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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

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

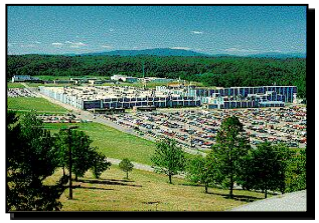
NAVAL REACTORS *480 people*

NAVAL REACTORS FACILITY
- Dry Storage Program
- Expended Core Facility

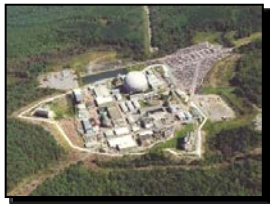
NUCLEAR POWERED FLEET -
85 warships
- About 45% of major combatants

DEDICATED LABORATORIES
- Bettis Atomic Power Laboratory -
Knolls Atomic Power Laboratory -
GOCO

SHIPYARDS 4
Public /2 Private



SPECIALIZED INDUSTRIAL BASE
- Hundreds of suppliers

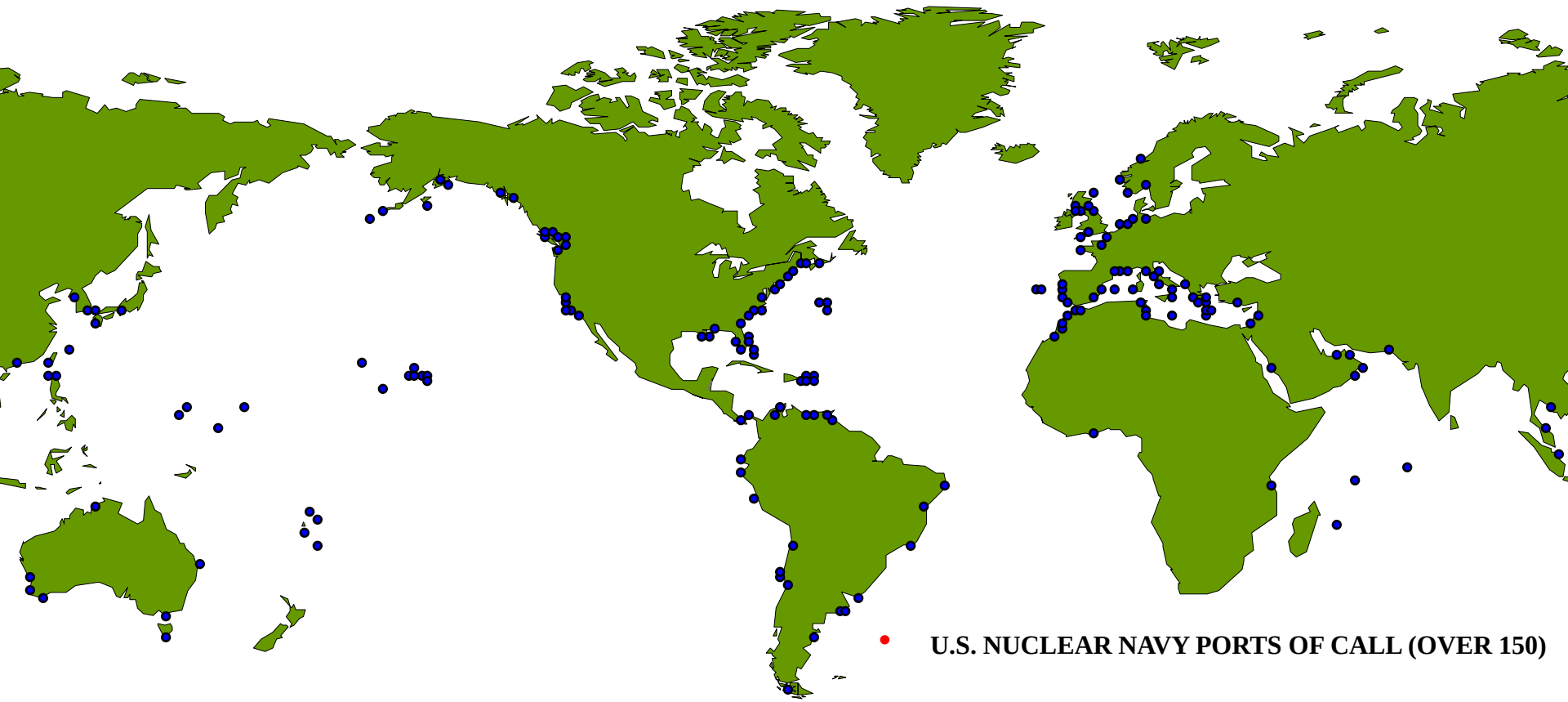


R&D/TRAINING REACTORS -
Train 3000 students/year

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.

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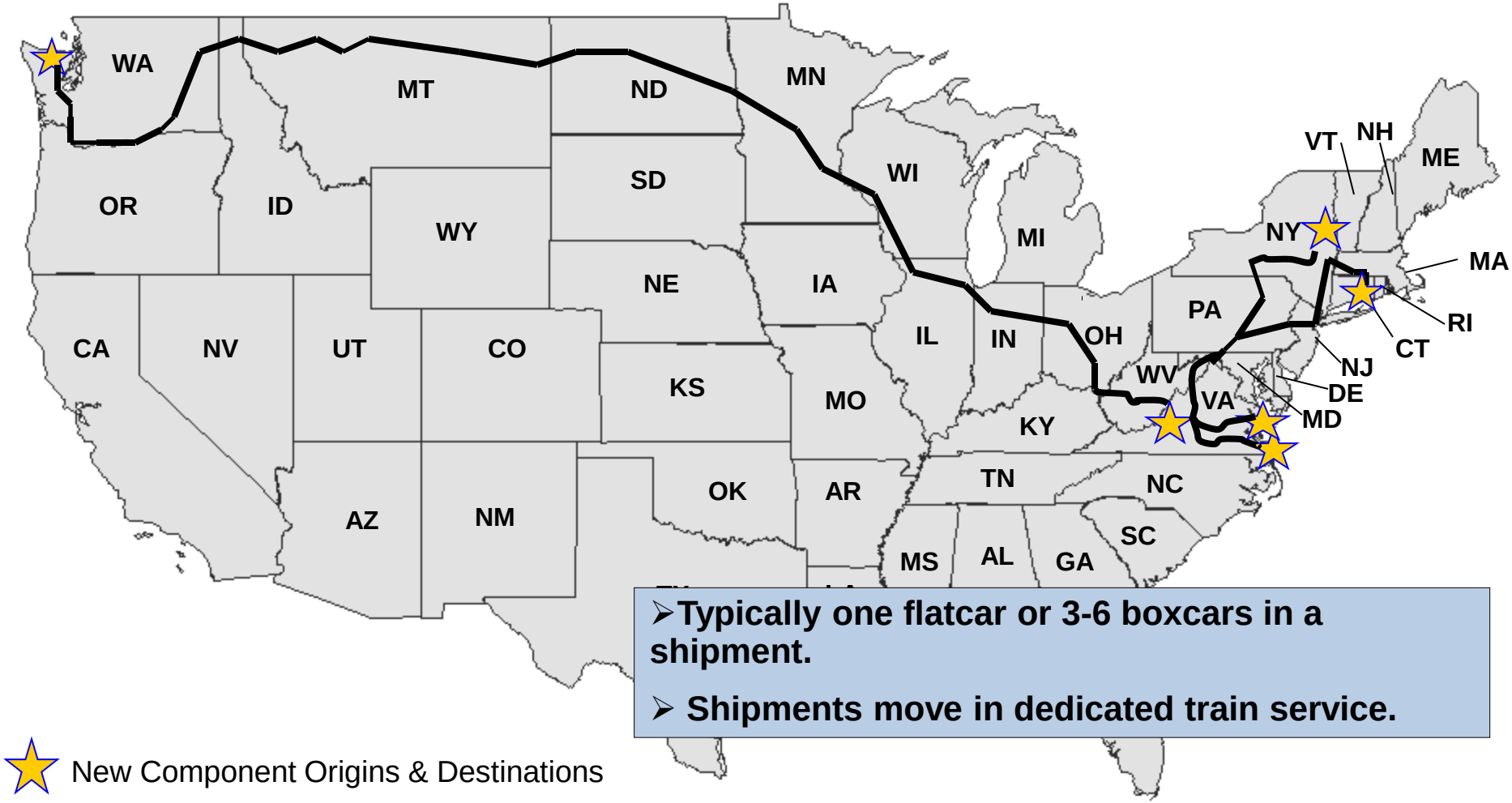
NNPP Reactor Fuel Component Shipments

- 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



- Typically one flatcar or 3-6 boxcars in a shipment.
- Shipments move in dedicated train service.

New Component Origins & Destinations

New Component Boxcar

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

New Component Flatcar and Shipping Container

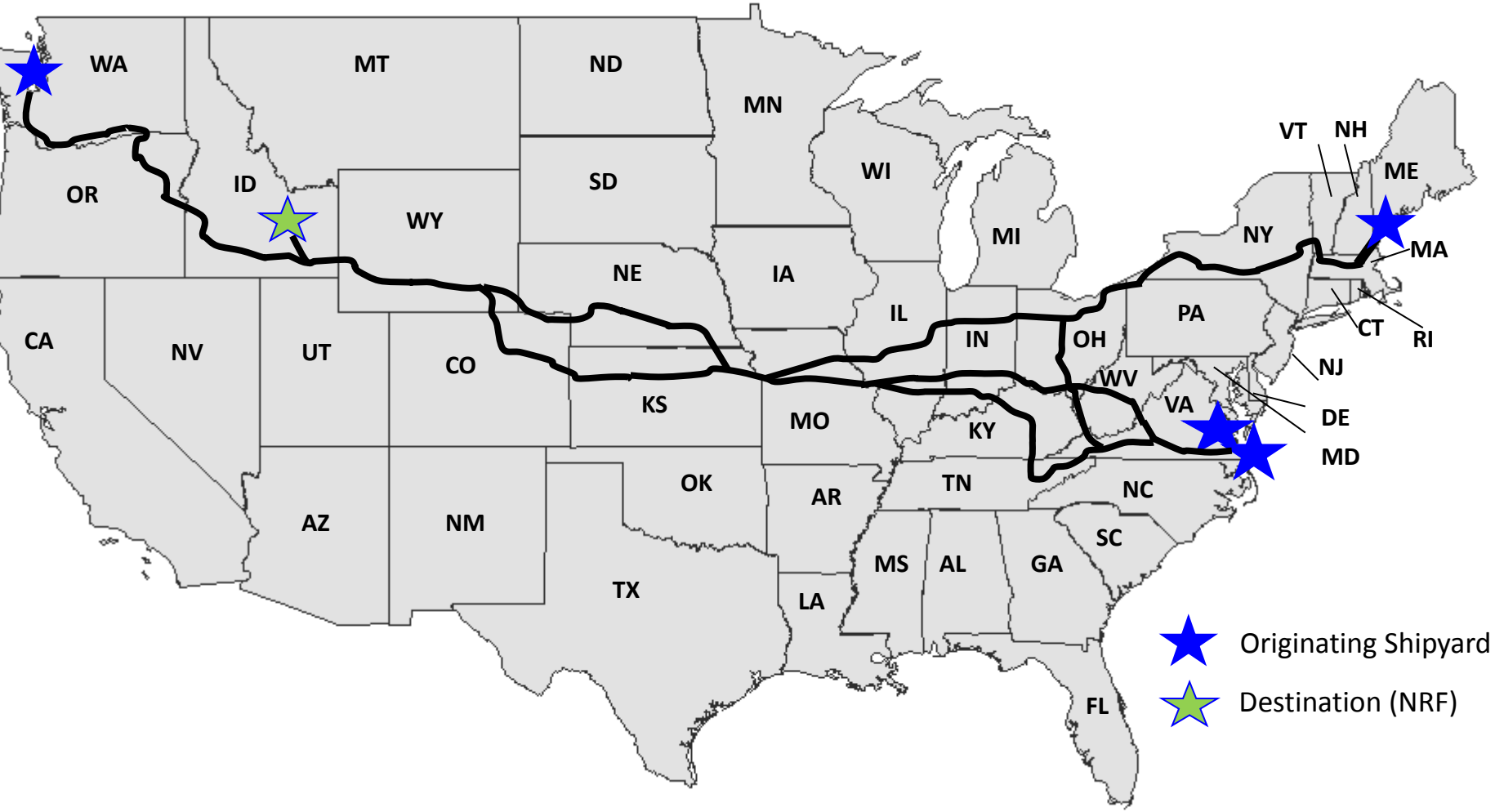
- **Large, heavy shipments**

Naval Spent Fuel Cycle

- **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:
  - o Type B NRC/DOE Certified
  - o At least 10” thick solid stainless steel
  - o 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:
  - o ~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

ESCORT VEHICLE

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

Accident Derailment Response

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

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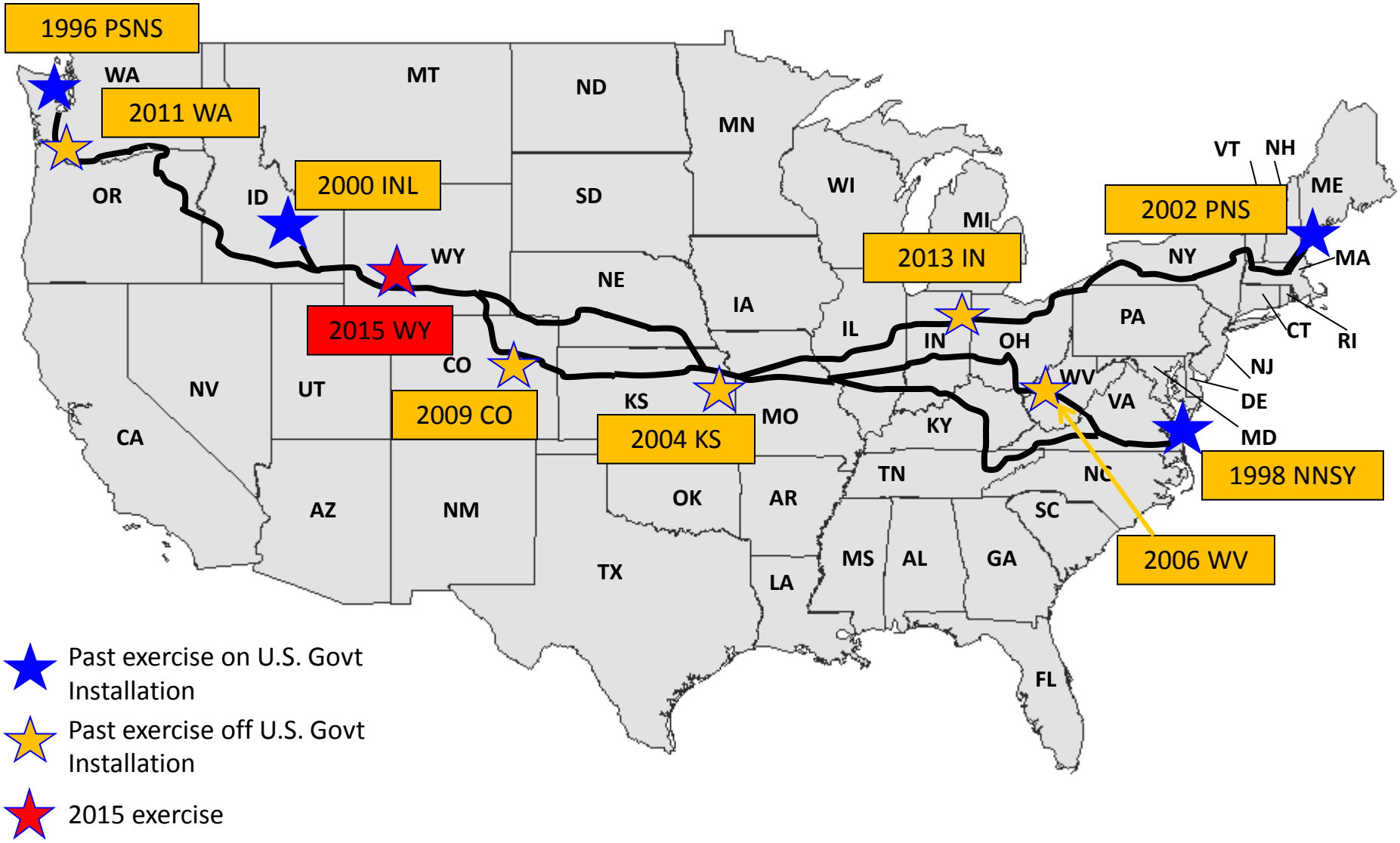
Naval Spent Fuel Shipment Exercise Objectives

- **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

- 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

- 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'
Video
20' X 20'
Bleachers
60' X 20'
Google earth
1994
Imagery Date: 6/5/2014 41°35'35.50" N 109°58'08.55" W elev 6278 ft eye alt 6704 ft

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M-290 Shipping Container

M-290 Shipping Container

M-290 Loading Facility – Newport News

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Dry Storage and Repository

Spent Nuclear Fuel Management Process
Naval Reactors Facility, Idaho

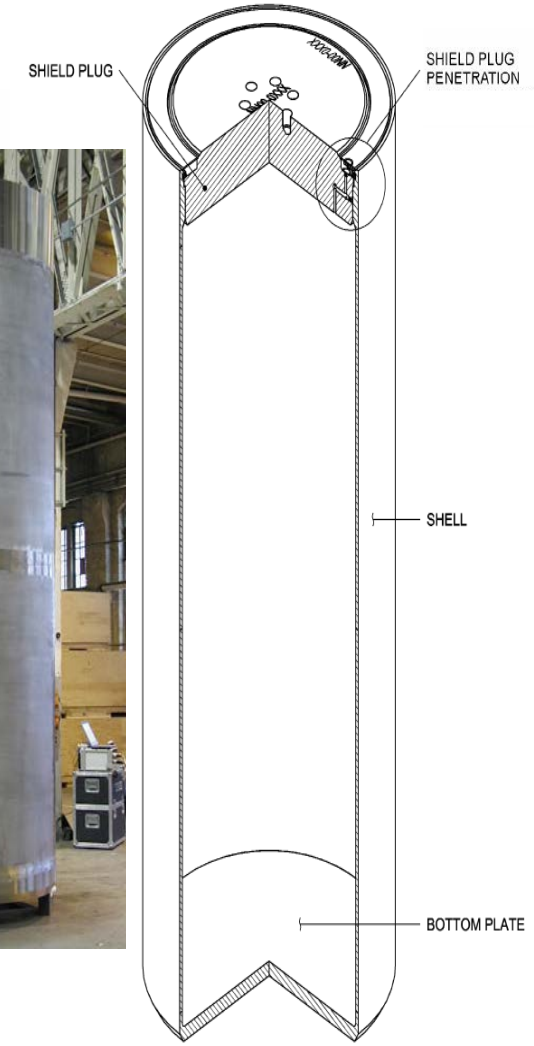
- All Naval spent fuel shipped to Idaho by rail and placed into a large water pool at the Naval Reactors Facility for temporary storage
- Since 2008, Naval spent fuel has been moved into Spent Fuel Canisters for dry storage

NNPP Dry Storage Program

- Spent Fuel Baskets

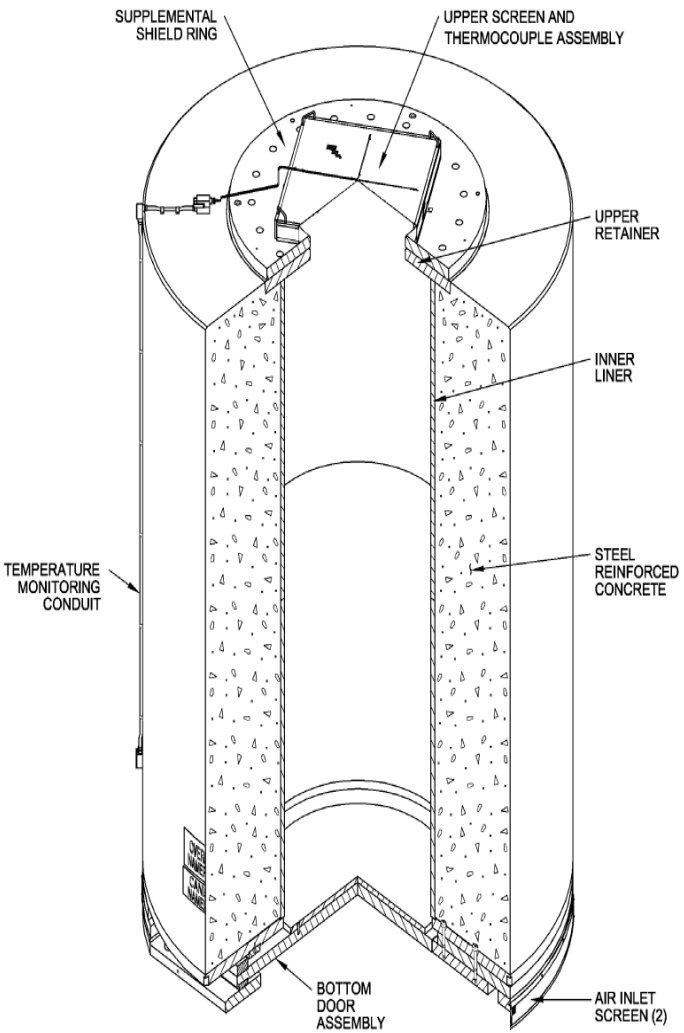
NNPP Dry Storage Program

- 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:
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