# TRENCH 94

## Final Resting Place:
## US Navy Nuclear-Powered Vessels' Reactor Compartments

Three hundred and ten miles from the sea, slightly radioactive remnants of dozens of nuclear-powered warships have been consigned to a low level burial ground in the arid, sandy soil of central Washington state. Over 120 nuclear-powered submarine and surface ship reactor compartments are already there. More will follow in the coming years.

Trench 94 is located at the Department of Energy's Hanford site. It is a relatively shallow and currently open trench, oriented east-west, that is over a thousand feet long. Nearby are the encapsulated remains of World War II plutonium production reactors, associated processing plants and many additional trenches for burial of a large percentage of the radioactive residue generated by the nation's nuclear weapons program.


In the mid-20th century, when nuclear-powered warships were being built and placed in service at a rapid pace, the elaborate process for disposing of obsolete navy nuclear reactors that is now utilized did not exist. Although it was always the plan to recycle their fuel, these ships' irradiated and contaminated reactor vessels were initially intended to be disposed of by dumping in the ocean.

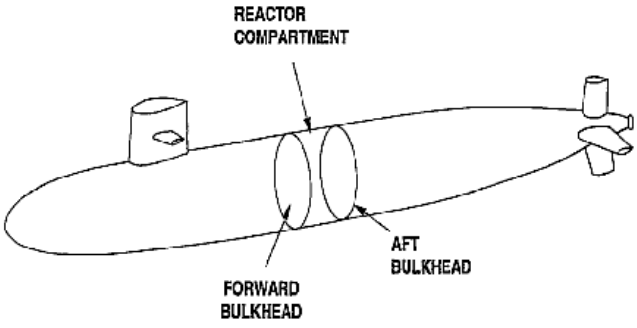
The first reactor installed in the USS SEAWOLF (SSN-575) was an experimental model that didn't live up to expectations. It was replaced in 1959 by the type of reactor now used throughout the US Navy. The removed reactor was scuttled in the Atlantic Ocean 125 miles off-shore and in water over 8,800 feet deep.

But in 1972, such practices were severely limited by international agreement, and later on ocean disposal of any radioactive waste was completely banned. That led to the US Navy's establishment of a program for land burial of reactors.

The Hanford site was selected in part because of its designation as a radioactive waste depository and also because of its relative closeness to the Puget Sound Naval Shipyard (PSNS), which the Navy had designated as the nation's sole facility for disposing of decommissioned nuclear-powered vessels.

The first submarine reactor compartment to be prepared at PSNS for shipment to the Hanford site was removed from the USS SCAMP (SSN-588) in 1990. The process utilized for SCAMP and the many obsolete nuclear-powered warships that have followed her to oblivion is summarized on the following pages.

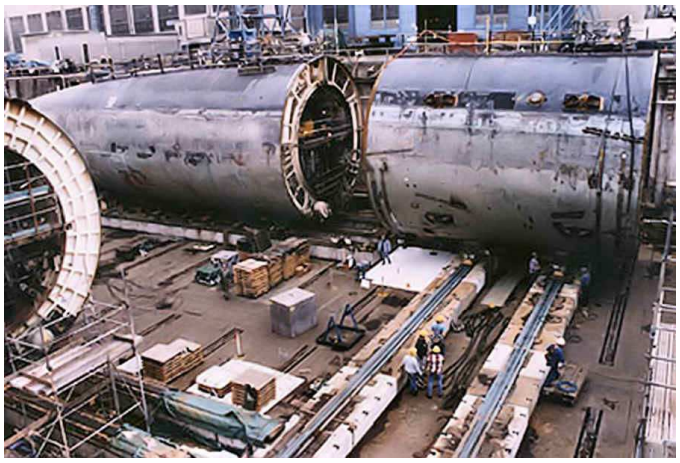
Somewhat fortuitously, the design of US Navy submarine reactor compartments is readily adaptable to a relatively economical disposal process. The first step is to remove expended nuclear fuel and ship it by rail in shielded containers to the Navy's reprocessing facility in Idaho.



Typical Submarine Reactor Compartment Location

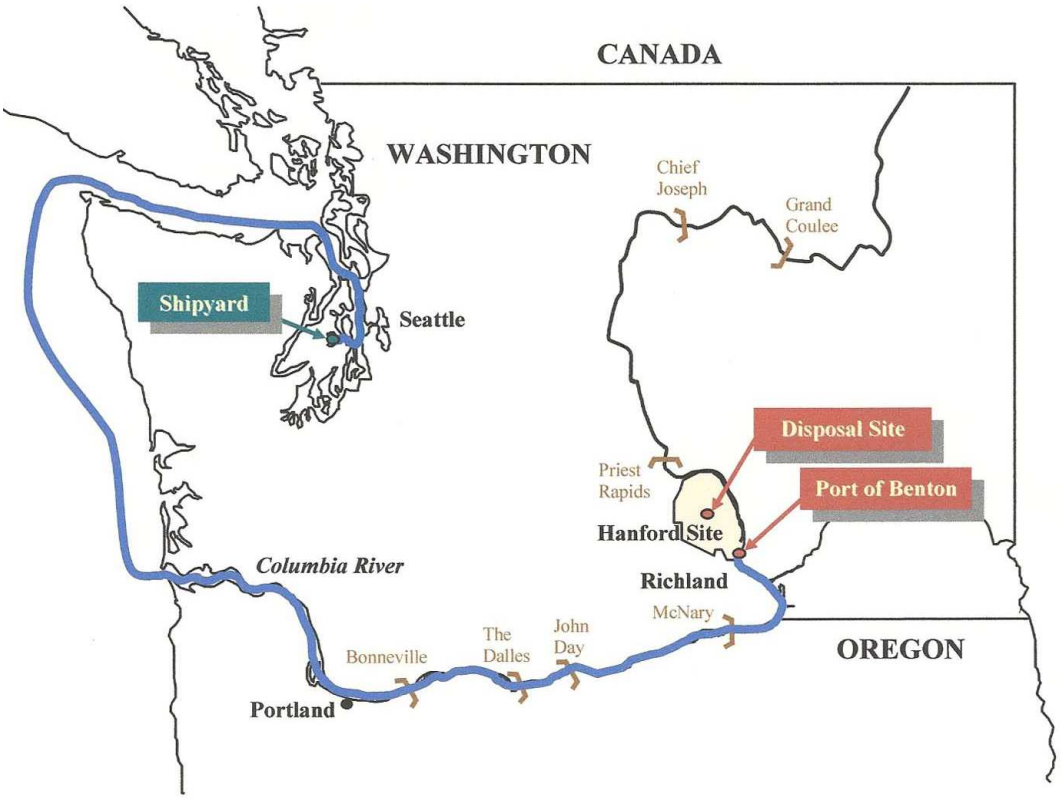
Contaminated fluids are then drained from the reactor vessel, steam generators, pumps and piping located within the reactor compartment, and properly disposed. Those components remain in place. Any residual water is soaked up using absorbents that are also left in the compartment. As a result, only one-tenth of one percent of the residual activity that existed beforehand remains.

While in a dry dock, a decommissioned submarine is cut into three or more pieces. The severed reactor compartment's fore and aft ends, and associated piping and electrical penetrations are sealed, encapsulating all of its internals.



Shipping and storage fixtures are then attached to the reactor compartment 'can'. In this photograph, a submarine reactor compartment [on the right] that has been separated is being readied for shipment. This process results in a sealed container that is, typically, thirty-three feet in diameter and forty feet in length, and weighs between 1,130 and 1,680 tons.

Once removed from dry dock, each reactor compartment is welded to the deck of a barge. Elaborate safety measures are incorporated in the barge to deal with any possible accident during shipment. The circuitous route that each barge shipment must follow is depicted on the next page, and takes three days, on average. One or two shipments occur yearly.




Despite innumerable predictions of disaster, all shipments to date...over 120... have been completed without incident. For each tow, a primary tug is backed up by a second one, and a third 'safety' tug is positioned on the Pacific coast, in case of need. A postulated 'worst case' accident would be some other vessel colliding and sinking a barge. Breach of a sealed reactor compartment is not considered even remotely possible.

Procedures are in place for recovering from such an unlikely occurrence. The Coast Guard escorts each shipment and keeps commercial craft well away from the barge while in transit. The principal concern associated with a sunk barge is the possibility of blocking shipping lanes. As a further caution, no shipments are made during severe weather...typically in the winter in the Northwest...or during Salmon spawning season or at times of extremely heavy downstream flow in the Columbia River.

Once each shipment reaches the Port of Benton, the sealed reactor compartments are lifted onto multi-wheeled transports for a seven mile overland journey to their final resting place. In addition to the Navy and other federal agencies, both Oregon and Washington State environmental agencies monitor the transport process.

Obviously, no other traffic is permitted on site roads when such shipments are nearing their final destination. Once alongside Trench 94, the transport vehicle goes slowly down an earthern ramp on one side of the trench. When alongside its designated final position, the sealed reactor compartment is skidded onto and welded to supports.

The size of a typical sealed container, after placement in Trench 94 can be contrasted with the individual walking under it in the following photo. Classified as low level radioactive waste, the containers' external radiation levels are so low they are not detectable more than a few yards away.

Lead shielding, asbestoes and PCBs that are purposefully left inside the container pose a theoretical environmental concern, long-term. But only if disturbed; a highly unlikely scenario, given the type of containment utilized.

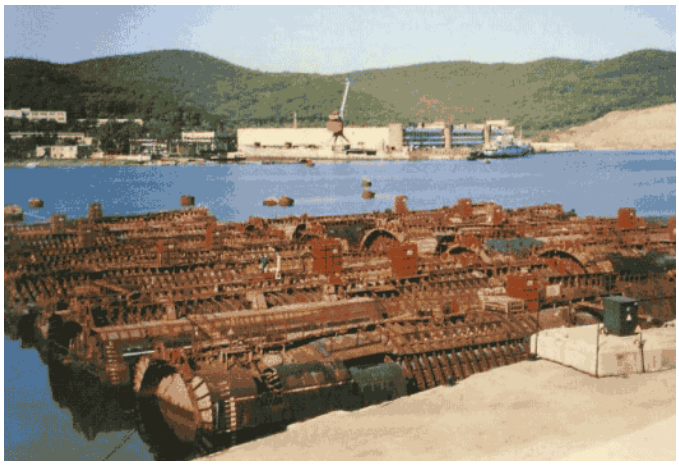
Eventually, when filled to capacity, the trench will be covered with earth. At present, it is left open to comply with various treaties between the United States and Russia regarding visual verification of nuclear weapons' systems.

Once covered over, the soil conditions at the burial site will all but eliminate the presence of moisture. In addition the thickness of the sealed containers is postulated to prevent any exposure of the materials inside for at least 1,000 years. By that time, the residual radioactivity sealed in the reactor compartments will have decayed to the point of being of no concern, even if somehow exposed.

This is not an inexpensive proposition. The disposal cost of each submarine that is decommissioned is between 25 and 50 million dollars. The cost for surface ships is somewhat higher. The percentage of that cost associated with the disposal of each reactor compartment has not been publicly revealed.

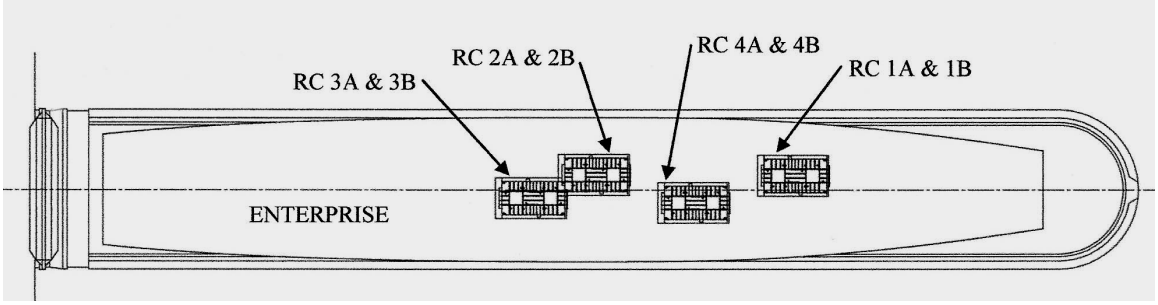
Some think the process involved in burying entire reactor compartments is an extravagant and questionable expenditure. But the US Navy has an unblemished record involving reactor safety, and that doesn't stop even after a nuclear-powered vessel is decommissioned and dismantled.

Environmentalists, of course, worry endlessly that each shipment may bring disaster to the Pacific Northwest. If they want to worry about something more likely to be a problem, they should turn their attention to the Russian practice of dismembering nuclear subs and leaving their contaminated reactor compartments with residual fuel still inside just 'rafted' in populated harbors.



Currently, reactor compartments from several US Navy nuclear-powered cruisers are being processed at PSNS for shipment to the Hanford site. They are larger and heavier than those removed from submarines, but the fundamental process is the same. The largest cruiser reactor compartments are the two associated with the USS LONG BEACH (CGN-9). They each measure 38x37x42 feet, and weigh 2,250 tons.

In years to come, the eight reactor compartments of the USS ENTERPRISE (CVN-65) will prepared as separate packages for shipment and burial. They will be roughly the same size and weight as those of LONG BEACH, described above. But to create these shipments, removal of a considerable amount of surrounding structure and tons shielding will be required. This is expected to be done while the hulk of the ENTERPRISE occupies PSNS's largest dry dock.



In the late 1990s, while visiting the Hanford site, I had the opportunity to stand on the rim of Trench 94. It was a depressing scene...at least to one who once had a small hand in the creation of some of the Navy's nuclear-powered vessels.

It was troubling to see several of the reactor compartments that I once worked in and around at Newport News Shipbuilding in this graveyard. Quite a contrast to the joyful occasion when the first nuclear sub built at NNS, the USS ROBERT E. LEE (SSN-601) was christened and slid majestically into the James River in 1959. Three-plus decades later, all that remains of that Cold War warrior is an innocuous can, simply marked ***#5***; alongside others in a huge hole in the ground.

The practical reality is that Trench 94 is a well-engineered repository for obsolete reactor compartments. But ever the romantic when it comes to matters maritime, I prefer to end this 'graveyard essay' more positively. Let us remember the decades of productive and protective service provided to our nation by ENTERPRISE and dozens of other nuclear-powered vessels. That thought, albeit admittedly and unashamedly nostalgic, brings to mind stirring scenes like the one that follows which are far more representative of these ships' ultimate legacy.

*Bill Lee*

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