

CHAPTER 5 ENVIRONMENTAL IMPACTS OF STATION OPERATION

Chapter 5 presents the potential environmental impacts of operation of the Clinch River (CR) Small Modular Reactor (SMR) Project, which includes operation of two or more SMRs at the Clinch River Nuclear (CRN) Site.

In accordance with Title 10 of the Code of Federal Regulations (10 CFR) Part 51, impacts are analyzed, and a significance level of potential impact to each resource (i.e. SMALL, MODERATE, or LARGE) is assigned consistent with the criteria that U.S. Nuclear Regulatory Commission (NRC) established in 10 CFR Part 51, Appendix B, Table B-1, Footnote 3. Unless the impact is identified as beneficial, the impact is adverse. In the case of "SMALL," the impact may be negligible. The definitions of significance are as follows:

- SMALL** Environmental effects are not detectable or are so minor that they neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered SMALL.
- MODERATE** Environmental effects are sufficient to alter noticeably, but not to destabilize important attributes of the resource.
- LARGE** Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

This chapter is divided into 11 sections:

- Land Use Impacts (Section 5.1)
- Water-Related Impacts (Section 5.2)
- Cooling System Impacts (Section 5.3)
- Radiological Impacts of Normal Operation (Section 5.4)
- Environmental Impacts of Waste (Section 5.5)
- Transmission System Impacts (Section 5.6)
- Uranium Fuel Cycle and Transportation Impacts (Section 5.7)
- Socioeconomics Impacts (Section 5.8)
- Decommissioning Impacts (Section 5.9)
- Measures and Controls to Limit Adverse Impacts During Operation (Section 5.10)
- Cumulative Impacts Related to Station Operation (Section 5.11)

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These sections present the potential environmental impacts of operation of the CR SMR Project. Impacts are analyzed and a significance level of potential impact to each resource is assigned. In addition, this section presents ways to avoid, minimize, or mitigate adverse impacts of CR SMR Project operations.

5.1 LAND USE IMPACTS

This section describes the potential impacts on land use of operating two or more small modular reactors (SMRs) at the Clinch River Nuclear (CRN) Site. For the purposes of this Environmental Report, the CRN Site, vicinity, and region are defined in Chapter 2. Subsection 5.1.1 describes the effects on land use at the CRN Site and vicinity. Subsection 5.1.2 describes effects that could occur along transmission lines and in offsite areas resulting from operation and maintenance activities. Subsection 5.1.3 describes potential effects on historic properties at the CRN Site and in the vicinity, along transmission corridors, and at offsite areas.

5.1.1 The Site and Vicinity

Adverse impacts to land use at the CRN Site and vicinity occur primarily during construction, as documented in Section 4.1.

5.1.1.1 The Site

Land use within and adjacent to the CRN Site is discussed in Subsection 2.2.1 and Table 2.2-1. Figure 2.2-2 illustrates land use. No new areas are expected to be disturbed after the construction phase ends, and no agricultural crop production is expected to occur on the CRN Site. Therefore, operations at the CRN Site are expected to have SMALL impacts on the pasture and developed land within the CRN Site.

Prime farmland at the CRN Site is discussed in Subsection 2.2.1.1. Figure 2.2-3 shows and Table 2.2-2 lists the soil types on the CRN Site and in the site vicinity. As described in Subsection 2.2.1.1, the modern prime farmland classification of soils should be similar to the first-class (good to excellent cropland) 1942 classification. There are no first-class soils within the CRN Site or in the immediate vicinity of the Oak Ridge Reservation (ORR). Therefore, the impact of the Clinch River (CR) SMR Project on the relative value of farmland would be SMALL.

The cooling systems that are used for the operation of two or more SMRs at the CRN Site are described in Subsection 3.4.1. Heat dissipation to the atmosphere from operation of the CR SMR Project cooling towers and the effects of the cooling tower plumes and drift are discussed in Subsection 5.3.3. The impacts of the cooling tower plume salts on the CRN Site area are also discussed in Subsection 5.3.3.

Transmission lines on the CRN Site are discussed in Subsection 2.2.3 and Section 3.7. During operations, actions associated with the onsite transmission lines would consist of routine maintenance and clearing activities. Impacts associated with routine maintenance and clearing activities are addressed in Section 5.6. Overall, the impact to land use associated with operation of the transmission lines on the CRN Site would be SMALL.

5.1.1.2 The Vicinity

Land use within the vicinity of the CRN Site is discussed in Subsection 2.2.1.2. Figure 2.2-4 illustrates land use within the vicinity. The majority of land located north and east in the vicinity of the CRN Site is federal land and is part of the ORR. No offsite land is expected to be disturbed after the construction phase, and operational land-use impacts of the CR SMR Project are confined to the CRN Site. Therefore, operations at the CRN Site would have a SMALL impact on the developed land and rural farmland in the vicinity of the CRN Site.

Land use impacts associated with CR SMR Project operation that may have social and economic effects in the region are discussed in Section 5.8. Housing is discussed in Subsection 2.5.2.6 and housing impacts related to the in-migrating plant operations workforce are discussed in Subsection 5.8.2.1. The effects of the cooling tower plumes and drift associated with the CR SMR Project are discussed in Subsection 5.3.3.

The CR SMR Project is expected to generate waste that requires disposal in permitted facilities and landfills. Discussions of impacts of non-radioactive waste as well as hazardous and mixed waste on land are provided in Section 5.5.

5.1.2 Transmission Corridors and Offsite Areas

Transmission lines at the CRN Site are discussed in Subsection 2.2.3 and Section 3.7. No additional transmission lines associated with the SMR Project in offsite areas are expected to be installed during the operations phase of the CR SMR Project. The impact to land use associated with offsite transmission lines during CR SMR Project operations would be SMALL.

The road and highway system in Roane, Loudon, Anderson, and Knox counties is shown in Figure 2.5.2-1 and discussed in Subsection 2.5.2.2. Information pertaining to the effects of operations workers on the local road and highway system is presented in Subsection 5.8.2.3. The land use impact on local roadways would be SMALL.

5.1.3 Historic Properties

This subsection focuses on the potential for the CR SMR Project to affect historic properties within the CRN Site, within a 0.5-mile (mi) radius surrounding the area in which vegetation clearing would take place, at the Melton Hill Dam, and within 0.5 mi of the Melton Hill Dam. Archaeological sites and aboveground historic properties are among the properties that can be considered for listing on the National Register of Historic Places (NRHP). They are the principal historic properties of concern with regard to effects from CR SMR Project operations at the CRN Site along with traditional cultural properties. Additionally, Subsection 2.5.3, Tables 2.5.3-1 and 2.5.3-2, and Figures 2.5.3-1 and 2.5.3-2 present the site numbers, locations, and NRHP status of relevant historic properties within the 10-mi radius of the CRN Site center point, which includes the Melton Hill Dam. Direct effects from CR SMR Project operations to historic

properties are possible within the CR SMR Project area of potential effect (CR SMR Project APE). The CR SMR Project APE is described in Subsection 2.5.3.

As described in Subsection 2.5.3, no NRHP-listed properties are listed on or immediately adjacent to the CRN Site. One NRHP eligible district is located within the CR SMR Project APE. Fifty-nine recorded archaeological sites, four isolated finds, one non-site locality, and one cemetery have been identified within or immediately adjacent to the CR SMR Project APE. Of these sites, one site is considered to be eligible for the NRHP, 16 sites are considered potentially eligible (or of undetermined eligibility) for the NRHP; and 42 are considered not eligible for the NRHP. Ten of the eligible and potentially eligible sites are avoidable.

As discussed in Subsection 4.1.3, Tennessee Valley Authority (TVA) has executed a Programmatic Agreement (PA) pursuant to Title 36 of the Code of Federal Regulations 800.14(b)(3). The PA provides for modifications to the CR SMR Project APE, evaluating the NRHP eligibility of unevaluated resources (archaeological sites and historic architectural resources), evaluating project effects to resources, and resolution of adverse effects. TVA would implement the provisions of the PA in the event of any changes to the CR SMR Project. The PA provides measures to mitigate impacts to historic properties associated with operations of the CR SMR Project.

5.1.3.1 Prehistoric and Historic Archaeological Sites

The highest potential for effects to archaeological sites would occur during the construction period as described in Subsection 4.1.3. Operations at the CR MR Project would occur in areas previously disturbed by CR SMR Project construction and preconstruction activities. A final assessment of effects to archaeological sites within the CR SMR Project APE and any required mitigation are dependent on the outcome of the Phase II testing/reporting as stipulated by the PA and conducted in consultation with the State Historic Preservation Officer (SHPO) and any federally recognized Native American Tribe that attaches religious and cultural significance to the historic property. Operational effects to archaeological sites determined in consultation to be eligible for listing in the NRHP would be treated pursuant to mitigation measures developed in consultation with the consulting parties as described in Subsection 4.1.3. Because most effects to archaeological properties would be anticipated during the construction period, impacts to archaeological sites on the CRN Site in association with CR SMR Project operations would be SMALL.

With preconstruction and construction activities, there is the possibility for the inadvertent discovery of previously unknown archaeological resources or human remains. The PA describes the measures that will be implemented in the event of such discoveries. Should previously unknown archaeological resources be discovered, sites will be protected and stabilized to prevent any further disturbance. Ground-disturbing work will stop within a 50-foot radius of the discovery. TVA, in consultation with the SHPO and federally recognized Native American tribes that attach religious and cultural significance to the property affected by the undertaking, would develop and implement a discovery plan to make an informed NRHP

eligibility determination. TVA would continue to fulfill all stipulations of the PA and its obligations under Section 106. Ground-disturbing work would not resume at the previously unknown site until completion of the NRHP determination and PA signatory consultation. (Reference 5.1-1) Subsection 4.1.3.1 describes the stipulations of the PA TVA would implement in the event of a discovery of previously unknown archaeological resources.

5.1.3.2 Historic Structures

As discussed in Subsection 2.5.3.7, one eligible district, the Melton Hill Hydroelectric Project/Melton Hill Dam was identified within the CR SMR Project APE. As described in Subsection 3.4.2.5, the Plant Parameter Envelope (PPE) includes minor modification to the flow of the Clinch River in the CR SMR Project vicinity to maintain up to 400 cfs flow. As described in Subsection 4.1.3.2 such a flow modification could require changes at Melton Hill Dam. Project designs would not be proposed until a reactor design is selected and most modifications are anticipated to occur during the preconstruction and construction phase. The Melton Hill Dam (including spillway) is a contributing structure to the Melton Hill Hydroelectric Project nominated NRHD. TVA will adhere to and comply with the stipulations of the PA with respect to modifications of the Melton Hill Dam. Therefore, impacts to historic structures as a result of operation activities associated with the CR SMR Project would be SMALL to MODERATE. Implementation of the mitigation measures as stipulated in the PA would minimize the potential for LARGE impacts to historic structures.

5.1.3.3 Cemeteries

One cemetery, the Hensley Cemetery, exists on the CRN Site. As discussed in Subsection 2.5.3.9, this cemetery is not eligible for the NRHP. TVA has determined that this cemetery would remain in place onsite, TVA would maintain the cemetery grounds and access road, and families would be able to access the cemetery (Reference 5.1-2). Therefore, impacts to the Hensley Cemetery associated with CR SMR Project operations would be SMALL and beneficial resulting in greater preservation, upkeep, and access.

5.1.3.4 Traditional Cultural Properties

As discussed in Subsection 2.5.3.10, no traditional cultural properties have been identified in consultation with any federally recognized Native American tribe that attaches religious and cultural significance to an archaeological historic property, or any other interested parties on the CRN Site or within a 0.5-mi surrounding the area in which vegetation clearing would take place.

5.1.4 References

Reference 5.1-1. Tennessee Valley Authority and Tennessee State Historic Preservation Officer, "Programmatic Agreement between the Tennessee Valley Authority and the Tennessee State Historic Preservation Office regarding the management of historic properties affected by the Clinch River SMR Project," July 20, 2016.

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Reference 5.1-2. AECOM, "Final Clinch River Site Land Use and Recreation Technical Report - Revision 2," Greenville, SC, Tennessee Valley Authority, October, 2014.