



United States Naval Nuclear Propulsion Program

**OPERATING NAVAL NUCLEAR
PROPULSION PLANTS AND SHIPPING
(RAIL) NAVAL SPENT FUEL SAFELY
FOR OVER 60 YEARS**



USS WASHINGTON (SSN 787)



USS GEORGE H.W. BUSH (CVN 77)



M-140 Naval Spent Fuel Shipping Container
(14" solid stainless steel)

Naval Spent Nuclear Fuel Shipments

- Since 1957, the Naval Nuclear Propulsion Program (NNPP) has made over 870 container shipments of naval spent nuclear fuel to the Idaho National Laboratory (INL). These shipments are subject to rigorous health and safety requirements. The result is that all of the U.S. Navy's spent nuclear fuel shipments have been done safely without any release of radioactivity or injury to workers or the public.
 - These spent nuclear fuel shipments are essential to maintaining and improving the U.S. Navy's nuclear-powered warships, which are key to the Navy's mission of protecting the nation.
 - Upon refueling/defueling of reactors, all naval spent nuclear fuel is transported to the Naval Reactors Facility (located at the INL) for examination to confirm performance of current fuel and to improve the design of fuel for future ships. For example, the first nuclear-powered submarine, USS NAUTILUS (SSN 571), was refueled after her first two years of operation having steamed about 62,000 miles. Today's nuclear-powered attack submarine will not require refueling during its 33-year life and will steam over one million miles.
 - Military advantages of nuclear-powered aircraft carriers and submarines include endurance at high speeds, independence from underway refueling, strategic and tactical flexibility, higher state of readiness upon arrival at destination, and submarine stealth at any speed. Today's nuclear fleet consists of:
 - 11 aircraft carriers (2 more under construction);
 - 70 submarines (3 more under construction);
- *More than 45 percent of the U.S. Navy's warships are nuclear-powered.
- As a matter of public record, the U.S. Navy's nuclear-powered ships have collectively steamed over 162 million miles and accumulated over 6,900 reactor-years of operating experience without a reactor accident or adverse impact on the public or the environment. The U.S. Navy operates these ships and conducts shipments of spent nuclear fuel with a strong commitment to safety and environmental protection.



USS GEORGIA (SSGN 729)



USS RONALD REAGAN (CVN 76)

Naval Spent Fuel Shipping Containers

- Naval spent nuclear fuel is packaged for shipment in formidable containers that meet or exceed all requirements of the Naval Nuclear Propulsion Program, the Nuclear Regulatory Commission, and the Department of Transportation.
- Collectively, these robust containers have traveled safely over 1.7 million miles throughout the United States loaded with spent nuclear fuel.
- Conservative engineering analysis, detailed calculations, scale model testing, and computer modeling demonstrate that the containers are designed to withstand severe real world accidents and remain safe. The regulatory accident performance standards that the container must withstand are:
 - 30-foot drop onto an unyielding surface;
 - 40-inch drop onto a 6-inch diameter vertical metal rod;
 - Fully-engulfing 1475 degree Fahrenheit fire for at least 30 minutes;
 - Immersion in 50 feet of water.

*Including combinations of these events

- Radiation levels outside the shipping container are extremely low and are not a threat to human health. Typical radiation levels on the outside of loaded Naval spent fuel shipping containers are about 100 times less than the Department of Transportation safety limits.



M-290 Naval Spent Fuel Shipping Container
(10-11" solid stainless steel)

Naval Spent Fuel Characteristics

- In addition to the robust nature of the shipping containers, the contents — naval spent nuclear fuel — are also extremely rugged.
 - Naval fuel is solid metal.
 - Naval fuel contains no flammable, explosive, or corrosive materials.
 - Naval fuel is designed to protect the warship's crew by fully containing the uranium fuel and all of its radioactive fission products produced during operation.
 - Naval fuel is built to withstand combat battle shock forces well in excess of 50 times the force of gravity (more than 100 times the force of a severe earthquake).
- The same characteristics of naval nuclear fuel that make reactor operations safe, with a warship's crew living in close proximity and under combat conditions, make it safe to transport in a robust shipping container.

Naval Spent Fuel Shipping Practices

- The following shipping practices are used for naval spent fuel shipments:
 - Shipments are escorted by specially trained and armed NNPP shipment couriers who maintain constant surveillance of the shipments. These couriers would act as on-board first responders in the event of a transportation incident.
 - Shipments are dry – no water in container during transit.
 - Shipment location and status are constantly monitored by the same tracking center used for nuclear weapons shipments.
 - Government-owned railcars are strictly inspected and regularly maintained.
 - Shipments are coordinated in advance with railroad police and operations personnel.
- Since 1996, the NNPP has conducted shipment accident exercises at the following locations: Bremerton, WA; Norfolk, VA; Idaho Falls, ID; Portsmouth, NH; Topeka, KS; Kenova, WV; Denver, CO; Vancouver, WA; Fort Wayne, IN; Granger, WY and Mechanicville, NY. These periodic exercises have been very well received by the states that have hosted them. Objectives of the NNPP's accident exercises include:
 - Regional outreach with the host state;
 - Opportunity to familiarize civilian emergency services personnel and interested political leaders with naval spent fuel shipments;
 - Opportunity for civilian emergency personnel to interact with shipment couriers;
 - Opportunity to train personnel and practice emergency actions, including communications and public affairs, in response to an accident scenario.

The key takeaway from these exercises is that a coordinated, collaborative response amongst the shipper (NNPP), carrier (railroad), and civilian authorities (state, tribal, local) is crucial.

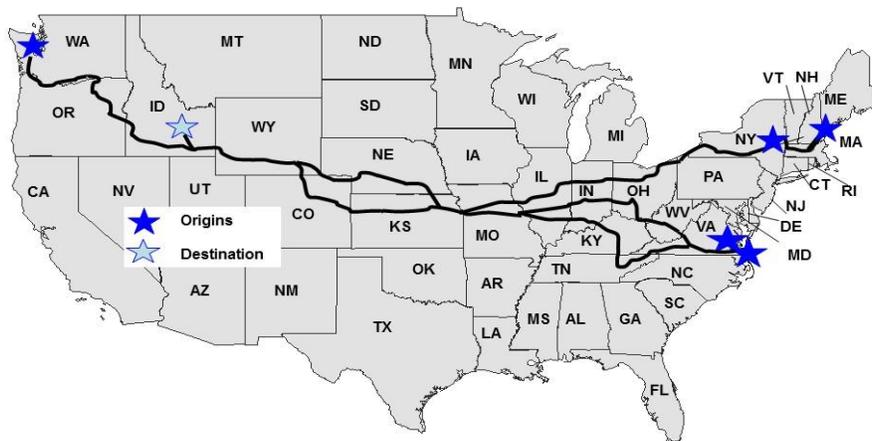


NNPP Shipment Couriers Integrate into Unified Command during the 2017 Accident Exercise in Mechanicville, NY

Conclusion

- The formidable construction of naval spent fuel shipping containers and the rugged nature of the fuel, along with the precautions taken during transit, have been successful in ensuring every shipment over the last 60 years has been conducted safely.

TYPICAL NAVAL SPENT FUEL SHIPPING ROUTES



24/7 Shipment Emergency Number: 412-476-5000 (Bettis Laboratory)

For questions, please call the Naval Spent Fuel Transportation Office: 412-476-7277.

For more information about the Naval Nuclear Propulsion Program, please visit:

<http://nnsa.energy.gov/ourmission/poweringnavy>