OAK RIDGE National Laboratory

Second Target Station (STS) Project

Final Design Review: Disposition of Moderator Reflector and Target Assemblies

STS Project SP-1 FDR MRA and TA

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U.S. DEPARTMENT of ENERGY

ORNL IS MANAGED BY UT-BATTELLE LLC
FOR THE US DEPARTMENT OF ENERGY

Final Environmental Impact Statement (FEIS) (April 1999)

- The proposed action is to construct and operate … a spallation neutron source….
- The …SNS would be designed to operate at a proton beam power of 1 MW and would be economically upgradeable in the future to 4 MW

S 1.2.1 PROPOSED ACTION

The proposed action is to construct and operate a state-of-the-art, short-pulsed spallation neutron source comprising an ion source, a linear accelerator (linac), a proton accumulator ring, a liquid mercury target, and a set of neutron scattering instrumentation. This facility, called the SNS, would be designed to operate at a proton beam power of 1 MW and would be economically upgradable in the future to 4 MW (refer to Figures S 1.2.1-1 and S 1.2.1-2). The scope of these upgrades over the operating life of the facility is envisioned to encompass the following chronological stages:

1. Adding a second target station with its own set of instrumentation (space for this is included in the facility footprint analyzed in the FEIS).
2. Increasing the proton beam power to 2 MW by doubling the ion source output.
3. Increasing the proton beam power to 4 MW by adding a second ion source, modifying the linac, and adding a second proton accumulator ring (space for the upgrades is included in the facility footprint, and the impacts of constructing and operating a 4-MW facility are analyzed in this FEIS).

Record of Decision (June 18, 1999)

- ROD notes that the FEIS analyzed environmental impacts over the projected life of the facility, both operating at an initial power of 1 megawatt (MW) and at the maximum potential upgrade power level of 4 MW

Tennessee) with respect to the affected wetlands. The Department will use runoff and siting controls during construction to restrict unnecessary damage to remaining wetland areas.

As changes evolve in facility design or as facility upgrade actions are proposed, the DOE shall revisit requirements of the National Environmental Policy Act (NEPA) to ensure continued compliance by the SNS.

Issued in Washington, D.C. this 18th day of June, 1999.

Bill Richardson,

Secretary of Energy.

[FR Doc. 99–16603 Filed 6–29–99; 8:45 am]

BILLING CODE 6450–01–P

Disposition of Moderator Reflector and Target Assemblies

- National Environmental Policy Act (NEPA)
  - STS is covered under DOE/EIS-0247
  - The current waste management activities at ORR include the treatment and storage of LLMW on site, and the treatment and disposal of LLW on site. Under the preferred alternatives in the Waste Management PEIS (DOE 1997a), ORR is one of six candidate sites for regional disposal of LLW and LLMW. DOE will choose two or three regional disposal sites from the six candidate sites. These sites are those at which DOE already has established LLW disposal operations and has large waste volumes for disposal. The ORR, along with the other sites, would have more than adequate capacity for the amounts of LLW that DOE will need to dispose (p. DOE/EIS-0247 SNS FEIS, p. 5-63).

NEPA (continued)

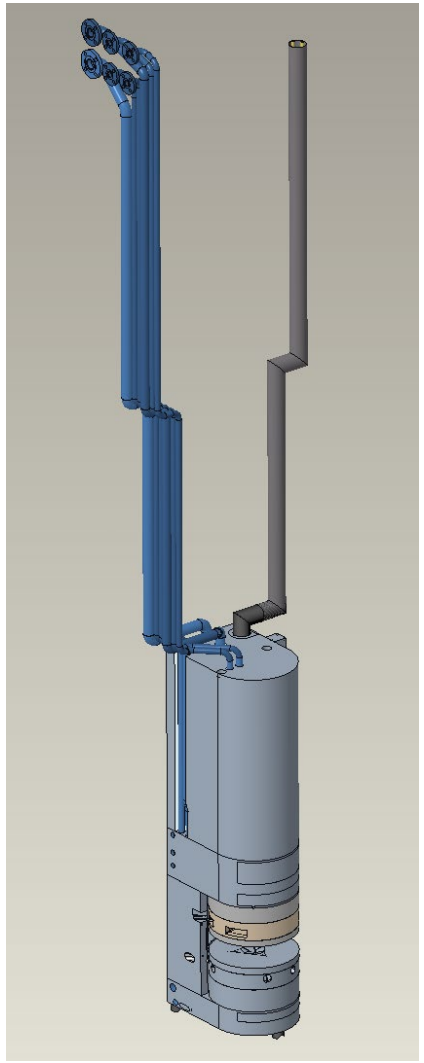
DOE Headquarters (DOE-HQ) has addressed planning for low-level waste (LLW) and mixed low level waste (MLLW). The Record of Decision for the *Department of Energy's Waste Management Program: Treatment and Disposal of Low-Level Waste and Mixed Low-Level Waste; Amendment of the Record of Decision for the Nevada Test Site* was issued February 18, 2000.

- DOE decided to establish regional LLW disposal at two DOE sites: the Hanford Site and the Nevada Test Site (NTS). This decision does not preclude DOE's use of commercial disposal facilities, consistent with current DOE regulations and policies (FR, February 25, 2000).
- DOE decided to establish regional MLLW disposal operations at two DOE sites: the Hanford site and the NTS. Once again, this decision does not preclude DOE's use of commercial disposal facilities, consistent with current DOE regulations and policies (FR, February 25, 2000).

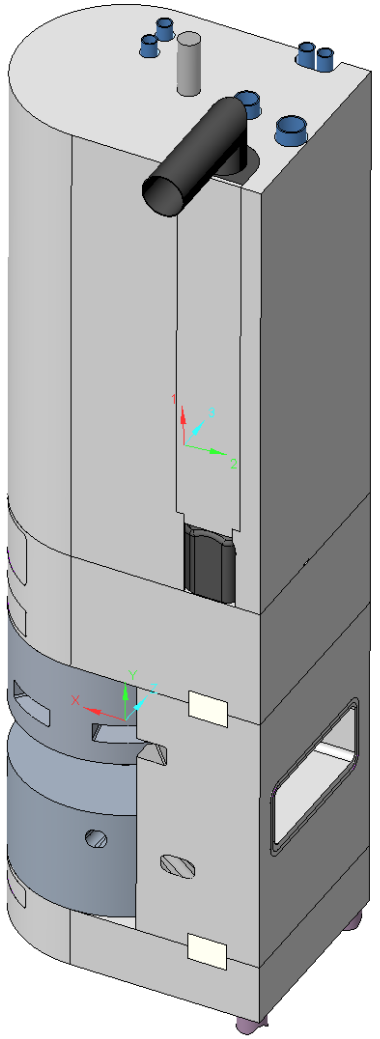
Moderator Reflector Assembly

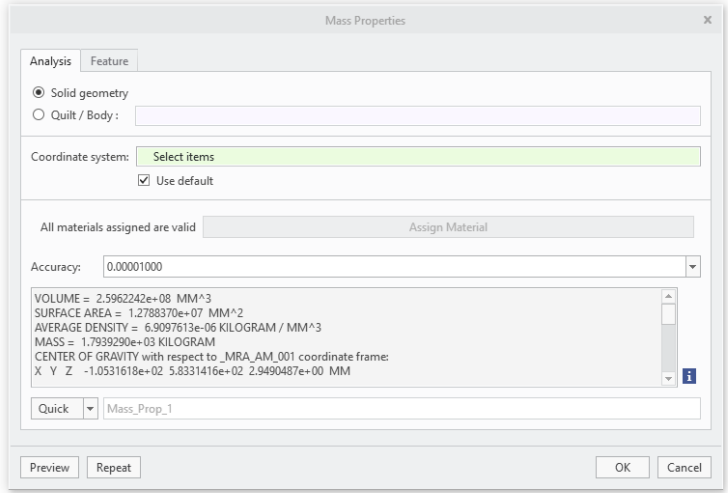
- Description: The MRA is composed of 2 reflector vessel assemblies which are supported by a backbone which supports the vessels and provides shielding. Each reflector vessel assembly features an inner Al 6061-T6 hydrogen vessel, which contains the liquid hydrogen for neutron moderation, supported by titanium pins inside the inner vacuum boundary of the reflector vessel. The outer chamber of each reflector vessel surrounds each beryllium reflector which is cooled by water, which also acts as a neutron premoderator. The backbone is a water cooled 316L stainless steel weldment designed to minimize thermal deflection of the moderators from beam induced heating. Additional shielding is provided by a plated A36 carbon steel shield block which reduces dose rates during MRA removal and installation. All utilities are routed through or recessed into the shield block and backbone and consist of 316L stainless water lines and a hydrogen transfer line with 2 Invar 36 inner lines surrounded by a 316L stainless steel outer vacuum jacket. The MRA has been designed for six years of routine operation prior to replacement.
- Neutronics: MRA and the current proposed packaging liner with appropriate shoring has been evaluated. A radionuclide inventory for one MRA which has been operated for six (6) years followed by six-months decay. The MRA includes a beryllium reflector which has uranium impurities. The respective neutronics calculations include the presence of uranium impurities within the beryllium.

MRA Upper Piping Removed to Reduce Size

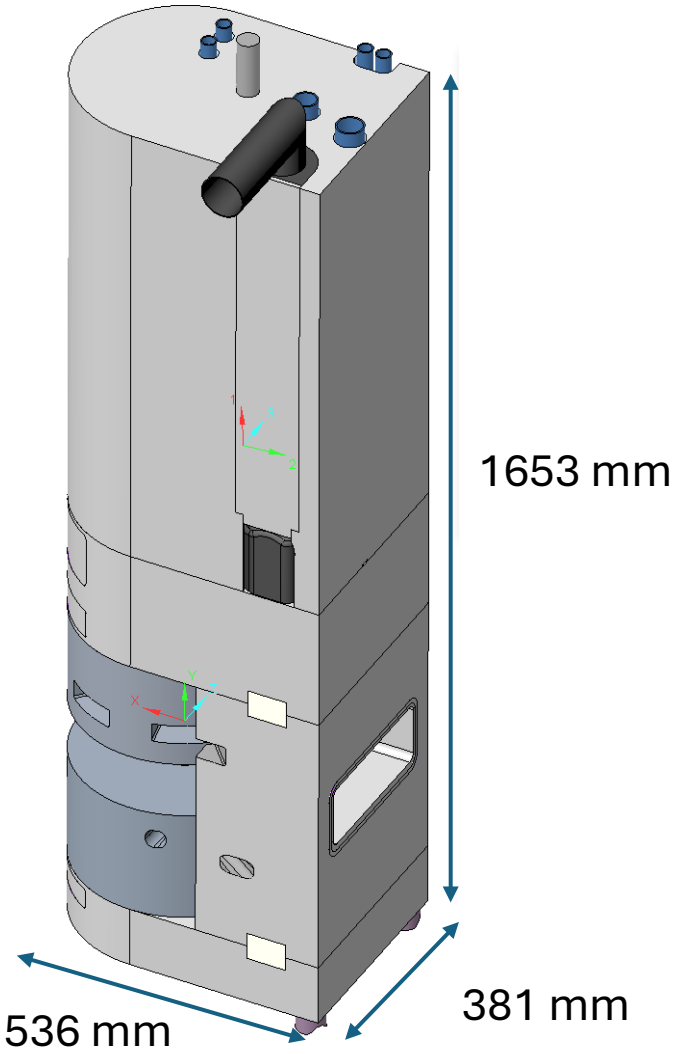


Upper Portions of SS and Invar Piping cut prior to removal from CV





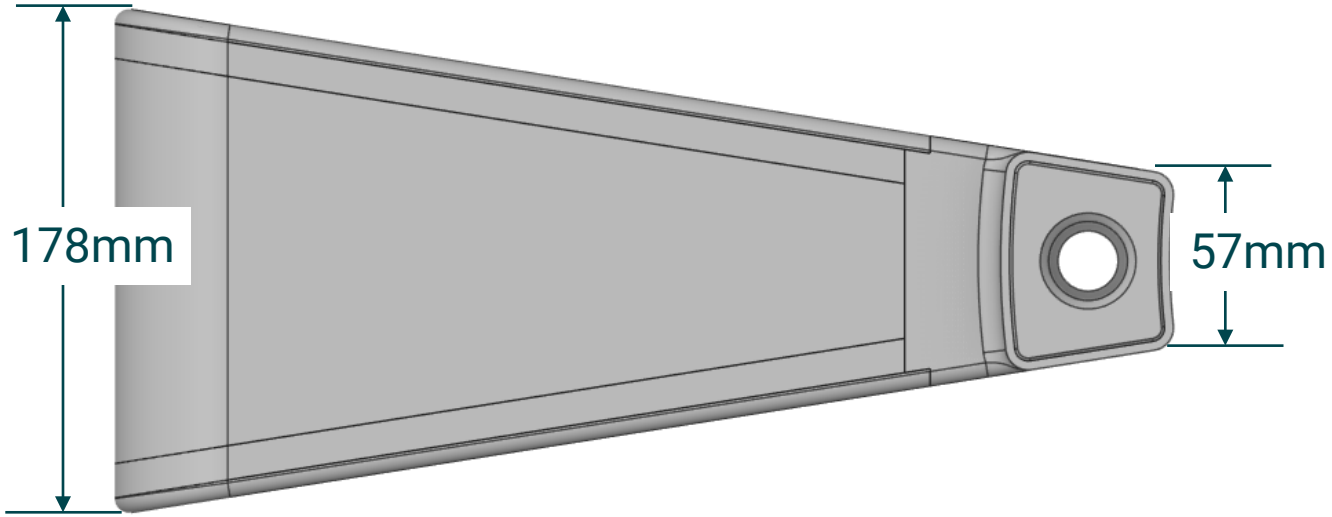
MRA Dimensions and Mass Breakdown

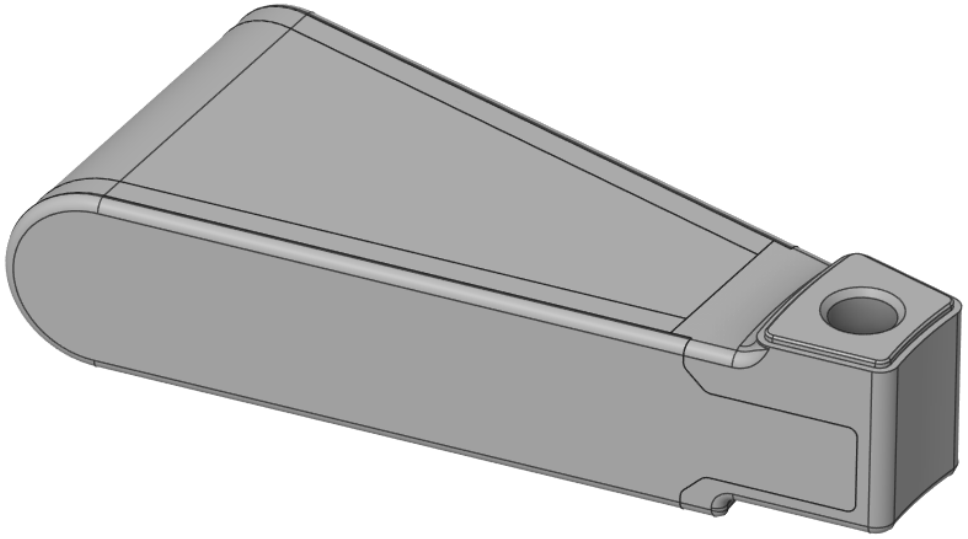


	Mass (kg)
Be	39
Al	38
Invar	2
SS	612
A36 Steel	1103
Total	1794

Target Assembly

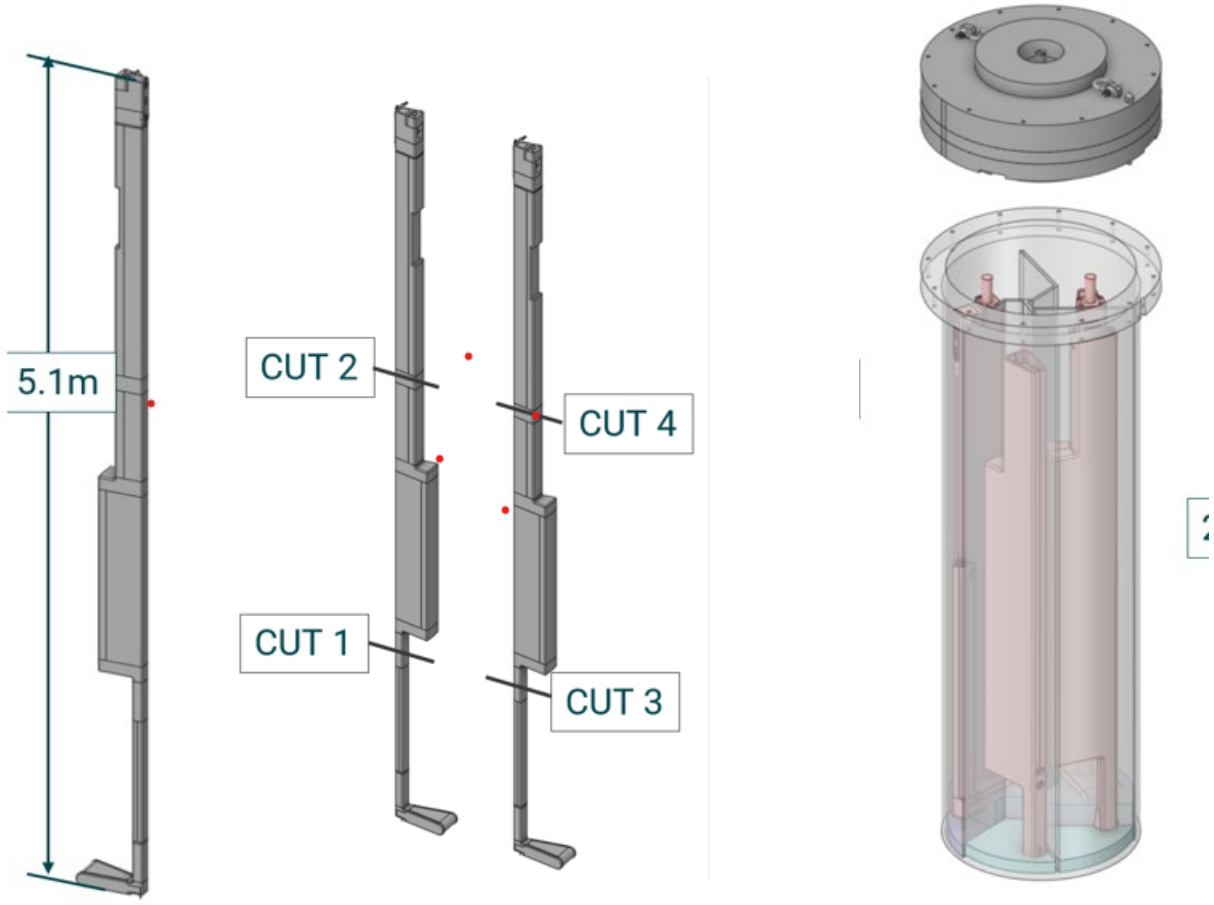
- Description: The solid tungsten/tantalum target segment consists of a top connection interface, stave, and foot. The lowest portion of the target segment, and most crucial to STS operation, is the target foot. The foot is constructed of 4 metals (Tungsten, Tantalum, Inconel, and Stainless Steel). This is the reference point for the moderators and the rest of the STS systems. Tungsten is the spallation material, while tantalum is the malleable interface between the tungsten plates. Inconel resides on the outside surface as a robust covering to contain the tungsten in the extreme conditions caused by the proton pulses. The "heel" portion of the foot is made from an Inconel shell with a stainless-steel core to bond the foot to the stave. The heel is bonded to both the foot and the stave via Electron Beam welding (EB-welding).
- Neutronics: A projected radionuclide inventory for one single target segment which has been operated for ten (10) years followed by one year decay and two target segments with net waste volumes, net waste weights, and proposed liner volumes. For the purposes of disposal, the radionuclide inventory was doubled to address two segments per proposed liner.

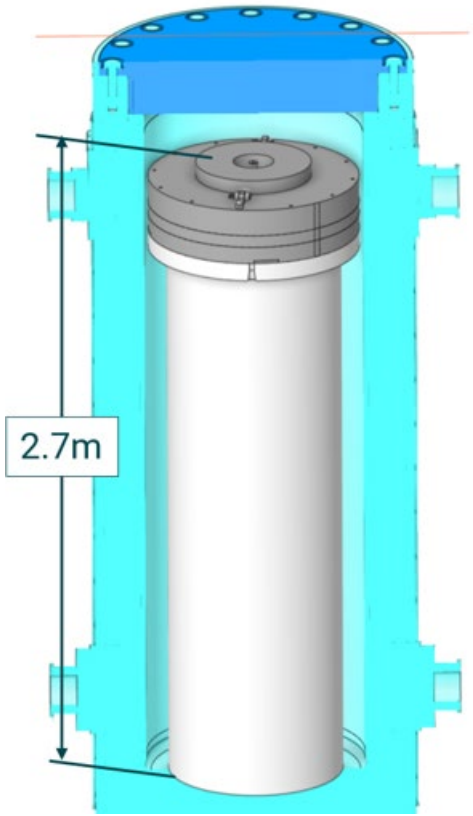

178mm
57mm




375mm
92mm

Target Segment and Conceptual Package





Waste Classification/Hazardous Waste (US EPA)

- Discarded Materials/Solid Wastes

  Is the product capable of being used for its intended purpose?

- Hazardous Waste

  Is the product listed?

  Does the product present a characteristic?

  Does the product contain any of the RCRA 8 (eight) metals? (As, Ba, Cd, Cr, Pb, Hg, Se, or Ag)

  If so, what are the results of Process Knowledge and/or Toxicity Characteristic Leaching Procedure testing?

Waste Classification/Radioactive Waste

US EPA

- US EPA is responsible for developing general environmental standards that apply to both the Department of Energy (DOE)-operated and the U.S. Nuclear Regulatory Commission (NRC)-licensed facilities that use radioactive material.

US NRC

- Radioactive materials at the end of their useful life or in a product that is no longer useful and requires proper disposal.

US DOE

- RADIOACTIVE WASTE. Any garbage, refuse, sludges, and other discarded material, including solid, liquid, semisolid, or contained gaseous material that must be managed for its radioactive content.

Waste Classification

- Discarded Materials
- Solid Wastes
- Hazardous Wastes
- Radioactive Wastes
- Mixed Waste

MRA	Target
Yes	Yes
Yes	Yes
No[1]	Maybe[2]
Yes	Yes
No	Maybe

[1]Invar is 64FeNi (64% iron and 36% nickel).

[2]Inconel718 is nickel-chromium-niobium (possibly cobalt and tantalum).

Conclusion

Based on the current design and description of the Moderator Reflector Assembly and the Target Assembly and the respective neutronics calculations, both components have Paths to Disposal.

Questions