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ENVIRONMENTAL ASSESSMENT

# SEQUOYAH NUCLEAR PLANT
# UNIT 2 STEAM GENERATOR REPLACEMENTS
**Hamilton County, Tennessee**

**PREPARED BY:**
TENNESSEE VALLEY AUTHORITY

NOVEMBER 2009

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| **APE** | Area of Potential Effect |
| **ARAP** | Aquatic Resource Alteration Permit |
| **BMPs** | Best Management Practices |
| **CFR** | Code of Federal Regulations |
| **dB** | Decibel |
| **dBA** | Decibel, A-Weighted |
| **EO** | Executive Order |
| **FONSI** | Finding of No Significant Impact |
| **HPA** | Habitat Protection Area |
| **HRM** | Hiwassee River Mile |
| **NEPA** | *National Environmental Protection Act* |
| **NHPA** | *National Historic Preservation Act* |
| **NPDES** | National Pollutant Discharge Elimination System |
| **NRC** | Nuclear Regulatory Commission |
| **NRHP** | National Register of Historic Places |
| **rem** | Roentgen Equivalent to Man |
| **RFAI** | Reservoir Fish Assemblage Index |
| **SHPO** | State Historic Preservation Officer |
| **SPCC** | Spill Prevention Control and Countermeasure |
| **SQN** | Sequoyah Nuclear Plant |
| **SR** | State Route |
| **SWPPP** | Storm Water Pollution Prevention Plan |
| **TDEC** | Tennessee Department of Environment and Conservation |
| **TRM** | Tennessee River Mile |
| **TVA** | Tennessee Valley Authority |
| **USFWS** | U. S. Fish and Wildlife Service |

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# CHAPTER 1

## 1.0 PURPOSE OF AND NEED FOR ACTION

### 1.1. The Decision

The Tennessee Valley Authority (TVA) proposes to replace the four steam generators in Unit 2 at the Sequoyah Nuclear Plant (SQN) during an outage scheduled for October 2012. 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. SQN is located approximately 18 miles northeast of downtown Chattanooga, Tennessee. A vicinity map of the SQN site is provided as Figure 1-1.

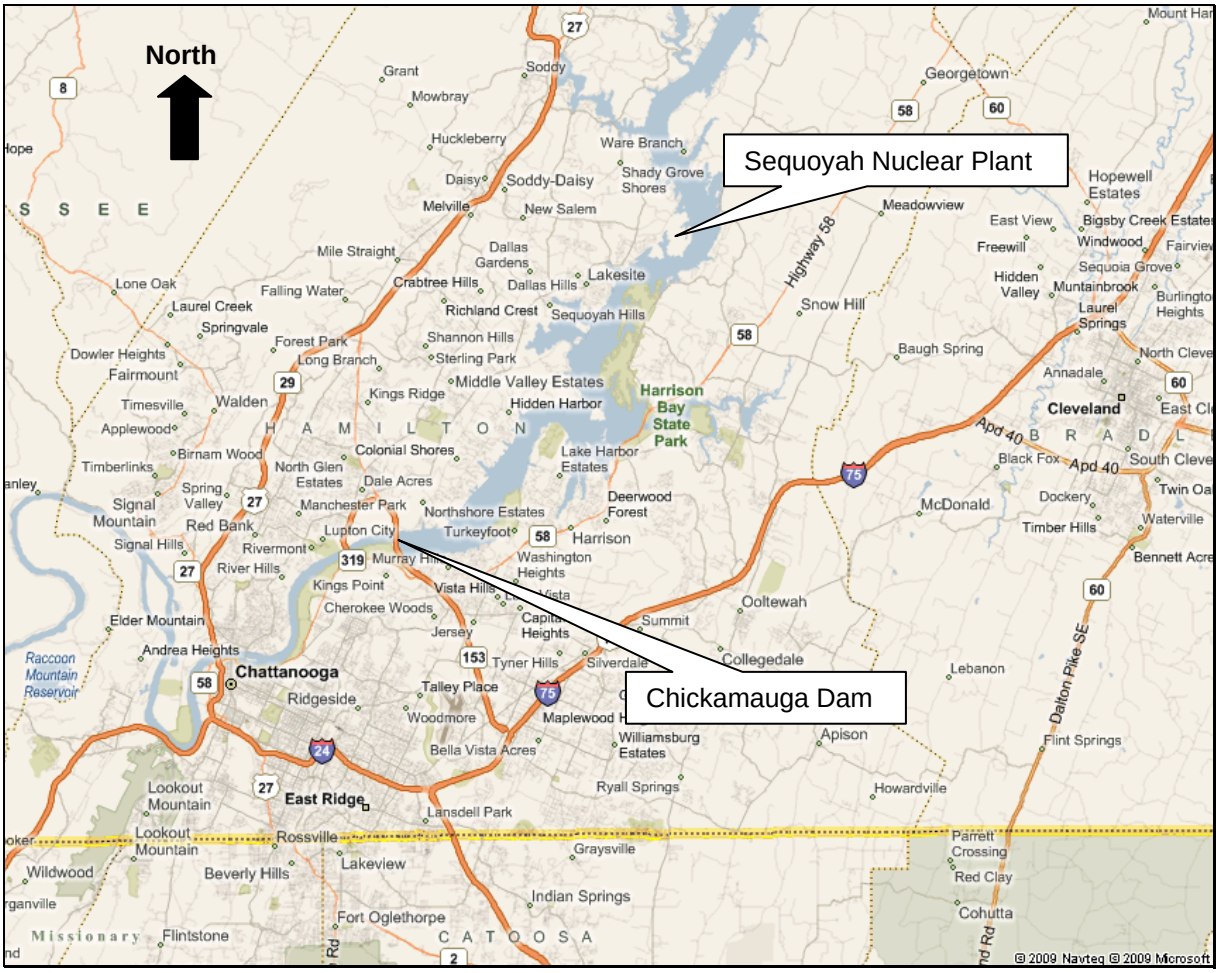


**Figure 1-1. Vicinity Map of Sequoyah Nuclear Plant, Hamilton County, Tennessee**

The subject steam generators are about 68 feet long and 15 feet in diameter. When they are in operation, they stand upright and are located in the concrete containment building. The steam generators use the extremely hot pressurized water from the nuclear reactor to produce a continuous supply of steam. This is accomplished by circulating the hot water from the reactor through a large number of tubes. Incoming "cool" water (i.e., condensate)

is circulated around these tubes, and heat is transferred to the incoming water, producing steam. The steam produced is then collected at the top of the steam generator and directed to the turbines. A schematic of a steam generator is provided as Figure 1-2.

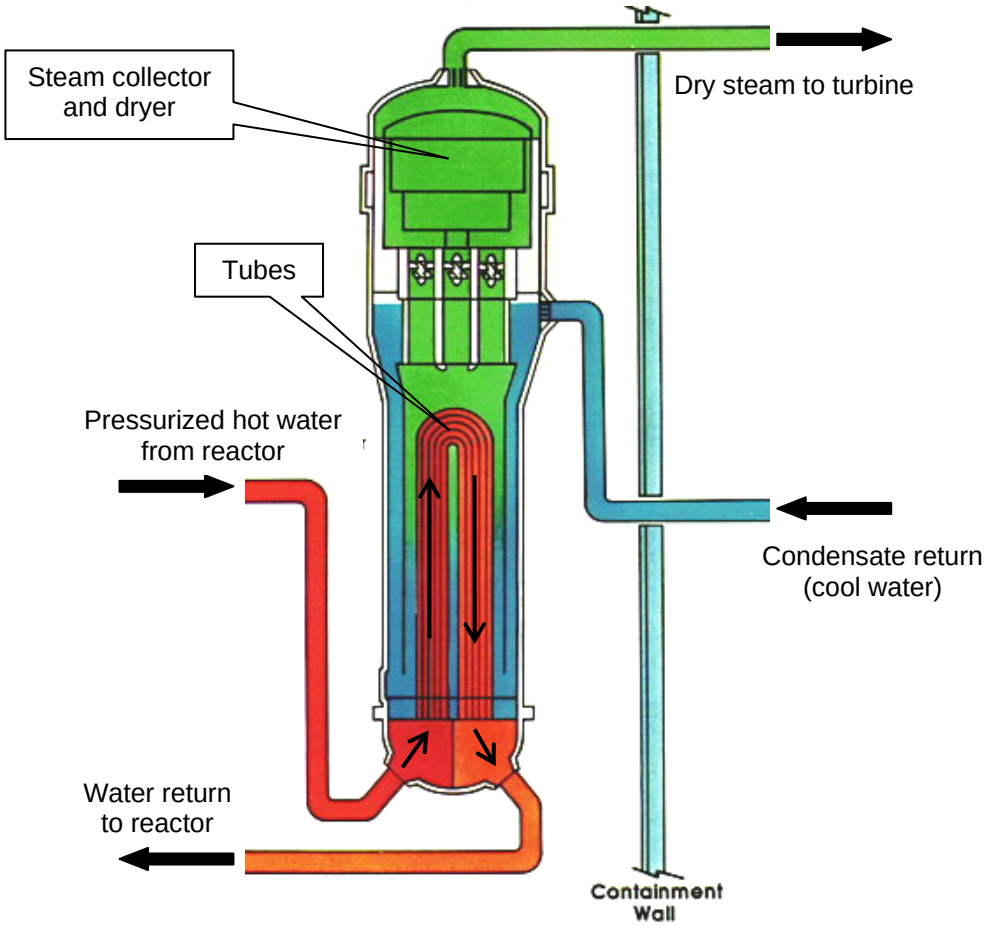


**Figure 1-2. Schematic Diagram of a Typical Steam Generator Used in a Nuclear Power Plant**

The tubes in steam generators (see Figure 1-2) tend to experience degradation over time and with use. Following regular inspections of the tubes, the Nuclear Regulatory Commission (NRC) requires repairs or plugging of any degraded tubes. Over time, the cumulative loss of tubes can lead to decreased efficiency and the need to derate[1] the unit, which results in losses of generation capability and revenue to TVA. The steam generators in Unit 2 are original equipment and have been in operation since the unit began commercial operation in June 1982. The steam generators in Unit 1 were replaced in 2003.

The decision before TVA is whether to continue to operate Unit 2 at SQN without replacing the four steam generators or to replace the four steam generators in Unit 2. Replacement of the steam generators would involve purchasing the generators, transporting them to the

[1] Derating refers to the deliberate reduction of the power output of the generating unit below its designed capacity due to practical considerations, e.g., to improve reliability.

site, removing the old steam generators, installing the generators, and on-site storage of the old steam generators.

## 1.2. Other Pertinent Environmental Reviews or Documentation

TVA prepared the *Watts Bar Nuclear Plant Unit 1 Replacement of Steam Generators, Rhea County, Tennessee, Environmental Assessment* in April 2005. In this environmental review, TVA documented the potential environmental effects of replacing the four steam generators in Unit 1 at the Watts Bar Nuclear Plant. The finding of no significant impact (FONSI) was issued on April 7, 2005.

In 2000, TVA documented the potential environmental effects of replacing the four steam generators in Unit 1 at SQN in the document *Replacement of Steam Generators, Sequoyah Nuclear Plant Unit 1 Abbreviated Environmental Assessment*. The FONSI was issued on May 15, 2000.

The *Sequoyah Nuclear Plant Units 1 and 2 Final Environmental Statement* was released in 1974. In this document, TVA evaluated the effects on the environment of the construction and operation of SQN.

## 1.3. The Scoping Process

An interdisciplinary team consisting of TVA technical staff reviewed the potential direct, indirect, and cumulative effects of implementing the two alternatives considered.

TVA notified the following federally recognized tribes of the proposed undertaking:

- Cherokee Nation
- Eastern Band of Cherokee Indians
- United Keetoowah Band of Cherokee Indians in Oklahoma
- The Chickasaw Nation
- Jena Band of Choctaw Indians
- Muscogee (Creek) Nation of Oklahoma
- Alabama-Coushatta Tribe of Texas
- Alabama-Quassarte Tribal Town
- Kialegee Tribal Town
- Thlopthlocco Tribal Town
- Absentee-Shawnee Tribe of Oklahoma
- Eastern Shawnee Tribe of Oklahoma
- Shawnee Tribe

## 1.4. Necessary Federal Permits or Licenses

The following permits and licenses could be required to implement the proposed action under Alternative B.

- An Aquatic Resource Alternation Permit (ARAP) and a Section 401 (of the *Clean Water Act*) Water Quality Certification from the Tennessee Department of Environment and Conservation (TDEC) for bank excavation and stabilization at the barge off-load site.

- A Section 404 permit from the U.S. Army Corps of Engineers and a Section 401 Water Quality Certification from TDEC for the installation of riprap at the barge off-load site.

- A Construction Storm Water Permit from TDEC if 1 acre or more of land is to be disturbed.

- The Tennessee Storm Water Multisector General Permit for Industrial Activities would be modified to include the new steam generator laydown area or any other areas affected by the project.

- A special waste approval from TDEC.

# CHAPTER 2

## 2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

### 2.1. Alternatives

Two feasible alternatives were developed. These include Alternative A (the No Action Alternative) and Alternative B (the Action Alternative - Steam Generator Replacement). These alternatives are described in additional detail below.

#### *2.1.1. Alternative A – The No Action Alternative*

Under the No Action Alternative, TVA would not replace the four Unit 2 steam generators. Adoption of this alternative would likely result in a gradual derating of Unit 2, which would lead to a reduction in power generation capability. Should the steam generators not be replaced, expensive repairs to the degraded tubes to forestall derating Unit 2 would be necessary. Over the long term, an eventual shutdown of Unit 2 could occur if degraded tubes could not be repaired effectively.

#### *2.1.2. Alternative B – Install Four New Unit 2 Steam Generators*

Under the Action Alternative, TVA would replace the four Unit 2 steam generators during a scheduled outage in 2012. The various actions and activities involved in replacing the generators are described in additional detail below. The proposed replacement of the steam generators would allow Unit 2 to function at full capacity and provide a reliable supply of electric power.

##### 2.1.2.1. Overview

The new steam generators would be manufactured overseas and delivered to the plant site by barge in October 2010. The generators are about 68 feet long and 15 feet in diameter and weigh approximately 350 tons. They would be removed from the barge by one of two methods described below in Section 2.1.2.3. One is to pull the barge into the existing barge slip (see Figure 2-1) and use an overhead gantry crane to lift the generator from the barge and place it on a special flatbed trailer for transport. The other option is to excavate the bank adjacent to the barge slip and lay down a portable ramp from the bank to the barge. The special flatbed trailer would be rolled onto the barge, and the generators would then be placed onto the trailer. Once unloaded from the barges, the new steam generators would be transported to a laydown area adjacent to the Unit 2 concrete shield building (see Figure 2-1).

In preparation for removing the old steam generators, a large access hole would be cut in the roof of the concrete shield building using a high-pressure water jet (i.e., a "hydroblaster"). The old generators would be disconnected from the existing steam piping system. They would then be lifted out of the concrete shield building (through the hole) with a large crane. This crane would be delivered to the site in sections by truck and constructed on site next to the concrete shield building. Once removed, the old steam generators would be transported to a new on-site concrete storage building. This new building would be constructed in a large graveled area (see Figure 2-1) adjacent to the storage building constructed previously to house the steam generators removed from

Unit 1. The dimensions of the steam generator storage building are approximately 150 feet (long) by 30 feet (high) by 40 feet (wide).

The replacement steam generators would be lowered through the hole in the roof of the concrete shield building by crane, set in place, and reconnected. Once the generators are installed, the roof would be reconstructed, and the crane would be disassembled and removed. Total project time is expected to be approximately 30 months. A detailed description of the activities involved is provided below.

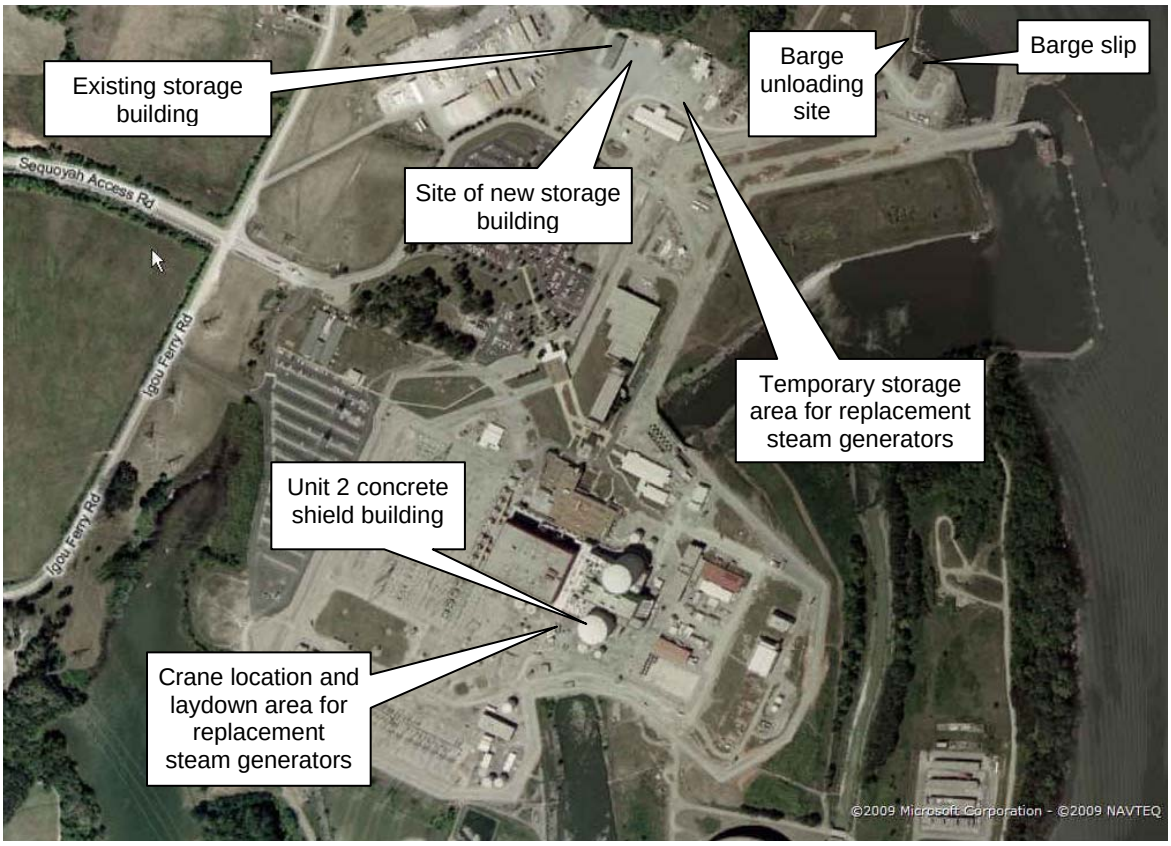


**Figure 2-1. Aerial View of Sequoyah Nuclear Plant, Hamilton County, Tennessee**

### 2.1.2.2. Construction Activities

General construction activities involved in replacing the Unit 2 steam generators include the following actions:

- Grading and excavation
- Delivery of permanent plant equipment (i.e., replacement steam generators) and temporary storage on support saddles
- Delivery of construction equipment and materials (e.g., trucks, compressors, pipe, steel plating, concrete)
- Construction of a new building for storing the old steam generators
- Excavation and foundation work for the outside lift system crane and the erection of the crane next to the Unit 2 concrete containment building

- Excavation and roadwork at the barge off-load site
- Demolition activities on the Unit 2 containment dome for access and removal of the existing steam generators
- Removal of waste concrete and steel
- Extraction of the old steam generators and associated piping from the Unit 2 containment building
- Installation of the new steam generators and associated piping in the Unit 2 containment building
- Replacement of steel and concrete shielding on the Unit 2 containment dome

#### 2.1.2.3. Replacement Steam Generator Off Loading, Delivery, and Temporary Storage

The four new steam generators would be delivered to SQN by barge via the Tennessee River. Barge deliveries would occur during the fall of 2012. Each barge would likely have a dedicated tow. The replacement steam generators would be shipped from overseas to either New Orleans, Louisiana, or Mobile, Alabama, where they would be loaded onto barges. If they were loaded in New Orleans, the barges would be transported via the Intracoastal Waterway to Mobile. From Mobile, the two barges, each loaded with two steam generators would be brought up the Tennessee-Tombigbee Waterway to the Tennessee River. As stated in Section 2.1.2, off loading would be accomplished using one of two possible options.

Off-Load Option 1 – Overhead Gantry Crane

This option involves the use of the existing barge slip (see Figure 2-1) and an overhead gantry crane to lift the steam generator units from the barge. The crane would be mounted on rails, and once a steam generator is lifted clear of the barge, the crane would be moved landward. The steam generator, still in a horizontal position, would be positioned over the special haul trailer and lowered into place for transport. There is currently no crane located at the barge slip. Because of the expense of constructing a crane, essentially for a one-time use, use of this option is not likely. Nevertheless, because it is a feasible option, it was considered in this review.

Off-Load Option 2 – Bank Excavation

The second off-load option calls for excavating and shaping the riverbank adjacent to the existing barge slip (see Figure 2-1). An area of the bank approximately 50 feet wide would be excavated to create a slope no greater than 5 percent. The toe of the slope would be at elevation 682, approximately 5 to 7 feet above the normal winter pool elevation of 675 to 677. Only the central 30 feet would be excavated. The sides of the ramp would be sloped at a 3:1 ratio (3 feet of horizontal distance for each foot of rise). Appropriate construction best management practices (BMPs) would be implemented during excavation to prevent the introduction of soil or other pollutants into surface waters. Class “A” aggregate, i.e., gravel, would be placed on the slope and compacted to create a satisfactory roadway for the trailer. A 20-foot by 20-foot timber mat 12 inches thick would be constructed at the toe of the slope. Approximately 50 feet of riprap would be placed on the shoreline to stabilize the bank. A steel off-load ramp, no longer than 40 feet, would be placed onto the barge from the bank. The landward end of the off-load ramp would be placed at least 5 feet onto the timber mat. Each new steam generator would then be raised from the barge deck by

special jacks, and the haul trailer would be rolled under the generator. The generator would then be lowered onto the trailer and transported to the laydown area.

Regardless of the off-load option, the replacement steam generators would be transported one at a time to the laydown area (see Figure 2-1). At the laydown area, the new steam generators would be off loaded from the transport trailer using a jack system. The existing heavy-duty roadway used during the Unit 1 steam generator replacement project would be used for the bulk of the haul road for this project. However, a section of existing road leading to the laydown area adjacent to Unit 2 could require some minor upgrades, mainly grading. Steel plates would be placed in areas where utility or water lines are located under the road to prevent damaging these lines.

#### 2.1.2.4. Temporary Storage of Equipment and Supplies

Equipment and supplies for the proposed work would be delivered to the SQN site by trucks. The construction contractor would erect a temporary warehouse near the current TVA warehouses. Laydown areas would be established in various existing locations to support work activities. The replacement steam generators would be stored in a vacant area near the proposed location of the old steam generator storage facility (see Figure 2-1).

#### 2.1.2.5. Old Steam Generator Storage Facility

A new building would be constructed next to the steam generator storage building built for the Unit 1 steam generator replacement project (see Figure 2-1). This area is currently graveled. Excavations would be necessary for the building foundation.

#### 2.1.2.6. Erection of the Outside Lift System Crane

The outside lift system crane would be erected adjacent to Unit 2 as shown in Figure 2-1. This area is currently graveled; however, some preparation for a suitable foundation for the crane would be necessary. These preparations could include minor excavation (i.e., 2 feet or less) and, possibly, the driving of pilings for foundation support.

#### 2.1.2.7. Demolition Activities at the Unit 2 Containment Building Dome

Demolition activities for the Unit 2 containment dome opening would consist of the installation of a debris barrier system inside the annulus area underneath the concrete dome. The concrete would be removed from the containment dome by a hydrodemolition process (i.e., “hydroblasting”), which uses a high-pressure water jet to remove concrete while leaving the steel reinforcement bars intact. This process would create a path through the 2-foot-thick concrete dome approximately 30 inches wide around the perimeter of a 45- by 22-foot oval opening. The remaining concrete section would be cut free of the reinforcements and removed intact. The water and concrete slurry from the hydrodemolition would be removed via a high suction vacuum system connected to a vacuum truck. Pending approval from TDEC, water removed by the vacuum process would be allowed to drain off the concrete debris within the immediate work area. Otherwise, this water would be collected and stored on site temporarily prior to off-site disposal. Concrete rubble would be analyzed for radiation and transported to an on-site spoil area by truck. The concrete section removed from the containment dome would likely be stored next to the steam generator storage building. Samples would be taken to determine if any

contamination exists on the section. If testing indicates no contamination, it would be pulverized and disposed of on site. Otherwise, it would continue to be stored on site intact.

Each of the four steam generators would be cut free from their existing piping and lifted by crane from the concrete shield building. The old generators would then be transported to the steam generator storage area and placed into storage in the old steam generator storage facility (see Section 2.1.2.5). The replacement steam generators would then be lowered into the containment building, and the piping would be reconnected.

Concrete rubble would be generated by the creation of the temporary opening. A small amount of waste steel would be contaminated. Noncontaminated waste steel would be reused or recycled. Piping would be decontaminated prior to welding the replacement steam generators to the existing piping to reduce worker radioactive exposure and dose. This decontamination would generate radioactive waste for disposal. With the exception of a small amount of insulation removed to access the base of the steam generators, the reflective metal insulation on the old steam generators would remain on the old units. Support activities for the proposed work would create radioactive and nonradioactive solid wastes.

## 2.2. Comparison of Alternatives

Under Alternative A, the No Action Alternative, TVA would not replace the existing four steam generators that serve Unit 2. Under the Action Alternative (i.e., Alternative B), the Unit 2 steam generators would be replaced. From an operational standpoint, adoption of Alternative B would allow SQN to maintain the capability to produce electric power efficiently from Unit 2; whereas, under the No Action Alternative, TVA would likely lose generation capability due to a reduction in available steam supply from the existing steam generators.

Adoption and implementation of the No Action Alternative would cause no changes in the visual character of the SQN site. No additional radioactive waste (beyond current levels) would be produced under the No Action Alternative. However, the need for additional maintenance on the existing steam generators could result in potential additional exposure for workers involved in maintaining this equipment. Current levels of radioactive and solid waste production would likely remain unchanged under Alternative A. Likewise, surface water quality and groundwater would not be affected under this alternative.

Under the Action Alternative, TVA would replace the four Unit 2 steam generators. Consequently, hydrodemolition activities would generate loud noise for approximately one week, and cranes and other heavy equipment would be brought on site for various periods. Total project duration would be approximately 30 weeks. Removal and placement of the old steam generators into on-site storage would expose workers to radioactivity. However, exposures would be monitored, and all work would be done in accordance with procedures. The proposed construction under Alternative B would generate approximately 3,200 to 4,800 cubic feet of concrete rubble from hydrodemolition on the Unit 2 containment dome. Because implementation of the Action Alternative would involve some ground disturbance, there are potential effects to water quality. However, appropriate measures would be taken to prevent adverse effects to surface water quality and to groundwater. Replacement of the steam generators would require as many as an additional 1,000 workers on site (above those normally required for a scheduled outage) during peak activities, which would last about 8 weeks.

Historic and cultural resources would not be affected under either alternative. Potential effects to biological resources, including terrestrial and aquatic life, threatened and endangered species, and wetlands are not anticipated under either alternative. Similarly, no natural areas or recreational facilities or opportunities would be affected under either alternative. No floodplain functions would be compromised regardless of the alternative selected.

## 2.3. The Preferred Alternative

TVA's preferred alternative is Alternative B.

# CHAPTER 3

## 3.0 AFFECTED ENVIRONMENT

SQN is located on a bend in the Tennessee River at Tennessee River Mile (TRM) 483.5 to 485. This segment of the Tennessee River constitutes Chickamauga Reservoir. The plant site is relatively level and contains a mixture of general and special purpose buildings, parking areas, roads, and graveled areas. Groundbreaking for SQN occurred in 1969, and major construction began about a year later. SQN has two generating units. Unit 1 began commercial operation on July 1, 1981, while Unit 2 became operational on June 1, 1982. Each of these units is capable of producing over 1,160 megawatts of electricity, and together they can provide electric power to about 1.3 million households per day.

The plant site is located approximately 18 miles northeast of downtown Chattanooga, Tennessee. The nearest town is Soddy-Daisy, which is located about 5 miles to the west. The land adjacent to the plant is mainly rural, with scattered farmland, forested areas, and some residential developments. Specific resources that could be potentially affected by the proposed action are described below.

### 3.1. Visual Character and Noise

The local area around SQN is mostly rural; however, there is scattered residential development in the areas around the plant site. There is a subdivision approximately 1 mile north of the plant site and another within a mile to the west along Hixson Pike (State Route [SR] 319). The closest residence to the Unit 2 construction site is located approximately 3,000 feet away in this subdivision. This subdivision is separated from the main part of the SQN site by an embayment, which has a border of trees on both sides. There are residences located on the eastern shoreline of Chickamauga Reservoir within 1 mile of the plant site.

The physical, biological, and cultural features of an area combine to make the visual landscape character both identifiable and unique. Scenic integrity indicates the degree of unity or wholeness of the visual character. Scenic attractiveness is the evaluation of outstanding or unique natural features, scenic variety, seasonal change, and strategic location. Where and how the landscape is viewed would affect the more subjective perceptions of its aesthetic quality and sense of place. Views of a landscape are described in terms of what is seen in foreground, middleground, and background distances. In the foreground, an area within 0.5 mile of the observer, details of objects are easily distinguished in the landscape. In the middleground, normally between 1 and 4 miles from the observer, objects may be distinguishable, but their details are weak and they tend to merge into larger patterns. Details and colors of objects in the background, the distant part of the landscape, are not normally discernible unless they are especially large and standing alone.

The predominant visual features of SQN include the powerhouse, cooling towers, and transmission lines and structures, which can be seen up to middleground distances along the Tennessee River to the north and south. Motorists have broad horizontal views of the plant site from the west along SR 312 (Birchwood Pike), including Skull Island recreation area near Cooley Road and a Tennessee Wildlife Resources Agency boat ramp south of Skull Island. Recreationists on the water have similar views from the eastern side of the Tennessee River. However, these views become less dominant, as the viewing position is

situated closer to the west side of the river near the plant site. Topography along the bank becomes very steep, and views are obscured by dense, mature hardwood and evergreen trees. Scenic attractiveness is common. Scenic integrity is low because of the presence of the plant site in the landscape.

At moderate levels, noise can interfere with communication, disrupt sleep, and cause stress. Noise can cause hearing loss at very high levels. Even at relatively low levels, noise can be an annoyance. Noise is measured in decibels (dB), which are measured on a logarithmic scale. Because some noise frequencies are not perceptible to the human ear, a measurement known as A-weighted decibels (dBA) was used in the noise assessment. This measurement does not include sound in frequencies above or below the range of human hearing. Thus, noise measurements expressed in dBA reflect those noise levels that affect people rather than the total noise. Average noise levels in rural areas are typically about 40 dBA during the day.

## 3.2. Radioactivity

SQN is a nuclear facility, and normal operations and maintenance involve radioactive materials. There are processes and procedures to contain radioactive materials and to limit the exposure of workers that must deal with radioactive materials. Treatment and handling of radioactive materials and wastes are in accordance with various regulations promulgated by the NRC.

### *3.2.1. Exposure to Radioactivity*

Occupational radiation doses during the storage, monitoring, and retrieval of radioactive wastes are a small percentage of the total dose to workers who handle radioactive materials or who work around radioactive materials regularly.

### *3.2.2. Radioactive Waste*

Radioactive wastes (collectively known as “radwaste”) are generated as part of normal SQN operations. These wastes are managed in accordance with various permits and licenses. There are various methods of compaction and incineration methods used to reduce the volumes of low-level radwaste. These methods result in an average reduction of dry solid waste greater than a 10 to 1 ratio. Mobile demineralizers are used to process wet waste.

## 3.3. Solid Waste

Currently, both solid and hazardous wastes are generated at SQN from plant operation and maintenance activities. SQN is a small quantity generator of hazardous waste. SQN’s Environmental Protection Agency Generator Identification Number is TN 5640020504. All waste generated at the plant is managed in accordance with applicable state and federal regulations.

## 3.4. Historic and Cultural Resources

Historic and cultural resources, including archaeological resources, are protected under several federal laws. These include the *Archaeological Resources Protection Act*, the *Native American Graves and Repatriation Act*, and the *National Historic Preservation Act*

(NHPA). Section 106 of NHPA requires federal agencies to consult with the respective State Historic Preservation Officer (SHPO) when federal actions could adversely affect these resources.

No comprehensive archaeological survey has been conducted on the SQN site. Two archaeological sites (40HA22 and 40HA20) were recorded during the preinundation survey of Chickamauga Reservoir. Site 40HA20, known as the McGill site, was the subject of some archaeological testing prior to inundation of the reservoir in the 1930s. The site was recorded as a Late Woodland/Early Mississippian Mound complex. Both sites were likely destroyed by the construction of SQN (TVA 1974). Additionally, the Igou Cemetery, which contains about 45 graves, is located near the firing range on the southwestern edge of SQN. Because the cemetery is located on the SQN site, access to the cemetery is by special permission only for security reasons.

A Phase I cultural resources survey was conducted for the barge area, the crane location and adjacent laydown area, and old steam generator storage building site (Jones and Karpynec 2009). Thus, the area of potential effect (APE) for archaeological resources included these three areas, as these areas are where ground-disturbing activities would occur. A survey for historic structures in the viewshed was also conducted to identify any standing structures or historic sites that may be impacted by the new construction. The architectural APE included that area within 0.5 mile of the sites in the archaeological APE. The survey confirmed that the entire archaeological APE had been disturbed previously by the construction of SQN. Site 40HA20 is not located within the archaeological APE. No historic structures or sites were identified within the viewshed of the proposed actions.

## 3.5. Water Quality

The 1972 amendments to the *Federal Water Pollution Control Act* (also known as the *Clean Water Act*) established the statutory basis for the National Pollutant Discharge Elimination System (NPDES) and the basic structure for regulating the discharge of pollutants from point sources to waters of the United States. A physical alteration to the properties of waters of the state requires an ARAP or a Water Quality Certification under Section 401 of the *Clean Water Act*. These permits are administered by TDEC. SQN currently operates under NPDES Permit TN0026450. Additionally, SQN holds Tennessee Multisector Permit TNR050015 for storm water discharges associated with industrial activities.

Chickamauga Reservoir is impounded by Chickamauga Dam, which was completed in 1940. The reservoir has 784 miles of shoreline and about 36,240 acres of water surface. The SQN plant site contains no perennial streams. However, SQN operates 24 storm water outfalls.

From about December 1 through the end of March, the target reservoir operating level is 675 to 677 feet. At the end of March, the reservoir is allowed to fill, and a target operating elevation of 681.5 to 682.5 feet is maintained from mid-May until early September. During late spring and summer, TVA varies the elevation of Chickamauga Reservoir for mosquito control. Specifically, the reservoir is lowered during the week and then raised about a foot on weekends.

TVA has developed the Ecological Health Monitoring Program to monitor water quality and ecological health of TVA reservoirs. Ecological Health Ratings are based on five indicators, i.e., dissolved oxygen, chlorophyll, fish, bottom life, and sediment contamination. In 2007,

dissolved oxygen rated good at some sample locations in Chickamauga Reservoir, but fair in the area near SQN. Historically, dissolved oxygen ratings have been good. Recent low ratings are likely the result of dry conditions, which because of reduced flow, can cause low dissolved oxygen conditions to develop near the bottom. For similar reasons, recent ratings for chlorophyll, which normally score in the good to fair range, have been fair.

## 3.6. Socioeconomics

Executive Order (EO) 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations) requires federal agencies to identify and address any disproportionately high and adverse human or environmental effects of its programs, policies, and activities on minority and low-income populations.

As previously mentioned, SQN is located in Hamilton County, Tennessee, north of Chattanooga near the town of Soddy-Daisy. Soddy-Daisy has an estimated population of 12,511, as of 2008 (U.S. Census Bureau 2009). The population of Hamilton County is estimated to be 332,848, as of 2008. The population of Hamilton County is 26.0 percent minority, slightly higher than the state average of 22.9 percent but lower than the national average of 34.4 percent. In 2007, the poverty level was an estimated 13.5 percent of the total, somewhat lower than the state average of 15.8 percent but slightly higher than the national average of 13.0 percent. The plant is located in Census Tract 103.01, Block Group 2, Block 2014. As of the 2000 Census of Population, Block 2014 had a total population of 246, of which 1.6 percent were minorities; the minority population in Census Tract 103.01 was 2.4 percent of total population and in Block Group 2, the minority population was 1.9 percent of the total. These shares are all well below the state and national averages. The poverty level in Census Tract 103.01 was 6.4 percent, and in Block Group 2 the level was 5.8 percent. Both are well below the county rate of 12.1 percent, as well as the state and national levels, which are 15.8 and 13.0 percent, respectively.

Sequoyah Access Road provides road access to the SQN site. This road runs eastward from U.S. Highway 27 and intersects with Hixson Pike (SR 319) near the SQN site. In 2008, the average daily traffic volume on Sequoyah Access Road immediately west of Hixson Pike was 3,526; on Hixson Pike immediately south of Sequoyah Access Road, the count was 2,850 (Tennessee Department of Transportation 2009).

## 3.7. Terrestrial Life

SQN is an industrial complex where approximately 90 percent of the reservation is comprised of buildings, parking lots, and mowed open areas. All of the proposed work would take place within the industrial area. Existing plant communities include herbaceous vegetation along fencerows and roadsides and two small wooded areas adjacent to Chickamauga Reservoir. Common herbaceous vegetation includes Japanese honeysuckle, trumpet creeper, and various weedy lawn species. Plant communities on site are common and representative of a heavily disturbed area. No designated critical habitat for any plant species is known to occur within or around SQN.

EO 13112 (Invasive Species) requires federal agencies to avoid actions that are likely to cause or promote the introduction or spread of invasive species. This EO defines an invasive nonnative species as any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, which is not native to that

ecosystem, and whose introduction does or is likely to cause economic or environmental harm or harm to human health. Invasive nonnative plants can occur as trees, shrubs, vines, grasses, ferns, and forbs. Because they tend to lack many of the natural controls (e.g., insects, animals, and competing plants) that kept them in check in their native environments, they can spread rapidly and out-compete some native plants.

Essentially the entire proposed project is on land in which the native vegetation has been altered extensively by previous land use history. Common invasive exotic plant species occurring within the area include Chinese privet, Japanese honeysuckle, Japanese stilt grass, multiflora rose, and sericea lespedeza. All of these species have the potential to affect the native plant communities adversely because of their potential to spread rapidly and displace native vegetation.

Plant habitat in the proposed area of excavation consists primarily of a mowed, grass field. Some shrubs exist along the shoreline where excavation is proposed. Birds common in this type of early successional habitat are American robin, killdeer, American crow, eastern bluebird, northern cardinal, and tree swallow. Mammals frequently observed in this habitat are eastern cottontail, Virginia opossum, striped skunk, white-tailed deer, coyote, and small rodents such as hispid cotton rat, least shrew, and eastern mole. Beavers have recently colonized the SQN area and have become a nuisance due to their tendency to block drainage systems. Common reptiles include eastern garter snake, black racer, and rat snake. Flooded depressions in this early successional habitat provides habitat for amphibians such as American toad, Fowler's toad, upland chorus frog, and northern cricket frog. The shoreline at the proposed excavation area is eroded in some areas and covered in riprap in others, preventing it from providing suitable habitat to terrestrial wildlife. The building for storing the old steam generators would be constructed in a graveled area. Similarly, the crane for removing and replacing the steam generators in the Unit 2 containment building would be erected in a graveled area that is essentially devoid of vegetation.

Two heron colonies and one cave occur within 3 miles of the site of the proposed action. The closest heron colony is 2.4 miles northeast of the proposed excavation/construction area. The cave is more than 1.5 miles away from the proposed project area.

The laydown yard and storage building are graveled areas and do not provide suitable habitat for wildlife.

## 3.8. Aquatic Life

TVA developed the Ecological Health Monitoring Program to determine reservoir health. The ecological health scoring system is based on five indicators: (1) dissolved oxygen; (2) chlorophyll, a measure of the amount of algae in the water; (3) sediment contaminants – polychlorinated biphenyls, pesticides, and metals; (4) benthic macroinvertebrates; and (5) fish assemblage. Evaluations for each indicator are combined into a single, composite score for each reservoir.

Chickamauga Reservoir was monitored on a semiannual basis from 1995 to 2007. Because collection methods and rating criteria for reservoir fish and benthic communities were different prior to 1994, those results cannot be compared directly to samples taken using current methods. Therefore, those results are not presented in this document.

With respect to Ecological Health Ratings (see Section 3.5) Chickamauga Reservoir has consistently rated in the “good” range with the exception of the 2007 rating (see Figure 3-1). Prolonged drought conditions in the Tennessee River drainage likely contributed to lower ratings for dissolved oxygen, chlorophyll, fish, and bottom life in 2007 in the entire main stem Tennessee River. Rainfall in 2009 is more typical, and these measures are expected to return to predrought levels.

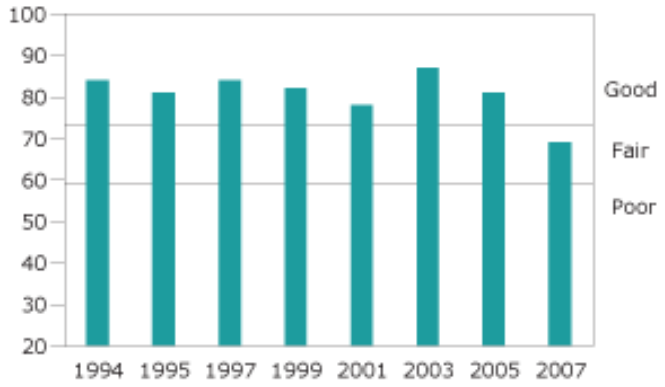


**Figure 3-1. Chickamauga Reservoir Ecological Health Ratings**

TVA’s Reservoir Vital Signs Monitoring Program included semiannual fish sampling on Chickamauga Reservoir from 1995 to 2007. Ratings are based primarily on fish community structure and function using a metric known as the Reservoir Fish Assemblage Index (RFAI) as shown in Table 3-1.

**Table 3-1. Reservoir Fish Assemblage Index Ratings in Chickamauga Reservoir**

| Station | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1995 | 1997 | 1999 | 2001 | 2003 | 2005 | 2007 |
| Forebay[1] TRM[2] 472.3 | Good | Fair | Good | Good | Fair | Good | Fair |
| Transition TRM 490.5 | Good | Fair | Good | Good | Fair | Good | Fair |
| Inflow TRM 518.0 | Fair | Fair | Fair | Good | Good | Fair | Fair |
| Hiwassee River Embayment HRM[3] 8.5 | Fair | Fair | Fair | Good | Fair | Good | Fair |

[1]The forebay is the deepwater part of the reservoir immediately upstream of the dam
[2]TRM – Tennessee River Mile
[3]HRM – Hiwassee River Mile

The RFAI scores for Chickamauga Reservoir have been relatively consistent during the monitoring period. This indicates that the fish community in Chickamauga Reservoir is stable with regard to fish species composition, abundances, and fish health. Sport fishing on Chickamauga Reservoir tends to be about as good as or better than fishing Valleywide. There are no fish consumption advisories for the reservoir.

Bottom life was included in aquatic monitoring programs because of its importance to the aquatic food chain and because these species have limited capability of movement, thereby preventing them from avoiding undesirable conditions. Sampling and data analysis that are indicative of good (or poor) water quality include total abundance of all species and proportions of samples with no organisms present.

The Chickamauga bottom life monitoring sites have consistently rated as “good” or “fair” (see Table 3-2). Like the RFAI scores for 2007, the “fair” and “poor” scores seen in 2007 are likely a result of recent prolonged drought conditions in the Tennessee Valley. The easing of drought conditions in 2009 will likely result in improvements in bottom communities in future years.

**Table 3-2. Recent Benthic Community Scores in Chickamauga Reservoir**

| Station | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1995 | 1997 | 1999 | 2001 | 2003 | 2005 | 2007 |
| Forebay TRM 472.3 | Good | Good | Fair | Good | Good | Fair | Fair |
| Transition TRM 490.5 | Good | Fair | Fair | Good | Good | Good | Fair |
| Inflow TRM 518.0 | Good | Good | Good | Fair | Good | Good | Fair |
| Hiwassee River Embayment HRM 8.5 | Good | Fair | Fair | Fair | Good | Fair | Poor |

## 3.9. Threatened and Endangered Species

Species listed at the federal level as threatened or endangered are protected under the *Endangered Species Act*, which is administered by the U.S. Fish and Wildlife Service (USFWS). Section 7 of this act requires federal agencies to consult with USFWS in situations where a federal action may adversely affect federally listed species or their habitats.

A review of the TVA Natural Heritage database indicated that one federally listed as threatened plant species, the large-flowered skullcap (*Scutellaria montana*), and one state species of special concern, gibbous panic grass (*Sacciolepis striata*), are known to occur within 5 miles of the project (see Table 3-3). Two additional federally listed species and one candidate species are reported from Hamilton County, Tennessee. No federally or state-listed plant species or habitat for these species were present on lands that would be affected by the proposed project.

**Table 3-3. Endangered, Threatened, and Other Species of Conservation Concern Known From the Hamilton County Area**

| Common Name | Scientific Name | Federal Status | State Status (Rank) |
|---|---|---|---|
| **Plants** | | | |
| Large-flowered skullcap | *Scutellaria montana* | THR | THR (S2) |
| Gibbous panic grass | *Sacciolepis striata* | -- | SPCO (S1) |
| Monkey-face orchid | *Platanthera integrilabia* | CAND | END (S2S3) |
| Small whorled pogonia | *Isotria medeoloides* | THR | END (S1) |
| Virginia spiraea | *Spiraea virginiana* | THR | END (S2) |
| **Birds** | | | |
| Bald eagle | *Haliaeetus leucocephalus* | PROT | NMGT (S3) |
| **Fish** | | | |
| Highfin carpsucker | *Carpiodes velifer* | -- | NMGT |
| Snail darter | *Percina tanasi* | THR | THR (S2S3) |
| **Crayfish** | | | |
| Chickamauga crayfish | *Cambarus extraneus* | -- | THR (S1S2) |
| **Mussels** | | | |
| Orange-foot pimpleback | *Plethobasus cooperianus* | END | END (S1) |
| Pink mucket | *Lampsilis abrupta* | END | END (S1) |
| Rough pigtoe | *Pleurobema plenum* | END | END (S1) |
| **Snails** | | | |
| Ornate rocksnail | *Lithasia geniculata* | -- | TRKD (S3) |

-- = Not applicable

Federal status abbreviations: END = Endangered; THR = Threatened; CAND = candidate; PROT = Protected

State status abbreviations: END = Endangered; THR = Threatened; SPCO = Species of special concern; NMGT = In need of management; TRKD = Tracked as sensitive but with no legal status

State rank abbreviations: S1 = Critically imperiled; S2 = Imperiled; S3 = Rare or uncommon (plants), Vulnerable (animals); S#S# = Occurrence numbers are uncertain

A review of the TVA Natural Heritage database during August 2009 indicated one federally listed as protected terrestrial animal species, the bald eagle, reported from Hamilton County. Although the bald eagle is no longer considered a threatened or endangered species at the federal level, it is protected by the federal *Bald and Golden Eagle Protection Act*. The bald eagle is considered “in need of management” in Tennessee. Bald eagles nest in forested areas near large bodies of water, where they forage. Two nests have been reported near SQN. The closest record is 1.25 miles to the northwest. No suitable habitat for bald eagles exists in the area where any of the proposed actions would occur.

Review of the TVA Natural Heritage database indicated that one federally listed as endangered mussel (the pink mucket) and one state-listed fish (the highfin carpsucker) are currently reported from Chickamauga Reservoir within a 10-mile radius of SQN. An additional five state- or federally listed aquatic species are known from Hamilton County, but are not reported from Chickamauga Reservoir near SQN (see Table 3-3).

The highfin carpsucker is the smallest of the carpsuckers, and apparently the species that has been most adversely affected by environmental changes in the Tennessee River drainage. It inhabits gravel substrate in relatively clear medium to large rivers. It is more susceptible to change by siltation and impoundments than other carpsuckers (Etnier and Starnes 1993). This species is occasionally encountered during RFAI sampling in Chickamauga Reservoir, but is not abundant in Chickamauga Reservoir.

The pink mucket mussel typically inhabits large rivers, but occasionally individuals become established in small to medium-sized tributaries of large rivers. It typically inhabits rocky bottoms with swift current, usually in less than 3 feet of water, but remnant populations of this species occur in riverlike areas in the main stem Tennessee River (Parmalee and Bogan 1998). Instream habitat adjacent to the existing barge slip was disturbed during construction of SQN and the barge slip and does not provide suitable habitat for the pink mucket.

## 3.10. Wetlands

Activities in wetlands are regulated under Sections 401 and 404 of the *Clean Water Act*, and are addressed by EO 11990 (Wetland Protection). Section 401 requires water quality certification by the respective state for projects permitted by the federal government. EO 11990 requires federal agencies to avoid construction or management practices that would adversely affect wetlands unless the agency finds that: (1) there is no practicable alternative and (2) the proposed action includes all practicable measures to minimize harm to wetlands.

An analysis of National Wetland Inventory maps indicated the presence of a small area of scrub-shrub wetlands near the plant boundary along Igou Ferry Road. There are no wetlands present in the proposed construction or laydown areas. There are no wetlands present in the barge slip or at the barge off-loading site.

## 3.11. Natural Areas and Recreation

There is a ball field located on the western side of the SQN site near the TVA Training Center and the Live Well Center. No natural areas are located within or adjacent to the proposed project site. However, five natural areas are located within 3 miles of SQN. These include a TVA-owned forest, three TVA habitat protection areas, and a state recreational park. No streams in the vicinity are included on the Nationwide Rivers Inventory. These natural areas are described below.

Friendship Forest is located approximately 0.8 mile northeast of and across the Chickamauga Reservoir from SQN. This 680-acre tract is owned by TVA and was leased to the University of Tennessee as a forestry experiment station for 53 years until 2002.

Chigger Point TVA Habitat Protection Area (HPA) is located across Chickamauga Reservoir from SQN, approximately 0.8 mile to the east. It is a 15.4-acre steeply wooded shoreline tract with a population of large-flowered skullcap.

Soddy Creek TVA HPA, which is located approximately 2.3 miles northwest of SQN, is a 35.5-acre tract that occupies over a mile of very steep shoreline. It provides habitat for bald eagles. Many species of water birds occupy the nearby shallow waters and mudflats during fall and winter months.

Ware Branch Bend TVA HPA, is a 41.5-acre tract of steep, rocky shoreline. It is located approximately 2.3 miles northwest of SQN. It is habitat for large-flowered skullcap and bald eagles.

Harrison Bay State Recreation Park is located approximately 1.2 miles south of SQN and comprises 1,200 acres with approximately 40 miles of shoreline on Chickamauga Reservoir. Renowned for its boat docking facilities, this park also offers biking and hiking trails, recreational vehicle and tent campsites, lake fishing, an Olympic-sized swimming pool, meeting and picnic facilities, and ballparks. Originally developed as a TVA recreation demonstration area in the 1930s, the park is now part of the Tennessee State Parks System and is managed by TDEC.

## 3.12. Floodplains

EO 11988 requires federal agencies to take actions to reduce the risk of flood loss, minimize impacts of floods on human health and welfare, and restore and preserve natural and beneficial floodplain values in their actions. Specifically, EO 11988 requires agencies to consider reasonable and feasible alternatives to siting facilities within floodplains.

The normal operating elevation of Chickamauga Reservoir at SQN varies from 675 feet in the winter to 682.5 feet in the summer. The 100-year flood[2] elevation at SQN is 686.8 feet. The 500-year flood elevation is estimated to be 688.5 feet. The Flood Risk Profile[3] in the area of SQN is 689 feet.

According to the Flood Insurance Rate Map (map number 47065C0255F) published by the Federal Emergency Management Agency, portions of the SQN reservation lie within the 100-year floodplain. The barge off-load area is within the 100-year floodplain. However, the area around Unit 2 where operations would occur is not located in the 100-year floodplain.

[2] The 100-year flood is a flood event anticipated to occur only once in a 100-year span, i.e., a 1 percent chance annually of occurring. Likewise, the 500-year flood is anticipated to occur once in a 500-year span (i.e., a probability of 0.2 percent).

[3] The Flood Risk Profile is usually approximately the same as the 500-year flood elevation. The Flood Risk Profile defines the area subject to potential flooding.

# CHAPTER 4

## 4.0 ENVIRONMENTAL CONSEQUENCES

This chapter includes a description of the potential effects to those resources mentioned in Chapter 3 likely to result under each of the two alternatives. The order of the potentially affected resources presented in this chapter follows the sequence provided in Chapter 3.

Under Alternative A, the No Action Alternative, TVA would not replace the Unit 2 steam generators at SQN. Consequently, Unit 2 would likely experience a decrease in efficiency due to the decreased ability of the generators to produce steam. This would eventually result in TVA derating Unit 2. This decrease in the power output would affect TVA's ability to provide baseload power. This derating of Unit 2 would also adversely affect TVA financially because it would lose the opportunity to generate and sell power.

Under Alternative B, TVA would replace the four steam generators in Unit 2 at SQN. This would allow Unit 2 to operate at a high level of efficiency for the remainder of the plant's operating license period. Adoption of Alternative B would preclude the need to derate Unit 2 due to decreased performance of the steam generators.

Some environmental resources would not be affected under either alternative. For example, land use would not change under either alternative. No prime farmland, unique farmland, or farmland of state significance, as defined by the Natural Resources Conservation Service, would be affected. The proposed project does not involve stream modification; thus, no stream modification would occur under either alternative. Because of the nature of the proposed action, there would be no additional measurable effects from the generation of electric and magnetic fields because voltages on existing transmission lines would remain the same, and no new transmission lines would be built.

Local air quality would not change under the No Action Alternative. Undertaking the proposed actions under the Action Alternative would likely result in exhaust emissions from construction equipment. However, these emissions would have minimal effects to local air quality.

### 4.1. Visual Character and Noise

#### *4.1.1. Anticipated Effects Under Alternative A*

Potential effects to visual resources and quality were examined based on changes between the existing landscape and the landscape character after alteration, identifying changes in the landscape character based on commonly held perceptions of landscape beauty and the aesthetic sense of place. Under the No Action Alternative, there would be no change in the visual character of SQN. In the event that Unit 2 was eventually shut down, visual resources would likely not be affected. Because the proposed construction would not take place under this alternative, there would be no change in existing ambient noise levels from current conditions.

#### *4.1.2. Anticipated Effects Under Alternative B*

Replacement of the four Unit 2 steam generators would include the introduction of a temporary crane and a laydown area near the Unit 2 concrete shield building and the

construction of a new storage building. The crane would be in place for three to four weeks. A barge access site would be required to deliver the generators to the site. Barge off loading would take four to five days.

Potential effects to visual resources and quality were examined based on changes between the existing landscape and the landscape character after alteration. Changes in the landscape character were based on commonly held perceptions of landscape beauty and the aesthetic sense of place.

Temporary impacts to the existing aesthetic character include an increase in traffic along local access roads, including Sequoyah Access Road and Igou Ferry Road to the west. This increase in traffic would likely be most noticeable to area residents and other motorists in the immediate area. New laydown and staging areas would be needed during construction, increasing the number of discordantly contrasting elements seen in the landscape around SQN. Additional visual disruptions would occur with an increase in equipment at the construction site.

Additional temporary visual impacts would include views of the proposed crane at the Unit 2 concrete shield building. The crane could potentially be seen up to background distances by area residents and recreationists along the river. The introduction of the crane would add to the number of vertically discordantly contrasting elements seen in the landscape in all directions from the plant site.

Delivery of the generators by barge would likely not create a noticeable increase in traffic along the river. However, unloading the generators would temporarily alter views of the shoreline for residents to the northwest. Scenic integrity would be reduced slightly for the duration of unloading activities, which would require about one day per steam generator.

Permanent visual impacts from the project are unlikely. The existing industrial landscape character of SQN would remain unchanged following construction, and area residents and recreationists would see little visual change from various viewing positions along the river or from the opposite shoreline. After project completion, scenic attractiveness and scenic integrity would return to preconstruction levels.

Overall, the proposed steam generator replacement project would have minor visual impacts for area residents, motorists, recreation users, and for SQN employees and visitors. There may be some minor visual discord during the construction and subsequent post-construction maintenance period due to an increase in personnel and equipment and the use of laydown and materials storage areas. These minor visual obtrusions would be temporary until all areas have been restored to preconstruction conditions. The barge unloading site would be restored and revegetated. Therefore, no major visual impacts are anticipated because of this project.

Construction activities associated with the proposed steam generator replacement would result in noise levels greater than those currently associated with normal operations at SQN. Typically, construction-related noise is intermittent and temporary. Excavation and construction work would typically occur during normal work hours (i.e., 7:00 a.m. to 5:00 p.m.) on a Monday to Friday basis.

The noise level from the hydrodemolition is expected to be 110 dBA at 50 feet. This level would be approximately 74 dBA at the nearest residence, which is located about 3,000 feet

away. This noise level at the nearest residence would be similar to that along a typical highway. This would be an increase over current ambient noise levels in the local area. Indoor noise levels are typically 15 to 20 dBA less than outdoor levels when doors and windows are closed (Cowan 1994). Thus, indoor noise levels at the nearest residence would be approximately 54 to 59 dBA. This noise level is not likely to interfere with normal speech or telephone conversations (Cowan 1994). While sleep disturbance is often associated with intermittent or sudden noises, continuous noise at this level could disrupt sleep for some people. Although noise from hydrodemolition is expected to be quite loud and may cause some temporary impacts at nearby residences, these effects would be confined to a period of approximately seven days. During this brief period, hydrodemolition would be conducted 24 hours per day.

Based on noise levels from construction equipment and the attenuation associated with distance, off-site adverse impacts from noise to the local population are not anticipated. Hydrodemolition and other activities could pose unacceptable adverse noise impacts to local residents especially during nighttime hours and on weekends. TVA would implement a noise awareness program prior to the start of the proposed project. This program would be implemented to raise public awareness and understanding of the nature and duration of the excessive noise-producing activities during the outage and to allow the public to communicate with SQN about noise. Thus, no long-term noise-related effects are likely.

Other construction activities would require the use of noise-generating equipment. This type of equipment is likely to generate noise levels ranging from 81 to 91 dB at 50 feet (U.S. Environmental Protection Agency 1971). Construction noise of 91 dBA at 50 feet would be about 55 dBA at the nearest residence. Although this could be audible over background noise levels, it is not likely to be a major effect.

## 4.2. Radioactivity

### *4.2.1. Anticipated Effects Under Alternative A*

If the steam generators were not replaced, additional radiation exposures of 31.1 Roentgen equivalent to man (rem) per outage would likely continue to be accumulated by workers who perform the required testing, maintenance, and repair to keep the unit operating at is expected power level. The radiation exposure level would likely increase with time, as work to repair tubes is conducted more often due to further degradation of the steam generator tubes.

If the steam generators were not replaced, there would be no additional exposure of the public to radiation beyond current ambient levels.

### *4.2.2. Anticipated Effects Under Alternative B*

#### 4.2.2.1. Anticipated Exposures

Implementation of Alternative B would involve some exposure of workers to radioactive materials. Prior to rewelding the replacement steam generators to the existing piping, the subject piping would be decontaminated to reduce exposure and dose. However, this decontamination effort would generate a small amount of radioactive waste for disposal.

The old steam generators would be stored on site in shielded buildings (see Section 2.1.2.1). Minimal long-term maintenance would be required, and the outside of the building would meet the definition in 10 CFR 20.1003 of an "unrestricted area.[4]" The potential radiological dose from such storage can be estimated from information gained from previous experience with steam generators. Each steam generator would contain approximately 300 curie[5] of fixed gamma emitters at the time it would be removed from the containment building. In past steam generator replacements, storage buildings that housed the old steam generators and associated equipment provided sufficient shielding to limit the dose rate to less than 1 millirems[6] per hour outside the building (TVA 2005). The expected dose rate at the site boundary from the storage building would be considerably less. Thus, exposure to the off-site public is within the 40 CFR 190.10 *Environmental Radiation Protection Standards for Nuclear Power Operations* limits. This dose rate would decrease rapidly during the first two years of storage because short-lived radionuclides (i.e., radioactive isotopes) would decay. After then, the radiation doses to the public from on-site storage of the steam generators and other equipment removed during the replacement would be very small.

#### 4.2.2.2. Radioactive Wastes

Based on the analysis of the replacements of the Unit 1 steam generators (TVA 2000), the proposed project is expected to produce approximately 4,500 cubic feet (uncompacted) of dry active radwaste, 500 gallons of liquid waste from decontamination activities resulting from efforts to minimize personnel dose, and another 1,000 cubic feet of uncompactable waste from construction. This waste is characterized as low-level radioactive waste. It would be shipped to an existing licensed burial or recovery area for permanent disposal. The total volume of radwaste generated by the proposed actions is expected to be about 6,000 cubic feet before compaction. However, the actual volume of radwaste requiring disposal depends on the efficiency of the compaction and decontamination efforts.

The old steam generators are considered radioactive waste. With the exception of a small amount of material removed from the base of the steam generators, the metal reflective insulation would remain in place with the generators in storage. The old generators would be stored on site in a concrete building (see Section 2.1.2.5). Such storage would require minimal long-term maintenance, and the outside of the building would meet the definition of an unrestricted area (10 CFR 20.1003).

## 4.3. Solid Waste

### *4.3.1. Anticipated Effects Under Alternative A*

Under the No Action Alternative, the steam generators would not be replaced, and the plant would operate as it does currently. Therefore, for the foreseeable future, no additional solid or hazardous waste would be generated beyond current levels.

[4] *Unrestricted area* means an area, access to which is neither limited nor controlled by the licensee (i.e., TVA).
[5] A curie is a measure of the activity or intensity of a radioactive source. One curie is approximately the amount of activity in one gram of radium 226.
[6] A millirem (mrem) is a measure of the biological effect of an absorbed dose of ionizing radiation.

### *4.3.2. Anticipated Effects Under Alternative B*

Creating the 45- by 22-foot oval opening in the concrete containment building would remove an estimated 1,600 cubic feet of concrete, i.e., about 500 cubic feet in the "cut" area and 1,100 cubic feet in the oval "plug." The concrete rubble from the hydrodemolition would occupy a larger volume than its intact volume of 500 cubic feet. Assuming that the volume of rubble is two to three times that of the intact concrete, the volume of concrete rubble requiring disposal in the short term is estimated to be 1,000 to 1,500 cubic feet. The "plug" would be removed intact and stored on site temporarily (see Section 2.1.2.7). If this piece were free of contamination, it would be pulverized, which would generate about 2,200 to 3,300 cubic feet of rubble. Some additional construction-related debris and waste, including concrete rubble, would also be generated. Concrete rubble would be disposed of on site.

Debris from the steam generator replacement would be managed in accordance with 0-PI-ENV-000-006.A, Special Waste Disposal Procedure. Any chemicals approved for use in the replacement effort would be assessed in accordance with Standard Programs and Processes 5.4, Chemical Traffic Control. Compliance with this procedure would ensure proper handling, disposal, or recycling of any chemicals used for the proposed project. Additional solid waste in the form of trash and disposable materials resulting from the presence of the additional 1,000 workers on site would be collected as part of normal trash collection operations at SQN, and this waste would be disposed of in local landfills.

## 4.4. Historic and Cultural Resources

### *4.4.1. Anticipated Effects Under Alternative A*

Under the No Action Alternative, there would be no additional ground-disturbing activities or other actions. Thus, there would be no effects to any historic properties directly or indirectly.

### *4.4.2. Anticipated Effects Under Alternative B*

A survey of structures within view of the proposed action did not reveal the presence of any historic structures that could potentially qualify for inclusion in the National Register of Historic Places (NRHP). Based on this finding and the results of the Phase I archaeological survey (see Section 3.4), TVA has determined that no historic properties would be affected by this undertaking. TVA submitted these findings to the Tennessee SHPO by letter dated October 7, 2009. By letter of October 23, 2009 (see Appendix A), the Tennessee SHPO determined that there are no NRHP-listed or -eligible properties affected by this undertaking. No comments were received from any of the Native American tribes contacted (see Section 1.3).

## 4.5. Water Quality

### *4.5.1. Anticipated Effects Under Alternative A*

For the foreseeable future, no changes in plant operations would occur under the No Action Alternative that would cause any effects to local surface water or to groundwater.

### *4.5.2. Anticipated Effects Under Alternative B*

If the overhead gantry crane were used to off load the steam generators, there would be no effects to surface water from the barge off-loading operations, as there would be no surface disturbance. However, if the excavation option were used, appropriate BMPs would be used at the barge off-load site to prevent or minimize the effects of runoff to the river. An ARAP would be obtained from TDEC. Following off-loading activities, the area would be returned to its approximate original contour and revegetated with noninvasive vegetation.

On-site storage of the old steam generators in a qualified building would be within the bounds of the SQN Unit 2 NRC license. All sites proposed for excavation would be reviewed internally for the presence of buried materials, piping, utility lines, etc., prior to digging. BMPs such as silt fences and hay bales around drain inlets would be employed in accordance with Spill Prevention Control and Countermeasure (SPCC) Plan 0-TI-ENV-000-003.0 Attachment 1 Storm Water Pollution Prevention Plan (SWPPP). SWPPP 0-TI-GXX-000-074.0 Appendix B – Work Permits would be updated as needed to address the construction of the concrete building and laydown area. If 1 acre or more of land in a given drainage area were estimated to be disturbed during construction of the steam generator storage building, a Construction Storm Water Permit would be obtained.

Potential surface water impacts from the proposed work would be mainly from wastewater generated from the hydrodemolition work on the Unit 2 concrete containment building roof and from storm water discharges associated with construction. The source water for the hydrodemolition would be the existing fire protection system for SQN or plant “raw water.” Both of these water sources are capable of supplying the necessary water, and the water from both sources are treated.

The flow amount for the hydrodemolition is approximately 40 to 50 gallons per minute delivered at 25,000 pounds per square inch. Approximately 75,000 gallons of water per day would be needed for a total of approximately seven days. Thus, a total of approximately 525,000 gallons of water would be needed for hydrodemolition. This water would be removed through a high suction vacuum system (see Section 2.1.2.7). Hydrodemolition water would be collected in on-site tanks, and solids would be allowed to settle. The clarified water would be discharged through Outfall 101, pending approval from TDEC. Compliance with the NPDES discharge limitations for this outfall would be maintained.

Excavation activities at the barge off-load site would result in exposed soils that could cause temporary increases in erosion and sediment runoff if not properly managed. Appropriate design and the use of BMPs would be used to minimize erosion and sediment runoff and to minimize the magnitude and duration of effects. If excavation and construction activities disturb 1 acre or more, TVA would obtain an NPDES Permit for Construction Storm Water Discharges Associated with Construction Activities prior to excavation. TVA would also prepare a Construction SWPPP to address BMPs that would be used to prevent or limit the potential for any construction activities to affect storm water quality.

Compliance with applicable NPDES limits would be maintained for all discharges to surface water. Storm water runoff from all areas disturbed during the project would be protected through the use of erosion and sediment control BMPs. Storm water runoff would continue to be monitored and inspected on a routine basis. Storm water would be collected and

treated (if necessary) before discharge. Therefore, there would be minor, if any effects on surface water quality from soil erosion or from the siltation of surface drainage.

The proposed project would be conducted in accordance with the existing SQN SPCC Plan (0-TI-ENV-000-003.0, Attachment 1) and with TVA procedures. These plans and procedures describe the appropriate BMPs to be used to prevent or minimize the release of hazardous substances used on the site and the corrective actions to be taken in the event of a release to limit the potential contamination of surface water and groundwater. With these measures in place, adverse effects to surface water quality from storm water runoff, hydrodemolition, or excavation associated with the proposed action are unlikely.

## 4.6. Socioeconomics

### *4.6.1. Anticipated Effects Under Alternative A*

The proposed replacement of the Unit 2 steam generators would not take place under the No Action Alternative. Additional workers would be brought in to assist in scheduled outages. However, no additional workers dedicated to the replacement project would be needed. The anticipated economic effects of this would be minor due to the temporary nature of the work. The normal increase in traffic due to additional workforce during outages would continue at current levels under the No Action Alternative.

### *4.6.2. Anticipated Effects Under Alternative B*

Total employment at the SQN site normally is about 900 to 1,000. The steam generator replacement project would occur during a scheduled outage. Regular outages typically require as many as 1,000 additional workers on site. The steam generator replacement project would also require an additional 1,000 workers during peak work periods. Thus, over a period of about six to eight weeks, there would be as many as 2,000 additional workers at the site. Employment would build up to that level over a period of two to three months, remain about that level for six to eight weeks, and then decline for two to three months until it returns to normal operational levels. Work would continue seven days per week, with three different shifts.

Most of the workers likely would access Sequoyah Access Road from either U.S. Highway 27 or Hixson Pike (SR 319). Because of the shift staggering, only a portion of the workers would be on these roads at any given time. Some of the workers would likely carpool, which would tend to decrease traffic impacts somewhat. Nevertheless, there are likely to be noticeable increases in traffic at some shift changes during the higher temporary employment levels. However, these effects on local traffic are expected to be minor, given the measures discussed above that would alleviate traffic impacts. Many of the workers are likely to be residents of Hamilton County and surrounding counties. Temporary relocation of some workers to Hamilton or surrounding counties would result in some modest positive impacts to the local economy, as these workers would buy goods and services locally. These impacts are expected to be minor due to their short duration and their size relative to the local economy, although they could be noticeable to specific businesses.

Any negative socioeconomic impacts likely would be the impacts on road traffic. Most of this impact would be on the major roads, specifically Sequoyah Access Road, U.S. Highway 27, and Hixson Pike. Impacts on other roads would be scattered and likely not very noticeable to other users of these roads.

The minority and low-income populations are relatively small and would not be impacted disproportionately. Therefore, no major socioeconomic or environmental justice impacts are expected.

## 4.7. Terrestrial Life

### *4.7.1. Anticipated Effects Under Alternative A*

Adoption of the No Action Alternative would not result in any project-related effects to local or regional terrestrial life because current site conditions would remain intact. Wildlife and wildlife habitats would not be affected. Although there would be no activities that would likely cause the introduction of invasive plant species, such plants could continue to become established naturally in areas where there is soil disturbance.

Because the project area currently consists of buildings and parking lots, the adoption of the No Action Alternative would result in no project-related impacts to rare plant species.

### *4.7.2. Anticipated Effects Under Alternative B*

Under the Action Alternative, an acre or less would be excavated for the barge off-load site, depending on the off-loading option chosen. The site of the potential excavation consists of early successional, mowed grass and a poorly vegetated shoreline covered with riprap. The proposed excavation would remove this habitat. Some wildlife occupying this area would move to other nearby habitats. Eventually natural revegetation of the site would allow the same species to repopulate the area. If the off loading were to occur at the barge slip, no excavation or ground disturbance at the site would be necessary, and there would be no effects to local terrestrial life. Excavation associated with the old steam generator storage building (see Section 2.1.2.5) would occur in a graveled area that does not provide suitable habitat for wildlife. The adoption and implementation of Alternative B would not cause a long-term loss of wildlife habitat or impacts to wildlife populations.

## 4.8. Aquatic Life

### *4.8.1. Anticipated Effects Under Alternative A*

Because operational conditions would not change, no additional effects to aquatic life in Chickamauga Reservoir are likely under this alternative.

### *4.8.2. Anticipated Effects Under Alternative B*

Aquatic life could be indirectly affected due to modification of the riparian zone and storm water runoff from areas disturbed while shaping the shoreline to the desired slope for equipment access and unloading. Potential impacts due to removal of shoreline vegetation include increased erosion, siltation, and loss of aquatic habitat. However, this area of the reservoir shoreline is already highly modified, and much of the local shoreline has been stabilized using riprap. No areas of high-quality aquatic habitat occur adjacent to the barge slip.

Siltation has a detrimental effect on many aquatic animals adapted to reservoir environments. Turbidity caused by suspended sediment can negatively affect spawning and feeding success of many fish species (Sutherland et al. 2002). Likewise, mussel species adapted to living on a sand and gravel bottom cannot survive in a bottom

environment composed of fine sediment. Such mussels are quickly destroyed by silt that clogs their gills, smothering the animal (Parmalee and Bogan 1998).

Appropriate construction BMPs would be used around all construction and stockpile materials to prevent sediment from entering the reservoir. Any disturbed land would be replanted with vegetation to reduce the potential of runoff. No concrete would be used at the barge off-load site; thus, no uncured concrete would contact the waters of Chickamauga Reservoir. With proper implementation of BMPs, direct, indirect, and cumulative impacts to aquatic life in Chickamauga Reservoir (including listed aquatic species) would be minor.

## 4.9. Threatened and Endangered Species

### *4.9.1. Anticipated Effects Under Alternative A*

Under the No Action Alternative, there would be no change in current conditions with respect to operations at SQN. There are currently no known adverse effects to any federally listed species from SQN operations. Adoption of the No Action Alternative would not affect any federally listed as threatened or endangered terrestrial or aquatic species or any critical habitats of such species.

### *4.9.2. Anticipated Effects Under Alternative B*

No federally or state-listed plant or animal species are known to occur on or adjacent to the SQN reservation, and no suitable habitats for listed species occur on site due to the disturbed nature of the site and because of ongoing operations. Therefore, no impacts to federally listed or state-listed terrestrial species are anticipated from the replacement of the Unit 2 steam generators.

Under the Action Alternative, the excavation of the proposed area would not affect any wildlife habitat for federally or state-listed species. No suitable habitat exits for the bald eagle in the project area. The proposed actions would not affect these species. No long-term loss of terrestrial habitats is expected under the Action Alternative; therefore, undertaking the proposed actions would not cause any adverse cumulative effects to any listed or protected terrestrial species.

Because snail darters are not found within the Chickamauga Reservoir pool, this project would have no impact on the federally listed snail darter. Three federally listed mussel species are reported from Chickamauga Reservoir. These include the orange-foot pimpleback, the pink mucket, and the rough pigtoe. These species may occur in Chickamauga Reservoir near SQN. However, instream areas adjacent to the barge slip do not contain suitable habitat for these species. With the proper implementation of BMPs as safeguards to prevent impacts to water quality and instream habitat in Chickamauga Reservoir, implementation of this alternative would have no effect on individuals or populations of these federally listed mussel species.

## 4.10. Wetlands

### *4.10.1. Anticipated Effects Under Alternative A*

There would be no additional wetland impacts associated with continued operation of the existing steam generators.

### *4.10.2. Anticipated Effects Under Alternative B*

There are no wetlands present in the areas proposed for laydown, construction, and barge unloading. Thus, there would be no wetland impacts from implementing the Action Alternative. There would be no overall, cumulative impacts to wetlands in the area.

## 4.11. Natural Areas and Recreation

### *4.11.1. Anticipated Effects Under Alternative A*

Under the No Action Alternative, there would be no direct or indirect effects to natural areas in the vicinity. Likewise, there would be no effects to local recreational facilities or opportunities if the proposed action were not undertaken because there would be no change from current conditions.

### *4.11.2. Anticipated Effects Under Alternative B*

There are no public recreation areas on the SQN site. There is a ball field near the TVA Training Center and the Live Well Center, but its availability would not be affected by the proposed project. Because there are no nearby public recreation areas that would be affected, adoption of Alternative B would not affect any recreation resource or the opportunity for recreation.

Due to the nature of the proposed action, there would be no direct effects to natural areas in the vicinity.

## 4.12. Floodplains

### *4.12.1. Anticipated Effects Under Alternative A*

Because there would be no change from current conditions with respect to floodplain values, adoption and implementation of the No Action Alternative would be consistent with EO 11988.

### *4.12.2. Anticipated Effects Under Alternative B*

The activities adjacent to Unit 2 that are directly associated with the installation of the new steam generators would occur in an area that is above the 100-year flood. However, barge off-loading operations, under Option 1 or 2 (see Section 2.1.2.3) would be located within the 100-year flood. Neither option involves the placement of fill within the floodplain. These actions would not affect flood storage or pose adverse effects to floodplain functions. Thus, implementation of the Action Alternative would be consistent with EO 11988 (Floodplain Management).

## 4.13. Summary of TVA Commitments and Proposed Mitigation Measures

No specific nonroutine environmental commitments or mitigation measures were identified to reduce potential environmental effects. Use of standard plant practices for work planning would minimize both worker and public radioactive exposure and dose. Implementation of routine BMPs during construction would minimize potential environmental effects associated with constructing the steam generator storage building and operations to off load the new steam generators from the delivery barges.

# CHAPTER 5

## 5.0 LIST OF PREPARERS

### 5.1. NEPA Project Management

**James F. Williamson Jr.**

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| Position: | Senior NEPA Specialist |
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### 5.2. Other Contributors

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# CHAPTER 6

## 6.0 LITERATURE CITED

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# Appendix A – Correspondence

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October 23, 2009

**TENNESSEE HISTORICAL COMMISSION**
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

Mr. A. Eric Howard
Tennessee Valley Authority
400 West Summet Hill Dr.
Knoxville, Tennessee, 37902-1499

RE: TVA, SEQUOYAH NUCLEAR PLANT IMPVTS., UNINCORPORATED, HAMILTON COUNTY

Dear Mr. Howard:

In response to your request, received on Monday, October 12, 2009, we have reviewed the documents you submitted regarding your proposed undertaking. Our review of and comment on your proposed undertaking are among the requirements of Section 106 of the National Historic Preservation Act. This Act requires federal agencies or applicant for federal assistance to consult with the appropriate State Historic Preservation Office before they carry out their proposed undertakings. The Advisory Council on Historic Preservation has codified procedures for carrying out Section 106 review in 36 CFR 800. You may wish to familiarize yourself with these procedures (Federal Register, December 12, 2000, pages 77698-77739) if you are unsure about the Section 106 process.

After considering the documents you submitted, we determine that THERE ARE NO NATIONAL REGISTER OF HISTORIC PLACES LISTED OR ELIGIBLE PROPERTIES AFFECTED BY THIS UNDERTAKING. We have made this determination either because of the specific location, scope and/or nature of your undertaking, and/or because of the size of the area of potential effect; or because no listed or eligible properties exist in the area of potential effect; or because the undertaking will not alter any characteristics of an identified eligible or listed property that qualify the property for listing in the National Register or alter such property's location, setting or use. Therefore, we have no objections to your proceeding with your undertaking.

If your agency proposes any modifications in current project plans or discovers any archaeological remains during the ground disturbance or construction phase, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. If you are applying for federal funds, license or permit, you should submit this letter as evidence of consultation under Section 106 to the appropriate federal agency, which, in turn, should contact us as required by 36 CFR 800. If you represent a federal agency, you should submit a formal determination of eligibility and effect to us for comment. You may find additional information concerning the Section 106 process and the Tennessee SHPO's documentation requirements at http://www.tennessee.gov/environment/hist/federal/sect106.shtm. You may direct questions or comments to Joe Garrison (615) 532-1550-103. This office appreciates your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jyg