



# TVA Clinch River SMR Project

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Emergency Preparedness

# Agenda

- Overview of TVA Clinch River Emergency Preparedness approach
- Proposed Exemptions for Clinch River for 2 Mile and Site Boundary Emergency Planning Zones (EPZs)

# Acknowledgement and Disclaimer

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# What SMR Features Improve Safety?

- Smaller reactor cores and radiological source terms
- Simplified integral designs (e.g., no large piping)
- Slower accident progression/longer coping times
- Enhanced threat protection from underground construction

SMR designs significantly reduce the risk of a radiological release and offsite consequences

# Why Clinch River Site?



## Attractive Site Features:

- Access to 500 KV and 161 KV transmission
- Neighbor to DOE, an interested customer
- Basic Infrastructure
- Abundant and skilled workforce
- Strong community support
- TVA owned/controlled

# TVA Approach Tiers From NEI Framework

- **NEI Framework:**
  - Generic to accommodate multiple designs and sites
  - Establishes dose criteria limits at EPZ boundary to allow scalable sizing
  - Addresses the 16 Planning Standards generically
- **TVA approach (two-step; ESPA and COLA):**
  - Clinch River Site specific, considering the four current U.S. SMR designs
  - Implements NEI Framework's dose criteria limits
  - In ESPA, proposing two specific EPZ: 2 miles and site boundary
    - Reasonable sizes based on preliminary data from SMR vendors
    - Benefits all future EPZ applications (evaluation addresses site boundary and scalable options)
    - Addresses the 16 Planning Standards in each EPZ size option
  - In COLA, confirm the selected SMR vendor's source terms result in a dose below the dose criteria limits at the selected EPZ boundary

# TVA's Emergency Planning Approach

## Step 1 - ESPA



## Step 2 - COLA

### i. Commit to dose criteria limit at EPZ boundary

- Design Basis Accidents: < 1 REM Total Effective Dose Equivalent (TEDE)
- Severe Accidents (Beyond Design Basis Accidents):
  - Very low probability that severe accidents cause fission product release
  - High confidence there is > 10 hours<sup>1</sup> duration from accident initiation until release exceeding 1 REM at EPZ
  - < 200 REM acute dose from severe accidents

### ii. EPZ size determination in ESPA

- Evaluated preliminary source term information provided by SMR vendors
- Used site atmospheric dispersion characteristics
- Compared with dose criteria limits at distance
- Concluded that criteria may be met at site boundary; 2-miles expected to be bounding

### iii. Emergency Plan development in ESPA

- Generate two emergency plans (E-Plans)
  - 2-mile EPZ: Offsite E-Plan
  - Site Boundary: Onsite E-Plan and offsite “all hazards” plan
- Evaluate all 16 Planning Standards for each case
- Request exemptions as appropriate
- Make commitments to address open items

### i. Calculate source term and dose at distance

- Based on a specific SMR design selected
- Using NEI EPZ White Paper methodology
  - Accident scenarios
  - Source term mitigation
  - Severe accidents and multiple units considered
  - Use of PRA to provide risk insights
- Using site atmospheric dispersion characteristics

### ii. Final EPZ size selected in COLA based upon:

- If calculated dose is < Dose Criteria at site boundary, then site boundary EPZ established. Implement an onsite emergency plan and an IPZ and coordinate with offsite emergency response organizations on an All Hazards Plan.
- If dose criteria limit reached between site boundary and 2-miles, then a 2-mile EPZ and an IPZ will be established and coordination on an all hazards plan.
- If calculated dose is > dose criteria limit at 2-miles, a new E-Plan submittal is required in COLA for NRC review.

### iii. Applicable ESPA E-Plan will be incorporated by reference into the COLA if dose criteria are met

<sup>1</sup> 10 hours is expected to provide sufficient time to implement emergency response and mitigative actions

# EPZ Dose Criteria Limit Basis

Criteria	Applicability	Description	Reference
<1 REM TEDE	Design Basis Events and More Probable, Less Severe accidents	Inclusive of thyroid dose. 30-day cumulative dose	Protective Action Guidelines (PAGs) (EPA 400-R-92-001) and NEI White Paper
< 200 REM Acute Dose	Severe Accidents	Calculated based on Design Specific implementation of NEI White Paper Methodology	NEI White Paper
Very low probability of an event leading to offsite fission product release. If release occurs, high confidence it will take > 10 hours from accident initiation until dose exceeding PAG limit (1 REM TEDE) at the EPZ boundary	Severe Accidents	Ten hours has been found to be a reasonable time, if necessary, to implement off-site protective actions using an “all hazards” plan approach.	



# Preliminary Emergency Planning Approach

- TVA will coordinate with Tennessee Emergency Management Agency (TEMA) to develop an offsite multi-jurisdictional radiological emergency response plan (MJERP) for the Clinch River Site to support the all-hazard Tennessee Emergency Management Plan (TEMP)
- Exemptions enable a graded application of emergency planning regulations commensurate with reduced risks of SMRs

## For 2-mile EPZ:

- TVA expects the majority of the Planning Standards will be largely unchanged from the existing TVA E-Plan for its operating nuclear fleet
- 2-mile E-Plan
- Tennessee MJERP for Clinch River

## For Site Boundary EPZ:

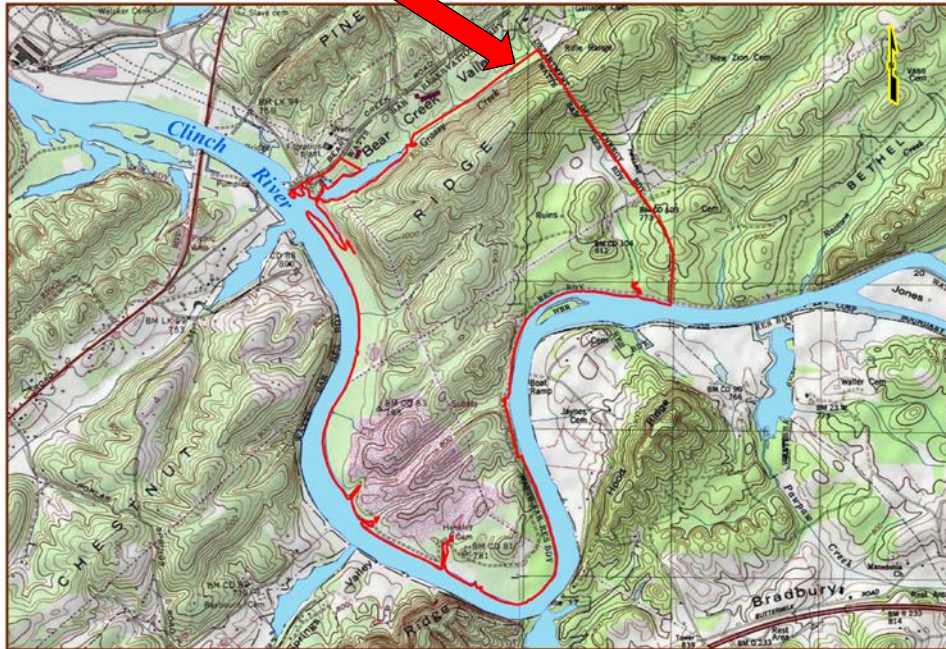
- Ensure all applicable guidance from the Planning Standards are incorporated into the onsite E-Plan
- Tennessee MJERP for Clinch River

# ESPA EPZ Key Open Items

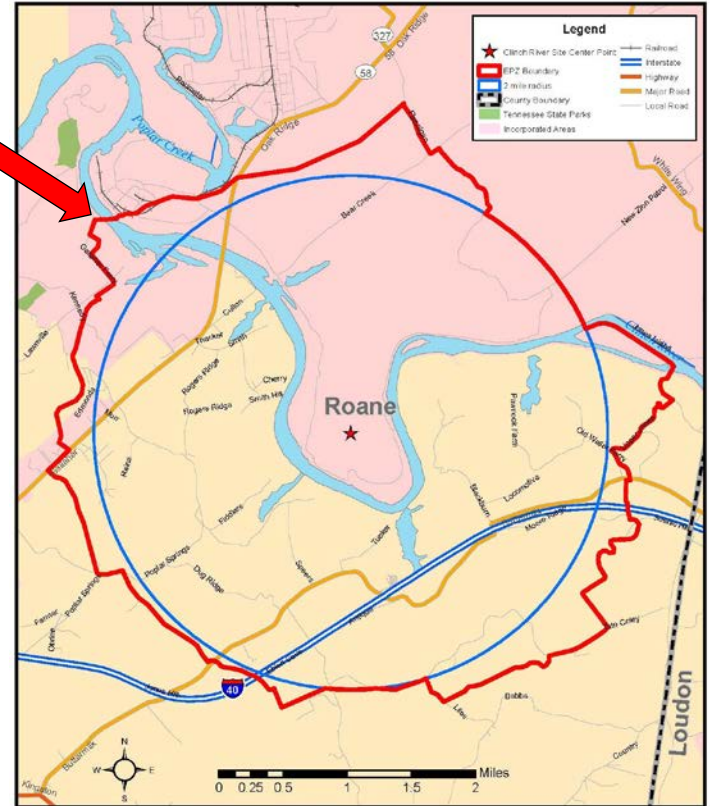
Topic to be addressed:	ESPA	DCA	COLA
<b>Emergency Action Level (EAL)</b>	Commitment to establish EALs in COLA	Considers accident sequences, hostile action scenarios, etc.	Define triggers for Emergency Classification Levels
<b>On-Shift Staffing</b>	Commitment to develop on-shift staffing in COLA	Develop plant staffing basis	Define On-Shift Staffing with commitment to perform required on-shift staffing analyses
<b>Augmented Emergency Response Organization (ERO)</b>	Commitment to define augmentation time in COLA	Define accidents and accident progression	Define ERO complement and augmentation time
<b>Ingestion Pathway Zone (IPZ)</b>	Commitment to address IPZ in COLA (IPZ size varies with EPZ size)	Design details inform IPZ	IPZ size defined

# EPZ Options

Site Boundary



Proposed  
2-mile



# Overview of Clinch River ESPA Exemptions

- TVA will include request for exemptions 10 CFR §50.33(g), 10 CFR §50.47(b), 10 CFR §50.47 (c)(2), and 10 CFR Part 50 Appendix E) in ESPA Part 6
- Proposed exemptions will be consistent with NEI EP Framework
- TVA will make available for audit the full set of changes to be included in the exemption request
- TVA will not request an exemption related to Technical Support Center (TSC) or Emergency Offsite Facility (EOF) requirements
- TVA will present 8 illustrative examples of the range of requirements to be included in the exemptions

# Example of Expected Proposed Exemption (1/8)

- Delete specific size for EPZ (10 miles in radius) and IPZ (50 miles in radius) in 10 CFR 50.33(g)
  - Applicable to both 2-Mile EPZ and Site Boundary EPZ options
  - Linked to future NRC policy decisions with respect to multi-unit sites

~~... Generally, the plume exposure pathway EPZ for nuclear power reactors shall consist of an area about 10 miles (16 km) in radius and the ingestion pathway EPZ shall consist of an area about 50 miles (80 km) in radius. The exact size and configuration of the EPZs surrounding a particular nuclear power reactor shall be determined in relation to the local emergency response needs and capabilities as they are affected by such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries. The size of the EPZs also may be determined on a case-by-case basis for gas cooled nuclear reactors and for reactors with an authorized power level less than 250 MW thermal. ...~~

## Example of Expected Proposed Exemption (2/8)

- Delete discussion of “within the Emergency Planning Zones” in 10 CFR 50.47(b)(1)
  - Applicable to Site Boundary EPZ option

Primary responsibilities for emergency response by the nuclear facility licensee and by State and local organizations ~~within the Emergency Planning Zones~~ have been assigned, the emergency responsibilities of the various supporting organizations have been specifically established, and each principal response organization has staff to respond and to augment its initial response on a continuous basis.

## Example of Expected Proposed Exemption (3/8)

- Delete discussion of offsite response E-plans in 10 CFR 50.47(b)(4)
  - Applicable to Site Boundary EPZ option

... A standard emergency classification and action level scheme, the bases of which include facility system and effluent parameters, is in use by the nuclear facility licensee, and State and local response plans call for reliance on information provided by facility licensees for determinations of minimum initial offsite response measures.

# Example of Expected Proposed Exemption (4/8)

- Delete public notification requirement for EPZ in 10 CFR 50.47(b)(5)
  - Applicable to Site Boundary EPZ option

... Procedures have been established for notification, by the licensee, of State and local response organizations and for notification of emergency personnel by all organizations; the content of initial and followup messages to response organizations ~~and the public has been established; and means to provide early notification and clear instruction to the populace within the plume exposure pathway~~ Emergency Planning Zone have been established.



# Example of Expected Proposed Exemption (5/8)

- Delete public notification requirement in 10 CFR 50.47(b)(6)
  - Applicable to Site Boundary EPZ option

Provisions exist for prompt communications among principal response organizations to emergency personnel ~~and to the public.~~

# Example of Expected Proposed Exemption (6/8)

- Delete public notification requirement for EPZ in 10 CFR 50.47(b)(10)
  - Applicable to Site Boundary EPZ option

~~A range of protective actions has been developed for the plume exposure pathway EPZ for emergency workers and the public. In developing this range of actions, consideration has been given to evacuation, sheltering, and, as a supplement to these, the prophylactic use of potassium iodide (KI), as appropriate. Evacuation time estimates have been developed by applicants and licensees. Licensees shall update the evacuation time estimates on a periodic basis. Guidelines for the choice of protective actions during an emergency, consistent with Federal guidance, are developed and in place, and protective actions for the ingestion exposure pathway EPZ appropriate to the locale have been developed.~~

# Example of Expected Proposed Exemption (7/8)

- Delete specific size for EPZ (10 miles in radius) and IPZ (50 miles in radius) in 10 CFR 50.47(c)(2)
  - Applicable to both 2 Mile EPZ and Site Boundary EPZ options
  - Linked to future NRC policy decisions with respect to multi-unit sites

~~Generally, the plume exposure pathway EPZ for nuclear power plants shall consist of an area about 10 miles (16 km) in radius and the ingestion pathway EPZ shall consist of an area about 50 miles (80 km) in radius. The exact size and configuration of the EPZs surrounding a particular nuclear power reactor shall be determined in relation to local emergency response needs and capabilities as they are affected by such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries. The size of the EPZs also may be determined on a case-by-case basis for gas cooled nuclear reactors and for reactors with an authorized power level less than 250 MW thermal.~~

# Example of Expected Proposed Exemption (8/8)

- Delete requirement for EPZ communication testing in 10 CFR Part 50 Appendix E Item E.9.a
  - Applicable to Site Boundary EPZ option

Provision for communications with contiguous State/local governments ~~within the plume exposure pathway~~ EPZ. Such communications shall be tested monthly.

# Summary

Progress underway in detailed development

No exemptions related to TSC or EOF

Proposed exemptions available for NRC audit

Approach consistent with NEI framework/approach

Proposed exemptions consistent with maintaining public health and safety

Proposed Clinch River emergency preparedness approach is commensurate with expected enhanced safety of SMR designs, to be verified in COL application and NRC review

# Closing

Questions?

Follow-up Action Review

CEMP = Comprehensive Emergency Management Plan  
COLA = Combined construction and Operating License Application  
DCA = Design Certification Application  
EAL = Emergency Action Levels  
EP = Emergency Preparedness  
E-Plan = Emergency Plan  
EPZ = Emergency Planning Zone  
ERO = Emergency Response Organization  
ESP = Early Site Permit  
ESPA = Early Site Permit Application  
IPZ = Ingestion Pathway Zone  
NEI = Nuclear Energy Institute  
NRC = Nuclear Regulatory Commission  
PAG = Protective Action Guidelines  
REM = Radiation Equivalent Man (a measure of radiological dose)  
SMR = Small Modular Reactor  
TEDE = Total Effective Dose Equivalent  
TVA = Tennessee Valley Authority