Clinch River Nuclear Site

Early Site Permit Application

Part 1

Administrative Information

Revision 0

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ACRONYMS AND ABBREVIATIONS

CEO	Chief Executive Officer
CFR	Code of Federal Regulations
COL	Combined License
CRN	Clinch River Nuclear
EPZ	Emergency Planning Zones
ER	Environmental Report
ERO	Emergency Response Organization
ESP	Early Site Permit
ESPA	Early Site Permit Application
FEMA	Federal Emergency Management Agency
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
PPE	Plant Parameter Envelope
SMR	Small Modular Reactor
SSAR	Site Safety Analysis Report
TVA	Tennessee Valley Authority

1.0 INTRODUCTION AND PURPOSE

1.1 Introduction

The Tennessee Valley Authority (TVA) hereby submits this application for an Early Site Permit (ESP) for small modular reactor (SMR) units at the Clinch River Nuclear (CRN) Site. The application for this ESP is submitted in accordance with Title 10 of the Code of Federal Regulations (CFR), Part 52 (10 CFR 52), Subpart A, Early Site Permits. TVA is the Applicant for this ESP and is hereinafter referred to as TVA or Applicant. The Applicant requests that the Nuclear Regulatory Commission (NRC) issue an ESP for the CRN Site described in this application for a period of 20 years from the date of issuance. The information in this application has been developed to support the issuance of that permit.

The CRN Site selected by TVA is a tract of land adjacent to the Clinch River arm of the Watts Bar Reservoir, located west of the Oak Ridge Reservation, within the City of Oak Ridge, Tennessee. The CRN Site is approximately 935 acres within a 1200 acre property owned by the United States of America and managed by TVA. The address of the site is 1300 Bear Creek Road, Oak Ridge, Roane County, Tennessee 37830. Part 2, Chapter 1, of this ESP application (ESPA) provides a more detailed description of the CRN Site.

This ESPA was developed using the Plant Parameter Envelope (PPE) approach. Technical information from various SMR reactor designs was used to develop bounding parameters that are intended to envelop the proposed facility characterization necessary to evaluate the suitability of the site for future construction and operation of a nuclear power plant. This provides the NRC with information to assess the suitability of the CRN Site for SMRs and allows TVA to choose the best technology if and when a decision is made to build. The information presented in this application supports the issuance of an ESP.

1.2 Purpose of an Early Site Permit Application

10 CFR 52 allows an applicant to obtain approval of a site for a nuclear power plant, prior to a decision to construct. 10 CFR 52.13 states the ESP applies when “any person who may apply for a construction permit under 10 CFR Part 50, or for a combined license under this part seeks an early site permit from the Commission separately from an application for a construction permit or a combined license.”

Large expenditures of an applicant’s time and money were necessary with the former licensing process well before key environmental, site safety, and emergency planning issues could be resolved. The purpose of an ESP is to allow for the resolution of key environmental, site safety and emergency planning issues well before the decision to build a nuclear facility and before substantial capital is invested in the construction of a new nuclear facility.

Environmental issues, site safety issues, and particular aspects of emergency preparedness are addressed as part of the ESP process. In those instances where the ESP applicant has not selected a particular reactor technology, the applicant may utilize the PPE approach as a surrogate for facility information to support required safety and environmental reviews. Under the PPE approach, the resulting ESP is applicable for a range of reactor designs.

In order for the NRC to grant an ESP to TVA for the CRN Site, TVA must demonstrate that a nuclear reactor or reactors with characteristics that fall within the site parameters can be constructed and operated on the site without undue risk to the health and safety of the public. The CRN Site ESPA was prepared in accordance with 10 CFR 52, *Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants.*

1.3 Contact Information

Any notices, questions, or correspondence in connection with this filing should be directed to:

Joseph P. Grimes, Jr.
Executive Vice President & Chief Nuclear Officer
Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402

David M. Czufin
Senior Vice President, Engineering & Operations Services
Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402

Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402

Daniel P. Stout
Senior Manager, Small Modular Reactors
Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402

2.0 EARLY SITE PERMIT APPLICATION FORMAT AND CONTENT

2.1 Format and Content

This application contains the information required by 10 CFR 52.17, *Contents of Applications,* for an ESP, and is submitted in accordance with NRC guidance on electronic submittals.

Multiple sources were consulted in the writing of this application, and these references are presented in separate reference lists contained in the application documents. However, the inclusion of references in these lists does not imply adherence to all criteria or guidance stated in each individual reference. The multiple reports and plans required for the ESPA were developed in accordance with applicable regulatory requirements and with consideration to available NRC guidance documents.

Part 1—Administrative Information

The Administrative Information section contains an overview of the ESPA, a general description of the format and content of the application, and corporate information as required by 10 CFR 50.33(a) through (d) including ownership, management, and boards of directors.

Part 2—Site Safety Analysis Report (SSAR)

The SSAR includes a discussion on the site description, safety assessment, quality assurance, general location of the CRN Site, site suitability, design parameters postulated for the CRN Site, population profiles and an assessment of site features that might affect the design chosen for the facility. The SSAR complies with the applicable portions of 10 CFR 52.17(a)(1). It contains a description and safety assessment of the proposed site and any aspect of the proposed plant that affects the site and can contribute to radiological consequence. The suitability of the site in relation to 10 CFR 100 is also described in the SSAR.

Regarding the description of the facilities for which the proposed site may be used, a particular reactor design has not been selected for construction at the CRN Site. In order to provide sufficient design information to enable the NRC to determine that the proposed site is suitable for nuclear reactor units, a surrogate design has been provided as part of the application. The surrogate plant is a set of bounding parameters, the PPE. The combination of PPE values and site characteristics that form the licensing basis for NRC's issuance of an ESP are identified in Section 2.0 of the SSAR.

The SSAR also discusses the capability of the facilities to withstand the natural and man-made environmental hazards of the site. The emergency preparedness information includes an assessment of any impediments to implementing an emergency plan at the CRN Site, as required by 10 CFR 52.17(b)(1). The quality assurance program under which ESP-related activities were performed is also provided.

Where practical, the SSAR section numbers correspond to the section numbers identified in NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition*. Consistent with that guidance, there are some intentional gaps in the numbering sequence. This approach is intended to facilitate subsequent integration of the information from this ESPA into a construction permit application or a combined license (COL) application, in which the complete numbering sequence is used.

The regulatory bases for the SSAR include:

- NRC Regulations—10 CFR 50, 10 CFR 52, and 10 CFR 100

- NRC Regulatory Guide 1.70, *Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants*
- NUREG-0800
- NRC Regulatory Guide 1.206, *Combined License Applications for Nuclear Power Plants (LWR Edition)*
- RS-002, *Processing Applications for Early Site Permits*

The following briefly describes the individual chapters of the SSAR:

- Chapter 1, *Introduction and Description of Proposed Facility*, includes an overview of the site.
- Chapter 2, *Site Characteristics*, includes geography and demography; nearby industrial, transportation and military facilities; meteorology; hydrologic engineering; geology, seismology and geotechnical engineering; and the PPE.
- Chapter 3, *Design of Structures, Components, Equipment and Systems*, contains a summary of the aircraft hazards analysis performed in Chapter 2.
- Chapter 11, *Radioactive Waste Management*, includes information on liquid and gaseous radioactive releases.
- Chapter 13, *Conduct of Operations*, includes an overview of emergency planning for the site and surrounding area in case of plant accidents and of the physical security provided for the site and plant sensitive areas.
- Chapter 15, *Transient and Accident Analyses*, includes a discussion of radiological consequence of bounding plant accidents and conformance with applicable 10 CFR 100, *Reactor Site Criteria* for the reactor technologies being considered.
- Chapter 17, *Quality Assurance*, includes the quality assurance program under which the ESPA was prepared.

Part 3—Environmental Report (ER)

The ER provides information required by 10 CFR 52.17(a)(2), using guidance provided by NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan*. The ER addresses the environmental impacts associated with the construction and operation of new SMRs.

The ER discusses the existing environment surrounding the site and in the vicinity of the site; postulates environmental impacts of construction and operation, and considers appropriate mitigation measures; reviews the impacts of design basis and severe accidents; and reviews alternative sites. This ER does not assess impacts based on a specific facility design, nor does it postulate specific costs and benefits associated with construction or operation of any one design option; rather, the ER considers bounding conditions of the surrogate plant.

The ER evaluates:

- The functional and operational needs of the facility as they relate to the site's natural and environmental resources; and
- The impact of the facility on the site's natural and environmental resources.

The regulatory bases for the ER include consideration of the following:

- National Environmental Policy Act,
- NRC Regulations—10 CFR 51 and 10 CFR 52,
- NRC Regulatory Guide 4.2, *Preparation of Environmental Reports for Nuclear Power Stations,*
- NRC Regulatory Guide 4.7, *General Site Suitability Criteria for Nuclear Power Stations,*
- NUREG-1555,

- Federal, regional, state and local environmental statutes, as applicable, and
- RS-002, *Processing Applications for Early Site Permits.*

The following briefly describes sections of the ER:

- Chapter 1, *Introduction to the Environmental Report*, includes a discussion of the Applicant's purpose for requesting the permit.
- Chapter 2, *Environmental Description*, examines the existing use of the site and describes the current surrounding physical environment along with the existing socioeconomic, demographic, historic, and community characteristics.
- Chapter 3, *Plant Description*, describes the proposed facility considered for the CRN Site and the PPE.
- Chapter 4, *Environmental Impacts of Construction*, describes the potential impacts on the surrounding environment of constructing a new nuclear plant at the CRN Site.
- Chapter 5, *Environmental Impacts of Station Operation*, describes the potential impacts of operating a new nuclear plant at the CRN Site.
- Chapter 6, *Environmental Measurements and Monitoring Programs*, describes the programs that will be used to monitor the environmental impacts of the construction and operation of a new nuclear plant at the CRN Site.
- Chapter 7, *Environmental Impacts of Postulated Accidents Involving Radioactive Materials*, describes the potential radiological consequences associated with operating a nuclear power facility at the CRN Site due to postulated accidents.
- Chapter 8, *Need for Power*, notes that an assessment of the power needs is not included in the application.
- Chapter 9, *Alternatives to the Proposed Action*, reviews potential alternatives (including alternative energy sources and sites) to constructing and operating a new nuclear plant at the CRN Site.
- Chapter 10, *Environmental Consequences of the Proposed Action*, analyzes unavoidable adverse environmental impacts, commitments of resources, and relevant costs and benefits, as they support the suitability of the proposed site.

Part 4—Site Redress Plan

If a limited work authorization is pursued, a Site Redress Plan is required per 10 CFR 52.17(c). TVA is not pursuing a limited work authorization with this application.

Part 5—Emergency Planning Information

The emergency planning information includes major features of the emergency plan, as allowed by 10 CFR 52.17(b)(2) using guidance provided in NUREG-0654/FEMA–REP-1, *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*.

The regulatory bases for the emergency planning information include consideration of the following:

- NRC Regulations—10 CFR 50 and 10 CFR 52,
- Federal Emergency Management Agency (FEMA) Regulations—44 CFR 350,
- NRC/FEMA Memorandum of Understanding, 58 Federal Register 47996,
- Environmental Protection Agency, 400-R-92-001, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents,*
- NUREG-0396, *Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants,*

- NUREG-0654, *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants,*
- NUREG-0696, *Functional Criteria for Emergency Response Facilities,* and
- NRC Regulatory Guide 1.101, *Emergency Planning and Preparedness for Nuclear Power Reactors*.

The following briefly describes contents of Part 5:

- Part 5A, emergency planning information based on a Site Boundary Plume Exposure Pathway Emergency Planning Zone (EPZ)
- Part 5B, emergency planning information based on a 2-mile EPZ

Part 6—Exemption Requests

This part lists Applicant-requested exemptions that are authorized by law; would not endanger life, property, or the common defense and security; and are otherwise in the public interest. A discussion and justification for each request is included in this part.

Part 7—Withheld Information

This part contains the information redacted from other parts of the application due to the sensitive or proprietary nature of the information.

Part 8—Enclosures

All enclosures submitted with the ESPA are provided in Part 8.

2.2 Labeling Conventions

Each page of this application, except title sheets, has a header and footer that identifies the part of this application to which it belongs and the current revision. Other content identity is established as described in the following sections.

2.2.1 Pagination

Footers include a page number. The pagination format indicates the page number within a chapter/section, e.g., “1.2-3” for Chapter 1, Section 2, page 3. In some cases, the section is numbered on the subsection level. If so, the page number format is chapter number, period, subsection number, dash, followed by current page number, e.g., “3.2.2-3” for Chapter 3, Subsection 2.2, page 3.

2.2.2 Section Numbering

Each part of the ESPA has multiple chapters, sections, and subsections. The term “Chapter” is applied to X-level material. The term “Section” is applied to X.Y-level content, and the term “Subsection” is used for X.Y.Z-level content and further subdivisions.

Chapter/section/subsection numbering and titles are consistent, to the extent practicable, with NUREG-0800. Additional subsections are added as needed.

2.2.3 References

Reference lists appear at the end of each X.Y section or X.Y.Z subsection.

2.2.4 Tables, Figures, and Appendices

Tables and figures are located at the end of each X.Y section or X.Y.Z subsection. Appendices are located at the end of the applicable chapter.

3.0 GENERAL CORPORATE INFORMATION

3.1 Name of Applicant and Owner

The Tennessee Valley Authority is the ESP Applicant. The CRN Site is owned by the United States of America and managed by TVA as the agent of the Federal government. TVA manages and operates the prospective SMR units installed on the CRN Site. TVA also manages and operates the associated transmission corridors, structures and power lines.

3.2 Address of Applicant

Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902
865-632-2101

3.3 Description of Business or Occupation of Applicant and Owner

TVA, a corporate agency and instrumentality of the United States, was created in 1933 by the U.S. Congress by virtue of the Tennessee Valley Authority Act of 1933, as amended, 16 U.S.C. §§ 831-831ee (as amended, the "TVA Act"). TVA was created to, among other things, improve navigation on the Tennessee River, reduce the damage from destructive flood waters within the Tennessee River system and downstream on the lower Ohio and Mississippi Rivers, further the economic development of TVA's service area in the southeastern United States, and sell the electricity generated at the facilities TVA operates.

TVA supplies power in most of Tennessee, northern Alabama, northeastern Mississippi, and southwestern Kentucky and in portions of northern Georgia, western North Carolina, and southwestern Virginia to a population of over nine million people. In 2015, the revenues generated from TVA's electricity sales were approximately $11 billion and accounted for virtually all of TVA's revenues.

3.4 Description of Organization and Management of Applicant and Owner

TVA is administered by a nine-member Board of Directors appointed by the President of the United States with the advice and consent of the U.S. Senate. All Board members are United States citizens. TVA Board members serve five-year terms, and at least one member's term ends each year. The TVA Board, among other things, establishes broad goals, objectives, and policies for TVA; develops long-range plans to guide TVA in achieving these goals, objectives, and policies; approves annual budgets; and establishes a compensation plan for employees. Board members select the Chairman of the Board.

The business address for the TVA Board is:

Tennessee Valley Authority Board of Directors
400 West Summit Hill Drive, WT6
Knoxville, TN 37914

As of the date of this application, the names of the board members are as follows:

- Joe H. Ritch (Chairman, term expires 2016)
- Marilyn A. Brown
- V. Lynn Evans
- Richard C. Howorth

- Virginia T. Lodge
- C. Peter Mahurin
- Michael R. McWherter
- Eric M. Satz
- Ronald A. Walter

The TVA Act gives the TVA Board sole responsibility for establishing the rates TVA charges for power. These rates are not subject to review or approval by any state or Federal regulatory body.

The President and CEO is a U.S. citizen, who is selected by the Board of Directors and is the senior executive responsible for TVA's day-to-day operations. The names and titles of the principal executives and officers of TVA, all of whom are U.S. Citizens, are as follows:

- William D. Johnson, President and Chief Executive Officer
- Joseph P. Grimes, Jr., Executive Vice President and Chief Nuclear Officer
- Charles G. Pardee, Executive Vice President and Chief Operating Officer
- Ricardo G. Perez, Senior Vice President, Shared Services
- Sherry A. Quirk, Executive Vice President and General Counsel
- John M. Thomas, III, Executive Vice President and Chief Financial Officer
- Van M. Wardlaw, Executive Vice President and Chief External Relations Officer