5.5 ENVIRONMENTAL IMPACTS OF WASTE

The following subsections discuss the environmental impacts of nonradioactive waste from the operation of two or more small modular reactor (SMR) units at the Clinch River Nuclear (CRN) Site. Regulations for generating, managing, handling, storing, treating, protecting, and disposing of these wastes are contained in federal regulations issued and overseen by the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Environmental Protection Agency (EPA), and in Tennessee regulations overseen by the Tennessee Department of Environment and Conservation (TDEC). These regulations include the Clean Air Act, Clean Water Act, Atomic Energy Act, Resource Conservation and Recovery Act (RCRA), and others.

In NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, , Volume 1, NRC assembled several years of data from operating nuclear power stations and their effects on the environment. Station operations, and the regulatory requirements for protection of the environment, show that the impact of nonradioactive waste discharges from nuclear power operations is considered to be SMALL.

5.5.1 Nonradioactive-Waste-System Impacts

Descriptions of the SMR nonradioactive waste systems and chemical parameters are presented in Section 3.6. Nonradioactive wastes are managed in accordance with applicable federal, state, and local laws, regulations, and permit requirements, as well as Tennessee Valley Authority (TVA) Procedures. TVA expects to construct and operate a permanent onsite landfill for construction, site clearing, and grading debris. The construction/demolition landfill would be sized to accommodate the anticipated materials and would be located in the permanently cleared laydown area north of the main plant area. The landfill would be constructed in accordance with all relevant permit and licenses. No hazardous or municipal waste would be disposed of in this landfill. The landfill would be closed at the end of the construction period. The assessment of potential impacts resulting from the discharge of nonradioactive wastes is presented in the following subsections.

5.5.1.1 Impacts of Discharges to Water

Nonradioactive wastewater discharges to surface water from the facility are described in Subsection 3.6.3.2. Wastewater discharges include cooling tower blowdown; wastewater from the demineralized water system; wastewater from floor drains, sinks, and laboratories; and stormwater runoff. Additional aqueous waste streams may include raw cooling water, air conditioning condensate, steam generator blowdown, and high pressure fire protection water.

Chemicals such as biocides and corrosion inhibitors are used to treat intake or process waters. The quantities of chemicals to be used are determined during development of a Biocide/Corrosion Treatment Plan, which will be submitted as part of the application for a National Pollution Discharge Elimination System (NPDES) permit.

The preliminary site grading plan includes a holding pond on the western side of the CRN Site, which serves as the collection point for most process waste streams except for sanitary wastes and some stormwater discharges. The holding pond discharges to Watts Bar Reservoir through one or more diffusers located at approximately Clinch River Mile 15.5.

Wastewater discharges are regulated by the TDEC through a NPDES permit. The anticipated constituents and their concentrations in the facility's non-radioactive liquid waste discharges are provided in Table 3.6-1, and the average and maximum flow rates for the discharges are discussed in Section 3.4 and Subsection 3.6.3.2. A NPDES permit includes discharge limits established to protect receiving waters, and monitoring to ensure compliance with those limits. Temperatures and chemical concentrations for all discharges are also conditions of the NPDES permit. Biocides and chemicals used for water treatment are added to discharges in part per million concentrations and are largely consumed serving their purposes. TDEC takes the potential for these substances being in the discharge into consideration when establishing requirements for appropriate chemical parameter monitoring and acceptable limits in the NPDES permit. Therefore the impact from these discharges would be SMALL.

The CRN Site currently has a stormwater management system, designed for the Clinch River Breeder Reactor Project, consisting of stormwater runoff/collection ponds and piping. There are currently no known areas of significant erosion on the CRN Site that require controls. The existing stormwater management system would be modified, as needed, to support the CR SMR Project. Modifications may include one or more stormwater retention ponds for settling of solids, but no need has been identified for other treatment or oil/water separators. As part of the application for a NPDES permit, TVA is required to submit a Notice of Intent for Construction Activity Stormwater Discharges and an associated Stormwater Pollution Prevention Plan (SWPPP) to the TDEC. The NPDES permit will be obtained before any construction activities take place. Stormwater discharges are managed in accordance with a SWPPP during construction. Permanent stormwater management systems are designed and constructed to support operations and a NPDES permit requires monitoring of the discharges during operations. Therefore, impacts from stormwater discharge would be SMALL.

In conclusion, because engineering controls which prevent or minimize the release of harmful effluents would be used, and effluent concentrations would be maintained at levels below permitted limits established to be protective of water quality and aquatic life, potential impacts of discharges to water would be SMALL.

5.5.1.2 Impacts of Discharges to Land

Nonradioactive solid waste expected to be generated from the facility are described in Subsection 3.6.3.3. TVA maintains multiple procedures related to the management of non-radioactive solid waste, including used oil wastes, hazardous wastes, non-hazardous solid wastes, construction and demolition wastes (including spoils), and Universal Wastes (lamps, batteries, and pesticides). Nonradioactive solid wastes are disposed using a TVA-approved vendor. TVA complies with applicable federal, state, and local requirements and standards for handling, transporting, and disposing of solid waste. These include the 1976 RCRA, which amended the 1965 Solid Waste Disposal Act. TVA expects to construct and operate an onsite landfill for construction, site clearing, and grading debris. The construction/demolition landfill would be sized to accommodate the anticipated materials and would be located in the permanently cleared laydown area north of the main plant area. The landfill would be constructed in accordance with all relevant permits and licenses. Therefore, potential impacts from land disposal of nonradioactive wastes would be SMALL.

5.5.1.3 Impacts of Discharges to Air

As described in Subsection 2.7.2, Roane County is considered in attainment with the National Ambient Air Quality Standards, except that the county is a partial nonattainment area for particulate matter with a diameter less than 2.5 microns ($PM_{2.5}$) (part of the Knoxville-Sevierville- La Follette, Tennessee 2006 nonattainment area and part of Knoxville 1997 $PM_{2.5}$ nonattainment area). The CRN Site, however, does not lie within the partial nonattainment area for $PM_{2.5}$ in Roane County. Thus the CRN Site is considered in attainment with the air quality standards for all criteria pollutants. The CRN Site is located near the boundaries of Roane County with Knox and Loudon Counties. Knox and Loudon counties, in their entirety, are also within the Knoxville- Sevierville- La Follette, Tennessee $PM_{2.5}$ 2006 nonattainment area and within the Knoxville, Tennessee 1997 $PM_{2.5}$ nonattainment area. (Reference 5.5-1) TVA will consult with TDEC regarding the need for a TDEC Title V Operating Permit under the Clean Air Act following selection of the reactor design.

Nonradioactive gaseous effluents expected to be generated from the facility are described in Subsection 3.6.3.1. Operation of the nuclear power units increase gaseous and particulate emissions to the air by a small amount, primarily from equipment associated with the cooling towers and facility auxiliary systems. The primary sources of emissions from auxiliary systems are auxiliary boilers (Table 3.6-2), diesel generators (Table 3.6-3), and gas turbine generators (Table 3.6-4). The auxiliary boilers are used for heating the facility buildings, primarily during the winter months, and for process steam during reactor startups. The diesel generators/gas turbines and engine driven emergency equipment are used intermittently and for brief durations. Cooling tower impacts on terrestrial ecosystems are discussed in Subsection 5.3.3.2.

Air emission sources associated with the SMR units would be managed in accordance with federal, state, and local air quality control laws and regulations. Accordingly, air quality impacts from operation of the CR SMR Project would be SMALL for the surrounding communities and the nearest residents.

5.5.1.4 Sanitary Waste

During construction and operation, the facility will discharge sanitary wastewaters to the City of Oak Ridge Public Works Department. The projected effluent flow of an average of 50 gallons per minute (gpm) from the facility’s potable/sanitary water system to the City of Oak Ridge sanitary treatment system is included in Table 3.1-2, Item 5.1.1. This equates to an average daily flow of 72,000 gallons per day (gpd). The maximum flow rate, included in Table 3.1-2, Item 5.1.2, is estimated to be 100 gpm, or a maximum daily flow of 144,000 gpd. The maximum flow rate represents a small proportion (approximately 2.6 percent) of the 5.6 million gallon per day capacity of the City of Oak Ridge sanitary treatment system (Reference 5.5-2). Potential impacts associated with disposal of sanitary waste from operation of the SMR would be SMALL.

5.5.2 Hazardous and Mixed Waste Impacts

It is anticipated that the facility would be a Small Quantity Generator of Hazardous Wastes. These wastes are disposed using a TVA-approved vendor. TVA maintains procedures for management of hazardous and mixed waste at their facilities.

The term "mixed waste" refers specifically to waste that contains both hazardous waste and source, special nuclear, or byproduct material. Because radioactive materials at nuclear power facilities are regulated by NRC and hazardous wastes are regulated by EPA, nuclear power facilities managing mixed waste must meet the requirements of both regulatory agencies. The radioactive component of mixed waste must satisfy the definition of low-level waste in the Low-Level Radioactive Waste Policy Amendments Act of 1985. The hazardous component must exhibit at least one of the hazardous waste characteristics identified in Title 40 of the Code of Federal Regulation (40 CFR) 261, Subpart C, or be listed as a hazardous waste under 40 CFR 261, Subpart D.

Additionally, entities that generate, treat, store, or dispose of mixed wastes are subject to the requirements of the Atomic Energy Act, the Solid Waste Disposal Act of 1965, as amended by the RCRA in 1976, and the Hazardous and Solid Waste Amendments, which amended RCRA in 1984. In the State of Tennessee, the EPA has authorized the state to regulate those portions of the Federal act under RCRA.

5.5.2.1 Plant Systems Producing Hazardous and Mixed Waste

Nuclear power facilities typically do not generate large volumes of hazardous or mixed waste due to industry-wide, ongoing efforts to reduce mixed-waste generation. A 1990 survey conducted by NRC identified the types of hazardous and potentially mixed low-level waste listed below as common to reactor facilities (NUREG-1437, Rev. 0). The types of hazardous and potentially mixed waste that would be generated by the reactor selected for the CRN Site is expected to be consistent with the types identified by the survey. Types of hazardous or mixed waste may include:

- Waste oil from pumps and other equipment
- Chlorinated fluorocarbons resulting from cleaning, refrigeration, degreasing, and decontamination activities
- Organic solvents, reagents, compounds, and associated materials such as rags and wipes
- Metals such as lead from shielding applications and chromium from solutions and acids

- Metal-contaminated organic sludge and other chemicals
- Aqueous corrosives consisting of organic and inorganic acids

5.5.2.2 Hazardous and Mixed Waste Storage and Disposal

Specific hazardous and mixed waste management practices, treatment methods, and storage areas have not been established for the CRN Site. However, industry standard and regulatory compliant hazardous chemical control and radiological control measures would be applied during testing, handling, and storage (accumulation area) of hazardous and mixed wastes. In accordance with hazardous material management regulations in 40 CFR 261 and 265, onsite storage of hazardous and mixed wastes are limited. Therefore, hazardous and mixed wastes would be shipped offsite for treatment or disposal after a short accumulation period.

Examples of best management practices (BMPs) for hazardous and mixed waste storage and disposal include:

- Development of an emergency response plan
- Segregation of hazardous and mixed wastes from nonhazardous wastes
- Securing waste accumulations areas
- Posting accumulation areas with signs containing language similar to the following: “MIXED/ HAZARDOUS WASTE AREA” and “DANGER-UNAUTHORIZED PERSONNEL-KEEP OUT”
- Use of secondary containment and the presence of spill kits for liquid hazardous and mixed waste storage
- Compliant container labeling
- Routine inspections of waste accumulation areas

5.5.2.3 Waste Minimization Plan

Pursuant to the regulations cited in Subsection 5.5.2 regarding hazardous and mixed waste management, TVA develops and implements Waste Minimization Plans for nuclear power facilities. The following industry BMPs are elements of the Waste Minimization Plan:

- Inventory identification and control that utilizes a tracking system to manage waste generation data and waste minimization opportunities
- Work planning to reduce mixed waste generation (An example of work planning is pre-task planning to determine what materials and equipment are needed to perform the anticipated work.)
- Mixed waste reduction, recycling, and reuse methods that maximize opportunities for reclamation and reuse of waste materials are used whenever feasible

- Training and education of employees on the principles and benefits of the waste minimization

5.5.2.4 Environmental Impacts of Hazardous and Mixed Waste

The development and implementation of hazardous and mixed waste management BMPs and the Waste Minimization Plan as described above in Subsections 5.5.2.2 and 5.5.2.3 would ensure that generation of hazardous and mixed wastes is minimized by the SMR units at the CRN Site. Due to the project small volume of hazardous and mixed waste, no significant emissions or releases of hazardous materials are expected as a result of mixed waste management practices. Therefore, environmental impacts of hazardous and mixed waste would be SMALL.

5.5.3 References

Reference 5.5-1. U.S. Environmental Protection Agency, Nonattainment Status for Each County by Year for Tennessee, Website: http://www.epa.gov/oaqps001/greenbk/anay_tn.html, December 5, 2013.

Reference 5.5-2. City of Oak Ridge, Welcome to the City of Oak Ridge, Tennessee, Website: http://www.oakridgetn.gov/department/PublicWorks/Divisions/Wastewater-Treatment, 2015.