Purpose of a Tabletop Exercise

According to NUREG – 1514:
A tabletop exercise is a structured discussion, which is based on a scenario or set of conditions for potential situations, among stakeholders in a low-stress environment. **Tabletops are not intended to solve all problems or make policy; they may simply identify areas which need resolution.** They are a teaching/training aid as well as an opportunity to talk through plans and procedures or discuss new systems. Their objective is both educational and developmental in that disconnects, perceptions, and procedures can be identified easily and then corrected.
Purpose of Today’s Exercise

• Structured discussion will help us all to identify issues that need resolution.

• Talking through plans and procedures can be a powerful teaching/training aid. Disconnects, perceptions, and procedures can be identified and adjusted, if needed.

• Sharing institutional knowledge can help everyone understand the history and evolution of transportation planning.

• MRMTC’s mission is to identify, prioritize, and work with DOE to resolve regional issues related to transport of spent nuclear fuel.
Important Disclaimer

• Today's discussion is for learning purposes only.
• Although the discussion draws from real, live documents, we are not talking about a real, live shipping campaign or even a future shipping campaign that may be real and/or live.
• Nothing in today's discussion is intended to influence DOE policies or procedures, nor is anything intended to imply that DOE had, has, or will have any policies or procedures that bear any resemblance to the ones we're using for the purposes of this learning experience for the Midwestern states and other participants.
Important Disclaimer

• This material is based upon work supported by the Department of Energy under Award Numbers DE-NE0008604, DE-EM0004869, and DE-EM0005168.

• This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
Ground Rules

• Be respectful
  • Turn off or silence cell phones and laptops.
  • When you’re in the room, be in the room.

• Be engaged
  • Participants may ask a question or make a comment by turning their name tent onto the short side and waiting to be called on.
  • Please ask your question or make your comment into a wireless mic so Zoom attendees can hear you.

• Be brief
  • With only 4 hours to complete the tabletop, we all need to get to the point and stay on point.
Important Background Information

• Midwestern Radioactive Materials Transportation Committee
The Unpronounceable MRMTC

• Organized in 1989
• 12 states, 12 gubernatorial appointees, up to 12 state legislators
• Mission: to identify, prioritize, and work with the U.S. Department of Energy to resolve regional issues related to the department's transport of radioactive waste and materials, including spent nuclear fuel
• One of the State Regional Groups (SRGs)
Important Background Information

- Midwestern Radioactive Materials Transportation Committee
- 10 Things to Know about Nuclear Waste
10 Things to Know

1. Nuclear Waste Policy Act (NWPA) made the federal government responsible for spent nuclear fuel (SNF) disposal
2. Yucca Mountain in Nevada was chosen from among 3 sites
3. 1998 was the original date (more than 23 years ago!)
4. Ratepayers, taxpayers – we all pay!
5. Project was terminated in 2010 – no repository was built
6. The State of Nevada was, is, and will be opposed
7. Current balance of Nuclear Waste Fund is $42.655 billion and there is currently over 34 thousand metric tons of initial uranium in the Midwest
 Licensed and Operating Independent Spent Fuel Storage Installations by State

October 2021

- ISFSI site-specific license (16)
- ISFSI general license (65)

35 States have at least one ISFSI
Cumulative commercial spent nuclear fuel in storage by state (1968–2017)

First:
Illinois
10,291 metric tons

Second:
Pennsylvania
7,302 metric tons

Metric tons spent uranium fuel:
- 5,001 or more
- 4,001–5,000
- 3,001–4,000
- 2,001–3,000
- 1,001–2,000
- 1–1,000
- No stored fuel

Midwest
10 Things to Know

8. Storage is temporary…but it doesn’t seem that way to communities hosting shutdown sites

9. Heavy weight of spent fuel storage casks ➔ transport by train or barge

10. Two private companies are seeking licensing to build independent spent fuel storage installations (ISFSI)
Objectives

• States
  • Identify ability to integrate into a DOE SNF shipment
  • Identify strengths and areas for improvement in transportation programs
  • Demonstrate ability to perform state-specific activities

• Transportation Planning
  • Identify strengths and weaknesses of a collaborative SNF shipment planning process
  • Understand what the Standard Contract is, who sets the routes, what activities are happening right now, and how they will inform eventual shipments
Tabletop Overview

• Standard Contract Explanation and Discussion – 45 minutes
  • Cyrus Nezhad (DOE Office of General Counsel)
• Shutdown and Operating Site Evaluations – 45 minutes
  • Steve Maheras (Pacific Northwest National Laboratory (PNNL))
• Carrier Route Selection Process and the Rail Corridor Risk Management System (RCRMS) – 45 minutes
  • Patrick Brady (BNSF Railway)
• How DOE Prepares for Shipment After Route Selection – 30 minutes
  • DOE Employees
• Transportation Infrastructure Discussion – 30 minutes
  • Matt Feldman (PNNL)
• State Preparation Activities – 30 minutes
  • MRMTC State Members
Tabletop Assumptions

• This is not a tabletop exercise of a particular hypothetical shipment
• There is no particular origin site or destination site
• This tabletop is to help us understand the leadup to eventual SNF shipments
• Learn what DOE is doing to prepare, what the railways will do, and how the states fit into this preparation
• We can build off this exercise and hypothesize particular shipments at future meetings
Tabletop Reference Materials

- [https://online.flippingbook.com/view/473251/](https://online.flippingbook.com/view/473251/)
- Primary reference materials will include:
  - NRC’s “Physical Protection of Shipments of Irradiated Reactor Fuel” (NUREG – 0561)
  - CSG Midwest’s “Planning Guide for Shipments of Radioactive Material through the Midwestern States”
  - DOE’s “Radioactive Materials Transportation Practices Manual” (460.2-1A)
Tabletop Reference Materials

• Other reference materials will include:
  • Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (10 CFR 961)
  • FRA’s Safety Compliance Oversight Plan (1998 version)
  • DOE’s 2005 Dedicated Train Decision and 2004 “mostly rail” Record of Decision
  • Orano’s De-Inventory Report for BRP
  • Principles of Agreement 2015
  • Shutdown Sites Report
  • CSG Midwest’s “NEI TTX Reference Guide for Midwestern States”
Standard Contract Explanation and Discussion
Nuclear Power Plant Site Evaluations
Overview and Status Report

Steven Maheras, PhD
Pacific Northwest National Laboratory

Midwestern Radioactive Materials Transportation Committee Fall Meeting
Transportation Tabletop Workshop
December 1, 2021
Chicago, Illinois
• This is a technical presentation that does not take into account contractual limitations or obligations under the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (Standard Contract) (10 CFR Part 961). For example, under the provisions of the Standard Contract, spent nuclear fuel in multi-assembly canisters is not an acceptable waste form, absent a mutually agreed to contract amendment.

• 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.
The purpose of nuclear power plant (NPP) site evaluations is to:

- Confirm, gather, and identify gaps in information related to the inventory of spent nuclear fuel (SNF) and greater-than-Class C (GTCC) waste at the NPP sites
- Document conditions at the NPP sites at time of evaluation
- Evaluate site transportation experience and near-site transportation infrastructure at the NPP sites

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

Based on the available information, identify options for transporting SNF and GTCC waste from the NPP sites
Locations of Commercial SNF

- Operating Commercial Reactor
- Shutdown Commercial Reactor
- "New Build" Reactor (Under Construction)

- Commercial SNF Pool Storage (Away-From-Reactor)
- Commercial SNF Dry Storage

SNF – Spent Nuclear Fuel
Updated June 2021
Note: Symbols do not reflect precise locations
NPP Site Evaluation Process

- Extensive NPP site research
- Planning with NPP Site
  - List of questions submitted to NPP site about two months before site evaluation
  - Coordinate regarding security access requirements and logistics
- Planning with nearby railroads
  - Federal Railroad Administration (FRA) leads this activity
  - Identify potential transload locations
- Planning with Federal, Tribal, State, and State Regional Group partners
  - US Army Corps of Engineers and US Coast Guard if barging transport mode possible
  - Variety of State agencies will typically participate in a site evaluation
- Planning with community engagement or advisory panels
- Logistics planning
- These activities will typically take 6 months
NPP Site Research

• Documents and Data Bases – Public Documents, DOE Documents, Data Bases, Nuclear Industry Sources
  – Energy Information Administration (EIA) GC-859 Nuclear Fuel Data Survey
    • Detailed characteristics of SNF discharged from commercial NPPs in the United States through 31 December 2017
  – Facility Interface Data Sheets (FIDS), Services Planning Documents (SPDs), Facility Interface Capability Assessment reports (FICAs), and Near-Site Transportation Infrastructure reports (NSTIs)
  – Original Environmental Impact Statements (EISs), License Renewal EISs
  – Post-Shutdown Decommissioning Activities Reports (PSDARs), Decommissioning Cost Estimates (DCEs), and Irradiated Fuel Management Plan (IFMPs)
  – SNF storage cask registration letters

• Independent Spent Fuel Storage Installation (ISFSI) Site Managers
  – Confirmed information obtained from other sources
  – Clarified current conditions at the NPP sites
  – Provided photos and other detailed information

• Heavy Equipment Lifting, Rigging, and Transporting Companies
NPP Site Research (continued)

• NPP Site Evaluations
  – Sixteen in-person NPP site evaluations conducted from August 2012 through November 2019
  – Virtual site evaluation conducted in June 2020
     • Morris ISFSI
  – Confirmed aspects of inventories at the sites, obtained detailed inventory data by canister, and canister load maps
  – Observed transportation infrastructure at and near sites
  – Detailed photos taken at sites
  – Tribal, FRA, State, and State Regional Group (SRG) representatives have participated in 14 site evaluations

• Google Earth
  – Understand layout of NPP sites
  – Used to provide detailed maps of NPP sites and ISFSIs
  – Portray transload locations, and rail and heavy haul routes
NPP Site Inventories

- NPP SNF site inventories based on the GC-859 Nuclear Fuel Data Survey
  - Most recent data through December 31, 2017
  - Number of spent nuclear fuel assemblies
  - Metric tons heavy metal (MTHM)
  - Discharge date, burnup, enrichment of spent nuclear fuel assemblies
  - Many other SNF related parameters

- Type and number of SNF storage systems (vendor and model) used at each site’s ISFSI
  - Canisters containing SNF
  - Canisters containing GTCC waste
  - Loading maps, logs, etc.

- Storage features/conditions
  - Number of damaged fuel assemblies
  - Number of high burnup fuel assemblies
  - Canned/Not canned
• Loading maps show the specific locations of SNF assemblies in canisters
• Used to determine realistic temperatures and dose rates
• Also used to determine when a canister may be shipped
Canister Transportability

- Discharge date, burnup, enrichment, decay heat, and loading map data used to determine when canisters containing SNF may be shipped
Site Conditions

• 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
Near-Site Transportation Infrastructure and Experience

- Evaluate transportation mode options for the NPP sites
- National, Regional, or Short-Line Rail Access
  - Condition and capacity of near-site commercial rail infrastructure
  - Potential transload locations
  - Site experience with rail shipments
- Local Roads and Highways
  - Distance to potential 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/sidings/shorelines
  - Site experience with barge shipments
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**
Google Earth and GIS Database Development

• GIS data on the NPP site is assembled
• Data layers are developed in various areas relevant to transportation planning, including:
  – PropertyBoundariesandOwner-ControlledAreas(e.g., ISFSILocations)
  – HighwayandRailNetworks
  – StrategicRailCorridorNetworks(STRACNET)
  – TransloadLocations
  – NavigableWaterways
  – EnvironmentalJusticePopulationsidentifiedunderExecutiveOrder12898
  – TribalAreas
  – MarineSecurityZones
  – NationalWetlandsInventory
  – NationalRegisterofHistoricPlaces
Google Earth Image Depicting Oyster Creek Site
Google Earth Image Depicting Navigation Channels and Dredging Depths at Oyster Creek
Key Part of NPP Site Evaluations Are Site Visits

- Site visits typically take place over three days
- First day – NPP site
- Second day – near-site transportation infrastructure
  - Rail infrastructure
  - Potential heavy haul truck routes
  - Potential rail and barge transload locations
- Third day – often spent meeting with community engagement or advisory panels
External Engagement During Site Visits

- Tribal and State representatives, SRG representatives, and FRA representatives participate in the entire site visit
  - SRG representatives from the Southern States Energy Board, the Western Interstate Energy Board, the Council of State Governments – Midwest, or the Council of State Governments – Eastern Regional Conference, according to the location of the NPP
  - State representatives typically represent their State department of energy, State department of environmental or natural resources, State Rail Safety Participation Program, State Police, State department of transportation, radiation protection organization, or emergency management organization
Tribal representatives explore issues associated with cultural affiliation and Tribal involvement with past and present site activities.

As the regulator of the U.S. railroads, the FRA representatives bring unique experience to the site visits.
- FRA also coordinates meetings with the railroads that serve the NPP sites.

Meeting with local community engagement or advisory panels.
- Provides an opportunity to inform these panels on DOE activities and the roles and responsibilities of federal agencies during site decommissioning.
Examples of Results

- The following slides provide examples of the types of information collected during site evaluations
Number of SNF Assemblies at each NPP Site
Metric Tons Heavy Metal at each NPP Site
Number of Dry Storage Canisters at each Site
Number of Canisters by Transportation Cask Type
General Types of Storage Systems Deployed at NPP Sites

- Vertical Concrete Casks at Maine Yankee (Wiscasset, Maine)
- Underground Storage Modules at Fort Calhoun (Fort Calhoun, Nebraska)
- HI-STORM UMAX Underground Storage Modules at San Onofre (San Clemente, California)
- Underground Storage Modules at Humboldt Bay (Eureka, California)
Transfer Cask, J-Skid, Gantry Towers, and Horizontal Transfer System at Big Rock Point in Michigan

Transfer Cask and J-Skid

Gantry Towers

Horizontal Transfer System
Barge Slip and Onsite Rail Line at Maine Yankee

Barge Slip

Onsite Rail Line
Transportation Infrastructure Near Zion in Illinois

- Junction of Plant Lead with Union Pacific Railroad with Concrete Ties on Corners
- Switch Derailer on Plant Lead
- Union Pacific Railroad at Plant Lead (Looking North)
- Union Pacific Railroad at Plant Lead Showing Zion Station (Looking South)
Offsite Rail Access at Hoosac Tunnel Near Yankee Rowe in Massachusetts
Low Overhead Clearance Abandoned Railroad Bridge on U.S. 31 Near Big Rock Point in Michigan

Low Overhead Bridge on U.S. 31

Top of Low Overhead Bridge
Bellevue Transload Location Near Kewaunee in Wisconsin

Bellevue Transload Location (Looking North)

Bellevue Transload Location (Looking South)

Bellevue Transload Location at WI-29

Approaching Bellevue Transload Location on WI-29 (Looking West)
Potential Transload Location Near Pilgrim NPP in Massachusetts

Looking East

Looking West
Onsite Rail Spur at Fort Calhoun in Nebraska

Rail Spur Looking Southeast

Rail Spur Looking Northwest
<table>
<thead>
<tr>
<th>Site</th>
<th>Transportation Mode Options</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine Yankee</td>
<td>Direct rail</td>
<td>Barge to rail The on-site rail spur is not currently maintained. The condition of the Central Maine and Quebec Railway would need to be verified.</td>
</tr>
<tr>
<td>Yankee Rowe</td>
<td>Heavy haul truck to rail</td>
<td>– The shortest heavy haul would be 7.5 miles to the east portal of the Hoosac Tunnel.</td>
</tr>
<tr>
<td>Connecticut Yankee</td>
<td>Barge to rail</td>
<td>Heavy haul truck to rail The on-site barge slip has not been used since decommissioning but remains intact. It is uncertain whether the cooling water discharge canal is deep enough to accommodate barges without dredging. The shortest heavy haul would be about 12.5 miles to the end of the Portland rail spur. The rail infrastructure at the end of the Portland rail spur would need to be evaluated.</td>
</tr>
<tr>
<td>Humboldt Bay</td>
<td>Heavy haul truck to rail</td>
<td>Heavy haul truck to barge to rail The heavy haul distance to a rail spur or siding would be in the range of 160 to 280 miles. The condition of the Fields Landing Terminal located two miles from the Humboldt Bay site would need to be verified for barge transport.</td>
</tr>
<tr>
<td>Big Rock Point</td>
<td>Heavy haul truck to rail</td>
<td>Barge to rail The heavy haul distance would likely be about 52 miles to Gaylord, Michigan. A shorter heavy haul distance of 13 miles to Petoskey, Michigan may be possible. 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 currently maintained. Weight restrictions on the lone Industrial Lead would require route clearance by the railroad or a track upgrade.</td>
</tr>
<tr>
<td>Trojan</td>
<td>Direct rail</td>
<td>Barge to rail The on-site rail spur was removed.</td>
</tr>
<tr>
<td>La Crosse</td>
<td>Direct rail</td>
<td>Barge to rail The on-site rail spur was used to ship the reactor pressure vessel. The location and method for loading the transportation cask and moving the transportation cask to a rail spur is uncertain.</td>
</tr>
<tr>
<td>Zion</td>
<td>Direct rail</td>
<td>Barge to rail The rail spur was refurbished to support reactor decommissioning waste shipments.</td>
</tr>
<tr>
<td>Crystal River</td>
<td>Direct rail</td>
<td>Barge to rail An extensive on-site rail system serves co-located fossil fuel plants.</td>
</tr>
<tr>
<td>Kewaunee</td>
<td>Heavy haul truck to rail</td>
<td>Heavy haul truck to barge to rail The condition of potential heavy haul truck routes, transload locations, and rail infrastructure would need to be evaluated.</td>
</tr>
<tr>
<td>San Onofre</td>
<td>Direct rail</td>
<td>Heavy haul truck to barge to rail The rail spur was refurbished to support reactor decommissioning shipments for San Onofre-1.</td>
</tr>
<tr>
<td>Vermont Yankee</td>
<td>Direct rail</td>
<td>– The on-site rail spur was reactivated to support decommissioning.</td>
</tr>
<tr>
<td>Fort Calhoun</td>
<td>Direct rail</td>
<td>Barge to rail The on-site rail spur could be reinstalled or on-site transload performed. Barge was used to ship steam generators, pressurizer, and reactor vessel head.</td>
</tr>
<tr>
<td>Oyster Creek</td>
<td>Barge to rail</td>
<td>Heavy haul truck to rail Two on-site barge access locations exist at the site. Heavy haul truck transport to rail transload locations could range from 30 to 70 miles.</td>
</tr>
<tr>
<td>Pilgrim</td>
<td>Barge to rail</td>
<td>Heavy haul truck to rail One on-site barge access location exists at the site. Heavy haul truck transport to rail transload location could range from 23 to 30 miles.</td>
</tr>
</tbody>
</table>
Future Work – NPP Site Evaluations

- Updated report includes Oyster Creek and Pilgrim
- COVID-19 pandemic put in-person site evaluations on hold
- Continue to collect data on conditions at the sites
  - GC-859 Nuclear Fuel Data Survey
  - Additional information on storage systems in use at the sites
  - New SNF load maps
  - Additional information on the local transportation infrastructure and transload locations around the sites
- DOE intends to continue conducting site evaluations of additional NPP sites and plans to eventually conduct evaluations for all NPP sites
  - When Dresden site evaluation occurs, conduct in-person site evaluation of Morris ISFSI to supplement virtual site evaluation of the Morris ISFSI conducted in June 2020
Break!

Please be back in the room ready to continue at 3:15 PM sharp!
Carrier Route Selection Process and the Rail Corridor Risk Management System (RCRMS)

(Patrick Brady will provide slides that will be shown during this portion.)
How DOE Prepares for Shipment After Route Selection
Transportation Infrastructure Discussion

About 1-7 Atlas SNF Railcars to transport the SNF containers

2 Locomotives to power the train

2 Buffer Railcars to separate the train crew and security personnel from the Atlas SNF railcars

1 Escort Railcar to carry security personnel, surveillance, and train monitoring equipment
State Preparation Activities

• How will your states evaluate the proposed route(s)?
• How will your states inspect shipments, if at all?
• How will your state distribute 180(c) funds (assuming they are provided)?
• How will your state organize trainings and emergency management exercises for SNF shipments?
Announcements

• Group Dinner at Elephant & Castle (185 N. Wabash Ave.) at 7 pm
  • Meet in the East Tower lobby at 6:45 pm to walk over.

• MRMTC Meeting tomorrow, Thursday, December 2
  • Join your colleagues for a networking breakfast beginning at 7:30 am in the Living Room Bar and Lounge, 2nd floor of the West Tower.
  • The meeting will begin promptly at 8:30 am in this same room, Crystal Ballroom A.
  • Plan to adjourn at 5 pm.
Thank you for participating!

Spent Nuclear Fuel Transportation Workshop

Midwestern Radioactive Materials Transportation Committee

December 1, 2021