13. CONDUCT OF OPERATIONS

13.3 Emergency Planning

13.3.1 Introduction

This section addresses the plans, design features, facilities, functions, and equipment necessary for radiological emergency planning (EP) that must be considered in an early site permit (ESP) application (hereinafter referred to as "ESPA" or "application") that includes proposed major features of the emergency plans, in accordance with the pertinent standards of Section 50.47 of Title 10 to the *Code of Federal Regulations* (10 CFR), and the requirements of Appendix E to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." As defined in 10 CFR 52.1, major feature of the emergency plans means an aspect of those plans necessary to (i) address in whole or part one or more of the 16 standards in 10 CFR 50.47(b); or (ii) describe the emergency planning zones as required in 10 CFR 50.33(g). The emergency plans are an expression of the overall concept of operation and describe the essential elements of advance planning that have been considered, as well as the provisions that have been made to cope with radiological emergency situations.

As addressed in 10 CFR 52.17(b)(1), an ESPA must identify physical characteristics of the proposed new reactor site that could pose a significant impediment to the development of emergency plans. In 10 CFR 100.21(g) includes the same requirement, with regard to non-seismic siting criteria associated with stationary power reactor site applications. In addition, as stated in 10 CFR 52.17(b)(4), the application must include a description of contacts and arrangements made with Federal, State, and local governmental agencies with EP responsibilities, and contain any certifications that have been obtained. Pursuant to 10 CFR 52.17(b)(2)(i), the NRC reviews and approves the major features of the emergency plans in consultation with the Federal Emergency Management Agency (FEMA) of the Department of Homeland Security (DHS).

The Tennessee Valley Authority (TVA) is the applicant for the ESP (hereinafter referred to as "TVA" or "applicant"). On May 12, 2016, TVA submitted its ESPA for approval of a site for construction of two or more small modular reactors (SMRs) (hereinafter referred to as "new units" or "new plant") (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16139A752). The NRC accepted the application for docketing and detailed technical review on December 30, 2016 (82 FR 3812) and the applicant was notified of the acceptance review results on January 5, 2017(Docket No. 52-047) (ADAMS Accession No. ML16355A162). On December 15, 2017, TVA submitted Revision 1 to the ESPA (ADAMS Accession No. ML18005A067). The ESPA is based on a plant parameter envelope (PPE) that considers some of the design information from four light-water SMRs under development in the United States by BWX Technologies, Holtec, NuScale Power, and Westinghouse.

The proposed site, designated by the applicant as the Clinch River Nuclear (CRN) Site, is located within the city limits of Oak Ridge, Tennessee (TN), in Roane County, adjacent to the Clinch River arm of the Watts Bar Reservoir, and is approximately 935 acres within a 1200 acre property owned by the United States of America and managed by TVA. The CRN Site is the location of the former Clinch River Breeder Reactor Project, and is bounded on the east, south, and west by

the Clinch River arm of the Watts Bar Reservoir and on the north by the Grassy Creek Habitat Protection Area. Communities located near the site include Kingston (approximately 6.8 miles (mi) west), Harriman (approximately 9.2 mi west-northwest), Lenoir City (approximately 8.8 mi southeast), Farragut (approximately 12 mi east), and Knoxville (approximately 25.6 mi east-northeast). ESPA Part 2 (i.e., Site Safety Analysis Report (SSAR)), Section 2.1, "Geography and Demography," provides a more detailed description of the site location, and Figures 2.1-3, "Vicinity Map," and 2.1-4, "50-Mile Region," show the CRN Site location and the surrounding 5-mi vicinity and 50-mi region, respectively.

As part of the application, TVA submitted two distinct (onsite) major features emergency plans for the new plant under 10 CFR 52.17(b)(2)(i), which consist of ESPA Part 5A (Emergency Plan, Site Boundary Emergency Planning Zone (EPZ)) and ESPA Part 5B (Emergency Plan, 2-Mile EPZ). Both emergency plans (hereinafter referred to as "ESP Plan 5A" and "ESP Plan 5B," respectively) are based on the existing TVA Generic Emergency Plan. ESP Plan 5A contains the major features of an emergency plan for a plume exposure pathway (PEP) EPZat the site boundary of the CRN Site. ESP Plan 5B contains the major features of an emergency plan for a PEP EPZ consisting of an area approximately two mi (3.22 kilometers (km)) in radius from the site center point. EPZs for commercial nuclear power reactors are addressed in 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50, which identify a PEP EPZ of about 10 mi (16 km) in radius from the site, and an ingestion exposure pathway of about 50 mi (80 km) in radius from the site.

The applicant stated that both of the major features emergency plans comply with 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50, except where they request exemption from the regulation, as described in ESPA Part 6, "Exemptions and Departures." The application did not include offsite (State or local) Radiological Emergency Preparedness (REP) plans, in support of the CRN Site, and stated in SSAR Section 13.3.3.2, "Ingestion Exposure Pathway," that the ingestion exposure pathway EPZ for the CRN Site will be described in a possible future combined license (COL) application (hereinafter referred to as "COLA").

ESPA Part 6 states that TVA is proposing a dose-based, consequence-oriented approach that could be used by a COL applicant to establish an appropriate PEP EPZ size that is consistent with, and based upon, the U.S. Environmental Protection Agency (EPA) protective action guide (PAG) dose criteria for early phase protective actions in the unlikely event of a severe accident.[1] The emergency plan (ESP Plan 5A or 5B) ultimately selected for the site in a future COLA will be based upon the selected SMR design's ability to meet the criteria in the applicable plan, including the PEP EPZ size, as well as conform to the criteria described in SSAR Section 13.3, "Emergency Preparedness."

On June 10, 2016, the applicant supplemented the ESPA with an Evacuation Time Estimate Report (hereinafter referred to as "ETE Report" or "ETE") (ADAMS Accession No. ML16166A054). The ETE Report was provided as a part of ESP Plan 5B, in order to support the NRC staff's

[1] Table 2-1, "PAGs and Protective Actions for the Early Phase of a Radiological Incident," in U.S. EPA Report No. EPA-400/R-17/001, "PAG Manual – Protective Action Guides and Planning Guidance for Radiological Incidents" January 2017 (www.epa.gov/radiation/protective-action-guides-pags) — summarizes the PAGs and corresponding protective actions during the early phase of a radiological incident. The January 2017 EPA PAG Manual supersedes the 1992, 2013 and 2016 EPA PAG Manuals

determination (pursuant to 10 CFR 52.18) on whether there are physical characteristics of the proposed site that could pose a significant impediment to the development of emergency plans that cannot be mitigated or eliminated. (The ETE Report is discussed below in Sections 13.3.4.1 and 13.3.4.5.17 of this report.)

As described below, the staff reviewed the ESPA, the applicant's responses to requests for additional information (RAIs), and generally available reference materials, in accordance with the guidance provided in the Standard Review Plan (SRP) (i.e., NUREG–0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)," Revision 3, March 2007), Section 13.3, "Emergency Planning."

In a letter dated February 13, 2017 (ADAMS Accession No. ML17040A318), pursuant to the FEMA-NRC Memorandum of Understanding (MOU),[2] NRC provided FEMA EP-related portions of the ESPA, and requested that FEMA review the application and provide NRC the following determinations:

1. Whether there is a significant impediment to the development of offsite emergency plans for the 2-mi PEP EPZ (for ESP Plan 5B), pursuant to 10 CFR 52.17(b)(1) and 10 CFR 52.18); and

2. Whether the proposed major features of ESP Plan 5B, specifically related to the exact size and configuration of the 2-mi PEP EPZ, is acceptable.

FEMA responded to NRC's February 13, 2017, letter on June 12, 2017 (ADAMS Accession No. ML17164A206), and supplemented its response on August 11, 2017 (ADAMS Accession No. ML17228A177). In a September 14, 2017, letter to FEMA (ADAMS Accession No. ML17192A105), NRC identified nine EP issues raised by FEMA in its June 12, 2017, letter, and provided a detailed response to each issue. On January 24, 2018 (ADAMS Accession No. ML18031B055) FEMA supplemented its June 12, 2017, and August 11, 2017, letters. The January 24, 2018, letter provided the two determinations associated with the ESPA that the NRC staff had requested. The staff reviewed the FEMA findings, and the overall FEMA conclusions for determinations 1 and 2 (above) are reflected below in Sections 13.3.4 and 13.3.5, respectively, of this report.

13.3.2 Summary of Application

In SSAR Section 13.3 describes emergency preparedness for an SMR facility at the CRN Site, and addresses the submission of major features of an emergency plan for a PEP EPZ at the site boundary (ESP Plan 5A), and for an area approximately 2 mi in radius from the site center point (ESP Plan 5B). In SSAR Section 13.3 addresses the physical characteristics of the CRN Site, the PEP EPZs for the new plant, ETE, and contacts and agreements with local, State, Federal, and other organizations with supporting emergency responsibilities. The ESPA did not include any EP inspections, tests, analyses, and acceptance criteria (ITAAC), pursuant to 10 CFR 52.17(b)(3).

[2] "Memorandum of Understanding Between the Department of Homeland Security/Federal Emergency Management Agency [DHS/FEMA] and Nuclear Regulatory Commission Regarding Radiological Emergency Response, Planning, and Preparedness," December 7, 2015 (ADAMS Accession No. ML15344A371).

The applicant also provided the following EP information in the ESPA:

Onsite Emergency Plan

As described in the SSAR, the ESPA emergency plan for a new plant at the CRN Site is provided in ESPA Part 5, and consists of two distinct major features emergency plans. ESPA Part 5A (ESP Plan 5A) contains the major features of an emergency plan for a PEP EPZ at the site boundary. ESPA Part 5B (ESP Plan 5B) contains the major features of an emergency plan for the PEP EPZ consisting of an area approximately two miles in radius from the site center point of the site. TVA proposed in its application that the NRC approve a methodology that COL applicant could use to determine whether a severe accident in a chosen reactor design would result in exceeding the EPA PAGs for the site boundary or the 2-mi PEP EPZ, as applicable. ESP Plan 5B also contains an ETE Report associated with the 2-mi PEP EPZ. The major features emergency plans, and respective PEP EPZ, are determined based on criteria that the selected SMR design must meet in order for the applicable major features emergency plan and PEP EPZ to apply. Site-specific information is included in Appendix A to both plans to address EP for the CRN Site.

Both major features emergency plans are based on the existing TVA "Nuclear Power Radiological Emergency Plan (NP-REP), Generic Part,"[3] and reflect the requested exemptions that are described in ESPA Part 6 (addressed in SER Section 13.3.4.4). The plans address pertinent requirements and associated guidance contained in NUREG–0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants" (hereinafter referred to as "NUREG–0654"), and Supplement 2, "Criteria for Emergency Planning in an Early Site Permit Application," to provide major features of the emergency plans. Information that was not available to TVA during the development of the ESPA will need to be addressed at the time of a COLA.

Offsite Emergency Plans

The ESPA did not include, nor is it required to include, offsite (State or local) REP plans, in support of the CRN Site. However, the ESPA did describe anticipated offsite support from various agencies (e.g., law enforcement, fire departments, ambulance services, etc.).

Exemption Requests

In ESPA Part 6, TVA identified exemption requests, pursuant to 10 CFR 52.7, from various requirements for onsite and offsite emergency plans, and the associated PEP EPZs. Tables 1-1 and 1-2 of Part 6 identify specific requirements in 10 CFR 50.33(g), 10 CFR 50.47(b), 10 CFR 50.47(c)(2), and Appendix E to 10 CFR Part 50, from which TVA is requesting exemptions associated with the site boundary PEP major features emergency plan in ESP Plan 5A. Table 1-3 of Part 6 identifies specific requirements in 10 CFR 50.33(g) and 50.47(c)(2), from which TVA is requesting exemptions associated with the 2-mi PEP major features emergency plan in ESP Plan 5B. (The staff's evaluation of the exemption requests is discussed in Section 13.3.4.4 of this report.)

[3] See TVA Letter No. CNL-15-154, November 18, 2015, "Radiological Emergency Plan Revision" (ADAMS Accession No. ML15323A210).

Departures

ESPA Part 6, Section 2.0, “Clinch River Nuclear Site Departures,” states that because TVA has not selected a reactor design, departures from a referenced Design Control Document (DCD) have not been identified.

13.3.3 Regulatory Basis

The applicable regulatory requirements and guidance for evaluation of the EP information submitted in this ESPA are:

- 10 CFR 50.12, “Specific exemptions”
- 10 CFR 50.33, “Contents of applications, general information”
- 10 CFR 50.34, “Contents of applications; technical information”
- 10 CFR 50.47, “Emergency plans”
- 10 CFR 50.72, “Immediate notification requirements for operating nuclear power reactors”
- 10 CFR 52.7, “Specific exemptions”
- 10 CFR 52.17, “Contents of applications; technical information”
- 10 CFR 52.18, “Standards for review of applications”
- 10 CFR 100.21, “Non-seismic siting criteria”
- 10 CFR Part 50, Appendix E, “Emergency Planning and Preparedness for Production and Utilization Facilities”
- U.S. NRC Office Instruction LIC-103, “Exemptions from NRC Regulations,” Revision 1, July 6, 2006 (ADAMS Accession No. ML052590073).
- U.S. NRC Final Rule, “10 CFR Parts 50 and 52 – Enhancements to Emergency Preparedness Regulations,” November 23, 2011 (76 FR 72560).
- U.S. NRC Final Rule, “10 CFR Parts 50 and 70 – Emergency Planning,” Paragraph II, “Emergency Planning Zone Concept,” and Paragraph III, “Position on Planning Basis for Small Light-Water Reactors and Ft. St. Vrain,” August 19, 1980 (45 FR 55402, 55406).
- Regulatory Guide (RG) 1.97, “Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants,” Revision 4, June 2006 (ADAMS Accession No. ML061580448).

- NUREG–0396/EPA 520/1-78-016 (NRC and EPA 1978), “Planning Basis for the Development of State and Local Government Radiological Emergency Response Plans in Support of Light Water Nuclear Power Plants,” December 1978 (ADAMS Accession No. ML051390356).

- NUREG–0654/FEMA-REP-1, Revision 1, “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants,” November 1980 (ADAMS Accession No. ML040420012).

- NUREG–0654/FEMA-REP-1, Revision 1, Supplement 2, “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants – Criteria for Emergency Planning in an Early Site Permit Application,” April 1996 (ADAMS Accession No. ML050130188).

- NUREG–0654/FEMA-REP-1, Revision 1, Supplement 3, “Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants – Guidance for Protective Action Strategies,” November 2011 (ADAMS Accession No. ML113010596).

- NUREG–0696, “Functional Criteria for Emergency Response Facilities – Final Report,” February 1981 (ADAMS Accession No. ML051390358).

- NUREG–0737, Supplement 1, “Clarification of TMI [Three Mile Island] Action Plan Requirements – Requirements for Emergency Response Capability (Generic Letter No. 82-33),” June 1982 (ADAMS Accession No. ML051390367).

- NUREG–0800, Revision 3, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” Revision 3, March 2007 (ADAMS Accession No. ML070810350).

- NUREG/CR-7002 (SAND2010-0016P), “Criteria for Development of Evacuation Time Estimate Studies,” November 2011 (ADAMS Accession No. ML113010515).

- NSIR/DPR-ISG-01, “Interim Staff Guidance – Emergency Planning for Nuclear Power Plants,” Revision 0, November 2011 (ADAMS Accession No. ML113010523).

- NSIR/DPR-ISG-02, “Interim Staff Guidance – Emergency Planning Exemption Requests for Decommissioning Nuclear Power Plants,” May 2015 (ADAMS Accession No. ML14106A057).

- SECY-96-0170, “Assessment of Exceptions Granted for Locations and Staffing Times of Emergency Operation[s] Facilities,” August 5, 1996 (ADAMS Accession No. ML083580044).

- SRM to SECY-96-0170, “Staff Requirements Memorandum – Assessment of Exceptions Granted for Locations and Staffing Times of Emergency Operation[s] Facilities,” September 18, 1996 (ADAMS Accession No. ML083580041).

- SECY-11-0152, “Development of an Emergency Planning and Preparedness Framework for Small Modular Reactors,” October 28, 2011 (ADAMS Accession No. ML112570439).

- SECY-15-0077, “Options for Emergency Preparedness for Small Modular Reactors and Other New Technologies,” May 29, 2015 (ADAMS Accession No. ML15037A176); and Staff Requirements Memorandum (SRM) SECY-15-0077, August 4, 2015 (ADAMS Accession No. ML15216A492).

- SECY-16-0012, “Accident Source Terms and Siting for Small Modular Reactors and Non-Light Water Reactors,” February 7, 2016 (ADAMS Accession No. ML15309A319).

- U.S. EPA “PAG Manual – Protective Action Guides and Planning Guidance for Radiological Incidents,” March 2013.

- U.S. EPA Report No. EPA-400/R-17/001, “PAG Manual – Protective Action Guides and Planning Guidance for Radiological Incidents,” January 2017.

13.3.4 Technical Evaluation

Pursuant to 10 CFR 52.17(b)(1), an ESPA must identify in the SSAR physical characteristics of the proposed site, such as egress limitations from the area surrounding the site, that could pose a significant impediment to the development of emergency plans. If such physical characteristics are identified, the application must identify measures that would, when implemented, mitigate or eliminate the significant impediment. In addition, 10 CFR 52.17(b)(2) allows an ESP applicant to also propose either major features of emergency plans or complete and integrated emergency plans, in accordance with the pertinent standards of 10 CFR 50.47 and requirements of Appendix E to 10 CFR Part 50.

Major features of emergency plans are defined in 10 CFR 52.1, as aspects of those plans necessary to address in whole or part one or more of the 16 planning standards in 10 CFR 50.47(b), or a description of the EPZs as required by 10 CFR 50.33(g).[4] For a complete and integrated emergency plan, 10 CFR 52.17(b)(4) requires that the applicant make good-faith efforts to obtain certifications from local, State, and Federal governmental agencies with EP responsibilities. In addition, 10 CFR 52.17(b)(3) requires that the complete and integrated emergency plans (if provided in the ESPA) include the proposed ITAAC that will provide reasonable assurance that the facility has been constructed and will be operated in conformity

[4] Before the amendment of 10 CFR Parts 50 and 52 in 2007 (see 72 FR 49352(Aug28, 2007)), *major features of the emergency plans* were defined in NUREG–0654, Supplement 2, “Criteria for Emergency Planning in an Early Site Permit Application – Draft Report for Comment,” published in April 1996. Section V, “Planning Standards and Evaluation Criteria for Major Features of the Emergency Plan,” of Supplement 2 defined major features as a reduced and revised set of NUREG–0654 planning standards and evaluation criteria, which were expanded in the 2007 rulemaking to the full set of NUREG–0654 planning standards and evaluation criteria; thus allowing a major features emergency plan to address any desired scope and depth of the emergency planning requirements, just short of a complete and integrated plan. While the definition of major features in Supplement 2 changed, the remaining guidance in Supplement 2 remains applicable to ESPAs.

with the emergency plans,[5] and the NRC regulations. Additional guidance applicable to ESPAs is provided in NUREG–0654, Supplement 2.

TVA proposed major features of an emergency plan for both ESP Plan 5A and ESP Plan 5B, pursuant to 10 CFR 52.17(b)(2)(i). In SSAR Section 1.2.2, "Site Development," states that 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, SMR designs. This set of bounding values, referred to as the PPE, is presented in SSAR Section 2.0, "Plant Parameter Envelope," and 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 megawatts thermal (MWt). The combined nuclear generating capacity from the site is not to exceed 2420 MWt (800 megawatts electrical (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. The CRN Site location is shown in SSAR Figure 1.2-1, "Clinch River Nuclear Site Location," while the general plant areas, including the power block area, are illustrated in SSAR Figure 1.2-2, "Clinch River Nuclear Site Plant Areas."

In SSAR Section 1.11, "Overview of Reactor Types," states that some of the design information from four conceptual, light-water cooled, SMR designs (identified below) was used by the applicant to create a "surrogate plant," and to develop the site-related design parameter values listed in SSAR Table 2.0-2 of Chapter 2.[6]

- BWXT mPower (Generation mPower LLC)
- NuScale (NuScale Power, LLC)
- SMR-160 (Holtec SMR, LLC)
- Westinghouse SMR (Westinghouse Electric Company, LLC)

In SSAR Section 1.11 further states that 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 loss of coolant accidents (LOCAs) precluded by elimination of large bore piping). All but the SMR-160 design 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.

In SSAR Section 13.3 states that the surrogate design is reasonable for SMR designs because it has been informed by preliminary information from vendors of SMRs that have had some pre-application discussions (for design certifications) with the NRC. In SSAR Section 13.3.3.1.3.1,

[5] *Atomic Energy Act of 1954*, as amended, 42 U.S.C. §§ 2011-2297 (2007).
[6] TVA used NEI 10-01, "Industry Guideline for Developing a Plant Parameter Envelope in Support of an Early Site Permit," Revision 1, to create a surrogate plant. (ADAMS Accession Nos. ML12144A428 and ML12144A429).)

"Multiple Reactors at the CRN Site," states that the surrogate design in the ESPA PPE includes multiple reactor units, and it is anticipated that the SMR design included in the COLA will also include multiple reactor units. In SSAR Section 13.3.3.1.4, "COLA," states that during preparation of a COLA, when TVA has selected a reactor design, TVA intends to demonstrate that the selected design falls within the design parameters postulated in the ESPA. (See Section 13.3.4.3 of this report, which addresses dose-based, consequence-oriented EPZ sizing associated with the SMR surrogate design.) Since the specific SMR type for the CRN Site has not been selected, technical information from various reactor designs was used to develop bounding parameters (i.e., PPE) intended to envelope the proposed facility characterization necessary to evaluate the suitability of the site for future construction and operation of a nuclear power plant. The choice of SMR type will be made by a COL applicant that uses the ESP as a reference for the CRN Site.

The staff reviewed the information in the ESPA, including SSAR Section 13.3, and the major features emergency plans (ESP Plans 5A and 5B) for conformance with applicable standards and requirements identified in Section 13.3 to NUREG–0800, and confirmed that the ESPA addresses the required information related to EP, subject to the requested exemptions identified in ESPA Part 6. The staff also conducted a site area visit to the CRN Site on May 16, 2017, consisting of a review of the various areas within and beyond the 2-mi PEP EPZ proposed in ESP Plan 5B, in order to gain first-hand knowledge of the CRN Site and surrounding areas, as they are addressed in the ESPA.

Consistent with Section 13.3 of NUREG–0800, the staff's technical reviews of the ESPA addressed the evaluation criteria for the 16 planning standards contained in Section II.A through II.P of NUREG–0654, to the extent that TVA addressed them in ESP Plans 5A and 5B.

13.3.4.1 Significant Impediments to the Development of Emergency Plans

Pursuant to 10 CFR 52.17(b)(1), an ESPA for a prospective commercial nuclear power reactor(s) must identify physical characteristics of the proposed site, such as egress limitations from the area surrounding the site, that could pose a significant impediment to the development of emergency plans. If any such physical characteristics are identified, the application must identify measures that would, when implemented, mitigate or eliminate the significant impediment.

The guidance in NUREG–0654, Supplement 2, defines *significant impediment* as a physical characteristic or combination of physical characteristics that would pose major difficulties for an evacuation or the taking of other protective actions as addressed in Section II, "Early Site Permit – Identification of Physical Characteristics," of NUREG–0654, Supplement 2. In addition, Section II states that an ESP applicant may identify such unique physical characteristics by performing a preliminary analysis of the time required to evacuate various sectors and distances within the PEP EPZ for transient and permanent populations, noting major impediments to the evacuation or the taking of other protective actions. Further, the ETE is an EP tool that can be used to assess the feasibility of developing emergency plans for a site, and would serve to demonstrate if any physical characteristics (or combination of physical characteristics) of the site could pose impediments to the development of emergency plans.

The requirements for developing an ETE are contained in Section IV, "Content of Emergency Plan," of Appendix E to 10 CFR Part 50. Associated guidance is provided in NUREG/CR-7002

(SAND2010-0016P), “Criteria for Development of Evacuation Time Estimate Studies” (ADAMS Accession No. ML113010515). In addition, NUREG–0800, Section 13.3, Subsection II, “Acceptance Criteria,” states the following in Criterion 16 under “SRP Acceptance Criteria”:

> For an ESP application, a preliminary analysis of evacuation times is one example of how some significant impediments to the development of emergency plans may be identified. Other factors, such as the availability of adequate shelter facilities, in consideration of local building practices and land use (e.g., outdoor recreation facilities, including camps, beaches, hunting or fishing areas), and the presence of large institutional or other special needs populations (e.g., schools, hospitals, nursing homes, prisons) should also be addressed when identifying significant impediments to the development of emergency plans. Any ETE analysis or other identification of physical impediments should include the latest population census numbers and reflect the most recent local conditions. Appendix 4 to NUREG-0654/FEMA-REP-1, Revision 1, and Supplement 2 to NUREG-0654/FEMA-REP-1, Revision 1, provide guidance relating to performing an ETE analysis. NUREG/CR-6863 provides additional information on ETEs.[7]

In SSAR Section 13.3.1, “Physical Characteristics,” TVA stated that the CRN Site lies north of U.S. Interstate 40, approximately midway between the communities of Harriman and Farragut in the eastern portion of the State of Tennessee. The U.S. Department of Energy’s (DOE’s) Oak Ridge Reservation (ORR) borders the north and east sides of the Clinch River Property, which covers an area of approximately 1200 acres located adjacent to the Clinch River Arm of the Watts Bar Reservoir in Oak Ridge, TN.

The permanent resident population was estimated using census block data obtained from the U.S. Census 2010 and is projected to 2015 for this analysis. According to the U.S. Census 2010 data, projected to the year 2015, there are 856 permanent residents within the 2-mi PEP EPZ of the CRN Site, and approximately 186,500 permanent residents within 14 mi of the proposed CRN Site. Additional details on the permanent resident population within the 2-mi PEP EPZ are provided in the ETE Report and in ESP Plan 5B of the ESPA.[8] A survey of the transient facilities was conducted to obtain information regarding the transient population expected at these locations. There is one campground (i.e., recreation vehicle park) within the 2-mi PEP EPZ with an estimated peak population of 197 persons.

In SSAR Section 13.3.1.2, “Area Population,” the applicant stated, in part, the following:

> The ETE does not identify any physical characteristics unique to the CRN Site which pose significant impediments to the development of the Emergency Plan for the CRN Site. The roadway network is modeled in the ETE and is shown to be

[7] NUREG/CR-6863 (SAND2004-5900), “Development of Evacuation Time Estimate Studies for Nuclear Power Plants,” January 2005 (ADAMS Accession No. ML050250240).

[8] The ESPA did not include an ETE analysis for the site boundary PEP EPZ in ESP Plan 5A because the site boundary PEP EPZ does not include any permanent residents, transients, or persons in special facilities (i.e., population distributions around the nuclear facility) that would have to be evacuated. This is consistent with the ETE requirements in Section IV of Appendix E to 10 CFR Part 50, and the guidance in NUREG–0654 (including Suppl. 2).

sufficient to handle the volume of traffic in the event of an emergency.

Section 13.3.4.5.17 of this report provides a detailed evaluation of the ETE Report. The ETE Report states in the Executive Summary that "[t]his ETE did not identify physical characteristics of the proposed site that could pose a significant impediment to the development of emergency plans."

FEMA Consultation

In its February 13, 2017, letter to FEMA, NRC requested that FEMA review the ESPA and provide the NRC its determination as to whether there is a significant impediment to the development of offsite emergency plans for the 2-mi PEP EPZ (for ESP Plan 5B).[9] In its August 11, 2017, response to NRC, FEMA stated, in part, the following:

> Your February 13, 2017 letter requested to know if FEMA identified any significant physical impediments to the development of offsite emergency response plans for the Clinch River Nuclear Site, presuming a 2-mile plume exposure pathway EPZ (for Emergency Plan 5B). FEMA, working with TEMA [Tennessee Emergency Management Agency], has not identified any physical impediments to a 2-mile plume exposure pathway EPZ, including evacuation if needed from that EPZ.

In its January 24, 2018, letter, FEMA supplemented its June 12, 2017, and August 11, 2017, letters with the following:

> With respect to the issue of significant impediments, as described in our August 11, 2017 letter, FEMA, working with Tennessee Emergency Management Agency (TEMA), has not identified physical characteristics of the proposed site that could pose a significant impediment to the development of emergency plans, including evacuation if needed from the 2-mile EPZ.

(Section 13.3.4.5 of this report also discusses FEMA's ESPA review associated with the exact size and configuration of the 2-mi PEP EPZ.)

The staff finds that the applicant has shown through use of the ETE Report, including consideration of other factors that support the CRN Site (such as FEMA's consultation with TEMA), that there are no physical characteristics unique to the CRN Site that could pose a significant impediment to the development of emergency plans.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in Supplement 2 to NUREG–0654 and NUREG–0800. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 52.17(b)(1) and 10 CFR 52.18, to identify physical characteristics of the proposed site that could pose a significant impediment to the

[9] The scope of FEMA's review for the ESPA is governed by the NRC regulations in 10 CFR 52.17(b)(1), (b)(2)(i) and (b)(4); 10 CFR 52.18; 10 CFR 50.47(a)(1)(iv) and (a)(2); and Appendix E of 10 CFR Part 50.

development of emergency plans, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations. The staff concludes that the applicant has demonstrated that there are no physical impediments to the development of emergency plans for the proposed 2-mi PEP EPZ, as described in ESP Plan 5B and the ETE Report.

13.3.4.2 Contacts and Arrangements with Local, State, and Federal Agencies

As part of the ESPA, TVA submitted major features of the emergency plans pursuant to 10 CFR 52.17(b)(2)(i). As such, 10 CFR 52.17(b)(4) requires that the applicant include in the SSAR a description of contacts and arrangements made with Federal, State, and local governmental agencies with EP responsibilities. These responsibilities are described in ESP Plan 5A and ESP Plan 5B, and are discussed below and in Sections 13.3.4.5.2 and 13.3.4.5.3 of this report.

Guidance regarding the specific nature of the contacts and arrangements is provided in Section 13.3 to NUREG–0800, which states in Subsection II (SRP Acceptance Criteria Nos. 15 and 18), that the ESPA should include copies of letters of agreement or other certifications, reflecting contacts and arrangements made with local, State, and Federal agencies (including agreements or other arrangements with tribal agencies and private organizations) with supporting EP responsibilities. The agreement information should be up-to-date when the application is submitted, and should reflect use of the proposed ESP site for possible construction of a new reactor (or reactors). In addition, a discussion of the details associated with any ambiguous or incomplete language in the letters of agreement should be provided in the application. If the applicant is unable to make arrangements with local, State, or Federal governmental agencies with EP responsibilities, the applicant should discuss its efforts to make such arrangements and describe any compensatory measures the applicant has taken or plans to take because of the lack of such arrangements.

Additional guidance is provided in Section II.B, “Contacts and Arrangements,” of Supplement 2 to NUREG–0654, which states that the descriptions of contacts and arrangements should include the name and location of the organization contacted, the title and/or position of the person(s) contacted, and the role of the organization in EP.

In SSAR Section 13.3.5, “Contacts and Agreements,” the applicant stated that TVA has held numerous discussions with local, State and county agencies, and emergency response organizations (EROs) that currently support DOE’s ORR. TVA stated that these discussions were productive and indicative of broad support from these organizations in further development of CRN emergency plans, and that the State of Tennessee and Anderson County provided letters of support. The applicant further stated that certification letters from the State of Tennessee, Roane County, and the City of Oak Ridge will be obtained by TVA and provided in the COLA. In addition, the applicant stated that TVA will maintain arrangements with surrounding EROs that currently support DOE’s ORR, including an existing agreement with the DOE’s Radiation Emergency Assistance Center/Training Site (REAC/TS) in Oak Ridge, TN. The applicant also stated that a letter of agreement with each organization (listed below) will be obtained by TVA for the CRN Site and provided in the COLA.

- Local medical facility services

- Offsite ambulance service
- Local firefighting support
- Local law enforcement agencies

The submission to the NRC of certification letters and letters of agreement in a COLA is addressed in Section 13.3.4.5.1 of this report.

As previously discussed, the ORR borders the north and east sides of the Clinch River Property, which includes the CRN Site, and is located adjacent to the Clinch River Arm of the Watts Bar Reservoir in Oak Ridge, TN. The applicant's reference to EROs that currently support ORR does not reflect an acknowledgement by those organizations of the proposed expanded responsibilities associated with the CRN Site. In addition, the applicant referenced letters from TEMA, and Anderson and Roane Counties, but did not include copies of these letters in the ESPA.

In an e-mail dated May 25, 2017, NRC provided TVA RAI-1-8761, Question 13.03.1 (ADAMS Accession No. ML17145A584), which requested copies of all letters and certifications (or other documentation of arrangements) from the local/offsite support organizations referred to in SSAR Section 13.3.5. These include TEMA, Anderson County, Roane County, City of Oak Ridge (if documentation exists), and the DOE REAC/TS. Consistent with the applicable guidance, the documents should describe each organization's acknowledgement of their support for the addition of a new reactor(s) at the CRN Site, and include the name and location of the organization contacted, the title and/or position of the person(s) contacted, and the role of the organization in EP and response.

In its June 15, 2017, response to RAI-1-8761, Question 13.03-1 (ADAMS Accession No. ML17166A455), TVA provided copies of letters from TEMA, Anderson County, Roane County, and the City of Oak Ridge.[10] In addition, TVA provided a copy of the existing letter of agreement with the DOE REAC/TS. With regard to contacts and arrangements made with local, State, and Federal agencies with EP responsibilities, TVA stated the following:

> TVA has held several productive discussions with these organizations and has received broad support from them, as indicated in the letters of support. Additionally, the letters express the organization's plans to actively participate in all emergency planning and radiological emergency preparedness exercises and evaluations.

[10] See (1) letter from D. Purkey, Deputy Commissioner, TEMA, to D. Stout (TVA), Subject: Support for TVA Small Modular Reactor Project, July 27, 2015; (2) letter from T. Frank, Anderson County Major, to D. Stout, Subject: Support for TVA Small Modular Reactor Project, December 11, 2015; (3) letter from R. Woody, County Executive, and R. Berry, Commission Chair, Roane County, to D. Stout, Subject: Support for TVA Small Modular Reactor Project, March 2, 2016; (4) letter from M. Watson, City Manager, City of Oak Ridge, TN, to D. Stout, Subject: Support for TVA Small Modular Reactor Project, February 24, 2016; and (5) letter from M. Branton, U.S. Department of Energy, to J. Parshall, TVA, "Letter of Agreement – Radiation Emergency Assistance Center/Training Site (REAC/TS) Support," March 27, 2015. See also, letter from D. Purkey, Deputy Commissioner, TEMA, to D. Stout, Subject: Determination of the EPZ Size for the Clinch River Site, April 8, 2015 (ADAMS Accession No. ML17354A198).

> The nature and extent of emergency planning support required from organizations referenced in SSAR Section 13.3.5 is not finalized because the ESPA proposes two distinct emergency plans requiring significantly different levels of emergency planning support. Therefore, TVA plans to obtain and provide the certification letters and letters of agreements from local/offsite support organizations at the COLA stage.

The staff reviewed the letters from offsite support organizations, and finds that TVA's response to RAI-1-8761, Question 13.03-1, provides an adequate description of contacts and arrangements made with Federal, State, and local governmental agencies, including other local/offsite organizations with EP responsibilities, pursuant to 10 CFR 52.17(b)(4). The staff finds the applicant's response to RAI-1-8761 acceptable and, therefore, considers RAI-1-8761, Question 13.03-1 resolved.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in Supplement 2 to NUREG–0654, and NUREG–0800. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 52.17(b)(4), to include a description of contacts and arrangements made with Federal, State, and local governmental agencies with EP responsibilities, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations. Specifically, the applicant provided an adequate description of contacts and arrangements made with Federal, State, and local governmental agencies.

13.3.4.3 Dose-Based, Consequence-Oriented EPZ Sizing

The purpose of this section is to address the methodology proposed by TVA in the ESPA that a COL applicant could use to establish a PEP EPZ for SMRs at the CRN Site, which includes the application of a graded approach to demonstrate compliance with EP regulatory requirements. Such an approach utilizes a consequence-oriented basis for determining the appropriate size of the PEP EPZ that is consistent with EPA early phase PAG criteria (i.e., dose-based).

13.3.4.3.1 Current Technical Bases for EPZs for Commercial Power Reactors

In 1978, a task force of NRC and EPA representatives established the technical basis for EP for large LWRs and published the results in NUREG–0396. The task force's report concluded that the objective of emergency response plans should be to produce dose savings for a wide spectrum of accidents that could produce offsite doses in excess of the EPA PAGs. The PAGs are reference values for radiation doses which warrant preselected protective actions (e.g., evacuation or sheltering-in-place) for public protection, if the projected dose received by an individual, in the absence of protective action, exceeds the PAGs.

The task force considered that the most important guidance for planning officials is the distance from the nuclear facility that defines the area over which planning for predetermined actions should be carried out. NUREG–0396 introduced the concept of the EPZ, stating that the recommended EPZ should be "of sufficient size to provide dose savings to the population in areas where the

projected dose from design-basis accidents (DBAs) could be expected to exceed the applicable PAGs under unfavorable atmospheric conditions." It identified the following two types of EPZs, where each has a distinct distance from the nuclear power plant, and defines a zone where advanced planning would be appropriate.

- A PEP EPZ, where the principal exposure sources from this pathway are (1) whole body external exposure to gamma radiation from the plume and from deposited material, and (2) inhalation exposure from the passing radioactive plume. The PEP EPZ is the zone in which plans are prepared for prompt or urgent actions to protect the public.

- An ingestion exposure pathway EPZ, where the principal exposure from this pathway would be from ingestion of contaminated water or foods, such as milk or fresh vegetables. The ingestion exposure pathway EPZ is the zone in which plans are prepared to prevent radioactive material from potentially entering the food chain.

In developing the recommendation, the task force considered several rationales for establishing the size of the EPZs. These rationales included the notions of risk criteria, probability limits, cost effectiveness, public perceptions, and a spectrum of accident consequences. The task force chose to base the rationale on a full spectrum of accidents and corresponding consequences, tempered by probability considerations. The task force stated that emergency plans for large LWRs could be based on a generic distance, out to which predetermined actions would provide dose savings for any such accidents.

Plume Exposure Pathway EPZ

The task force recommended a 10-mi (16-km) radius for this zone, primarily based on estimation of potential radiological consequences of accidents. The following considerations were used to determine the generic distance (i.e., 10 mi (16 km)) for the PEP EPZ:

- The EPZ would be the area beyond which the projected dose from DBAs would not exceed the EPA early phase PAG levels.

- The EPZ would be the area beyond which the doses from less severe core damage accidents (i.e., not involving large releases of radioactive material to the environment) would not exceed the EPA early phase PAGs.

- The EPZ would be of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt sequence accidents (i.e., beyond design basis severe events with release of substantial quantities of radioactive materials to the environment). In this case, life threatening doses would not occur outside the zone.

- Detailed planning for protective actions within the 10-mi (16-km) EPZ should provide a basis for the expansion of response efforts beyond the PEP EPZ, if needed.

The task force stated that the detailed planning within the PEP EPZ would provide a substantial base for expanding response efforts, if necessary for low probability, high consequence events, from which the effects could extend beyond the PEP EPZ. The task force determined the size of

the PEP EPZ by evaluating DBA data from licensees' Final Safety Analysis Reports (FSARs), and accident sequences, risk, and source term data from NUREG–75/014 (WASH 1400), "Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants," October 1975.

Ingestion Exposure Pathway EPZ

The task force recommended that the ingestion exposure pathway EPZ have a 50-mi (80-km) radius, based on the projected distance intended for longer-term response actions, and at which distance doses to the infant thyroid from the ingestion of milk would not exceed the thyroid exposure PAG for milk ingestion.

13.3.4.3.2 Dose-Based, Consequence-Oriented EPZ Size Concept for SMRs

Following public meetings with industry and stakeholders, the staff issued SECY-11-0152, "Development of an Emergency Planning and Preparedness Framework for Small Modular Reactors," dated October 28, 2011 (ADAMS Accession No. ML112570439). This paper discussed the staff's intent to develop a technology-neutral, dose-based, consequence-oriented EP framework for SMR sites that takes into account the various designs, modularity and co-location, as well as the size of the EPZ. It also stated that the "staff will work with stakeholders to develop general guidance on calculating the offsite dose, and is anticipating that the industry will develop and implement the detailed calculation method for review and approval by the staff."

In SECY-15-0077, the staff proposed a consequence-oriented approach to establish requirements commensurate with the potential consequence to public health and safety, and the common defense and security at SMR and other new technology (ONT) facilities. The staff stated that the need to establish an EP framework for SMRs and ONTs is based upon the projected offsite dose in the unlikely occurrence of a severe accident. In the SRM to SECY-15-0077, "Staff Requirements – SECY-15-0077 – Options for Emergency Preparedness for Small Modular Reactors and Other New Technologies," dated August 4, 2015 (ADAMS Accession No. ML15216A492), the Commission directed the staff to proceed with rulemaking, and that for any SMR reviews conducted prior to the establishment of a rule, the staff should be prepared to adapt an approach to EPZs for SMRs under existing exemption processes, in parallel with its rulemaking efforts. As discussed in SECY-11-0152, a scalable method for determining the EPZ for SMRs is based on offsite dose considerations.

13.3.4.3.3 Method for Determining Plume Exposure Pathway EPZ Size

In the SRM to SECY-15-0077, the Commission has indicated that it is open to considering SMR proposals to change the EPZ size, including exemption requests, until such time as the ongoing EP rulemaking for SMRs and ONTs is complete. Therefore, the staff is evaluating the reasonableness of the applicant's proposal in the ESPA for a method to perform analyses to support the determination of the PEP EPZ size. The staff used NUREG–0396 and other regulatory guidance (listed in Section 13.3.3 of this report) on accident assessment to perform this review.

In SSAR Section 13.3.3.1, "Plume Exposure Pathway Emergency Planning Zone," describes TVA's method for performing analyses to determine an appropriate EPZ size for the Clinch River site that

a COL applicant could use to determine the size of the PEP EPZ. The approach considers the use of the existing EP regulatory framework, including the dose saving criteria in NUREG–0396. Specifically, the applicant proposed that the technical criteria for determining the PEP EPZ are the following:

- The PEP EPZ should encompass those areas in which projected dose from DBAs could exceed the EPA early phase PAGs.

- The PEP EPZ should encompass those areas in which consequences of less severe core melt accidents could exceed the EPA early phase PAGs.

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

Similar to the analysis in NUREG–0396, the applicant's proposed method to determine PEP EPZ size relies upon consequence analyses for a range of potential accidents, including DBAs and severe accidents. Although the applicant discussed qualitatively the likelihood of the surrogate design used in the ESPA PPE to meet the proposed criteria, the applicant proposed that the COLA that references the CRN Site ESP would confirm that the criteria are met for the selected PEP EPZ, using the specific information related to potential accidents that result in airborne radiological releases for the plant design chosen to be constructed and operated at the CRN Site. Therefore, for the ESPA, the staff is not reviewing or approving a specific PEP EPZ size that is associated with a specific SMR technology. The staff is evaluating the reasonableness of the applicant's proposed criteria and method to determine the PEP EPZ, which is to be used by the COL applicant as justification for the PEP EPZ in the COLA.

The applicant's proposed method to determine the PEP EPZ size would be used to verify that, beyond the proposed PEP EPZ, the dose consequences for most accidents do not exceed the EPA early phase PAGs, and that there is a substantial reduction in early health effects[11] for releases due to less probable, more severe accidents. The method includes the following steps:

1. Selection and categorization of accident scenarios.

2. Development of fission product release to the environment as a function of time (radiological release source term).

3. Calculation of projected dose consequences at a distance, and comparison to dose criteria for DBAs and less severe accidents.

[11] The EPA PAG Manual describes the *early phase* for taking protective actions (i.e., sheltering-in-place, evacuation, or administration of stable/radioprotectant potassium iodide (KI)) as lasting hours to days following an incident, and for Table 2-1, "PAGs and Protective Actions for the Early Phase of a Radiological Incident" (i.e., early phase PAGs), as occurring over the first four days following the anticipated (or actual) start of a radioactive release. The four-day period is chosen as the duration of exposure during the early phase because it is a reasonable estimate of the time necessary to make measurements, reach decisions, and prepare to implement further protective actions (such as relocation) if necessary. *Early health effects* are generally associated with a period of days to weeks following radiation exposure.

4. Calculation of probability of dose exceedance at distance, and evaluation of substantial reduction in early health effects criterion for more severe accidents.

Proposed Criteria

The applicant proposed dose criteria to aid in determination of EPZ size, that if not exceeded by projected consequences for potential accidents for average meteorological conditions at the site (i.e., mean value of meteorological conditions), would assure that areas outside the PEP EPZ would not require early protective actions, such as evacuation to ensure public health and safety. The dose criteria proposed by the applicant are that beyond the PEP EPZ outer boundary distance from the facility, the consequences of DBAs and less severe accidents would not exceed the EPA early phase PAGs. For more severe accidents, the criterion is that there is a substantial reduction in early health effects in areas beyond the selected PEP EPZ.

The dose criterion for DBAs and less severe accidents is that the projected dose from exposure to airborne releases during the initial four days (including exposure to the radioactive plume and deposited radioactive material) is less than 1 roentgen equivalent man (rem) (0.01 sievert (Sv)) total effective dose equivalent (TEDE). This dose criterion is consistent with the lower end of the range of projected TEDE that would warrant recommending initiation of protective actions for the public, as given in the (EPA) PAG Manual's description of early phase PAGs to protect against exposure to accident airborne releases. As given in NUREG–0396, the 10-mi PEP EPZ in the EP regulations for commercial power reactors is also based on identification of the area where the early phase PAGs would not be exceeded for DBAs and less severe accidents (e.g., more probable core damage accidents with release of radioactive material to the atmosphere). Because the applicant's proposed dose criterion for DBAs and less severe accidents is based upon the same reasoning that was used as the technical basis for the PEP EPZ distance codified in NRC regulations, the staff finds that the proposed dose criterion for DBAs and less severe accidents is acceptable for use in analyses that form the technical basis for PEP EPZ size.

The substantial reduction in early health effects criterion is that the conditional probability of acute dose exceeding 200 rem whole body from more severe accident scenarios is less than 1×10^{-3} per reactor-year (rx-yr). This criterion is similar to the criterion used to evaluate consequences of very severe accidents (e.g., less probable core damage accidents that release very large quantities of radioactive material to the atmosphere) in NUREG–0396, which is the technical basis for the 10-mi PEP EPZ in the EP regulations for commercial power reactors. The NUREG–0396 task force determined that certain features of the more severe core-melt accidents should be considered in planning to assure that some capability exists to reduce the consequences of even the most severe accidents. The projected consequences of very severe accidents were plotted against distance, and showed that for large LWRs, the conditional probability of exceeding a whole body dose of 200 rem decreases rapidly as one approaches 10 mi, which was subsequently chosen to be the PEP EPZ radius based on all factors considered. As stated in the discussion on page I-37 of NUREG–0396, 200 rem whole body is the dose at which significant early injuries start to occur. Because the applicant's proposed substantial reduction in early health effects criterion is based upon the same reasoning that was used as the technical basis for the PEP EPZ distance, as codified in NRC regulations, the staff finds that the applicant's proposed substantial reduction in early health effects criterion is acceptable for use in analyses that form the technical basis for PEP EPZ size.

Accident Selection and Categorization

Consistent with the NUREG–0396 analysis, the applicant proposed to evaluate a range of accidents to determine the PEP EPZ size. As stated in SSAR Section 13.3.3.1.1, "Environmental Protection Agency Protective Action Guides," the DBA scenarios will be taken from those postulated accidents identified in a future COLA FSAR. The staff will evaluate the acceptability of the identified postulated accidents, as discussed in Chapter 15, "Transient and Accident Analysis," of NUREG–0800, as part of the COLA review.

For severe accidents, the applicant has proposed a methodical procedure to select accident scenarios from the plant-specific probabilistic risk assessment (PRA), and categorize them as less severe or more severe, based on core damage frequency (CDF). The applicant proposed that the less severe accident category includes core melt accidents with intact containment, beyond design basis scenarios, and accident scenarios with mean CDF greater than 1×10^{-6} per rx-yr. Scenarios will be grouped based on similar timing of core damage and similar equipment availability. The applicant proposed that the more severe accident category includes core melt accidents with postulated containment bypass or failure with potential for higher consequences with mean CDF greater than 1×10^{-7} per rx-yr. For both severe accident categories, the initial accident sequence selection should include accident sequences with mean CDF greater than 1×10^{-8} per rx-yr.

As noted by the applicant in SSAR Section 13.3.3.1.2, "Substantial Reduction in Early Health Effects," there are a number of precedents for the use of 1×10^{-7} per year frequency as a basis for accident sequences selection, including information from NUREG–0396. Although the frequency bounds for the severe accident categories presented by the applicant appear to be reasonable based on the stated precedents, the staff is not making a determination on acceptability at this time, and will review the selection and categorization of severe accidents in more detail when the design-specific PRA and EPZ size basis analyses are evaluated as part of a COLA review.

Radiological Release Source Terms

The applicant stated that DBA radiological release source terms will be the same as defined for postulated accidents in a COLA FSAR Chapter 15. The DBA radiological consequence analyses will be evaluated by the staff in its review of a COLA, as discussed in Section 15.0.3, "Design Basis Accident Radiological Consequence Analyses for Advanced Light Water Reactors," of NUREG–0800, or comparable design specific review standard, if applicable. Similarly, the PEP EPZ size basis analyses, including the applicant's use of the DBA radiological release source terms within the analyses, will also be evaluated by the staff during a COLA review. Therefore, the staff finds that the commitment in the ESPA to use COLA FSAR DBA radiological release source terms is acceptable for use in the analyses to support selection of the PEP EPZ size.

The applicant stated that the severe accident radiological release source terms will be determined based on an NRC-accepted methodology. In SSAR Section 13.3.3.1.4, the applicant stated that a COLA will include detailed information on the Level 2 PRA[12] for the selected reactor technology to

[12] The NRC uses PRA to estimate risk by computing real numbers to determine what can go wrong, how likely it is, and what are its consequences. Thus, PRA provides insights into the strengths and weaknesses

be constructed and operated at the CRN Site. The Level 2 PRA information is used to define severe accident fission product releases for the selected less severe and more severe accident sequences that are included in the analyses to support PEP EPZ size. The Level 2 PRA will be evaluated by the staff in its review of a COLA, as discussed in Chapter 19, "Severe Accidents," of NUREG–0800. Similarly, the PEP EPZ size basis analyses, including the applicant's use of the Level 2 PRA within the analyses, will also be evaluated by the staff during a COLA review. Because an ESP does not permit construction or operation of a power reactor at the site, specific information on reactor design such as a PRA is not provided or reviewed as part of the ESPA. In addition, the applicant is not determining the PEP EPZ size in the ESPA, and has deferred that determination until detailed design information for the specific SMR design is included as part of the COLA. Therefore, the staff finds that the applicant's descriptions of how severe accident radiological release source terms could be determined in a COLA are reasonable.

Consequence Analysis

In SSAR Section 13.3.3.1.1, the applicant described considerations for performing the DBA and less severe accident consequence analyses for comparison to the dose criterion (i.e., EPA early phase PAG of 1 rem TEDE). The analyses will calculate TEDE for the following exposure pathways: external exposure to the cloud (plume), inhalation, ground shine, and re-suspended ground contamination. The TEDE will be calculated for a 4-day period, consistent with the discussion in the PAG Manual for use of the early phase PAGs. The analyses will also use site-specific information on meteorology to develop average expected (50^{th} percentile) dispersion[13] characteristics and plant-specific radiological release source terms. The dose results will be compared to the dose criterion to determine that the EPA early phase PAG of 1 rem TEDE is not exceeded at the PEP EPZ boundary.

In SSAR Section 13.3.3.1.2, the applicant described considerations for performing the more severe accident consequence analysis, and the calculation of the conditional probability of exceeding the dose at which early health effects may occur. The applicant stated that the dose calculations will be based on methodology accepted for the selected certified SMR beyond design basis accidents. For each of the accident scenarios in the more severe accident category, the probability of exceeding 200 rem whole body acute dose will be calculated as a function of distance. At each given distance, the scenario frequency-weighted probabilities are summed over all scenarios and normalized by total CDF to give conditional probability of exceeding 200 rem whole body per rx-yr. The normalized conditional probability versus distance is plotted, and the distance where the result drops below 1×10^{-3} per rx-yr is determined. This distance is then confirmed to be within the PEP EPZ.

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of the design and operation of a nuclear power plant. For the type of nuclear plant currently operating in the United States, a PRA can estimate three levels of risk, including: (1) a Level 1 PRA estimates the frequency of accidents that cause damage to the nuclear reactor core (commonly called CDF; (2) a Level 2 PRA, which starts with the Level 1 core damage accidents, estimates the frequency of accidents that release radioactivity form the nuclear power plant; and (3) a Level 3 PRA, which starts with the Level 2 radioactivity release accidents, estimates the consequences in terms of injury to the public and damage to the environment. (Source: https://www.nrc.gov/about-nrc/regulatory/risk-informed/pra.html)

[13] 50^{th} percentile dispersion, or 50 percent meteorology, refers to the average atmospheric dispersion characteristics for the site.

The staff finds that the applicant's description of the method to perform the consequence analyses to support the determination in a COLA of the PEP EPZ size is reasonable and consistent with the analyses that were described in NUREG–0396. The staff is not making a final determination of the acceptability of the PEP EPZ size at this time, and will review the consequence analyses in more detail when the PEP EPZ size basis analyses are evaluated as part of a COLA review.

Small Modular Reactor Plant Parameters for Plume Exposure Pathway Emergency Planning Zone Size Considerations

To support the exemption requests in ESPA Part 6 and the emergency plans in ESPA Part 5, TVA concluded that a PEP EPZ of 2-mi radius around the CRN Site provides reasonable assurance of public health and safety from potential accidents for any of the four SMRs within the PPE. TVA further stated that it is possible that at least one of the SMR designs will be able to demonstrate that the 1 rem TEDE threshold, established in the EPA PAG Manual, will not be exceeded at the site boundary in the event of an accident. To aid in its evaluation of the exemption requests, in eRAI-8885 the staff requested TVA provide additional information to describe whether and how the proposed accident consequence criteria in SSAR 13.3 are met at a given PEP EPZ boundary distance of less than 10 miles (including at the site boundary) for potential reactor facilities that would be encompassed within the PPE, as requested in the ESPA.

By letters dated August 24, 2017, March 9, 2018, and March 30, 2018 (ADAMS Accession Nos.ML17237A175, ML18068A732, and ML18089A605, respectively), in response to eRAI-8885 and eRAI-9602, TVA described an example evaluation using information on potential design basis and severe accidents for one of the SMR designs used to develop the ESPA PPE. This evaluation used the EPZ size determination methodology in SSAR Section 13.3 to show that, if a COLA selects that specific SMR design, it is likely that the COL applicant will be able to show that the resulting offsite doses would support a PEP EPZ size at the site boundary, or alternatively at a 2-mi radius. Because the analysis used information for an SMR design that is at the lower end of the design rated power that would fit the ESPA PPE (i.e., a range of 160 megawatts thermal (MWt) to 800 MWt per reactor), the accident releases and resulting doses are not bounding for any other SMR design considered within the ESPA. The example evaluation results show that the mean doses calculated at the site boundary and at the 2-mi radius for the specific SMR design are much less than the EPA early phase PAG for DBAs and more probable core melt accidents. The specific design used in the example analysis does not have accident scenarios in the category for comparison to the SSAR Section 13.3 criterion related to less probable core melt accidents. Therefore, the example is more likely to meet the dose criteria at the site boundary as compared to what would be expected in COLA analyses from the other SMR designs in the PPE, and doesn't necessarily support whether any other SMR in the PPE could support a PEP EPZ of less than 10 mi.

The staff audited the example calculation and related documents supporting the responses to eRAI-8885 and eRAI-9206, which provided source terms and dose results for a DBA and a severe accident using preliminary design information for a specific SMR design. The staff also evaluated key parameters associated with the accident source term to assess their reasonableness for, and representativeness of, the SMR design. The staff's summary of the audit was issued on May 22, 2018 (ADAMS Accession No. ML18122A344).

The specific accident release source term information used in the example calculation is proprietary to the vendor for the SMR design used in the analysis. The accident source terms for the example analysis are based on a design that uses fuel that is similar to standard LWR fuel, which is representative of the SMR designs under consideration in the CRN Site ESPA. It also assumes a core power level for a single unit at 160 MWt. TVA anticipates that comparable methodologies and techniques that are used for the development of the source terms for large LWRs will be used in the development of the SMR accident source terms to be presented in SMR design documents for evaluation of the radiological consequences of accidents.

The NRC staff determined that the DBA and severe accident scenarios, as well as isotopic release values in the example calculation, are consistent with the information that the SMR vendor supplied in its design certification application FSAR and supporting documents. In addition, the staff determined that the SMR vendor used reasonable assumptions and accepted computer codes to develop the accident source terms. Therefore, based on its evaluation of the applicant's information, the staff finds the example calculation accident source terms to be not unreasonable for use in evaluation of the likelihood that a COLA would be able to justify an EPZ size of less than a 10-mi radius, with an analysis using SMR design-specific information.

TVA has stated that it does not intend that the exemption requests are only applicable to a specific design as in the example calculation, and has established plant parameters that will ensure the appropriate application of the exemption requests to support a site-specific PEP EPZ at the CRN Site. Therefore, as described in Enclosure 1 to the March 30, 2018, response to eRAI-9206, TVA developed non-design-specific plant parameters (i.e., accident atmospheric release source term) for the EPZ exemption requests. This non-design-specific plant parameter accident atmospheric release source term provided in the RAI response describes the bounding isotopic releases for a 4-day release from the proxy plant described in the ESPA PPE, for the purposes of determining the PEP EPZ size using the SSAR 13.3 methodology.

To develop the non-design-specific 4-day total atmospheric release source term, TVA created a composite source term based on vendor information on accident source terms from a spectrum of accidents and SMR vendors. Specifically, TVA used information from the ESPA SSAR Chapter 15 PPE source term (for a 800 MWt SMR design) and the vendor-specific information for the two accident source terms used in the EPZ size consideration example calculation for a separate SMR design of 160 MWt per reactor. Using the information from the three accident source terms for the two SMR designs, TVA took the largest release magnitude for each included isotope, within each analysis release time period, from any of the three source terms. TVA then added together the results for each time period to determine the maximum total release over 4 days for each isotope. To account for design uncertainty and the current analysis maturity for all the SMRs, TVA increased the isotopic releases by a discretionary margin of 25 percent. As a final step, TVA used the non-design-specific accident source term as input to an analysis using the SSAR 13.3 PEP EPZ size determination methodology. The analysis included adjustments to the isotopic activity values necessary for use as input to the MELCOR Accident Consequence Code System (MACCS) computer code, which takes source term input as fractional release of core inventory per chemical group (e.g., noble gases), instead of per isotope. These adjustments increased the margin to more than 25 percent. The analyses confirmed that the radiological consequences of accidents would not exceed the methodology dose criteria using the source term reported in the RAI response. The staff assessed TVA's assumptions and determined that they were reasonable, and finds that this

analysis provides assurance that, if the releases from the specific plant chosen for a COLA are bounded by those in the non-design-specific plant parameter accident atmospheric release source term, it is likely that the COLA evaluation of EPZ size would support the use of either set of EP exemptions. Therefore, the non-design-specific atmospheric release source term, presented below in Table 13.3-1, is based on a range of core melt accidents for two SMR designs with rated thermal power levels at the lower and upper end of the range of SMRs included in the ESPA PPE.

In order to evaluate the reasonableness of the non-design-specific plant parameter accident atmospheric release source term, the NRC staff audited the example calculations and related documents supporting the development of the plant parameter source term for EPZ size determination. The staff evaluated the process associated with the development of the bounding accident source term to assess its reasonableness for, and representativeness of, the range of SMR designs used as the basis for the ESPA PPE. The staff's summary of the audit was issued on May 22, 2018, (ADAMS Accession No. ML18122A344). The staff finds that the process that TVA used to develop the non-design-specific plant parameter accident atmospheric release source term took into appropriate consideration the currently available design accident release information for two SMR designs within the ESPA PPE, applied conservative analysis margin, and generalized the source term to be bounding for a range of accidents for any of the SMR designs considered within the ESPA PPE. The staff determined that the DBA and severe accident scenarios and isotopic release values in the example calculation and in SSAR Chapter 15 are consistent with the information that the SMR vendors supplied to TVA. The staff also found that, by taking the composite maximum releases for each isotope for three accidents from two SMR designs and applying additional margin of more than 25 percent, both in the TVA composite source term and in the adjustments to the source term input to the MACCS analysis cases, TVA has proposed a reasonably bounding potential accident release source term for a 4-day release from a proxy plant that is representative of a range of SMR designs. Therefore, based on its evaluation of the applicant's information, the staff finds that the non-design-specific plant parameter accident atmospheric release source term is not unreasonable for use in evaluation of the likeliness that a COLA would be able to justify an EPZ size less than a 10-mi radius, with an analysis using SMR information.

As stated in SSAR Section 1.2.2, the ESPA 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, where the combined generating capacity of the site is not to exceed 2,420 MWt. The non-design-specific plant parameters provided by TVA in the March 30, 2018, response to eRAI-9206 provide a bounding accident atmospheric release source term that would be applicable to the range of SMR designs included in the basis for the ESPA PPE. Therefore, the staff is proposing the following permit condition for the exemption, where the COL applicant must demonstrate that the SMR design information (used to support the exemption request) is bounding for the SMR technology selected. If TVA intends to implement the exemptions discussed in this evaluation, or propose similar exemptions related to PEP EPZ size, a COLA must provide an analysis using the methodology and criteria in SSAR Section 13.3 to justify the PEP EPZ size.

Permit Condition 1

An applicant for a combined license (COL) that references this early site permit shall provide detailed information in the COL application that demonstrates that the accident release source term

information for the selected SMR design used in analyses to support the determination of the plume exposure pathway emergency planning zone (EPZ) size is bounded by the non-design-specific plant parameter source term information used in the analysis supporting the exemption requests, as described in the following Table 13.3-1, “Plant Parameter Accident Releases for Determining Emergency Planning Zone (EPZ) Size in Support of Emergency Planning Exemptions.”

Table 13.3-1

Plant Parameter Accident Releases for Determining Emergency Planning Zone (EPZ) Size in Support of Emergency Planning Exemptions

Nuclide	4-Day Total Activity (Ci)	Nuclide	4-Day Total Activity (Ci)
Kr-85	3.29E+03	Ru-106	2.68E+00
Kr-85m	1.94E+03	Rh-103m	4.11E+00
Kr-87	1.10E+03	Rh-106	2.70E+00
Kr-88	3.04E+03	Nb-95	6.45E+01
Xe-133	1.74E+05	Co-58	7.88E-05
Xe-135	1.49E+04	Co-60	8.74E-04
Xe-135m	6.95E+02	Mo-99	6.16E+01
Cs-134	1.26E+02	Tc-99m	5.80E+01
Cs-136	2.82E+01	Nb-97	3.95E+00
Cs-137	8.88E+01	Nb-97m	4.61E-01
Rb-86	9.92E-01	Ce-141	1.31E+00
Rb-88	2.59E+03	Ce-143	1.09E+00
Ba-139	1.22E+01	Ce-144	1.10E+00
Ba-140	4.82E+01	Np-239	1.10E+01
Sr-89	2.20E+01	Pu-238	7.75E-03
Sr-90	7.46E+00	Pu-239	3.21E-04
Sr-91	2.05E+01	Pu-240	6.48E-04
Sr-92	1.27E+01	Pu-241	1.60E-01
Ba-137m	8.00E+01	Zr-95	6.34E-01
I-131	6.79E+02	Zr-97	5.64E-01
I-132	4.35E+02	Am-241	1.06E-04
I-133	9.72E+02	Cm-242	2.61E-02
I-134	2.08E+02	Cm-244	1.09E-02
I-135	6.59E+02	La-140	4.75E+00
Sb-127	1.51E+01	La-141	2.45E-02
Sb-129	1.23E+01	La-142	8.65E-01
Te-127	1.60E+01	Nd-147	6.82E+00
Te-127m	2.86E+00	Pr-143	3.10E-01
Te-129	1.75E+01	Y-90	5.05E-01
Te-129m	8.15E+00	Y-91	2.74E-01
Te-131m	2.22E+01	Y-92	7.46E+00
Te-132	1.78E+02	Y-93	2.90E-01
Te-131	1.09E+01	Y-91m	9.90E+00
Rh-105	2.90E+00	Pr-144	9.65E-01
Ru-103	4.13E+00	Pr-144m	1.72E-02
Ru-105	1.55E+00		

COLA

In SSAR Section 13.3.3.1.4, the applicant described the information to be provided in a COLA, as a technical basis for a site-specific PEP EPZ size. A COLA will apply the methodology proposed in SSAR Section 13.3.3, "Emergency Planning Zones," to determine the CRN Site's site-specific PEP EPZ, and further evaluate whether either of the two major features emergency plans (included in ESPA Part 5) may be applicable to the COLA PEP EPZ. A COLA will also provide supporting information for the PEP EPZ technical basis analysis, such as the DBA radiological consequence analysis, Level 1 and Level 2 PRA information, and the information on the consequence analyses using the PEP EPZ size methodology described in SSAR Sections 13.3.3.1.1 and 13.3.3.1.2. While the ESPA does not include any COL action items related to the PEP EPZ size, the staff proposed COL Action Item 13.3-1 in Section 13.3.4.4 of this report.

Conclusion

The staff concludes that the applicant's proposed methodology (described in SSAR Section 13.3) to prepare an analysis, as the technical basis to support the PEP EPZ size determination in a subsequent CRN Site COLA, is reasonable, consistent with Commission considerations for SMR EPZ size determinations, and consistent with the analyses that form the technical basis for the current regulatory requirement of a PEP EPZ about 10 mi in radius for large LWRs. Therefore, the proposed methodology is acceptable for determining the appropriate size of the PEP EPZ for the CRN Site, subject to approval of the exemptions discussed in Section 13.3.4.4 of this report.

13.3.4.4 Exemption Requests – Site Boundary & 2-Mile EPZ

In Part 5 of the ESPA, TVA provided the "major features" of two distinct emergency plans, pursuant to 10 CFR 52.17(b)(2)(i), which describe two different PEP EPZs. ESPA Part 5A, "Emergency Plan (Site Boundary EPZ)," provides the major features of an emergency plan for a PEP EPZ at the site boundary (i.e., ESP Plan 5A), and ESPA Part 5B, "Emergency Plan (2-Mile EPZ)," provides the major features of an emergency plan for a PEP EPZ that consists of an area approximately 2 mi in radius from the CRN Site center point (i.e., ESP Plan 5B).

In ESPA Part 6, "Exemptions and Departures," TVA provided two sets of requested exemptions from NRC's emergency planning (EP) regulations for nuclear power plants, which are reflected in the respective major features emergency plans. Specifically, ESP Plan 5A includes the 25 individual requested exemptions in Table 1-1, "Exemptions Requested from 10 CFR 50.33(g), 50.47(b), and (c)(2) for the Site Boundary EPZ Emergency Plan," and Table 1-2, "Exemptions Requested from 10 CFR Part 50, Appendix E for the Site Boundary EPZ Emergency Plan." ESP Plan 5B includes two individual requested exemptions in Table 1-3, "Exemptions Requested from 10 CFR 50.33(g), 50.47(b), and (c)(2) for the 2-Mile EPZ Emergency Plan," consisting of 10 CFR 50.33(g) and 10 CFR 50.47(c)(2). Both sets of exemptions reflect the use of an alternative method for emergency planning for use in a COLA to determine the EPZ, considering that the NRC's EP regulations require that the PEP EPZ for commercial nuclear power reactors encompasses an area with a radius of approximately 10 mi (16 km) (TVA 2017-TN4921|TVA 2016-TN4637|).

TVA requested that NRC review the two distinct major features emergency plans (i.e., ESP

Plan 5A and 5B), which are based on the establishment in a COLA of a PEP EPZ that is able to meet the radiological dose-related criteria (set forth in Site Safety Analysis Report (SSAR) Section 13.3, "Emergency Preparedness,") for the SMR technology that will be selected by the COL applicant. The staff's evaluation of the requested exemptions takes into account the proposed methodology in SSAR Section 13.3 that a COLA applicant (referencing the CRN Site ESP) would use to determine the adequacy of the PEP EPZ size.

TVA requested exemptions from various NRC requirements associated with onsite (licensee) and offsite (State/local) REP plans related to the two different major features emergency plans the applicant submitted with the ESPA: ESPA Plan 5A involving the establishment of a PEP EPZ at the site boundary, and ESPA Plan 5B consisting of an area approximately 2 mi in radius from the site center point. In SSAR Section 13.3 provides a general overview of the two major features emergency plans included in ESPA Part 5. It states that both major features emergency plans are based on the existing TVA generic emergency plan, and that they comply with 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50, considering the requested exemptions that are described in ESPA Part 6 (addressed below). ESPA Part 6 states that TVA is proposing a dose-based, consequence-oriented approach to establish an appropriate PEP EPZ size that is consistent with, and based upon, the EPA PAG dose criteria for early phase protective actions in the unlikely event of a severe accident.

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when: (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Special circumstances exist when application of the regulation in the particular circumstance would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule (see 10 CFR 50.12(a)(2)(ii)).

TVA identified two sets of proposed exemptions, consisting of (1) exemptions for a PEP EPZ at the site boundary (see ESPA Part 6 Table 1-1, "Exemptions Requested from 10 CFR 50.33(g), 50.47(b), and (c)(2) for the Site Boundary EPZ Emergency Plan," and Table 1-2, "Exemptions Requested from 10 CFR Part 50, Appendix E for the Site Boundary EPZ Emergency Plan"); and (2) exemptions for an approximate 2-mi PEP EPZ (see ESPA Part 6 Table 1-3, "Exemptions Requested from 10 CFR 50.33(g), 50.47(b), and (c)(2) for the 2-Mile EPZ Emergency Plan").

With regard to establishing the size of the PEP EPZ, the requirements in 10 CFR 50.33(g) and 10 CFR 50.47(c)(2) include the statement that "[t]he size of the EPZs also may be determined on a case-by-case basis for gas-cooled reactors and for reactors with an authorized power level less than 250 MW thermal." In addition, 10 CFR Part 50, Appendix E, provides the flexibility to determine other emergency planning considerations, such as organization, assessment actions, activation of emergency organization, emergency facilities, and equipment, on a case-by-case basis for certain facilities.

However, while there is flexibility in terms of what Appendix E may require, the staff has found that TVA's request for exemption from certain Appendix E requirements is acceptable to allow approval of a site boundary PEP EPZ major features emergency plan where the EPZ selected by a COL applicant would not extend beyond the site boundary to cover offsite areas. This is discussed in

greater detail in section 13.3.4.4.C. Also a specific reactor technology has not been selected, and 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. In addition, the combined nuclear generating capacity from the site is not to exceed 2420 MWt (800 MWe). Since the proposed PPE for the CRN Site includes power levels that exceed 250 MWt, and do not identify an SMR that is gas-cooled, the proposed exemptions must be reviewed pursuant to NRC's exemption process, rather than on a case-by-case basis.

The staff reviewed the proposed methodology, requested exemptions, and the two major features emergency plans, as part of its review of ESPA Chapter 13. Importantly, the ESP application does not request and the staff has not approved or determined a specific PEP EPZ size or reactor technology for the CRN Site. The staff has evaluated the reasonableness of the applicant's proposed criteria and method for determining the PEP EPZ and EP requirements in a future COL application, which will, if submitted, reference a specific reactor design. The regulatory evaluation of the 25 exemption requests for the site boundary PEP EPZ is provided below in Section 13.3.4.4.A. The regulatory evaluation of the two exemption requests for the 2-mi PEP EPZ is provided below in Section 13.3.4.4.B. The staff's technical evaluation of all proposed exemptions, is provided below in Section 13.3.4.4.C.

In SSAR Section 13.3, TVA described its approach for establishing the PEP EPZ sizing for the CRN Site. Specifically, the appropriateness of the exemptions requested in ESPA Part 6 is established using a consequence-based approach for a spectrum of accidents that could produce offsite doses in excess of the EPA early phase PAGs. This approach is consistent with the objective of emergency response plans (i.e., to provide dose savings), and with NUREG–0396.

TVA stated that a PEP EPZ less than the "about 10 miles," cited in 10 CFR 50.47(c)(2), is justified based upon the significantly reduced risk of radiological release and offsite radiological consequences expected for SMR designs. Specifically, SMR designs will have small radionuclide inventory and source terms; the projected rate of progression of postulated accidents is anticipated to be slower; and various design features may eliminate several normally considered DBAs. Further, beyond-DBAs are significantly less likely.[14] The ESPA uses an EPZ sizing approach – consistent with that recommended by the NRC staff in SECY-15-0077 – for establishing a PEP EPZ boundary that ensures public protection from dose levels above the 1 rem TEDE threshold established in the PAG Manual (discussed in Section 13.3.4.3.2 of this report). TVA concluded that a 2-mi radius from the site center point provides reasonable assurance of public health and safety from any of the four SMR designs within the PPE. Further, it is possible that at least one of the SMR designs will demonstrate that the 1 rem TEDE threshold established in the PAG Manual will not be exceeded at the site boundary. Therefore, TVA has chosen to include two major features emergency plans in its application.

The major features emergency plan associated with the 2-mi PEP EPZ contains the same features as a traditional 10-mi EPZ emergency plan. For a PEP EPZ established at the site boundary, TVA proposed that there is no need for a pre-planned, offsite REP plan, as traditionally defined by the

[14] The advantages of SMR designs are addressed in more detail in NRC's July 28, 2017, eRAI-8885 (ADAMS Accession No. ML17209A401), and TVA's August 24, 2017, response to eRAI-8885 (ADAMS Accession No. ML17237A175).

NRC and FEMA, because of the very low calculated radiological risk. The hazards from a radiological event from an SMR design are deemed to be roughly equivalent to non-radiological hazards at other industrial or chemical facilities. Therefore, from an offsite planning and preparedness perspective, EP would be similar to those types of facilities and addressed in accordance with the State and local Comprehensive Emergency Management Plan (CEMP)[15] (sometimes referred to as an "all hazards plan"). In the case of the Clinch River SMR project, TVA stated that it will coordinate with TEMA to develop a Multi-Jurisdictional Emergency Response Plan (MJERP) for the CRN Site, which would become part of the State's overall CEMP.

TVA stated that its approach is based on (1) the expectation of enhanced safety inherent in the design of SMRs to significantly reduce the risk of radiological release and offsite consequence, and (2) application of the significant body of risk information available to inform the technical basis for the PEP EPZ size. The proposed technical criteria for determining the EPZ size consider the utilization of the existing EP regulatory framework and dose saving criteria established in NUREG-0396. In summary, the proposed technical criteria for determining the EPZ size are:

- The EPZ should encompass those areas in which projected dose from DBAs could exceed the EPA early phase PAGs.

- The EPZ should encompass those areas in which consequences of less severe core melt accidents could exceed the EPA early phase PAGs.

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

Implementation of the site boundary PEP EPZ (as described in ESP Plan 5A) does not rely on specific offsite radiological emergency plans. As addressed in FEMA's Comprehensive Preparedness Guide (CPG)-101, "Developing and Maintaining Emergency Operations Plans," if determined appropriate by government officials, they may utilize a CEMP approach to EP to implement ad hoc protective actions to protect the public.

In SSAR Section 13.3.3.1.4, TVA stated that it intends to include one complete and integrated emergency plan in the COLA based upon the selection of the SMR reactor technology. TVA intends to demonstrate that the design of the facility presented in the COLA falls within the design parameters for the surrogate plant PPE postulated in the ESPA. If the dose consequences of the chosen SMR technology do not exceed the EPA early phase PAGs at the site boundary, and do not present a substantial risk that doses at which significant early health effects may occur, then TVA could elect to establish the PEP EPZ at the site boundary in the COLA. In this scenario, TVA will coordinate with the applicable offsite response organizations (OROs) regarding establishment of the PEP EPZ at the site boundary. If the dose consequences of the SMR technology do not

[15] The CEMP is part of FEMA's Comprehensive Preparedness Guide (CPG)-101, "Developing and Maintaining Emergency Operations Plans" (https:/www.fema.gov/media-library-data/20130726-1828-25045-0014/cpg_ 101_comprehensive_preparedness_guide_ developing_and_maintaininig_emergency_operations_plans_2010.pdf, visited December 22, 2017). It helps planners at all levels of government in their efforts to develop and maintain viable, all-hazards, all-threats emergency plans. A CEMP is often referred to as "all hazards planning." See www.tnema.org/ema/response/plans.html, visited December 28, 2017.

exceed the EPA early phase PAGs at a 2-mi radius, and do not present a substantial risk that doses at which significant early health effects may occur, then TVA proposed to be allowed to elect to establish the PEP EPZ at an approximate 2-mi radius from the site center point in the COLA. If the dose consequences of the chosen SMR technology exceed the EPA early phase PAGs at the 2-mi radius, or present a substantial risk that doses at which significant early health effects may occur for the PEP EPZ boundary at a 2-mi radius, then neither major features emergency plan included in ESPA Part 5 will be incorporated by reference in the COLA, and a new emergency plan will be included in the COLA for NRC review.

In SSAR Section 13.3.3.1.4 further states that the COLA will include detailed information of the selected reactor technology that is pertinent to the emergency plan, and will apply the methodology in Subsection 13.3.3.1.1 for EPA early phase PAGs and Subsection 13.3.3.1.2 for substantial reduction in early health effects to the selected SMR reactor technology to confirm that either the site boundary or 2-mi PEP EPZ is appropriate, or to determine an acceptable PEP EPZ size. The NRC staff will evaluate the justification of the PEP EPZ size in its review of the COLA. Consistent with the applicant's statements in SSAR Section 13.3.3.1.4 to address the ability of the SMR reactor technology chosen in a COLA to meet the EPA early phase PAGs and substantial reduction in early health effects criteria, the staff identified the following COL action item:

COL Action Item 13.3-1

> An applicant for a combined license (COL) that references this early site permit should identify the chosen small modular reactor (SMR) technology for the Clinch River Nuclear Site, including the applicable early site permit major features emergency plan; or, if appropriate, a new emergency plan for NRC review. In addition, if the dose consequences of the chosen SMR technology support the site boundary plume exposure pathway (PEP) emergency planning zone (EPZ), the applicant will inform the offsite response organizations regarding establishment of the PEP EPZ at the site boundary. The applicant should update the major features emergency plan to reflect the chosen SMR technology, and incorporate it into a complete and integrated emergency plan. In addition, the applicant should provide detailed information that shows the ability of the chosen reactor technology to meet the applicable plume exposure pathway emergency planning zone, as described in ESP application, Part 2, Section 13.3.3, "Emergency Planning Zones."

EPA PAG Manual

TVA based its major features emergency plans (including exemption requests) on the 2013 PAG Manual, which was in effect (and had been issued as a draft for interim use and public comment) when TVA submitted its ESPA to the NRC on May 12, 2016. The 1992 PAG Manual had been the most authoritative and widely used (by government and the nuclear industry) version, and most of its PAGs and corresponding protective actions remain unchanged in both the 2013 and 2017 PAG Manuals. The staff's review of the ESPA was based on the 2017 PAG Manual, which represents the EPA's current revision in effect at the completion of the staff's review.

In SSAR Section 13.3, TVA stated, in part, that "[t]he revised EPA PAG (issued in 1992 as EPA-400-R-92-001) provides that licensed facilities that can demonstrate that accident doses at the Site Boundary would not exceed the PAG should not be required to have either defined EPZs or

comprehensive offsite emergency planning." This statement is consistent with Section 2.1.2, "Emergency Planning Zones and the PAGs," of the 1992 PAG Manual, which states, in part, that "since it will usually not be necessary to have offsite planning if PAGs cannot be exceeded offsite, EPZs need not be established for such cases."

In Section 2.2.4, "PAGs and Nuclear Facilities Emergency Planning Zones (EPZ)," of the 2017 PAG Manual, EPA removed a sentence from the 2013 PAG Manual (Section 2.3.5, "PAGs and Nuclear Facilities Emergency Planning Zones (EPZ)," which stated: "EPZs are not necessary at those facilities where it is not possible for PAGs to be exceeded off-site." For purposes of the ESPA review, the staff determined in its review of the 2017 PAG Manual that the absence of this sentence does not affect the technical basis within the manual that underlies/supports the removed EPA statement. For example, the 2017 PAG Manual retains language in the same paragraph, which states that "the size of the EPZ is based on the maximum distance at which a PAG might be exceeded." Therefore, the absence of the sentence in the 2017 PAG Manual does not indicate that the removed statement is no longer a valid conclusion that can be reached by the NRC (consistent with current and past policy and practice).

The conclusion that offsite planning (including the establishment of EPZs) is not needed where the EPA early phase PAGs cannot be exceeded offsite (i.e., beyond the site boundary), is still supported by the technical details within the 2017 EPA Manual. Specifically, for the reasons stated below, the staff's review of the 2017 EPA Manual supports the conclusion that a PEP EPZ is not necessary where the early phase PAGs will not be exceeded off-site.

- The manual states that the size of the EPZ is based on the maximum distance at which a PAG might be exceeded (see above).

- The manual does not recommend offsite EP for dose levels less than EPA early phase PAGs.

- The manual does not recommend early phase protective actions for dose levels less than EPA early phase PAGs.

- Just as EPA early phase PAGs are used by the NRC to establish a PEP EPZ, they can also be used to reduce EPZs by comparing them against projected accident doses.

- The NRC's reliance on the manual and NUREG–0396, for using EPA early phase PAGs as the cutoff for PEP EPZs, is consistent with NRC's past practice in the context of regulating EP for large LWRs.

Sections 13.3.4.4.1.C reflects the staff's technical evaluation of TVA's specific exemption requests. The references to the three ESPA Part 6 exemption tables (i.e., Tables 1-1, 1-2, and 1-3) are important, as the specific exemptions listed in Tables 1-1 and 1-2 are only applicable to ESP Plan 5A (with a site boundary PEP EPZ), and Table 1-3 is only applicable to ESP Plan 5B (with a 2-mi PEP EPZ). There are two common exemptions, consisting of 10 CFR 50.33(g) and 10 CFR 50.47(c)(2), which apply to both the site boundary and 2-mi PEP EPZ, and are listed in both Table 1-1 and Table 1-3, respectively.

The staff' is evaluating the exemptions as part of the ESP review to determine whether the staff can recommend Commission approval of major features emergency plans for either a site boundary or 2-mile PEP EPZ. In the discussion below, the NRC staff evaluates 25 requested exemptions in ESPA Part 6, Tables 1-1 and 1-2 for a site boundary PEP EPZ (hereafter referred to as the "site boundary PEP EPZ"), and two requested exemptions in Table 1-3 for the 2-mi PEP EPZ. Sections 13.3.4.4.A and 13.3.4.4.B below address the regulatory evaluation for the site boundary and 2-mi PEP EPZ, respectively. Section 13.3.4.4.C below provides a detailed ESPA technical safety evaluation supporting both the site boundary and 2-mi PEP EPZs.

Pursuant to 10 CFR 50.12, "Specific Exemptions," the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50, "Domestic Licensing of Production and Facilities." Section 50.12(a)(1) provides that the requested exemption must be authorized by law, not present an undue risk to the public health and safety, and be consistent with the common defense and security. The provisions of 10 CFR 50.12(a)(2) list six special circumstances for which an exemption may be granted. It is necessary for one of these special circumstances to be present in order for NRC to consider granting an exemption request.

Pursuant to 10 CFR 52.7 "Specific Exemptions," which is governed by 10 CFR 50.12, TVA requested exemptions from various EP requirements in 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50, which reflect a smaller PEP EPZ at the CRN Site. A future COL applicant will need to demonstrate in their application the adequacy of the selected EPZ size.

The applicant considered the following four SMR designs in developing values in the PPE that the applicant references in its FSAR analysis as a bounding "surrogate" for the SMR reactor technology that may be selected in the COLA:

- BWXT mPower (Generation mPower)
- NuScale (NuScale Power)
- SMR-160 (Holtec SMR)
- Westinghouse SMR (Westinghouse Electric Company)

Features of these four designs were considered to formulate the PPE values for the ESPA; the PPE does not encompass all aspects of each of these designs and the COL applicant referencing the ESP is not required to reference one of these designs in its COL application. The COL applicant will be required to show, using the dose-related methodology in ESPA SSAR Section 13.3, that the consequences of potential radiological events at the CRN Site for the referenced SMR design would not exceed specific U.S. Environmental Protective Agency (EPA) PAGs. The COL applicant will be required to demonstrate the ability of the selected SMR design to meet the EPA early phase PAGs at either the site boundary or 2-mile radius using the methodology TVA has provided as part of its requested exemption, in order to utilize these exemptions and support either a site boundary or 2-mile PEP EPZ in the COLA.

The staff reviewed the requests for exemptions submitted by the applicant in ESPA Part 6, Tables 1-1, 1-2, and 1-3. The regulatory evaluations of the exemption requests for the site boundary and 2-mi PEP EPZ appears below in Sections 13.3.4.4.A and 13.3.4.4.B, respectively.

13.3.4.4.A **Regulatory Evaluation of Exemption Request – Site Boundary Plume Exposure Pathway Emergency Planning Zone**

13.3.4.4.A.1 Summary of Exemptions

ESPA Part 6, Table 1-1 requests an exemption from certain requirements of 10 CFR 50.33(g), 10 CFR 50.47(b), and 10 CFR 50.47(c)(2). ESPA Part 6, Table 1-2 requests an exemption from certain requirements of 10 CFR Part 50, Appendix E. Together, Tables 1-1 and 1-2 request 25 individual exemptions for the CRN Site, as indicated by the following strikeout and bolded text.

13.3.4.4.A.2 Evaluation of Exemptions

Applicable criteria for when the Commission may grant the requested specific exemption are provided in 10 CFR 50.12(a)(1) and (a)(2), as described above. The applicant stated that the requested exemption meets the special circumstances of 10 CFR 50.12(a)(2)(ii). That subsection defines special circumstances as when "[a]pplication of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule." The staff's analysis of each of these findings is presented below for the site boundary PEP EPZ.

13.3.4.4.A.2.1 Authorized by Law

The exemptions would allow an applicant for a COL that references the ESP to adopt a site boundary PEP EPZ that is defined in the ESPA, rather than propose a 10-mi PEP EPZ for the CRN Site. The COL applicant would have to show that the chosen SMR technology meets the applicable EPA early phase PAGs at the site boundary PEP EPZ, in accordance with the criteria in ESPA SSAR Section 13.3. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50. The NRC staff has determined that granting of the applicant's proposed exemptions will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

13.3.4.4.A.2.2 No Undue Risk to Public Health and Safety

The underlying purpose of the 10-mi PEP EPZ in 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50 is to ensure that the PEP EPZ is of sufficient size to provide dose savings to the population in areas where the projected dose from DBAs could be expected to exceed the applicable EPA early phase PAGs under unfavorable atmospheric conditions (see NUREG-0396, Section III.B, "Size of the Emergency Planning Zone"). Since the site boundary PEP EPZ is required to meet the same EPA early phase PAGs as the 10-mi PEP EPZs for LLWRs, there is no change in risk to public health and safety. Based on the above, no new accident precursors are created by reducing the PEP EPZ to the site boundary, thus, the probability of postulated accidents is not increased. Also, based on the above, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety.

13.3.4.4.A.2.3 Consistent with Common Defense and Security

The proposed exemptions would allow an applicant for a COL that references the ESP to adopt the site boundary PEP EPZ that is defined in the ESP application, rather than propose a 10-mi PEP EPZ for the CRN Site. The COL applicant would have to show that the chosen SMR technology meets the applicable EPA early phase PAGs at the site boundary PEP EPZ, in accordance with the criteria in ESPA SSAR Section 13.3. These changes to the CRN Site's PEP EPZ have no relation to security issues. Therefore, the common defense and security is not impacted by these exemptions.

13.3.4.4.A.2.4 Special Circumstances

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances would not serve the underlying purpose of the rule, or is not necessary to achieve the underlying purpose of the rule. The underlying purpose of the 10-mi PEP EPZ in 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50 is to ensure that the PEP EPZ is of sufficient size to provide dose savings to the population in areas where the projected dose from DBAs could be expected to exceed the applicable EPA early phase PAGs under unfavorable atmospheric conditions (see NUREG-0396, Section III.B). Since the site boundary PEP EPZ will be subject to the same EPA early phase PAGs, the underlying purpose will be met under the terms of the proposed exemptions, pursuant to meeting Permit Condition 1. Therefore, as discussed above in Section 13.3.4.4.A.2 and below in Section 13.3.4.4.C, since the underlying purpose of 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50 is achieved, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of the exemptions from 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50 exist.

Characteristics of SMRs that Support the Exemption Requests

In ESPA Part 6, Section 1.3.4, TVA stated that special circumstances exist at the CRN Site because the enhanced safety features inherent in the design of SMRs, which result in significant enhancements in nuclear safety, provide for significant additional confidence in the protection of public health and safety. TVA also stated that the exemption requests were developed using risk-informed considerations and the understanding that the SMR designs evaluated under the CRN ESPA PPE include enhanced safety features.

TVA stated that a PEP EPZ with a radius of less than the "about 10 miles," cited in 10 CFR 50.33(g) and 10 CFR 50.47(c)(2), is justified based upon the significantly reduced risk of radiological release and offsite radiological consequences expected for SMR designs. Specifically, SMR designs may have small radionuclide inventory and source terms; the projected rate of progression of postulated accidents is anticipated to be slower; and various design features may eliminate several normally considered design-basis accidents. Further, beyond-design-basis accidents are significantly less likely. By letters dated August 24, 2017, and March 30, 2018 (ADAMS Accession Nos. ML17237A175 and ML18089A605, respectively), in response to RAIs 8885 and 9602, TVA provided information to describe the SMR design features and characteristics that result in the expected significantly reduced risk of radiological release and

offsite radiological consequences. The RAI response also includes tables which provide comparison of specific design features or characteristics between a range of SMRs, traditional LLWRs, and the AP1000 certified design. Discussion of each of the characteristics which lead to the reduced radiological risk and consequences is given below.

The reduced likelihood of accidents is demonstrated by reduced CDF and large release frequency (LRF) values of SMRs compared to large light water reactors. As described in the RAI responses, SMRs can be expected to reduce CDF values from traditional LLWRs by 3 orders of magnitude or more as a design goal. CDF and LRF reductions are supported in SMR design, in part, by eliminating multiple historically considered design-basis events (DBEs). The elimination of large break LOCAs is a primary example. Given that some SMR designs do not include large-bore reactor coolant system piping, the possibility of large break loss of coolant accidents may be eliminated. An additional example is the elimination of events related to a loss or reduction of forced reactor coolant flow. By designing a reactor that does not have reactor coolant pumps, and instead relying on natural circulation for core cooling, events related to a loss or reduction of forced reactor coolant flow and pump seal failures have been eliminated.

As described in the responses to RAIs 8885 and 9602, another key to reducing CDF and LRF in SMRs is the design goal for reduced complexity of systems and the inclusion of passive processes in those systems. Fewer safety systems with fewer components eliminates a significant number of opportunities for system or component failure. SMR designs may be able to achieve safety goals with fewer safety-related systems compared to a traditional LLWR. Additionally, many of these systems include passive processes, which eliminates failure mechanisms related to use of active systems (e.g., pump failure). The use of passive processes in safety functions within SMR designs has a positive influence on the CDF and LRF values. Additionally, SMR design is aided by use of PRA insights and information, which result in SMR designs that may be inherently less likely than the current industry plants to undergo a severe accident requiring offsite protective measures.

Slower accident progression is demonstrated by the time it takes for the coolant water level to uncover the core after initiation of an event. For LLWRs, core uncovery can occur within seconds during a design basis event. As described in the RAI responses, for SMRs in general it is expected that there will be more than 96 hours until the core is uncovered, while some designs under consideration for the CRN Site may be able to show that the core never uncovers during design basis events. For beyond design basis events, it can take more than 27 hours to reach core uncovery for some SMR designs. A key to slowing accident progression is the amount of coolant available to provide core cooling. The more coolant that is available compared to the heat generated by the core, the longer it will take to reach core uncovery. As described in the RAI responses, the ratio of primary system liquid mass to core power for SMR designs is expected to be more than 4 times that of a typical LLWR.

Reduced accident consequences are demonstrated by reduced doses from a range of accidents. As an example of the expected differences, the response to eRAI-9206 provides a comparison of offsite doses as a result of a design basis loss of coolant accident, for a range of SMRs, traditional LLWRs, and the AP1000. Doses provided in the RAI response are calculated at each design's respective assumed exclusion area boundary (EAB) distance and atmospheric dispersion conditions. Because the assumed EAB distance for each dose result is not the same, the doses

are not directly comparable. However, considering that the doses calculated for the SMR designs presented in the RAI response have assumed smaller EAB distances than the traditional LLWRs (which may result in higher dose due to reduced dispersion), the differences in dose demonstrated in the Table in the RAI response are expected to be larger when applied to similar EAB distances and meteorological conditions. Regardless, the doses from SMRs are estimated to be lower than those for LLWRs and the AP1000.

The primary factor in reducing the accident dose consequences for SMRs is the reduction in accident release source terms. Reductions in estimated accident release source terms for SMRs are primarily driven by reduced core power, which results in less fuel in the core. Since there is less fissile material, and therefore fewer fission products and activated material, there is less radioactive material that can be released from the core. Additionally, in the event of a core release accident, a goal of SMR designs is to provide for enhanced removal of radioisotopes by engineered passive features. For example, aerosol scrubbing in submerged SMR containments is improved compared to LLWRs due to designed higher surface area to volume ratios, along with enhanced condensation on the interior of the containment surface. The increased deposition surface area, condensation surface area, and higher condensation rates lead to higher fission product aerosol removal rates and decontamination factors. Table 2 in the response to eRAI-9206 Key Issue 1, dated March 30, 2018, includes a comparison of the core parameters and approximate total source term activity for a range of SMRs, traditional LLWRs, and the AP1000.

The staff evaluated TVA's description of the expected features and characteristics of SMRs as described in the responses to RAIs 8885 and 9206, and agrees that that the SMR designs under consideration for the CRN Site may result in significant reductions in the risk of radiological release and offsite radiological consequences from accidents.

13.3.4.4.A.3 Conclusion

For the reasons given above, and as discussed in Section 13.3.4.4.C. below, as set forth in 10 CFR 50.12(a), the staff concludes that the proposed exemptions specified in ESPA Part 6, Tables 1-1 and 1-2 are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. Also, the special circumstances in 10 CFR 50.12(a)(2)(ii) are present, in that the application of the regulations in 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50 in the particular circumstances would not serve the underlying purpose of the rule, or is not necessary to achieve the underlying purpose of the rule. Therefore, the staff concludes that the proposed exemptions should be granted.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12 and 10 CFR 52.7, the exemptions are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. Also, special circumstances are present. Therefore, pursuant to the permit conditions, the Commission hereby grants TVA the exemptions (in Part 6 Tables 1-1 and 1-2) from the requirement for a 10-mi (16-km) PEP EPZ, as specified in 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50, for the CRN Site.

13.3.4.4.B **Regulatory Evaluation of Exemption Request – 2-Mile Plume Exposure Pathway Emergency Planning Zone**

13.3.4.4.B.1 Summary of Exemptions

Table 1-3 requests an exemption from certain requirements of 10 CFR 50.33(g) and 10 CFR 50.47(c)(2) for the CRN Site, as indicated by the strikeout and bolded text below.

13.3.4.4.B.2 Evaluation of Exemptions

Applicable criteria for when the Commission may grant the requested specific exemption are provided in 10 CFR 50.12(a)(1) and (a)(2), as described above. The applicant stated that the requested exemption meets the special circumstances of 10 CFR 50.12(a)(2)(ii). That subsection defines special circumstances as when "[a]pplication of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule." The staff's analysis of each of these findings is presented below for the 2-mi PEP EPZ.

13.3.4.4.B.2.1 Authorized by Law

The exemptions would allow an applicant for a COL that references the ESP to adopt the 2-mi PEP EPZ that is defined in the ESPA, rather than propose a 10-mi PEP EPZ for the CRN Site. The COL applicant would have to show that the chosen SMR technology meets the applicable EPA early phase PAGs at the 2-mi PEP EPZ, in accordance with the criteria in SSAR Section 13.3. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR 50.33(g) and 10 CFR 50.47(c)(2). The NRC staff has determined that granting of the applicant's proposed exemptions will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

13.3.4.4.B.2.2 No Undue Risk to Public Health and Safety

The underlying purpose of the 10-mi PEP EPZ in 10 CFR 50.33(g) and 10 CFR 50.47(c)(2) is to ensure that the PEP EPZ is of sufficient size to provide dose savings to the population in areas where the projected dose from design basis accidents could be expected to exceed the applicable EPA early phase PAGs under unfavorable atmospheric conditions (see NUREG-0396, Section III.B, "Size of the Emergency Planning Zone"). Since the 2-mi PEP EPZ is required to meet the same EPA early phase PAGs as the 10-mi PEP EPZs for LLWRs, there is no change in risk to public health and safety. Based on the above, no new accident precursors are created by reducing the PEP EPZ to 2 mi, thus, the probability of postulated accidents is not increased. Also, based on the above, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety.

13.3.4.4.B.2.3 Consistent with Common Defense and Security

The proposed exemptions would allow an applicant for a COL that references the ESP to adopt the 2-mi PEP EPZ that is defined in the ESP application, rather than propose a 10-mi PEP EPZ for the CRN Site. The COL applicant would have to show that the chosen SMR technology meets the applicable EPA early phase PAGs at the 2-mi PEP EPZ, in accordance with the criteria in

ESPA SSAR Section 13.3. These changes to the CRN Site's PEP EPZ have no relation to security issues. Therefore, the common defense and security is not impacted by these exemptions.

13.3.4.4.B.2.4 Special Circumstances

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances would not serve the underlying purpose of the rule, or is not necessary to achieve the underlying purpose of the rule. The underlying purpose of the 10-mi PEP EPZ in 10 CFR 50.33(g) and 10 CFR 50.47(c)(2) is to ensure that the PEP EPZ is of sufficient size to provide dose savings to the population in areas where the projected dose from design basis accidents could be expected to exceed the applicable EPA early phase PAGs under unfavorable atmospheric conditions (see NUREG-0396, Section III.B). Since the 2-mi PEP EPZ will be subject to the same EPA early phase PAGs, the underlying purpose will be met under the terms of the proposed exemptions, pursuant to meeting Permit Condition 1. Therefore, as discussed above in section 13.3.4.4.B.2 and below in Sections 13.3.4.4.C.1 and 13.3.3.4.4.C.2.7, since the underlying purpose of 10 CFR 50.33(g) and 10 CFR 50.47(c)(2) is achieved, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of the exemptions from 10 CFR 50.33(g) and 10 CFR 50.47(c)(2) exist.

Characteristics of SMRs that Support the Exemption Requests

In ESPA Part 6, Section 1.3.4, TVA stated that special circumstances exist at the CRN site because the enhanced safety features inherent in the design of SMRs, which result in significant enhancements in nuclear safety, provide for significant additional confidence in the protection of public health and safety. TVA also stated that the exemption requests were developed using risk-informed considerations and the understanding that the SMR designs evaluated under the CRN ESPA plant parameter envelope, include enhanced safety features.

TVA stated that a PEP EPZ with a radius of less than the "about 10 miles," cited in 10 CFR 50.33(g) and 10 CFR 50.47(c)(2), is justified based upon the significantly reduced risk of radiological release and offsite radiological consequences expected for SMR designs. Specifically, SMR designs may have small radionuclide inventory and source terms; the projected rate of progression of postulated accidents is anticipated to be slower; and various design features may eliminate several normally considered design-basis accidents. Further, beyond-design-basis accidents are significantly less likely. By letters dated August 24, 2017, and March 30, 2018 (ADAMS Accession Nos. ML17237A175 and ML18089A605, respectively), in response to Request for Additional Information (RAI) 8885 and RAI 9602, TVA provided information to describe the SMR design features and characteristics that result in the expected significantly reduced risk of radiological release and offsite radiological consequences. The RAI response also includes tables which provide comparison of specific design features or characteristics between a range of SMRs, traditional light water reactors, and the AP1000 certified design. Discussion of each of the characteristics which lead to the reduced radiological risk and consequences is given below.

The reduced likelihood of accidents is demonstrated by reduced CDF and LRF values of referenced SMRs compared to large light water reactors. As described in the RAI responses, SMRs can be expected to reduce CDF values from traditional LLWRs by 3 orders of magnitude or

more as a design goal. CDF and LRF reductions are supported in SMR design, in part, by eliminating multiple historically considered DBEs. The elimination of large break loss of coolant accidents is a primary example. Given that some SMR designs do not include large-bore reactor coolant system piping, the possibility of large break loss of coolant accidents may be eliminated. An additional example is the elimination of events related to a loss or reduction of forced reactor coolant flow. By designing a reactor that does not have reactor coolant pumps, and instead relying on natural circulation for core cooling, events related to a loss or reduction of forced reactor coolant flow and pump seal failures have been eliminated.

As described in the responses to RAIs 8885 and 9602, another key to reducing CDF and LRF in SMRs is the design goal for reduced complexity of systems and the inclusion of passive processes in those systems. Fewer safety systems with fewer components eliminates a significant number of opportunities for system or component failure. SMR designs may be able to achieve safety goals with fewer safety-related systems compared to a traditional LLWR. Additionally, many of these systems include passive processes, which eliminates failure mechanisms related to use of active systems (e.g., pump failure). The use of passive processes in safety functions within SMR designs has a positive influence on the CDF and LRF values. Additionally, SMR design is aided by use of PRA insights and information, which result in SMR designs that may be inherently less likely than the current industry plants to undergo a severe accident requiring offsite protective measures.

Slower accident progression is demonstrated by the time it takes for the coolant water level to uncover the core after initiation of an event. For LLWRs, core uncovery can occur within seconds during a design basis event. As described in the RAI responses, for SMRs in general it is expected that there will be more than 96 hours until the core is uncovered, while some designs under consideration for the CRN Site may be able to show that the core is never uncovered during design basis events. For beyond design basis events, it can take more than 27 hours to uncover the core for some SMR designs. A key to slowing accident progression is the amount of coolant available to provide core cooling. The more coolant that is available compared to the heat generated by the core, the longer it will take to reach core uncovery. As described in the RAI responses, the ratio of primary system liquid mass to core power for SMR designs is expected to be more than 4 times that of a typical LLWR.

Reduced accident consequences are demonstrated by reduced doses from a range of accidents. As an example of the expected differences, the response to RAI 9206 provides a comparison of offsite doses as a result of a design basis loss of coolant accident, for a range of SMRs, traditional LLWRs, and the AP1000. Doses provided in the RAI response are calculated at each design's respective assumed EAB distance and atmospheric dispersion conditions. Because the assumed EAB distance for each dose result is not the same, the doses are not directly comparable. However, considering that the doses calculated for the SMR designs presented in the RAI response have assumed smaller EAB distances than the traditional LLWRs (which may result in higher dose due to reduced dispersion), the differences in dose demonstrated in the Table-4, "Comparison of Accident Consequences Between SMRs and large LWRs," in the response to RAI 9206 are expected to be larger when applied to similar EAB distances and meteorological conditions. Regardless, the doses from SMRs are estimated to be lower than those for LLWRs and the AP1000.

The primary factor in reducing the accident dose consequences for SMRs is the reduction in accident release source terms. Reductions in estimated accident release source terms for SMRs are primarily driven by reduced core power, which results in less fuel in the core. Since there is less fissile material, and therefore fewer fission products and activated material, there is less radioactive material that can be released from the core. Additionally, in the event of a core release accident, a goal of SMR designs is to provide for enhanced removal of radioisotopes by engineered passive features. For example, aerosol scrubbing in submerged SMR containments is improved compared to LLWRs due to designed higher surface area to volume ratios, along with enhanced condensation on the interior of the containment surface. The increased deposition surface area, condensation surface area, and higher condensation rates lead to higher fission product aerosol removal rates and decontamination factors. Table 2 in the response to RAI 9206 (Key Issue 1), dated March 30, 2018, includes a comparison of the core parameters and approximate total source term activity for a range of SMRs, traditional LLWRs, and the AP1000.

The staff evaluated TVA's description of the expected features and characteristics of SMRs, as described in the responses to RAI 8885 and RAI 9206, and agrees that the SMR designs under consideration for the CRN Site may result in significant reductions in the risk of radiological release and offsite radiological consequences from accidents.

13.3.4.4.B.3 Conclusion

For the reasons given above and as discussed below in Section 13.3.4.4.C, as set forth in 10 CFR 50.12(a), the staff concludes that the proposed exemptions specified in ESPA Part 6, Table 1-3 are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. Also, the special circumstances in 10 CFR 50.12(a)(2)(ii) are present, in that the application of the regulations in 10 CFR 50.33(g) and 10 CFR 50.47(c)(2) in the particular circumstances would not serve the underlying purpose of the rule, or is not necessary to achieve the underlying purpose of the rule. Therefore, the staff concludes that the proposed exemptions should be granted.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12 and 10 CFR 52.7, the exemptions are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. Also, special circumstances are present. Therefore, pursuant to the permit conditions, the Commission hereby grants TVA the exemptions (in Part 6 Table 1-3) from the requirement for a 10-mi (16-km) PEP EPZ, as specified in 10 CFR 50.33(g) and 10 CFR 50.47(c)(2), for the CRN Site.

13.3.4.4.C Technical Evaluation of Exemption Requests

13.3.4.4.C.1 Specific Exemptions for 10 CFR 50.33(g)

ESPA Part 6, Table 1-1 (for the site boundary PEP EPZ) and Table 1-3 (for the 2-mi PEP EPZ), request an exemption from certain requirements (as indicated by strikeout and bolded text) of 10 CFR 50.33(g) for the CRN Site. The regulatory evaluation of the exemption requests appears above in Sections 13.3.4.4.A and 13.3.4.4.B. The following exemption for 10 CFR 50.33(g) applies to both the site boundary and 2-mi PEP EPZ.

13.3.4.4. C.1.1 10 CFR 50.33(g)

> If the application is for an operating license or combined license for a nuclear power reactor, or if the application is for an early site permit and contains plans for coping with emergencies under § 52.17(b)(2)(ii) of this chapter, the applicant shall submit radiological emergency response plans of State and local government entities in the United States that are wholly or partially within the plume exposure pathway emergency planning zone (EPZ), as well as the plans of State governments wholly or partially within the ingestion pathway EPZ. If the application is for an early site permit that, under 10 CFR 52.17(b)(2)(i), proposes major features of the emergency plans describing the EPZs, then the descriptions of the EPZs must meet the requirements of this paragraph. 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 reactors and for reactors with an authorized power level less than 250 MW thermal. The plans for the ingestion pathway shall focus on such actions as are appropriate to protect the food ingestion pathway.

TVA's exemption request states in Table 1-1 (site boundary PEP EPZ) and Table 1-3 (2-mi PEP EPZ) that the basis for the exemption is that the criteria established in SSAR Section 13.3 provide for adequate protection of public health and safety by providing an EPZ that encompasses the areas in which the plume exposure doses could exceed the early phase EPA PAG, and for which there is a substantial reduction in risk of significant early health effects. Table 1-1 adds that because there are no offsite consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, defined EPZs and formal offsite radiological emergency response plans are not necessary.

In SSAR Section 13.3 states that the site boundary and 2-mi PEP EPZs encompass the areas in which the plume exposure doses could exceed the EPA early phase PAGs, and for which there is a substantial risk of doses at which significant early health effects may occur. The ESPA establishes a PEP EPZ boundary that ensures public protection from dose levels above the 1 rem TEDE threshold established in the PAG Manual. The primary purpose of the CRN Site PEP EPZ is to encompass those areas in which the plume exposure doses from DBAs and less severe core melt accidents could exceed the EPA PAG. Thus, areas outside of the CRN Site PEP EPZ would meet the EPA PAG dose threshold of less than 1 rem TEDE using average expected (50^{th} percentile) dispersion characteristics based on site-specific meteorology.

The PAG Manual provides radiological protection criteria for application to all incidents that would require consideration of protective actions. These include recommended numerical PAGs for the principal protective actions available to public officials during a radiological incident. Section 1.3.4, "Special Circumstances," of ESPA Part 6 states that the underlying purpose of the requirements in

10 CFR 50.33(g), 10 CFR 50.47, and Section IV to Appendix E of 10 CFR Part 50 is to (1) ensure that licensees maintain effective onsite and offsite radiological emergency response plans, (2) ensure that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency, and (3) establish plume exposure and ingestion pathway EPZs for nuclear power plants. The staff agrees with this description of the underlying purpose. The underlying objectives of the recommended (PEP and ingestion pathway) EPZs in NUREG–0396 were to ensure that pre-planned protective actions would be identified and practiced, and to reduce dose in the unlikely event of a large release that would exceed the EPA PAGs offsite.[16]

NUREG–0396 introduced the concept of generic (10-mi and 50-mi) EPZs as the basis for pre-planned response actions that would result in dose savings in the environs of a nuclear facilities in the event of a serious power reactor accident. EPZs are designated as the areas for which planning is recommended to assure that prompt and effective actions can be taken to protect the public in the event of an accident. As established by the PAG Manual, the 10-mi and 50-mi EPZs provide bounding distances for large LWRs, beyond which radiation exposures would not likely exceed the EPA PAGs.[17] In NUREG–0396, the task force concluded the following:

> The establishment of Emergency Planning Zones of about 10 miles for the plume exposure pathway and about 50 miles for the ingestion pathway is sufficient to scope the areas in which planning for the initiation of predetermined protective action is warranted for any given nuclear power plant.

Section I.D of NUREG–0654 states that the NRC and FEMA concluded that the guidance in NUREG-0396 should be used as the planning basis for emergency preparedness around nuclear power facilities. The development of EP requirements, including the 10-mi and 50-mi EPZs, complemented the prevention and mitigation measures existing in the NRC's defense-in-depth approach to protecting people and the environment against the harms of radiation in the unlikely event of a severe radiological accident resulting in offsite dose.

The staff finds that the basis for the establishment of a site boundary and 2-mi PEP EPZ in the ESPA maintains the same level of protection (i.e., dose savings) in the environs of the CRN Site, as that which exists at the 10-mi PEP EPZ for large LWRs. The staff's basis for this conclusion is because the methodology that is, or would be, used to determine acceptability of all three distances (i.e., site boundary, 2-mi, and 10-mi PEP EPZs) uses the same radiation exposure bounding criteria/limits, which ensure that any radiation exposures beyond the PEP EPZ would be highly unlikely to exceed the EPA early phase PAGs. As such, the establishment of the basis for the site boundary and 2-mi PEP EPZs for the CRN Site is acceptable because it meets the same radiation protection criteria (i.e., the EPA early phase PAGs) that is required for large LWRs. When TVA selects an SMR technology in a COLA, the ability of that SMR design to meet the EPA early

[16] See SECY-15-0077 (a summary is provided in Appendix 13.3-A of this report).
[17] The NRC has licensed LWRs with relatively low power (e.g., Big Rock Point and La Crosse) and a high-temperature gas-cooled reactor (i.e., Fort St. Vrain); each with a PEP EPZ size that was smaller than those for large LWRs. The PEP EPZs for Fort St. Vrain, Big Rock Point, and La Crosse were each established at 5 mi (8 km). See Docket Nos. 05000267, 05000155, and 05000409, respectively.

phase PAGs (for either the site boundary or 2-mi PEP EPZ) must be confirmed by the NRC, pursuant to COL Action Item 13.3-1.

In the absence of a specific reactor design, the staff cannot evaluate the applicant's assertions that there are no offsite consequences from any credible event in excess of the criteria provided in SSAR Section 13.3. However, for the above stated reasons, this determination does not impact the staff's conclusions regarding the acceptability of the method for which the applicant seeks approval, or the acceptability of the exemption request.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary or 2-mi PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the site boundary PEP EPZ. Offsite plans would still be required for the 2-mi PEP EPZ. Therefore, the requirement for a 10-mi PEP EPZ would not be needed.

Based on the above analysis and as discussed above in Section 13.3.4.4.A and Section 13.3.4.4.B, the staff concludes that the exempted language from 10 CFR 50.33(g), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii). A COL applicant will address COL Action Item 13.3-1.

13.3.4.4.C.2 Specific Exemptions for 10 CFR 50.47

ESPA Part 6, Table 1-1 (for the site boundary PEP EPZ) and Table 1-3 (10 CFR to 50.47(c)(2) only) (for the 2-mi PEP EPZ), request an exemption from certain requirements (as indicated by strikeout and bolded text) of 10 CFR 50.47 for the CRN Site. The regulatory evaluation of the exemption requests appears above in Section 13.3.4.4.A and Section 13.3.4.4.B. The following exemptions for 10 CFR 50.47(b), (b)(4), (b)(5), (b)(6), (b)(9), and (b)(10) apply only to the site boundary PEP EPZ. The exemption for 10 CFR 50.47(c)(2) applies to both the site boundary and 2-mi PEP EPZ.

13.3.4.4.C.2.1 <u>10 CFR 50.47(b)</u>

> The onsite **~~and, except as provided in paragraph (d) of this section, offsite~~** emergency response plans for nuclear power reactors must meet the following standards:

TVA's exemption request states in Table 1-1 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite radiological emergency response

plans are not necessary.

The cited paragraph (d) (i.e., 10 CFR 50.47(d)) states, in part, that no NRC or FEMA review findings, or determinations concerning the state of offsite emergency preparedness or adequacy of offsite emergency plans, are required prior to issuance of an operating license authorizing only fuel loading or low power testing and training (up to 5 percent of the rated thermal power).

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in a COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement related to NRC or FEMA review findings, or determinations concerning the state of offsite emergency preparedness or adequacy of offsite emergency plans, would not be needed.

Based on the above analysis and the analysis provided in Section 13.3.4.4.C.1.1 of this report, the staff concludes that the exempted language from 10 CFR 50.47(b), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4. C.2.2 10 CFR 50.47(b)(4)

> A standard emergency classification and action level scheme, the basis 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~~**.

TVA's exemption request states in Table 1-1 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. In addition, although the likelihood of an accident or event resulting in offsite radiological doses exceeding the EPA PAGs beyond the site boundary is extremely remote, TVA's Emergency Plan will describe the capabilities to determine if a radiological release is occurring and promptly communicate that information to OROs for their consideration.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP

EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement for minimum initial offsite response measures would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR 50.47(b)(4), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.2.3 10 CFR 50.47(b)(5)

> 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**.

TVA's exemption request states in Table 1-1 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that defined EPZs and formal offsite REP plans are not necessary. In addition, the PEP EPZ would be within the site boundary, so there is no populace within the PEP that would require early notification or instructions. Notification and instructions to members of the public that may be onsite are addressed in 10 CFR 50.47(b)(10) [see Section 13.3.4.4.C.2.6 of this report].

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, a means to provide early notification and clear instruction to the populace within a designated PEP EPZ would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR 50.47(b)(5), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.2.4 10 CFR 50.47(b)(6)

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

TVA's exemption request states in Table 1-1 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there is no need to require prompt communications to the public beyond the site boundary.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to provide prompt communication to the public, with regard to initial or pre-determined protective actions within a designated PEP EPZ, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR 50.47(b)(6), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.2.5 10 CFR 50.47(b)(9)

> Adequate methods, systems, and equipment for assessing and monitoring actual or potential ~~**offsite**~~ consequences of a radiological emergency condition are in use.

TVA's exemption request states in Table 1-1 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. TVA will maintain the capability to assess the impact of radiological releases, and communicate the results to the OROs.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP

EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement for assessing or monitoring offsite consequences beyond the site boundary would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR 50.47(b)(9), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.2.6 10 CFR 50.47(b)(10)

> 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.

TVA's exemption request states in Table 1-1 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, the language regarding the range of actions to be considered, with respect to the public beyond the site boundary and the development of an ETE, is not applicable.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the consideration of a range of protective actions consistent with Federal guidance for the public beyond the site boundary and development of an ETE, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR

50.47(b)(10), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.2.7 10 CFR 50.47(c)(2)

> 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. The plans for the ingestion pathway shall focus on such actions as are appropriate to protect the food ingestion pathway.

This exemption for 10 CFR 50.47(c)(2) applies to both the site boundary and 2-mi PEP EPZ. TVA's exemption request states in Table 1-1 (site boundary PEP EPZ) and Table 1-3 (2-mi PEP EPZ) that the basis for the exemption is that the criteria established in SSAR Section 13.3 provide for adequate protection of public health and safety by providing an EPZ that encompasses the areas in which the plume exposure doses could exceed the early phase EPA PAGs, and for which there is a substantial reduction in risk of significant early health effects. For the site boundary PEP EPZ, TVA further stated in Table 1-1 that because there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, formal offsite REP plans are not necessary.

TVA's exemption request for 10 CFR 50.47(c)(2) in Table 1-1 (site boundary PEP EPZ) and Table 1-3 (2-mi PEP EPZ) is the same as that for 10 CFR 50.33(g) in Tables 1-1 and 1-3. Therefore, the analysis provided in Section 13.3.4.4.C.1.1 of this report for 10 CFR 50.33(g) is also applicable to 10 CFR 50.47(c)(2).

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary or 2-mi PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the site boundary PEP EPZ. Offsite plans would still be required for the 2-mi PEP EPZ. Therefore, the requirement for a 10-mi PEP EPZ would not be needed.

Based on the above analysis and the analysis provided in Section 13.3.4.4.C.1.1 of this report, the

staff concludes that the exempted language from 10 CFR 50.47(c)(2), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3 Specific Exemptions for 10 CFR Part 50, Appendix E, Section IV

ESPA Part 6, Table 1-2 (for the site boundary PEP EPZ) requests an exemption from certain requirements (as indicated by strikeout and bolded text) of Appendix E to 10 CFR Part 50 for the CRN Site. The regulatory evaluation of the exemption requests appears above in Sections 13.3.4.4.A and 13.3.4.4.B. The following exemptions for Section IV of Appendix E to 10 CFR Part 50 apply only to the site boundary PEP EPZ.

13.3.4.4.C.3.1 10 CFR Part 50, Appendix E, Section IV.2

> **~~This nuclear power reactor license application shall also provide an analysis of the time required to evacuate various sectors and distances within the plume exposure pathway EPZ for transient and permanent populations, using the most recent U.S. Census Bureau data as of the date the applicant submits its application to the NRC.~~**

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there is no need for ETEs in support of detailed evacuation preplanning.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement for ETEs would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.2, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.2 10 CFR Part 50, Appendix E, Section IV.3

> **~~Nuclear power reactor licensees shall use NRC approved evacuation time estimates (ETEs) and updates to the ETEs in the formulation of protective action recommendations and shall provide the ETEs and ETE updates to State and local governmental authorities for use in developing offsite protective action strategies.~~**

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there is no need for ETEs in support of detailed evacuation preplanning.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to develop an ETE and provide it to State and local governmental authorities for use in developing offsite protective action strategies would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.3, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.3 10 CFR Part 50, Appendix E, Section IV.4

> **~~Within 365 days of the later of the date of the availability of the most recent decennial census data from the U.S. Census Bureau or December 23, 2011, nuclear power reactor licensees shall develop an ETE analysis using this decennial data and submit it under § 50.4 to the NRC. These licensees shall submit this ETE analysis to the NRC at least 180 days before using it to form protective action recommendations and providing it to State and local governmental authorities for use in developing offsite protective action strategies.~~**

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there is no need for ETEs, or to update ETEs, in support of detailed evacuation preplanning.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to have an ETE and to perform an update to the ETE would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.4, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.4 10 CFR Part 50, Appendix E, Section IV.5

> ~~**During the years between decennial censuses, nuclear power reactor licensees shall estimate EPZ permanent resident population changes once a year, but no later than 365 days from the date of the previous estimate, using the most recent U.S. Census Bureau annual resident population estimate and State/local government population data, if available. These licensees shall maintain these estimates so that they are available for NRC inspection during the period between decennial censuses and shall submit these estimates to the NRC with any updated ETE analysis.**~~

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there is no need for ETEs, or to update ETEs, in support of detailed evacuation preplanning.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to have an ETE and to perform an update to the ETE would not be

needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.5, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.5 10 CFR Part 50, Appendix E, Section IV.6

> ~~**If at any time during the decennial period, the EPZ permanent resident population increases such that it causes the longest ETE value for the 2-mile zone or 5-mile zone, including all affected Emergency Response Planning Areas, or for the entire 10-mile EPZ to increase by 25 percent or 30 minutes, whichever is less, from the nuclear power reactor licensee's currently NRC approved or updated ETE, the licensee shall update the ETE analysis to reflect the impact of that population increase. The licensee shall submit the updated ETE analysis to the NRC under § 50.4 no later than 365 days after the licensee's determination that the criteria for updating the ETE have been met and at least 180 days before using it to form protective action recommendations and providing it to State and local governmental authorities for use in developing offsite protective action strategies.**~~

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there is no need for ETEs, or to update ETEs, in support of detailed evacuation preplanning.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to have an ETE and to perform an update to the ETE would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.6, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond

the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.6 10 CFR Part 50, Appendix E, Section IV.7

> ~~**After an applicant for a combined license under part 52 of this chapter receives its license, the licensee shall conduct at least one review of any changes in the population of its EPZ at least 365 days prior to its scheduled fuel load. The licensee shall estimate EPZ permanent resident population changes using the most recent U.S. Census Bureau annual resident population estimate and State/local government population data, if available. If the EPZ permanent resident population increases such that it causes the longest ETE value for the 2-mile zone or 5- mile zone, including all affected Emergency Response Planning Areas, or for the entire 10-mile EPZ, to increase by 25 percent or 30 minutes, whichever is less, from the licensee's currently approved ETE, the licensee shall update the ETE analysis to reflect the impact of that population increase. The licensee shall submit the updated ETE analysis to the NRC for review under § 50.4 of this chapter no later than 365 days before the licensee's scheduled fuel load.**~~

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there is no need for ETEs, or to update ETEs, in support of detailed evacuation preplanning.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to have an ETE and to perform an update to the ETE would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.7, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.7 10 CFR Part 50, Appendix E, Section IV.D.1

> Administrative and physical means for notifying local, State, and Federal officials and agencies ~~**and agreements reached with these officials and agencies for the prompt notification of the public and for public evacuation or other protective measures, should they become necessary,**~~ shall be described. This description shall include identification ~~**of the appropriate officials, by title and agency,**~~ of the State and local government agencies within the EPZs.

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Although the likelihood of an accident or event resulting in offsite radiological doses exceeding the EPA PAGs beyond the site boundary is extremely remote, TVA's Emergency Plan will describe the capabilities to determine if a radiological release is occurring and promptly communicate that information to OROs for their consideration.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement for prompt notification of the public, and for public evacuation or other protective measures, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.D.1, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.8 10 CFR Part 50, Appendix E, Section IV.D.3

> A licensee shall have the capability to notify responsible State and local governmental agencies within 15 minutes after declaring an emergency.– ~~**The licensee shall demonstrate that the appropriate governmental authorities have the capability to make a public alerting and notification decision promptly on being informed by the licensee of an emergency condition. Prior to initial operation greater than 5 percent of rated thermal power of the first reactor at a site, each nuclear power reactor licensee shall demonstrate that administrative and physical means have been established for alerting and providing prompt instructions to the public within the plume exposure pathway EPZ. The design objective of the prompt public alert and notification**~~

~~system shall be to have the capability to essentially complete the initial alerting and initiate notification of the public within the plume exposure EPZ within about 15 minutes. The use of this alerting and notification capability will range from immediate alerting and notification of the public (within 15 minutes of the time that State and local officials are notified that a situation exists requiring urgent action) to the more likely events where there is substantial time available for the appropriate governmental authorities to make a judgment whether or not to activate the public alert and notification system. The alerting and notification capability shall additionally include administrative and physical means for a backup method of public alerting and notification capable of being used in the event the primary method of alerting and notification is unavailable during an emergency to alert or notify all or portions of the plume exposure pathway EPZ population. The backup method shall have the capability to alert and notify the public within the plume exposure pathway EPZ, but does not need to meet the 15-minute design objective for the primary prompt public alert and notification system. When there is a decision to activate the alert and notification system, the appropriate governmental authorities will determine whether to activate the entire alert and notification system simultaneously or in a graduated or staged manner. The responsibility for activating such a public alert and notification system shall remain with the appropriate governmental authorities.~~

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there would be no members of the public within the PEP EPZ to alert and inform, and no need for action by governmental authorities beyond the site boundary. TVA will maintain the capability to assess, classify, and declare an emergency condition and notify offsite governmental organizations within times specified in the Emergency Plan.

Table 1-2 states that the elimination of the regulatory required time to alert and notify the public is acceptable because there is no need for State or local response organizations to implement immediate protective actions. Table 1-2 further states that the 10 CFR 50.72(a)(3) requirement to complete an Emergency Notification System (ENS) notification [to NRC] of the declaration of an Emergency Class within one hour after the time TVA declares one of the Emergency Classes is not impacted by this exemption.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering

that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement for prompt notification of the public would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.D.3, above, is not necessary to achieve the underlying purpose of this requirement as it applies to the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.9 10 CFR Part 50, Appendix E, Section IV.D.4

> ~~**If FEMA has approved a nuclear power reactor site's alert and notification design report, including the backup alert and notification capability, as of December 23, 2011, then the backup alert and notification capability requirements in Section IV.D.3 must be implemented by December 24, 2012. If the alert and notification design report does not include a backup alert and notification capability or needs revision to ensure adequate backup alert and notification capability, then a revision of the alert and notification design report must be submitted to FEMA for review by June 24, 2013, and the FEMA-approved backup alert and notification means must be implemented within 365 days after FEMA approval. However, the total time period to implement a FEMA-approved backup alert and notification means must not exceed June 22, 2015.**~~

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is the same as that for 10 CFR Part 50, Appendix E, Section IV.D.3, regarding the alert and notification system (ANS) requirements.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement for a FEMA-approved alert and notification design report, including the backup alert and notification capability, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.3.8 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.D.4, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.10 10 CFR Part 50, Appendix E, Section IV.F.2

> The plan shall describe provisions for the conduct of emergency preparedness exercises as follows: Exercises shall test the adequacy of timing and content of implementing procedures and methods, test emergency equipment and communications networks, **~~test the public alert and notification system,~~** and ensure that emergency organization personnel are familiar with their duties.

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, a dedicated public ANS would not be used and no testing is required.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement for prompt notification of the public, including a test of the public ANS, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.F.2, above, is not necessary to achieve the underlying purpose of this requirement as it applies to the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.11 10 CFR Part 50, Appendix E, Section IV.F.2.a

> **An ~~full participation~~** exercise which tests as much of the licensee**~~, State, and local~~** emergency plans as is reasonably achievable **~~without mandatory public participation~~** shall be conducted for each site at which a power reactor is located. Nuclear power reactor licensees shall submit exercise scenarios under § 50.4 at least 60 days before use in **an ~~full participation~~** exercise required by this paragraph 2.a.

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, a full participation exercise, which would involve demonstrating the implementation of formal offsite REP plans, is not required. TVA would continue to invite State and

local support organizations to participate in the periodic drills and exercises conducted.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to conduct a full participation exercise with State and local agencies, which would involve demonstrating the implementation of formal offsite REP plans, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.2.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.F.2.a, above, is not necessary to achieve the underlying purpose of this requirement as it applies to the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.12 10 CFR Part 50, Appendix E, Section IV.F.2.a.(i)

> For an operating license issued under this part, this exercise must be conducted within two years before the issuance of the first operation license for full power (one authorizing operation above 5 percent of rated power) of the first reactor and shall include participation by ~~**each State and local government within the plume exposure pathway EPZ and**~~ each state within the ingestion exposure pathway EPZ. If the ~~**full participation**~~ exercise is conducted more than 1 year prior to issuance of an operating licensee [sic] for full power, an exercise which tests the licensee's onsite emergency plans must be conducted within one year before issuance of an operating license for full power. ~~**This exercise need not have State or local government participation.**~~

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that TVA would be exempt from those portions of 10 CFR Part 50, Appendix E, Section IV.F.2.a.(i)-(iii) related to offsite participation in exercises because TVA would be exempt from the umbrella provisions of 10 CFR Part 50, Appendix E, Section IV.F.2.a.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to conduct a full participation exercise with State and local agencies, which would involve demonstrating the implementation of offsite REP plans, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.3.11 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.F.2.a.(i), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.13 10 CFR Part 50, Appendix E, Section IV.F.2.a.(ii)

> For a combined license issued under part 52 of this chapter, this exercise must be conducted within two years of the scheduled date for initial loading of fuel. If the ~~**first full participation**~~ exercise is conducted more than one year before the scheduled date for initial loading of fuel, an exercise which tests the licensee's onsite emergency plans must be conducted within one year before the scheduled date for initial loading of fuel. ~~**This exercise need not have State or local government participation. If FEMA identifies one or more deficiencies in the state of offsite emergency preparedness as the result of the first full participation exercise, or i[I]f**~~ the Commission finds that the state of emergency preparedness does not provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency, the provisions of § 50.54(gg) apply.

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that TVA would be exempt from those portions of 10 CFR Part 50, Appendix E, Section IV.F.2.a.(i)-(iii) related to offsite participation in exercises because TVA would be exempt from the umbrella provisions of 10 CFR Part 50, Appendix E, Section IV.F.2.a.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering

that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to conduct a full participation exercise with State and local agencies, which would involve demonstrating the implementation of formal offsite REP plans and FEMA assessment of formal offsite REP plans, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.3.11 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.F.2.a.(ii), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.14 10 CFR Part 50, Appendix E, Section IV.F.2.a.(iii)

> For a combined license issued under part 52 of this chapter, if the applicant currently has an operating reactor at the site, an exercise, ~~**either full or partial participation,**~~ shall be conducted for each subsequent reactor constructed on the site. This exercise may be incorporated in the exercise requirements of Sections IV.F.2.b. and c. in this appendix. ~~**If FEMA identifies one or more deficiencies in the state of offsite emergency preparedness as the result of this exercise for the new reactor, or i**~~**[I]f** the Commission finds that the state of emergency preparedness does not provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency, the provisions of § 50.54(gg) apply.

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that TVA would be exempt from those portions of 10 CFR Part 50, Appendix E, Section IV.F.2.a.(i)-(iii) related to offsite participation in exercises because TVA would be exempt from the umbrella provisions of 10 CFR Part 50, Appendix E, Section IV.F.2.a.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to conduct a full participation exercise with State and local agencies, which would involve demonstrating the implementation of formal offsite REP plans and FEMA assessment of formal offsite REP plans, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.3.11 of this report, the staff concludes that the exempted language from 10 CFR

Part 50, Appendix E, Section IV.F.2.a.(iii), above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.15 10 CFR Part 50, Appendix E, Section IV.F.2.b

> Each licensee at each site shall conduct a subsequent exercise of its onsite emergency plan every 2 years. Nuclear power reactor licensees shall submit exercise scenarios under § 50.4 at least 60 days before use in an exercise required by this paragraph 2.b. ~~**The exercise may be included in the full participation biennial exercise required by paragraph 2.c. of this section.**~~ In addition, the licensee shall take actions necessary to ensure that adequate emergency response capabilities are maintained during the interval between biennial exercises by conducting drills, including at least one drill involving a combination of some of the principal functional areas of the licensee's onsite emergency response capabilities. The principal functional areas of emergency response include activities such as management and coordination of emergency response, accident assessment, event classification, notification of offsite authorities, assessment of the onsite ~~**and offsite**~~ impact of radiological releases**,** ~~**protective action recommendation development, protective action decision making,**~~ plant system repair and mitigative action implementation. During these drills, activation of all of the licensee's emergency response facilities (Technical Support Center (TSC), Operations Support Center (OSC), and Emergency Operations Facility (EOF)) would not be necessary, licensees would have the opportunity to consider accident management strategies, supervised instruction would be permitted, operating staff in all participating facilities would have the opportunity to resolve problems (success paths) rather than have controllers intervene, and the drills may focus on the onsite exercise training objectives.

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that TVA would be exempt from those portions of 10 CFR Part 50, Appendix E, Section IV.F.2.a.(i)-(iii) related to offsite participation in exercises because TVA would be exempt from the umbrella provisions of 10 CFR Part 50, Appendix E, Section IV.F.2.a.[18] The relief form the requirements for offsite exercises would include the relief from offsite exercises required by 10 CFR Part 50, Appendix E, Section IV.F.2.b.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when

[18] See also, TVA Letter No. CNL-18-071, April 27, 2018, "Supplemental Information Related to Emergency Planning Exemption Requests in Support of Early Site Permit Application for Clinch River Nuclear Site" (ADAMS Accession No. ML18117A291).

applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement to conduct a full participation exercise with State and local agencies, which would involve demonstrating the implementation of formal offsite REP plans, would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1 and 13.3.4.4.C.3.11 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.F.2.b, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.16 10 CFR Part 50, Appendix E, Section IV.F.2.c

~~**Offsite plans for each site shall be exercised biennially with full participation by each offsite authority having a role under the radiological response plan. Where the offsite authority has a role under a radiological response plan for more than one site, it shall fully participate in one exercise every two years and shall, at least, partially participate in other offsite plan exercises in this period. If two different licensees each have licensed facilities located either on the same site or on adjacent, contiguous sites, and share most of the elements defining co-located licensees, then each licensee shall:**~~

~~**(1) Conduct an exercise biennially of its onsite emergency plan;**~~

~~**(2) Participate quadrennially in an offsite biennial full or partial participation exercise;**~~

~~**(3) Conduct emergency preparedness activities and interactions in the years between its participation in the offsite full or partial participation exercise with offsite authorities, to test and maintain interface among the affected State and local authorities and the licensee. Co-located licensees shall also participate in emergency preparedness activities and interaction with offsite authorities for the period between exercises;**~~

~~**(4) Conduct a hostile action exercise of its onsite emergency plan in each exercise cycle; and**~~

~~**(5) Participate in an offsite biennial full or partial participation hostile action exercise in alternating exercise cycles.**~~

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there is no need for OROs to participate in biennial exercises. Although the likelihood of an accident or event resulting in offsite radiological doses exceeding the EPA PAGs beyond the site boundary is extremely remote, TVA's Emergency Plan will describe the capabilities to determine if a radiological release is occurring and promptly communicate that information to OROs for their consideration. Formal offsite REP plans would not be required. Therefore, a full participation exercise is not required.[19]

Table 1-2 further states that TVA would continue to invite State and local support organizations to participate in the periodic drills and exercises conducted. Those portions of F.2.c relating to co-located facilities are not applicable to the CRN Site ESPA. However, if in the future, the CRN Site became a co-located facility, those portions of F.2.c applicable to the CRN Site are addressed elsewhere in 10 CFR Part 50, Appendix E, Section IV.F.2.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement for exercising offsite response capabilities by each offsite authority having a role under a formal REP plan would not be needed.

Based on the above analysis and the analysis provided in Sections 13.3.4.4.C.1.1, 13.3.4.4.C.2.1, 13.3.4.4.C.2.2, and 13.3.4.4.C.3.11 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.F.2.c, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

13.3.4.4.C.3.17 10 CFR Part 50, Appendix E, Section IV.F.2.d

> Each State with responsibility for nuclear power reactor emergency preparedness should fully participate in the ingestion pathway portion of exercises at least once every exercise cycle. In States with more than one nuclear power reactor plume exposure pathway EPZ, the State should rotate this participation from site to site. ~~**Each State with responsibility for nuclear power emergency preparedness should fully participate in a hostile action exercise at least once every cycle and should fully**~~

[19] See also, request for additional information (eRAI-9227), addressed in Section 13.3.4.4.C.3.17, which addressed a minor revisions to this requested exemption.

~~**participate in one hostile action exercise by December 31, 2015. States with more than one nuclear power reactor plume exposure pathway EPZ should rotate this participation from site to site.**~~

TVA's exemption request states in Table 1-2 (site boundary PEP EPZ) that the basis for the exemption is that there are no offsite radiological consequences from any credible event in excess of the criteria provided in SSAR Section 13.3, such that formal offsite REP plans are not necessary. Therefore, there is no need for ORO's to participate in hostile action exercises. Although the likelihood of an accident or event resulting in offsite radiological doses exceeding the EPA PAG beyond the site boundary is extremely remote, TVA's Emergency Plan will describe the capabilities to determine if a radiological release is occurring and promptly communicate that information to OROs for their consideration. Formal offsite radiological emergency response plans would not be required. Therefore, offsite participation in a hostile action exercise is not required. TVA would continue to invite State and local support organizations to participate in the periodic drills and exercises conducted to assess its ability to perform responsibilities related to an emergency at the facility.

In its December 21, 2017 request for additional information, eRAI-9227 (ADAMS Accession No. ML18004A297), the staff asked TVA to address the proposed exemption from Section IV.F.2.d of Appendix E, with regard to removal of the requirements associated with exercising the ingestion pathway, that were not addressed in the ESPA. In its January 22, 2018, response to eRAI-9227 (ADAMS Accession No. ML18022A917), TVA revised the requested exemption to retain the requirement associated with the ingestion exposure pathway EPZ, and stated that the ingestion exposure pathway EPZ for the CRN Site will be addressed in a COLA (which is consistent with SSAR Section 13.3.3.2). On February 20, 2018, and April 27, 2018, TVA supplemented its January 22, 2018, response to eRAI-9227. See TVA Letter No. CNL-18-019, February 20, 2018, "Replacement Pages for Response to Request for Additional Information Related to Emergency Planning Exemption Requests in Support of Early Site Permit Application for Clinch River Nuclear Site" (ADAMS Accession No. ML18052A085), and TVA Letter No. CNL-18-071, April 27, 2018, "Supplemental Information Related to Emergency Planning Exemption Requests in Support of Early site Permit Application for Clinch River Nuclear Site" (ADAMS Accession No. ML18117A291). The staff identified as **Confirmatory Item 13.3-1**, the ESPA revisions in Enclosures 2 and 3 to TVA Letter No. CNL-18-071, regarding the withdrawal of exemption request Item No. 19 (for Section IV.F.2.f of Appendix E to 10 CFR Part 50). The staff reviewed the applicant's responses to eRAI-9227, and finds the responses acceptable. Therefore, the staff considers eRAI-9227 resolved.

The NRC requires a level of licensee emergency preparedness commensurate with the potential consequences to public health and safety at the licensee's site. TVA's exemption request includes a dose-based, consequence-oriented methodology for determining the PEP EPZ, that when applied in the COLA, may show that the radiological consequences of DBAs or less severe core melt accidents will not exceed the limits of the EPA early phase PAGs at the site boundary PEP EPZ, and that the EPZ is of sufficient size to provide for substantial reduction in early severe health effects in the event of more severe core melt accidents. If this demonstration is made, considering that the areas outside the PEP EPZ would also meet this criterion, offsite REP plans would not be necessary for the CRN Site if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, the requirement for States to participate in a hostile action exercise would not be

needed.

Based on the above analysis, and the analysis provided in Section 13.3.4.4.C.1.1 of this report, the staff concludes that the exempted language from 10 CFR Part 50, Appendix E, Section IV.F.2.d, above, is not necessary to achieve the underlying purpose of this requirement, as it applies to the CRN Site, if the EPA early phase PAGs are not exceeded beyond the PEP EPZ. Therefore, it meets the special circumstances provisions of 10 CFR 50.12(a)(2)(ii).

Conclusion

For the reasons given above, the staff concludes that, subject to **Confirmatory Item No. 13.3-1**, the proposed exemptions specified in ESPA Part 6, Tables 1-1, 1-2, and 1-3, are acceptable. In addition, as set forth in 10 CFR 50.12(a), the staff concludes that the proposed exemptions are authorized by law, will not present an undue risk to the public health and safety. Also, the special circumstances in 10 CFR 50.12(a)(2)(ii) are present, in that the application of the regulations in 10 CFR 50.33(g), 10 CFR 50.47(b) and (c)(2), and Appendix E to 10 CFR Part 50 in the particular circumstances would not serve the underlying purpose of the rule, or is not necessary to achieve the underlying purpose of the rule. The COL applicant will address COL Action Item 13.3-1. Therefore, the staff concludes that the proposed exemptions should be granted.

13.3.4.5 Major Features Emergency Plan

As described in Section 13.3.1 of this report, TVA submitted two separate onsite major features emergency plans for the new plant at the CRN Site under 10 CFR 52.17(b)(2)(i), consisting of ESP Plan 5A (with a site boundary PEP EPZ) and ESP Plan 5B (with a 2-mi PEP EPZ). The application did not address the ingestion pathway EPZ, which will be described in a COLA that references the CRN Site ESP. As required by 10 CFR 52.17(b)(2)(i) and Section III of Appendix E to 10 CFR Part 50, an ESPA which proposes major features of the emergency plans must address the relevant provisions in 10 CFR 50.47 and Appendix E to 10 CFR Part 50. An applicant is not required to address all of the major features of an emergency plan in the ESPA, as identified in Supplement 2 to NUREG–0654. Pursuant to 10 CFR 52.18, the staff evaluated the acceptability of both ESP plans, in accordance with the applicable standards of 10 CFR 50.47 and the requirements of Appendix E to 10 CFR Part 50.

Since the major features of each emergency plan address only a limited portion of the total EP requirements in 10 CFR 50.47 and Appendix E to 10 CFR Part 50, the staff's evaluation only addresses the acceptability of those limited major features. A COL applicant will be required to submit complete and integrated emergency plans that supplement the major features in either ESP Plan 5A or ESP Plan 5B, or an entirely new emergency plan, depending upon the selected SMR technology, with information that meets all of the EP requirements in 10 CFR 50.47 and Appendix E to 10 CFR Part 50.

Sections 13.3.4.5.1 through 13.3.4.5.17 describe the staff's technical evaluation of the information provided in the ESPA. The section designations of the technical evaluation generally correspond to the 16 planning standards in NUREG–0654, Section II. Specifically, SER Sections 13.3.4.5.1 through 13.3.4.5.16 address NUREG–0654, Section II, Planning Standards A through P, respectively. The format of the staff's review of ESP Plan 5A and ESP Plan 5B is patterned after

these 16 planning standards, which reflects the requirements in 10 CFR 50.47(b)(1) through 10 CFR 50.47(b)(16). In 10 CFR Part 50, Appendix E provides additional requirements that duplicate and supplement the evaluation criteria associated with the planning standards. The staff's evaluation of the various aspects of 10 CFR Part 50, Appendix E is included within the staff's review.

While the ESPA includes two separate major features emergency plans, the details of both plans are either identical or very similar in content. This is because both plans (1) reflect the same CRN Site; (2) are limited to the onsite emergency plan; and (3) describe the same limited scope and depth of the chosen EP major features. In order to take advantage of the similarities between the two plans, the staff's review findings for each major feature apply to both plans. This is reflected by references to the "ESP Plan," which means that the evaluation and findings apply to both ESP Plan 5A and ESP Plan 5B. Where the staff identified differences between ESP Plan 5A and ESP Plan 5B, those differences (and related findings) are clearly identified.

As discussed above, 10 CFR 52.17(b)(2) allows an ESP applicant to propose major features of emergency plans, in accordance with the pertinent standards of 10 CFR 50.47 and requirements of Appendix E to 10 CFR Part 50. The staff's review of the major features is similar to the review of complete and integrated emergency plan, except that the major features review examines a reduced scope of the full EP requirements. This reduced scope reflects the limited extent of the emergency plans (i.e., major features) that the applicant chooses to have reviewed as part of the ESPA, and provides flexibility for the applicant to tailor the details of the major features, in order to obtain an early review and associated finality for selected EP details associated with the proposed ESP site. When an application for a COL references the ESP, the remaining details associated with complete and integrated emergency plans for the ESP site (i.e., the delta) must be addressed. That is, the difference between the approved major features, and what's required for complete and integrated emergency plans, must be addressed in a COLA.

The following review of the CRN Site's major features emergency plans includes numerous COL action items (identified by both TVA and the NRC staff), which reflect various requirements of complete and integrated emergency plans that must be addressed in a COLA. These COL action items do not necessarily constitute a full list of all aspects of complete and integrated emergency plans, but represent the differences between the approved major features emergency plan and complete and integrated emergency plans – that must be identified and adequately addressed by the COL applicant. As such, a COL applicant that references this ESP is responsible for identifying, and adequately addressing, all required aspects of complete and integrated emergency plans that were not addressed and found adequate in the ESPA, in accordance with applicable requirements and guidance.

FEMA Consultation

In its February 13, 2017, letter to FEMA, NRC requested that FEMA review the ESPA and provide NRC with its determination as to whether the proposed major features of the emergency plan, specifically related to the exact size and configuration of the 2-mi PEP EPZ, are acceptable for ESP Plan 5B.[20] FEMA responded to NRC's February 13, 2017, letter on June 12, 2017, and

[20] TVA is requesting NRC approval of the ESPA's description of the 2-mi PEP EPZ. TVA is not requesting

supplemented its response on August 11, 2017, and January 24, 2018. In its January 24, 2018, letter, FEMA stated, in part, the following:

> With respect to the issue of whether the proposed major features of the emergency plan, specifically related to the exact size and configuration of the 2-mile PEP EPZ, is acceptable (for Emergency Plan 5B), FEMA and NRC staffs have engaged in multiple discussions to better clarify the appropriate FEMA deliverable. Specifically, the NRC has not requested FEMA's approval of the 2-mile radius for the PEP EPZ. Rather, NRC requests FEMA's determination, as part of a limited major feature review, that the exact size and configuration of the 2-mile PEP EPZ for Emergency Plan 5B 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, in accordance with Section I.3 of Appendix E to 10 CFR Part 50. Therefore, NRC seeks a FEMA determination whether the boundary established for the proposed 2-mile PEP EPZ, as described in Emergency Plan 5B and the ETE report, adequately addresses these criteria.
>
> Accordingly, FEMA, working with the TEMA, has determined that the boundary established for the proposed 2-mile PEP EPZ (as reflected in Emergency Plan 5B and its ETE Report), 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. This finding does not, however, endorse or determine the adequacy of a proposed 2-mile PEP EPZ for the CRN Site if proposed during the licensing process.
>
> Notwithstanding these determinations, as the licensing process moves forward and the NRC staff reviews TVA's exemption request that would permit the use of a methodology for establishing a scalable PEP EPZ boundary for the small modular reactor (SMR) design that will later be selected for the combined license (COL) application, FEMA looks forward to providing continued consultative support to the NRC consistent with each agency's statutes, applicable regulations, and the joint FEMA/NRC MOU.

Section 13.3.4.1 of this report documents FEMA's ESPA review associated with significant impediments to the development of offsite emergency plans for the 2-mi PEP EPZ.

13.3.4.5.1 Assignment of Responsibility (Organization Control)

As reflected in NUREG–0654, Section II, Planning Standard A, "Assignment of Responsibility (Organization Control)," 10 CFR 50.47(b)(1) requires that primary responsibilities for emergency

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approval of the application of the 2-mi PEP EPZ to the CRN Site, as this would be addressed in a COLA. The extent of NRC approval of the description of the 2-mi PEP EPZ is limited to whether that description reflects such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries, in accordance with Section I.3 of Appendix E to 10 CFR Part 50. See also, Sections 13.3.4.3.3 and 13.3.4.5.17 of this report.

response by the nuclear facility licensee and by State and local organizations within the EPZs 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. In addition, 10 CFR Part 50, Appendix E, Section III requires that the emergency plans incorporate information about the emergency response roles of supporting organizations and offsite agencies, and that the incorporated information shall be sufficient to provide assurance of coordination among the supporting groups and with the licensee. In addition, 10 CFR Part 50, Appendix E, Section IV.A requires a description of the local offsite services to be provided in support of the licensee's emergency organization; identification of, and a description of the assistance expected from, appropriate local, State, and Federal agencies with responsibilities for coping with emergencies, including hostile action at the site; and identification of the State and/or local officials responsible for planning for, ordering, and controlling appropriate protective actions, including evacuations when necessary.

In the following ESP Plan sections, the applicant described the responsibilities of TVA and various local, State, and Federal agencies, as well as private sector organizations that are part of the ERO for the CRN Site and might be needed to respond to an emergency onsite at the CRN Site:

- ESP Plan Section 2.3, "State Radiological Emergency Plan,"
- ESP Plan Section 3.1, "Roles and Responsibilities,"
- ESP Plan Section 3.2, "Onsite Organization,"
- ESP Plan Section 3.3, "Offsite Organization,"
- ESP Plan Section 5.2, "Offsite,"
- ESP Plan Section 16.5, "Agreement Letters,"
- ESP Plan Section A.3, "Site Emergency Organization (Concept of Operations)," of Appendix A,
- ESP Plan Section A.4.5.2, "First Aid and Medical Facilities," of Appendix A,
- ESP Plan Section A.4.6, "Additional Local Support," of Appendix A, and
- ESP Plan Section A.5.1, "Responsibility for the Emergency Preparedness Effort," of Appendix A.

The staff reviewed these sections, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard A, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(1).

In ESP Plan Section A.5.1 of Appendix A, the applicant stated that the Site Vice President maintains overall authority and responsibility for radiological emergency response planning. The Director, Emergency Preparedness is assigned responsibility for coordinating emergency preparedness efforts, including activities related to the development of emergency plans and procedures and coordinating the plans and procedures with supporting organizations to ensure the overall effectiveness of the program. ESP Plan Section A.3.6.1, "Site Vice President," of Appendix A includes the responsibilities of the Site Vice President.

ESP Plan Section 2.3 states that the State Radiological Emergency Plan, which is referenced in Appendix A, Attachment 1, "State Multijurisdictional Radiological Emergency Response Plan," provides for the coordinated response of the State and affected local governments, and defines roles and responsibilities. ESP Plan Table 2-1, "Principal Organizational Responsibilities," identifies the responsibilities of the major organizations, including local, State, and TVA. ESP Plan 5B, Section 2.3 further states that the State and local governments include those within the CRN Site ingestion exposure pathway EPZ. ESP Plan 5A, Section 2.3 does not include a reference to the CRN Site ingestion exposure pathway EPZ, but adds the following:

> As addressed in the Federal Emergency Management Agency's (FEMA) Comprehensive Preparedness Guide 101, "Developing and Maintaining Emergency Operations Plans" (CPG-101), if determined appropriate, government officials may utilize a CEMP [Comprehensive Emergency Management Plan] approach to emergency planning to implement ad hoc protective actions to protect the public.

ESP Plan Section 3.1.1, "Emergency Management Organization (Concept of Operations)," states that the CRN Site Emergency Management Organization (also referred to as the emergency response organization (ERO)), is divided into two categories: the onsite organization and the offsite emergency organization. The onsite organization is comprised of the Site Emergency Director (SED) and technical staff located in the TSC, a Control Room staff of Operations personnel, and additional support personnel located in the OSC. The onsite organization is responsible for the onsite response to an emergency condition. Onsite activities are directed by the SED to include such functions as Control Room operations, technical assessment, emergency mitigation analysis, onsite radiation surveys, and dose tracking for site personnel. ESP Plan 5B, Section A.3.6.2, "Site Emergency Director," of Appendix A includes an additional responsibility for the SED to make recommendations for protective actions (if necessary) to the State and local agencies prior to the Central Emergency Control Center (CECC) being staffed – at which time this responsibility can be transferred only to the CECC Director. (The ESP Plan relies on the use of the CECC as the EOF for the CRN Site, as discussed in Section 13.3.4.5.3 of this report.)

The TVA offsite organization is designated as the CECC staff, which is comprised of a CECC Director, a supporting group of technical assistants, and representatives of other TVA organizations. The CECC Director and supporting technical assistants report to the CECC during an emergency, as required. Other TVA organizations will send representatives to the CECC, as requested by the CECC Director. The CECC is responsible for directing and coordinating the overall TVA response to an emergency condition. Functions such as offsite radiological monitoring and dose assessment, public information, State and local government coordination, and additional plant assessment are handled by the CECC, relieving the onsite organization of the many peripheral duties necessary for the successful emergency response. ESP Plan Figure 3-1, "Offsite Emergency Organization," illustrates in a block diagram the interrelationships of TVA's offsite emergency organization.

ESP Plan Section 3.2 states that the CRN Site is staffed on a continual 24-hour basis, with minimum staffing requirements for plant operations established in the plant Technical Specifications, and the staff responsibilities for normal operations identified in plant Technical Specifications remain unchanged during an emergency. In ESP Plan Section A.3 of Appendix A, the applicant provided a general description of the organization TVA maintains that is capable of responding to a radiological emergency, and stated that the on-shift staff is continually present on a 24-hour basis. In addition, ESP Plan Section 5.2 states that essential emergency positions are covered on a 24-hour-a-day basis by duty personnel. Specifically, 24-hour per day manning of communications links is discussed in Section 13.3.4.5.6 of this report.

ESP Plan Section 3.2 further states that under emergency conditions, the normal plant staff is supplemented, as shown in ESP Plan Appendix A (i.e., Figure A.3-1, "Technical Support Center Organization," and Figure A.3-2, "Operations Support Center Organization"), which also provides descriptions of the responsibilities of the personnel who augment the normal plant operating organization. The person primarily responsible for mitigation of an emergency is the SED. Upon declaration of an emergency, the on-duty Shift Manager (SM) initially fills the position of SED and directs emergency response from the Control Room. This position is transferred to the TSC when the facility is activated, at which time the TSC will provide technical support to the Control Room as part of their overall response to the emergency.

The onsite organization augments the on-shift normal plant operating organization. If members of the onsite organization are not present when an emergency occurs, the on-duty SM (or a designated Unit Supervisor when acting as the SM) is designated the SED and acts as such until relieved by the SED assigned to the TSC. The interrelationships of TVA's onsite organization are illustrated in block diagrams in ESP Plan Figure A.3-1, "Technical Support Center Organization," of Appendix A, and ESP Plan Figure A.3-2, "Operations Support Center Organization," of Appendix A. The onsite emergency organization is addressed further in ESP Plan Section A.3.6, "Onsite Emergency Management Organization," of Appendix A, and discussed in Section 13.3.4.5.2 of this report.

Upon detection of a known or suspected emergency, the on-duty SM refers to a CRN-Emergency Plan Implementing Procedures (EPIP) to determine the emergency classification. ESP Plan Section A.8, "Emergency Plan Implementing Procedures," of Appendix A lists a CRN-EPIP topic entitled "Emergency Classification." In addition, emergency classification is addressed in ESP Plan Section 4.0, "Emergency Conditions," and discussed in Section 13.3.4.5.4 of this report.

After determining the classification of the incident, the SM assumes the responsibilities of SED (under declaration of an emergency) and initiates the appropriate procedure referenced by the CRN-EPIP. Emergency communications/ notifications with local, State, and Federal agencies, along with staffing instructions for the emergency response facilities are specified in CRN-EPIPs. CRN-EPIPs designate personnel who will staff the ENS and Health Physics Network (HPN) communication functions using the NRC Federal Telecommunications System (FTS) 2000 System to interface with the NRC during TSC operation. (Emergency communications are addressed in ESP Plan Section 6.0, "Communications," and discussed in Section 13.3.4.5.6 of this report.)

ESP Plan Section 3.3 identifies the titles and responsibilities of those positions that comprise TVA's offsite organization that augments the normal plant operating organization (also shown in ESP Plan Figure 3-1), and lists the specific responsibilities. ESP Plan Section 3.3.1, "CECC Director," states that the CECC Director has overall responsibility and authority for ensuring adequate TVA response, and directs and coordinates TVA's emergency response. This includes responsibility for ensuring 24-hour/day operations are established during the emergency, if required. ESP Plan 5B, Section 3.3.1 adds that the CECC Director ensures adequate TVA response to affected State/local governments in protecting the health and safety of the public, and makes protective action recommendations (PARs) to the State. Protective actions are addressed in ESP Plan Section 10.0, "Protective Response," and discussed in Section 13.3.4.5.10 of this report.

In contrast, ESP Plan 5A, Section 3.3.1 states that the CECC Director:

> Ensures sufficient information relative to the plant status, radiological impacts, and protective measures is made available to government officials to enable them to implement ad hoc protective measures . . . for the protection of the public, should they be determined appropriate by offsite officials.

Offsite support organizations that are intended to respond onsite to an emergency at the CRN Site are described in ESP Plan Section 3.3.24, "Local Support," which states that TVA maintains agreements with police departments, fire departments, ambulance services, and hospitals near the CRN Site to provide appropriate services for a response onsite, as requested. Arrangements for ambulance services and local medical facilities are also addressed in ESP Plan Section 12.0, "Medical Support," ESP Plan Sections A.4.5.2.3, "Receiving Hospitals and Supplies," of Appendix A, and ESP Plan Section A.4.5.2.4, "Ambulance Service," of Appendix A, and discussed further in Section 13.3.4.5.12 of this report.

ESP Plan Section 3.3.25, "Federal Agency Support," states that TVA maintains an agreement with DOE REAC/TS. Other Federal support would be requested through the National Response Framework (NRF), which is addressed in ESP Plan Section 2.4, "National Response Framework," and discussed in Section 13.3.4.5.3 of this report.[21] ESP Plan Section 3.3.26, "Vendor Support," states that TVA may obtain technical support from the Nuclear Steam Supply System (NSSS)

[21] National Response Framework, "Nuclear/Radiological Incident Annex," June 2008 (see http://www.fema.gov.pdf/emergency/nrf/nrf_nuclearradiologicalincidentannex.pdf, visited December 11, 2013). See also, "National Response Framework," Notice of availability of the final National Response Framework, January 28, 2008 (73 FR 4887).

vendor during emergency situations, and may procure other vendor support, as needed. Finally, ESP Plan Section 3.3.27, "INPO," states that TVA maintains an agreement with the Institute of Nuclear Power Operations (INPO), a consortium of nuclear utilities and other nuclear industries, to obtain any necessary support available from the industry during an emergency.

In ESP Plan Section 16.5, the applicant also stated that the detailed agreements with TEMA, DOE, Roane County, and the City of Oak Ridge will be addressed in the COLA, and documented in a Multi-Jurisdictional Emergency Response Plan. (See ESP Plan Appendix A, Attachment 1, referenced above, which identifies the "State of Tennessee Multijurisdictional Radiological Emergency Response Plan.") Arrangements for offsite support are also addressed in ESP Plan Section A.4.6 of Appendix A, and discussed in Section 13.3.4.5.3 of this report.

With regard to the guidance in NUREG–0654, Section II, Evaluation Criterion II.A.3, the applicant did not include in the ESPA written agreements referring to the concept of operations developed between Federal, State, and local agencies and other support organizations having an emergency response role within the EPZs. (The staff's evaluation of contacts and arrangements with local, State, and Federal agencies are addressed in Section 13.3.4.2 of this report.)

Pursuant to 10 CFR 52.39(b), an applicant for a COL that references this ESP shall update the EP information that was provided under 10 CFR 52.17(b), including written agreements with offsite agencies, and discuss whether the updated information materially changes the bases for compliance with applicable NRC requirements. Consistent with this requirement and related guidance, as well as the applicant's statement above to address various detailed agreements with offsite emergency support entities in a COLA, the staff identified the following COL action item to address necessary agreements with offsite support organizations:

COL Action Item 13.3-2

> An applicant for a combined license (COL) that references this early site permit should submit to the NRC up-to-date letters of agreement or memoranda of understanding with offsite support organizations, which address the concept of operations in support of their respective emergency response roles associated with the chosen plant design, including hostile actions at the Clinch River Nuclear Site, consistent with applicable requirements and guidance.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard A. A COL applicant will address COL Action Item 13.3-2. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(1) and 10 CFR Part 50, Appendix E, Sections III and IV.A, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.2 Onsite Emergency Organization

As reflected in NUREG–0654, Section II, Planning Standard B, "Onsite Emergency Organization,"

10 CFR 50.47(b)(2) requires that on-shift facility licensee responsibilities for emergency response are unambiguously defined, that adequate staffing to provide initial facility accident response in key functional areas is maintained at all times, that timely augmentation of response capabilities is available, and that interfaces among various onsite response activities and offsite support and response activities are specified. In addition, 10 CFR Part 50, Appendix E, Section IV.A requires a description of the organization for coping with radiological emergencies, including definition of authorities, responsibilities, and duties of individuals assigned to the licensee's emergency organization, and the means for notification of such individuals in the event of an emergency. This shall include a description of the normal plant operating organization, onsite ERO, headquarters personnel who will augment the onsite emergency organization, and local offsite services to be provided in support of the licensee's emergency organization. The emergency plan shall identify persons within the licensee organization who will be responsible for making offsite dose projections, and other employees with special qualifications for coping with emergency conditions that might arise. Other persons with special qualifications, who are not licensee employees and who may be called on for assistance, shall also be identified, including a description of their special qualifications. In 10 CFR Part 50, Appendix E, Section IV.A.9 requires a detailed analysis demonstrating that on-shift personnel assigned emergency plan implementation functions are not assigned responsibilities that would prevent the timely performance of their assigned functions, as specified in the emergency plan.

In the following ESP Plan sections, the applicant described the ERO and its key positions and associated responsibilities, including outlining the staffing requirements that provide initial emergency response actions and provisions for timely augmentation of on-shift personnel when required.

- ESP Plan Section 3.1.1, "Emergency Management Organization (Concept of Operations),"
- ESP Plan Section 3.2, "Onsite Organization,"
- ESP Plan Section 3.3, "Offsite Organization,"
- ESP Plan Section 5.2, "Offsite,"
- ESP Plan Section 7.0, "Public Information and Education,"
- ESP Plan Section 12.0, "Medical Support,"
- ESP Plan Section 13.0, "Termination and Recovery,"
- ESP Plan Section 16.5, "Agreement Letters,"
- ESP Plan Section A.3, "Site Emergency Organization (Concept of Operations)," of Appendix A,
- ESP Plan Section A.4.5.2, "First Aid and Medical Facilities," of Appendix A, and

- ESP Plan Section A.4.6, “Additional Local Support,” of Appendix A

The staff reviewed these sections, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff’s primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard B, and Section IV.C, “On-Shift Staffing Analysis,” of NSIR/DPR-ISG-01,[22] “Emergency Planning for Nuclear Power Plants,” which provide the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(2).

ESP Plan Section 3.1.1 states that the CRN Site Emergency Management Organization is divided into two categories; the onsite organization and the offsite emergency organization. The onsite organization is comprised of the SED and technical staff located in the TSC, a Control Room staff of Operations personnel, and additional support personnel located in the OSC. The onsite organization is responsible for the onsite response to an emergency condition. Onsite activities are directed by the SED to include such functions as Control Room operations, technical assessment, emergency mitigation analysis, onsite radiation surveys, and dose tracking for site personnel. ESP Plan Figures A.3-1 and A.3-2 of Appendix A illustrate in block diagrams the interrelationships of TVA’s onsite organization.

The offsite organization is designated as the CECC staff, which is comprised of a CECC Director, a supporting group of technical assistants, and representatives of other TVA organizations. The CECC Director and supporting technical assistants report to the CECC during an emergency, as required. Other TVA organizations will send representatives to the CECC, as requested by the CECC Director. The CECC is responsible for directing and coordinating the overall TVA response to an emergency condition. (ESP Plan Section 9.2.1, “General Information,” lists CECC-EPIP-18, “Transportation and Staffing Under Abnormal Conditions.”) Functions such as offsite radiological monitoring and dose assessment, public information, State and local government coordination, and additional plant assessment are handled by the CECC relieving the onsite organization of the many peripheral duties necessary for the successful emergency response. ESP Plan Figure 3-1 illustrates in a block diagram the interrelationships of TVA’s offsite emergency organization.

ESP Plan Section 3.2 states that under normal conditions the Site Vice President is in charge of activities at the site, and the Plant Manager is responsible for the safe efficient operation of the plant. Management level interface by the Site Vice President with governmental authorities is addressed in ESP Plan Section A.3.6.1 of Appendix A, and discussed further in Section 13.3.4.5.1 of this report. The ERO position primarily responsible for mitigation of an emergency is the SED. Upon declaration of an emergency, the on-duty SM initially fills the position of SED and directs emergency response from the Control Room. This position is transferred to the TSC when the facility is activated, at which time the TSC provides technical support to the Control Room as part of their overall response to the emergency.

ESP Plan Section A.3.6.2 describes SED responsibilities, and identifies which responsibilities cannot be delegated. ESP Plan 5B, Section A.3.6.2 of Appendix A includes an additional

[22] *NSIR/DPR-ISG* – (NRC Office of) Nuclear Security and Incident Response/Division of Preparedness and Response, Interim Staff Guidance.

responsibility for the SED to make recommendations for protective actions (if necessary) to the State and local agencies prior to the CECC being staffed. This responsibility can be transferred only to the CECC Director. The authority and responsibilities of the SED, including various aspects of the onsite and offsite organizations, are discussed further in Section 13.3.4.5.1 of this report.

ESP Plan Section 3.2 states that the CRN Site is staffed on a continual 24-hour basis, with minimum staffing requirements for plant operations established in the plant Technical Specifications, and the staff responsibilities for normal operations identified in plant Technical Specifications remain unchanged during an emergency. In ESP Plan Section A.3 of Appendix A, the applicant provided a general description of the organization TVA maintains that is capable of responding to a radiological emergency, and stated that the on-shift staff is continually present on a 24-hour basis. The applicant also stated that TVA will specify on-shift staffing in the COLA. In addition, ESP Plan Section 5.2 states that essential emergency positions are covered on a 24-hour-a-day basis by duty personnel.

ESP Plan Section 3.2 further states that under emergency conditions, the normal plant staff is supplemented, as shown in ESP Plan Appendix A, which also provides descriptions of the responsibilities of the personnel who augment the normal plant operating organization. Support personnel will be notified to report as required by the situation. Staffing time for the augmenting forces is indicated in ESP Plan Appendix A. Staff notifications are addressed in ESP Plan Section 5.0, “Emergency Notification and Activation of Plan,” and discussed in Section 13.3.4.5.5 of this report.

The onsite organization augments the shift operations crew. If members of the onsite organization are not present when an emergency occurs, the on-duty SM (or a designated Unit Supervisor, when acting as the SM) is designated the SED, and acts as such until relieved by the SED assigned to the TSC. Upon detection of a known or suspected emergency, the on-duty SM refers to a CRN-EPIP to determine the emergency classification. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP topic entitled “Emergency Classification.” In addition, emergency classification is addressed in ESP Plan Section 4.0 and discussed in Section 13.3.4.5.4 of this report.) After determining the classification of the incident, the SM assumes the responsibilities of SED and initiates the appropriate procedure referenced by the CRN-EPIP. Emergency communications/notifications with local, State, and Federal agencies, along with staffing instructions for the emergency response facilities are specified in CRN-EPIPs. CRN-EPIPs designate personnel who staff the ENS and HPN communication systems, as well as interface with the NRC during TSC operation. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP topic entitled “Staffing and Operation of Emergency Response Facilities.”)

ESP Plan Section 3.3 identifies the titles and responsibilities of those positions that comprise TVA’s offsite organization that augments the plant staff (also shown in ESP Plan Figure 3-1), and lists the specific responsibilities. The applicant also stated that the prescribed response times for the offsite organization will be addressed in the COLA. (Notification and activation of emergency response personnel is addressed in ESP Plan Section 5.0 and discussed in Section 13.3.4.5.5 of this report.) ESP Plan Section 3.3.1 states that the CECC Director has overall responsibility and authority for ensuring adequate TVA response, and directs and coordinates TVA’s emergency response. This includes responsibility for ensuring 24-hour/day operations are established, if required. ESP Plan 5B, Section 3.3.1 adds that the CECC Director ensures adequate TVA response to affected

State/local governments in protecting the health and safety of the public, and makes PARs to the State. (Protective actions are addressed in ESP Plan Section 10.0 and discussed in Section 13.3.4.5.10 of this report.) In contrast, ESP Plan 5A, Section 3.3.1 includes the following additional responsibility for the CECC Director:

> Ensures sufficient information relative to the plant status, radiological impacts, and protective measures is made available to government officials to enable them to implement ad hoc protective measures . . . for the protection of the public, should they be determined appropriate by offsite officials.

In ESP Plan Section 3.3.13, "Public Information Manager," the applicant listed the Public Information Manager's responsibilities, which include providing information to inform the public and news media in response to an emergency. ESP Plan Section 7.0 identifies the support personnel who are responsible for the approval and release of information to the news media during an emergency. TVA's emergency public information program is discussed further in Section 13.3.4.5.7 of this report.

Consistent with the applicant's intention to address the on-shift ERO staffing in a COLA (described above), the staff identified the following COL action item.

COL Action Item 13.3-3

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe on-shift emergency response organization staffing in support of the chosen small modular reactors (SMR) technology for the Clinch River Nuclear Site, including the capability for on-site and off-site emergency response organization positions to be staffed and emergency response facilities activated, consistent with the applicable requirements and guidance.

Logistical support for emergency personnel is addressed in ESP Plan Section 3.3.23, "Management Services," which states that Management Services provides for clerical support, food and water, sanitary facilities, TVA transportation services, lodging, specialized equipment and supplies, communications, drawings, and controlled documents. In addition, Management Services is authorized to issue checks to outside firms for payment for emergency services.

Offsite support organizations that are intended to be part of the overall response organization are described in ESP Plan Section 3.3.24, which states that TVA maintains agreements with police departments, fire departments, ambulance services, and hospitals near the CRN Site to provide appropriate services, as requested. Arrangements for ambulance services and local medical facilities are also addressed in ESP Plan Section 12.0, ESP Plan Sections A.4.5.2.3 of Appendix A, and ESP Plan Section A.4.5.2.4 of Appendix A, and discussed further in Section 13.3.4.5.12 of this report.

ESP Plan Section 3.3.25 states that TVA maintains an agreement with DOE REAC/TS, and that other Federal support would be requested through the NRF. (The NRF is addressed in ESP Plan Section 2.4 and discussed in Section 13.3.4.5.3 of this report.) ESP Plan Section 3.3.26 states that TVA may obtain technical support from the NSSS vendor during emergency situations, and

may procure other vendor support, as needed. Finally, ESP Plan Section 3.3.27 states that TVA maintains an agreement with INPO, a consortium of nuclear utilities and other nuclear industries, to obtain any necessary support available from the industry during an emergency. ESP Plan Table 2-1 identifies the responsibilities of the major organizations, including local, State, and TVA. Emergency response roles of supporting organizations and offsite agencies, including arrangements and agreements reached in support of the CRN Site (addressed in ESP Plan Section 16.5), are discussed further in ESP Plan Section 13.3.4.5.1 of this report.

Fukushima Dai-ichi – NTTF Recommendation 9.3

On March 12, 2012, the NRC requested additional information from all power reactor licensees and holders of construction permits, associated with the NRC Near-Term Task Force (NTTF) review of the accident at the Fukushima Dai-ichi nuclear facility (ADAMS Accession No. ML12053A340). In Recommendation 9.3, the NTTF addressed staffing and communications provisions for enhancing emergency preparedness. On January 23, 2013, the NRC issued a follow-up letter (ADAMS Accession No. ML13010A162), which identified generic technical issues that need to be addressed as part of the Recommendation 9.3 communications capability assessment. Emergency communications are addressed in Section 13.3.4.5.6 of this report.

With regard to staffing, the accident at Fukushima highlighted the need to determine and implement the required staff to fill all necessary positions responding to a multi-unit event. Specifically, NTTF Recommendation 9.3 requests that all power reactor licensees and holders of construction permits (in active or deferred status) assess their current staffing levels and determine the appropriate staff to fill all necessary positions for responding to a multi-unit event during a beyond design basis natural event, and determine if any enhancements are appropriate. Single-unit sites should provide the requested information, as it pertains to an extended loss of all alternating current (AC) power and impeded access to the site.

TVA did not address NTTF Recommendation 9.3 in the ESPA. Since the NTTF Recommendation 9.3 staffing and communications provisions are an essential part of the staff's review of the onsite emergency organization and emergency communications, in support of full-power operations, the staff identified the following permit conditions, which address enhanced staffing and communications capabilities. The permit conditions include the use of Nuclear Energy Institute (NEI) technical report NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities," which the NRC has endorsed as an acceptable method for licensees to employ when addressing NTTF Recommendation 9.3.[23]

Permit Conditions 2 and 3

2. An applicant for a combined license (COL) that references this early site permit shall propose

[23] See (1) NRC May 15, 2012, letter, 'U.S. Nuclear Regulatory Commission Review of NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities," Revision 0, dated May 2012' (ADAMS Accession No. ML12131A043); (2) NEI May 3, 2012, letter, 'Transmittal of NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities," Revision 0, dated May 2012' (ADAMS Accession No. ML12125A411); and (3) NEI Report No. 12-01, Revision 0, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities," May 2012 (ADAMS Accession No. ML12125A412).

a license condition for the licensee to perform the following:

(i) No later than eighteen (18) months before the latest date set forth in the schedule submitted in accordance with 10 CFR 52.99(a) for completing the inspections, tests, and analyses in the ITAAC, the licensee shall have performed an assessment of on-site and augmented staffing capability for response to a multi-unit event. The staffing assessment shall be performed in accordance with the latest NRC-endorsed revision of NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities."

(ii) No later than one hundred eighty (180) days before the date scheduled for initial fuel load, as set forth in the notification submitted in accordance with 10 CFR 52.103(a), the licensee shall revise the emergency plan to include the following:

a. Incorporation of corrective actions identified in the staffing assessment required by this license conditions; and

b. Identification of how the augmented staff will be notified, given degraded communications capabilities.

3. An applicant for a combined license (COL) that references this early site permit shall propose a license condition for the licensee to perform the following:

(i) No later than eighteen (18) months before the latest date set forth in the schedule submitted in accordance with 10 CFR 52.99(a) for completing the inspections, tests, and analyses in the ITAAC, the licensee shall have performed an assessment of on-site and off-site communications systems and equipment relied upon during an emergency event to ensure communications capabilities can be maintained during an extended loss of AC power. The communications capabilities assessment shall be performed in accordance with the latest NRC-endorsed revision of NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities;

(ii) No later than one hundred eighty (180) days before the date scheduled for initial fuel load set forth in the notification submitted in accordance with 10 CFR 52.103(a), the licensee shall have completed implementation of corrective actions identified in the communications capability assessment, including revisions to the emergency plan.

Enhancements to Emergency Preparedness Regulations

In addition to appropriate staffing levels associated with multi-unit events (discussed above), 10 CFR Part 50, Appendix E, Section IV.A.9 requires that nuclear power reactor licensees provide a detailed analysis demonstrating that on-shift personnel assigned emergency plan implementation functions are not assigned responsibilities that would prevent the timely performance of their assigned functions, as specified in the emergency plan.

In support of this requirement, NRC issued associated guidance in Interim Staff Guidance

NSIR/DPR-ISG-01. In Section IV.C of NSIR/DPR-ISG-01, NRC endorsed NEI technical report NEI 10-05, "Assessment of On-Shift Emergency Response Organization Staffing and Capabilities," Revision 0, dated June 2011 (ADAMS Accession No. ML111751698), stating, in part, that NEI 10-05 establishes a standard methodology for a licensee to perform the required staffing analysis (in 10 CFR Part 50, Appendix E, Section IV.A.9), and that the NRC has reviewed NEI 10-05 and finds it to be an acceptable methodology for this purpose.

TVA did not include a detailed on-shift staffing analysis in the ESPA. Since the staffing provisions are an essential part of the staff's review of the onsite emergency organization, in support of full-power operations, the staff identified the following permit condition, which addresses the actions that will be taken to analyze on-shift personnel assigned emergency plan implementation function.

Permit Condition 4

4. An applicant for a combined license (COL) that references this early site permit shall update the emergency plan to describe on-shift personnel assigned emergency plan implementing functions associated with the chosen small modular reactor (SMR) technology and the number of proposed reactor units. In addition, the COL applicant shall propose a license condition for the licensee to perform the following:

   (i) No later than eighteen (18) months before the latest date set forth in the schedule submitted in accordance with 10 CFR 52.99(a) for completing the inspections, tests, and analyses in the ITAAC, the licensee shall have performed a detailed staffing analysis, in accordance with the latest NRC-endorsed revision of NEI 10-05, "Assessment of On-Shift Emergency Response Organization Staffing and Capabilities;"

   (ii) No later than one hundred eighty (180) days before the date schedule for initial fuel loading set forth in the notification submitted in accordance with 10 CFR 52.103(a), the licensee shall have revised the emergency plan to incorporate any changes identified in the staffing analysis that are needed to bring staffing to the required levels.

Subject to Permit Conditions 2, 3, and 4, the staff finds that the applicant unambiguously defined its responsibilities for emergency response, has adequate staffing to provide and maintain at all times initial facility accident response in key functional areas, and is capable of timely augmentation of the response capabilities. The applicant adequately specified the interfaces among various onsite and offsite support and response activities. In addition, the applicant described the organization for coping with radiological emergencies, including the authorities, responsibilities, and duties of individuals assigned to the licensee's emergency organization and the means for their notification in the event of an emergency. The applicant also described the normal plant operating organization, the onsite ERO, and the headquarters and local offsite personnel and services that will augment and support the onsite organization. Further, licensee employees who are responsible for making offsite dose projections, and licensee and other persons with special qualifications for coping with emergency conditions, are also identified. An analysis of on-shift staffing personnel responsibilities is addressed in Permit Condition 3.

Conclusion

Subject to Permit Conditions 2, 3, and 4, the staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard B and NSIR/DPR-ISG-01, Section IV.C. A COL applicant will address COL Action Item13.3-3. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(2) and 10 CFR Part 50, Appendix E, Section IV.A, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.3 Emergency Response Support and Resources

As reflected in NUREG–0654, Section II, Planning Standard C, "Emergency Response Support and Resources," 10 CFR 50.47(b)(3) requires that arrangements for requesting and effectively using assistance resources have been made, arrangements to accommodate State and local staff at the licensee emergency operations facility (EOF) have been made, and other organizations capable of augmenting the planned response have been identified. In addition, 10 CFR Part 50, Appendix E, Section III requires that the emergency plans incorporate information about the emergency response roles of supporting organizations and offsite agencies, and that the information shall be sufficient to provide assurance of coordination among the supporting groups and with the licensee. In addition, 10 CFR Part 50, Appendix E, Section IV.A.7 requires identification of, and a description of the assistance expected from, appropriate local, State, and Federal agencies with responsibilities for coping with emergencies, including hostile action at the site.

In the following ESP Plan sections, the applicant described the provisions for requesting and effectively using support resources and for accommodating offsite officials at the emergency response facilities:

- ESP Plan Section 2.4, "National Response Framework,"
- ESP Plan Section 3.3, "Offsite Organization,"
- ESP Plan Section 5.2.3, "Site Area Emergency,"
- ESP Plan Section 8.2, "Central Emergency Control Center,"
- ESP Plan Section 9.2, "Offsite,"
- ESP Plan Section 10.2, "Onsite Protective Actions for Hostile Action Events,"
- ESP Plan 5A/5B Section 12.3/12.4, "Interagency Assistance from REAC/TS,"
- ESP Plan Section 16.5, "Agreement Letters,"
- ESP Plan Attachment 1, "Justification for the Central Emergency Control Center," and
- ESP Plan Section A.4, "Emergency Response Facilities, Equipment, and Supplies," of

Appendix A.

The staff reviewed these sections, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard C, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirement in 10 CFR 50.47(b)(3).

In ESP Plan Section 8.2, the applicant stated that the CECC coordinates with offsite Federal agencies, such as NRC and DOE, to ensure availability of additional outside resources to TVA. The CECC is provided with direct communication links with State emergency response centers, other TVA EROs and nuclear plant sites, the Joint Information Center (JIC), and offsite Federal and State organizations. ESP Plan Attachment 1 states that the ESP Plan relies on the use of the CECC as the EOF for the CRN Site, and that the CECC, discussed in Section 13.3.4.5.8 of this report, meets the functional and design criteria provided in NUREG–0696 for an EOF, including working space to accommodate State and local staff. In addition, ESP Plan Section 5.2.3 states that upon declaration of the Site Area Emergency classification, TVA personnel knowledgeable of plant systems for the selected reactor technology are dispatched to the State Emergency Operations Center (SEOC).

ESP Plan Section 2.4 states that the NRF Nuclear/Radiological Incident Annex (NRIA) provides for timely, coordinated response by Federal agencies to a fixed nuclear power plant facility incident. The NRF NRIA provides the Federal government's concept of operations for responding to radiological emergencies (i.e., offsite response), and supports State and local governments. The NRF is activated by either the affected State notifying DHS, or the utility notifying the NRC of a radiological emergency at a nuclear plant site. The CECC Director is the TVA representative authorized to request Federal assistance from the NRC. Because of the close proximity of the DOE ORR to the CRN Site, requested DOE response is expected within 1 to 2 hours.

In ESP Plan 5A, Section 12.3, and ESP Plan 5B, Section 12.4, "Interagency Assistance from REAC/TS," the applicant stated that TVA maintains arrangements with DOE's REAC/TS as the CRN Site receiving hospital. REAC/TS, which is in close proximity to the CRN Site, is a DOE-sponsored facility operated by Oak Ridge Associated Universities Medical and Health Sciences Division, in cooperation with Oak Ridge Methodist Medical Center in Oak Ridge, TN. The University of Tennessee Medical Center in Knoxville, TN serves as a back-up to REAC/TS. Specialized facilities and expert personnel are available at both medical facilities for definitive care for radiation emergency victims, and TVA maintains letters of agreement for services with each. In addition, ESP Plan Section 3.3.25 states that TVA maintains an agreement with DOE REAC/TS, and that other Federal support would be requested through the NRF.

In ESP Plan Section 16.5, the applicant provided a listing of agreements or contracts that TVA maintains for services of outside organizations during an emergency. These offsite organizations include law enforcement, ambulance and fire department services, other offsite organizations, and DOE REAC/TS support. Arrangements for offsite support are also discussed in ESP Plan Sections 3.3.24, 3.3.26, and 3.3.27, and ESP Plan Section A.4.6 of Appendix A. Contacts and arrangements with local, State, and Federal agencies are addressed in Section 13.3.4.2 of this

report.

With regard to offsite radiological support, ESP Plan 5B, Section 9.2.2, “Sampling Team,” states that State agencies have the responsibility to coordinate and evaluate offsite assessment action, and additional environmental monitoring assistance is available from the DOE offices at Oak Ridge, TN, or Aiken, South Carolina. The U.S. EPA in Montgomery, AL can also provide assistance, including environmental monitoring teams and mobile radioanalytical laboratories. In addition, ESP Plan Section A.4.3, “Laboratory and Equipment,” states that TVA provides laboratory facilities for chemical and radiological analysis of solid, liquid, and air samples. (Environmental monitoring assistance from DOE is also addressed in ESP Plan Section 9.0, “Accident Assessment,” and discussed in Section 13.3.4.5.9 of this report.)

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard C. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(3) and 10 CFR Part 50, Appendix E, Sections III and IV.A.7, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.4 Emergency Classification System

As reflected in NUREG–0654, Section II, Planning Standard D, “Emergency Classification System,” 10 CFR 50.47(b)(4) requires that 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 that State and local response plans call for reliance on information provided by facility licensees for determinations of minimum initial offsite response measures. In addition, 10 CFR Part 50, Appendix E, Section IV.B requires a description of the means to be used for determining the magnitude, and for continually assessing the impact, of the release of radioactive materials, including emergency action levels (EALs) that are to be used as criteria for determining the need for offsite agency notifications and participation, and when and what types of protective measures should be considered. The EALs must include hostile actions that might adversely affect the nuclear power plant. The initial EALs shall be discussed and agreed on by the applicant or licensee and State and local governmental authorities, and approved by the NRC. Thereafter, EALs shall be reviewed with State and local governmental authorities on an annual basis. In addition, 10 CFR Part 50, Appendix E, Section IV.C requires a description of EALs and emergency conditions that involve alerting or activating the total emergency organization, including communication steps to be taken under each emergency classification level (ECL) (also referred to as “emergency class”). The emergency classes defined shall include (1) notification of unusual event, (2) alert, (3) site area emergency, and (4) general emergency. In addition, 10 CFR Part 50, Appendix E, Section IV.C.2 requires the capability to assess, classify, and declare an emergency condition within 15 minutes after the availability of indications to plant operators that an EAL has been exceeded, and to promptly declare the emergency conditions as soon as possible after the identification of the appropriate ECL.

In ESP Plan Section 4.0, the applicant described the emergency classifications used to determine the minimum response to an abnormal event at the plant. The staff reviewed this section, as well

as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard D, which provides detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(4).

In an ESPA (with a proposed complete and integrated emergency plan), as well as in a COLA, the requisite EAL information is limited and consists of four critical elements, consisting of (1) an overview of the EAL scheme, including a definition of the four ECLs and general list of licensee actions; (2) a commitment to develop the remainder of the EAL scheme using a specified NRC-endorsed guidance document; (3) a proposed license condition that addresses EAL completion, agreement with State and local officials (as appropriate), and submission of the fully developed EAL scheme to the NRC; and (4) maintaining the EAL scheme in a document controlled by 10 CFR 50.54(q). The information associated with these critical elements provides a sufficient level of application detail to support the staff's reasonable assurance evaluation.

Pursuant to 10 CFR 52.17(b)(2)(i), TVA submitted an ESPA for the CRN Site, which includes the major features of the onsite emergency plan for both ESP Plan 5A and ESP Plan 5B. In ESP Plan Section 4.0, the applicant provided a limited description of the emergency classification system. The staff reviewed this limited (major features) description for each plan, and determined that neither plan fully addresses any of the four critical elements of an emergency classification system (described above), in support of the four conceptual SMR designs identified for the CRN Site.

With regard to critical element (1), in ESP Plan Section 4.0, TVA provided an overview of the EAL scheme, consisting of the definition of the four ECLs (i.e., notification of unusual event (NOUE), alert, site area emergency, and general emergency), and a general list of licensee actions for each ECL. ESP Plan Section A.8 of Appendix A lists a CRN-EPIP topic entitled "Emergency Classification." In addition, ESP Plan 5A, Section 4.1, "Classification System," states that NEI 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors" [November 2012, ADAMS Accession No. ML12326A805], provides definitions of the ECLs, and that not all elements of these definitions apply to SMR technology; further stating that the differences are addressed in ESP Plan 5A, Section 4.1.1, "NOUE," Section 4.1.2, "Alert," Section 4.1.3, "Site Area Emergency," and Section 4.1.4, "General Emergency." In contrast, ESP Plan 5B, Section 4.1, "Classification System," does not include a similar reference to NEI 99-01, Revision 6, or a statement that not all elements of the NEI 99-01 definitions apply to SMR technology.

In ESP Plan 5A, Section 4.1.4, the applicant stated (in part) that "[d]ue to the SMR design, releases are not expected to exceed EPA PAG exposure levels offsite." This statement is consistent with a Site Area Emergency definition in Appendix 1, "Emergency Action Level Guidelines for Nuclear Power Plants," of NUREG–0654, which states (in part) in the Class Description table that "[a]ny releases [are] not expected to exceed EPA Protective Action Guideline exposure levels except near site boundary." However, the description of a General Emergency in ESP Plan 5A, Section 4.1.4 is not consistent with the comparable Appendix 1 Class Description for a General Emergency, which states (in part) that "[r]eleases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels offsite for more than the immediate site area."

Further, the descriptions of expected releases for a Site Area Emergency and General Emergency in ESP Plan 5A appear to be the same. Specifically, ESP Plan 5A, Section 4.1.3 states that (for a Site Area Emergency) "[a]ny releases are not expected to result in exposure levels which exceed EPA PAG exposure levels beyond the site boundary," while ESP Plan 5A, Section 4.1.4 states that (for a General Emergency) "releases are not expected to exceed EPA PAG exposure levels offsite." Since releases are not expected to exceed EPA PAG exposure levels offsite for ESP Plan 5A, the definition of a General Emergency in Appendix 1 appears to indicate that this classification is not necessary for ESP Plan 5A.

For the reasons discussed above, and because the SMR technology is not yet available, the staff determined that ESP Plan Sections 4.1.1, 4.1.2, 4.1.3 and 4.1.4, which define the four ECLs and list general licensee actions, (1) do not adequately address the extent to which the definitions of the emergency classifications apply to SMR technology, and (2) do not adequately address whether a General Emergency classification is needed for ESP Plan 5A. As such, the EAL information provided in ESP Plan Section 4.0 does not satisfy critical element (1). In addition, ESP Plan Section 4.0 does not address critical elements (2) and (3). Finally, with regard to critical element (4), ESP Plan Section 4.2, "Identification of Emergency Classes," states that "[t]he instrument readings and parameters required for determination of these EALs are detailed in the CRN-EPIPs." Since the applicant did not indicate that these CRN-EPIPs are documents that are controlled by 10 CFR 50.54(q), the application does not satisfy critical element (4).

Therefore, the staff finds that the applicant has not adequately addressed any of the four critical elements associated with providing a standard emergency classification and action level scheme for the identified SMR technologies, and that there is no partial approval of the limited (major features) description of the SMR emergency classification system in ESP Plan Section 4.0. As such, the staff identified the following COL action item to address the need for a COL applicant to provide an emergency classification and action level scheme for the SMR technology that is chosen for the CRN Site, consistent with applicable requirements and the above discussion.

COL Action Item 13.3-4

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the emergency classification and action level scheme applicable to the chosen small modular reactor (SMR) technology for the Clinch River Nuclear Site, consistent with the applicable requirements and guidance.

Conclusion

For the reasons described above, the staff concludes that the information provided in the ESPA does not fully address any of the four critical elements of an emergency classification system and is not consistent with the guidelines in NUREG–0654, Section II, Planning Standard D. Therefore, the staff finds the information is not acceptable and does not meet the relevant requirements of 10 CFR 50.47(b)(4) and 10 CFR Part 50, Appendix E, Sections IV.B and IV.C, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations. A COL applicant will address COL Action Item 13.3-4 in a COLA that references a specific SMR design.

13.3.4.5.5 Notification Methods and Procedures

As reflected in NUREG–0654, Section II, Planning Standard E, "Notification Methods and Procedures," 10 CFR 50.47(b)(5) requires that procedures have been established for notification, by the licensee, of State and local response organizations and for notification of emergency personnel by all organizations; that the content of initial and follow-up messages to response organizations and the public has been established; and that the means to provide early notification and clear instruction to the populace within the 16-km (10-mi) PEP EPZ have been established. In addition, 10 CFR Part 50, Appendix E, Section IV.A.4 requires a description of how offsite dose projections will be made and the results transmitted to State and local authorities, NRC, and other appropriate governmental entities. In addition, 10 CFR Part 50, Appendix E, Section IV.C requires a description of EALs and emergency conditions that involve alerting or activating the emergency organization, including communication steps to be taken under each ECL, and the existence of a message-authentication scheme. In addition, 10 CFR Part 50, Appendix E, Section IV.D.1 requires a description of administrative and physical means for notifying local, State, and Federal officials and agencies and agreements reached with these officials and agencies for the prompt notification of the public and for public evacuation or other protective measures. The description shall include identification of the appropriate officials, by title and agency, of the State and local government agencies within the EPZs. In addition, 10 CFR Part 50, Appendix E, Section IV.D.3 requires the licensee to have the capability to notify responsible State and local governmental agencies within 15 minutes after declaring an emergency. The licensee shall demonstrate that appropriate governmental authorities have the capability to make a public alerting and notification decision promptly on being informed by the licensee of an emergency condition, and that administrative and physical means have been established for alerting and providing prompt instructions to the public within the PEP EPZ. The alerting and notification capability shall include a backup method. Finally, 10 CFR 50.72(a)(3) requires NRC notification no later than 1 hour after declaring an emergency, and 50.72(a)(4) requires activation of the Emergency Response Data System (ERDS) as soon as possible, but not later than 1 hour, after declaring an emergency class of alert, site area emergency, or general emergency.

In ESP Plan Section 5.0, the applicant described notification of ERO personnel; State, county, and Federal agencies during a declared emergency. The staff reviewed this section, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard E, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(5).

ESP Plan Section 5.0 states that emergency measures are developed to aid the mitigation of emergency conditions. Emergency measures begin with the declaration of an emergency class and activation of associated emergency organizations. ESP Plan Section 5.0 describes these measures in general terms for each emergency class, and includes actions for assessment, correction, and protection. Details of these emergency measures will be found in the appropriate sections of the CRN-EPIPs. When an emergency is declared, TVA initiates certain predetermined actions based on the emergency classification. Notification is carried out as shown in ESP Plan Figure 5-1, "Chains of Notification," to alert ERO personnel to handle the emergency situation.

ESP Plan Section 5.1, “Onsite,” states that upon detection of a known or suspected emergency, the on-duty SM will utilize a CRN-EPIP to determine the classification of the emergency. After declaring the appropriate emergency classification, the SED will initiate the appropriate procedures referenced by the CRN-EPIP. Each procedure referenced by the CRN-EPIP gives specific instructions for notifying appropriate offsite authorities, the Operations Duty Specialist (ODS), and the NRC. ESP Plan Section 3.3.5, “TVA Operations Duty Specialist,” states that the position of ODS is staffed seven days a week, 24 hours a day. After being notified of an emergency from the CRN Site, the ODS is responsible for making initial notification to the TVA REP Emergency Management Organization. In addition, pursuant to 10 CFR 50.72(a)(4), ESP Plan Section A.4.4.5, “Emergency Response Data System,” of Appendix A states that the ODS activates the ERDS, which transmits selected plant monitoring data to the NRC, within one hour of the declaration of an Alert or higher level emergency classification. (ESP Plan Section 9.2.1 lists CECC-EPIP-2, “Operations Duty Specialist Procedures for Notification of Unusual Event,” and CECC-EPIP-3, “Operations Duty Specialist Procedure for Alert, Site Area Emergency, or General Emergency.”)

ESP Plan Section 3.3.6, “Emergency Duty Officer,” states that the Emergency Duty Officer (EDO) is responsible for establishing initial operation of the CECC in the event the NP-REP is activated at the Alert or higher emergency classification. The EDO is responsible for ensuring that appropriate initial notifications of TVA and offsite emergency organizations have been made for each ECL. (ESP Plan Section 9.2.1 lists CECC-EPIP-21, “Emergency Duty Officer Procedure for Notification of Unusual Event, Alert, Site Area Emergency, and General Emergency.”) (ESP Plan Section 4.0 describes the emergency classification and action level scheme, which is discussed in Section 13.3.4.5.4 of this report.)

ESP Plan Section 5.2, “Offsite,” states that implementing procedures are provided to activate emergency staffs. Essential emergency positions are covered on a 24-hour-a-day basis by duty personnel. Emergency response facilities are located to ensure rapid and effective response of personnel.

The applicant described the actions that TVA will initiate for the four ECLs in ESP Plan Sections 5.2.1, 5.2.2, 5.2.3, and 5.2.4. TVA will notify and relay information to the State within 15 minutes of the declaration of an ECL. TVA utilizes a dedicated “ring-down” phone to make the notifications, with an available commercial telephone line as a back-up method. TVA will notify the NRC immediately after notifying the State, but not later than one hour after the emergency declaration is made. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIPs entitled “Notifications Associated with Emergency Conditions,” and “Activation of the Emergency Response Organization.”) TVA initiates additional actions, consisting of the following:

- The ODS in Chattanooga, TN is notified of the event by the Control Room and records the details of the event in accordance with the appropriate EPIP. (ESP Plan Section 9.2.1 lists CECC-EPIP-2, “Operations Duty Specialist Procedure for Notification of Unusual Event,” and CECC-EPIP-3, “Operations Duty Specialist Procedure for Alert, Site Area Emergency, or General Emergency.”)

- The ODS notifies and relays the information to the EDO and CECC Director, and the EDO keeps the CECC Director and the Public Information Manager informed of the situation, as

necessary. (ESP Plan Section 9.2.1 lists CECC-EPIP-21, "Emergency Duty Officer Procedure for Notification of Unusual Event, Alert, Site Area Emergency, and General Emergency.")

- The Public Information Manager notifies the Site Communications Consultant, Director, Public Relations & Corporate Information, and the TVA News Bureau (Knoxville, TN). (The distribution of information to the public is addressed in ESP Plan Section 7.0, "Public Information and Education," and discussed in Section 13.3.4.5.7 of this report. ESP Plan Section 9.2.1 lists CECC-EPIP-14, "Nuclear Emergency Public Information Organization and Operations.")

- The SED augments plant on-shift personnel, as necessary, to initiate corrective actions. (ESP Plan 5B, Section 5.2.1.G includes the initiation of corrective or protective actions.)

For an Alert or higher classification, TVA will update the State agencies hourly (or more often, as necessary) through the CECC on appropriate plant status and environmental conditions (as listed in ESP Plan Section 5.2.2). ESP Plan 5B, Section 5.2.2.F includes an additional condition, which consists of the projected dose rates and integrated dose at about 0.5, 1, and 2 mi. For the Site Area Emergency and General Emergency, ESP Plan 5A and 5B include various differences, which reflect the existence of a PEP EPZ beyond the site boundary for ESP Plan 5B.

Specifically, ESP Plan Section 5.2.3 states that upon declaration of the Site Area Emergency classification, personnel knowledgeable of plant systems are dispatched to the SEOC. ESP Plan 5A, Section 5.2.3.B adds that the personnel will be dispatched to the SEOC "if determined appropriate by the CECC Director and if offsite officials elect to activate the SEOC." In addition, ESP Plan 5B, Section 5.2.3.C states that the CECC recommends appropriate protective actions for the public to State agencies. In contrast, ESP Plan 5A, Section 5.2.3.C states the following:

> Upon declaration of this classification . . . [s]ufficient information relative to the plant status, radiological impacts, and protective measures is made available to government officials to enable them to implement ad hoc protective measures (in accordance with a CEMP) for the protection of the public should they be determined appropriate by offsite officials.

ESP Plan 5B, Section 5.2.4 states that "[a]ppropriate PARs to the State are required upon declaration of General Emergency," and "[i]f this is the initial classification, the Control Room notifies the local government agencies within 15 minutes and provides the PARs." In contrast, ESP Plan 5A, Section 5.2.4.B states the following:

> Upon declaration of this classification . . . [i]f this is the initial classification, the Control Room notifies the local government agencies within 15 minutes. Performance of Subsection 5.2.2, Step 6, enables government officials to implement ad hoc protective measures for protection of the public per a CEMP should they be determined appropriate by offsite officials.

With regard to PARs, ESP Plan 5A and 5B include additional differences in ESP Plan Section 3.3.1, which are associated with the CECC Director's responsibilities. Specifically, ESP

Plan 5B states that the CECC Director has overall responsibility and authority for ensuring adequate TVA response, adding that this response is "to affected State/local governments in protecting the health and safety of the public." In addition, the CECC Director "[m]akes Protective Action Recommendations (PARs) to the State." In contrast, ESP Plan 5A, Section 3.3.1 states the following:

> The CECC Director . . . [e]nsures sufficient information relative to the plant status, radiological impacts, and protective measures is made available to government officials to enable them to implement ad hoc protective measures (in accordance with a CEMP) for the protection of the public should they be determined appropriate by offsite officials.

(The responsibilities of the CECC Director are discussed further in Section 13.3.4.5.1 of this report.) Additional information is provided in ESP Plan Section 9.2.1, which includes differences between ESP Plan 5A and 5B, and address timely notifications by the CECC, including messages that contain PARs for the public. Specifically, ESP Plan 5A, Section 9.2.1 states that "TVA maintains the capability to assess the consequences of potential or actual releases of radioactivity offsite. If determined appropriate by State and local agencies, protective actions for the protection of the public may be implemented using an all hazards approach to emergency planning." In contrast, ESP Plan 5B, Section 9.2.1 states the following:

> TVA and State agencies are prepared to assess the consequences of potential or actual releases of radioactivity offsite. State and local agencies implement protective actions for the public. Written messages have been prepared which give the public instructions with regard to specific protective actions to be taken by occupants of affected areas. These messages are included in the State Plan referenced in Appendix A, Attachment 1.

ESP Plan Section 9.2.1 further states that implementing procedures have been developed for the CECC to ensure that emergencies are properly evaluated, timely notifications are made, and assessment and protective actions are performed. Once an SMR technology is selected, the details on staffing levels, response times, and accident progressing rates will be known and can be reflected in a set of EPIPs (similar to the CECC-EPIP list in ESP Plan Section 9.2.1). (See Section 13.3.4.5.16 of this report.) Activation and staffing of the emergency facilities, including staff-identified COL action items, are addressed in ESP Plan Sections 3.2 and 3.3 (discussed in Section 13.3.4.5.2 of this report), and ESP Plan Section 8.0, "Emergency Response Facilities, Equipment, and Supplies" (discussed in Section 13.3.4.5.8 of this report. Accident assessments are addressed in ESP Plan Section 9.0 and discussed in Section 13.3.4.5.9 of this report.

ESP Plan 5B, Section 8.5, "Alert and Notification System," states that information regarding the CRN Site ANS is provided in ESP Plan Appendix A, and that additional details describing the CRN Site ANS will be addressed in the CRN Site COLA. (In contrast, ESP Plan 5A does not include a comparable Section 8.5.) ESP Plan 5B, Section A.6, "Alert and Notification System," states that the network consists of one or more alerting and notification systems. Various technologies may be employed, as TVA and the affected State and local agencies assess and consider these technologies. The ANS network is under the control of the State or local emergency management agencies. The systems are designed to provide alert signals and instructional messages to the

population within the PEP EPZ of the CRN Site within 15 minutes of the decision to notify the public. In contrast, the applicant stated that ESP Plan 5A, Section A.6 is not applicable. Consistent with the applicant's intention to assess various technologies associated with the ANS network (described above), the NRC staff identified the following COL action item.

COL Action Item 13.3-5

> An applicant for a combined license (COL) that references this early site permit, including the Part 5B Emergency Plan (2-Mile Emergency Planning Zone (EPZ)), should update the emergency plan to describe the chosen Alert and Notification System (ANS) network(s), which reflects the assessment of the various technologies by Tennessee Valley Authority and the affected State and local agencies, and meets the applicable requirements and guidance.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard E. A COL applicant will address COL Action Item 13.3-5. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(5), 10 CFR 50.72(a)(3), 10 CFR 50.72(a)(4), and 10 CFR Part 50, Appendix E, Sections IV.A.4, IV.C, IV.D.1, and IV.D.3, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.6 Emergency Communications

As reflected in NUREG–0654, Section II, Planning Standard F, "Emergency Communications," 10 CFR 50.47(b)(6) requires that provisions exist for prompt communications among principal response organizations, to emergency personnel, and to the public. In addition, 10 CFR Part 50, Appendix E, Section IV.E.9 requires onsite and offsite communication systems with backup power sources, including provisions for communications with State and local governments within the plume exposure EPZ, and Federal EROs and the NRC. Also required are provisions for communications among the Control Room, TSC, EOF, principal State and local EOCs [emergency operation centers], and field assessment teams. Communication systems shall be tested at designated frequencies.

In ESP Plan Section 6.0, the applicant described the provisions used for radiological emergency communications. The staff reviewed this section, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard F, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(6).

ESP Plan Section 6.0 states that the radiological emergency communications network consists of the EP telephone system, the EP notification system, and the EP radio system. These systems are designed to complement each other in the overall plan for REP communications. The

communications facilities described in ESP Plan Section 6.0 are integrated with the requirements for communications to local and State response organizations. TVA conducts testing of these systems in accordance with established procedures.

The EP telephone system includes communications equipment installed at the CRN Site and the CECC, a number of leased commercial circuits, and privately-owned circuits connecting the CRN Site to the required locations. The telephone switching equipment installed at the CRN Site consists of one or more switching centers equipped with fully redundant common logic and redundant power sources. The majority of plant telecommunications services are served from this switching equipment. ESP Plan Section 6.3, "Plant or Building Loudspeaker Paging," states that the paging system(s) may be accessed from the plant telephone system, and is used for normal plant operations (plant paging) and to instruct and notify personnel during an emergency.

ESP Plan Section 6.6, "TVA Enterprise Emergency Notification System" (TEENS), states that TEENS is a hosted notification system that notifies Emergency Management Organization personnel by contacting devices such as assigned office, mobile and home telephones, work e-mail, and assigned pagers. TEENS is an automated system that is used to notify key TVA personnel during nuclear emergencies, and has provisions to periodically monitor its own performance to detect and report equipment failures.

The EP radio system is a very high frequency (VHF) mobile radio system, which provides redundant radio coverage. ESP Plan 5B further states that the EP radio system provides redundant radio coverage of the PEP EPZ. In addition, the EP radio system provides radiological monitoring vehicles with mobile communications to other vehicles, and to Radiation Protection at the CRN Site, TSC, Control Room, and the CECC.

ESP Plan Section 6.8, "Other Radio Communications," states that there is an in-plant repeater system utilized by Nuclear Security Services, which enables transmission without interruption to various areas of the plant. A separate radio located in the plant Central Alarm Station is a direct link to the local law enforcement agency officials. The plant ambulance has a radio used for communication with the local hospitals and the plant. Portable two-way radios are available for additional site communications.

ESP Plan Section 6.4, "Offsite Telephone Communications," states that the offsite communications network is used to communicate with Federal, State, and other supporting agencies. Access to these agencies is provided through several redundant, diverse routes. This diversity provides offsite routing through more than one type of facility. These facilities include, but are not limited to commercial facilities, such as central office trunks, tie-lines and digital services, plus privately owned and maintained microwave and fiber-optic systems. The offsite telecommunications network is designed to facilitate traffic in the most fail-safe manner to EROs. Telecommunications services are provided between the following locations in a redundant, diverse manner:

- CECC to State Emergency Management Agencies.
- CECC to the CRN Site.
- State Emergency Management Agencies to County Emergency Management Agencies.

In addition to the above listed emergency organizations, the JIC(s) and Field Coordination

Center(s) are also equipped with public telephone lines. Finally, ENS and HPN (NRC FTS 2000 System) telephones provide communications from the TSC, Control Room, and the CECC to the NRC Headquarters and regional offices. CRN-EPIPs designate personnel who staff the ENS and HPN telephones. CRN-EPIPs also designate the interface with the NRC during TSC operation. TVA performs testing of these telephones on a monthly basis. In addition, ESP Plan Section 14.1.7, "Communication Drills," states that communications drills are conducted at least once each calendar year at the CRN Site.

ESP Plan Section A.3, of Appendix A, states that the on-shift staff is continually present on a 24-hour basis, and ESP Plan Section 5.2 states that essential emergency positions are covered on a 24-hour-a-day basis by duty personnel. Organizational titles associated with communications are identified in ESP Plan Section 3.2, which states that the CRN Site is staffed on a continual 24-hour basis, and that emergency communications/notifications with State, local and Federal agencies, along with staffing instructions for the emergency response facilities, are specified in CRN-EPIPs. (The staff's review of the onsite organization is included in Section 13.3.4.5.2 of this report.)

The staff's review of CRN Site staffing is included in Sections 13.3.4.5.1 and 13.3.4.5.2 of this report. In addition, initial and follow-up notification is addressed in ESP Plan Section 5.0, and discussed in Section 13.3.4.5.5 of this report. Section A.8 of ESP Plan Appendix A lists the following CRN-EPIP topics associated with emergency staffing and emergency notifications.

- Notification Associated with Emergency Conditions,
- Emergency Communications,
- Activation of the Emergency Response Organization, and
- Staffing and Operation of Emergency Response Facilities.

In Section A.4.5.1, "Emergency Communications Equipment," of ESP Plan Appendix A, the applicant stated that "[i]nformation regarding the CRN Site Emergency Communications Equipment [will be] addressed in the CRN Site COLA." The staff understands from past new reactor licensing reviews that the design details associated with such equipment is usually dependent upon the specific reactor technology. As such, the NRC staff identified the following COL action item to address the emergency communications equipment for the chosen SMR technology.

COL Action Item 13.3-6

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the Clinch River Nuclear Site Emergency Communications Equipment, including all required communications and data links, associated with the chosen small modular reactor (SMR) technology, consistent with the applicable regulations and guidance.

Fukushima Dai-ichi – NTTF Recommendation 9.3

As discussed above in SER Section 13.3.4.2, on March 12, 2012, the NRC requested additional information from all power reactor licensees and holders of construction permits, associated with the NRC NTTF review of the accident at the Fukushima Dai-ichi nuclear facility. In Recommendation 9.3, the NTTF addressed staffing and communications provisions for enhancing emergency preparedness. With regard to communications, the accident at Fukushima highlighted the need to ensure that the communications equipment relied upon to coordinate the event response during a prolonged station blackout can be powered. Specifically, NTTF Recommendation 9.3 requests that all power reactor licensees and holders of construction permits (in active or deferred status) assess their current communications systems and equipment used during an emergency event, including consideration of any enhancements that may be appropriate for the emergency plan with respect to the communications requirements of 10 CFR 50.47, Appendix E to 10 CFR Part 50, and NUREG–0696. In addition, the means necessary to power the new and existing communications equipment during a prolonged station blackout should be considered. The resolution of NTTF Recommendation 9.3, including the staff's identified Permit Condition 3, associated with emergency communications, is addressed in Section 13.3.4.2 of this report.

Conclusion

Subject to Permit Condition 3, the staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard F. A COL applicant will address COL Action Item 13.3-6. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(6) and 10 CFR Part 50, Appendix E, Section IV.E.9, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.7 Public Education and Information

As reflected in NUREG–0654, Section II, Planning Standard G, "Public Education and Information," 10 CFR 50.47(b)(7) requires that information be made available periodically to the public concerning notification methods and initial actions the public should take in an emergency (e.g., listening to a local broadcast station and remaining indoors), that the principal points of contact with the news media for dissemination of information during an emergency (including the physical location or locations) be established in advance, and that procedures for coordinating dissemination of information to the public be established. In addition, 10 CFR Part 50, Appendix E, Section IV.D.2 requires a description of provisions for yearly dissemination to the public within the PEP EPZ of basic EP information, such as methods for public notifications and protective actions planned if an accident occurs, general information as to the nature and effects of radiation, and a listing of local broadcast stations that will be used for dissemination of information during an emergency. Signs or other measures shall also be used to disseminate information to any transient population within the PEP (16-km (10-mi)) EPZ.

In ESP Plan Section 7.0, the applicant described the TVA emergency public information and education program. The staff reviewed this section, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies

with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard G, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(7).

ESP Plan Section 7.1, "Purpose," states that the purpose of the TVA emergency public information and education program is to ensure timely distribution of accurate information during an emergency, in accordance with applicable EPIPs. The program also provides for TVA to coordinate emergency information with non-TVA agencies that have a primary response role prior to its release to the public or news media. The program provides for a JIC to be established for use during an emergency. The purpose of the JIC is to provide a single location for TVA, local, State, and Federal agencies to coordinate public information activities. TVA and the State conduct coordinated annual orientations to acquaint the local area news media with the emergency plans, radiological information, and points of contact for release of information in an emergency. ESP Plan Section 8.4, "Joint Information Center," states that the CRN Site has a JIC established near the site to assist the news media in providing press coverage during an emergency, and that the location, function, and capabilities of the CRN Site JIC [will be] addressed in the CRN Site COLA. Consistent with the applicant's stated intention to identify the JIC in the COLA, the staff identified the following COL action item:

COL Action Item 13.3-7

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the location, function, and capabilities of the Joint Information Center (JIC), consistent with the applicable regulations and guidance.

ESP Plan Section 7.2, "Responsibilities," addresses the responsibilities of the offsite emergency organization performing public information functions. The CECC Director (or delegate) is responsible for approving written news statements after the CECC is activated. ESP Plan Section 9.2.1 lists CECC-EPIP-14, "Nuclear Emergency Public Information Organization and Operations." The JIC Spokesperson is responsible for representing TVA during news briefings, and coordinating information with other Federal, State, and local spokespersons prior to the briefings. The Director, Public Relations & Corporate Information is responsible for directing emergency public information activities of the agency, in accordance with approved procedures. ESP Plan Section A.8 of Appendix A lists a CRN-EPIP topic, entitled "Emergency Media Relations," which addresses the responsibility for coordinating with the CECC Director and non-TVA agencies, who would participate in JIC activities, and determining when to activate or deactivate the JIC. Finally, Operations Communications is responsible for the development, implementation, and maintenance of nuclear public information organizations and activities for an emergency, as well as those nuclear public information programs conducted on an annual basis.

ESP Plan Section 7.3, "Public Information Facilities," states that public information personnel are present at three locations with sufficient staff available to maintain operations on a 24-hour basis: (1) Operations Communications directs the activities of the emergency public news media present at the site; (2) the CECC in the Chattanooga Office Complex (COC), where staff will develop news releases and coordinate the news releases with offsite agencies; and (3) the JIC, where staff coordinates with the offsite agencies in presenting emergency news briefings and respond to

public telephone inquiries.

ESP Plan Section 7.4, “Coordination of Information,” states that prior to activation of the CECC, coordination of public information with non-TVA primary response agencies is handled through Operations Communications, in accordance with emergency public information procedures. Upon activation and staffing of the CECC, the responsibility for coordination of public information with non-TVA agencies shifts to the CECC Information Staff. Upon JIC activation, the responsibility for coordination of public information shifts from the CECC to the JIC emergency response staff when, and if, offsite agencies are also operational at the JIC. The CECC Director continues to approve written news statements. Non-TVA primary response agencies are provided copies of written news statements until they are available to support coordination in the JIC.

Under ESP Plan Section 3.3, “Offsite Organization,” TVA described the responsibilities of the JIC Liaison in ESP Plan Section 3.3.14, “JIC Liaison.” The JIC Liaison contacts responding agencies and transmits information for coordination, and establishes and maintains an information flow from the JIC or Site Communications to the CECC. In addition, ESP Plan Section 3.3.13 lists the following overall responsibilities of the Public Information Manager.

- Coordinates the decision to activate the JIC with the CECC Director, Director – Public Relations & Corporate Information, and SEOC, if offsite officials elect to activate the SEOC.

- Ensures the JIC Spokesperson and the JIC Information Staff are provided information to inform the public and news media in response to an emergency.

- Informs the CECC Director of TVA public information activities, in response to an emergency.

- Coordinates news release drafts with the State and Federal agencies participating at the JIC, and secures approval of the CECC Director prior to making a release to the media.

- Coordinates the decision to establish the JIC with the SEOC.

- Directs the activities of support personnel who develop public information and maintain information flow into, and from, the JIC.

ESP Plan Section 7.5, “Public Education,” states that TVA coordinates development and distribution of public education materials and programs with the appropriate State agencies. In ESP Plan 5B, TVA described additional actions that will be taken with regard to the 2-mi PEP EPZ. Specifically, the public information and education program also provides education to the public located within the PEP EPZ on emergency plans. On an annual, non-emergency basis, the program provides that TVA, in coordination with the State, disseminates information to the public regarding emergency notification methods and actions. In addition, TVA will distribute within the 2-mi PEP EPZ, on an annual basis, public information on actions the permanent and transient populations should take in the event of an emergency. Mailing lists for the public in the PEP EPZ are updated annually to assure thorough and accurate distribution of the emergency information.

In ESP Plan Section 7.7, “Rumor Control/Public Information,” TVA described its coordinated

arrangements for dealing with rumors. Specifically, teams in the JIC are responsible for emergency information. A trained media relations team responds to news media inquiries by telephone and media briefing, and a trained information team responds to citizen telephone inquiries. Also in the JIC, a trained media monitoring team monitors news media coverage. TVA coordinates information activities with offsite agencies at the JIC.

ESP Plan Section 7.6, "Employee Communications," states that an information system that employees can access provides a method of informing TVA employees, who do not have emergency response assignments, about an emergency. Finally, ESP Plan Section 7.8, "Training," states that TVA provides initial training and annual retraining to emergency public information staff to allow them to respond to an emergency.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard G. A COL applicant will address COL Action Item 13.3-7. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(7) and 10 CFR Part 50, Appendix E, Section IV.D.2, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.8 Emergency Facilities and Equipment

As reflected in NUREG–0654, Section II, Planning Standard H, "Emergency Facilities and Equipment," 10 CFR 50.47(b)(8) requires that adequate emergency facilities and equipment to support the emergency response be provided and maintained. In addition, 10 CFR Part 50, Appendix E, Section IV.E.8 requires that adequate provision be made and described for emergency facilities and equipment, including a licensee's onsite OSC and TSC, as well as an EOF from which effective direction can be given and effective control can be exercised during an emergency. In 10 CFR Part 50, Appendix E, Section IV.E.8.b addresses various requirements associated with an EOF located more than 25 mi from a nuclear power reactor site. In addition, 10 CFR Part 50, Appendix E, Section IV.E.8.c requires various EOF capabilities, which include supporting response to multiple reactors/sites and simultaneous events, as applicable. In addition, 10 CFR Part 50, Appendix E, Section IV.E.8.d requires an alternative facility (for use when onsite emergency facilities cannot be safely accessed during hostile actions) that would be accessible and could function as a staging area for augmentation of emergency response staff. In addition, 10 CFR Part 50, Appendix E, Section IV.G requires a description of provisions to be employed to ensure that the emergency plan, its implementing procedures, and emergency equipment and supplies are maintained up to date.

In the following ESP Plan sections, the applicant described the functions and locations of the emergency response facilities and equipment that will be used and maintained by TVA in coordinating and performing emergency response activities:

- ESP Plan Section 3.3, "Offsite Organization,"
- ESP Plan Section 6.0, "Communications,"

- ESP Plan Section 8.0, “Emergency Response Facilities, Equipment, and Supplies,”
- ESP Plan Section 9.0, “Accident Assessment,”
- ESP Plan Section 11.0, “Radiological Protection,”
- ESP Plan Section A.4, “Emergency Response Facilities, Equipment, and Supplies,” of Appendix A,
- ESP Plan Section A.8, “Emergency Plan Implementing Procedures,” of Appendix A, and
- ESP Plan Appendix A, Attachment 2, “Emergency Equipment and Supplies.”

The staff reviewed these sections, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff’s primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard H, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(8).

ESP Plan Section A.4.4, “Onsite Monitoring Systems and Equipment,” of Appendix A briefly describes various area and process (radiological and non-radiological) monitoring systems and equipment, and states that information regarding onsite monitoring systems and equipment [will be] addressed in a COLA. In addition, ESP Plan Section A.4.4.2, “Radiological Monitors,” of Appendix A states that the installed Radiation Monitoring System consists of process monitors and area monitors, and that additional information regarding this system [will be] addressed in the CRN Site COLA. Radiological protection is addressed in ESP Plan Section 11.0 and discussed in Section 13.3.4.5.11 of this report. Consistent with the applicant’s stated intention to address the onsite monitoring systems and equipment in the COLA, the staff identified the following COL action item:

COL Action Item 13.3-8

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe onsite monitoring systems and equipment, including the installed Radiation Monitoring System, consistent with the applicable regulations and guidance.

ESP Plan Section A.4.4.6, “Fire Protection,” of Appendix A states that the plant’s fire protection system provides extinguishing agents with the capability of extinguishing any single or probable combination of simultaneous fires that might occur, and that TVA controls the use of combustible materials.

ESP Plan Section A.4.4.1, “Natural Phenomena,” of Appendix A states that in the event an emergency is the result of a natural phenomenon, there is instrumentation to monitor its severity. The Environmental Data Station is located onsite and contains instruments capable of measuring

wind direction, wind speed, and temperatures. ESP Plan Section 9.2.4, “Meteorological Information,” states that TVA has developed the meteorological measurements program to conform to the intent and guidance of RG 1.23, “Meteorological Monitoring Programs for Nuclear Power Plants” (ADAMS Accession No. ML070350028), and provides a brief description of access to, and use of, meteorological data. In addition, the applicant stated that more specific information on the meteorological measurements program can be found in Section 2.3, “Meteorology,” of the CRN SSAR (i.e., ESPA Part 2).

Seismic instrumentation is available in the plant to monitor acceleration levels of ground movement. Hydrological monitoring systems are installed to supply flow and level information. Meteorological and seismic instrumentation have accessible readout in the Control Room. In the event of a failure of the onsite natural phenomena monitoring systems, TVA maintains access to back-up data sources. These back-up sources include telephone and web-based contact with Federal government data sources and alternate sources, including university and news media sources. Additional seismic and hydrological information can be obtained by the CECC from other TVA nuclear plants or the TVA water quality organization.

ESP Plan Section A.4.4.3, “Process Monitors (Non-radiological),” states that the Control Room provides a central, protected location for placement of the necessary instrumentation to assess plant systems status, including reactor coolant system pressure and temperature, containment pressure and temperature, liquid levels, flow rates, fire detection equipment, and meteorological instrumentation.

ESP Plan Section A.4.5, “Emergency Equipment,” of Appendix A states that the CRN Site maintains supplies of emergency equipment located in designated storage locations. The CRN Site implements site-specific procedures to ensure required calibrations are carried out on a routine basis. ESP Plan Appendix A, Attachment 2 provides additional information regarding emergency equipment and supplies, and that TVA establishes and maintains inventories of emergency equipment and supplies for use by emergency response personnel in the emergency response facilities, and by TVA off-site field monitoring teams. (Onsite and offsite radiological monitoring systems, equipment, and teams are addressed in Sections 13.3.4.5.9 and 13.3.4.5.11 of this report.) The actual inventories are based on the activities that occur in, or are dispatched from, each individual facility, and are established in inventory lists in accordance with EPIPs. Section A.8 of ESP Plan Appendix A list a supporting plant procedure entitled “Emergency Equipment and Communications Systems inventory and Operational Tests.” In addition Section A.8 lists the following three CRN-EPIP topics associated with emergency facilities and equipment:

- Staffing and Operation of Emergency Response Facilities,
- Activation of the Emergency Response Organization, and
- Emergency Communications.

Finally, ESP Plan Section 8.1.5, “Equipment, Supplies, and Supplemental Data,” states that the CRN Site has sufficient equipment and supplies for the operation of the site emergency response facilities.

Control Room

As described in Section 1.2, “Control Room,” of NUREG–0696, the Control Room is the onsite location from which the nuclear power plant is operated. During abnormal operating conditions, the complexity of licensee responsibilities increases significantly, and the Control Room personnel must assume all of these responsibilities until additional onsite and offsite staff and facilities are activated to assume various emergency response actions. Additional Control Room responsibilities are described in NUREG–0737, Supplement 1.

While the ESP Plan does not include a separate section that addresses Control Room responsibilities and actions during an emergency at the CRN Site, the specific Control Room support of the overall site response, including interfaces with the other emergency response facilities and personnel, are addressed throughout the ESP Plan, and discussed in the respective sections of this report.

Technical Support Center

ESP Plan Section 8.1.1, “Technical Support Center,” states that the CRN Site has a TSC, which is dedicated for use during an emergency. Once activated, the TSC is the focal point of onsite activity, and is the primary source of communication from the site with offsite organizations during the event. The TSC has sufficient staff to provide management control of the site response to the event. Equipment is available to enable the TSC staff to communicate with onsite and offsite TVA emergency personnel. An area within the TSC is dedicated for NRC use, which includes commercial telephones and the NRC FTS 2000 System telephones. (Emergency communications are addressed in ESP Plan Section 6.0, and discussed in Section 13.3.4.5.6 of this report.) Sufficient plant parameter information is available to enable the TSC staff to assess the consequences of an event and assist the Control Room personnel in mitigating the emergency.

ESP Plan 5B further states that “[s]ufficient information is transmitted to the CECC to enable the CECC Director to make PARs to State authorities.” The TSC is activated during radiological emergencies, in accordance with CRN-EPIPs, which also describe the staffing and operation of the TSC. The degree of activation varies depending upon the emergency class. (The emergency classification system is addressed in ESP Plan Section 4.0, and discussed in Section 13.3.4.5.4 of this report.) Additional information regarding the TSC is provided in ESP Plan Appendix A.

ESP Plan Section A.4.1, “Technical Support Center,” of Appendix A states that the TSC is established consistent with NUREG–0696 and describes the following guidance associated with the TSC.

- Function – The TSC provides plant management and technical support personnel (including the appropriate number of NRC personnel) with a facility from which they can assist plant operating personnel located in the Control Room during an emergency. The SED and the NRC representative are located in the same general area to promote proper communications.

- Location – The TSC has the ability to retrieve plant data and displays available in the Control Room, and is equipped with sophisticated communications systems. This precludes the need for frequent face-to-face interchange between the TSC and Control Room personnel.

- Staffing and Training – The level of staffing and training is describe in the Emergency Plan.

The TSC accommodates the required personnel to support an emergency affecting the CRN Site. The level of staffing may vary according to the severity of the emergency condition.

- Size – The TSC provides working space, without crowding for the personnel assigned to the TSC at the maximum level of occupancy. The working space is sized for a minimum of 25 persons. Minimum size of working space is approximately 75 square feet (ft^2) per person.

- Structure – The TSC is designed in accordance with the Uniform Building Code to withstand earthquakes and high winds.

- Habitability – The ventilation system is operated in accordance with approved procedures, and is manually controlled from the TSC. In addition, portable radiation monitors are available to personnel in the TSC. Equipment and supplies are provided in accordance with the Emergency Plan. The ventilation system includes high efficiency particulate air filters and charcoal filters. The ventilation system is designed to maintain exposures at or below 5 rem (0.05 Sv) TEDE, as defined in 10 CFR 50.2, for the duration of an emergency. The TSC structure, shielding, and ventilation system are designed to protect the TSC personnel from radiological hazards.

- Communications – The TSC has reliable voice communications to the Control Room, the OSC, the CECC, and the NRC. Provisions for communications with State and local operations centers are also provided in the TSC. The communications facilities include the means for reliable primary and backup communication. (Emergency communications is addressed in ESP Plan Section 6.0 and discussed in Section 13.3.4.5.6 of this report.)

- Instrumentation, Data System Equipment, and Power Supplies – The TSC is provided with reliable power and backup power supplies. Lighting is powered by the normal and backup electrical supply system. An emergency battery operated lighting system is installed. Power for vital information systems is provided by reliable power supplies, including a battery-backed Uninterruptible Power Supply (UPS) system.

- Technical Data and Data System – Within the TSC, technical and operational data and information is available for each unit. Support facilities are located within the TSC to support long term operation of the TSC. The TSC is equipped with a computer system, which provides source term and meteorological data, and technical data displays to allow TSC personnel to perform detailed analysis and diagnosis of abnormal plant conditions, including assessment of any significant release of radioactivity to the environment. Human factors engineering is incorporated into the design of the TSC, related to the display and availability of plant data.

- Records Availability and Management – The TSC has ready access to plant records. The documents maintained in the TSC include technical specifications, plant and emergency operating procedures, final safety analysis report, system piping and ventilation diagrams and heating, ventilation, and air conditioning flow diagrams, piping area diagrams, and records needed to perform the functions of the CECC when it is not operational. All of these documents, as well as plant operating records and Plant Review Board records and reports, are available in CRN Site Document Control, and are updated, as necessary.

The staff reviewed this description of the TSC and determined that the ESPA did not adequately address the relevant criteria in NUREG–0696 and Supplement 1 to NUREG–0737. As such, the staff identified the following COL action item:

COL Action Item 13.3-9

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe how the criteria in Section 2 of NUREG–0696 and Section 8 of Supplement 1 to NUREG–0737 are met for the Technical Support Center (TSC), including emergency classification requiring activation and time frame for designated personnel to report to the TSC and achieve full functional operation.

Operations Support Center

ESP Plan Section 8.1.2, "Operations Support Center," states that the CRN Site has an OSC, which is a pre-designated area for the assembly of personnel to support the Control Room Operations crew during an emergency. The OSC area is under the control of the SED in the Control Room until the TSC is staffed, and will provide damage assessment, maintenance and repair services, and necessary technical services. Communications are available with the TSC. The OSC also establishes and maintains appropriate communications with any teams that may enter the plant for assessment or repair. Respiratory protective devices, protective clothing, portable lighting, other protective equipment and tools are available in the OSC, as needed. The OSC is activated during radiological emergencies, in accordance with CRN-EPIPs. Additional information regarding the OSC is provided in ESP Plan Appendix A.

ESP Plan Section A.4.2, "Operations Support Center," of Appendix A states that designated plant support personnel assemble in the OSC to provide support to both the Control Room and TSC. The primary function of the OSC staff is to dispatch assessment, corrective action, and rescue personnel to locations in the plant, as directed by the TSC and Control Room. TVA provides for an OSC assembly area separate from the Control Room and the TSC. Personnel reporting to the OSC can be assigned duties in support of emergency operations. The OSC is not designed to remain habitable under all projected emergency conditions; however, implementing procedures make provisions for relocating the OSC, as needed, based on ongoing assessments of plant conditions and facility habitability. The SED directs relocation of the OSC, if required. CRN-EPIPs describe the staffing and operation of the OSC. The applicant did not identify the specific OSC location in the ESPA. As such, the staff identified the following COL action item:

COL Action Item 13.3-10

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the location of the Operations Support Center (OSC) and communications capabilities consistent with Section 3.3 of NUREG–0696.

Local Recovery Center

ESP Plan Section 8.1.3, "Local Recovery Center," states that the CRN Site has a Local Recovery Center (LRC), which is a pre-designated facility dedicated for use by offsite TVA and NRC personnel that may be assigned to the CRN Site for recovery operations. The NRC has the capability to communicate offsite, and the LRC may be used by the NRC during the event as an area near the site for assessment and assistance. Personnel in the LRC have access to necessary drawings and documents, including meteorological information. The LRC may serve as an alternate emergency response facility, as needed, and during an emergency may be used as a staging location for personnel prior to dispatch to the CRN Site.

ESP Plan Appendix A, Section A.4.8, "Local Recovery Center," of Appendix A states that the LRC may be used by the NRC during an emergency event as an area near the site for assessment and assistance, and has the capability to communicate offsite. In addition, personnel in the LRC have access to necessary drawings, manuals, procedures and documents. Meteorological information and dose rate calculations are available in the LRC. The LRC has telephone communications capabilities to enable personnel to communicate with the CECC and the CRN Site TSC. The LRC is able to send and receive data, and document production/ reproduction equipment is available. The location, function, and capabilities of the LRC [will be] addressed in the CRN Site COLA. Consistent with the applicant's stated intention for the LRC, the staff identified the following COL action item:

COL Action Item 13.3-11

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the location, function, and capabilities of the Local Recovery Center (LRC). In addition, the applicant should describe how the LRC meets the applicable requirements in Sections IV.E.8.b and IV.E.8.d of Appendix E to 10 CFR Part 50, and the criteria in Sections IV.D and IV.I of NSIR/DPR-ISG-01.

Central Emergency Control Center

ESP Plan Section 8.2, "Central Emergency Control Center," states that the purpose of the CECC and associated CECC staff is to provide the facilities and manpower for evaluating, coordinating, and directing the overall activities involved in coping with a radiological emergency. The specific response time for staffing the CECC will be determined as a result of evaluating the specific accident sequences and included in the COLA. ESP Plan Section 3.3 states that activation for the CECC is accomplished within a prescribed time following declaration of an Alert or higher emergency classification at the CRN Site, depending upon time of day, weather conditions, or immediate availability of personnel. The prescribed activation time for the CECC for an event at the CRN Site will be addressed in a COLA. (Emergency notification and activation of the emergency organization is addressed in ESP Plan Section 5.0, and discussed in Section 13.3.4.5.5 of this report.)

ESP Plan 5A, Section 8.2 states that during an emergency, the CECC Director and staff will review the response to the emergency by TVA to ensure an effective response. Additionally, the CECC Director and staff ensure that appropriate information is communicated to governmental officials.

In contrast, ESP Plan 5B, Section 8.2 states that the CECC Director and staff will review the response to the emergency by TVA and the appropriate State agencies to ensure that an effective and cooperative effort is being made, and that the CECC Director is responsible for providing PARs to the appropriate State officials.

ESP Plan Section 8.2 states that the CECC staff coordinates with other TVA emergency response facilities to ensure an effective TVA effort in response to an emergency situation. The CECC staff also provides an accurate description of the emergency situation for TVA management and public information. In addition, the CECC coordinates with offsite Federal agencies, such as NRC and DOE, to ensure availability of additional outside resources to TVA.

The CECC is located in the northeast corner of the sixth floor of Lookout Place in the TVA COC in Chattanooga, TN. It is designed to house the CECC Director and staff during an emergency situation. Included in the CECC are areas for the plant systems assessment, radiological assessment, and public information staff. A floor plan for the CECC is provided in ESP Plan Figure 8-1, "Central Emergency Control Center," and access control is provided by security personnel. The CECC is designed to serve as the central point for information collection, assessment, and transfer during an emergency. The CECC is provided with direct communication links with State emergency response centers, other TVA EROs, other TVA nuclear plant sites, the JIC, and offsite Federal and State organizations.

The CECC is activated during radiological emergencies, in accordance with CRN-EPIPs. The degree of activation varies, depending upon the emergency classification. (ESP Plan Section 9.2.1 lists CECC-EPIP-1, "Central Emergency Control Center Operations," CECC-EPIP-11, "Security of Offsite Emergency Response Facilities," and CECC-EPIP-12, "Operational Readiness Check of the CECC and the Field Coordination Centers for SQN, BFN, WBN & CRN and Joint Information Centers (JIC).") ESP Plan Attachment 1, "Justification for the Central Emergency Control Center," provides additional description of, and justification for, the location of the CECC.

ESP Plan Attachment 1 states that the CECC is used as the EOF for the CRN Site. The CECC serves as the EOF for the other TVA nuclear plants (i.e., Browns Ferry Nuclear Plant (BFN), Sequoyah Nuclear Plant (SQN), and Watts Bar Nuclear Plant (WBN)).[24] The CECC is located approximately 78 air mi from the CRN Site (i.e., more than 20 mi from the CRN Site TSC),[25] as is the case for BFN, SQN, and WBN, but does not alter the functions of the EOF, as described in

[24] See NRC's January 21, 1981, Memorandum from S. J. Chilk (Secretary) to W. J. Dircks (Executive Director for Operations), entitled "Action Plan III.A.1.2 – EOF" (COMJA-80-37) (ADAMS Accession Nos. ML110340232 and ML110340241 (package)), and NRC's March 18, 1981, letter from D. G. Eisenhut (Director, Division of Licensing, Office of Nuclear Reactor Regulation) to H. G. Parris (TVA Manager of Power) (ADAMS Accession No. ML110340233), which address the acceptability of the TVA arrangement for a centralized EOF, and the near-site EOF for each reactor site.

[25] In NUREG–0696, Table 2, "Relation of EOF Location to Habitability Criteria," an EOF location beyond 20 mi of the TSC requires specific NRC Commission approval. Pursuant to SRM to SECY-96-0170, the criteria in Table 2 were modified to change the EOF distance requirement for Commission approval from 20 mi to 25 mi from the TSC. This change is reflected in Section IV.E.8.b of Appendix E, which was added by the November 23, 2011, Final Rule, "Enhancements to Emergency Preparedness Regulations" (76 FR 72560), and addressed in the associated Interim Staff Guidance NSIR/DPR-ISG-01, Section IV.I, "Emergency Operations Facility – Performance-Based Approach."

NUREG–0696.

Section IV.E.8.b of Appendix E to 10 CFR Part 50 states that an EOF may serve more than one nuclear power reactor site. In addition, if a licensee desires to locate an EOF more than 25 mi from a nuclear power site, provisions must be made for locating NRC and offsite responders closer to the site so that NRC and offsite responders can interact face-to-face with emergency response personnel entering and leaving the site. Section IV.E.8.b lists the following requirements for this near-site facility, as addressed in Section IV.I of the associated guidance in NSIR/DPR-ISG-01.[26]

- Space for members of an NRC site team and Federal, State, and local responders;
- Additional space for conducting briefings with emergency response personnel;
- Communication with other licensee and off-site emergency response facilities;
- Access to plant data and radiological information; and
- Access to copying equipment and office supplies.

In ESP Plan Section 8.1.3 and Section A.4.8 of Appendix A, the applicant identified the LRC (discussed above) as the near-site facility, and described how its capabilities meet the requirements of Section IV.E.8.b of Appendix E. ESP Plan Attachment 1 further states that the use of the CECC as the EOF for the CRN Site allows TVA to continue to operate a standardized program for corporate management and response to radiological emergencies at TVA nuclear facilities. The effectiveness of CECC operations has been demonstrated during numerous drills and exercises. Communications systems, data links, and staffing have been incorporated and tested. Using the CECC for the CRN Site also allows TVA to apply its corporate emergency response structure and experience to the CRN Site emergency plan.

In addition, ESP Plan Attachment 1 states that TVA has discussed this concept with TEMA. TEMA is familiar with the CECC because the facility is used for responding to radiological emergencies at SQN and WBN. Through the letter referenced in SSAR Section 13.3 of the CRN ESPA, TEMA confirms their support of the TVA emergency response program, including the use of the CECC in Chattanooga, TN. (Contacts and arrangements with offsite agencies and organizations, including TEMA, are discussed in Section 13.3.4.2 of this report.)

TVA also included in ESP Plan Attachment 1 an evaluation of the CECC against the criteria provided in NUREG–0696, which addresses the guidance associated with an EOF (described below). TVA concluded that the CECC meets the functional and design criteria provided in NUREG–0696 for an EOF, with the exception that it is located more than 20 mi from the CRN Site. ESP Plan Attachment 1 describes the TVA approach to assuring that these functional and design criteria are met and maintained. The consolidation of TVA corporate emergency response functions into a centralized facility provides a timely and effective response to a radiological emergency at the CRN Site.

[26] In SECY-17-0050, “Duke Energy Proposal to Further Consolidate Duke Corporate Emergency Operations Facility” (April 14, 2017), the staff reviewed the concept of a consolidated or common EOF, which supports multiple nuclear power reactor sites and is located beyond 25 mi from the nuclear power reactor site (ADAMS Accession Nos. ML16363A439, ML16363A442, and ML17067A502). The staff consideration of such requests is conducted on a case-by-case basis, with a focus on the adequacy of the consolidated EOF to support a declared emergency event at multiple sites.

- Evaluation Against NUREG–0696 – The CECC is designed to provide for the effective and timely performance associated with management of overall licensee emergency response, and coordination of radiological and environmental assessment. The primary roles of the CECC is to relieve the plant staff of the functions of keeping the Federal, State, and county EROs informed, for directing dose assessment and field monitoring, for managing the informational needs of the media, interested industry groups, and elected officials, and for supporting the emergency assessment needs of the TSC staff. The NRC will have access to plant data through the CECC computer system and ERDS. The NRC also has telephones on the Emergency Telecommunications System (ETS) in Chattanooga, TN.

  Equipment exists in the CECC for the acquisition, display, and evaluation of radiological meteorological, and plant system data. Because a similar set of data currently used for BFN, SQN, and WBN are required for the CRN Site, the plant and effluent data would be provided on as timely a basis at the CECC as it would be at a near-site location. Normal industrial security is already provided for the CECC, and processes are already established to upgrade the security of the facility during an activation.

- Location, Structure, and Habitability – The CECC is located in the northeast corner of the sixth floor of Lookout Place in the TVA COC in Chattanooga, TN. The CECC has proven to be an effective facility for implementation of the TVA nuclear station emergency plans. The CECC is used for existing TVA nuclear plants at the BFN, SQN, and WBN sites. The facility is more than 10 mi from any of the TVA nuclear stations; therefore, there are no specific habitability criteria.

- Staffing and Training – Incorporation of CRN emergency response functions into the CECC will not adversely affect the ability of TVA to staff the CECC in a timely manner. The CECC is staffed with experienced personnel from the TVA COC and personnel from one or more TVA nuclear plants. The CECC staff has demonstrated their ability to staff the CEC within required time-frames following emergency declaration during previous staff augmentation drills. The CECC staff includes personnel to manage overall licensee emergency response, and coordinate radiological and environmental assessment.

- Size – The CECC size has proven to be adequate during drills and exercises for the existing TVA nuclear facilities. In addition, the NRC has workspace co-located with the decision makers, radiological assessment, and emergency assessment personnel.

- Radiological Monitoring – The CECC is beyond 10 mi from any nuclear stations, and therefore does not require radiological monitoring equipment.

- Communications – The communications systems available in the CECC consist of central office trunks, tie-lines, digital services, privately-owned/maintained microwave systems, NRC ETS phones, and EP radio system. The emergency communications systems at the CECC are designed to provide a reliable, timely flow of information between the parties having an emergency response role. The single facility results in commonality of communications and interface with offsite officials and liaisons. The EP telephone system continues to be the primary means of communicating changes in event classification. This system operates on a

combination of the TVA telecommunications network and leased circuits.

The offsite communications network is used to communicate with Federal, State, and other supporting agencies. Access to these agencies is provided through several redundant, diverse routes. This diversity provides offsite routing through more than one type of facility. These facilities include, but are not limited to, commercial facilities such as central office trunks, tie-lines and digital services, plus privately owned and maintained microwave and fiber-optic systems. The offsite telecommunications network is designed to facilitate traffic in the most fail-safe manner to the EROs.

The ENS and HPN (NRC FTS 2000 System) communication systems provide communications from each site TSC, Control Room, and the CECC to the NRC Headquarters and regional offices. These telephones are tested on a periodic basis, consistent with the CRN Site emergency plan. The EP radio system is a VHF mobile radio system which provides redundant radio coverage of the PEP EPZ, and provides radiological monitoring vehicles with mobile communications to other vehicle(s) and to the following locations: Radiological Control, TSC, Control Room at each TVA plant, and the CECC.

- Instrumentation, Data System Equipment, and Power Supplies – Various plant parameters are available to the CECC staff via a connection through the TVA CECC computer network. Data available at the CECC provides a snapshot of data from each unit's integrated set of plant data. These plant parameters are sufficient to perform emergency assessment and evaluate the potential environmental consequences of an emergency at the CRN Site. Detailed discussion on CRN Site plant-specific parameters are described in the emergency plan. The computers in the dose assessment area are capable of running the dose projection computer programs and accessing plant status data.

  Hourly and 15-minute average meteorological data from the plant Environmental Data Station are available to the CECC, TSC, State, and LRC. The CECC computer system provides access to up to the most recent 168 hours of this data. A meteorologist in the CECC provides meteorological information to the CECC staff, in support of offsite dose projections.

  The CECC draws its primary power from commercial power. A loss of commercial power should not impact any of the voice or data communications equipment located in the CECC. Common TVA telecommunications infrastructure that supports CECC functions, including, but not limited to fiber optic transmission equipment, telephone switching equipment, and data network routers, is configured to operate from at least one (and usually multiple) backup power sources in the event of a loss of commercial power. These backup sources include generator, dc battery, and UPS systems.

- Technical Data and Data Systems – As discussed in the previous section, a variety of plant parameters are provided over the TVA communications network to the CECC.

- Reports Availability and Management – Hard copies of key reference materials for the CRN Site are maintained in the CECC. In addition, station design documentation, plant drawings, procedures, etc. are available via Local Area Network connection from the Business Support Library. Information available at the CECC for the CRN Site includes plant technical

specifications, plant and emergency operating procedures, final safety analysis report, and up-to-date licensee, State, and local emergency response plans.

The staff reviewed the applicant's description of the CECC against the EOF guidance in NUREG-0696 and Supplement 1 to NUREG–0737, as supplemented by NSIR/DPR-ISG-01, and determined that the application does not adequately describe CECC size, or identify the specific technical data systems and plant parameters that are available in the CECC. In addition, the applicant did not address the capability of the CECC to support response to events occurring simultaneously at the CRN Site, and at one or more of TVA's other nuclear power reactor sites that are also served by the CECC.[27] Finally, the applicant did not address the need for prior Commission approval to locate an EOF (i.e., the CECC) beyond 25 mi of the CRN Site. As such, the staff identified the following COL action item to address these issues (in some cases supplementing the CECC description in the ESPA); including the CECC activation time, and response time for staffing the CECC (identified above):

COL Action Item 13.3-12

An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the capability of the Central Emergency Control Center (CECC) to support response to events occurring simultaneously at the CRN Site and at one or more of the other Tennessee Valley Authority nuclear power reactor sites that are served by the CECC. The CECC description should address, as a minimum, the following considerations, consistent with the applicable regulations and guidance, and based on the selected SMR technology:

a) The facility's location and size.

b) The prescribed activation time for the facility.

c) Whether the facility would be able to fulfill its intended required emergency response functions.

d) The anticipated staffing (including response time) and training of licensee emergency response personnel at the facility.

e) The facility's communication capabilities and data systems.

f) The availability in the facility of the radiation monitoring system and Safety Parameter Display System (SPDS) plant parameter variables, including those identified in NRC RG 1.97, Revision 4 (or other applicable guidance).

g) The facility's capacity for accommodating a multi-site event.

h) Impact on the NRC and/or State and local response organizations.

[27] *Id.*

Radiological Monitoring Control Center

ESP Plan Section 8.3, "Radiological Monitoring Control Center," states that the Radiological Monitoring Control Center (RMCC) is located in the TEMA East facility (TEMA East) in Knoxville, TN. ESP Plan 5B, Section 8.3 states that the RMCC is staffed by the TVA Field Coordinator and personnel from the State. In contrast, ESP Plan 5A, Section 8.3 states the following:

> If it is deemed necessary by TEMA East for an emergency at the CRN Site, the RMCC will be staffed by the TVA Field Coordinator and personnel from the State in an ad hoc manner, consistent with the CEMP approach. TVA will be co-located in the RMCC, and coordination of TVA and State monitoring teams will be conducted form that point. Finally, environmental monitoring data will be shared between the State and TVA.

ESP Plan Section 8.3 further states that these personnel cooperate in providing direction and control of the monitoring teams. Monitoring teams have maps of the area, and are directed to selected monitoring points or locations to collect data. This data is transmitted to the RMCC and CECC for analysis. Facilities at the RMCC include radio and telephone communications, and necessary desks, tables, and chairs. ESP Plan 5B, Section 8.3 further states that maps of the PEP EPZ and the ingestion exposure pathway EPZ for the CRN Site are located at the RMCC.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard H. A COL applicant will address COL Action Items 13.3-8, 13.3-9, 13.3-10, 13.3-11 and 13.3-12. Therefore, staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(8) and 10 CFR Part 50, Appendix E, Sections IV.E.8, IV.G, and VI.1, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.9 Accident Assessment

As reflected in NUREG–0654, Section II, Planning Standard I, "Accident Assessment," 10 CFR 50.47(b)(9) requires the use of adequate methods, systems, and equipment for assessing and monitoring the actual or potential offsite consequences of a radiological emergency condition. In addition, 10 CFR Part 50, Appendix E, Section IV.A.4 requires the identification of persons within the licensee organization who will be responsible for making offsite dose projections, and a description of how these projections will be made and the results transmitted to State and local authorities, the NRC, and other appropriate governmental entities. In addition, 10 CFR Part 50, Appendix E, Section IV.B requires a description of the means to be used for determining the magnitude of, and for continually assessing the impact of, the release of radioactive materials. In addition, 10 CFR Part 50, Appendix E, Section IV.E.2 requires that adequate provisions shall be made and described for emergency facilities and equipment, including equipment for determining the magnitude of, and for continuously assessing the impact of, the release of radioactive materials to the environment.

In ESP Plan Section 9.0, the applicant described the methods, systems, and equipment available

for assessing and monitoring the actual or potential consequences of a radiological emergency. The staff reviewed this section, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard I, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(9).

ESP Plan Section 9.1, "Onsite," states that in-plant accident assessment actions are carried out by the plant emergency staff in order to properly characterize and classify the emergency, determine the actual or potential radioactivity releases, and determine the effect on plant personnel and (for ESP Plan 5B only) the public. Assessment methodology consists of actions carried out through plant operating procedures, as well as CRN-EPIPs. ESP Plan Section A.8 of Appendix A lists a CRN-EPIP, entitled "Core Damage Assessment." At the onset of an emergency, plant operating procedures (normal, abnormal, and emergency) assist the plant operator and SED in identifying the cause of the emergency, actions necessary to control the emergency, radioactivity release rate (if any), and in-plant radiation levels. The CRN-EPIPs assist the SED in: (1) identifying and reassessing emergency classification; (2) determining the need for plant area evacuation; (3) initiating activation of onsite and (for ESP Plan 5B only) offsite emergency organizations; (4) directing the utilization of needed medical and/or decontamination facilities; (5) implementing predetermined security and access control plans; and (for ESP Plan 5B only) (6) determining the need for offsite protective actions.

Each of the above-mentioned activities is described within the plant operating procedures or CRN-EPIPs, as applicable, for a given situation. The distinct breakdown of assessment actions into operating procedures and implementing procedures is necessary since some assessment actions are necessarily carried out prior to identification or classification of an emergency. The procedures to ensure that emergencies are properly evaluated, timely notifications are made, and assessment and protective actions are performed, are compiled in the CRN-EPIPs. These procedures are summarized by topic in Appendix A, Attachment 1. Under severe emergency conditions, and as required by the plant emergency operating procedures, the onsite emergency organization is responsible for recognition of severe emergency conditions, transition to, and implementation of the Severe Accident Management Guidelines (SAMG).

In ESP Plan Section 9.2, "Offsite," the implementation of protective actions include various differences between ESP Plan 5A (with a site boundary PEP EPZ), and ESP Plan 5B (with a 2-mi PEP EPZ). Specifically, ESP Plan 5A states that TVA maintains the capability to assess the consequences of potential or actual releases of radioactivity offsite, and if determined appropriate by State and local agencies, protective actions for the protection of the public may be implemented using a CEMP (or *all hazards* approach) to EP. In contrast, ESP Plan 5B states the following:

> TVA and State agencies are prepared to assess the consequences of potential or actual releases of radioactivity offsite. State and local agencies implement protective actions for the public. Written messages have been prepared which give the public instructions with regard to specific protective actions to be taken by occupants of affected areas. These messages are included in the State Plan

referenced in Appendix A, Attachment 1.

Implementing procedures have been developed for the CECC to ensure that emergencies are properly evaluated, timely notifications are made, and assessment and onsite protective actions are performed. Once an SMR technology is selected, the details on accident progression rates and radiological release pathways will be known, and can then be reflected in a set of EPIPs and dose assessment modeling, similar to the CECC-EPIP list in ESP Plan Section 9.2.1. (See Section 13.3.4.5.16 of this report.) ESP Plan Section 9.2.1 lists the following CECC-EPIPs associated with CECC accident assessment activities that support the CRN Site:

- CECC-EPIP-6, "CECC Plant Assessment Staff Procedure for Alert, Site Area Emergency, and General Emergency,"
- CECC-EPIP-7, "CECC Radiological Assessment Staff Procedure for Alert, Site Area Emergency, and General Emergency,"
- CECC-EPIP-8, "Dose Assessment Staff Activities During Nuclear Plant Radiological Emergencies,"
- CECC-EPIP-9, "Environmental Radiological Monitoring Procedures," and
- CECC-EPIP-15, "EP Field Support Staff Radiological Emergency Procedure."

Pursuant to 10 CFR 50.47(b)(9), and Sections IV.B and IV.E.2 of Appendix E to 10 CFR Part 50, the emergency plan must include a description of the means to be used for determining the magnitude of, and for continually assessing the impact of, the release of radioactive materials to the environment. Such means may include a description of methods, systems, and equipment that identify plant system and effluent parameter values characteristic of a spectrum of off-normal conditions and accidents (see Section II.I, Evaluation Criterion 1, of NUREG–0654).[28] While the specific details may be reflected in a set of EPIPs, the emergency plan must also include an overview description. Consistent with the applicant's intention to identify the details on accident progression rates when an SMR technology is selected, the staff identified the following COL action item to address the description of radiation monitoring and other systems and equipment associated with the chosen SMR technology that support accident assessment activities, as well as specific monitoring and dose-assessment and dose-projection modeling capabilities.

COL Action Item 13.3-13

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the radiation monitoring and other systems and equipment, including potential radiological release points from the plant, associated with

[28] See also, NUREG–0696, "Functional Criteria for Emergency Response Facilities – Final Report," February 1981; NUREG–0737, Supplement 1, "Clarification of TMI Action Plan Requirements – Requirements for Emergency Response Capability (Generic Letter No. 82-33)," January 1983; and NUREG-0800, Revision 3, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," March 2007.

> the chosen small modular reactor (SMR) technology that support accident assessment activities. The emergency plan should also identify the specific monitoring capability for the radiological parameters identified in NRC Regulatory Guide 1.97, Revision 4, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants" (or other applicable guidance), and dose assessment and projection modeling system.

Section 13.3.4.5.8 of this report also discusses the availability of plant parameter and meteorological variables in the TSC.

ESP Plan Section 9.2.2, "Sampling Team," states that TVA has vehicles equipped to monitor the environment for radioactivity. Each vehicle has an air sampler, radiation measurement equipment, a generator, radio, and other assorted equipment. A detailed listing of the minimum required equipment is available in the CECC-EPIPs. These vehicles are dispatched for environmental monitoring at a Site Area Emergency and General Emergency declaration. TVA may deploy these vehicles for an NOUE and Alert declaration, if warranted. One or more vehicles are stationed at the CRN Site. Each sampling team has the capacity to:

- Obtain environmental samples for analysis,
- Make direct radiation readings,
- Collect air samples and analyze them for gross beta-gamma radioactivity over a range of energies, and
- Collect air samples and analyze them for radioiodine in the field, to concentrations as low as 10^{-7} microcuries/cc (µCi/cc).

CRN-EPIPs describe the composition and activation of sampling teams. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP entitled "Plume Tracking and Assessment of Radiological Conditions.") For the Site Area Emergency and General Emergency classifications, sampling teams are dispatched from the nearest location. If necessary, TVA can coordinate team transport via helicopter or fixed-wing aircraft. The TSC Radiation Protection Manager or CECC Environs Assessor can request assistance from a neighboring plant for environmental monitoring, if deemed necessary. TVA has aquatic monitoring teams located at Chattanooga, TN, and Knoxville, TN. These teams have boats that can be deployed to obtain samples form the river for subsequent analysis for radioactivity in the laboratories. ESP Plan 5B, Section 9.2.2 includes the following additional description:

> State agencies have the responsibility to coordinate and evaluate offsite assessment actions. Environmental monitoring activities are coordinated through the RMCC. State environmental monitoring capabilities and the RMCC operations are referenced in Appendix A, Attachment 1. TVA personnel are co-located in the RMCC, which provides for coordination of TVA and State monitoring teams. TVA and the State share environmental monitoring data.
>
> Additional environmental monitoring assistance is available from the DOE offices at Oak Ridge, Tennessee, or Aiken, South Carolina. The EPA in Montgomery,

Alabama [AL], can also provide assistance. Available support includes environmental monitoring teams and mobile radioanalytical laboratories. The State agencies usually request and coordinate these services.

The RMCC is described in Section 13.3.4.5.8 of this report. ESP Plan Section 9.2.3, "Analyzing Environmental Samples," states that the sampling teams may send samples to the Western Area Radiological Laboratory (WARL) for analysis. The WARL is a TVA laboratory located in Muscle Shoals, AL, and has the capability to perform further quantitative and qualitative analysis (i.e., analyze environmental samples for radioactive content). The WARL is available, as needed, and can be operated 24 hours per day. The WARL can establish a central point for receipt of samples when needed. ESP Plan Section A.8 of Appendix A lists a CRN-EPIP entitled "Obtaining and Analyzing High Activity Samples Under Emergency Conditions."

ESP Plan Section 9.2.4 states that TVA has developed the meteorological program to conform to the intent and guidance of RG 1.23. Wind direction, wind speed, and air temperature are measured at two levels. The temperature difference is used to estimate the Pasquill stability class. Precipitation and dew point temperature are also measured. Hourly and 15-minute average meteorological data from the plant Environmental Data Station are available to the CECC, TSC, State, and LRC. More specific information on the meteorological measurements program can be found in Section 2.3, "Meteorology," of the CRN SSAR (i.e., ESPA Part 2, "Site Safety Analysis Report"). TVA has prepared objective backup procedures to provide estimates for missing or garbled data needed to perform dose calculations, and to determine transport estimates. They incorporate available onsite and offsite data. Each procedure has an accompanying statement of reliability.

In SSAR Section 2.3.3, "Onsite Meteorological Measurements Program," the applicant described the historical meteorological monitoring that has been performed at the CRN Site, the meteorological monitoring program used for the ESPA, and the proposed operational monitoring program. The applicant stated that the primary meteorological facility for the ESPA consisted of a 110-meter tower with wind, temperature, and dew point measurements at the two lowest levels (i.e., 10- and 60-meters); a ground-based instrument for rainfall measurements; and an environmental data station, which housed the data processing and recording equipment. This facility was located approximately 830 meters south-southeast of the expected plant site, and had a base elevation of seven meters below plant grade. The applicant further stated that the primary 110-meter tower used for collecting data for the ESPA has been removed, and that a new tower will be installed to collect data during the CRN Site operational phase. The meteorological program will be implemented during operation of the CRN SMR, consistent with the guidance in NRC RG 1.23. The new tower, and the associated instrumentation, will be designed to meet the requirements of RG 1.23, and meteorological data will be collected and retained for the life of the facility at the CRN Site. Consistent with the applicant's stated intention to install a new meteorological tower and implement a meteorological monitoring program, the NRC staff identified the following COL action item.

COL Action Item 13.3-14

An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the new meteorological tower and meteorological

monitoring program at the Clinch River Nuclear Site, in accordance with NRC RG 1.23, Revision 1, "Meteorological Monitoring Programs for Nuclear Power Plants." The emergency plan should also describe the specific design, instrumentation, and capabilities to provide required meteorological information in support of the new reactor(s) at the CRN Site.

ESP Plan Section 9.2.4 further states that the CECC Meteorologist has the responsibility for providing meteorological information to CECC staff, and the dose assessors use this information to project doses. ESP Plan 5B, Section 9.2.4.3, "Real Time and Forecast Meteorological Data," adds that the dose assessors project offsite doses, and that plume positions are plotted on a site area map. The meteorological support actions and projection of doses are discussed in detail in CECC-EPIPs. Meteorological support may be provided in the CECC or from a remote location. Access of up to the most recent 168 hours of 15-minute and hourly meteorological data is available to authorized users through the CECC computer. The remote access system gathers data from the CRN Site, performs unit conversion, reformats data, and flags questionable values. ESP Plan Section 9.2.1 lists CECC-EPIP-17, "Central Emergency Control Center Meteorologist Procedures."

ESP Plan Section 9.2.5, "Dose Assessment," states that on-shift dose assessment capability is maintained at the CRN Site, and can be implemented if needed during the initial phase of an emergency until the CECC is activated and assumes the dose assessment function. Doses from emergency-related releases of radioactivity are estimated using a combination of calculations, field measurements, and laboratory analyses of environmental samples. ESP Plan 5A includes the estimation of offsite doses, and further states that "[d]ata on meteorological conditions are used in determining offsite dispersion factors."

ESP Plan Section 9.2.5 continues by stating that using plant operational data, field measurements, and effluent monitor readings, actual or potential releases of radioactivity are analyzed by the plant staff, the Radiological Assessment staff, or the CECC Plant Assessment Team to generate or modify a source term for use in the dose assessment. With this information, the CECC Dose Assessment Team can predict offsite doses through the use of several models and/or methods described in the CECC-EPIPs. These models provide a means of estimating public exposures throughout the emergency and recovery period. Environs measurements are used, to the extent possible, to confirm doses projected by modeling.

A preliminary dose projection is performed following receipt of measured effluent release data (the source term) and meteorological data. The preliminary dose projection is followed up by a more detailed assessment using computerized dose models. Manual dose assessment methods are available for use in the event that the computer is unavailable. Input to the detailed calculations includes measured source terms, projected future releases, near real-time and forecast meteorological data, field measurements of exposure rates and/or airborne radioactivity in the environs around the plant, or a combination thereof. Field measurements are used to estimate doses, and (especially in the case of an unmonitored release) source terms, and to verify doses projected using models. After termination of emergency-related releases to the atmosphere, integrated doses are calculated to assist in recovery/reentry operations. ESP Plan 5B, Section 9.2.5 adds the following description regarding determinations of radiological impact:

A combination of inputs including results from modeling field exposure rate and air concentration measurements and laboratory analyses of soil, vegetation, and water samples are used to assess doses. Recommendations are made regarding evacuation area clearance and reentry based on doses calculated for exposure from ground contamination, inhalation of re-suspended radioactivity, and ingestion of radioactivity in vegetables and milk.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard I. A COL applicant will address COL Action Items 13.3-13 and 13.3-14. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(9) and 10 CFR Part 50, Appendix E, Sections IV.A.4, IV.B, and IV.E.2, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.10 Protective Response

As reflected in NUREG–0654, Section II, Planning Standard J, "Protective Response," 10 CFR 50.47(b)(10) requires that a range of protective actions have been developed for the PEP 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). ETEs have been developed by applicants and licensees, and licensees shall update the ETEs on a periodic basis. Guidelines for the choice of protective actions during an emergency are developed and in place, and protective actions for the ingestion exposure pathway EPZ appropriate to the locale have been developed. In 10 CFR Part 50, Appendix E, Section IV.I requires the development of a range of protective actions to protect onsite personnel during hostile action to ensure the continued ability of the licensee to safely shut down the reactor and perform the functions of the emergency plan.

In ESP Plan Sections 10.0, "Protective Response," and 11.0, "Radiological Protection," the applicant described the range of protective actions that have been developed for TVA emergency workers and the general public in the PEP EPZ. The staff reviewed this section, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard J, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(10).

ESP Plan Section 10.1, "Onsite Protective Actions for Radiological Events," states that in the event of an unplanned significant release of radioactivity or sudden increase in radiation levels, it is the responsibility of the SED to make the decision concerning the necessity for building and area evacuation. In arriving at this decision, the primary consideration is personnel safety. The SED may use various radiation and airborne radioactivity monitors placed throughout the plant, with readout in the Control Room, to assess the extent of the radiological hazards and to determine the extent of evacuation necessary.

ESP Plan Section A.4.7, “Assembly/Accountability Alarm,” of Appendix A states that TVA maintains warning signals to alert onsite personnel of hazards and the need for assembly or evacuation. ESP Plan Section 10.1 further states that the assembly/accountability alarm is used to initiate the assembly of site personnel. The public address system is used if only specific areas are to be evacuated. Nuclear Security Services personnel patrol the area between the security boundary described in the Physical Security Plan and the site boundary, and evacuate any nonessential personnel.

Upon hearing the emergency alarm, persons in the plant areas proceed to pre-assigned assembly areas to be accounted for, and await further instructions from the SED. Predetermined assembly areas are identified in approved procedures. The capability exists to determine the number of unaccounted individuals within approximately 30 minutes for persons within the security area, as defined in the Physical Security Plan. If only a particular area is cleared, personnel in that area evacuate to a safe area. An accountability report is provided to the SED from Security. Further details of evacuation procedures are described in CRN-EPIPs. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP topic, entitled “Onsite Protective Action Recommendations.”)

If radiation levels or airborne radioactivity at an assembly point is significantly higher than alternative assemble areas, or the SED deems it necessary, the SED orders relocation to a safe assembly point. Employees are released from this assembly point when the SED determines it is suitable to do so. Procedures require that potentially contaminated people and vehicles pass through a Rad Protection check-point for survey prior to being released. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP topic entitled “Personnel Monitoring.”)

In the event of the evacuation of nonessential site personnel, the SED notifies the CECC Director. If the personnel require transportation and sheltering, the CECC Director coordinates arrangements with the appropriate State agency. If the evacuees require radiological decontamination, they are informed of transportation, sheltering, and decontamination arrangements prior to leaving the plant site. An alternate decontamination facility is specified in a CRN-EPIP. Contaminated personnel are decontaminated to the limits specified in the CRN Site Radiological Control Instructions by methods described in the instructions before being released by TVA. ESP Plan Section A.8 of Appendix A lists a CRN-EPIP topic entitled “Decontamination.”

Procedures also specify the actions to be taken by, and the accountability of, personnel having an emergency assignment. Essential plant personnel remaining onsite are protected by plant systems designed to provide a habitable environment. In addition, precautionary measures may include the use of respiratory protective equipment and protective clothing. Personnel doses are controlled in accordance with ESP Plan Section 11.0.

ESP Plan Section 10.2 states that a range of protective actions to protect onsite personnel during a hostile action event are developed to ensure the continued ability to safely shut down the reactor(s) and perform the functions of the emergency plan. This range of protective actions is contained in the CRN Site abnormal procedures, which are classified as security sensitive.

ESP Plan 5A, Section 10.3, “Offsite,” states that, if determined appropriate, government officials may utilize a CEMP approach to EP to implement ad hoc protective actions to protect the public. This is addressed in FEMA’s Comprehensive Preparedness Guide 101, “Developing and

Maintaining Emergency Operations Plans" (CPG-101). In contrast, ESP Plan 5B, Section 10.3 states the following:

> Should an event be initially classified as a General Emergency, the SED has the responsibility to determine an initial protective action for recommendation to State and local government agencies. CRN-EPIPs provide a logic diagram as a decisional aid to facilitate this recommendation.
>
> After the CECC is staffed, the responsibility for PARs is transferred to the CECC Director. The CECC Plant Assessment Manager provides an assessment of actual and projected plant conditions. The RAM [Radiological Assessment Manager] provides an assessment of actual and/or projected radiological conditions offsite. The RAM also provides a recommendation for a specific protective action. The CECC Director evaluates the recommendation from staff and make[s] a recommendation to the State. The logic diagram for PEP recommendations is provided in the CECC-EPIPs as a decisional aid to facilitate the recommendation.
>
> The State and local agencies are responsible for implementing actions to protect the health and safety of the public offsite. Although TVA may recommend protective actions to these agencies, the State and local governments are responsible for deciding if any actions are needed and what they should be. The CECC will discuss and provide ingestion exposure pathway recommendations (i.e., agricultural) and recommendations for liquid release (i.e., closing of public water supplies) with the State as appropriate.
>
> The decision to implement one or more of the above actions is based upon some or all of the following considerations:
>
> - Projected offsite integrated doses,
> - Actual measured dose rates,
> - Present and future weather conditions,
> - Projected improvement or deterioration of plant conditions,
> - State PAGs,
> - Levels of airborne radioactivity,
> - Levels of waterborne radioactivity,
> - Concentrations of radioactivity in items for human consumption, and
> - Evacuation time estimate.

In NUREG–0654, Section II, Planning Standard J, Evaluation Criteria II.J.8, II.J.10.a, and II.J.10.b address the need for the emergency plan to contain time estimates for evacuation within the plume exposure EPZ, which include maps showing population distribution around the nuclear facility, evacuation areas and routes, relocation centers, and preselected radiological sampling and monitoring points. The applicant included as part of ESP Plan 5B, a CRN Site ETE Report associated with the 2-mi PEP EPZ, which is discussed in Section 13.3.4.3.17 of this report.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard J. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(10), 10 CFR 50.47(c)(2), and 10 CFR Part 50, Appendix E, Sections I and IV.I, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.11 Radiological Exposure Control

As reflected in NUREG–0654, Section II, Planning Standard K, "Radiological Exposure Control," 10 CFR 50.47(b)(11) requires that the means for controlling radiological exposures in an emergency be established for emergency workers. The means for controlling radiological exposures shall include exposure guidelines consistent with the EPA PAG Manual. In addition, 10 CFR Part 50, Appendix E, Section IV.E.3 requires that adequate provisions shall be made and described for emergency facilities and equipment, including facilities and supplies at the site for decontamination of onsite individuals.

In ESP Plan Section 11.0, the applicant described the means to control emergency workers' radiological exposures during an emergency, including measures to provide assistance to persons injured by or exposed to radioactive materials. The staff reviewed this section, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard K, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(11).

ESP Plan Section 11.0 states that the Radiological Protection Section at the CRN Site is responsible for radiological protection activities onsite. Its function is to develop instructions to implement the requirements of 10 CFR Part 20, "Standards for Protection Against Radiation," and other required standards, as well as the requirements and policies in TVA radiological control procedures. The Radiological Protection Section provides surveillance during normal operation and emergency situations, and advises key plant personnel on radiological matters for routine and emergency conditions.

The limiting doses to occupational workers during routine plant operations are found in TVA Radiological Control Procedures. If possible, TVA maintains these limits during emergency operations. If these standards cannot be met during emergencies, TVA implements the dose guidance described in ESP Plan Table 11-1, "Emergency Worker Dose Guidance." A CRN-EPIP describes the methods to authorize and use the emergency worker doses in ESP Plan Table 11-1. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP, entitled "Radiation Protection Under Emergency Conditions.") ESP Plan Table 11-2, "Health Effects of Radiation Doses Greater than 25 RAD," describes the health effects of radiation doses greater than 25 rad.[29] Authorizations for emergency dose limits for onsite personnel is provided by the SED. ESP Plan 5B, Section 11.0 further states that "authorization for offsite personnel is provided by the CECC Radiological Assessment Manager."

[29] 10 CFR 20.1004, "Units of radiation dose," defines "rad" as the special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram, or 0.01 joule/kilogram (0.01 gray).

For individuals entering radiation work permit areas, electronic dosimeters and primary dosimeters are issued and read in accordance with the site TVA Radiological Control Procedures. (ESP Plan Section A8 lists a CRN-EPIP, entitled "Personnel Monitoring.") The electronic dosimeters can be read at any time. Primary dosimetry processing and evaluation is performed by an organization currently accredited by the National Voluntary Laboratory Accreditation Program of the National Institute of Standards and Technology for the type(s) of radiation that most closely approximates the type of radiation(s) for which the individual wearing the dosimeter is monitored. Dose records are maintained on each individual by computer.

TVA Radiological Control Procedures contain the criteria used to establish contamination zones, and for the release of personnel, equipment, and clothing. Onsite facilities are available to decontaminate equipment and personnel. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP, entitled "Decontamination.) Procedures for using individual respiratory protection and protective clothing are provided in specific plant operating procedures, and procedures for use of radioprotective drugs are provided in the EPIPs. Drinking water and eating controls are established by Radiation Protection. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP, entitled "Respiratory Protection and Distribution of Radioprotective Drugs.")

ESP Plan Section 8.1.4, "Site Decontamination Facilities," states that the CRN Site has facilities for the decontamination of personnel, including those with injuries, and that information on these facilities is provided in ESP Plan Appendix A. ESP Plan Section A.4.5.2.1, "Decontamination Facilities," of Appendix A states that the site maintains supplies and equipment as needed to establish a temporary decontamination area for the purpose of gross radiological decontamination and injured person evaluation and stabilization. Equipment and materials for decontamination and first aid, including a stretcher, is available. (Arrangements for medical services for contaminated and injured personnel at the CRN Site is addressed in ESP Plan Section 12.0 and discussed in Section 13.3.4.5.12 of this report.) The ESPA did not identify the location of the site decontamination facility. As such, the staff identified the following COL action item.

COL Action Item 13.3-15

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the location of the onsite personnel decontamination facility.

ESP Plan Section 11.0 further states that TVA implements adequate protective measures so that dose, considering both internal and external pathways, is maintained As Low As Reasonably Achievable (ALARA). Internal dose is minimized by the use of respiratory protection equipment, consistent with maintaining the TEDE ALARA, and protective clothing is used to minimize personnel contamination. If a projected dose to a plant worker's thyroid is expected to exceed 10 rem during a radiological emergency, KI is issued, in accordance with applicable implementing procedures.

Receipt of emergency exposures in excess of 10 CFR 20.1201 limits shall be on a voluntary basis. Personnel receiving emergency exposures shall be informed of the risks involved, including the numerical levels of dose at which acute effects of radiation will be incurred, and numerical

estimates of the risk of delayed effects. ESP Plan Table 11-2 provides information that is consistent with "Environmental Protection Agency Protective Action Guides and Planning Guidance for Radiological Incidents (EPA PAG Manual), Draft for Interim Use and Public Comment, dated March 2013."[30]

Personnel shall not enter any area where dose rates are unknown, or unmeasurable with either instruments or available dosimetry. Any personnel dose in excess of 5 rem TEDE shall be handled in accordance with the TVA Nuclear Radiological Protection Plan. Personnel receiving emergency doses should be restricted for further occupational exposure, pending the outcome of exposure evaluations and medical surveillance, if necessary.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard K. A COL applicant will address COL Action Item 13.3-15. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(11) and 10 CFR Part 50, Appendix E, Section IV.E.3, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.12 Medical and Public Health Support

As reflected in NUREG–0654, Section II, Planning Standard L, "Medical and Public Health Support," 10 CFR 50.47(b)(12) requires that arrangements be made for medical services for contaminated injured individuals. In addition, 10 CFR Part 50, Appendix E, Section IV.E requires facilities and medical supplies at the site for appropriate emergency first aid treatment, and arrangements for medical service providers qualified to handle radiation emergencies onsite. Arrangements are also required for transportation of contaminated injured individuals from the site to specifically identified treatment facilities outside the site boundary.

In ESP Plan Section 12.0, the applicant described the arrangements for medical services for contaminated injured personnel at the CRN Site. The staff reviewed this section, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard L, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(12).

ESP Plan Section 12.0 states that facilities, equipment, medical supplies, and trained personnel are available for first aid/emergency medical treatment of ill or injured persons onsite, including those who are have been overexposed to radiation, or are known to be or suspected of being contaminated. (Radiological emergency response training is addressed in ESP Plan Section 15.0, "Training," and discussed in Section 13.3.4.5.15 of this report.) Immediate lifesaving and disability limiting procedures take precedence over non-critical decontamination and

[30] The March 2013 EPA PAG Manual (Draft for Interim Use) was in effect when the NRC docketed the ESPA on December 30, 2016 (Docket No. 52-047).

dosimetry assessment measures. Guidance for medical assistance is found in a CRN-EPIP. When activated, the CECC coordinates the care, disposition, and reporting of injuries known or suspected to be associated with excess levels of radiation exposure or contamination. The purpose of the Medical Emergency Response Team (MERT) (team composition specified in a CRN Site procedure) is to:

- Provide first aid/emergency medical treatment for ill or injured persons onsite, including those who may have been exposed to or contaminated with radioactive material;

- Minimize injury during the rescue treatment, and transport of injured persons, while minimizing radiological hazards and exposure to the victim;

- Advise and protect attending personnel from unacceptable and unnecessary radiological hazards and exposures; and

- Identify, document, and control radiation exposure and contamination hazards associated with the emergency.

Section A.4.5.2.2, "First Aid Stations and Supplies," of ESP Plan Appendix A states that Emergency Medical Technicians (EMTs) provide first aid for injured individuals, and that first aid treatment is available 24 hours a day. Emergency medical equipment is strategically located throughout the plant, with trauma kits and other specified equipment available for use by the MERT. In addition, radiation protection stores and controls KI tablets for onsite personnel. CRN-EPIPs provide usage information, including information addressing authorization for use and dispersal of KI. (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP topic, entitled "Respiratory Protection and Distribution of Radioprotective Drugs.")

ESP Plan Section 12.3, "Transportation of Injured Personnel," states that the decision to transport a patient offsite is the responsibility of the emergency medical care provider performing patient assessment (i.e., EMT or Registered Nurse). When ambulance transportation is indicated, transport may be provided by either the site Fire Protection EMTs (using a TVA ambulance), or by an agreement ambulance service. ESP Plan Section 16.5 states that agreements are maintained with ambulance services for 24-hour availability of EMT-staffed ambulances for the transport of irradiated/contaminated patients. (ESP Plan Section 6.8 states that "[t]he plant ambulance has a radio used for communication with the local hospitals and the plant" (see Section 13.3.4.5.6, "Emergency Communications," of this report).) The MERT Leader coordinates requests for offsite ambulance assistance through the SM, who performs initial requests and notifications for assistance.

TVA maintains arrangements for one or more agreement ambulance services for the CRN Site with trained personnel to transport patients, including those who may have been exposed to, or contaminated with, radioactive material. These services are designated in a CRN-EPIP, and letters of agreement for response are maintained. (ESP Plan Section A.8 of Appendix A lists CRN-EPIP topics entitled "Radiation Protection Under Emergency Conditions," "Personnel Monitoring," and "Decontamination.") (See ESP Plan Section 16.5.)

ESP Plan Section 12.4 states that TVA maintains arrangements with REAC/TS[31] as the CRN Site receiving hospital. REAC/TS, which is in close proximity to the CRN Site, is a DOE-sponsored facility operated by Oak Ridge Associated Universities Medical and Health Sciences Division, in cooperation with the Oak Ridge Methodist Medical Center in Oak Ridge, TN. The University of Tennessee Medical Center in Knoxville, TN serves as a backup to REAC/TS. Specialized facilities and expert personnel are available at both medical facilities for definitive care for radiation emergency victims. Letters of agreement for services are maintained. (See ESP Plan Section 16.5.)

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard L. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(12) and 10 CFR Part 50, Appendix E, Section IV.E, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.13 Recovery and Reentry Planning and Post-Accident Operations

As reflected in NUREG–0654, Section II, Planning Standard M, "Recovery and Reentry Planning and Post-Accident Operations," 10 CFR 50.47(b)(13) requires that general plans for recovery and reentry be developed. In addition, 10 CFR Part 50, Appendix E, Section IV.H requires a description of criteria to be used to determine when, following an accident, reentry of the facility would be appropriate or when operation could be resumed.

In ESP Plan Section 13.0 the applicant described activities for reentry into the areas of the plant that have been evacuated as a result of an accident, as well as the recovery organization and its concepts of operation. The staff reviewed this section, as well as other relevant portions, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard M, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(13).

ESP Plan Section 13.1, "Termination," states that in the event of an incident requiring activation of onsite and offsite emergency centers, the SED is responsible for the decision to terminate an event, and coordinates the decision to terminate the event with the CECC Director after consultation with the plant technical and operations staffs. The CECC Director, after consultation with the State, the SED, and discussion with the NRC (if appropriate), announces that the emergency has terminated and the recovery phase is to be initiated, if appropriate. TVA then develops procedures and plans to implement the most expeditious recovery sequence to return the

[31] U.S. Department of Energy REAC/TS staff is available 24 hours a day, 7 days a week, to deploy and provide emergency medical consultation for incidents involving radiation anywhere in the world. REAC/TS provides direct support for the National Nuclear Security Administration's Office of Emergency Response and the Federal Radiological Monitoring and Assessment Center. Source: https://orise.orau.gov/reacts/, visited April 13, 2017.

plant to normal operations. The State has the authority and responsibility for offsite recovery efforts, and TVA will provide requested assistance through the recovery organization shown in Figure 13-1, "TVA Recovery Organization," which lists functions that must be addressed for recovery. State representatives are responsible for decisions to relax protective measures for the public that may have been implemented.

ESP Plan Section 13.2, "Recovery Organization," describes the positions/titles and responsibilities of individuals who will fill key positions in the facility recovery organization. ESP Plan Section 13.3, "Onsite Recovery," states that most post-emergency onsite recovery measures are performed in accordance with written procedures (ESP Plan Section A.8 of Appendix A lists a CRN-EPIP topic, entitled "Recovery and Reentry"), and that additional procedures may be developed following an emergency to address the following activities:

- The first auxiliary/reactor building entry,
- The first containment building entry,
- Damage evaluation,
- Decontamination,
- Disassembly,
- Repair,
- Disposal, and
- Test and startup of restored facilities.

In addition, appropriate personnel protective measures are taken on initial entries and throughout assessment and recovery operations to limit exposures to those outlined in ESP Plan Section 11.0. (ESP Plan Section A.8 of Appendix A lists CRN-EPIP topics entitled "Radiation Protection Under Emergency Conditions," "Respiratory Protection and Distribution of Radioprotective Drugs," "Personnel Monitoring," and "Decontamination.") Reentry and recovery individual and population dose estimates are obtained using dose rate measurements or calculations and population distribution, as described in ESP Plan Section 9.2.5, for which the methodology is contained in CECC-EPIPs. Section A.8 of ESP Plan Appendix A lists a CRN-EPIP topic, entitled "Plume Tracking and Assessment of Radiological Conditions." In addition, ESP Plan Section 9.2.1 lists CECC-EPIP-16, "Termination and Recovery," and CECC-EPIP-19, "Post Emergency Fuel Damage Assessment."

ESP Plan Section 13.4, "Local Recovery Center," describes the LRC, which provides a facility for TVA recovery management, NRC emergency response personnel, and other emergency and/or recovery personnel. The LRC provides adequate space for TVA and others who may locate there to support the site should additional office space near the site become necessary during the recovery phase. The LRC provides dedicated space for NRC personnel and contains adequate supplies, communications, and data necessary for them to carry out appropriate functions. Section A.4.8, "Local Recovery Center," of ESP Plan Appendix A, provides a more detailed description of the LRC, and states that the location, function, and capabilities of the LRC is addressed in the CRN Site COL application.

With regard to actions that are taken offsite, ESP Plan 5A and ESP Plan 5B provide the following different descriptions in their respective ESP Plan Section 13.5, "Offsite Recovery:"

ESP Plan 5A (Site Boundary EPZ), Section 13.5

> As addressed in the FEMA Comprehensive Preparedness Guide 101, "Developing and Maintaining Emergency Operations Plans" (CPG-101), if determined appropriate, government officials may utilize a CEMP approach to emergency planning to implement ad hoc protective actions to protect the public.

ESP Plan 5B (2-Mile EPZ), Section 13.5

> The State has the authority for actions taken offsite; however, TVA serves as an important source of technical and analytic assistance for the State in offsite monitoring and sampling needed to determine the extent and methods of offsite recovery. The Chief Nuclear Officer, or designee, serve as the State's contact for coordination of TVA efforts in offsite monitoring, sampling, and recovery.

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard M. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(13) and 10 CFR Part 50, Appendix E, Section IV.H, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.14 Exercises and Drills

As reflected in NUREG–0654, Section II, Planning Standard N, "Exercises and Drills," 10 CFR 50.47(b)(14) requires that periodic exercises be conducted to evaluate major portions of emergency response capabilities, periodic drills be conducted to develop and maintain key skills, and deficiencies identified as a result of exercises or drills be corrected. In addition, 10 CFR Part 50, Appendix E, Section IV.F requires a description of the program that provides for training of employees, exercising by periodic drills, and participation by other assisting persons. The exercises, including hostile action exercises of the onsite and offsite emergency plans, shall test the adequacy of timing and content of implementing procedures and methods, test emergency equipment and communications networks, test the public ANS, and ensure that emergency organization personnel are familiar with their duties. Title 10 CFR Part 50, Appendix E, Section IV.F further describes the full participation exercise (including timing), participation by each offsite authority having a role under the radiological response plan, deficiencies identified during the exercise, remedial exercises, exercise scenarios, and 8-year exercise cycle.

In ESP Plan Section 14.0, the applicant described the program for drills and exercises conducted to practice, test, and evaluate the adequacy of the emergency preparedness program, including facilities, equipment, procedures, communication links, actions of ERO personnel, and coordination between TVA and OROs. The staff reviewed this section, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, Planning Standard N, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan

meets the applicable regulatory requirements in 10 CFR 50.47(b)(14).

ESP Plan Section A.7.2, “Drills and Exercises,” of Appendix A states that TVA conducts drills and exercises to develop and maintain the key skills that are required for emergency response, and that TVA may conduct the drills identified in ESP Plan Section 14.0. (ESP Plan Section A.8 of Appendix A lists a supporting plant procedure, entitled “Conduct of Emergency Drills and Exercises.”) ESP Plan Section 14.2, “Exercises,” states that exercises are scheduled and conducted such that a biennial exercise will be conducted for the CRN Site to test the REP every 2 calendar years. ESP Plan 5B, Section 14.2 further states that State of Tennessee participation in other TVA exercises within the State determines if there will be full or partial participation by the State during CRN Site exercises.

ESP Plan Section 14.2 further states that the CRN Site ensures that adequate emergency response capabilities are maintained during the interval between biennial exercises by conducting drills, including at least one drill involving a combination of some of the principal functional areas of the onsite emergency response capabilities. The principal functional areas of emergency response include activities such as management and coordination of emergency response, emergency assessment, plant system repair and corrective actions, and (for ESP Plan 5B only) protective action decision-making.[32] During these drills supervised instruction is permitted, and activation of all of the emergency response facilities is not necessary. Sites have the opportunity to consider emergency management strategies, operating staff have the opportunity to resolve problems (success paths) rather than have controllers intervene, and the drills can focus on onsite training objectives. Sites shall enable the state and local authorities to participate in such drills when requested.

In ESP Plan 5A, Section 14.2, the applicant stated that TVA offers State and local authorities and support organizations the opportunity to participate in drills and exercises to the extent their assistance would be expected during an emergency at the CRN Site; however, participation is not required. In contrast, ESP Plan 5B, Section 14.2 adds the following:

> An exercise is conducted for the CRN Site, with full participation by State and local authorities, every two years. (Where a State has more than one site it shall participate fully every two years at some site and partially participate at the other sites offsite exercises.)
>
> An exercise is conducted for the CRN Site such that the State may exercise emergency plans related to ingestion exposure pathway measures every eight years. (Where a State has more than one site, this participation should be rotated between sites.)

ESP Plan Section 14.2 further states that major elements of the emergency plans and organizations are tested within an eight-year period, and that the CRN Site initiates an exercise

[32] See Section 13.3.4.4.3.15 of this report, related to TVA’s exemption request associated with Section IV.F.2.b of Appendix E to 10 CFR Part 50 for the site boundary PEP EPZ (i.e., ESP Plan 5A), which addresses the need to include the functional areas of protective action recommendation development and decision making for onsite response.

between 6:00 p.m. and 4:00 a.m. at least once every eight years (where the exact time of the exercise is unannounced).

ESP Plan Section 14.1, “Drills,” states that drills are conducted to develop and maintain key skills required for emergency response, and that these drills may be conducted individually or as part of an REP exercise. The following are required drills:

- Medical Emergency Drills – A medical emergency drill involving a simulated contaminated/ injured individual, with participation by a TVA or agreement ambulance and each agreement hospital (see ESP Plan Section 16.5) is conducted each calendar year for the CRN Site. Scenario development, drill activities and evaluations will be jointly conducted and critiqued by EP and the site.

- Radiological Monitoring Drills – Environmental monitoring vehicle drills are conducted each calendar year for the CRN Site. These drills include collection and analyses of sample media (i.e., water, air, grass, and/or soil as may be required by the scenario), direct radiation measurements, operation of vehicles, communication equipment, sampling equipment, and recordkeeping. The scenario is developed and the drills are conducted and critiqued by the site or EP.

- Rad Protection Drills – Rad Protection drills are conducted twice each calendar year for the CRN Site. These drills involve response to, and analysis of, simulated elevated airborne samples and direct radiation readings in the plant. The scenario is developed and the drills are conducted and critiqued by the site.

- Radio Chemistry Drills – Radiochemistry drills are conducted each calendar year at the CRN Site. These drills involve collecting and analyzing in-plant liquid and gaseous samples containing actual or simulated elevated levels, including use or simulated use of the post-emergency sampling system. The scenario is developed and the drills are conducted and critiqued by the site.

- Radiological Dose Assessment – Radiological dose assessment drills are conducted at least twice each calendar year to test the procedures, calculation techniques, computer codes, and environmental assessment abilities of the CECC staff and support groups. These scenarios are developed and the drills are conducted and critiqued by EP.

- Fire Drills – Fire drills will be conducted at the CRN Site in accordance with, and as required by, specific procedural requirements.

- Communications Drills – Communications drills are conducted at least once each calendar year at the CRN Site.

The frequency for communications drills are not consistent with the evaluation criteria in Section II.N.2.a of NUREG–0654, which includes monthly and quarterly testing. In addition, as described above, Section IV.F of Appendix E to 10 CFR Part 50 requires exercising by periodic drills, including hostile action exercises. Since ESP Plan Section 14.0 does not reflect the relevant communications testing guidance, and does not address hostile action exercises and drills for the

CRN Site, the staff identified the following COL action item:

COL Action Item 13.3-16

> An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the frequency for communications testing, and for the conduct of hostile action exercises, consistent with the applicable regulations and guidance.

ESP Plan Section 14.3, "Scenarios," states that drills and exercises are conducted in accordance with scenarios that have been properly planned, research, and developed. The drill and exercise scenarios include, but are not limited to, the following:

- The basic objectives of each drill or exercise;
- The date(s), time period, place(s), and participating organizations;
- The simulated events;
- A time schedule of real and simulated initiating events; and
- A narrative summary describing the conduct of the exercises or drill, including simulated casualties, offsite fire department assistance, rescue of personnel, use of protective clothing, deployment of radiological monitoring teams, and public information activities.

Drill scenario development and implementation is the responsibility of the organization responsible for the specific drill. Exercise scenario development and implementation is the responsibility of EP, and scenario specifics are not released by those representatives prior to the exercise. ESP Plan 5A, Section 14.3 adds that "[e]xercise scenario planning and development is coordinated with representatives of appropriate organizations and State agencies."

ESP Plan Section 14.3 further states that exercise scenarios will be developed to thoroughly test the REP on an eight year cycle. The exact time of an exercise is not released; however, a time span within which the exercise is to occur may be supplied to appropriate organizations and the news media, so that the exercise is not confused with an actual emergency. In the event a remedial exercise is required, a scenario is developed to demonstrate that corrective measures have been taken regarding the described deficiencies.

ESP Plan Section 14.4, "Critiques," states that representatives of Quality Assurance, INPO, NRC, DHS, State/local agencies, and others may observe the exercise. Additional evaluators may be requested from other organizations, as necessary. Evaluators are provided with sufficient material and a briefing prior to the exercise to become familiar with the Emergency Plan and exercise scenario.

At the conclusion of each exercise/drill, a critique is conducted where the exercise/drill and its participants are evaluated for effectiveness, procedural compliance, and good practices. The Emergency Preparedness Department evaluates critique comments, develops a formal written

report, coordinates corrective actions for deficiencies or items needing improvement, and follows up to ensure completion of corrective actions. Drill critiques, critique reports, coordination of corrective action and follow-up to ensure completion is the responsibility of the organization administering the drill.

Conclusion

For the reasons given above, and as discussed in Section 13.3.4.4.C.3.17 with the resolution of **Confirmatory Item 13.3-1** to retain requirements associated with exercising the ingestion pathway**,** the staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard N. A COL applicant will address COL Action Item 13.3-16. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(14) and 10 CFR Part 50, Appendix E, Section IV.F, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.15 Radiological Emergency Response Training

As reflected in NUREG–0654, Section II, Planning Standard O, "Radiological Emergency Response Training," 10 CFR 50.47(b)(15), requires that radiological emergency response training be provided to those who may be called on to assist in an emergency. In addition, 10 CFR Part 50, Appendix E, Section IV.F.1 requires a description of the program that provides for training of employees, exercising by periodic drills, and participation by other assisting persons.

In ESP Plan Section 15.0, the applicant described the radiological emergency response training program which ensures the training, qualification, and requalification of individuals who will be required to provide assistance during an emergency at the CRN Site. The staff reviewed this section, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan against NUREG–0654, Section II, *Planning Standard O, which provides the detailed evaluation criteria that the staff should consider to determine whether the emergency plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(15).

ESP Plan Section A.7.1, "Training Personnel," of Appendix A states that personnel with specific duties and responsibilities in the CRN Site REP Program receive instruction in the performance of their duties and responsibilities, in accordance with CRN Site training procedures, and as required in ESP Plan 5A/5B Section 15.0. ESP Plan Section 15.0 states that TVA ensures that personnel with specific duties and responsibilities in the NP-REP receive instruction in the performance of these duties and responsibilities. ESP Plan Section 15.1, "Onsite," states that Site Nuclear Training/line organizations/site EP provide training in emergency procedures to permanent plant personnel and applicable non-plant personnel, in accordance with plant training procedures. (ESP Plan Section A.8 of Appendix A lists a supporting plant procedure entitled "Emergency Plan Training.")

For personnel with specific duties involving the NP-REP, this training consists of initial training

classes and annual retraining to maintain familiarity with the features of the NP-REP.[33] Participation in drills, while not a requirement for all personnel with specific duties involving the NP-REP, does augment the training of those personnel who do participate. Key site responders are required to participate in drills on a periodic basis. The site EP group provides training to key site responders in the TSC and OSC, and the SED, in accordance with applicable procedures. Training for plant access is conducted in accordance with applicable CRN Site security procedures.

ESP Plan Section 15.1 further states that the Safety and Emergency Response Training Academy (SERTA) provides emergency medical care training to medical personnel and selected Nuclear Power personnel stationed at the CRN Site. Successful completion of training commensurate with their duties allows personnel to fulfill the role of medical care provider on the site MERT.

ESP Plan Section 15.2, "Offsite," states that CECC personnel have current fitness for duty training. The Emergency Preparedness Department is responsible for ensuring that lesson plans are developed and training is conducted for CECC personnel. Training provided under the ESP Plan is documented on an annual basis. Such documentation includes the date of the training, the names of those trained, and the training administered. Training and annual retraining are provided to local plant support agencies (security, fire, ambulance, and hospital personnel) who may be involved with direct support of the site during an emergency.

Nuclear Support Services is responsible for providing agreement hospital and ambulance support training. (Emergency first aid team qualifications and treatment are addressed in ESP Plan Section 12.0 and discussed in Section 13.3.4.5.12 of this report.) The CRN Site is responsible for providing fire support training, with assistance from Nuclear Support Services, as needed. The CRN Site is responsible for providing local law enforcement (security) training. Training includes procedures for notification, basic radiation protection, expected roles, and site access procedures (as applicable).

ESP Plan Section 15.3, "Professional Development Training," states that full time EP staff members are afforded formal professional development training or activities commensurate with their duties and experience. (EP staff members responsible for maintaining CRN Site emergency preparedness are addressed in ESP Plan Section A.5, "Maintaining Emergency Preparedness," and discussed in Section 13.3.4.5.16 of this report.)

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard O. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(15) and 10 CFR Part 50, Appendix E, Section IV.F.1, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

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[33] ESP Plan Section 17.0, "Definitions and Acronyms," states that the NP-REP provides the policies and the actions to be used to minimize the impact on personnel, public, and the environment from an emergency at a TVA nuclear plant.

13.3.4.5.16 Responsibility for the Planning Effort: Development, Periodic Review and Distribution of Emergency Plans

As reflected in NUREG–0654, Section II, Planning Standard P, "Responsibility for the Planning Effort: Development, Periodic Review and Distribution of Emergency Plans," 10 CFR 50.47(b)(16) requires that responsibilities for plan development and review and for distribution of emergency plans are established and that planners are properly trained. In addition, 10 CFR Part 50, Appendix E, Section IV.G requires a description of provisions to be employed to ensure that the emergency plan, its implementing procedures, and emergency equipment and supplies are maintained up to date.

In the following ESP Plan sections, the applicant described the responsibilities associated with maintaining the emergency preparedness program, including the development, review, and distribution of the emergency plan:

- ESP Plan Section 9.2.1, "General Information,"
- ESP Plan Section 15.3, "Professional Development Training,"
- ESP Plan Section 16.0, "Plan Maintenance,"
- ESP Plan Section A.5, "Maintaining Emergency Preparedness," of Appendix A,
- ESP Plan Section A.7.1, "Training Personnel," of Appendix A,
- ESP Plan Section A.8, "Emergency Plan Implementing Procedures," of Appendix A, and
- ESP Plan Appendix A, Attachment 1, "State Multijurisdictional Radiological Emergency Response Plan."

The staff reviewed these sections, as well as other relevant portions of the application, to determine whether the application conforms to the applicable guidance and complies with the pertinent regulatory requirements. The staff's primary focus was to evaluate the emergency plan compared to NUREG–0654, Planning Standard P, which provides the detailed evaluation criteria that the staff should consider to determine whether the ESP Plan meets the applicable regulatory requirements in 10 CFR 50.47(b)(16).

ESP Plan Section A.5.1 of Appendix A states that the Site Vice President maintains overall authority and responsibility for radiological emergency response planning. The Director, Emergency Preparedness is assigned responsibility for coordinating emergency preparedness efforts, including activities related to the development of emergency plans and procedures, and coordinating the plans and procedures with supporting organizations to ensure the overall effectiveness of the program.

ESP Plan Section A.7.1 of Appendix A states that personnel with specific duties and responsibilities in the CRN Site REP Program receive instruction in the performance of their duties and responsibilities in accordance with CRN Site training procedures, and as required in ESP

Plan Section 15.0. In addition, ESP Plan Section 15.3 states that full-time EP staff members are afforded formal professional development training, or activities commensurate with their duties and experience. (The TVA radiological emergency response training program is addressed in ESP Plan Section 15.0, and discussed in Section 13.3.4.5.15 of this report.)

ESP Plan Section 16.0 describes how TVA maintains the ESP Plan. Specifically, the CRN NP-REP and the appendices are reviewed by CRN Site and EP staff annually for accuracy, completeness, operational readiness, and compliance with existing regulations and established policy. Revision to the CRN NP-REP may result from these periodic reviews, drills, exercises, or changes in regulations. Revisions are made as expeditiously as possible, and are not necessarily held for submittal with an annual review. Each (CRN NP-REP) line affected by a particular revision is marked in the margin, and changes in a revision are stated in the revision log (which includes a brief explanation of the pages affected).

The Plant Operations Review Committee approves CRN NP-REP revisions to ESP Plan Appendix A prior to their implementation. Changes to the CRN EP-REP are approved by the General Manager, Support Services, or designee. Changes are made and distributed according to ESP Plan Figure 16.1, "Update Procedure for NP-REP and Appendices." To provide REP holders with assurance that the Plan is up-to-date, cover pages and revision logs are distributed with each revision or addition. The revision log lists the latest revision number, the date revised, pages revised, and the reason for the revision.

ESP Plan Section A.5.2, "Procedures," states that the CRN Site maintains a range of CRN-EPIPs that provide instructions for implementing the emergency response measures described in the ESP Plan. ESP Plan Section 16.0 provides a description of the CRN-EPIP document control, approval, and revision processes. ESP Plan Section 16.2, "EPIPs," describes how the EPIPs are controlled and reviewed, including how changes are made and distributed (in accordance with ESP Plan Figure 16-2, "Update Procedure for EPIPs").

ESP Plan Section A.5.3, "Independent Reviews of Emergency Preparedness," of Appendix A states that TVA's independent Quality Assurance organization performs, or oversees the performance of, periodic independent audits of the emergency preparedness program, consistent with the requirements of 10 CFR 50.54(t). The audits include, at a minimum, the following:

- The emergency plan,
- EPIPs and practices,
- The emergency preparedness training program,
- Readiness testing (e.g., drills and exercises),
- Emergency response facilities, equipment, and supplies,
- Interfaces with State and local government agencies, and
- Required records and documentation.

TVA's independent Quality Assurance organization documents audit results and improvement recommendations, and reports these results to the CRN Site and TVA management. TVA establishes and maintains the frequency of the periodic audits based on an assessment of performance, as compared to performance indicators; however, the audit frequency is not less than once every 24 months. In addition, TVA conducts a program audit as soon as reasonably practicable after a change occurs in personnel, procedures, equipment, or facilities that potentially could adversely affect emergency preparedness; but no longer than 12 months after the change. TVA makes those portions of the audits that address the adequacy of interfaces with State and local governments available to the affected governments. In addition, ESP Plan Section 16.4, "Audits," states that Quality Assurance is also responsible for offering recommendations on overall emergency plan improvement, and retaining the audit results in the files for a period of 5 years.

ESP Plan Section 9.2.1 states that EPIPs have been developed for the CECC to ensure that emergencies are properly evaluated, timely notifications are made, and assessment and protective actions are performed (ESP Plan 5A is limited to onsite protective actions). Section 9.2.1 includes a listing of CECC-EPIPs, and ESP Plan Section A.8 includes a listing of CRN Site EPIPs and additional plant procedures that support the ongoing maintenance of the EP program. (ESP Plan Section A.8 of Appendix A lists a supporting plant procedure entitled "Maintaining Emergency Preparedness.") In addition, ESP Plan Appendix A, Attachment 1, "State Multijurisdictional Radiological Emergency Response Plan," states that the State of Tennessee Multijurisdictional Radiological Emergency Response Plan is maintained in the CECC and the CRN Site TSC.

Finally, the applicant included ESP Plan tables of contents, with cross-references to NUREG-0654 evaluation criteria, in (1) ESP Plan "Table of Contents;" (2) ESP Plan Appendix A, "Table of Contents;" and (3) ESP Plan Appendix A, Attachment 3, "Cross-Reference to Regulations and Guidance."

Conclusion

The staff concludes that the information provided in the ESPA is consistent with the guidelines in NUREG–0654, Section II, Planning Standard P. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(16) and 10 CFR Part 50, Appendix E, Section IV.G, insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.4.5.17 Evacuation Time Estimate Analysis

10 CFR 50.47(b)(10) requires, in part, that ETEs have been developed by applicants and licensees, and that licensees shall update the ETEs on a periodic basis. In addition, 10 CFR Part 50, Appendix E, Section IV requires that the applicant provide an analysis of the time required to evacuate various sectors and distances within the PEP EPZ for transient and permanent populations, using the most recent U.S. Census Bureau data as of the application submission date. These requirements also apply to ESP applicants that propose complete and integrated emergency plans pursuant to 10 CFR 52.17(b)(2)(ii), and may be addressed by ESP applicants that propose major features of the emergency plans pursuant to 10 CFR 52.17(b)(2)(i).

NUREG/CR-7002 contains the detailed guidance to be used by the staff to determine whether the ETE Report meets the applicable regulatory requirements in 10 CFR Part 50, Appendix E. ETEs are part of the required EP basis and provide TVA and State and local governments with site-specific information needed for protective action decision making.

In SSAR Section 13.3.4, "Evacuation Time Estimates," states that an independent ETE study has been performed to provide estimates of the time required to evacuate permanent resident and transient resident populations from the CRN Site PEP (2-mi) EPZ for various times of the day, week and year under favorable and adverse weather conditions. For the emergency plan in ESPA Part 5B (i.e., ESP Plan 5B), the ETE for evacuation of an approximately 2-mi PEP EPZ is detailed in the ETE Report provided in ESP Plan 5B. The analyses were conducted in accordance with the guidance provided in NUREG/CR-7002. For the emergency plan in ESPA Part 5A (i.e., ESP Plan 5A), an ETE study was not performed because the plan does not require the establishment of a PEP EPZ beyond the site boundary and development of offsite REP plans.

The staff evaluated the ETE Report against the criteria set forth in the latest guidance contained in NUREG/CR-7002. The evaluation included checking the ETE Report for internal consistency, consistency with other parts of the emergency plan, and consistency with other parts of the ESPA, including the SSAR. The following discussion reflects information contained in the ETE Report, including the staff's evaluation and RAIs.

The CRN Site is a proposed SMR project on 1200 acres of land adjacent to the Clinch River arm of the Watts Bar Reservoir, south of the DOE ORR, within the City of Oak Ridge, in Roane County, TN. For the proposed CRN Site, the PEP EPZ is an area encompassing an approximate 2-mi radius around the proposed reactor center point location. Figure 1.1, "CRN Site Vicinity Map," shows the proposed CRN Site, surrounding communicates, political boundaries, and major highways and geographic features. The mapping provided in Section 3, "Roadway Capacity" shows details that include intersections, as well as collectors, arterials, and Interstates. Major roads out of the EPZ are illustrated in Figure 2.5, "Roadway Network in the Vicinity of the CRN Site."

This ETE Report includes a discussion of the traffic simulation model INTEGRATION, which was used in performing the ETE analysis. The CRN Site was modeled using the INTEGRATION system, which reflected demographic and field survey information for the defined evacuation region, and applied the procedures specified in the 2010 Highway Capacity Manual. Additional details regarding the traffic simulation model are included in Section 4.2, "Evacuation Time Estimate Modeling."

As described in ETE Report Section 1.1, "Approach," TVA conducted a detailed field survey of the roadway network and traffic conditions within the EPZ to validate existing mapping and obtain characteristics of the primary roadways. The evacuation network used in the analysis is illustrated on mapping provided in Section 3, "Roadway Capacity," and the types and capacities of each roadway segment are listed by unique link numbers in Table A.2, "Link Input File." Field survey data was used to adjust roadway characteristics to reflect actual conditions, such as roadway capacity and intersection control.

The ETE is used as an information tool; therefore, no minimum evacuation time must be achieved.

The guidance in Evaluation Criterion J.10 of NUREG–0654, Section II, provides additional information regarding the use of ETE results, in support of protective response within the EPZ. For purposes of the ESPA, the ETE also serves to satisfy the requirements in 10 CFR 52.17(b)(1), which states that the SSAR must identify physical characteristics of the proposed site, such as egress limitations from the area surrounding the site, that could pose a significant impediment to the development of emergency plans. The Executive Summary of the ETE Report states that the ETE did not identify physical characteristics of the proposed site that could pose a significant impediment to the development of emergency plans (see also, Section 13.3.4.1 of this report).

The ETEs are calculations of the time necessary to evacuate the 2-mi PEP EPZ. The exact size and configuration of the PEP EPZ surrounding the CRN Site was developed 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. Of particular interest in the development of CRN Site 2-mi PEP EPZ is the overlapping EPZ for the DOE ORR. The ETEs are primarily used by OROs to inform protective action decision-making; and may also be used in the development of traffic management plans to support an evacuation. The Preface of the ETE Report summarizes the ETE contents, as follows:

- Section 1: Provides an introduction to the ETE, describes the characteristics of the EPZ, establishes general assumptions, and identifies the evacuation scenarios evaluated in this analysis.

- Section 2: Provides details considered in developing demand estimates for permanent residents and transients, transit dependent populations, special facilities, schools, special events, and quantifying a shadow evacuation.

- Section 3: Describes the approach for evaluating the roadway capacity and establishes values for use in adverse weather calculations.

- Section 4: Discusses the process for developing trip generation times and provides details on information included in traffic simulation modeling.

- Section 5: Identifies other considerations including the need for development of a traffic control plan, potential enhancements to the ETE, and State and local review.

- Appendix A: Provides characteristics for the roadways in the roadway network.

- Appendix B: Includes ETE review criteria contained in Appendix B of NUREG/CR-7002.

The ETE Report was prepared based on guidance provided in NUREG/CR-7002. Consistent with this guidance, the ETE provides the time to evacuate 90 percent and 100 percent of the total population of the EPZ. The 90 percent ETEs provides the evacuation times that would typically be used to support PARs and decision-making. As described in ETE Report Section 1.4, “Emergency Response Planning Areas,” and consistent with NUREG–0654, Supplement 3, “Guidance for Protective Action Strategies,” PARs would be implemented consistently throughout the 2-mi PEP EPZ.

The ETE Report includes an analysis of permanent residents and transient populations, transit dependent permanent residents (including ambulatory and non-ambulatory), special facility residents, and schools. The PEP EPZ is sparsely populated with no major commercial facilities [except for the two major employers, identified below], schools, correctional facilities, licensed day care facilities, nursing home facilities, or major retail facilities located in the PEP EPZ. The ETE Report also provides details on the development of the evacuation demand considered in the ETE (described above), preparation activities associated with development of the ETE, and the use of traffic simulation modeling.

As described in Section 2.1, "Permanent Residents and Transient Population," the 856 permanent residents within the PEP EPZ are based on the 2010 U.S. Census[34] (projected to 2015). In addition to the demand estimates for resident and transient populations, demand estimates were also considered for people who work in the PEP EPZ. Section 2.5, "Other Demand Estimate Considerations," provided estimate of the number of employees and evacuating vehicles for major employers (i.e., those with 50 or more employees) identified in the vicinity of the CRN Site. Table 2.7, "Major Employers in the EPZ," identifies Kingston Academy and Duratek, which have a total of 450 employees with 107 evacuating vehicles. Other considerations included in this ETE analysis include:

- A shadow evacuation extending to 15 mi from the CRN Site assumes that 20 percent of the public outside the boundary of the PEP EPZ to a distance of 15 mi for the CRN Site would spontaneously evacuate.

- Lack of existing emergency preparedness programs and evacuation plans, including the absence of existing registration programs for people with disabilities and those with access and functional needs who do not reside in special facilities, and the absence of existing evacuation routes and traffic control plans.

- Verification of the future commitment of resources, such as buses and ambulances.

- Consideration of the evacuation tail.

- Future ETE updates related to a combined license application[35]

The Soaring Eagle Campground is the only facility in the PEP EPZ that attracts transients, and is located approximately one mi south of the proposed CRN Site. No hotels or motels were identified within the PEP EPZ. An estimate of the transient population is provided in Section 2.1.2, "Transient Population," with the peak transient population of 197 (requiring 116 evacuating vehicles) presented in Table 2.4, "Peak Transient Population and Evacuating Vehicles." This estimate assumes the facility operates at capacity during the summer.

Section 2.3, "Special Facility Residents" describes one special facility within the PEP EPZ,

[34] 2010 U.S. Census ("Census 2010") (https://www.census.gov/2010census/, visited December 28, 2017).
[35] In the event the site boundary EPZ (reflected in ESP Plan 5A) is selected for the CRN Site, TVA has proposed an exemption from the requirements to perform an ETE, and an update to the (ESP Plan 5B) ETE will not be necessary.

consisting of the Kingston Academy. The Kingston Academy is a psychiatric residential treatment facility with living quarters and a capacity for 52 children. Table 2.6 indicates that the 47 residents (90%) of the Kingston Academy are transported using 3 facility vans, and Table 4.12, "ETEs for Special Facility Populations," provides an ETE for the Kingston Academy of 1:19 (hour:minute). The Kingston Academy is further described in Section 4.1.3, "Special Facilities."

The special event evaluated in the analysis was new plant (SMR) construction. Table 2.8, "Total Population Considered for Each Scenario," identifies the peak construction year as 2024, and explains that the permanent resident and shadow populations were extrapolated to this year to determine the ETE. During the peak construction period the workforce estimate is 2700 construction workers. The existing roadway system was used for this scenario and no roadway improvements were considered. However, because a site plan detailing road access to the site has not been finalized, it was assumed that driveway access to and from the site would be along Bear Creek road.

There are 10 evacuation scenarios described in Table 1.3, "Evacuation Scenarios," which include ETEs associated with summer, winter, midweek, weekend, daytime, evening, normal and adverse weather, roadway impact, and a special event consisting of peak construction. For the 10 evacuation scenarios, Table 4.13, "ETEs for Evacuation of the General Public (90% of the Affected Population," and Table 4.14, "ETEs for Evacuation of the General Public (100% of the Affected Population," provide the ETEs for the evacuation of the general public, which range from 1:40 (hour:minute) to 2:17 for the 90th percentile general population (excluding the peak construction scenario). The maximum ETE for the 100th percentile is 4:07 for evacuation during peak construction of the new (SMR) plant. Separate ETEs were developed for the transit dependent and special facility populations. Table 2.6, "Summary of Transit Dependent Residents," indicates that there are a total of 82 transit dependent individual in the EPZ, and Table 4.11, "Evacuation of Transit Dependent Individuals," provides the associated ETEs, which range from 2:10 to 2:36.

ETE Section 5.3, "State and Local Review," states that State and local authorities were involved in the development of the ETE. Interactions began with a kick-off meeting in Knoxville, TN in January 2014, during which the regulatory requirements, the process used to develop the ETE and the associated data and information needs were discussed. The meeting was attended by representatives of the following State and local agencies and private sector support organizations:

- Tennessee Emergency Management Agency,
- Tennessee Highway Patrol,
- Roane County Office of Emergency Services and Homeland Security,
- Anderson County Office of Emergency Management and Homeland Security,
- Loudon County Major,
- Loudon County Homeland Security and Emergency Management Agency,
- Loudon County Sheriff's Office,
- Knox County Emergency Management Agency,
- Knox County Sheriff's Office,
- Knox County Engineering,
- City of Oak Ridge Fire Department,
- Kingston Police Department,

- Lenoir City Fire Department,
- Rural/Metro of East Tennessee, and
- American Red Cross of East Tennessee,

Following the kick-off meeting, a telephone survey instrument was prepared and provided to the TEMA for review and comment, resulting in several modifications. Each agency approved the instrument prior to initiating the telephone survey. TEMA and Roane County provided assistance with completing data collection related to the permanent resident and transient populations, schools, major employers, transportation resources, transit-dependent residents, and hotels, motels and campgrounds in the PEP EPZ. Site-specific telephone survey results were used to establish demographic characteristics and auto occupancy information, including the population without access to a vehicle or who are dependent on help to evacuate. Specific assumptions supporting the demand estimation, vehicle usage, and trip generation times are based on the results of a site-specific telephone survey, which was not included in the report.

In an e-mail dated August 21, 2017, NRC provided TVA with eRAI-9029 (ADAMS Accession No. ML17233A359), which requested that the applicant address various areas of the ETE Report, including: (1) the methodology used to project population growth from 2010 to 2015, (2) identification of major employers within the 2-mi PEP EPZ, (3) PEP EPZ population and evacuation network modeling, and (4) various ETE inconsistencies. In a September 15, 2017, response to eRAI-9029 (ADAMS Accession No. ML17261A066), the applicant addressed the staff's questions. The staff reviewed the applicant's responses to eRAI-9029, and found the responses acceptable because they (1) stated that the methodology used to project the 2015 transient, permanent, and shadow evacuation populations used in the ETE Report is the same methodology described in ESPA Part 2, and provided additional methodology description. In addition, the applicant (2) described the major employers within the 2-mi PEP EPZ, which consists of Energy Solutions, VW Group of America, and HT Hackney facility, and the applicant included specific descriptions of each employer. The applicant also (3) provided a detailed description of PEP EPZ population and evacuation network modeling, and (4) resolved the various ETE inconsistencies that the staff identified. Therefore the staff considers eRAI-9029 resolved.
As described above, the staff finds that the applicant has developed adequate ETEs for the PEP EPZ for transient and permanent populations using the most recent U.S. Census Bureau data as of the application submission date, and that the ETEs are consistent with the guidance in NUREG/CR-7002.

Conclusion

The staff concludes that Revision 1 of the ETE Report is consistent with the guidelines in NUREG/CR-7002. Therefore, the staff finds the information acceptable and meets the relevant requirements of 10 CFR 50.47(b)(10); 10 CFR Part 50, Appendix E, Section IV; and 10 CFR 52.17(b)(2)(ii), insofar as the information describes the essential elements of advanced planning and the provisions made to cope with emergency situations.

13.3.5 Conclusion

The staff reviewed the TVA ESPA, including the major features emergency plans, for the proposed new unit(s) at the CRN Site against the relevant requirements and guidance identified

above in Section 13.3.3 of this report. Pursuant to 10 CFR 52.17 and 10 CFR 52.18, and in consultation with FEMA, the staff concludes that (1) there are no physical characteristics unique to the CRN Site that could pose a significant impediment to the development of emergency plans; (2) TVA has provided an adequate description of contacts and arrangements made with Federal, State, and local governmental agencies with EP responsibilities; and (3) except for the emergency classification system described above in Section 13.3.4.5.4, the proposed major features of the emergency plans meet the pertinent standards of 10 CFR 50.47 and the requirements of Appendix E to 10 CFR Part 50, insofar as the plans address a limited description of the major features as proposed in the ESPA.

In addition, the staff concludes that the proposed methodology (described in SSAR Section 13.3) to prepare an analysis, as the technical basis to support the PEP EPZ size determination in a subsequent CRN Site COLA, is reasonable, consistent with Commission considerations for SMR EPZ size determinations, and consistent with the analyses that form the technical basis for the current regulatory requirement of a PEP EPZ about 10 mi in radius for large LWRs.

The staff evaluation and findings on the exemption requests with respect to the Commission regulations on exemptions is provided above in sections 13.3.4.4.A and 13.3.4.4.B.

When referenced by a COL applicant pursuant to 10 CFR 52.73, “Relationship to Subparts A and B,” this ESP is subject to these COL action items, permit conditions, and confirmatory item:

COL Action Items 13.3-1 through 13.3-16

13.3-1 An applicant for a combined license (COL) that references this early site permit should identify the chosen small modular reactor (SMR) technology for the Clinch River Nuclear Site, including the applicable early site permit major features emergency plan; or, if appropriate, a new emergency plan for NRC review. In addition, if the dose consequences of the chosen SMR technology support the site boundary plume exposure pathway (PEP) emergency planning zone (EPZ), the applicant will inform the offsite response organizations regarding establishment of the PEP EPZ at the site boundary. The applicant should update the major features emergency plan to reflect the chosen SMR technology, and incorporate it into a complete and integrated emergency plan. In addition, the applicant should provide detailed information that shows the ability of the chosen SMR technology to meet the applicable plume exposure pathway emergency planning zone, as described in ESP application, Part 2, Section 13.3.3, “Emergency Planning Zones.” (See Section 13.3.4.4 of this report.)

13.3-2 An applicant for a combined license (COL) that references this early site permit should submit to the NRC up-to-date letters of agreement or memoranda of understanding with offsite support organizations, which address the concept of operations in support of their respective emergency response roles associated with the chosen plant design, including hostile actions at the Clinch River Nuclear Site, consistent with applicable requirements and guidance. (See Section 13.3.4.5.1 of this report.)

13.3-3 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe on-shift emergency response organization staffing

in support of the chosen small modular reactor (SMR) technology for the Clinch River Nuclear Site, including the capability for on-site and off-site emergency response organization positions to be staffed and emergency response facilities activated, consistent with the applicable requirements and guidance. (See Section 13.3.4.5.2 of this report.)

13.3-4 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the emergency classification and action level scheme applicable to the chosen small modular reactor (SMR) technology for the CRN Site, consistent with the applicable requirements and guidance. (See Section 13.3.4.5.4 of this report.)

13.3-5 An applicant for a combined license (COL) that references this early site permit, including the Part 5B Emergency Plan (2-Mile Emergency Planning Zone (EPZ)), should update the emergency plan to describe the chosen Alert and Notification System (ANS) network(s), which reflects the assessment of the various technologies by Tennessee Valley Authority and the affected State and local agencies, and meets the applicable requirements and guidance. (See Section 13.3.4.5.5 of this report.)

13.3-6 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the Clinch River Nuclear Site Emergency Communications Equipment, including all required communications and data links, associated with the chosen small modular reactor (SMR) technology, consistent with the applicable regulations and guidance. (See Section 13.3.4.5.6 of this report.)

13.3-7 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the location, function, and capabilities of the Joint Information Center (JIC), consistent with the applicable regulations and guidance. (See Section 13.3.4.5.7 of this report.)

13.3-8 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe onsite monitoring systems and equipment, including the installed Radiation Monitoring System, consistent with the applicable regulations and guidance. (See Section 13.3.4.5.8 of this report.)

13.3-9 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe how the criteria in Section 2 of NUREG–0696 and Section 8 of Supplement 1 to NUREG–0737 are met for the Technical Support Center (TSC), including emergency classification requiring activation and time frame for designated personnel to report to the TSC and achieve full functional operation. (See Section 13.3.4.5.8 of this report.)

13.3-10 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the location of the Operations Support Center (OSC) and communications capabilities consistent with Section 3.3 of NUREG–0696. (See Section 13.3.4.5.8 of this report.)

13.3-11 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the location, function, and capabilities of the Local Recovery Center (LRC). In addition, the applicant should describe how the LRC meets the applicable requirements in Sections IV.E.8.b and IV.E.8.d of Appendix E to 10 CFR Part 50, and the criteria in Sections IV.D and IV.I of NSIR/DPR-ISG-01. (See Section 13.3.4.5.8 of this report.)

13.3-12 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the capability of the Central Emergency Control Center (CECC) to support response to events occurring simultaneously at the CRN Site and at one or more of the other Tennessee Valley Authority nuclear power reactor sites that are served by the CECC. The CECC description should address, as a minimum, the following considerations, consistent with the applicable regulations and guidance.

a) The facility's location and size.

b) The prescribed activation time for the facility.

c) Whether the facility would be able to fulfill its intended required emergency response functions.

d) The anticipated staffing (including response time) and training of licensee emergency response personnel at the facility.

e) The facility's communication capabilities and data systems.

f) The availability in the facility of the radiation monitoring system and SPDS plant parameter variables, including those identified in NRC RG 1.97, Revision 4 (or other applicable guidance).

g) The facility's capacity for accommodating a multi-site event.

h) Impact on the NRC and/or State and local response organizations.

(See Section 13.3.4.5.8 of this report.)

13.3-13 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the radiation monitoring and other systems and equipment, including potential major release points from the plant, associated with the chosen small modular reactor (SMR) technology that support accident assessment activities. The emergency plan should also identify the specific monitoring capability for the radiological parameters identified in NRC Regulatory Guide 1.97, Revision 4, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants" (or other applicable guidance), and dose assessment and projection modeling system. (See Section 13.3.4.5.9 of this report.)

13.3-14 An applicant for a combined license (COL) that references this early site permit should

update the emergency plan to describe the new meteorological tower and meteorological monitoring program at the Clinch River Nuclear Site, in accordance with NRC Regulatory Guide 1.23, Revision 1, “Meteorological Monitoring Programs for Nuclear Power Plants.” The emergency plan should also describe the specific design, instrumentation, and capabilities to provide required meteorological information in support of the new reactor(s) at the CRN Site. (See Section 13.3.4.5.9 of this report.)

13.3-15 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the location of the onsite personnel decontamination facility. (See Section 13.3.4.5.11 of this report.)

13.3-16 An applicant for a combined license (COL) that references this early site permit should update the emergency plan to describe the frequency for communications testing, and for the conduct of hostile action exercises, consistent with the applicable regulations and guidance. (See Section 13.3.4.5.14 of this report.)

Permit Conditions 1 through 4

1. An applicant for a combined license (COL) that references this early site permit shall provide detailed information in the COL application that demonstrates that the accident release source term information for the selected SMR design used in analyses to support the determination of the plume exposure pathway emergency planning zone (EPZ) size is bounded by the non-design-specific plant parameter source term information used in the analysis supporting the exemption requests, as described in the following Table 13.3-1, “Plant Parameter Accident Releases for Determining Emergency Planning Zone (EPZ) Size in Support of Emergency Planning Exemptions.”

Table 13.3-1
Plant Parameter Accident Releases for Determining Emergency Planning Zone (EPZ) Size in Support of Emergency Planning Exemptions

Nuclide	4-Day Total Activity (Ci)	Nuclide	4-Day Total Activity (Ci)
Kr-85	3.29E+03	Ru-106	2.68E+00
Kr-85m	1.94E+03	Rh-103m	4.11E+00
Kr-87	1.10E+03	Rh-106	2.70E+00
Kr-88	3.04E+03	Nb-95	6.45E+01
Xe-133	1.74E+05	Co-58	7.88E-05
Xe-135	1.49E+04	Co-60	8.74E-04
Xe-135m	6.95E+02	Mo-99	6.16E+01
Cs-134	1.26E+02	Tc-99m	5.80E+01
Cs-136	2.82E+01	Nb-97	3.95E+00
Cs-137	8.88E+01	Nb-97m	4.61E-01
Rb-86	9.92E-01	Ce-141	1.31E+00
Rb-88	2.59E+03	Ce-143	1.09E+00
Ba-139	1.22E+01	Ce-144	1.10E+00
Ba-140	4.82E+01	Np-239	1.10E+01
Sr-89	2.20E+01	Pu-238	7.75E-03
Sr-90	7.46E+00	Pu-239	3.21E-04
Sr-91	2.05E+01	Pu-240	6.48E-04
Sr-92	1.27E+01	Pu-241	1.60E-01
Ba-137m	8.00E+01	Zr-95	6.34E-01
I-131	6.79E+02	Zr-97	5.64E-01
I-132	4.35E+02	Am-241	1.06E-04
I-133	9.72E+02	Cm-242	2.61E-02
I-134	2.08E+02	Cm-244	1.09E-02
I-135	6.59E+02	La-140	4.75E+00
Sb-127	1.51E+01	La-141	2.45E-02
Sb-129	1.23E+01	La-142	8.65E-01
Te-127	1.60E+01	Nd-147	6.82E+00
Te-127m	2.86E+00	Pr-143	3.10E-01
Te-129	1.75E+01	Y-90	5.05E-01
Te-129m	8.15E+00	Y-91	2.74E-01
Te-131m	2.22E+01	Y-92	7.46E+00
Te-132	1.78E+02	Y-93	2.90E-01
Te-131	1.09E+01	Y-91m	9.90E+00
Rh-105	2.90E+00	Pr-144	9.65E-01
Ru-103	4.13E+00	Pr-144m	1.72E-02
Ru-105	1.55E+00		

(See Section 13.3.4.3.3 of this report.)

2. An applicant for a combined license (COL) that references this early site permit shall propose a license condition for the licensee to perform the following:

   (i) No later than eighteen (18) months before the latest date set forth in the schedule submitted in accordance with 10 CFR 52.99(a) for completing the inspections, tests, and analyses in the ITAAC, the licensee shall have performed an assessment of on-site and augmented staffing capability for response to a multi-unit event. The staffing assessment shall be performed in accordance with the latest NRC-endorsed revision of NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities."

   (ii) No later than one hundred eighty (180) days before the date scheduled for initial fuel load, as set forth in the notification submitted in accordance with 10 CFR 52.103(a), the licensee shall revise the Emergency Plan to include the following:

      a. Incorporation of corrective actions identified in the staffing assessment required by this license conditions; and

      b. Identification of how the augmented staff will be notified, given degraded communications capabilities.

(See Section 13.3.4.5.2 of this report.)

3. An applicant for a combined license (COL) that references this early site permit shall propose a license condition for the licensee to perform the following:

   (i) No later than eighteen (18) months before the latest date set forth in the schedule submitted in accordance with 10 CFR 52.99(a) for completing the inspections, tests, and analyses in the ITAAC, the licensee shall have performed an assessment of on-site and off-site communications systems and equipment relied upon during an emergency event to ensure communications capabilities can be maintained during an extended loss of AC power. The communications capabilities assessment shall be performed in accordance with the latest NRC-endorsed revision of NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities;

   (ii) No later than one hundred eighty (180) days before the date scheduled for initial fuel load set forth in the notification submitted in accordance with 10 CFR 52.103(a), the licensee shall have completed implementation of corrective actions identified in the communications capability assessment, including revisions to the Emergency Plan.

(See Section 13.3.4.5.2 of this report.)

4. An applicant for a combined license (COL) that references this early site permit shall update the emergency plan to describe on-shift personnel assigned emergency plan implementing functions associated with the chosen small modular reactor (SMR) technology and the number of proposed reactor units. In addition, the COL applicant shall propose a license condition for the licensee to perform the following**:**

(i) No later than eighteen (18) months before the latest date set forth in the schedule submitted in accordance with 10 CFR 52.99(a) for completing the inspections, tests, and analyses in the ITAAC, the licensee shall have performed a detailed staffing analysis, in accordance with the latest NRC-endorsed revision of NEI 10-05, "Assessment of On-Shift Emergency Response Organization Staffing and Capabilities;"

(ii) No later than one hundred eighty (180) days before the date schedule for initial fuel loading set forth in the notification submitted in accordance with 10 CFR 52.103(a), the licensee shall have revised the emergency plan to incorporate any changes identified in the staffing analysis that are needed to bring staffing to the required levels.

(See Section 13.3.4.5.2 of this report.)

Confirmatory Item 13.3-1

13.3-1 The Early Site Permit Application (ESPA) revisions in Enclosures 2 and 3 to TVA Letter No. CNL-18-071, April 27, 2018, regarding the withdrawal of exemption request Item No. 19 (for Section IV.F.2.f of Appendix E to 10 CFR Part 50), will be incorporated in a future ESPA revision.

(See Section 13.3.4.4.C.3.17 of this report.)