



**Early Site Permit
Application (ESPA) Review
Clinch River
Nuclear Site**

Safety Panel

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Panelists

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Clinch River PPE

- The safety review accounts for the plants that might be located at the site
- TVA PPE based on construction and operation of two or more small modular reactors (SMRs)
 - Single unit does not exceed 800 MWt (reactor core)
 - Site total does not exceed 2,420 MWt (800 MWe)

Clinch River PPE (cont.)

- TVA used the following SMR designs to develop the ESP PPE:
 - BWXT mPower SMR, 530 MWt (180 MWe)
 - NuScale SMR, 160 MWt (50 MWe)
 - Holtec SMR-160, 525 MWt (160 MWe)
 - Westinghouse SMR, 800 MWt (225 MWe)

COL or CP Application

- A combined license (COL) or construction permit (CP) application that incorporates the ESP by reference must:
 - Identify the chosen SMR technology for the Clinch River Nuclear Site
 - Address COL action items and permit conditions
 - Provide other information necessary to support COL or CP issuance

Staff Safety Review

- 5 audits and 1 inspection
- 12 requests for additional information
 - 50 questions
- Final Safety Evaluation Report
 - 41 COL Action Items
 - 7 Permit Conditions

Clinch River ESPA Safety Review (cont.)

Specific Topics Covered

Seismology	Site Hazards Evaluation
Geology	Radiological Effluents
Hydrology	Radiological Dose Consequences
Meteorology	Emergency Preparedness
Geography	Security Plan Feasibility
Demography (inc. population distribution)	Quality Assurance

Permit Conditions

- Assessment of potential facility hazards
 - Permit Conditions 1 & 2
- Site investigation and improvement activities associated with excavation
 - Permit Conditions 3 & 4
- Emergency Planning
 - Permit Conditions 5 & 6
- CP Reference of ESP
 - Permit Condition 7

Staff Conclusions

- The ESPA satisfies the applicable standards in 10 CFR Parts 50, 52, and 100
- ESP issuance will not be inimical to the common defense and security or to the health and safety of the public

Staff Conclusions (cont.)

Two or more SMRs can be safely sited on the Clinch River Nuclear Site if they:

- (1) have design characteristics falling within the design parameters for the site,
- (2) have site parameters falling within the site characteristics for the site, and
- (3) meet the ESP terms and conditions

Overview of TVA's Unique Approach to EPZ Sizing

- Risk-informed, dose-based, and consequence-oriented methodology for plume exposure pathway (PEP) emergency planning zone (EPZ) sizing
- ESP does not set the PEP EPZ size
 - Size established during COL or CP review
- Associated exemption requests

Emergency Planning (EP)

TVA ESPA

The ESPA requested review of 3 key areas, which consist of:

- 2 Major Features (onsite) Emergency Plans (ESPA Part 5)
- 25 exemption requests (ESPA Part 6)
- PEP EPZ sizing methodology

2 Major Features Emergency Plans (Onsite)

- ESPA Part 5A reflects a Site Boundary PEP EPZ
- ESPA Part 5B reflects a 2-Mile PEP EPZ
 - including an evacuation time estimate (ETE)
- COL or CP applicant would choose an ESP plan based on the results of the EPZ sizing analysis

Exemption Requests

- 10 CFR 50.33(g) & 50.47(c)
 - Requests to exempt both emergency plans from the 10-mile radius requirement for the PEP EPZ
- 10 CFR 50.47 & Appendix E to 10 CFR Part 50
 - Site boundary EPZ only: Requests for exemption from various offsite emergency planning requirements (e.g., State/local emergency plans, offsite exercises)

Overview

- EPZ sizing methodology
 - Technical criteria and description
 - Dose criteria
 - Review basis and finding
- Permit Condition 5
 - Plant parameters
- COL Application (COLA) or CP application (CPA) use of methodology

Review of EPZ Sizing Methodology

- Novel and unique review
 - Staff looked at technical basis for PEP EPZ size in current regulations to support review
 - Concept of allowing site-specific EPZ sizing for SMRs supported by previous Commission decisions

TVA EPZ Sizing Methodology

Technical Criteria

- PEP EPZ should encompass areas
 - where projected dose from design basis accidents (DBAs) could exceed Environmental Protection Agency (EPA) early phase protective action guides (PAGs)
 - where consequences of less severe core melt accidents could exceed the EPA early phase PAGs

TVA EPZ Sizing Methodology Technical Criteria (cont.)

- PEP EPZ should be of sufficient size to provide for substantial reduction in early health effects in the event of more severe core melt accidents

TVA EPZ Sizing Methodology

Steps

- Accident scenario selection
 - Use bounding DBA
 - Use site- and design-specific probabilistic risk assessment (PRA) to categorize severe accident scenarios

TVA EPZ Sizing Methodology

Steps (cont.)

- Determine source term releases to atmosphere
- Calculate dose consequences at distance from plant
- Determine PEP EPZ size that meets the dose criteria

TVA EPZ Sizing Methodology

Dose Criteria

- Dose to individual from exposure to the airborne plume and groundshine
- DBAs and less severe accidents
 - 1 rem total effective dose equivalent (TEDE) from 96-hr exposure
- More severe accidents
 - Conditional probability to exceed 200 rem whole body from 24-hr exposure is less than 10^{-3} per reactor year outside PEP EPZ

TVA EPZ Sizing Methodology

- TVA's methodology is consistent with NUREG-0396
 - Considers a range of accidents
 - Performs accident consequence analyses
 - Determines an area outside of which early protective actions are not likely to be necessary
 - TVA's technical criteria essentially the same as criteria used in NUREG-0396

Conclusions on PEP EPZ Size Methodology

- The methodology maintains the same level of radiation protection that the 10-mi PEP EPZ provides for large light-water reactors
- The methodology is reasonable and consistent with the analyses that form the basis for the current 10-mile PEP EPZ requirement

Permit Condition 5

- COL or CP applicant must demonstrate that the design-specific accident release source term used in the EPZ sizing analysis is bounded by the source term in Permit Condition 5

Permit Condition 5 (cont.)

- The ESP accident release source term is not design-specific
 - Bounding 4-day accident release source term that meets EPZ size criteria at the site boundary
 - Same idea as DBA source term to envelop an unknown design
 - COL/CP applicant must meet Permit Condition 5 to use ESP exemptions, unless a variance is approved

Exemption Review

10 CFR 50.12

- Authorized by law
- Will not present an undue risk to the public health and safety
- Consistent with the common defense and security
- Special circumstances are present

Exemption Review (cont.)

- The staff determined that the requested exemptions are:
 - authorized by law
 - do not present an undue risk to the public health and safety
 - are consistent with the common defense and security

Exemption Review (cont.)

- 10 CFR 50.12 identifies 6 possible special circumstances.
- For this review, the applicable special circumstance is:
 - Application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule

Exemptions Review (cont.)

The staff finds that:

- The establishment of a PEP EPZ in a COLA or CPA using criteria proposed by the ESP applicant will maintain the same level of protection (i.e., dose savings) surrounding the Clinch River Nuclear Site, as that which currently exists at the 10-mi PEP EPZ for large light-water reactors
- TVA's approach will meet the same underlying purpose as current regulations

Federal Emergency Management Agency (FEMA) Consultation

- NRC performed its review in consultation with FEMA, in accordance with 10 CFR 52.17 and 52.18, pursuant to the FEMA-NRC Memorandum of Understanding (MOU) (December 7, 2015, ML15344A371)

FEMA Consultation (cont.)

FEMA review was limited because:

- The ESPA did not include offsite emergency plans
 - But the ESPA did include an ETE for the 2-mile PEP EPZ
- The major features plans only addressed limited onsite EP features

FEMA Consultation (cont.)

FEMA's January 24, 2018, letter (ML18031B055) stated that:

- FEMA did not identify physical characteristics of the proposed site that could pose a significant impediment to the development of emergency plans, including evacuation from the 2-mi PEP EPZ

FEMA Consultation (cont.)

- The boundary established for the proposed 2-mi PEP EPZ was established relative to local emergency response needs and capabilities, as they are affected by such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries

FEMA Consultation (cont.)

- At this time, FEMA's findings do not endorse or determine the adequacy of a proposed 2-mi PEP EPZ for the site if proposed
- FEMA looks forward to continued consultative support during any future application review

Recent FEMA Correspondence

- In response to an NRC staff suggestion, FEMA provided a letter dated July 8, 2019, that shared its views on the ESP application
- The letter expressed concerns regarding EPZ sizing for SMRs that could be sited at the Clinch River Nuclear Site

NRC Staff Response

- NRC regulations are risk-informed, not focused on worst conceivable case
- Dose outcome (hence input to EPZ sizing) for human-induced events similar to outcomes of other events
- EPZ sizing will suit the protection to the hazard
- Staff's approach to Clinch River EPZ sizing review is consistent with the approach taken when the EPZ regulations were developed

NRC Staff Response (cont.)

- Staff seeks input on EP, but Commission decides what requirements are
 - States, local authorities, and licensees free to arrange additional capabilities
- EPA PAG role in staff's EPZ sizing review is consistent with EPA guidance
- Massive/rapid all-hazards response not needed if site boundary EPZ is justified
 - Similar to other very low hazard facilities such as non-power reactors

Outreach

- Staff has reached out to, and sought views of, numerous stakeholders on EPZ sizing for SMRs
 - FEMA
 - Tennessee Emergency Management Agency
 - Conference of Radiation Control Program Directors
 - National Emergency Management Association
 - Federal Radiological Preparedness Coordinating Committee

ESP Approval Regarding EP

- Upon issuance of the ESP, the applicant acquires approval, with conditions, on:
 - The PEP EPZ sizing methodology
 - The 2 major features emergency plans (site boundary/2-mile PEP EPZ)
 - The 25 requested exemptions

EP in COLA or CPA

A COLA or CPA, which incorporates the ESP by reference, must:

- Demonstrate that the EPZ sizing methodology supports either the site boundary or 2-mile PEP EPZ and the use of the exemptions
 - COLA/CPA analysis will be based on the chosen SMR technology
 - Address 16 COL Action Items and 2 Permit Conditions related to EP
- Provide all other required EP information

EP Review Conclusions

The staff concludes that:

- The PEP EPZ sizing methodology is acceptable for determining the appropriate size of the PEP EPZ for the Clinch River Nuclear Site because it is consistent with the analyses that form the technical basis for the current 10-mile PEP EPZ requirement

EP Review Conclusions (cont.)

- The 2 major features emergency plans meet applicable regulatory requirements
- The exemption requests are acceptable because they are authorized by law, will not present an undue risk to the public health and safety, are consistent with the common defense and security, and special circumstances are present