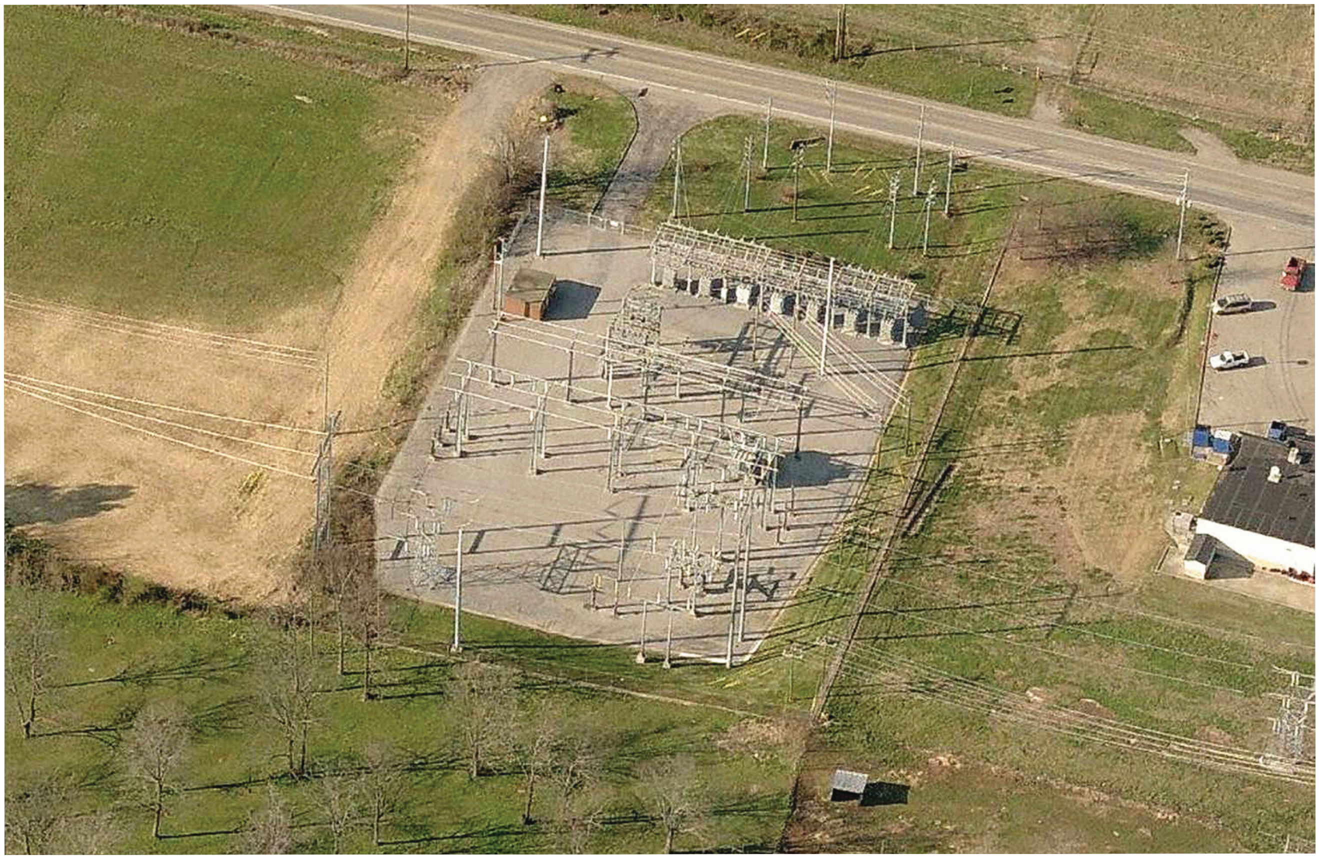
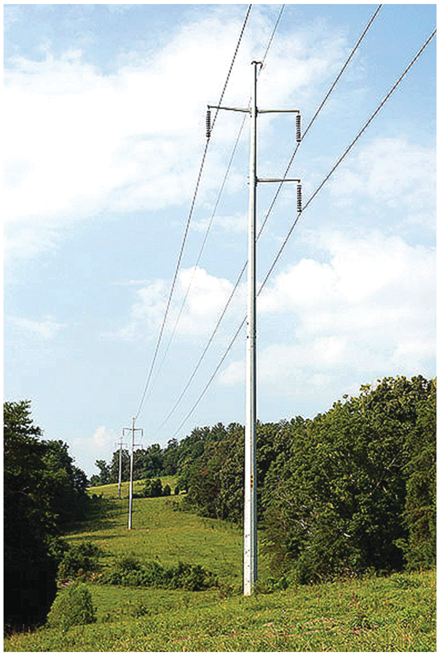


Figure 3.7-4. Typical TVA 161 kV Switchyard

Figure 3.7-5. Typical TVA 500 kV Structure



Single-Pole
161 kV Transmission Structure

Double-Pole Single-Circuit
161 kV Transmission
H-frame Structure

Figure 3.7-6. Typical TVA 161 kV Transmission Structures

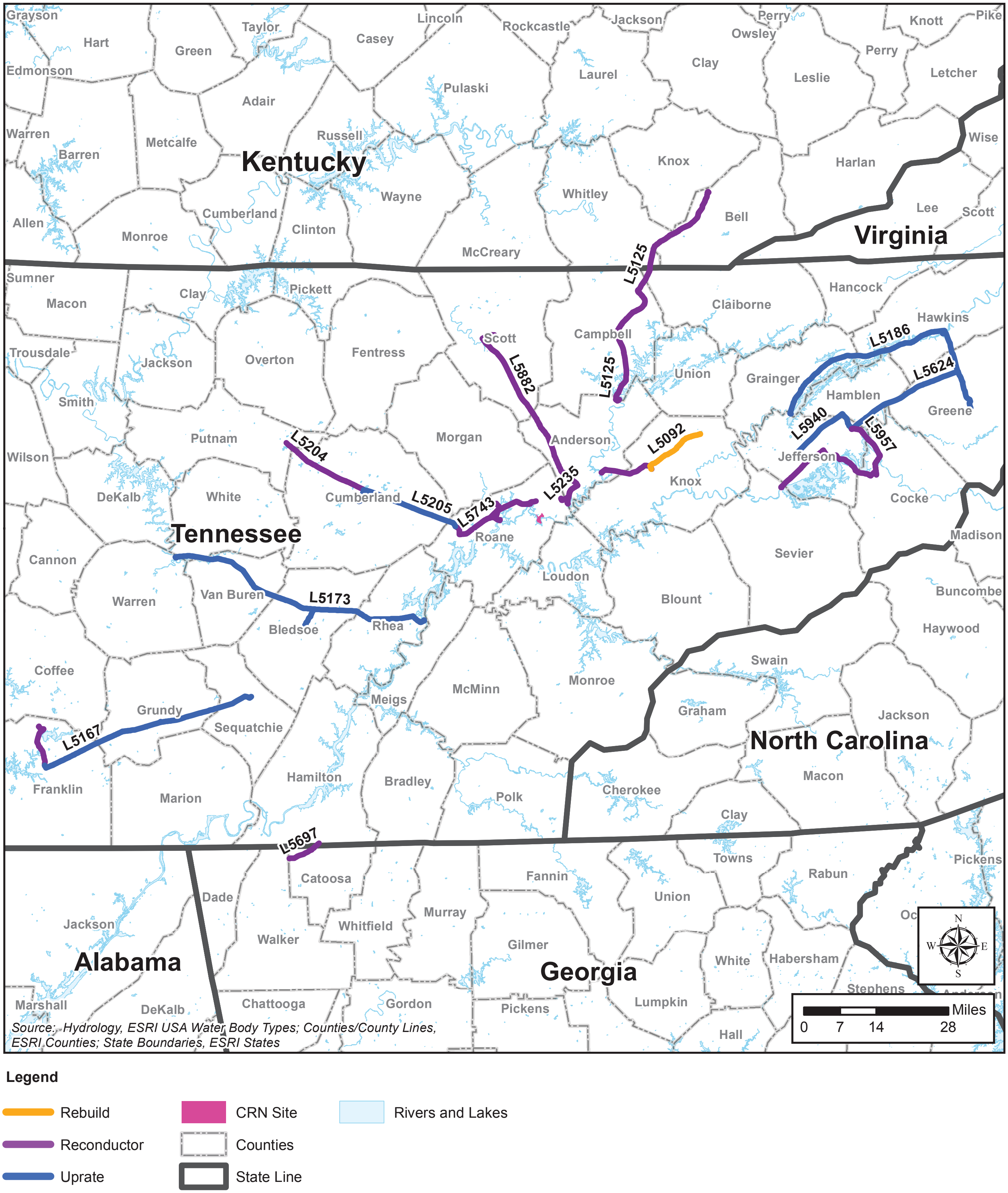


Figure 3.7-7. Transmission Line Segments Requiring Upgrades

3.8 TRANSPORTATION OF RADIOACTIVE MATERIALS

Operation of two or more small modular reactors (SMRs) at the Clinch River Nuclear (CRN) Site, as described by the plant parameter envelope in Table 3.1-2, requires transportation of unirradiated fuel, irradiated fuel (spent nuclear fuel), and radioactive waste. The following subsections describe transportation of these three types of radioactive materials. Subsection 5.7.2 addresses the conditions in subparagraphs under Title 10 of the Code of Federal Regulations (10 CFR) 51.52(a)(1) through (5) and the environmental impact of transportation of fuel and waste to and from the reactor as set forth in 10 CFR 51.52 (c) Table S-4. Section 7.4 addresses radiological transportation accidents.

3.8.1 Transportation of Unirradiated Fuel

Transportation of new fuel assemblies to the CRN Site from a fuel fabrication facility is to be in accordance with U.S. Department of Transportation (DOT) and U.S. Nuclear Regulatory Commission (NRC) regulations. Based on the current bounding case for SMRs at the CRN Site, the initial fuel load may require up to 96 assemblies per unit for the new facility. As provided in Table 3.1-2, Item 18.0.4, refueling is expected to be performed every 2 years (yr) and requires up to 96 fuel assemblies.

The fuel assemblies described in Table 3.1-2, Item 18.0.2 are fabricated at a fuel fabrication plant and shipped by truck to the CRN Site before fuel load. The details of the container designs, shipping procedures, and transportation routes are to be in accordance with DOT (49 CFR 173 and 178) and NRC (10 CFR 71) regulations and depend on the requirements of the suppliers providing the fuel fabrication services. Each truck shipment is to comply with federal and state gross vehicle weight restrictions.

3.8.2 Transportation of Irradiated Fuel

Following fuel burn as described in Table 3.1-2, Item 18.0.4, spent fuel assemblies are to be discharged every 2 yr per unit. Spent fuel assemblies are to remain in the spent fuel pool at each unit for at least 5 yr while short half-life isotopes decay, as required in 10 CFR 961, Appendix E. As provided in Table 3.1-2, Item 18.0.4, each unit is to have a spent fuel pool with capacity for a minimum of 6 yr of fuel discharges. After a minimum 5-year decay period, the fuel is to be removed from the pool and packaged in casks for storage onsite at an independent spent fuel storage installation and may be transported offsite. Uncertainty remains as to the availability of the U.S. Department of Energy (DOE) repository for permanent storage or regional spent fuel storage, including where such facilities would be sited and when the facilities would be in operation. Section 7.4 describes assumptions on transportation distances for irradiated fuel for the use of transportation accident analyses.

Packaging of the fuel for offsite shipment is to comply with applicable DOT (49 CFR 173 and 178) and NRC (10 CFR 71) regulations for transportation of radioactive material. As required by the Nuclear Waste Policy Act of 1982, Section 302, the DOE is responsible for spent fuel

transportation from reactor sites to a repository and makes the decision on transport mode. Classification of the irradiated fuel prior to delivery to DOE is to meet the regulation in 10 CFR 961, Standard Contract for Disposal of Spent Nuclear Fuel and/or High-level Radioactive Waste.

3.8.3 Transportation of Radioactive Waste

Solid low-level waste is to be the only type of radioactive waste transported offsite in accordance with 10 CFR 51.52(a)(4). Low-level radioactive waste is to be packaged onsite for transportation to a licensed radioactive waste processor or a licensed low-level radioactive waste disposal facility. Packaging of waste for offsite shipment is to comply with applicable DOT (49 CFR 173 and 178) and NRC (10 CFR 71) regulations for transportation of radioactive material. The packaged waste is to be stored onsite on an interim basis before being shipped offsite to a licensed processing or disposal facility. No long-term storage of solid radiological waste onsite is anticipated. However, the design includes plans for a facility for temporary storage of solid radiological waste to be constructed to house solid radiological waste for up to one year until it is shipped offsite. As provided in Table 3.1-2, Item 11.2.3, the anticipated volume of solid radioactive wastes generated during routine plant operations is 5000 cubic feet per year per unit. Radioactive waste is to be shipped offsite by truck.

3.9 CONSTRUCTION ACTIVITIES

This section provides a conceptual description of preconstruction and construction activities for the deployment of two or more small modular reactors (SMRs) at the Clinch River Nuclear (CRN) Site. Preconstruction activities, which may include site exploration, preparing the CRN Site for construction of the SMRs, excavation, and other activities described in Title 10 of the Code of Federal Regulations (10 CFR) 50.10(a)(2), are not related to nuclear safety and are generally more site-wide in scope. Conversely, construction activities are more likely to be unit-specific and include activities associated with safety-related structures, systems, and components (SSCs), certain fire- and security-related SSCs, and other activities as described in 10 CFR 50.10(a)(1).

SMRs would be manufactured in factories, with large, fabricated components shipped to the facility site. Therefore, less onsite construction is required for installation of SMRs than for installation of a typical commercial reactor. In most SMR designs, the reactor containment vessel is underground and features advanced passive safety systems. Because an SMR design has not yet been selected, a plant parameter envelope (PPE) has been developed for use in evaluating potential environmental impacts. The PPE is described in Section 3.1. The number of units varies based upon the SMR design selected; therefore, the arrangement of the units on the CRN Site is provided as a part of the combined license application (COLA) submittal for the selected design. The basic layout of the CRN Site is provided in Figure 3.1-2.

Development of the facility would be conducted in two stages: (1) preconstruction site preparation activities and (2) construction activities (as described above). Upon receipt of necessary approvals but before receipt of the combined license (COL), preconstruction activities would be initiated at the CRN Site including, for example, initial site excavation and rough grading; installation of temporary facilities; and construction of support facilities, service facilities, utilities, barge unloading area, cooling water pipelines, road improvements, and other nonsafety-related structures, systems, and components. Prior to initiation of preconstruction activities, the necessary permissions, permits, and licenses would be obtained. After receipt of the COL, the construction activities described in 10 CFR 50.10(a)(1) would begin, including placement of safety-related concrete and the in-place erection of the steel containment vessels.

3.9.1 Construction Schedule

The early site permit application (ESPA) for the CRN Site is designed to bound multiple SMR designs with varying numbers of units. The schedule used for the ESPA is based on a sequential construction and operation timeline of the first unit to the last unit. Construction of two twin-pack BWXT mPower plants (four units) was used as the basis for development of the schedule used in this section, because the BWXT mPower design and construction plans were the most developed at the time the schedule was prepared. Table 3.9-1 summarizes the projected major milestones for the preconstruction activities, construction, startup, and operations. The milestones are based on key transition periods from a workforce planning standpoint, when staffing is increased or decreased or the composition of the workforce

changes. The projected start date for preconstruction (site preparation) activities is July 2020, which is 12 months prior to the start of initial construction of the selected SMR design in July 2021. Safety-related construction is projected to occur over a five-year period, through fuel load of the last unit in July 2026. Tennessee Valley Authority (TVA) assumes that construction starts on the last unit 21 months after the start of construction of the first unit.

3.9.2 Preconstruction Activities

Preconstruction and site preparation activities would commence upon receipt of the necessary permissions, permits, licenses, and other regulatory approvals. Activities not constituting construction as defined in 10 CFR 50.10(a)(1) are permissible before receipt of a COL.

3.9.2.1 Clearing, Grubbing, and Spoils Management

Initial excavation and grading activities at the CRN Site include clearing, grubbing, and spoils management. Clearing and grubbing would be performed sparingly, with trees being removed to the minimum extent required. Appropriate, approved techniques would be utilized for clearing trees, scrub, and brush. Disposal of organic materials would be through approved local and state waste disposal techniques, and in compliance with TVA procedures.

Temporary spoils areas would be established on the CRN Site to manage materials from clearing, grubbing, and excavation activities at the CRN Site. TVA anticipates that initial grading of the CRN Site would produce cut and fill quantities that are close to being balanced. Therefore, removal of excavated material from the CRN Site is not anticipated. As described in Subsection 2.2.3, TVA anticipates using fill material obtained from currently operating offsite borrow pits. Drainage control measures for the spoils piles may include berms, riprap, sedimentation filters, and detention ponds to control stormwater runoff before its release to the Clinch River arm of the Watts Bar Reservoir or surrounding property.

3.9.2.2 Connection to Existing Power Transmission Corridor

As described in Subsection 3.7.3, preconstruction activities may include construction of a 500-kilovolt (kV) switchyard and a 161-kV switchyard on the CRN Site, relocation of a portion of the Kingston FP-Fort Loudon HP#1 161- kV transmission line within the CRN Site, uprating of existing 161-kV transmission lines, and installation of a 69-kV underground transmission line along the existing Watts Bar NP - Bull Run FP 500-kV corridor which crosses CRN Site and ties into the Bethel Valley substation.

Construction of the replacement 161-kV transmission line/corridor requires clearing and the installation of new towers and lines. Transition to the replacement line can be accomplished without interruption of service. The proposed 69-kV transmission line would be buried within the right-of-way (ROW) of the existing Watts Bar NP - Bull Run FP 500-kV transmission line.

3.9.2.3 Access Road

Site preparation activities include installation of road improvements both onsite and offsite. Road improvements include the proper foundation work, runoff control, and drainage management, including replacement of the Grassy Creek culvert.

Construction traffic is expected to access the CRN Site via Oak Ridge Turnpike (Tennessee State Highway [TN] 58) and Bear Creek Road. Offsite road improvements are anticipated to include work on TN 58, the exit from TN 58 onto Bear Creek Road, Bear Creek Road, and TN 95. Offsite road improvements may include road widening, turn lane additions, and traffic signal additions, as described in Subsection 4.4.2.3. (Reference 3.9-1)

The existing Bear Creek Road and the site access road would be upgraded to serve as a haul route for heavy loads. A shown in Figure 3.1-1, the proposed route starts at the rail delivery area northwest of the CRN Site, passes the barge unloading area, and extends generally southwest onto the CRN Site. Five acres of permanent heavy haul route are anticipated for normal operations and refueling at the CRN Site, as presented in Table 3.1-2, Item 15.1.1.

3.9.2.4 Rail Siding and Barge Facility Improvements

TVA anticipates that the majority of module and component deliveries would be over road and rail. TVA anticipates utilizing the EnergySolutions Heritage Railroad rail siding near the CRN Site for deliveries. The refurbishment of this rail siding is addressed in the U.S. Department of Energy's (DOE) *Environmental Assessment, Transfer of Land and Facilities Within the East Tennessee Technology Park and Surrounding Area, Oak Ridge, Tennessee (DOE/EA-1640)* (Reference 3.9-2).

TVA also anticipates making improvements to the inactive DOE former K-1251 Barge Loading Area near Bear Creek Road between TN 58 and the CRN Site entrance for deliveries.

3.9.2.5 Preconstruction Security

Preconstruction security programs and features would be implemented as part of site preparation activities at the CRN Site. Security structures include features such as access control points and security stations. Temporary security measures are also used. (Details of the security plan for safety-related construction activities at the CRN Site is to be provided at COLA.)

3.9.2.6 Temporary Construction Utilities

Temporary utilities to support the construction site and associated activities would be installed during preconstruction at the CRN Site. Temporary utilities include aboveground and belowground infrastructure for power, lighting, communications, waste treatment facilities, fire protection, and construction gases and air systems. Construction areas supported by the utilities

include construction offices, warehouses, storage areas, laydown areas, fabrication shops, maintenance shops, the concrete batch plant, test and calibration labs, and the power block.

3.9.2.7 Temporary Construction Facilities

The parking lot, laydown, storage and fabrication areas, and the road system to accommodate construction traffic would be cleared, grubbed, and graded and appropriately surfaced. Construction facilities, including offices, warehouses, workshops, sanitary facilities, locker rooms, training facilities, storage facilities, and access facilities, would be installed and/or constructed.

The site of the concrete batch plant would be prepared for cement and aggregate unloading and storage and cement storage silos and the concrete batch plant erected. Dry material storage facilities use dust control measures as necessary to meet the requirements of the applicable permits and guidelines.

Preparation for the installation of construction facilities includes activities such as:

- Conducting property surveys to establish local coordinates and the placement of benchmarks for horizontal and vertical control
- Grading, stabilizing, and surfacing laydown areas
- Installing construction fencing
- Installing concrete work slabs for formwork laydown and module assembly
- Installing equipment maintenance and parking areas
- Installing fuel and lubricant storage areas
- Installing concrete foundations and pads for cranes and crane assembly

3.9.2.8 Power Block Earthwork (Excavation)

Excavation activities for the power block(s) occur in conjunction with site preparation activities. The power block footprint encompasses the nuclear and turbine island building areas, which include the following major buildings: reactor service building, radwaste building, and turbine building. The turbine and radwaste buildings are above-grade structures that require relatively minor excavations in comparison to the reactor service building, which is primarily below grade level.

Excavation requires the removal of soil and rock. Periodic blasting during the dayshift would be used to remove rock. Temporary dewatering and traditional earth retention methods including sheet piling, slurry wall, and earth/rock anchor tie-backs are used to establish the working excavation site. Drainage sumps installed at the bottom of the excavation pump surface drainage and/or accumulated groundwater to an established release point. A fence/fall

protection system incorporated into the top of the retention system serves to protect personnel above and below, and an additional system of barriers limits proximity of equipment.

3.9.2.9 Cooling Towers and Makeup Water Supply Pipelines

As described in Section 3.4, mechanical draft cooling towers would be installed to support the SMRs. Site preparation, excavation, and construction of the cooling tower systems, as described in Subsection 3.4.2, includes the following:

- The cooling tower basins, forebays, and pump houses would be constructed on structural fill.
- The circulating water system piping would be routed from the discharge of the circulating water pumps to the condenser in the turbine building and from the condenser to the cooling towers. The section of the circulating water piping beneath the condenser requires deep excavation, and the remaining sections would be installed in open excavations.
- The source water for the circulating water system would be taken from the Clinch River arm of the Watts Bar Reservoir. Make-up piping would be routed from the cooling water intake facility on the east side of the CRN Site to the cooling tower basins.
- The blowdown piping would be routed from the circulating water discharge header to the cooling water outflow on the west side of the CRN Site.

Also, as described in Subsection 3.4.2.2, the blowdown from the cooling water system would pass through a holding pond (for discharge flow mixing) on its way to the discharge on the reservoir. The configuration of the cooling towers, holding pond, and discharge structure on the CRN Site is shown in Figure 3.1-2.

3.9.2.10 Potable Water Pipelines

TVA anticipates obtaining potable water and other process water (i.e., raw water, fire water, etc.) for the CRN Site from the City of Oak Ridge Department of Public Works. The buried pipeline is expected to originate at an existing City of Oak Ridge supply line at the Bear Creek Road entrance to the CRN Site and extend onto the CRN Site and around the CR SMR Project as required.

3.9.2.11 Dredging

No dredging would be required for the project. Shoreline excavation would be required for construction of the intake structure, along a length of shoreline approximately 50 ft wide. The diffuser pipe for the discharge would be partially buried, which would also require underwater excavation. No dredging would be required for construction of the Barge/Traffic Area.

3.9.3 Construction Activities

Construction as defined in 10 CFR 50.10(a)(1) (including safety-related structures, systems, and components) may begin after receipt of the COL. The CR SMR Project is a combined set of buildings and structures with systems installed within the structures. Much of the commodity installation is anticipated to consist of prefabricated civil/structural, electrical, mechanical, and piping modules with field-installed interconnections. Power plants are typically constructed with the major mechanical and electrical equipment and piping systems installed in each respective elevation as the civil construction advances upward. Each power block consists of three major buildings, the reactor service building, radwaste building, and turbine building. Construction of these main buildings, as well as other facilities, is described below.

3.9.3.1 Reactor Service Building

The reactor service building would be constructed of steel and concrete and is anticipated to have one or more floor elevations at approximately grade level and several floor elevations below grade. It would be a combination of a reactor containment building housing steel reactor containments and an annex building. Although the details of construction may vary based on the selected SMR design, representative major activities associated with construction of a reactor service building include:

- Placing the combined basemat for the reactor containment vessels
- Erecting the reactor containment vessel modules
- Inside the reactor containment
  - Placing the walls, slabs, platforms, and reactor supports
  - Installing the reactor pressure vessels and coolant pump superstructure
  - Setting the major mechanical and electrical equipment, piping, and valves
  - Setting the reactor containment jib and bridge cranes
  - Setting the upper reactor containment roof structures
- Outside the reactor containment
  - Placing the walls, slabs, and platforms
  - Setting the major mechanical and electrical equipment, piping, and valves
  - Setting the refueling machine
  - Setting the gantry and bridge cranes
  - Setting the diesel generators

The remaining mechanical, piping, fire sprinkler system, heating/ventilation/air conditioning system, and electrical installations begin in the lower elevations and continue above grade. TVA anticipates the containment service building to have the longest construction duration.

3.9.3.2 Radwaste Building

The radwaste building houses equipment for handling, processing, and packaging liquid and solid radioactive wastes. TVA anticipates the radwaste building would have one floor at approximately grade level.

3.9.3.3 Turbine Building

TVA anticipates the turbine building would have three main floor elevations (one at grade and two above) and two additional partial floors above the upper main floor. Construction would begin with installation of the turbine generator pedestal basemat and the buried circulating water pipe, followed by installation of the turbine generator pedestal components. Then the turbine generator building is erected, followed by installation of the turbine building crane and installation and assembly of the turbine generator.

3.9.3.4 Other Facilities

Other facilities anticipated to be constructed or installed include:

- Outage support, laboratory, and medical facilities
- Meteorological tower
- Vehicle service, maintenance, and warehouse buildings
- Tunnels and pipe chases
- Fire protection storage tanks and building
- Water treatment building
- Security stations, sally ports, protected area, and delay fence
- Administration and training building
- Various yard tanks
- Bulk gas storage facilities (compressed gases such as nitrogen and hydrogen)

The common yard area construction is anticipated to occur over the full construction duration beginning at the start of site preparation. The necessary permits and authorizations would be obtained to ensure compliance with all applicable rules and regulations.

3.9.4 Construction Equipment

Approximately 2100 pieces of construction equipment are expected onsite at any one time throughout the six-year construction period, with approximately 4000 pieces of equipment onsite during the peak construction period. The types of construction equipment include such items as:

- Trucks (dump, flatbed, fuel)
- Dozers, loaders, compactors
- Forklifts
- Compressors, welders, pumps
- Generators
- Cranes

3.9.5 Construction Traffic and Scheduling

Over the course of the six-year construction period, approximately 100,000 transport and construction vehicles (tractor-trailers, dump trucks, delivery vans, etc.) are expected to enter and exit the CRN Site. Assuming day shift construction with a normal 10-hour (hr) shift, 4 days per week for 50 weeks per year, approximately 9 vehicles per hr or 90 vehicles per day would enter and leave the CRN Site. TVA anticipates peak construction/transport traffic to be 30 vehicles per hr during the 10-hr day shift (7:00 AM to 5:30 PM).

TVA anticipates the maximum number of vehicles entering and exiting the CRN Site would normally coincide with the arrival and departure of day shift construction workers, between 6:30 and 7:00 AM and 5:30 and 6:00 PM, respectively. Approximately 1777 vehicles are expected to enter and exit the CRN Site, based on the following assumptions:

- A day shift construction staff of approximately 2200 persons
- Approximately 110 operations-related arrivals and departures
- No other construction or commercial vehicle traffic during the subject times
- An average of 1.3 persons per vehicle

Although the majority of workers would be onsite during the dayshift, both night and weekend crews are anticipated. TVA anticipates some night shift construction activities occurring on either a second shift (for example, 6:00 PM to 4:30 AM) or third shift (for example, 11:00 PM to 8:30 AM). Night shift construction activities are expected to involve typical civil, electrical, and mechanical work. TVA anticipates a small number of construction workers would work weekends, tending to critical activities such as dewatering, concrete curing, and maintenance.

3.9.6 Noise

Preconstruction and construction activities at the CRN Site are expected to generate noise and vibrations from various sources, such as:

- Hand tools
- Pneumatic equipment
- Generators
- Cranes
- Pile-drivers
- Earthmoving equipment
- Blasting operations

TVA anticipates that the maximum expected sound level due to construction activities, measured at 50 ft from the noise source, is 101 decibels (dB), as presented in Table 3.1-2, Item 17.3.1. Table 3.9-2 summarizes noise levels from the types of construction equipment expected to be used during construction activities at the CRN Site. Subsection 4.4.1.1 addresses the offsite level of construction noise.

3.9.7 References

Reference 3.9-1. AECOM, "Clinch River Site Traffic Assessment, Final Technical Report, Revision 0," Tennessee Valley Authority, March, 2015.

Reference 3.9-2. U.S. Department of Energy, "Environmental Assessment - Transfer of Land and Facilities with the East Tennessee Technology Park and Surrounding Area, Oak Ridge, Tennessee," Oak Ridge, TN, October, 2011.

Reference 3.9-3. Golden, J., R.P Ouelette, S.Saari, and P.N Cheremisinoff, Environmental Impact Data Book, Chapter 8: Noise, Table 8.3 Noise Sources dBA, 1st, Ann Arbor Science, Ann Arbor, Michigan, p.507-509, 1979.

Table 3.9-1
Projected Schedule for Construction and Operation of Two or More SMR Units at the CRN Site

Milestone	1st Unit	Last Unit
Site Preparation	7/1/2020	7/1/2020
NRC Issues COL	5/1/2021	5/1/2021
Plant Construction Starts	7/1/2021	4/1/2023
Preoperational Testing Begins	11/1/2023	7/1/2025
Construction Complete	9/1/2024	4/1/2026
Fuel Load	12/1/2024	7/1/2026
Startup Testing Begins	1/1/2025	12/1/2026
Commence Operation	1/1/2026	5/1/2027

Table 3.9-2
Peak and Attenuated Noise Levels
Expected from Operation of Construction Equipment

Source	Noise Level				
		Distance from Source			
	(peak)	50 ft	100 ft	200 ft	400 ft
Heavy trucks	95	84–89	78–83	72–77	66–71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80–89	74–82	68–77	60–71
Dozer	107	87–102	81–96	75–90	69–84
Generator	96	76	70	64	58
Crane	104	75–88	69–82	63–76	55–70
Loader	104	73–86	67–80	61–74	55–68
Grader	108	88–91	82–85	76–79	70–73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Forklift	100	95	89	83	77

Note: Noise levels expressed in dBA - decibel (A-weighted sound pressure level)

Source: (Reference 3.9-3)

3.10 WORKFORCE CHARACTERIZATION

This section provides a description of the workforce required to construct and operate the Clinch River (CR) Small Modular Reactor (SMR) Project at the Clinch River Nuclear (CRN) Site. As presented in Section 3.9, the development of two or more SMRs at the CRN Site is conducted in two stages: (1) preconstruction site preparation activities that are not safety related and (2) construction activities that include safety related structures, systems, and components.

The estimated construction and operations workforce, and their anticipated relocation and commuting patterns, are described in the following subsections. As shown in Table 3.9-1, the overall construction schedule duration from the start of preconstruction and site preparation activities until initiation of fuel load of the last unit is projected to be 72 months.

3.10.1 Construction Workforce Characterization

A construction workforce consists of two components: field craft labor and field non-manual labor. Field craft labor, including civil, mechanical/piping, electrical, and support personnel, is the largest component of the construction workforce. It represents approximately 77 percent of the field workforce in conventional pressurized water reactor nuclear facility construction. Field craft labor is used during the construction and startup of the SMRs. Field non-manual labor makes up the balance of the construction workforce, or approximately 23 percent, with the assumption that design engineering is performed offsite. The field non-manual labor includes field management, field supervision, field engineers, quality assurance/quality control, environmental/safety and health, and administrative/clerical staff.

Table 3.10-1 illustrates the representative percentage for each labor category within the field craft and field non-manual labor workforce components for construction activities. The skill set makeup is representative of typical nuclear power facility construction.

3.10.1.1 Preconstruction Activities Workforce

As described in Section 3.9, preconstruction activities include site preparation activities, which are assumed to start 12 months before the start of safety-related construction for the initial unit(s). The onsite peak workforce for the site preparation and excavation activity is estimated to be approximately 400 personnel. Table 3.10-2 and Figure 3.10-1 summarize the workforce personnel requirements by month for preconstruction activities, months 1 through 12.

3.10.1.2 Construction Activities Workforce

The SMR design facilitates a modular construction approach, and erection of multiple units at a time. The amount of modularization depends on the characteristics of the site, transportation route restrictions, and transport methods. Modularization shifts some of the typically onsite work (and workforce) to another offsite location for the prefabrication, thereby decreasing the required onsite construction staff. The construction duration and estimated onsite workforce presented assumes offsite fabrication with onsite module assembly and erection.

Per the construction schedule presented in Section 3.9, the total onsite construction workforce assumes an estimated 22 million construction hours and approximately 4.5 million operations hours during the construction schedule based on a sequential construction and operation timeline from the first unit to the last unit. Construction of the safety-related portion of the facility is estimated to require approximately 65 percent of the total estimated construction labor hours. Operations hours associated with safety-related structures, systems and components during the same period are estimated to be in the same range (that is, approximately 65 percent of the total estimated hours through commencement of commercial operation of the last unit).

It is assumed that a 10 hour (hr) per day, Monday through Thursday, four day work week is used throughout the construction period. It is assumed that approximately two-thirds of the construction workforce works the day shift, from 7:00 AM to 5:30 PM; and that the remaining one-third of the construction workforce works either a second shift (6:00 PM to 4:30 AM) or third shift (11:00 PM to 8:30 AM). A small number of construction workers are assumed to work weekends, tending to critical activities such as dewatering, concrete curing, maintenance, etc. It is assumed that construction personnel commute to and from the CRN Site, and that staggered shift periods are not implemented. However, it is also assumed that no other construction or commercial vehicle traffic is scheduled during the peak arrival and departure times of dayshift construction personnel; that is, between 6:30 and 7:00 AM and 5:30 and 6:00 PM, respectively.

The peak phase of construction is estimated to occur during the fourth year of a projected six-year construction schedule (that is, from beginning of site preparation until fuel load of the last unit). During that period, the maximum construction workforce onsite at any one time is estimated to be 2200, as presented in Table 3.1-2, Item 17.4.1. However, the maximum number of construction personnel onsite during a 24-hr period is estimated to be 3300, due to the potential use of multiple shifts. Table 3.10-2 provides the estimated temporal distribution of the construction workforce monthly, quarterly, and annually, and Figure 3.10-1 summarizes the approximate workforce requirements by month.

In addition to the onsite construction activities, there are associated offsite construction activities, such as access road improvements (to the Tennessee State Highway 58 ramp and Bear Creek Road), construction of a 69-kilovolt (kV) underground transmission line following an existing 500 kV Watts Bar NP – Bull Run FP line which crosses CRN Site and ties into the Bethel Valley substation, improvements to a barge loading area and offsite borrow locations. The estimated workforce for these construction activities is not known, and is not included in this workforce evaluation.

3.10.2 Construction Worker Relocation and Commuting

Several assumptions are used to bound the construction workforce composition with respect to workforce commuting and relocation. It is assumed that construction workers typically commute up to a maximum of 50 miles (mi) to the jobsite, therefore, individuals living within a 50-mi radius of the project site are considered “local”. The largest cities within 50 mi of the CRN Site are Knoxville, Oak Ridge, and Maryville, Tennessee, with 2010 populations of 178,874; 29,330; and

27,465, respectively (Reference 3.10-1). It is assumed that 80 percent of the field craft labor workforce is available to the project from within a 50-mi radius, or approximately 2033 local craft personnel (based on a peak construction personnel workforce number of 3300 and 77 percent field craft labor). The balance of the construction craft workforce (508 personnel) comes from outside the 50-mi radius. These personnel are assumed to relocate within the 50-mi area to minimize their commute distance and seek temporary housing.

It is further assumed that 80 percent of the field non-manual labor workforce (based on 23 percent field non-manual labor) or 607 personnel relocate from outside the 50-mi radius, and seek permanent housing. The balance of the field non manual labor staff or 152 personnel are assumed to come from the local labor market within the 50-mi area, and commute.

3.10.3 Operations Workforce

The total facility operations workforce is estimated to be 500, as presented in Table 3.1-2, Item 16.3.1. It is estimated that 50 percent of the operations workforce is recruited and trained from the Oak Ridge/Knoxville area, and 50 percent relocate to the Oak Ridge/Knoxville area from outside the 50-mi radius.

It is assumed that operations staffing begins as site preparation begins to allow time for simulator training and startup testing support and increases to the full complement of personnel at the time of the initial unit(s) operation, and continue staffing to ensure a full complement of operations personnel at the time of the additional unit(s) operation.

3.10.4 References

Reference 3.10-1. U.S. Department of Commerce, Tennessee: 2010 Population and Housing Unit Counts - Table 10. Rank by 2010 Population and Housing Units: 2000 and 2010, Website: http://www.census.gov/prod/cen2010/cph-2-44.pdf, September, 2012.

Table 3.10-1
Estimated Percent of Onsite Construction Labor Force by Category

Labor Category	Installation Items/Responsibility	Estimated Percent of Total Workforce
Civil/Architectural Workforce	Earthwork, Yard Pipe, Piling, Concrete and Reinforcing Steel, Rigging, Structural/Miscellaneous Steel, Fire Proofing, Insulation, Coatings/Painting	25
Mechanical/Piping Workforce	NSSS, Turbine Generator, Condenser, Cooling Towers, Process Equipment, HVAC, Piping, Tubing, Valves, Hangers/Supports	24
Electrical Workforce	Electrical Equipment, Cable Tray, Conduit, Supports, Cable & Wire, Connections and Terminations	14
Site Support Workforce	Scaffolding, Equipment Operation, Transport, Cleaning, Maintenance, etc.	14
Non-manual Workforce	Management, Supervision, Field Engineering, Quality Assurance/Quality Control, Environmental/Safety and Health, Administration, and Startup	23

Notes:
NSSS – nuclear steam supply system
HVAC – heating, ventilation, air conditioning

Table 3.10-2 (Sheet 1 of 2)
Estimated Construction Workforce for a Projected Six-Year Construction Schedule
(From Beginning of Site Preparation until Fuel Load of the Last Unit)

Month	Estimated Workforce	Approximate Quarterly Average	Approximate Annual Average
1	100	125	250
2	125		
3	150		
4	175	200	
5	200		
6	225		
7	250	275	
8	275		
9	300		
10	325	350	
11	350		
12	400		
13	500	600	1100
14	600		
15	700		
16	800	900	
17	900		
18	1000		
19	1100	1250	
20	1200		
21	1400		
22	1525	1650	
23	1650		
24	1775		
25	1900	2025	2450
26	2025		
27	2150		
28	2275	2375	
29	2400		
30	2475		
31	2500	2575	
32	2550		
33	2650		
34	2750	2850	
35	2850		
36	2950		

Table 3.10-2 (Sheet 2 of 2)
Estimated Construction Workforce for a Projected Six-Year Construction Schedule
(From Beginning of Site Preparation until Fuel Load of the Last Unit)

Month	Estimated Workforce	Approximate Quarterly Average	Approximate Annual Average
37	3050	3125	3250
38	3150		
39	3200		
40	3200	3250	
41	3250		
42	3300		
43	3300	3300	
44	3300		
45	3300		
46	3300	3275	
47	3300		
48	3200		
49	2900	2725	2300
50	2750		
51	2550		
52	2350	2225	
53	2200		
54	2150		
55	2150	2150	
56	2150		
57	2150		
58	2150	2100	
59	2100		
60	2000		
61	1950	1875	1250
62	1900		
63	1800		
64	1700	1600	
65	1600		
66	1500		
67	1400	1125	
68	1200		
69	800		
70	600	400	
71	400		
72	200		

Note: It is also estimated that there will be a small residual onsite construction workforce, in the range of 100 or less, for some period of time following the end of a projected six-year construction schedule (that is, following fuel load of the last unit).

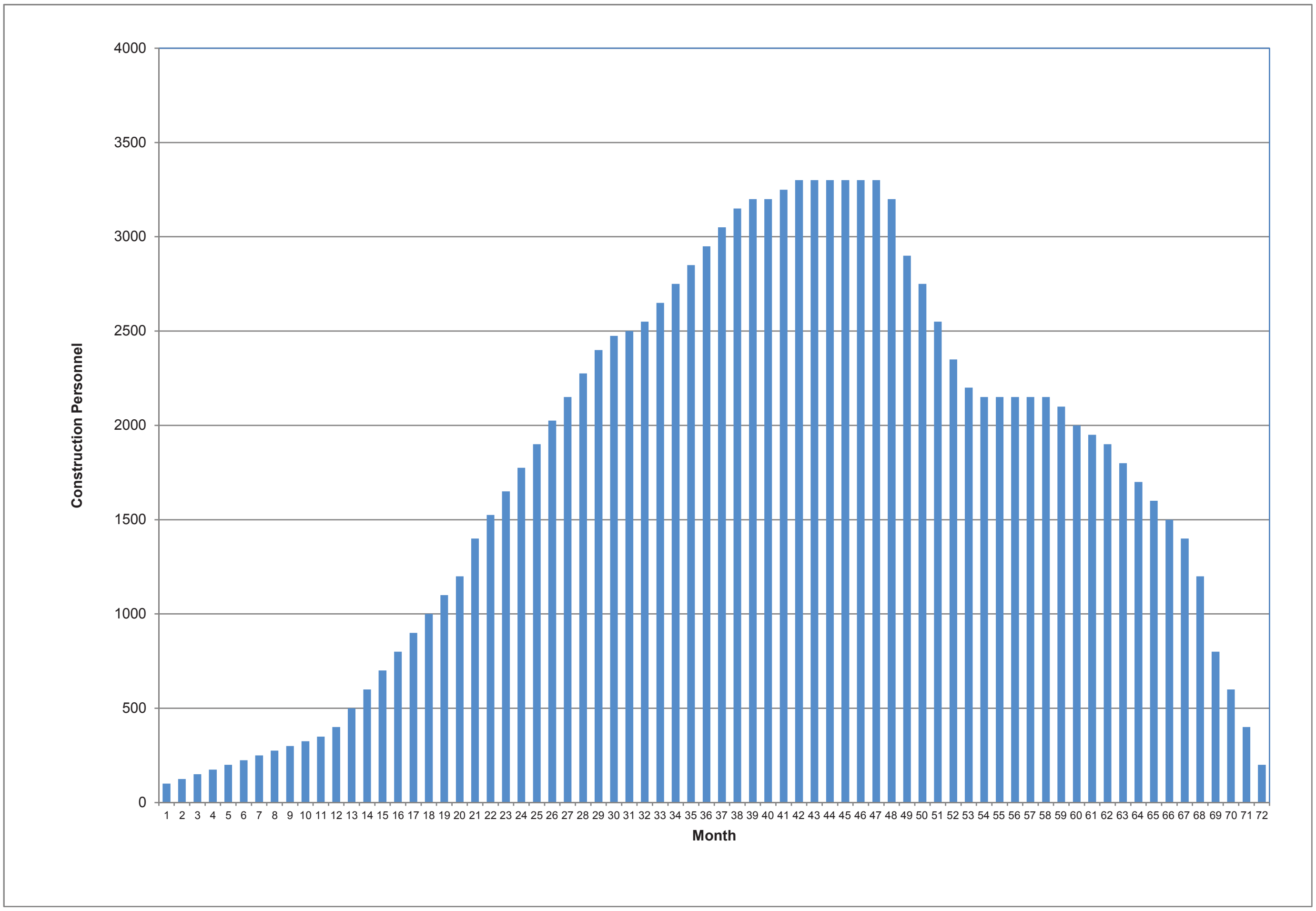


Figure 3.10-1. Estimated Construction Workforce by Month