Four designs being evaluated for TVA's Clinch River nuclear project in Tennessee

The plan covers at least two SMRs with a maximum rated thermal power per unit of 800 MWt

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The U.S. Nuclear Regulatory Commission will post in the June 23 Federal Register a notice about a May 12 application by the Tennessee Valley Authority (TVA) for an early site permit (ESP) for the Clinch River Nuclear Site located in Oak Ridge, Tennessee.

An applicant is allowed to seek an ESP separate from the filing of an application for a construction permit (CP) or combined license (COL) for a nuclear power facility. The ESP process allows resolution of issues relating to siting. At any time during the period of an ESP (up to 20 years), the permit holder may reference the permit in an application for a CP or COL.

The Clinch River Nuclear (CRN) Site comprises approximately 935 acres of land adjacent to the Clinch River arm of the Watts Bar Reservoir. The CRN Site is the location of the former Clinch River Breeder Reactor Project.

TVA has not selected a reactor technology to be constructed at the CRN Site. Instead, a set of bounding plant parameter values has been identified, based upon the available information from various light-water-cooled, small modular reactor (SMR) designs. This set of bounding values, referred to as the plant parameter envelope (PPE), provides the basis for future site development at the CRN Site. The PPE is based on construction and operation at the CRN Site of two or more SMRs with a maximum rated thermal power for a single unit of 800 MWt. The combined nuclear generating capacity from the site is not to exceed 2420 MWt (800 MWe). Because a specific reactor technology has not been selected, an area, referred to as the “power block area,” has been proposed as the location of the reactor modules on the site.

TVA identified in the application these contractors that it is working with on this project: **BWX Technologies Inc.** - TVA has a contract with BWX Technologies (BWXT) to provide technical information to TVA in support of the ESP Application (ESPA). **Generation mPower LLC** - BWXT has contracted Generation mPower (GmP) to manage development of portions of the ESPA. **Bechtel Power Corp.** - Bechtel Power assisted in developing portions of the Site Safety Analysis Report (SSAR) and conducted various analyses and investigations, including: geotechnical field investigations, with contracted support from **Amec Foster Wheeler**; identification and characterization of seismic source zones, with contracted support from **Lettis Consultants International**; and determination of site-specific distribution coefficients, with contracted support from **Argonne National Laboratory**.

Contractual relationships were established between TVA and specialized consulting firms to assist in preparation of the ESPA for the CRN Site: **Barge Waggoner Sumner & Cannon Inc.** - TVA contracted Barge Waggoner Sumner & Cannon to perform evaluations and studies in the area of hydrology. **Enercon Services Inc.** - TVA contracted Enercon Services to prepare portions of the SSAR related to demography and meteorology and to develop the Emergency Plans. **AECOM Technical Services Inc.** - TVA contracted AECOM Technical Services to perform a portion of the seismic analyses.
Four conceptual, light-water cooled, small modular reactor (SMR) designs were used to create a “surrogate plant” and to develop the site-related design parameter values. These reactor designs are: BWXT mPower (Generation mPower LLC design); NuScale (NuScale Power LLC design); SMR-160 (Holtec SMR LLC design); and Westinghouse SMR (Westinghouse Electric Co. LLC design).

All four designs are described as passively safe with minimal or no reliance on offsite power, offsite water, or operator action for safety. Based on design features, these designs eliminate various conventional design basis events (e.g., large-break LOCAs precluded by elimination of large bore piping). All but the SMR-160 are integral pressurized water reactors (iPWRs); that is, pressurized water reactor (PWR) designs in which the primary coolant system and all (or most) of its components (i.e., pressurizer, steam generators, and reactor coolant pumps, where applicable) are enclosed in one pressure vessel. The BWXT mPower SMR is an advanced iPWR that generates 530 MWt, with an estimated power output of 180 MWe. The mPower reactor uses standard PWR fuel with a shorter fuel assembly length. The iPWR is located in a below-grade containment. The mPower SMR is designed to be built in multiples of two reactors per plant, and up to two plants (four reactors) would be placed on the CRN Site. The NuScale SMR is an advanced iPWR that generates 160 MWt, with an estimated power output of 50 MWe. The NuScale SMR uses standard light water reactor fuel with a shorter fuel assembly length. The reactor sits within a containment vessel, and up to 12 reactors can be housed in one below-grade shared pool. The NuScale SMR is a multi-unit configuration that is designed to include up to 12 reactors per plant, and up to 12 reactors would be placed on the CRN Site. The Holtec Inherently-Safe Modular Underground Reactor (HI-SMURTM) SMR-160 is an advanced pressurized water reactor design that generates 525 MWt, with an estimated power output of 160 MWe. This reactor design does not use standard fuel. Instead, it uses a unitary cartridge containing all fuel that is replaced entirely each refueling. The reactor, steam generator, and spent fuel pool are located inside the containment structure. The reactor core is located below grade. Each unit is built as a stand-alone plant, and up to four SMR-160 reactors would be placed on the CRN Site. The Westinghouse SMR is an advanced iPWR that generates 800 MWt, with an estimated power output of 225 MWe. It uses standard PWR fuel, with a shorter fuel assembly length. The iPWR vessel is housed in a containment located below grade. Each unit is built as a stand-alone plant, and up to three Westinghouse SMRs would be placed on the CRN Site.

ABOUT THE AUTHOR

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