CHAPTER 1

1.0 PURPOSE OF AND NEED FOR PROPOSED ACTION

The current operating licenses for Sequoyah Nuclear Plant (SQN) expire at midnight on September 17, 2020, and September 15, 2021, for Units 1 and 2, respectively. The Tennessee Valley Authority (TVA) must decide whether to submit a license renewal application (LRA) to the U.S. Nuclear Regulatory Commission (NRC) to extend the operating licenses of the two units for an additional 20 years beyond their current license terms.

As an integral part of TVA's current generation portfolio, SQN provides substantive base load generation to the TVA power system. Renewal of the current operating licenses would allow SQN to continue supplying approximately 2,400 megawatts electric (MWe) installed capacity of reliable and cost-effective power in the period between 2020 and 2040.

TVA operates the nation's largest public power system, producing 4 percent of all electricity in the nation. It serves about nine million people in the seven-state TVA power service area (Figure 1-1). Historically, net system requirements grew at an average rate of 2.3 percent (1990 – 2008) before the recent economic downturn. Consistent with current forecasting and power system planning models, TVA expects peak load and net system power requirements to increase through 2029 (Section 1.3). TVA has an obligation to meet this need while maintaining low-cost, reliable power for consumers in the power service area. Consistent with its Environmental Policy, TVA also plans to use cleaner energy options and energy efficiency initiatives to reduce the intensity of carbon emissions from its power system.

In its Integrated Resource Plan (IRP), TVA assumed that existing nuclear plants, including SQN, would continue to be the backbone of TVA's power supply in the future. The IRP forecasts the power supply demands and options to meet those demands through the year 2029 (TVA 2011a).

The purposes of the proposed action are to (1) obtain extended licenses to operate SQN Units 1 and 2 to help meet the identified need for power between 2020 and 2031; (2) maximize use of existing assets; and (3) support TVA's efforts to reduce the carbon emissions of its generating system.

Renewal of SQN operating licenses would involve continuation of normal operations, maintenance, and refueling. These activities would continue to be managed in accordance with TVA programs and procedures. SQN has an on-site independent spent fuel storage installation (ISFSI) using dry cask storage. As a related future action, expansion of the on-site spent fuel storage capacity may be required by 2026 to support SQN operations during the period of license renewal if the U.S. Department of Energy (DOE) does not take responsibility for the permanent storage and disposal of the on-site spent fuel. This expansion would potentially require the construction of an additional concrete storage pad similar to the one used for the current ISFSI. Existing equipment and procedures would continue to be used to store the spent fuel. No refurbishments, as described in Sections 2.6 and 3.1 of federal guidelines, *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (NRC 1996), would occur during the license renewal term.

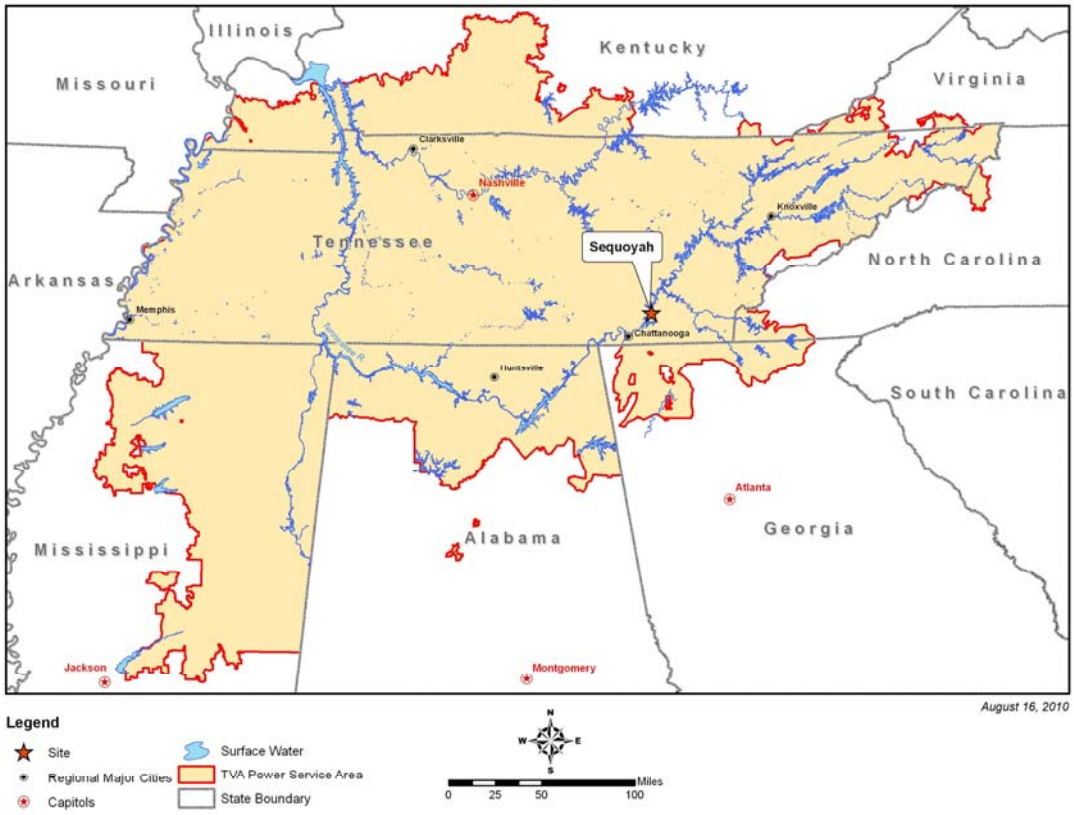


Figure 1-1. TVA Power Service Area

TVA has prepared this supplemental environmental impact statement (SEIS) to inform TVA decision-makers, agencies, and the public of the potential environmental impacts associated with operating SQN for an additional 20-year period, that is, until 2040 for Unit 1 and 2041 for Unit 2. Based in part on this evaluation of impacts, TVA will decide whether to submit the LRA and thereby pursue renewal of the operating licenses necessary to continue operating SQN. Subsequently, the NRC would evaluate TVA's LRA and conduct its own environmental review to evaluate the potential environmental impacts of granting renewed licenses. As part of the LRA, TVA would submit an environmental report describing the potential environmental impacts of renewing SQN operating licenses.

1.1. Brief History and Description of SQN

SQN began commercial operation of Unit 1 in July 1981 and Unit 2 in June 1982. The SQN site is approximately 630 acres that includes approximately 525 acres of land known as the industrial site and approximately 105 acres known as the training area peninsula. SQN is near the geographical center of Hamilton County, Tennessee, on a peninsula on the western shore of Chickamauga Reservoir at Tennessee River mile (TRM) 484.5. SQN is close to the city of Soddy-Daisy, Tennessee, and approximately 18 miles northeast of the Chattanooga, Tennessee, city center (Figures 1-2 and 1-3). (DOE 1999)

1.1.1. General Plant Description

The principal structures of SQN consist of two reactor buildings, a turbine building, an auxiliary building, a control building, a service and office building, a diesel generator building, an intake pumping station, essential raw cooling water (ERCW) pumping station, two natural draft cooling towers, 161-kilovolt (kV) and 500-kV switchyards, a condensing water discharge and diffuser system, and an ISFSI. (TVA 2008a, TVA 1974a) Figure 1-4 shows the general features of the facility, the exclusion area boundary (EAB), and protected area. The EAB is the area generally surrounding the site that TVA controls and ensures the public does not reside within this boundary. The protected area is controlled by TVA for access by authorized personnel only. The protected area contains the safety-related equipment needed for the protection of the plant and the health and safety of the public. No residences are permitted within the EAB or protected area.

The site utilizes two pressurized water reactors (PWRs) in the nuclear steam supply system and a circulating water system that withdraws water from, and discharges water to, Chickamauga Reservoir. The cooling system is supplemented by intermittent operation of the cooling towers. After passing through the turbines, the steam is converted back to water by circulating it around tubes carrying cooling water in the condensers. The condensed steam – now water – is returned to the steam generators to repeat the cycle.

Fuel for SQN is made of slightly enriched (< 5 percent by weight) uranium dioxide (UO_2), ceramic cylindrical pellets contained in Zircaloy-4 tubing, which is sealed at the ends to encapsulate the fuel (TVA 2008a). Based on core design values, SQN operates at an individual rod average fuel burnup (burnup is the amount of fuel utilized in the fission process) of no more than 62,000 megawatt-days per metric ton uranium (MWD/MTU) (TVA 2008a), which ensures that peak burnups remain within acceptable limits specified in applicable federal regulations (10 CFR Part 51, Subpart A, Appendix B, Table B-1).

The NRC has approved technical specification changes for the production of tritium in the reactor units. Tritium production could be performed at either one or both reactors as needed. SQN has not actually produced tritium for the DOE as of this date, but the possibility is still a viable option. The production of tritium was evaluated in detail by the DOE in its tritium production final environmental impact statement (FEIS). (DOE 1999) TVA was a cooperating agency with the DOE in development of the environmental impact statement (EIS), and TVA adopted the DOE FEIS in May 2000.

<u>Condenser Circulating Water System</u>

All power plants convert a source of energy or fuel into electricity. Most large plants do so by heating water to create steam, which turns a turbine that drives an electric generator. In PWRs, like the two at SQN, radioactive water is pumped through the reactor core and heated by the fission process. The water is kept under high pressure inside the reactor so it does not boil. The heated water from the reactor passes through tubes inside four steam generators where the heat is transferred to nonradioactive water flowing around the tubes. The nonradioactive water boils and turns to steam. The steam is piped to the turbines. The force of the expanding steam drives the turbines, which spin a magnet in a coil of wire — the generator — to produce electricity. After passing through the turbines, the steam is converted back to water by circulating it around tubes carrying the cooling water from the condenser circulating water (CCW) system. It should be noted that the radioactive water system used in the reactors is not permitted to mix with other nonradioactive water systems.

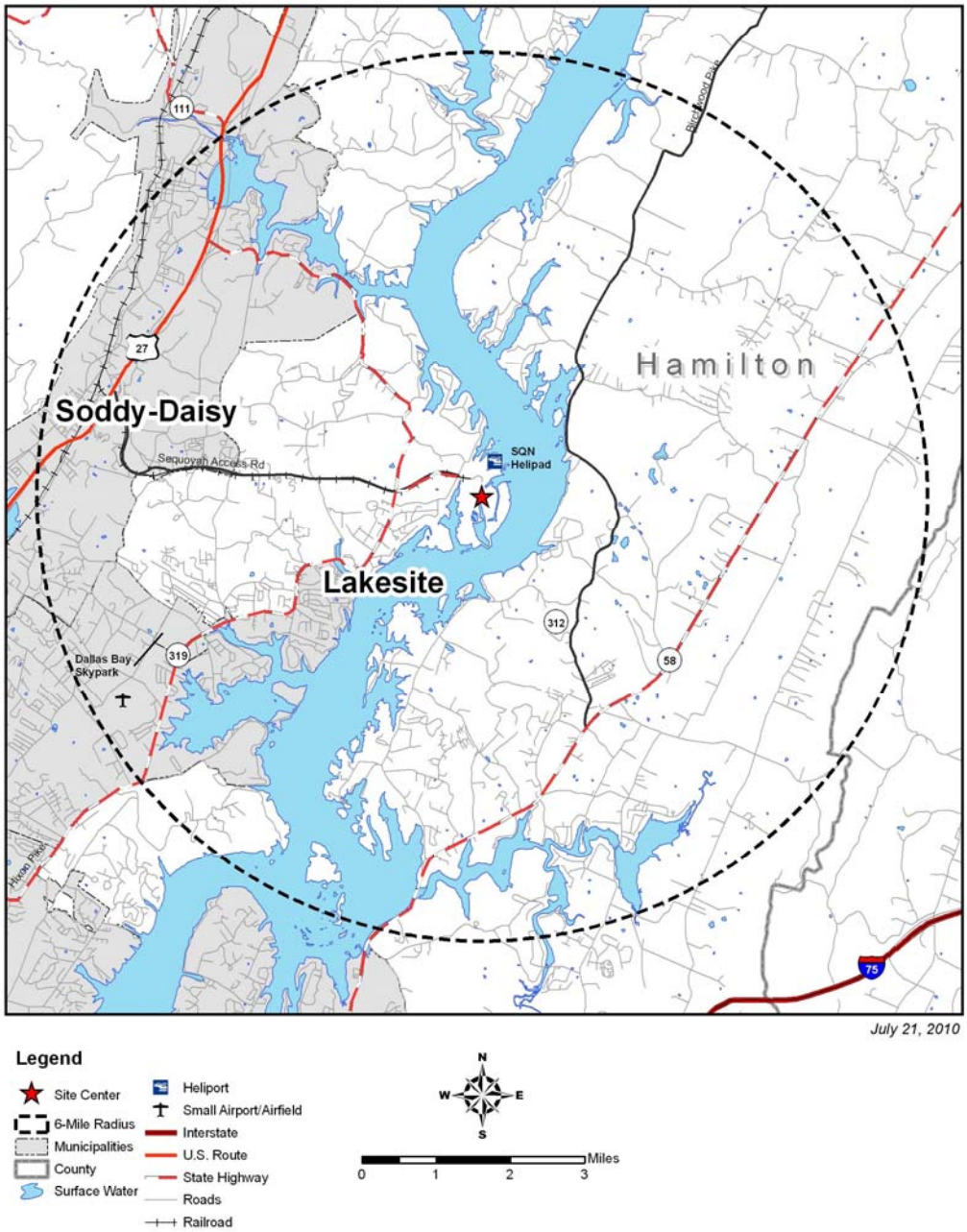


Figure 1-2. 6-Mile Radius of SQN

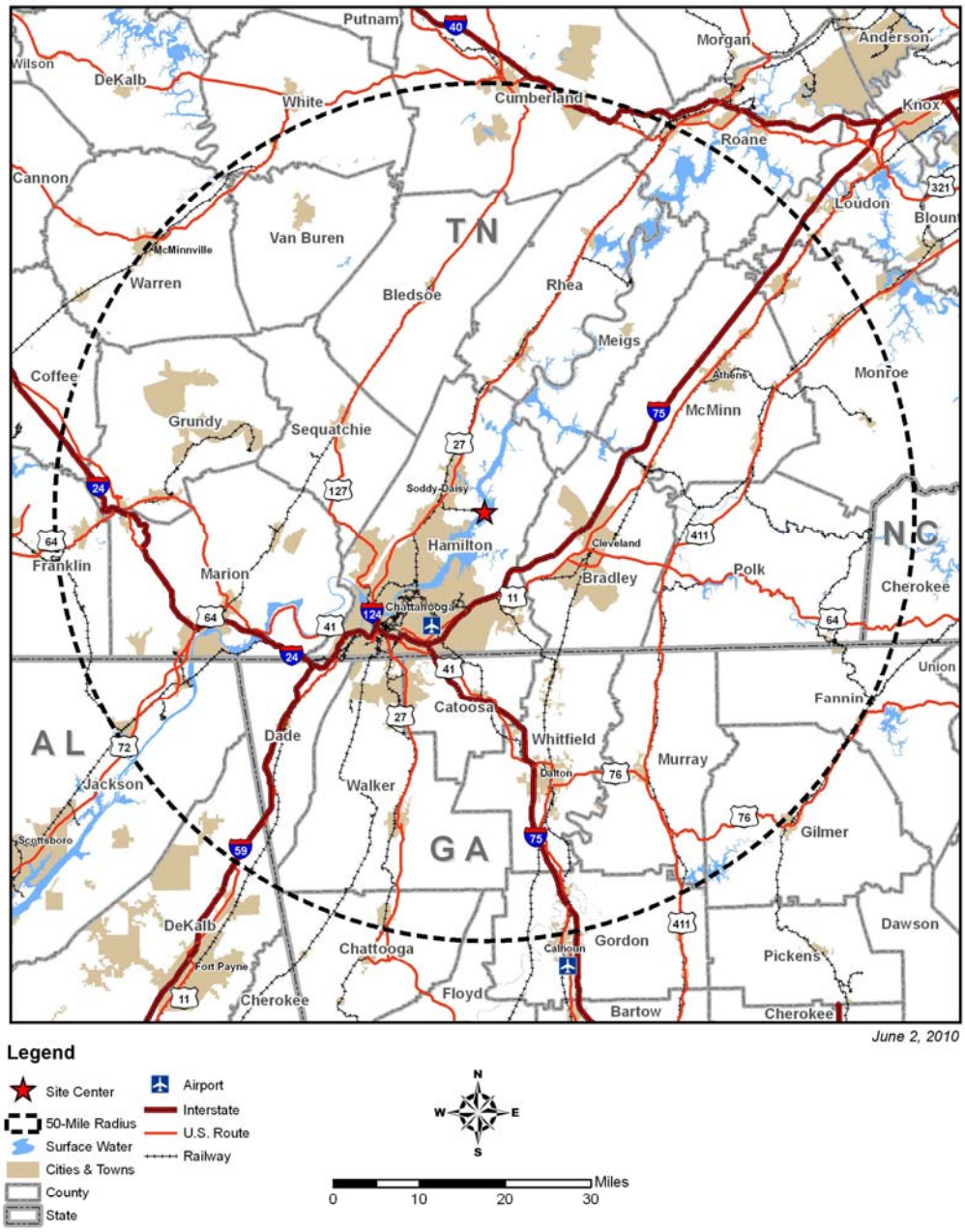


Figure 1-3. 50-Mile Radius of SQN

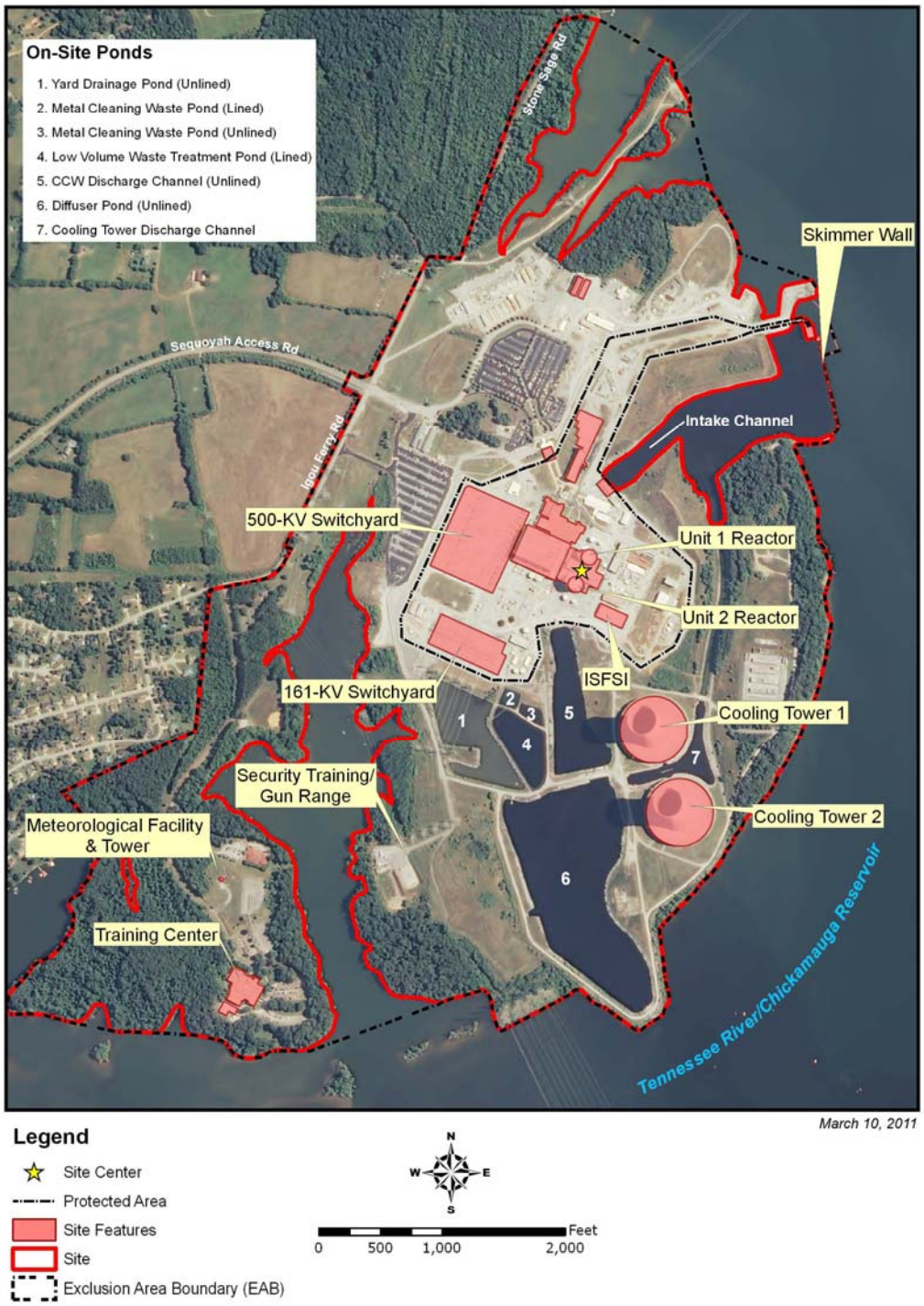


Figure 1-4. Site Layout (Aerial)

CCW is withdrawn from Chickamauga Reservoir at a combined intake structure and pumping station situated at the end of an intake channel, which leads from an intake embayment. The intake pumping station houses the CCW pumps, traveling screens, and screen wash pumps. For each unit, three pumps are provided in the intake pumping station to pump CCW through the condensers. A security boom is located around the ERCW building. An intake skimmer wall also spans the entrance to the embayment.

The skimmer wall has a clear opening length of 550 feet and an opening height of 9.7 feet, with the top of the opening at an elevation of 641 feet above mean sea level (msl), approximately 34 feet below minimum pool elevation of Chickamauga Reservoir. The skimmer wall is designed to allow withdrawal of cooler water from the lower depths of the reservoir. Because of the low elevation of withdrawal, the temperature of the water entering the condensers is normally less than the temperature at the reservoir surface.

An underwater dam across the main river downstream of SQN impounds cooler water in the lower layer of the reservoir, making cooler water available to the plant intake.

The intake conduits that take cooling water to the plant and the discharge conduit that carries cooling water and cooling tower blowdown back to the Chickamauga Reservoir are shown in Figure 3-3. SQN operates in a once-through type cooling, normally called the open mode, for the majority of the year when the cooling tower lift pumps are bypassed. During certain portions of the year, when thermal limit requirements require it, SQN uses a helper mode cooling tower system. The cooling tower lift pumps move water into the cooling towers. Water passes through the cooling towers to reject part of the heat, discharging cooling tower blowdown (wastewater released back into the environment) via a diffuser into the Chickamauga Reservoir. Therefore, only a small amount of water is consumed through evaporation compared to the average flow in the reservoir. For both Units 1 and 2, approximately 7 percent of the average flow is withdrawn from Chickamauga Reservoir, and approximately 7 percent is discharged back to Chickamauga Reservoir at full load. In the helper mode, up to 32,762 gallons per minute (gpm) of additional water (makeup water) is required to make up for that lost by drift, blowdown, or evaporation, which is less than 1 percent of the available average flow through Chickamauga Reservoir. The closed-cycle cooling mode is not currently used, but can be utilized if needed.

The CCW system provides each unit a nominal flow of 535,000 gpm to the main steam turbine condensers. This water flow is a sufficient quantity to condense the steam at an optimum main condenser back pressure and dissipate all rejected heat. The CCW can dissipate a portion of the waste heat directly to the atmosphere by use of the cooling towers in the helper mode when required to meet thermal criteria. The CCW can also provide for dilution and dispersion of routine low-level radioactive liquid wastes. Low-level radioactive effluents are released only in small quantities and in accordance with federal regulations to ensure that the health and safety of the public are protected. This information is discussed in Section 3.17.

In addition to the water supplied for CCW, the CCW system supplies water to the plant raw cooling water pumps and raw service water pumps; this in turn supplies cooling water to nonessential systems (systems not necessary for the safe shutdown of the reactor) (TVA 2008a).

Essential Raw Cooling Water

The ERCW system is designed to supply cooling water to various heat loads in both the primary (radioactive) and secondary (nonradioactive) portions of each unit. Provisions are made to ensure a continuously available flow of cooling water to those systems and components necessary for plant safety during either normal operation or under accident conditions. The ERCW system discharges into the return channel of the natural draft cooling towers and provides a continuous source of blowdown for effluent dilution. (TVA 2008a)

The ERCW system consists of eight ERCW pumps, four traveling water screens, four screen wash pumps, and four strainers in the ERCW pumping station, and associated piping and valves. The ERCW station draws water directly from Chickamauga Reservoir (Figure 3-3). (TVA 2008a)

The ERCW pumping station is located within the plant intake skimmer structure, and has direct connection with the main river channel for all reservoir levels including loss of a downstream dam. The ERCW station and essential equipment therein remain operable during the probable maximum flood and loss of a downstream dam. (TVA 2008a)

Discharge Structure

Heated water is discharged from the condensers or from the cooling towers directly into the diffuser pond, from which it is discharged to the reservoir through two diffuser pipes (Figure 3-5). The upstream and downstream diffuser pipes are 17 feet and 16 feet in diameter, respectively, and the diffuser sections of the discharge pipes are installed in the approximately 900-foot wide navigation channel of Chickamauga Reservoir. Each diffuser section is 350 feet long and has 17 individual 2-inch diameter ports per foot of pipe length.

Flow through the diffuser pipes is controlled by the difference in elevation between the diffuser pond and reservoir surface water levels. At maximum plant capacity, each diffuser discharges about 1,240 cubic feet per second (cfs). When the plant discharge into the pond is reduced, the flow through each diffuser and the difference in elevation between the water level in the pond and the water level in the reservoir drop in a similar manner.

The system is designed to operate in any of three modes: open, helper, or closed. In the open mode, the water bypasses the cooling tower lift pumps and is returned to the reservoir via discharge diffusers and the diffuser pond. In helper mode, the water is pumped into the cooling towers by the lift pumps, passes through the cooling towers where part of the waste heat is liberated directly to the atmosphere, and the cooled water is then returned to the reservoir via the diffuser pond, and the discharge diffusers. In closed mode, the water is pumped through the cooling towers where the waste heat is liberated directly to the atmosphere and returned to the intake channel through the return channel. (TVA 2008a)

Blowdown from the towers is taken from the return channel (cold water channel), mixed with the plant effluent, and discharged directly into the diffuser pond. The system is designed to ensure that under no conditions does radioactive waste backflow into the return channel. The ERCW discharges into the return channel and provides a continuous source of blowdown for effluent dilution. (TVA 2008a)

The diffusers are designed to provide rapid mixing of the discharged effluent with the river flow. Flow is discharged into the diffuser pond via the blowdown line, ERCW system, and CCW system. The two diffusers provide mixing across nearly the entire river channel width. (TVA 2008a)

1.1.2. Transmission Lines

TVA's 1974 final environmental statement (FES) for SQN identifies the 267.25 miles of transmission lines constructed for the purpose of originally connecting SQN to the TVA transmission grid. An additional 20 miles of right-of-way (ROW) were utilized for the line connections to SQN (1974a). Since the FES was published, another 124.45 miles of transmission lines have been added. Table 1-1 provides detailed information on the total of 391.7 miles of transmission lines. TVA is the owner and operator of the lines. SQN Unit 1 is connected into the 500-kV transmission network, and SQN Unit 2 is connected into the 161-kV transmission system (Dennis Lundy, TVA, personal communication, April 20, 2010). The two systems are interconnected at SQN through a 1,200-megavolt ampere, 500 – 161-kV intertie transformer bank.

Table 1-1. SQN Transmission Lines

Line Name	Voltage (kV)	Length (miles)
Sequoyah-Widows Creek Charleston	161	22.48
Sequoyah-Watts Bar Chickamauga No. 1	161	17.07
Sequoyah-Chickamauga No. 2	161	19.53
Sequoyah-East Cleveland	161	29.48
Sequoyah-Concord	161	18.39
Sequoyah-Watts Bar Hydro	161	38.41
Sequoyah-Charleston No. 1	161	20.82
Sequoyah-Charleston No. 2	161	20.82
Sequoyah-Franklin (initial operation at 161 kV)	500	62.77
Sequoyah-Georgia State Line	500	17.48
Sequoyah-Widows Creek*	500	49.46
Sequoyah-Watts Bar No. 1*	500	40.49
Sequoyah-Watts Bar No. 2*	500	34.50

*Transmission lines not included in TVA's 1974 FES for SQN (TVA 2010a).

1.2. The TVA Power System

TVA was established by an Act of Congress in 1933 as a federal agency charged with developing and conserving the natural resources of the Tennessee Valley region and improving the lives of the region's population. From its beginning, TVA's challenge has been to look at economic development and natural resource issues in a comprehensive fashion. TVA was originally managed by a three-member board of directors appointed by the President of the United States and approved by the U.S. Senate. (TVA 2002a) In 2006, pursuant to congressional amendments to the TVA Act, TVA made the transition to a nine-member, part-time board of directors and a full-time chief executive officer. (TVA 2007a)

In 2008, TVA's power system had a generating capacity of about 36,490 megawatts (MW) of total summer net capacity, which included 2,774 MW of purchased power and other agreements (see Table 1-2). TVA's generating system consisted of 280 units producing electrical power. Table 1-2 provides a brief summary of the TVA power generation system reported for 2008. (TVA 2009a) TVA transmits electricity from these facilities over almost 15,954 circuit miles of transmission lines (TVA 2009a). Like other utility systems, TVA has power interchange agreements with utilities surrounding the Tennessee Valley region, and purchases and sells power on an economic basis almost daily (TVA 2010b). TVA owns about 2.4 MW of non-hydro renewable capacity consisting of one small wind farm with three 660-kW turbines on Buffalo Mountain near Oliver Springs, Tennessee, and 15 photovoltaic (PV) installations throughout the TVA region. TVA also co-fires methane from a nearby sewage treatment plant in a boiler at Allen Fossil Plant and co-fires wood waste in a boiler at Colbert Fossil Plant. (TVA 2011a) In addition, TVA purchases power from 15 more commercially owned wind turbines at the Buffalo Mountain, Tennessee, site. As of September 30, 2009, the digester gas co-firing site provided TVA with about 3 MW of renewable summer net capacity. In addition, the wind energy site, the solar energy sites, and the biomass co-firing site provided additional capacity, but it is not considered summer net capacity (TVA 2009a). In addition to the two units at SQN, TVA operates three units at the Browns Ferry Nuclear Plant (BFN) in Alabama, and one unit at the Watts Bar Nuclear Plant (WBN). In 2007, TVA resumed construction of WBN Unit 2, which had been halted in the mid-1980s. Once complete in 2013, this unit will provide an additional 1180 MW of net summer capacity. Detailed description of TVA's nuclear capacity is provided in the IRP EIS, Chapter 3 (TVA 2011a).

TVA is one of the largest producers of electricity in the United States. TVA's power system serves approximately nine million people in a seven-state power system, covering 80,000 square miles (sq mi) (Figure 1-1) (TVA 2007a, TVA 2008a). TVA's electricity is distributed to homes and businesses through a network of 155 power distributors, including municipally owned utilities and electric cooperatives. TVA also sells power directly to 57 large industrial customers and federal facilities (TVA 2011a). The total number of businesses and residential customers served in 2008 was 4,571,600. TVA supplies most of the electricity needs in Tennessee, 31 percent in Mississippi, 24 percent in Alabama, and 26 percent in Kentucky. Its contribution to the electricity needs in Virginia, North Carolina, and Georgia is 3 percent or less. The TVA Act requires the TVA power system to be self supporting and operated on a nonprofit basis, and the TVA Act directs TVA to sell power at rates as low as feasible. (TVA 2010b)

Table 1-2. TVA Power Generation System – 2008

Type	# Units	Capacity (MW)	Percent of TVA System
Coal-Fired	59	14,711	53
Natural Gas and Oil-Fired	93	6,871	2*
Diesel Generator	9	13	*
Nuclear	6	6,624	37
Hydroelectric	113	5,494	8
Renewable Resources		3	<1
Power Purchase and Others		2,774	NA
Total Summer Net Capacity		36,490	

*Part of natural gas 2 percent.
(TVA 2009a)

1.3. Projecting Need for Power

One of TVA's most important responsibilities is meeting the demand for electricity placed on its power system. Thousands of businesses, industries and public facilities, and millions of people, depend on TVA every day to supply their power needs reliably. That responsibility drives the purpose and need for the proposed action described in this SEIS.

To meet this responsibility, TVA forecasts future demand and the need for additional generating resources in the region it serves. A need for additional power exists when future demand exceeds the capabilities of currently available and planned generating resources. Because planning, permitting, and construction of new generating capacity and transmission require a long lead time, TVA must make decisions to build new generating capacity well in advance of the actual need.

This section updates the need for power analysis in TVA's 1974 FES for SQN (TVA 1974a). To determine the need for power between 2020 and 2041, TVA forecasts economic conditions, costs of fuel and technology, and other contributing factors. The planning forecasts include the years between 2011 and 2020 to demonstrate long-term trends. Current power supply resources available to meet the demand for power are identified. TVA uses this comparison to assess the need for power.

Terms used in this section have the following meanings:

- Capacity: The output rating of a generator, measured in MW.
- Demand (also called load): The amount of energy required in a specific time period, typically measured in MW.

- Generation: How much energy or electricity is produced over a specified time period, typically measured in gigawatt hours (GWh).

- Interruptibles: Agreements with end use customers that allow TVA to interrupt service when capacity resources are in short supply. Interruptibles are not included in energy efficiency and demand response (EEDR).

- Peak Load: The maximum load during a specific time period, which could be hourly, annually, seasonally, or monthly.

- Renewables: Resources that provide energy generated from sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished). Examples in the TVA region include wind, solar, biomass, and hydroelectric.

1.3.1. The Integrated Resource Planning Process

Integrated resource planning (IRP) is a common utility planning process that evaluates supply-side and demand-side energy resources that can be used to meet the future demand for electricity or energy from the utility power system. In December 1995, TVA completed a comprehensive IRP process, including the preparation of *Energy Vision 2020 Integrated Resource Plan Environmental Impact Statement*. The Energy Vision 2020 IRP has been replaced by a new IRP study which included the preparation of another EIS. This IRP was issued in March 2011 and is hereafter referred to as the IRP (TVA 2011a).

This SEIS incorporates information used in the development of the IRP. The IRP EIS identifies TVA's preferred alternative as the recommended planning direction. This is a robust planning strategy that performs best in terms of cost and risk/benefits over the anticipated range of future scenarios. The recommended planning direction is based upon slightly different assumptions than the IRP baseline, which was used for this SQN license renewal analysis. Those differences include a slightly lower load forecast for some scenarios, more idled coal capacity, a new pumped storage project, and more renewable energy resources. Under the recommended planning direction, as with all other planning strategies evaluated in the IRP, it is assumed that SQN Units 1 and 2 continue to operate through 2029.

Assumptions are routinely updated as part of TVA's normal planning process, and study outcomes are reviewed to ensure that findings and recommendations are not dramatically impacted by new data. These adjustments in assumptions did not fundamentally alter the outcome of the baseline from which SQN license renewal options were evaluated. Key resource options selected in the final IRP cases are essentially the same as those identified in the draft study results (such as the identification of Bellefonte Nuclear Plant (BLN) units to meet future needs and the assumption that SQN will continue to operate) with only minor timing changes. Therefore, the need for power, the projected capacity gap, and the anticipated future resources presented in the final IRP do not result in materially different conclusions about the effect of renewing or not renewing the SQN license identified in this SEIS.

1.3.2. Power Demand

TVA's long-term demand forecast is developed from individual forecasts of residential, commercial and industrial sales. These forecasts serve as the basis for planning the TVA power system, budgeting, and financial planning. TVA considers forecasts based upon

several potential future conditions, including scenarios for the high and low load growth. A description of TVA's load forecasting methodology is presented in Chapter 4 of the IRP.

Figures 1-5 and 1-6 show the peak load and net system energy requirements forecasts as developed for the IRP. The planning period for the IRP was through 2029, so to arrive at the forecast through 2040, average annual growth through 2029 was assumed to remain constant through 2040. This analysis is based on the spring 2010 reference case, which represents a scenario characterized by moderate load growth, regulatory changes, and cost factors over the planning period. The baseline strategy tested in the IRP allows for nuclear expansion after 2018, assumes idling of 2,150 MW of coal capacity, includes new gas-fired capacity as needed, and includes EEDR development portfolios and wind power purchase agreements (PPAs). The spring 2010 reference case forecast shows relatively steady demand through 2013 and increasing demand after 2014, resulting in 1.3 percent average annual growth in the peak load forecast from 2010 to 2029. That rate of growth has been extended through 2040 in this SEIS. The average annual growth rate in net system requirements is 1.0 percent for the same period. In addition to the spring 2010 reference case, the figures show the high and low forecast scenarios modeled during the IRP.

The high forecast assumes higher demand and energy usage are driven by a combination of favorable economic conditions, retail electricity, and gas price assumptions. It also assumes additional industrial growth in the directly served sector. Peak load and net system requirements are projected to grow at an average annual rate of 2.0 percent and 1.9 percent, respectively, for the 2010 – 2040 time period by extending the growth rates utilized in the IRP for the high load forecast. It would be highly unlikely that the actual load would exceed the high forecast, given the range of possible outcomes used in the forecast.

The low forecast assumes lower demand and energy usage are driven by a combination of unfavorable conditions, including assumptions for economic growth and retail electricity and gas prices. Under the low forecast scenario, peak load and net system requirements are projected to decline at a rate of 0.3 percent and 0.4 percent, respectively, for the 2010 – 2040 time period, based upon the assumptions utilized in the IRP. It would be highly unlikely that the actual load would fall below the low forecast given the range of possible outcomes used in the forecast. While the low forecast is useful in planning, it is not used to determine the operation and construction of power generation assets, as that could pose serious risks to system reliability.

1.3.3. Power Supply

Currently, projects approved by the TVA Board include WBN Unit 2, scheduled to begin operation in 2013, and the new combustion turbine/combined-cycle plant at John Sevier Fossil Plant (JSF), scheduled to begin generating at full capacity in 2012. TVA's generating supply includes a combination of existing TVA-owned resources, budgeted and approved projects (such as new plant additions and uprates to existing assets), and PPAs. The supply includes a diverse portfolio of coal, nuclear, hydroelectric, natural gas and oil, market purchases, and renewable resources designed to provide reliable, affordable power while reducing the risk of disproportionate reliance on any single resource. Each type of generation can be categorized into base load, intermediate, or peaking generation.

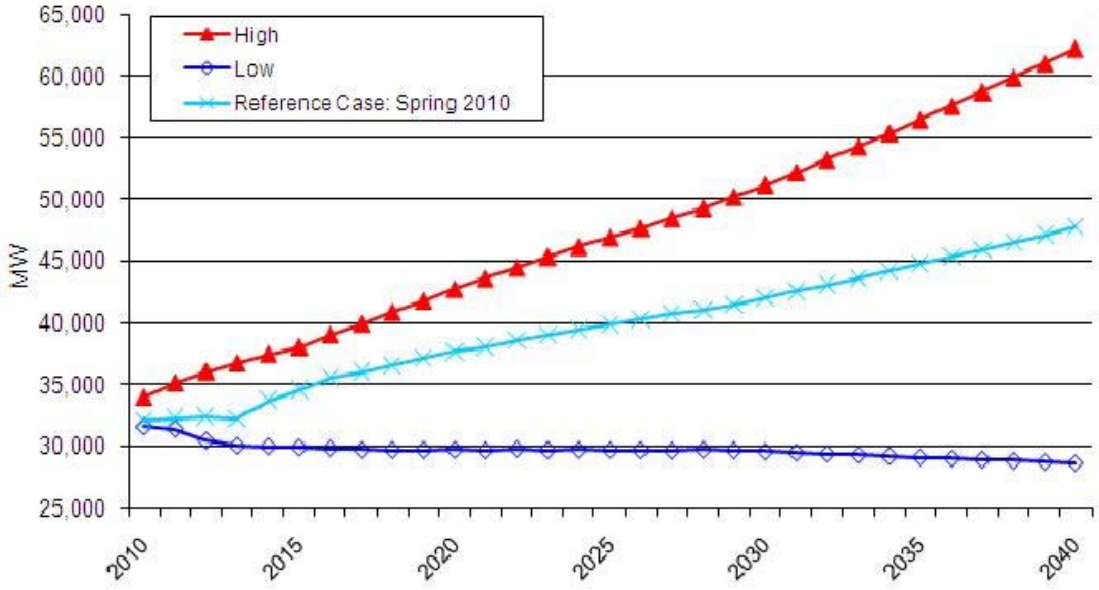


Figure 1-5. Peak Load Forecast

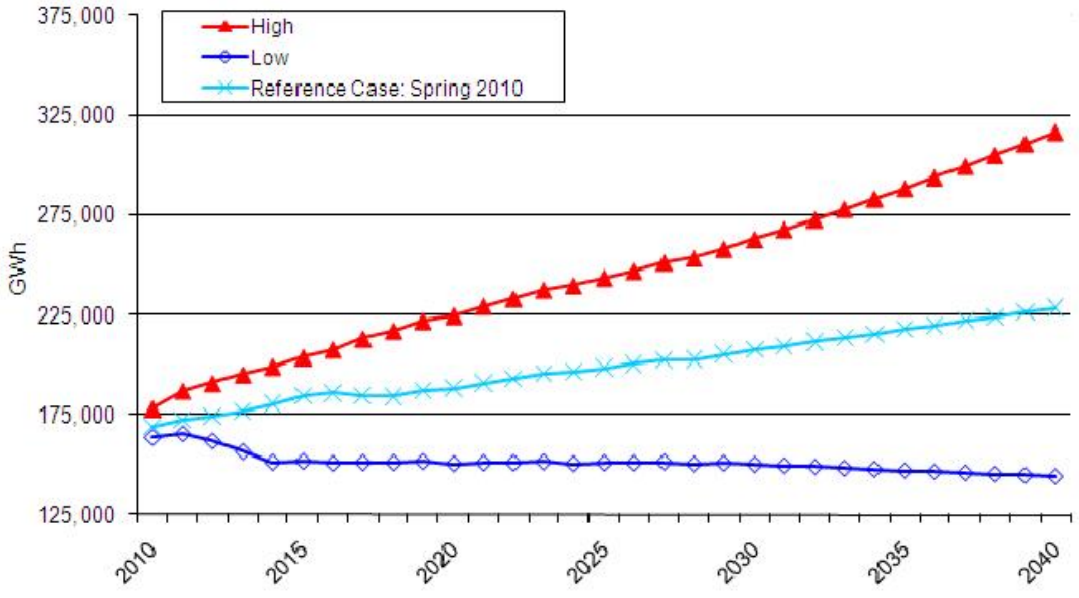


Figure 1-6. Energy Forecast

Base load generators are primarily used to meet continuous energy needs because they have lower operating costs and are expected to be available and operate continuously throughout the day. However, they typically have higher capital costs. This type of energy is generated from technologies that can provide continuous, reliable power over a period of uniform demand; generally, larger coal plants and nuclear plants. Some energy providers may consider combined-cycle plants for incremental base load generation needs, but historically, natural gas prices, when compared to coal and nuclear fuel prices, make combined-cycle an expensive option for larger continuous generation needs.

Intermediate resources are primarily used to fill the gap in generation between base load and peaking needs. These units are required to cycle with more or less output as the energy demand increases and decreases over time (usually during the course of a day). Intermediate units are more costly to operate than base load units but cheaper than peaking units. This type of generation typically comes from natural gas-fired combined-cycle plants and smaller coal plants. Renewable resources such as wind and solar, which are intermittent in nature and have capacity factors typically well below 50 percent, are increasingly used as a source of intermediate generation. It is possible, however, to increase the availability of the energy generated from a solar or wind project with integration of energy storage technologies, but this increases costs.

Peaking units, conversely, are only expected to operate during shorter duration high-demand periods and are essential for maintaining system reliability requirements as they can ramp up quickly to meet sudden demand changes. Typical peaking resources include natural gas-fired combustion turbines, hydroelectric generation, and renewable resources.

TVA's power generation system employs a wide range of technologies to produce electricity and meet the needs of the Tennessee Valley's nine million residents and its directly served commercial customers. See Figure 1-7 for a breakdown of capacity and energy by technology. The 2010 Baseline Portfolio - Firm Capacity pie chart in Figure 1-7 shows the allocation of capacity among TVA's total 37,259 MW, and the 2010 Baseline Portfolio – Generation pie chart shows the allocation based on a total of 166,785 GWh. The pie charts show the majority of energy generated by TVA comes from high capacity factor technologies like coal and nuclear. Gas-powered technologies, represented by the combined-cycle and combustion turbine components, are less expensive to install but have higher operating costs, so are primarily used to meet the demand during intermediate or peak loads.

In 2010, approximately 55 percent of TVA's generation will be produced from coal and natural gas-fired plants (51.8 percent coal; 3.5 percent gas in combustion turbine and combined-cycle plants). Nuclear plants will generate about 32 percent, and hydroelectric plants will produce approximately 12 percent. Most of the remaining capacity need is provided by interruptibles and EEDR programs. Minor amounts of generation and capacity come from diesels and other (non-hydroelectric) renewables.

Figure 1-8 shows the changing composition of existing resources projected to be operated through 2040, and includes operating license renewals for SQN. Shown only are those resources that currently exist or are under contract (such as purchases of renewable, coal, or combined-cycle generation and EEDR programs) and changes to existing resources that are projected and approved, including WBN Unit 2 and the combined-cycle plant at JSF. The renewable energy component of the existing portfolio is primarily composed of wind PPAs. The current EEDR programs are 0.8 percent of the capacity. The IRP forecasts

resource capacity through 2029. However, for the SQN SEIS, most resources are forecast at 2029 capacities through 2040. EEDR is forecast to continue to grow at the average annual rate of 3.9 percent through 2040. The total capacity of existing resources decreases primarily because of the idling of 2,150 MW of coal-fired capacity. Total capacity also decreases when PPAs for combined-cycle capacity expire (e.g., approximately 2021 and 2022). Therefore, by 2023, the capacity of the TVA system, based upon current resources including SQN Units 1 and 2, is approximately 34,800 MW.

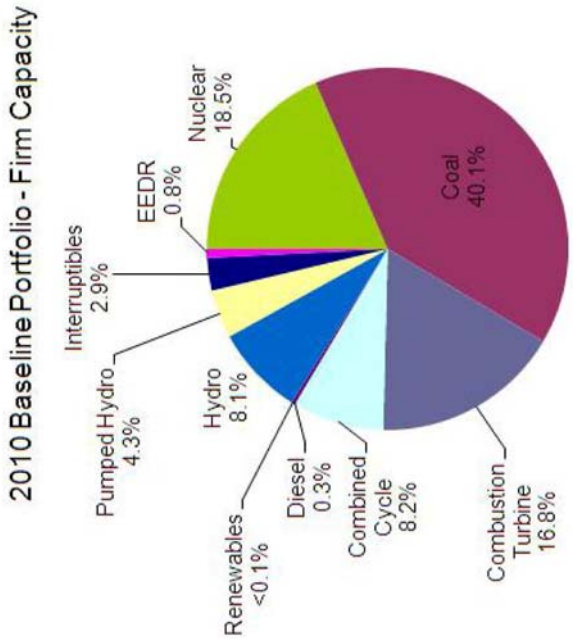
Figure 1-9 shows the capacity profile without SQN license renewal. Under this scenario, the TVA system capacity is approximately 32,500 MW by 2023.

1.3.4. Need for Power between 2020 and 2040

To ensure enough capacity is available to meet peak demand in most circumstances, including unforeseen contingency, it is necessary to have available additional generating capacity beyond that which is needed to meet peak demand. This additional generating capacity, known as “reserve capacity” or “total reserves,” must be large enough to cover the loss of the largest single operating unit (contingency reserves), be able to respond to moment-by-moment changes in system load (regulating reserves), and replace contingency resources should they fail (replacement reserves). Total reserves must also be sufficient to cover unplanned unit outages, load forecasting error including abnormal weather, and undelivered purchased capacity, among other uncertainties. As typical for the utility industry, TVA plans for total reserves of between 12 and 20 percent of total system load. TVA optimizes its mix of generating assets and purchases to meet these standards. For the IRP and this SEIS, required total reserves were set at 15 percent, which coincides with TVA’s current planning reserve margin target. Therefore, available generating capacity must be adequate to meet the peak demand shown in Figure 1-5 plus 15 percent.

The capacity gap is defined as the difference between the existing firm capacity (adjusted for specified planning strategy inputs) and the firm requirements developed from load forecasts for any particular scenario. Figure 1-10 shows the capacity gap comparing the current resources in Figure 1-8 to the high, baseline and low peak load forecasts in Figure 1-5. Two scenarios are shown, one in which SQN operating licenses are renewed (solid line) and one in which SQN licenses are not renewed (dashed line). Figure 1-11 shows the comparison of current resources to the energy forecasts in Figure 1-6. Figures 1-10 and 1-11 show that under most scenarios, the capacity and generation gaps increase over time, and TVA requires additional capacity and generation to meet forecasted energy needs. EEDR programs could also be used to offset forecasted energy needs. The spring 2010 reference case need for additional generating capacity or EEDR programs is 9,617 MW and 29,086 GWh of additional generation in 2019, growing to 15,513 MW and 44,988 GWh in 2029. Under the reference case, SQN is approved for license renewal and continues to operate. If SQN is not approved for license renewal, the capacity gap grows, beginning in 2020 and 2021, by an additional 2,400 MW, and the generation gap grows by approximately 19,000 GWh.

Chapter 7 of the IRP addresses the alternative strategies by which TVA could acquire additional capacity and generation, as well as EEDR programs, to meet the need for power shown in Figures 1-10 and 1-11 (TVA 2011a). TVA anticipates using a mix of resources, including EEDR programs, renewable resources, natural gas-fired generation, and nuclear generation to provide the additional resources to meet future needs. Given the magnitude of the capacity and energy need, and to avoid the risk of relying on only one fuel or technology, no single resource is used to meet all future energy and capacity requirements.



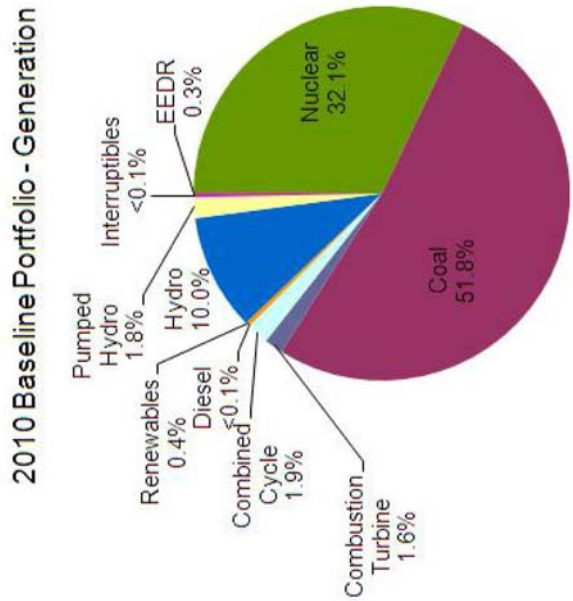


Figure 1-7. Capacity and Energy Mix

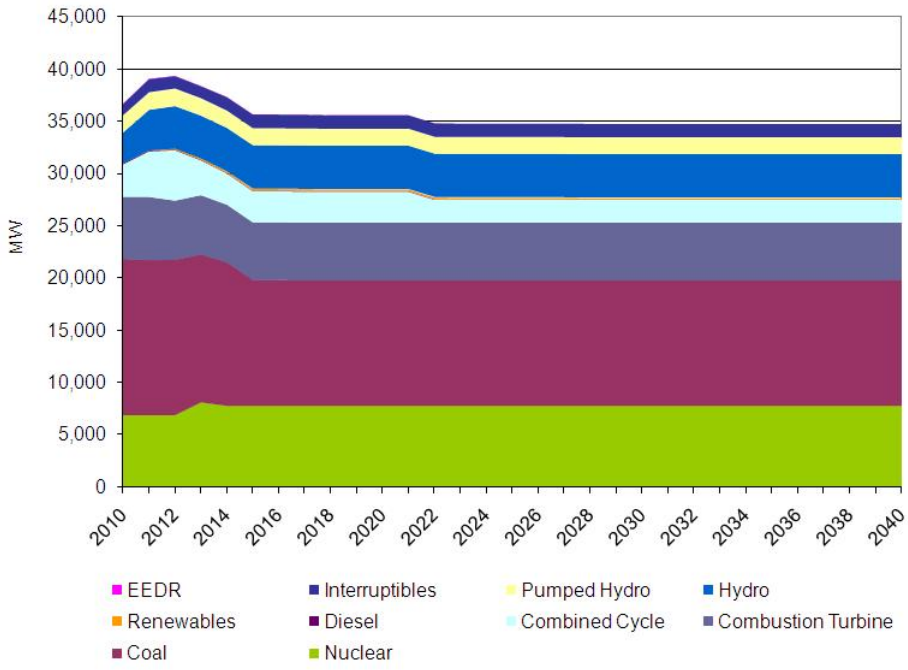


Figure 1-8. Capacity Profile of Current Resources

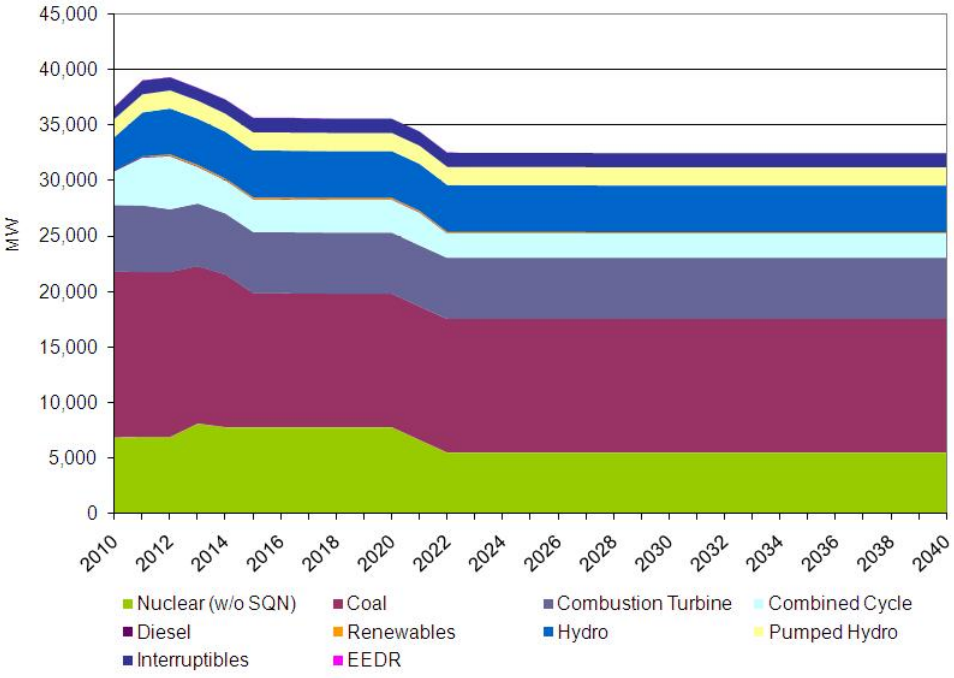


Figure 1-9. Capacity Profile Without SQN License Renewal

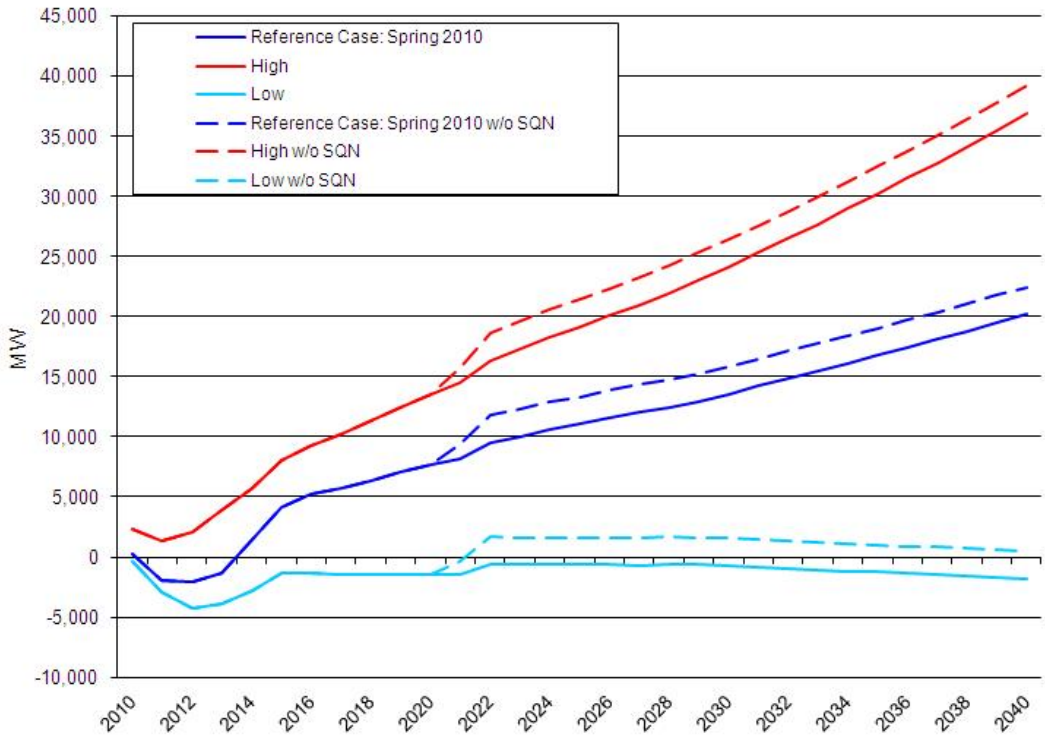


Figure 1-10. Capacity Gap

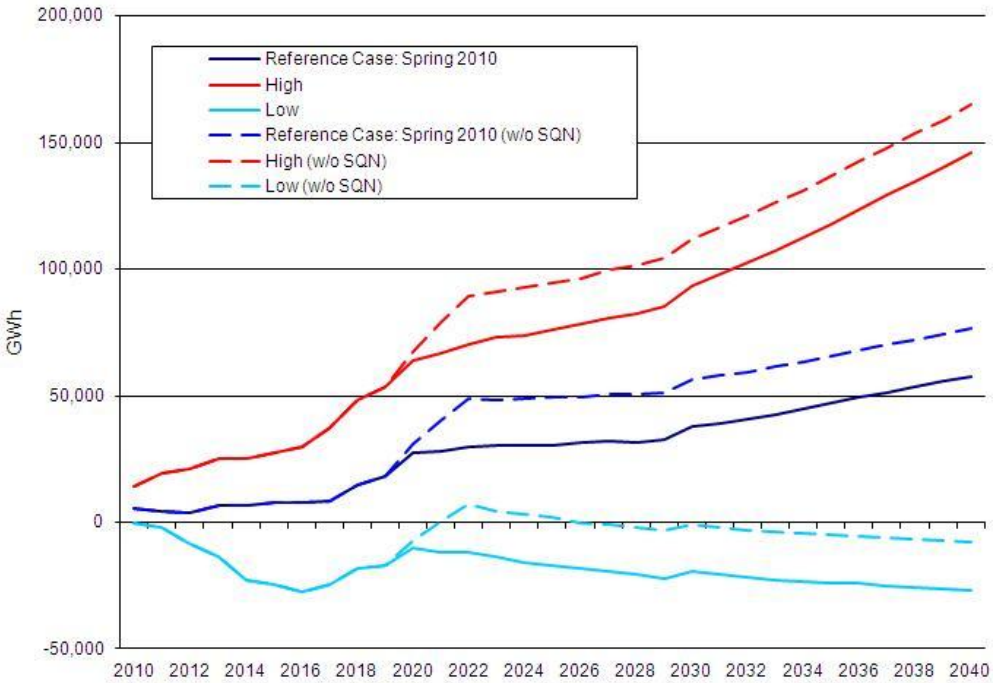


Figure 1-11. Generation Gap

1.4. The NEPA Process

TVA is preparing this SEIS in accordance with the National Environmental Policy Act (NEPA), 42 U.S. Code (USC) Parts 4321 et seq., the regulations published by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500 – 1508), and TVA's procedures implementing NEPA.

The NEPA process requires federal agencies to consider the impact of their proposed actions on the environment before making decisions. If an action is expected to have a significant impact on the environment, the agency proposing the action must develop a study — an environmental impact statement — for public and agency review. This EIS is an analysis of the potential impacts to the natural and human environment from the proposed action, as well as identified alternatives. CEQ regulations (40 CFR §1505.1) require federal agencies to make environmental review documents, comments, and responses a part of each agency's administrative record.

TVA is preparing this supplemental EIS to update information in the original 1974 FES for SQN. Many of the conditions described in the 1974 FES have not significantly changed, including the plant design, systems, structures, and components. Site history, topography, geology, hydrology, and climate, as well as operational parameters, limits, and conditions of operation, remain consistent with the original 1974 FES and are incorporated by reference or, where necessary, additional detail is provided. Changes that have occurred since 1974, including the replacement of Unit 1 steam generators, increase in power output, license amendments, and construction and operation of the ISFSI, are described in related documents or environmental reviews. Future replacement of Unit 2 steam generators is also planned (Section 1.4.1).

1.4.1. Other Pertinent Environmental Reviews and Documents

SQN site-specific, TVA, and generic information in the following documents were evaluated and used where appropriate during the development of the SEIS. These related documents and their contents are discussed below:

Final Environmental Statement, Sequoyah Nuclear Plant Units 1 and 2 (TVA 1974a)

TVA prepared and submitted a comprehensive FES prior to construction activities for SQN Units 1 and 2. This FES included impact analyses for the plant site, surrounding areas, and the proposed transmission corridors. Information from this document was analyzed and updated where needed to develop the SEIS.

In 1978, as requested by the NRC, TVA amended the FES with revised analysis of impacts to the aquatic environment from changes made to the plant prior to its operation. In 1979, the NRC issued an environmental impact appraisal that concluded all potential consequences to the aquatic environment were amenable to acceptable impact control and were appropriately addressed by the U.S. Environmental Protection Agency (EPA) in its drafting of the national pollutant discharge elimination system (NPDES) permit for operation of SQN.

Environmental Assessment and Finding of No Significant Impact for Low-Level Radwaste Management, Sequoyah Nuclear Plant (TVA 1980)

In 1980, TVA revised its plans for treatment and storage of low-level radioactive waste (LLRW) at SQN. TVA prepared an environmental assessment (EA) to consider the potential environmental impacts of this revised plan. The proposed management plan was

threefold, consisting of (1) establishing a temporary LLRW management plan, including temporary storage, (2) installing equipment for volume reduction and solidification of LLRW, and (3) constructing facilities to safely store LLRW for the operational life of the plant.

Environmental Assessment and Finding of No Significant Impact – Change in Expiration Dates of Facility Operating License Nos DPR-77 and DPR-79, Tennessee Valley Authority, Sequoyah Nuclear Plant, Units 1 and 2 (TVA 1988)

The original operating license terms for SQN, as supported by the 1974 FES, were to end on May 27, 2010. Accounting for the time required for plant construction, this represented an effective operating license term of approximately 29 years and four months for Unit 1 and 28 years and eight months for Unit 2. TVA submitted an amended application that requested an extension of the operating license expiration dates so the fixed period of the licenses would be 40 years from the date of the operating license issuance for both units. Based on TVA's amended application and associated EA, the NRC staff concluded that there were no significant radiological or nonradiological impacts associated with the extension of the licenses.

Energy Vision 2020 – Integrated Resource Plan and Final Programmatic Environmental Impact Statement (TVA 1995a)

In December 1995, TVA completed this comprehensive environmental review of alternative means of meeting demand for power on the TVA system through the year 2020. The alternative adopted by the TVA Board was a portfolio of various supply- and demand-side energy resources, which included operation of SQN.

Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS, NUREG-1437) (NRC 1996)

This SEIS incorporates information from the GEIS in which the NRC considered the environmental effects of 20-year renewals of nuclear power plant operating licenses (results codified in 10 CFR Part 51). The GEIS identifies 92 environmental issues and reaches generic conclusions on environmental impacts for 69 of those issues that apply to all nuclear plants or to plants with specific design or site characteristics. It is expected that the generic assessment in NRC's GEIS would be relevant to the assessment of impacts of the proposed action at SQN. Information from NRC's GEIS related to the current assessment was referenced following the procedures described in federal regulations unless new and significant information is identified that bears on the GEIS analysis and conclusions (40 CFR §1502.21 – Incorporation By Reference). Additional plant-specific review is conducted for the remaining 23 issues. As part of the NRC's review and approval of the SQN LRA, the NRC will produce a site-specific GEIS supplement for SQN. To date, the NRC has issued 37 site-specific GEIS supplements for 61 current operating nuclear power units. Information from these site-specific GEIS supplements is used and/or incorporated by reference as appropriate.

Environmental Assessment and Finding of No Significant Impact – Low Level Radioactive Waste Transport and Storage Watts Bar and Sequoyah Nuclear Plants (TVA 1999)

TVA evaluated the effects of using the existing SQN on-site facility to store LLRW from SQN, as well as LLRW transported from Watts Bar. TVA concluded there would be no significant impact from implementing the proposed transportation and storage.

Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor (DOE 1999)

On December 22, 1998, DOE announced that commercial light water reactors (CLWRs) would be the primary tritium supply technology for the nation's defense needs. The secretary designated the Watts Bar Unit 1 reactor near Spring City, Tennessee, and SQN as the potential CLWRs available for tritium production. TVA was a cooperating agency with DOE in development of the subject FEIS, which evaluated environmental effects associated with tritium production at these three units. TVA adopted the FEIS in May 2000. TVA produces tritium at Watts Bar Unit 1, but does not produce tritium at SQN.

Environmental Assessment and Finding of No Significant Impact – Replacement of Steam Generators, Sequoyah Nuclear Plant, Unit 1 (TVA 2000a)

TVA prepared an EA prior to replacement of the four steam generators in Unit 1 at SQN during the March 2003 scheduled outage. Steam generators, a type of heat exchanger, are large cylindrical pieces of equipment used to produce steam for propelling the turbines, which then spin the generators to produce electric power. The EA evaluated the effects of replacing the steam generators and concluded there would be no or very minimal environmental impact.

Environmental Assessment and Finding of No Significant Impact – Independent Spent Fuel Storage Installation Sequoyah Nuclear Plant (TVA 2000b)

TVA utilizes the NRC's general license to store spent fuel at the SQN on-site ISFSI outdoor dry cask storage facility. A general license is an option available to current commercial nuclear power licensees to store spent fuel outside of the spent fuel pool at an ISFSI. The general license requires the use of a fuel storage system that has been previously approved by the NRC as demonstrated by the issuance of an NRC Certificate of Compliance.

TVA originally screened 13 sites for the construction of the ISFSI at SQN and prepared an EA evaluating the effects of a proposed location and alternatives. In April 2000, TVA prepared an EA and issued a finding of no significant impact for constructing and operating the ISFSI between the entrance road to SQN and the 500-kV switchyard.

Environmental Assessment and Finding of No Significant Impact – Leading Edge Flow Measurements System Installation (TVA 2001)

TVA prepared an EA to evaluate the effects of installing a leading edge flow measurements (LEFM) system for the feed water supply to the steam generators. Installation of the LEFM system facilitated a power increase of 1.3 percent. TVA concluded there was no significant impact to the environment from installation of the LEFM system.

Supplemental Environmental Assessment and Finding of No Significant Impact – Independent Spent Fuel Storage Installation, Sequoyah Nuclear Plant, Hamilton County, Tennessee (TVA 2002b)

TVA prepared this supplemental EA to evaluate a different proposed location for the ISFSI, as well as other changes proposed since the April 2000 EA (TVA 2000b). TVA concluded no significant impact to the environment would occur from constructing and operating the ISFSI on a site southwest of the dry active waste building.

Environmental Assessment for SQN Unit 2 Steam Generator Replacements (TVA 2009h) and *Finding of No Significant Impact for SQN Unit 2 Steam Generator Replacements* (TVA 2009b)

TVA prepared an EA to evaluate the effects of replacing the four steam generators in Unit 2 at SQN and concluded there would be no or very minimal environmental impact..

Environmental Impact Statement for the Integrated Resource Plan (TVA 2011a)

TVA prepared an updated IRP, a comprehensive study of alternatives for meeting the future electrical energy needs of the Tennessee Valley. This document updates the Energy Vision 2020 IRP described above. The purpose of the IRP is to develop a plan that TVA can enact to achieve a sustainable future and meet the energy needs of the Tennessee Valley over the next 20 years. The IRP EIS evaluates the environmental impacts of proposed and alternative supply- and demand-side energy resource strategies to meet the growing demand for energy in the region. This SEIS uses information and analyses from the IRP EIS process, particularly for load forecasting and evaluation of energy generation portfolios designed to meet forecast needs.

Environmental Reviews of Potential Alternate Nuclear Fuels in TVA Reactors

TVA is considering the potential use of nuclear fuels other than low-enriched uranium (LEU) fuel in TVA nuclear reactors, including SQN. Independent of the SQN license renewal process, TVA is coordinating with the DOE on projects regarding two types of nuclear fuel. Both projects involve the DOE's disposition of nuclear materials pursuant to U.S. nuclear non-proliferation policies. Part of TVA's decision-making process on both projects is an environmental review in accordance with NEPA on activities that TVA proposes to conduct.

The DOE's National Nuclear Security Administration recently announced its intent to modify the scope of the *Surplus Plutonium Disposition Supplemental Environmental Impact Statement* (SPD Supplemental EIS), to potentially provide alternative methods of disposing of surplus plutonium (75 FR 41850). The DOE, with TVA as a cooperating agency, is to prepare the SPD Supplemental EIS to analyze the potential environmental impacts of the disposal of plutonium. The use of mixed oxide (MOX) fuel in up to five reactors operated by TVA at SQN and BFN would be included in the analysis. Fabricating MOX fuel entails mixing plutonium oxide with depleted uranium oxide, manufacturing the fuel into pellets, and loading the pellets into fuel assemblies for use in nuclear reactors.

In the original SPD EIS published in 1999, the DOE evaluated environmental impacts of using MOX fuel at three nuclear plants in North Carolina and Virginia. The DOE concluded that the use of MOX fuel in those reactors would not require changes in the procedures for handling radioactive, hazardous, or non-hazardous waste. The use of MOX fuel would not require changes in the use of land or water, and would not result in increased emissions of pollutants to the air or water. In normal operations, the use of MOX fuel would not change the radiation dose to the public or the expected risk of accidents during normal reactor operation. The consequences of design-basis and beyond-design-basis accidents in a reactor burning MOX fuel could result in greater or less risk to the public depending on the type of accident, but the probability of those accidents is very low for reactors burning either LEU or MOX fuel (DOE 1999). If the DOE decides to dispose of some surplus plutonium by loading it in nuclear reactors, several decisions would need to be made by the NRC and TVA before MOX fuel is used at SQN and/or BFN. TVA would need to submit license amendment applications to the NRC.

TVA recently announced a proposal to obtain an additional 27 metric tons (mt) of highly enriched uranium (HEU) into blended low-enriched uranium (BLEU) for use as fuel at BFN or SQN. TVA evaluated the impacts of using 33 mt of HEU-derived fuel at BFN when it adopted the DOE's final EIS, *Disposition of Surplus Highly Enriched Uranium*, which was released in 1996. TVA found that implementation of those activities would result in low environmental and health impacts during normal operations (66 FR 57997). From spring 1999 through fall 2000, TVA conducted a successful limited demonstration at SQN using four fuel assemblies derived from HEU. Results of the test indicated that the HEU-derived fuel performed normally, caused no changes in plant operational parameters, characteristics, or safety, and resulted in no new or additional wastes beyond those occurring with typical operations. LEU fuel derived from the first 33 mt of HEU has been successfully loaded into TVA reactors since 2005.

TVA has not yet proposed to use MOX fuel at SQN and is updating its proposed continued use of HEU-derived (i.e., BLEU) fuel at BFN and SQN. The results of the HEU update are anticipated to be available this year, considered, and referenced in this SEIS. Assuming that TVA proposes to use MOX fuel, the DOE-TVA update of the SPD Supplemental EIS would appropriately consider any cumulative impacts associated with the proposed extension of the SQN operating licenses.

1.4.2. Public Scoping

The NEPA process requires public participation and interagency coordination and review during the preparation of an EIS. This section summarizes TVA's efforts to involve the public, agencies, and tribes to help define the content of the SEIS.

TVA determined that preparing an SEIS would be appropriate to update the 1974 FES by assessing the effects of proposed operation of SQN for an additional 20 years. Although NEPA regulations do not require a public scoping process for the preparation of an SEIS, TVA decided to employ public scoping for this SEIS.

TVA issued a press release on April 9, 2010, announcing that it was preparing an SEIS on the potential effect of extending the licenses for SQN Units 1 and 2 (see Appendix A). A notice of intent (NOI) to prepare the SEIS was published in the *Federal Register* on Monday, April 12, 2010 (see Appendix A). The NOI described the SQN plant and its location, summarized the proposed action and alternatives, enumerated the environmental issues to be addressed in the SEIS, and detailed the scoping process. The deadline for comments was May 11, 2010.

As summarized in the scoping report (Appendix B), a total of seven comment letters were received concerning this SEIS. Comments were received from the Tennessee Department of Environment and Conservation (TDEC), Tennessee Wildlife Resources Agency (TWRA), Tennessee Historical Commission (THC), State Historical Preservation Office (SHPO), United Keetoowah Band of Cherokee Indians in Oklahoma, Seminole Tribe of Florida, Tribal Historic Preservation Office, Alabama-Coushatta Tribe of Texas, Tribal Historic Preservation Office, and the Partnership for Affordable Clean Energy (see Appendix C). No objections were voiced and only minor informational requests were made. These will be addressed as necessary.

1.4.3. Issue and Resource Identification

Based on the scoping process, reviews, and assessments of the proposed action, TVA has determined that the scope of the SEIS should include the following topics:

- Surface Water Resources, Hydrology, and Water Quality – For the surface water resource, the discussion includes chemical and thermal influences on the surface water resource as well as hydrology and consumptive use impacts of the project.

- Groundwater Resources, Hydrology, and Groundwater Quality – Groundwater discussion provides potential chemical impacts and the planned use of the groundwater resource.

- Floodplains and Flood Risk – Discussion of impacts to floodplains and impacts related to the risk of flooding from the Tennessee River and from the probable maximum precipitation event.

- Wetlands – The discussion provides information relevant to SQN on-site wetlands.

- Aquatic and Terrestrial Ecology – The discussed aquatic and terrestrial ecology resource impacts include destruction or degradation of aquatic organisms, terrestrial vegetation, and wildlife.

- Endangered and Threatened Species – The potential for impacts to state-listed or federally threatened or endangered species and/or their habitat are addressed.

- Natural Areas – Natural areas are discussed for potential degradation or loss of quality.

- Recreation – The impacts on recreational resources are discussed.

- Archaeological Resources and Historic Structures – Archaeological and historical resources are evaluated for potential damage from the project.

- Visual Resources – Effects on visual resources and scenic quality are addressed.

- Noise – The potential for nuisance related to noise is addressed.

- Socioeconomics, including Environmental Justice – Socioeconomic resources are discussed dealing with changes in population, employment, income, and tax revenue. The potential for disproportionate effects on low-income populations and minorities is considered along with potential changes in housing, public services such as fire, police, and schools, land use, roads, and resulting traffic.

- Solid and Hazardous Waste – The generation and disposal of solid and hazardous waste are discussed.

- Seismology (i.e., earthquakes) – The discussion includes the seismic adequacy of SQN's design.

- Climatology and Meteorology, Air Quality, and Global Climate Change – Air quality related to the radiological effluents released into the air is discussed, as well as the fossil-fired fuel sources that support the operation of SQN. The effects of local meteorology on dispersion of effluents from proposed power plants are addressed. Also addressed is the contribution of proposed actions to global climate change (GCC), as well as the impacts of possible climate change on proposed actions.

- Radiological Effects of Normal Operations – Radiological effects on the public and on the biota from radiological releases are included.

- Uranium Fuel Use Effects – The discussion addresses radioactive waste, spent fuel, and transportation of radioactive materials.

- Nuclear Plant Safety and Security – Nuclear plant safety includes the discussion of design-basis accidents (DBAs), severe accidents, and nuclear-related radiological materials. The required security associated with the control of radioactive materials is addressed.

Decommissioning, spent fuel storage, and transmission line maintenance would be necessary actions regardless of TVA's decision to pursue license renewal. SQN would undergo decommissioning at the end of the current licenses, or at the end of the license renewal period, if approved by the NRC. A brief introduction of the possible methods and conditions of decommissioning and impacts that the eventual decommissioning of SQN will cause are discussed. Spent fuel would be stored and kept safe at SQN as long as necessary until the DOE takes possession of it. Spent fuel would be created by operating SQN until the end of the operating licenses, current or extended operational period. Potential environmental impacts associated with spent fuel storage are addressed.

Transmission lines connected to SQN are an integral part of the electrical system grid, and would therefore be in use whether SQN is operated or shut down. Maintenance (e.g. clearing vegetation in the ROW) of those transmission lines would likewise be a requirement while SQN is in current or extended operation, and probably beyond the SQN operational period to maintain the vital electrical system grid. Transmission line operation and maintenance does not depend upon the decision to renew SQN operating licenses; proposed maintenance activities and associated environmental effects would be identical regardless of the decision made. Therefore, the operation of transmission lines and maintenance of ROWs are not addressed in this SEIS.

Based upon information gathered during the scoping period, TVA has determined there is no potential to affect the following resources: wild or scenic rivers, scenic highways, park lands, prime farmlands, geological characteristics and resources, or critical or essential habitats. Accordingly, these resources are not addressed in detail.

1.4.4. Projects Included in the Evaluation of Cumulative Effects

Cumulative effects are those resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.

Cumulative impacts are evaluated by section in Chapter 3 (Affected Environment and Environmental Consequences). Past and present actions near SQN have resulted in a region shaped, in part, by TVA's successful achievement of the purpose and goals set by Congress to improve navigation, control floods, provide for the proper use of marginal lands, provide for industrial development, and provide power at rates as low as feasible, all for the general purpose of fostering the physical, economic, and social development of the Tennessee Valley region. Eastern Tennessee is characterized by primarily rural and suburban land use, with a few urban metropolitan areas. TVA dams and reservoirs reduce the risk of flooding and secure for its residents the benefits of a navigable waterway, while ensuring water quality and availability. Creation of reservoirs along the Tennessee River

has provided opportunities for recreation, industrial and municipal development, and growth of shoreline residential and community facilities. TVA's development of electric generation and associated facilities has led to the power system described in Section 1.2.

Cumulative effects of constructing and operating SQN were considered in the 1974 FES. Some SQN operations have been evaluated together with operations of other nuclear plants. Cumulative effects of spent fuel storage and transportation were addressed in DOE's tritium production FEIS (DOE 1999); cumulative effects of transportation of radioactive materials were addressed in NUREG-75/038 (NRC 1975); and cumulative hydrothermal and water supply effects of TVA operations, including SQN, were addressed in the reservoir operations study (ROS) FEIS (TVA 2004a).

Reasonably foreseeable future projects that may contribute to cumulative effects on resources within the SQN region include:

- Potential production of tritium at SQN for the DOE program. DOE has identified the purchase of irradiation services from the WBN and SQN reactor facilities as preferred for the production of tritium. Tritium production could require the addition of employees (fewer than 10 employees per unit), as well as additional plant modifications. It is expected that irradiated fabricating tritium-producing burnable absorber rod (TPBAR) assemblies, nonradioactive waste, and some additional LLRW would be transported off site for processing and disposal. (DOE 1999) To date, SQN has not produced tritium for the DOE, but the option remains open.

- Operation of Watts Bar Nuclear Unit 2 (similar to Watts Bar Nuclear Unit 1 and scheduled for operation in 2013), which would be located in Rhea County on 1,700 acres at the northern end of Chickamauga Reservoir, adjacent to the TVA Watts Bar Dam Reservation at TRM 528 on the western shore of Chickamauga Reservoir.

- Operation of the proposed single BLN nuclear unit (scheduled for operation in 2018) located on a 1,600-acre peninsula on the western shore of Guntersville Reservoir at TRM 392 in Jackson County in northeastern Alabama.

- A potential future project from the Chattanooga-Hamilton County Regional Planning Agency presented in the *2035 Long Range Transportation Plan* to widen the Daisy Dallas Road and a proposed Tennessee River bridge connection to US 27 (CHCRPA 2010).

The cumulative impact of concern for the majority of the projects would be water quality and water use during low-flow conditions along the Tennessee River system. Cumulative impacts on socioeconomic factors are also addressed. SQN's capability to produce tritium for the DOE program is discussed for the potential cumulative impacts on such things as the additional radiation doses, additional spent fuel, added radioactive waste generation, and potential impacts to the public.

Radiological effluent releases in water and air do not normally cause cumulative impacts because the limits for release are so restrictive and based on the principle that once released, below the specified limits, there is no cumulative impact. Appropriate environmental monitoring programs are in place to ensure there are no detectable cumulative effects in the local environment. See Section 3.17 for a description of the radiological environmental monitoring program (REMP).

1.4.5. Review of the Draft and Preparation of the Final SEIS

A notice of availability for the draft SEIS (DSEIS) was published in the *Federal Register* on November 5, 2010 (see Appendix A). Copies of the document were transmitted to state, federal, and local agencies, and federally recognized tribes. It was also available on TVA's website for review. In addition, TVA issued a press release on November 29, 2010, announcing a public meeting and identifying ways for the public to comment on the DSEIS (see Appendix A).

TVA held a public open house on December 2, 2010, at the SQN Training Center in Soddy-Daisy, Tennessee. During the open house, comments on the DSEIS could be made orally to a court reporter, on a web-based comment form using a computer, or by written comment form. TVA staff was available at the open house to answer questions about DSEIS (see Appendix A).

Public comments were accepted November 5, 2010, through December 22, 2010. Nine agencies and individuals commented on the DSEIS via email, and verbal statements. All comments received and TVA's responses to these comments are included in Appendix D.

This final SEIS (FSEIS) reflects revisions in support of the responses to comments on the DSEIS including additional data and clarification about air quality, meteorological conditions, socioeconomics, and updated information on TVA's recently issued IRP.

1.5. Permits, Licenses, and Approvals

Federal and state environmental laws establish standards for radiation exposure in the general environment (areas outside of the NRC-regulated area) and for sources of air pollution, water pollution, and hazardous waste. TVA maintains applicable permits for operation of SQN. Environmental permits contain specific conditions governing operation of SQN emission sources, describe pollution abatement and prevention methods to reduce pollutants, and contain emission limits for the pollutants that would be emitted from the facility. Chapter 5 of this SEIS provides additional information on the permits and licenses maintained by SQN. Table 1-3 provides a list of current permits and licenses that would be maintained throughout the license renewal period. Table 1-4 provides a list of the other federal environmental regulations and guidance that potentially are relevant to plant activities.

Table 1-3. Current Permits (Also Required During License Renewal)

Permit Type	Current Authorizations	Notes
NRC	DPR-77	Current Unit 1 operating license
NRC	DPR-79	Current Unit 2 operating license
NPDES	TN0026450	Permit effective March 1, 2011
Resource Conservation and Recovery Act (RCRA)	TN5640020504	Hazardous waste permit
Radioactive Waste Delivery License	T-TN002-L10	Radioactive waste delivery license for Tennessee
Storm Water Permit	TNR 050015	General storm water permit
Air	4150-30600701-01C	Cooling tower Unit 1
Air	4150-30600701-03C	Cooling tower Unit 2
Air	4150-30700804-06C	Insulation saw A and saw B
Air	4150-10200501-08C	Auxiliary boilers A and B
Air	4150-30703099-09C	Carpenter shop
Air	4150-30900203-10C	Abrasive blasting operation
Air	4150-20200102-11C	Emergency generators 1A, 1B, 2A, and 2B and Generators 1 and 2
Air Asbestos	A-123008	Annual asbestos permit – Hamilton County (renewed as needed)
Solid Waste	DML 331050021	Inert landfill for construction and demolition waste

Table 1-4. Relevant Federal Environmental Regulations and Guidance

Statute / Agency	Authority	Activity Covered
U.S. Nuclear Regulatory Commission	10 CFR Parts 50, 51, and 54	Operation of commercial nuclear plants and license renewal.
Endangered Species Act , U.S. Fish and Wildlife Service	16 USC §1531 et seq.	Consultation with U.S. Fish and Wildlife Service in the event that proposed activities at SQN have potential to affect federally listed species.
Native American Graves Protection and Repatriation Act	25 USC §3001 et seq.	Provides for the repatriation of Native American human remains or cultural items that are excavated from or inadvertently discovered on federal lands.
National Historic Preservation Act of 1966; Alabama, Tennessee, and Georgia Historical Commissions; SHPO; Federal Advisory Council on Historic Conservation	16 USC §470 et seq.	Consultation with state historical preservation officer in the event that proposed activities at SQN have potential to impact historical properties listed, or eligible for listing, on the National Registry of Historical Places.
Executive Order 11514	40 CFR Parts 1500–1508	Requires federal agencies to protect and enhance the quality of the environment and develop procedures to ensure the fullest practicable provisions of timely public information and understanding of federal plans and programs that may have potential environmental impacts that the views of interested parties can be obtained.
Executive Order 11988	10 CFR Part 1022; 18 CFR Part 725	Requires federal agencies to avoid floodplain impacts to the extent practicable.
Executive Order 11990	42 USC 4321 et seq.; 42 USC 4331(b)(3)	Requires federal agencies to avoid direct or indirect support of new construction in wetlands whenever there is a practicable alternative.
Executive Order 13423	42 USC 4321	Subject to the availability of appropriations, requires agencies to implement sustainable practices including energy efficiency, greenhouse gas emissions avoidance or reduction, and petroleum products use reduction.