



# Barry Miles

Deputy Director, Reactor Refueling  
Naval Nuclear Propulsion Program

NAVAL SPENT FUEL TRANSPORTATION



# Naval Nuclear Propulsion Program

**Overview of Naval Nuclear Propulsion Program (NNPP)**

**Overview of Naval Fuel Shipments**

**Shipping Container Accident Exercises**

**M-290 Spent Fuel Shipping Container**

**Dry Storage and Repository**



# Integrated Navy and DOE Program

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## **CLEAR, TOTAL RESPONSIBILITY AND ACCOUNTABILITY FOR ALL PROGRAM ASPECTS:**

- Research, development, design, construction
- Maintenance, repair, overhaul, disposal
- Radiological controls, environment, safety, and health matters
- Officer operator selection, operator training
- Administration (security, nuclear safeguards, TRANSPORTATION, public information, procurement and fiscal management)
- Spent fuel custody
- Emergency Planning
- Cradle-to-Grave Responsibility

## **SIMPLE, ENDURING, LEAN ORGANIZATIONAL STRUCTURE**

- Director tenure 8 years, 4-Star Admiral/Deputy Administrator in National Nuclear Security Administration (NNSA)
- Dual agency structure with direct access to Secretaries of Energy and Navy
- Small headquarters, field activities

**EXECUTIVE ORDER 12344 SET FORTH IN PUBLIC LAW 98-525 AND 106-65**



# NNPP Background

- **Naval Nuclear Propulsion Program founded in 1948**
- **Currently operating:**
  - 100 reactors (compared to 99 for the US commercial industry)
  - 11 nuclear powered aircraft carriers (two more under construction)
  - 74 submarines (four more under construction)
  - Two land based prototypes
  - Two Moored Training Ships
- **Nuclear-powered warships comprise more than 45% of all the Navy's major combatants**



# NAVAL NUCLEAR PROPULSION PROGRAM

## Field Offices

### REPORT TO DIRECTOR

- Ensures focus on mission
- Immediate identification of concerns



### NAVAL REACTORS FACILITY

- Dry Storage Program
- Expended Core Facility



### NUCLEAR POWERED FLEET

- 85 warships
- About 45% of major combatants

**NAVAL  
REACTORS** 480  
people



### DEDICATED LABORATORIES

- Bettis Atomic Power Laboratory
- Knolls Atomic Power Laboratory
- GOCO



### SPECIALIZED INDUSTRIAL BASE

- Hundreds of suppliers



### R&D/TRAINING REACTORS -

Train 3000 students/year



### SHIPYARDS

4  
Public / 2 Private



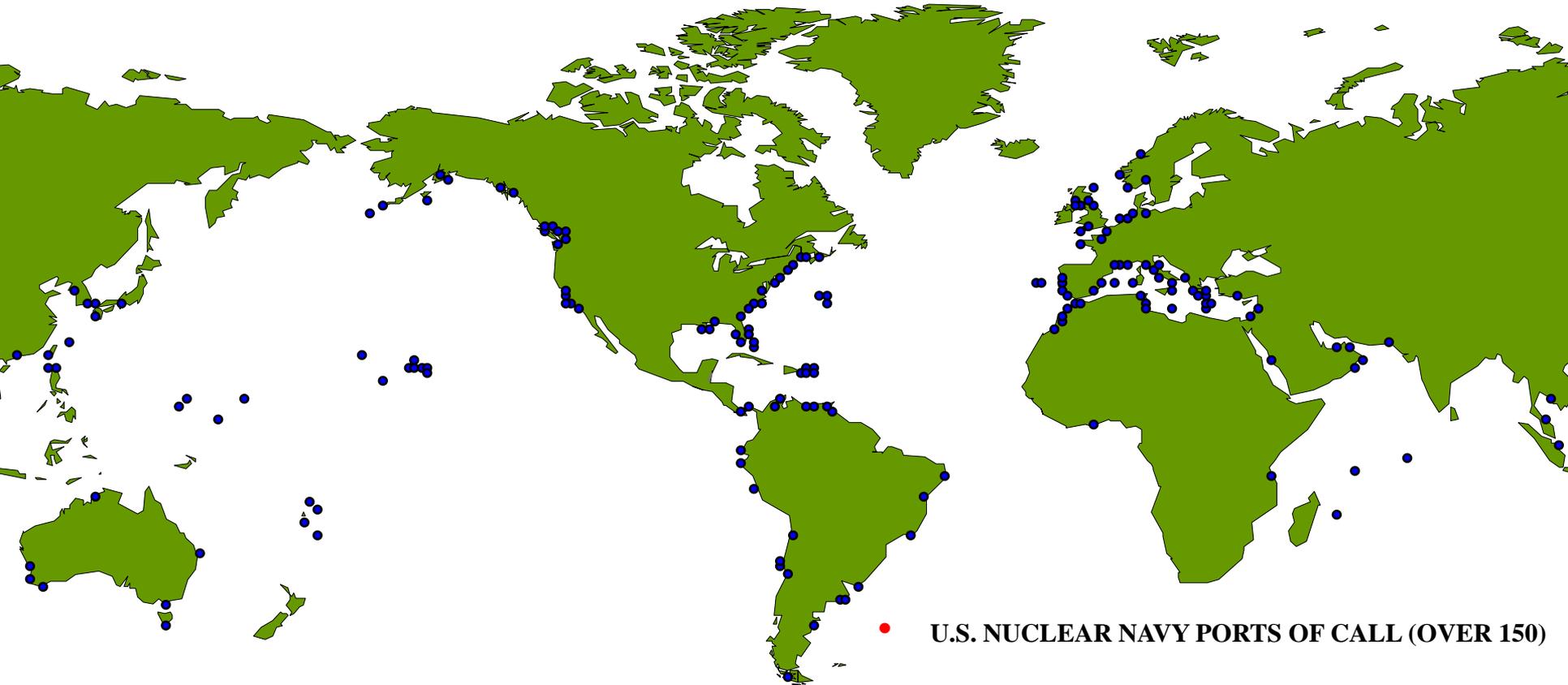
### SCHOOLS

- Nuclear Power School

**100 reactors operating worldwide**



# World-Wide Access and Demonstrated Safety Record



- World-wide operation, visiting over 150 ports in over 50 countries and dependencies.
- Over 6,800 reactor-years of operating experience without a reactor accident or any problem causing a significant effect on the environment.
- Over 159 million miles safely steamed by nuclear-powered ships.



# Naval Nuclear Propulsion Program

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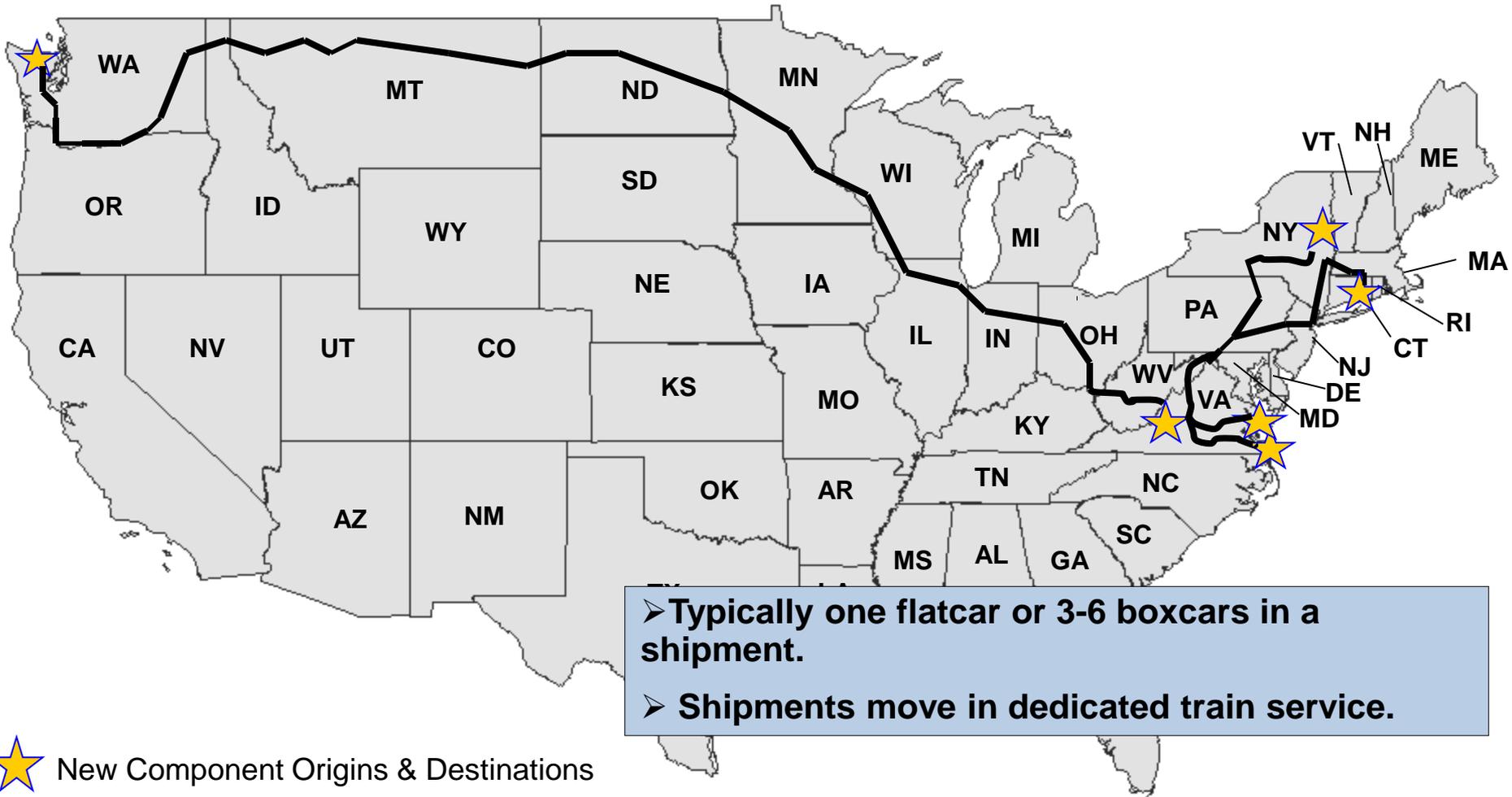
# NNPP Reactor Fuel Component Shipments

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- Shipping by rail for over 60 years.
- Two types of fuel shipments:
  - New fuel not yet installed in a propulsion plant
  - Used fuel removed from a propulsion plant (spent fuel)
- All shipments classified (security) and invoke the Department of Transportation (DOT) National Security Exemption (49CFR173.7b).
  - Radioactive labels and placards not used..
  - No advance notification



# Typical New Component Shipping Routes





# New Component Boxcar



- Metal shipping containers mounted/tied-down inside boxcars.
- Boxcars locked and sealed.



# New Component Flatcar and Shipping Container



➤ Large, heavy shipments



# Naval Spent Fuel Cycle

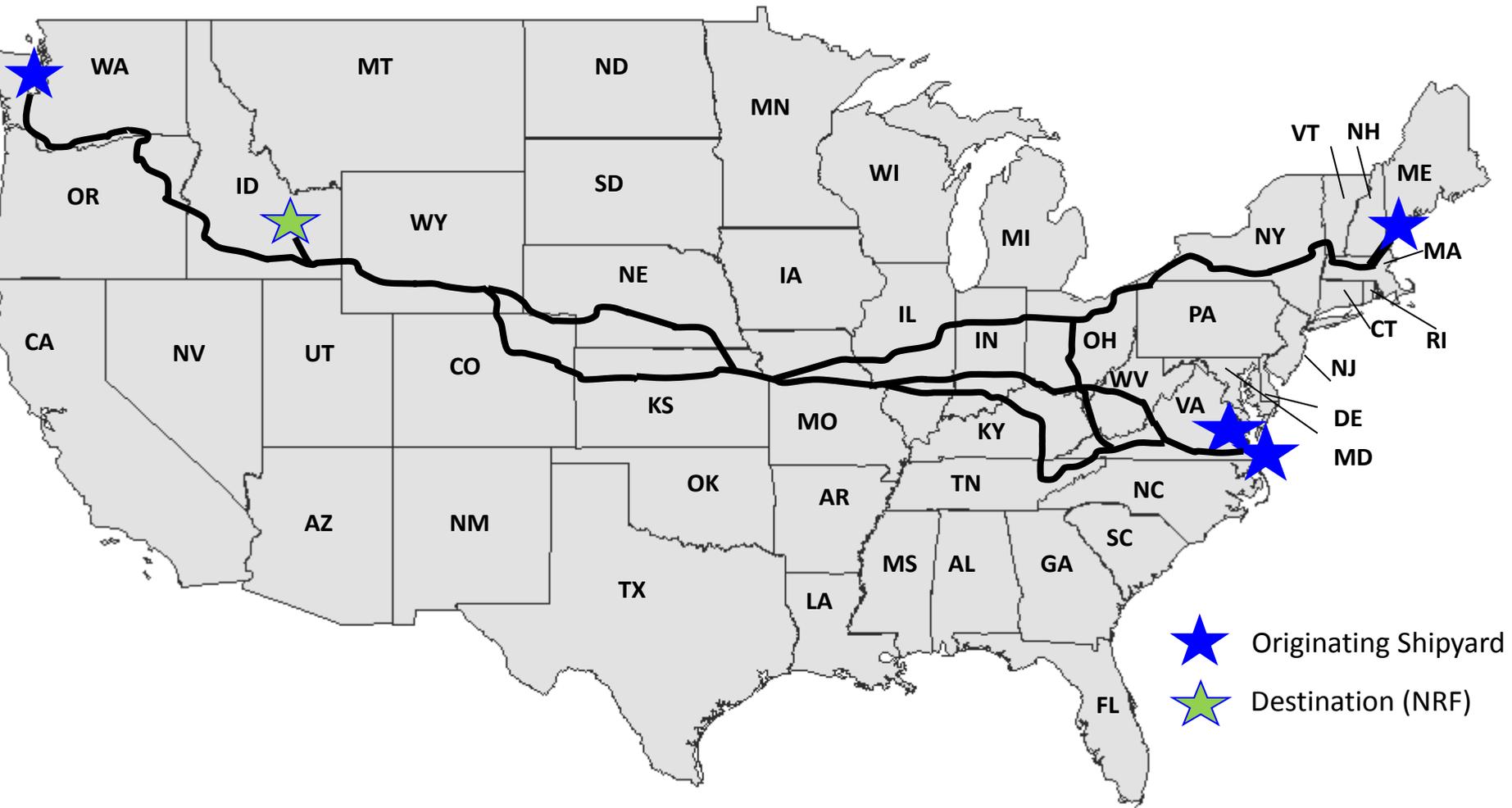
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- **Upon refueling/defueling, all naval spent (*used*) fuel transported by rail to Program's facility in Idaho for examination to:**
  - Ensure maximum performance of current fuel
  - Enable design of new fuel with longer lifetimes
- **For perspective:**
  - First nuclear powered submarine fuel operated 2 years
  - Current fuel operates for 33 years – the life of an attack submarine
- **Fuel is stored temporarily pending disposal in geologic repository or interim storage site.**



# Naval Spent Fuel Shipping Routes

850 CONTAINERS SHIPPED  
(March 1957 to Present)





# Shipment Safety

- **Nature of the Fuel**
  - Rugged
- **Shipping Containers**
  - Robust
- **Shipping Practices**
  - Couriers



**NAVAL SPENT FUEL SHIPMENTS ARE SAFE**



# Naval Fuel Characteristics

- Solid metal; not flammable, explosive, or corrosive
- Built for combat battle shock conditions (well over 50g's)
- Contains fully all long-lived radioactivity (fission products)
- Safe to operate in close proximity to sailors on warships



**EXCEPTIONALLY WELL-SUITED FOR SAFE TRANSPORT AND STORAGE  
FOR LONG PERIODS**



# Naval Spent Fuel Type B Shipping Containers

- Models M-140 and M-290:
  - Type B NRC/DOE Certified
  - At least 10" thick solid stainless steel
  - 350,000 and 520,000 pounds (loaded), respectively
- Thick, solid steel typically results in radiation levels much lower than the safe maximum DOT limits:

	DOT Limit	Naval Container	Typical Chest X-Ray
On contact	200 mR/hr	1 to 5 mR/hr	10 mR
At 2 meters	10 mR/hr	.1 to .5 mR/hr	

- Everyday life exposure to radiation:
  - ~300 mr/yr – soil, rocks, cosmic rays, radon



M-140 Naval Spent Fuel Shipping Container



M-290 Naval Spent Fuel Shipping Container



# Shipping Practices

- Railcars frequently inspected and maintained at highest standard
- Location and status constantly monitored via satellite tracking
- Advance arrangements with railroad operations and railroad police
- Outreach with civilian authorities, e.g., accident exercises



- Escorted by specially trained NNPP shipment couriers
  - 24/7 surveillance
  - Immediate emergency response



# Accident Derailment Response

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## Emergency Response Priorities:

- Emergency first-aid
- Summon assistance
- Prevent further injury/damage
- Verify radiological condition

## NNPP Couriers assist Incident Commander:

- Shipper Specialist Employee (29CFR1910.120)
- Response priorities
- Communications and public information

**ROBUST SHIPPING  
CONTAINERS PROVIDE  
A FORMIDABLE  
BARRIER TO PREVENT  
RELEASE OF  
RADIOACTIVE  
MATERIAL OR  
SIGNIFICANT  
RADIATION LEVELS**



# Naval Nuclear Propulsion Program

Overview of Naval Nuclear Propulsion Program (NNPP)

Overview of Naval Fuel Shipments

**Shipping Container Accident Exercises**

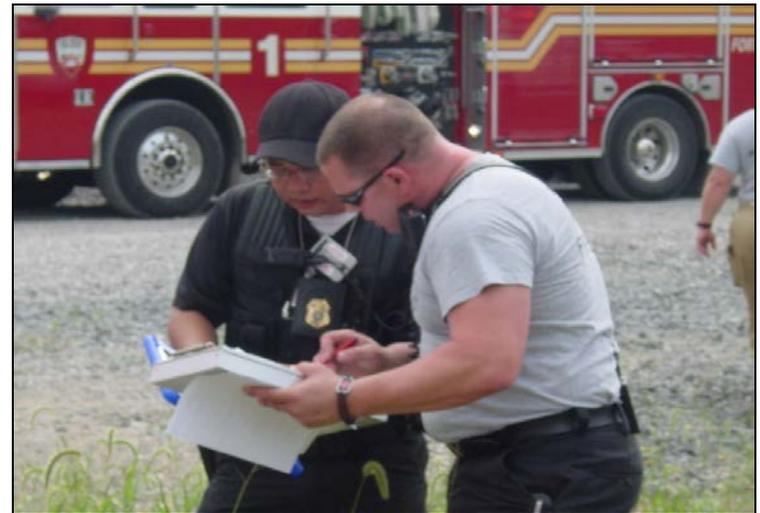
M-290 Spent Fuel Shipping Container

Dry Storage and Repository



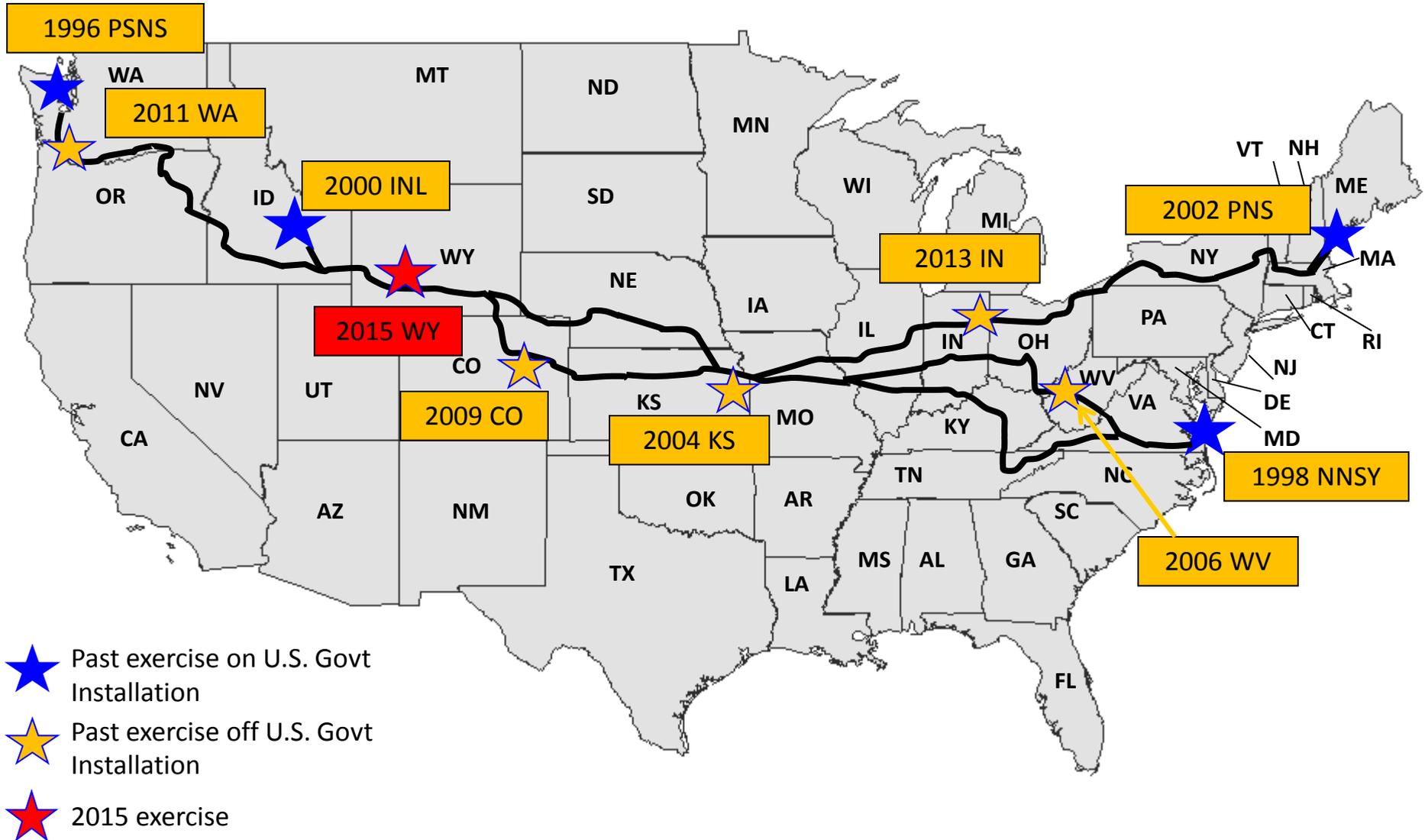
# Naval Spent Fuel Shipment Exercise Objectives

- Familiarize stakeholders with Naval spent fuel shipping container characteristics and shipping practices.
- Evaluate the interactions of NNPP couriers accompanying spent fuel shipments and civilian emergency response representatives.
- Gain an understanding of how **communication links** would be activated in an accident involving a Naval spent fuel shipment.
- Evaluate the NNPP's ability to **integrate** into Unified Command and the Joint Information Center (JIC) (if established).





# Naval Spent Fuel Shipment Exercises





# Summary of 2015 Wyoming Exercise Planning

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- Site Assessment – 15 October 2014
- Initial Planning Conference – 2 April 2015
- Exercise Planning Conference #2 – 7 May
- Tabletop Exercise – 29 July
- Full Scale Exercise – 13 August
- Final Demonstration – 17 September



# 2015 Wyoming Exercise Scenario

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- Naval spent fuel shipment en route from Newport News VA to the Naval Reactors Facility in Idaho- escorted by two NNPP couriers
- Dump truck collides with the M-290 container railcar at a railroad crossing in Granger, WY ; one truck is derailed
- Driver is injured
- Communications between shipper (NNPP), Union Pacific Railroad, local responders, and State of Wyoming
- Unified Command established
- Local media and resident approach the scene
- Radiological surveys – NNPP couriers and Rock Springs Regional Emergency Response Team
- Radiological condition normal; re-rail and continue shipment



Truck

Media  
10' X 10'

Bleachers  
60' X 20'

Video  
20' X 20'



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# M-290 Shipping Container



# M-290 Shipping Container



# M-290 Loading Facility – Newport News





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# Spent Nuclear Fuel Management Process

## Naval Reactors Facility, Idaho

- All Naval spent fuel shipped to Idaho by rail and placed into a large water pool at the Naval Reactors Facility for temporary storage
- Since 2008, Naval spent fuel has been moved into Spent Fuel Canisters for dry storage

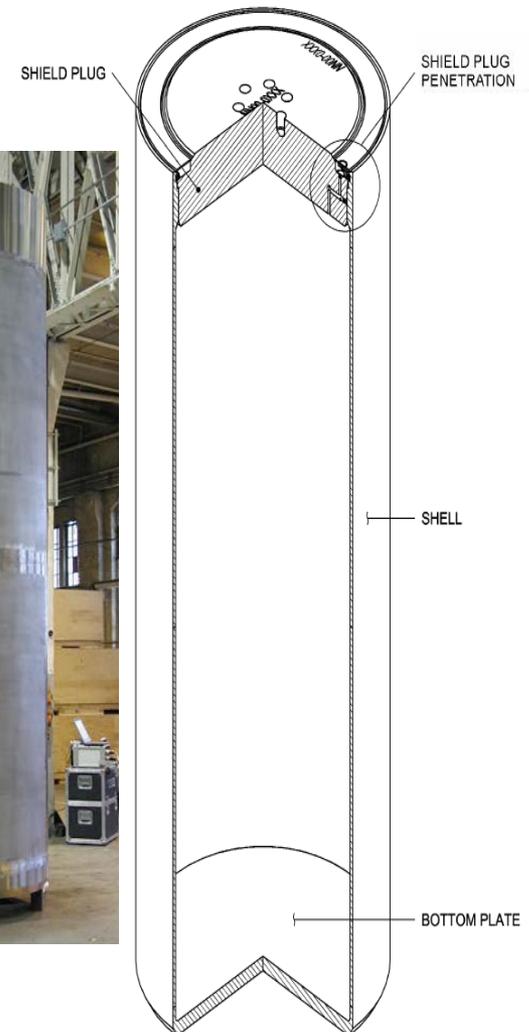
# NNPP Dry Storage Program

- Spent Fuel Baskets



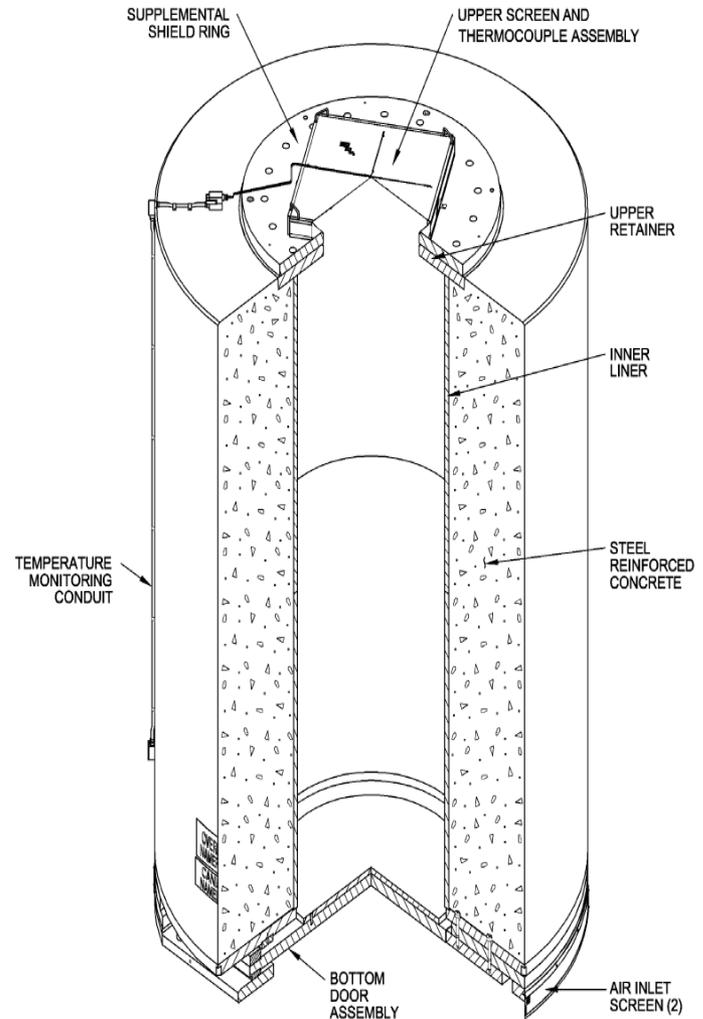
# NNPP Dry Storage Program

- Spent Fuel Canister
  - Designed for dry storage, transportation, and emplacement in the final disposal site.
    - 316L stainless steel
    - 66" OD
    - 185" and 210" height with a maximum loaded weight of 96,000 lbs
    - Shield plug is 15" thick



# NNPP Dry Storage Program

- Overpack
  - 2" thick steel inner liner
  - 38" thick steel reinforced concrete wall
  - 154" OD
  - 205" and 230" heights
  - 380,000 lbs maximum empty weight.
  - **Air inlet and outlet vents for natural convective cooling**



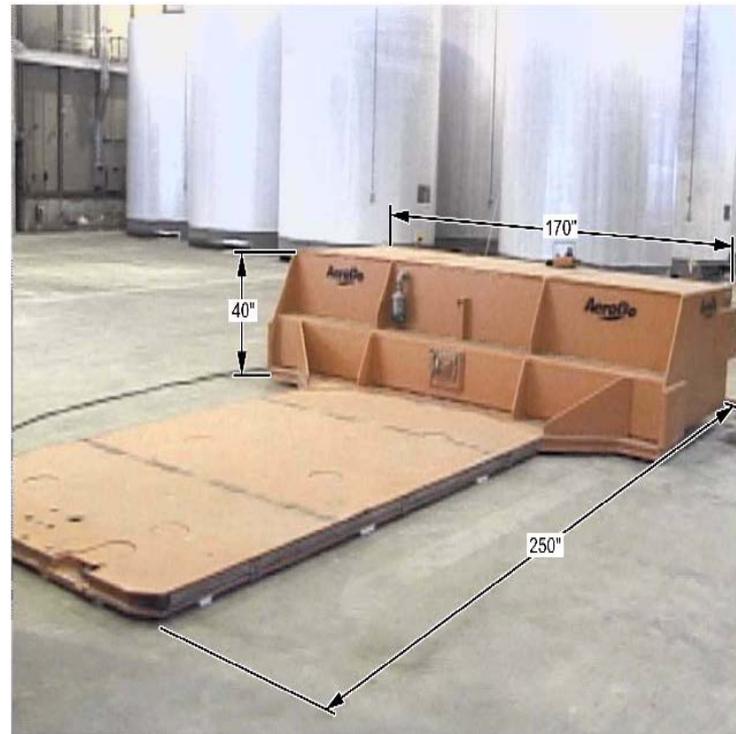
# NNPP Dry Storage Program

- Overpack rebar



# NNPP Dry Storage Program

- Air Pallets
  - 6 air bladders
  - each with lift capacity of 80,000 lbs



# NNPP Dry Storage Program

- Crawler
  - loaded weight 857,000 lbs, height 34'



# NNPP Dry Storage Program

- Overpack storage building



# Shipments to a Repository or Interim Storage Site



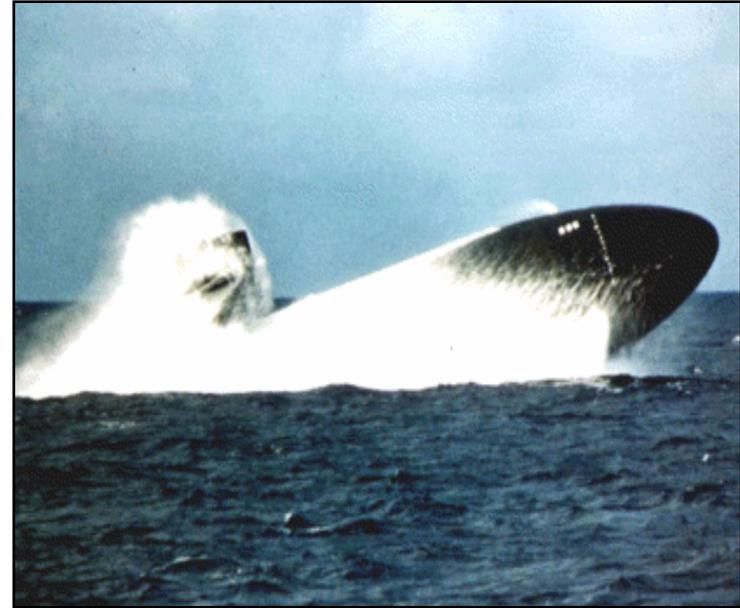
- Spent fuel in Spent Fuel Canisters
- M-290 container will ship the canisters
- Navy will be responsible for the shipment to the repository and hand off custody at the receiving site

# NEW NAVY ESCORT VEHICLE

- Vigor Works (formerly Oregon Iron Works) designing new NNPP escort vehicle
- Meet latest AAR requirements (e.g., S-2043 specification) and both freight and passenger car requirements
- Design is 90% complete as of August 2016
- Initial procurement planned for Summer 2017; delivery and tested-January 2020
- Procure four additional vehicles in 2020 and 2021 (2 each year)
- **Committed to provide design to DOE/NE for DOE use for commercial shipments**



# Naval Nuclear Propulsion Program



Operating naval nuclear propulsion plants and shipping naval spent fuel safely for over 50 years. Key to the U.S. Navy continuing to meet its national security mission.

**Questions:**

**Barry Miles**

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**Naval Nuclear Propulsion Program**

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