Proposed Action

The Department of Energy's (DOE's) Proposed Action consists of authorizing the expenditure of federal funding by TerraPower, LLC (TerraPower) to support the construction and operation of the Sodium Test and Fill Facility (TFF).

The Natrium™ reactor, a TerraPower and General Electric-Hitachi technology, is a pool-type reactor which uses liquid sodium as the coolant instead of water. To increase the technical readiness level of the design of the Natrium™ reactor, functional and qualification tests of various equipment will be conducted in simulated environmental conditions that are expected during normal operation of a plant utilizing the Natrium technology.

The TFF would receive, sample, process, store, and deliver liquid sodium to areas where component tests are performed as well as the planned Kemmerer Unit 1. The TFF would be a non-nuclear industrial facility that would at no time have radioactive material, contain no nuclear safety related systems, and be classified as a non-safety related (NSR) commercial structure. The research from the TFF would serve the sodium reactor community at large as the technology continues to grow and be adopted around the world. The TFF would serve three main missions: (1) to support prototype scale sodium testing/qualification for the Natrium™ Demonstration Plant, (2) advance technologies for future Natrium™ style reactors, and (3) provide the initial sodium fill for the first Natrium™ Demonstration Plant, a GE-Hitachi technology.

Project Location

The land on which the TFF would be built is owned by TerraPower. The TFF would be located on approximately 35 acres in a portion of Sections 19 and 20, Township 20 North, Range 116 West, P.M, Lincoln County, Wyoming in the vicinity of Kemmerer.

Construction

The proposed project would consist of the construction, operation, and the eventual decommissioning of the TFF and supporting infrastructure. The construction phase of the TFF would include a peak workforce of approximately 120 – 150 people and is estimated to take roughly 29-35 months to complete. All work would be done in accordance with local, state, and federal regulations and permits and be completed with approved Best Management Practices (BMPs) in place to ensure proper environmental protection. Throughout construction water would be used for dust suppression per permit requirements and site plans.

Construction Sequence

The anticipated construction sequence for the TFF would be as follows:

- Setting up the site – Setting up items such as field trailers, temporary fencing, laydown areas, chemical storage areas, temporary power, sanitation, and snow removal.
- Earthworks – Approximately 12 acres of site clearing, setting up erosion controls and environmental protection, setting up areas for removed material to be safely stored for the drilled shafts.
- Drilled shafts and liners – Eight vertically-oriented, cylindrical, sub-surface shafts (ranging from approximately 10 to 31 feet (ft) in diameter) would be drilled in the area located under the metal building to be installed later (described below). Each shaft would have an associated liner that would be installed post drilling.
- Rectangular drilled shaft pit – An approximately 60 ft by 70 ft rectangular pit located above the 31 ft drilled shaft would be excavated.

- Earthworks – Continuation of site clearing an approximately an additional 12 acres would be cleared and grubbed), installing a water retention basin, culvert, storm drains, duct banks plus any additional cutting and/or backfill.
- Building foundations (internal) –A reinforced concrete foundation would be poured prior to erection of the pre-engineered metal building (described below). During the erection of the building, and before the roof is installed, an overhead bridge crane would be installed (and used for subsequent construction activities).
- Metal building – A pre-engineered metal building would be erected over the top of the previously poured building foundations. The building would comprise of a structural steel frame and external insulated siding panels.
- Internal Mechanical, Electrical and Piping – All internal components would be set and fully installed. Examples include tanks, heaters, electrical panels, Heating, Ventilation, and Air Conditioning (HVAC) equipment, piping, and insulation.
- External equipment foundations – Reinforced concrete pads would be installed prior to placement of electrical and mechanical equipment and tanks to be installed outside of the metal building.
- External Mechanical, Electrical, and Piping – All external components to be installed outside the metal building would be set on the respective equipment pad(s) and fully installed. Examples include backup diesel generator, tanks, HVAC equipment, piping, tanks, and piping racks.
- Office and control trailer – Reinforced concrete foundation would be installed and, subsequently, setting a prefabricated office trailer would be placed and anchored to the foundation and/or ground.
- Final earthworks – Final grading, paving, and fencing would be installed.
- Construction testing – Assurance that all installed components are in appropriate working condition.

Entrance Road

Access to the TFF property would be from a proposed intersection constructed on U.S. Highway 189 (U.S. 189), south of County Road (C.R.) 325 (Skull Point Road), and north of the Bureau of Land Management (BLM) intersection at the road to Blazon Gap. The proposed intersection is anticipated to be located between 1,300 ft and 2,000 ft south of C.R. 325.

TerraPower has begun discussions with Wyoming Department of Transportation (WYDOT) on the preliminary design of the proposed intersection. The final intersection design would be based on a WYDOT approved Traffic Impact Study, performed in accordance with the WYDOT Traffic Program Access Manual.

The intersection concept (located on the east side of the U.S. 189, Right of Way) includes:

- Four lanes to and from the project area,
- A left turn lane for travel onto U.S. 189 southbound,
- Wider turn radii to accommodate the TFF vehicular traffic (to and from the site), and
- Cattle guard(s).

The intersection concept (located in the U.S. Highway right of way) includes the following improvements to U.S. 189 in order to safely accommodate the additional TFF vehicular traffic:

- The addition of a left turn lane (out of the project area) and corresponding acceleration lane to U.S. 189 southbound,
- An additional acceleration lane (out of the project area) to U.S. 189 northbound, and

- A deceleration lane located on the northbound lane (to the project area) from U.S. 189.

The anticipated area of disturbance for the intersection improvements would be within approximately 1,400 ft of the centerline of the intersection, for a total length of approximately 2,800 ft, and an extended width which would remain within the WYDOT Right of Way (ROW) limits. The anticipated area of disturbance would not be located within the identified cultural and archaeological sites, in accordance with the WYDOT "Standard Specifications for Road and Bridge Construction", Section 112. The anticipated area of disturbance for the access road to the project area, located within the site property, would be within approximately 100 ft on either side of the centerline of the access road.

At peak construction for TFF 30-50 trips for shipments of construction materials, and 120-150 personnel vehicle trips per day is anticipated.

Project Facilities and Components

Outside Equipment Area

This area would contain the following components:

- Backup diesel generator and associated skid and concrete pad.
- Cryogenic liquid argon storage (estimated 2,000 gal)
- Cryogenic liquid nitrogen storage (estimated 2,000 gal)
- Any outdoor electrical power supply equipment necessary for the TFF to receive offsite power and power from the backup diesel generator.
- A new service drop (utility pole) would be placed on the East side of U.S. 189. This service would be a three Phase 25 kV and include a junction to support construction power to the TFF.
- HVAC equipment.
- Sodium to Air (Dump) Heat Exchanger (ADHX).
- Water Storage Tanks (deionized and wastewater, 20,000 gallons each).

Office and Control Trailer

The Office and Control Trailer would be, approximately, a 60 ft by 72 ft prefabricated modular trailer complex to be used as administrative offices for the personnel working at the TFF. The Office and Control Trailer would include workspace accommodation (offices, desks, and workspaces) for testing and support personnel, conference room(s), infrastructure, restrooms, and a break room. The trailer would have self-contained sanitary systems to be serviced by an outside licensed vendor. An outside vendor would also supply water (containerized). No water or sewer hook ups are planned.

Sodium Test Building

The sodium test building would be a pre-engineered metal building approximately 125 ft by 220 ft and approximately 108 ft tall at the highest point. The metal building would be a traditional steel building structure that would include a steel roof deck covered with an insulated membrane roofing system with gutters and downspouts. The TFF Sodium Test Building provides an enclosed, climate-controlled facility sized to accommodate equipment testing. The steel lined shafts housing the sodium test tanks and apparatus would reside in this building. The floor would be a reinforced concrete mat foundation. Equipment platforms would be provided where needed for access to equipment and to provide adequate personnel protection.

Outside Sodium Storage Area

This area would contain the following components:

- External sodium storage tank used for filling operations,
- Pump and sodium cleanup filter skid, and

- Cover gas treatment equipment servicing the external sodium storage tank.

Operation

The TFF would perform ongoing testing to increase the Technology Readiness Level (TRL) of select systems and components planned to be used in the design and operation of new advanced reactor plants using the sodium fast reactor (SFR) environment technology. Additionally test data would inform safety assessments as well as support equipment qualification programs. The TFF would be used to advance the following Natrium™ technologies which support the development of SFRs:

- Fuel handling equipment, including the In-vessel Transfer Machine (IVTM),
- Control Rod Drive Mechanism (CRDM),
- Primary Sodium Pump (mechanical pump) (PSP),
- Compact Heat Exchanger development,
- Electro-mechanical pump development,
- Novel waste disposal techniques (no radiological material is to be used),
- Training for sodium handling and operations, and
- Mobile Fill System.

The TFF would test full-scale test pieces and perform its testing function prior to and during operation of Kemmerer Unit 1, the first application of the Natrium™ Demonstration Plant. The TFF would be capable of operating throughout the expected component test duration without interruption during normal operation. There are expected to be 20-30 permanent employees working and maintenance activities would occur as necessary throughout the life of the TFF.

The sodium used in the TFF would be from a yet to be determined, established industry source, and transported via trucks within the US. The sodium transportation and delivery to the TFF would be accomplished by using 20 metric ton International Organization for Standardization (ISO) shipping containers. There would be an estimated 115-130 shipping containers received. The sodium would be loaded in molten, liquid form into the road certified shipping containers, then solidified for transport under an Argon cover gas for safe transportation. The certified shipping container and Argon cover gas combination ensures a safe transport system that prevents sodium from coming into contact and reacting with oxygen or moisture in the environment (CAMEO 2023).

When the sodium container reaches the facility, it would be pulled into a loading dock that has specialized equipment for receipt of sodium. A set of heating coils inside the ISO container enable an applicable heat transfer oil to be passed through and the sodium safely melted. This process would take about 18 hours. Once molten, additional argon would be pumped into the container pushing the sodium into a holding tank. Once a sample has been chemically tested by a qualified vendor for purity, the sodium would be pumped through a filter. The sodium would be stored in a large external tank of approximately 400,000 gallons until enough is stored for sodium fill operations of Kemmerer Unit 1.

During operations, the TFF would have water holding tank for water used for purposes other than drinking. There would be no direct utility connections. After large component testing is completed, the equipment would be cleaned using standard sodium cleaning operations. All supply water and wastewater would be stored in the external tanks with fill/removal service provided by vendors.

Decommissioning

The TFF would be expected to operate for approximately 20 years with the possibility of extensions to be determined at a later time. Decommissioning would take place under a defined decommissioning plan with appropriate BMPs to complete the work. General steps for decommissioning the TFF may include, but are not limited to:

- Temporary storage areas for dismantled components and material for recycling, disposal, or sale would be established.
- Sodium contaminated equipment would be cleaned, disposed of, or both per regulatory guidelines.
- Any chemicals remaining on site would be reused at other facilities, sold, or disposed of following applicable regulatory guidelines.
- On site access roads, building foundations, and subsurface features no longer needed would be removed and restored if not desired by future landowners.
- Disturbed areas would be restored to original grade.

References

(CAMEO 2023) U.S. EPA and the National Oceanic and Atmospheric Administration's Office of Response and Restoration, *Computer-Aided Management of Emergency Operations (CAMEO),* including USGS CHRIS Code Datasheet for Sodium. Available from: https://cameochemicals.noaa.gov/, CAMEO Chemicals version 2.8.0 rev 1, Accessed May 15, 2023.