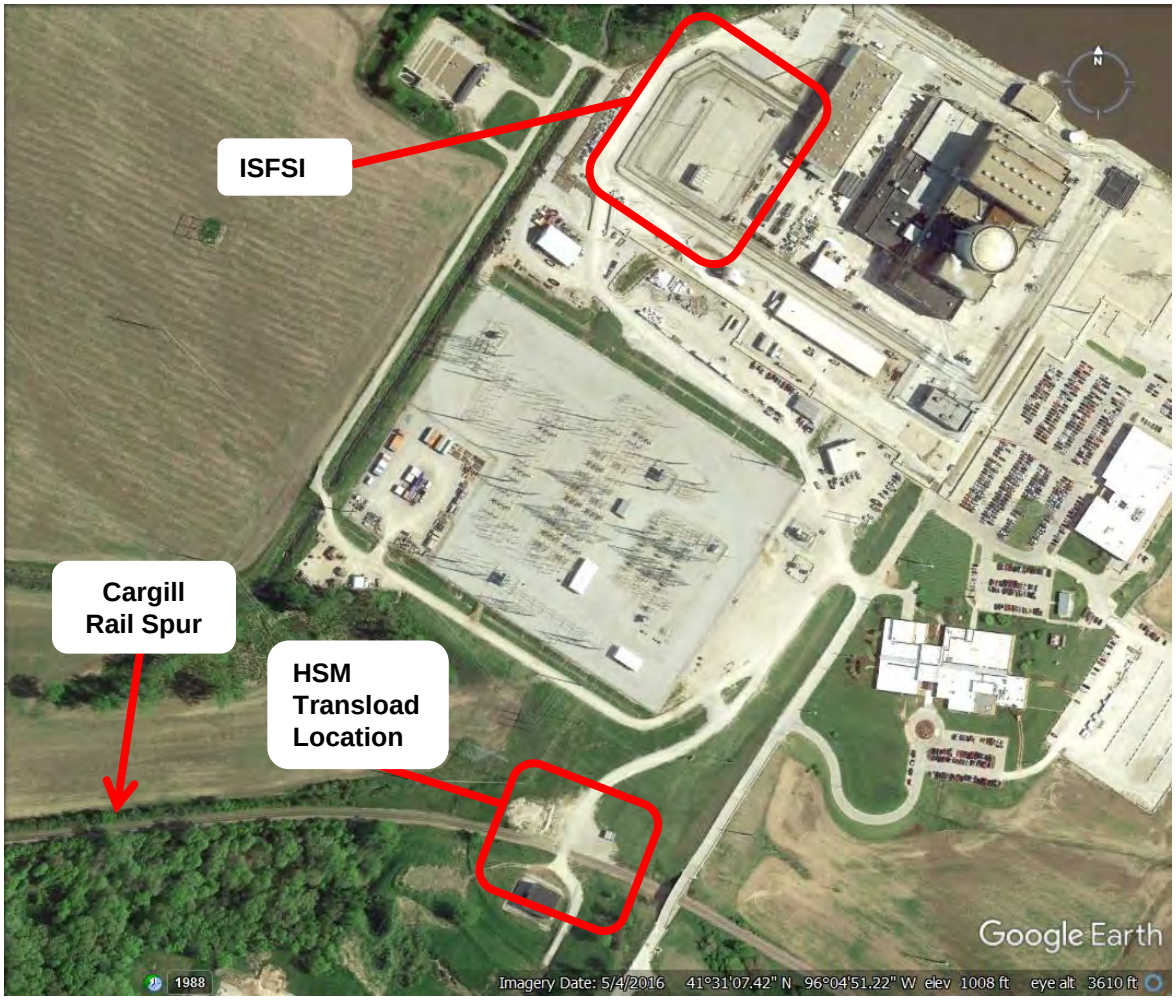
Installation of HSMs on ISFSI Pad

Photos courtesy of Fort Calhoun

Cargill Rail Spur, HSM Transload Location, and ISFSI



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Current Condition of Transload Location and Haul Road

Site Transportation Experience – Barge

- 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

Photo courtesy of Fort Calhoun

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Aerial View of Barge Area

Barge Transport on Missouri River and Arrival

Photos courtesy of Fort Calhoun

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Barge Arrival and Offloading

Photos courtesy of Fort Calhoun

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Reactor Vessel and Steam Generators Shipped by Barge During Construction

Photos courtesy of Fort Calhoun

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Summary of Transportation Mode Options Identified for Shutdown Sites

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

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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