



Supplier Opportunities: Versatile Test Reactor Program

TerraPower is under contract with Idaho National Laboratory (INL) to provide support to develop supplier strategy and qualification of HT9 material and core components for the Versatile Test Reactor (VTR) Program. This task includes seeking and surveying potential suppliers, assessing willingness and capability, providing recommendations on qualification, and collecting budgetary estimates for HT9 material and component supply.

TerraPower is part of a team under contract with Idaho National Laboratory to support development of a new fast spectrum neutron irradiation test facility. The focus of this effort is to develop a Versatile Test Reactor (VTR) design concept adequately to support generation of a high-confidence cost estimate and schedule that would inform a Department of Energy (DOE) decision on whether to proceed. Pending approval to proceed with final design and construction, a nominal 300 MWth sodium-cooled fast test reactor would be built to supply the fast neutron irradiation capability by 2026. To meet the aggressive timeline for establishing the fast neutron capability, it is necessary to base design work on existing mature sodium-cooled fast reactor design approaches and also to begin key (controlling path) efforts such as the core and fuel supply chain. Additional overview information can be found at the INL website - <https://inl.gov/trending-topic/versatile-test-reactor/>.

Initial scoping design efforts have identified some aspects of the core configuration and materials. VTR core assemblies are comprised of hexagonally-shaped tubular SS components (ducts) measuring 11.7 cm flat-to-flat and approximately 366 cm long. The fuel assemblies each contain a bundle of 217 fuel pins clad with a 6.25 mm OD thin-walled SS tube approximately 165 cm long. The fuel pin cladding tubes are each sealed with lower and upper end hardware and helically wrapped with a small-diameter SS wire. The ducts, cladding, end hardware, and wire are currently assumed to be made up of HT9.

The following announcement provides a summary of certain supplier opportunities related to potential development and production of core structural materials (i.e. stainless steels) and derivative components to support the Versatile Test Reactor (VTR) Program. This is an initial list of opportunities related to these components, and will be updated periodically. It is envisioned that multiple suppliers will eventually form the supply chain of core materials and components.

Quality requirements for the development of these materials and components will be appropriate to the phase of work being conducted. However, final production will invoke quality requirements applicable to the safety classification of the product; as such, work will need to be performed under a quality program consistent with nuclear reactor applications.

To be considered as a potential supplier for any opportunities listed below:

Please complete the registration form at <http://www.terrapower.com/suppliers> to share information about your company's capabilities with us. Suppliers are requested to respond by registering with available information on or before **November 15, 2019**.

HT9 Material

TerraPower is seeking expressions of interest from potential suppliers for the development and supply of HT9 stainless steel material. HT9 is a ferritic-martensitic stainless steel meeting ASTM A831 grade UNS42100. Product forms required for the UNS42100 will include round bloom/billet, bar, rod, and wire, as well as cold rolled plate. Approximately, 120 tons of HT9 will be required for the initial supply. For reference, approximately 75 tons of material are required for manufacture of the first core load of core assembly ducts in addition to approximately 2 tons for fuel cladding. Delivery for the initial supply may start within 4 to 6 years from the present date. Subsequent annual supply will require approximately 5 to 26 tons.

The specification for the UNS42100 will be provided by TerraPower, based on supplier-specific non-disclosure agreements. Qualification and demonstration of production readiness of the material supply will be necessary and, thus, development work is expected.

Cladding Tube

TerraPower is seeking expressions of interest from potential suppliers for the development and supply of cladding tube to support the Versatile Test Reactor program. Approximately 17,000 cladding tubes are required for the initial supply, with potential delivery needs starting within 4 to 6 years from the present date. Annual supply quantities of approximately 3000 to 15000 tubes will be required after the initial supply. Qualification and demonstration of production readiness of the cladding tube supply will be necessary and, thus, development work is expected.

The cladding tubes are to be seamless and made from UNS42100 ferritic-martensitic stainless steel material. The starting material will be required to meet a specification provided by TerraPower.

The following is a representative image of TerraPower HT9 cladding tube:



Strict dimensional and tolerance requirements for the tube diameter, wall thickness, and straightness will be required. Multiple cladding tube sizes are needed for the various core components. The principal quantity of tubes has an outer diameter of approximately 6.25 mm and a length of approximately 165 cm. Other cladding tube sizes, while being needed in much smaller quantities, have larger diameter and wall thickness dimensions. The finished cladding tubes will be required to meet a specification provided by TerraPower.

A normalization and temper heat treatment process is required for the final product. To accomplish this heat treatment, equipment for bright hydrogen and vacuum furnace annealing or inert gas furnace annealing is necessary that is capable of handling the product size and quantities. Furthermore, the finished tubes are required to be examined for defects by ultrasonic testing (UT) in accordance with ASTM Practice E213.

Duct Tube

TerraPower is seeking expressions of interest from potential suppliers for the development and commercial supply of duct tube to support the Versatile Test Reactor program. Approximately 300 duct tubes are required for the initial supply, with potential delivery needs starting within 4 to 6 years from the present date. Annual supply quantities of approximately 15 to 70 tubes will be required after the initial supply. Qualification and demonstration of production readiness of the duct tube supply will be necessary and, thus, development work is expected.

The duct tubes are to be seamless, hexagonal in cross section, and made from UNS42100 ferritic-martensitic stainless steel material. The starting material will be required to meet a specification provided by TerraPower.

The following is a representative image of TerraPower HT9 duct tube:



Strict dimensional and tolerance requirements for the tube hexagonal profile, wall thickness, and straightness will be required. The duct tube has an outer dimension of approximately 11.7 cm and a length of approximately 366 cm. The finished ducts will be required to meet a specification provided by TerraPower.

A normalization and temper heat treatment process is required for the final product. To accomplish this heat treatment, equipment for vacuum furnace annealing is necessary that is capable of handling the product size and quantities.

Wire

TerraPower is seeking expressions of interest from potential suppliers for the development and supply of wire to support the Versatile Test Reactor program. Approximately 0.2 tons (100,000 ft.) of wire are required for the initial supply, with potential delivery needs starting within 4 to 6

years from the present date. Annual reload quantities of approximately 14,000 to 76,000 ft. per year of wire will be required after the initial supply. To simplify procurement and reduce cost, the wire could be purchased to support many years of demands. Qualification and demonstration of production readiness of the wire supply will be necessary and, thus, development work is expected. Strict dimensional and tolerance requirements for the wire diameter will be required. Multiple wire sizes may be needed for the various core components. The principal quantity of wire has a diameter of approximately 1 mm. The finished wire will be required to meet a specification provided by TerraPower.