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**WATTS BAR NUCLEAR PLANT UNIT 2
REPLACEMENT OF STEAM GENERATORS
FINAL ENVIRONMENTAL ASSESSMENT
Rhea County, Tennessee**

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Symbols, Acronyms, and Abbreviations

°F	degrees Fahrenheit
APE	Area of Potential Effect
ARAP	Aquatic Resource Alteration Permit
BMP	best management practices
CFR	Code of Federal Regulations
CO ₂	carbon dioxide
dB	decibel
dBA	A-weighted decibel
EA	Environmental Assessment
EO	Executive Order
FRP	Flood Risk Profile
GHG	greenhouse gas
IPPP	Integrated Pollution Prevention Plan
Leq	continuous equivalent sound level or average sound level
MaxP	maximum peak sound level
mrem	milli-Roentgen equivalent to man
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
OLS	outside lift system
OSG	old steam generator
OSGSF	old steam generator storage facility
rem	Roentgen equivalent to man
RSG	replacement steam generator
SPCC	spill prevention, control, and countermeasure plan
SR	state route
SWPPP	Stormwater Pollution Prevention Plan
TDEC	Tennessee Department of Environment and Conservation
TRM	Tennessee River Mile
TVA	Tennessee Valley Authority
TVARAM	TVA Rapid Assessment Method
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WBN	Watts Bar Nuclear Plant

EXECUTIVE SUMMARY

The United States Nuclear Regulatory Commission (NRC) requires that extensive testing be done periodically during each refueling outage at nuclear facilities to ensure the integrity of the steam generator tubes, which are critical parts of the reactor coolant system pressure boundary. Tubes found to be degraded must be plugged or otherwise repaired. These repairs reduce heat transfer surface area and may ultimately restrict the steam pressure to the turbine generator. Reduced steam pressure to the turbine generator reduces the generator's ability to produce power and ultimately results in the shutdown of Unit 2.

Based on the Tennessee Valley Authority's (TVA) operating experience at Sequoyah Nuclear Plant (SQN), Watts Bar Nuclear Plant (WBN) Unit 1, and in the nuclear industry as a whole, the type of steam generators (Westinghouse Model D3) currently in use at WBN Unit 2 become less reliable over time. The tubes of the Westinghouse steam generators are subject to progressively clog over time, reducing the steam generator's capacity. Inconel 600 tube material issues include a demonstrated tube failure trend attributed to stress corrosion cracking. Continued tube degradation due to primary water stress corrosion cracking and outside diameter stress corrosion cracking is predicted to lead to higher maintenance costs associated with inspection and repairs, increased potential for tube leakage and eventually to reduced operating efficiency as more tubes become clogged.

Because of the tube issues, nuclear facilities have been replacing the Model D3 steam generators. In addition to resolving the tube failure issues, the tube material (Inconel 690) in the replacement steam generators (RSGs) has substantially lower nickel content resulting in lower production of Co-58, a significant contributor to occupational dose. The WBN Unit 1 steam generators were replaced 2006. The SQN Unit 1 steam generators were replaced in 2003 and Unit 2 in 2012.

Based on the operating history for the Model D3 steam generators installed at WBN Unit 2, the old steam generators (OSGs) are not expected to perform consistently for more than 10 years and continued operation will reduce reliability and be costly. TVA has determined that the OSGs will require replacement at some point between four and six operating cycles from initial startup in order to maintain steam pressures required for full power operation. TVA is conducting this environmental assessment (EA) to evaluate the effects associated with the removal of the OSGs and installation of the RSGs.

Alternatives

This Environmental Assessment (EA) addresses potential impacts of the proposed project as well as the alternative of not implementing the action. Under the No Action Alternative, TVA would continue to operate Unit 2 at WBN without replacing the OSGs. This would result in gradual derating (reduction of power generation) of WBN Unit 2 followed by subsequent shutdown of the unit or large expenditures of resources for repair of the degraded steam generator tubes. When the power level could no longer be maintained, additional power would need to be made up to support the Tennessee Valley's power needs. At some point, the economic viability of the unit would be threatened.

Under Alternative B, TVA proposes to accept delivery of the RSGs at WBN in fall 2018 and replace the four Unit 2 steam generators during a scheduled outage between 2018 and 2024. The date of the replacement would be determined based on the findings of inspections conducted during each refueling outage (which occur every 18 months). Before the tubes become 15 percent clogged, TVA would schedule the steam generator replacement to occur during the following outage.

The replacement of the four steam generators would occur in two Phases. Phase I would occur in 2018, when the four RSGs would be delivered to WBN and stored in a temporary structure until installation. Phase I would also include construction of a permanent storage building for the Unit 2 OSGs immediately adjacent to the existing Unit 1 OSG Storage Facility (OSGSF).

The commencement of Phase II would be determined by the status of the tubes as described above. During Phase II, two lift cranes (one large and one medium sized) would be placed on crane mats or poured concrete pads adjacent to the Unit 2 containment building. Two openings would be made in the Unit 2 reactor containment dome and four openings in the interior concrete shell and steel containment structures using a hydrodemolition process (a high pressure water stream over a multiple day period), torch, and diamond wire. Each of the four OSGs would be cut free from existing piping and lifted by crane to the self-propelled modular transporter and transported to the new storage building. The RSGs would be transported along the same route to the containment building. The crane would then lift the RSGs into the containment building where they would be connected to the existing piping. The removed portions of the concrete dome would be replaced with new concrete and rebar. The temporary openings in the containment building would be reclosed using the refurbished steel and concrete cutouts. The old concrete would be stored near the OSGSF or crushed and transported for disposal at a permitted landfill.

The construction of the Unit 2 OSGSF would last approximately 7-10 months and would begin no earlier than summer 2018. Installation of the RSGs would occur at the next refueling cycle after the inspection deemed replacement would be necessary. There is 18 months between refueling campaigns. Removal of the OSGs, installation of the RSGs, and repairs to the containment building would take approximately 2.5 months during an outage.

Impact Assessment

During preliminary review TVA determined that the proposed actions would have no impacts to wildlife, vegetation, aquatic ecology, threatened and endangered species, wetlands, and natural areas. These resource areas were not evaluated in detail in this EA. After further review TVA also determined there would be no impacts to climate change, floodplains and flood risk, and cultural and historic resources.

TVA determined there would be minor and temporary adverse impacts associated with hazardous materials and solid and hazardous waste, surface water, navigation/transportation, land use and visual resources, noise, and socioeconomics and environmental justice. Additionally, TVA determined there would be minor impacts associated with occupational

radiation doses and radioactive/mixed waste. There would be beneficial impacts associated with air quality.

TVA has determined that incremental cumulative impacts of purchasing, transporting, and installing four RSGs for Unit 2 at WBN and onsite interim storage of the OSGs would be minor.

Mitigation

To minimize or reduce the environmental effects of the project, TVA would utilize standard operating procedures, best management practices, and mitigation measures as described below.

Standard Operating Procedures/Best Management Practices include:

- The primary fuel for the equipment and vehicles would be low-sulfur diesel fuel.
- Appropriate BMPs would be implemented to control and reduce fugitive dust emission from steam generator replacement (SGR) construction activities.
- All wastes would be managed in accordance with existing WBN waste management procedures and general BMPs.
- Any radioactive SGR construction wastes would be managed by TVA in accordance with 10 Code of Federal Regulations (CFR) Part 100 limits and WBN's implementing procedures.
- TVA would coordinate with River Scheduling to ensure that Tennessee River flows would be kept as steady as possible during the delivery operations of the RSGs.
- All excavation would be performed in accordance with digging permits, TVA-TSP-18.804, TVA Safety Manual Form 29205, and appropriate BMPs.
- If 1 acre or more of land were to be disturbed in a given drainage area during construction, a Construction Storm Water Permit would be obtained.
- For excavation and grading within 60-feet of the normal Chickamauga Reservoir high water mark, an Aquatic Resource Alteration Permit (ARAP) permit would be obtained.
- Storm water runoff from all areas disturbed during the SGR work (i.e., RSG off-loading area, OSGSF areas, temporary construction laydown and parking, etc.) would be protected through the use of erosion and sediment control BMPs as defined in the WBN ECM-4, 4.0 Best Management Practices (TVA 2004c), SPCC Plan ECM-8 (TVA 2004e), and TVA's Corrective Action procedure (NPG-SPP-22.300, Corrective Action Program).
- The source water for hydrodemolition activities for the Unit 2 containment dome would be the existing fire protection system for WBN. This water would be filtered and discharged through Outfall 101. Compliance with the NPDES discharge limitations for this outfall would be maintained.
- Prior to hydrodemolition, TVA personnel would coordinate with TDEC, Water Division, on the proper method for sampling, treating, and releasing this process water.

- WBN's Storm Water Pollution Prevention Plan and/or Integrated Pollution Prevention Plan would be modified to include the new steam generator laydown and other areas affected by the project. TVA would notify the State of Tennessee of the change and coordinate any updates to the site's coverage under the Tennessee Storm Water Multi-Sector General Permit for Industrial Activities as needed.
- A member of TVA's Navigation staff would assist in communication with the locks and the tows while the RSGs were enroute to WBN.
- Hydroexcavation slurry would be transported and placed at the WBN spoils area with geotextile fabric and/or hay bales, silt fences, and straw wattles for filtration.

In addition to the standard operating procedures and best management practices described above, TVA would implement the following non-standard, project-specific mitigation measures:

- TVA would implement (as necessary) a public noise awareness program prior to the start of the SGR work.

Conclusion and Findings

Based on the findings listed above TVA's proposed action is to implement Alternative B: remove four OSGs from WBN Unit 2, transport and install four RSGs at WBN Unit 2, and provide permanent onsite storage for the OSGs.

CHAPTER 1 - PURPOSE OF AND NEED FOR ACTION

1.1 Introduction and Background

The United States Nuclear Regulatory Commission (NRC) requires that extensive testing be done periodically during each refueling outage at nuclear facilities to ensure the integrity of the steam generator tubes, which are critical parts of the reactor coolant system pressure boundary. Tubes found to be degraded must be plugged or otherwise repaired. These repairs reduce heat transfer surface area and may ultimately restrict the steam pressure to the turbine generator. Reduced steam pressure to the turbine generator reduces the generator's ability to produce power and ultimately results in the shutdown of Unit 2.

Based on the Tennessee Valley Authority's (TVA) operating experience at Sequoyah Nuclear Plant (SQN), Watts Bar Nuclear Plant (WBN) Unit 1, and in the nuclear industry as a whole, the type of steam generators (Westinghouse Model D3) currently in use at WBN Unit 2 become less reliable over time. The Inconel 600 tubes of the Westinghouse steam generators are subject to progressive clogging over time, reducing the steam generator's capacity resulting in a demonstrated tube failure trend attributed to stress corrosion cracking. Continued tube degradation due to primary water stress corrosion cracking and outside diameter stress corrosion cracking leads to higher maintenance costs associated with inspection and repairs, increased potential for tube leakage and eventually to reduced operating efficiency as more tubes become clogged.

Because of these tube issues, nuclear facilities have been replacing the Model D3 steam generators (steam generator replacement, or SGR). In addition to resolving the tube issues, the tube material (Inconel 690) in the replacement steam generators (RSGs) has substantially lower nickel content resulting in lower production of Co-58, a significant contributor to occupational dose. The WBN Unit 1 steam generators were replaced 2006. The SQN Unit 1 steam generators were replaced in 2003 and Unit 2 in 2012.

WBN is located on a tract of approximately 1,000 acres in Rhea County in East Tennessee (Figure 1-1). It is on the west bank of the Tennessee River (Chickamauga Reservoir) between Tennessee River Miles (TRM) 528 and 528.6. The site is approximately 1.25 miles south of the Watts Bar Dam and approximately 31 miles north-northeast of SQN.



Figure 1-1. WBN Location Map

1.1 Purpose and Need

Based on the operating history for the Model D3 steam generators installed at WBN Unit 2, the WBN Unit 2 steam generators (henceforth known as the old steam generators, or OSGs) are not expected to last more than 10 years and operation is expected to be problematic and costly. TVA has determined that the OSGs will require replacement at some point between four and six operating cycles from initial startup in order to maintain steam pressures required for full power operation. TVA is conducting this environmental assessment (EA) to evaluate the effects associated with the removal of the OSGs and installation of the RSGs.

1.2 Decision to be Made

TVA must decide whether (1) to continue to operate Unit 2 at WBN without replacing the four OSGs or (2) to replace the four OSGs. Replacement would include transporting the RSGs to the site and temporary onsite storage, removing the OSGs and installing the RSGs, and building a storage facility for onsite storage of the OSGs.

1.3 Related Documents

National Environmental Policy Act (NEPA) documents and other documents related to WBN steam generator replacement are listed below:

- Integrated Resource Plan (TVA 2015)
- Integrated Resource Plan 2015 Final Supplemental Environmental Impact Statement (TVA 2015)
- Final Supplemental Environmental Impact Statement Completion and Operation of Watts Bar Nuclear Plant Unit 2 (TVA 2007)
- Final Environmental Assessment Watts Bar Nuclear Plant Unit 1 Replacement of Steam Generators (TVA 2005)
- Final Environmental Impact Statement Related to the Operation of Watts Bar Nuclear Plant Units 1 and 2 (NRC 1995)
- Final Supplemental Environmental Review Relating to the Operation of Watts Bar Nuclear Plant (TVA 1995b)
- Final Environmental Impact Statement Related to the Operation of Watts Bar Nuclear Plant Units 1 and 2 (TVA 1978)
- Environmental Impact Statement for Watts Bar Nuclear Plant Units 1 and 2 (TVA 1972)

1.4 Scope of the Environmental Assessment

TVA has prepared this EA to comply with NEPA and associated implementing regulations. TVA considered the possible environmental effects of the proposed action and determined that potential effects to the environmental resources listed below were relevant to the decision to be made; thus, the following environmental resources are addressed in detail in this EA.

- Air Quality
- Climate Change and Greenhouse Gases
- Solid and Hazardous Waste
- Occupational Radiation Doses and Radioactive Mixed Waste
- Wetlands
- Floodplains and Flood Risk
- Surface Water
- Land Use and Visual Resources
- Noise
- Cultural and Historic Resources
- Navigation/Transportation
- Socioeconomics and Environmental Justice

The detailed analysis in this EA focuses on those resource areas above that have the potential for significant impacts or those that typically interest the public. TVA determined there would be no impacts for the following resource areas:

- *Wildlife* – The proposed project footprint and all associated actions occur within heavily disturbed, previously permitted areas of WBN. At most, early successional (i.e. grasses and weeds) habitat may be present within some of the action area. These disturbed areas do not provide suitable habitat for any state or federally listed species known from the action area. Therefore, impacts to wildlife resulting from the proposed project actions or the No Action Alternative are not anticipated.
- *Threatened and Endangered Wildlife* - The TVA Natural Heritage database indicated that two federally listed and ten Tennessee state-protected animal species have been reported from Rhea and nearby Meigs Counties. Suitable habitat for most of these species does not exist within the project area. Therefore, these species would not be affected by the proposed project. The adjacent Tennessee River, although outside of the proposed project area, may provide foraging habitat for bald eagles, gray bats, Indiana bats, northern long-eared bats, and osprey. No other habitat requirements for these species exist within the proposed project area, and activities within the project area would not affect the Tennessee River as potential foraging habitat for these species. The noise levels produced by cutting the top of the shield building dome during a 12-day period may cause a temporary disturbance for bald eagles and gray bats foraging along the adjacent section of the Tennessee River. However, nearby sections of this river beyond disturbing noise levels would provide ample, alternative foraging habitat during this time period. All caves in Rhea and Meigs County are greater than 3 miles from the source of noise; because of this distance, no disturbance is expected for this species. One bald eagle nest exists approximately 1.8 miles from this noise source; the noise level at this distance would decrease to 64 dB and would not adversely affect this nest. In addition, this particular pair of birds is well acclimated to frequent noise and disturbance from nearby farm and cattle operations, as well as boat traffic from the adjacent Tennessee River. Two records of osprey nests are known approximately 1.3

and 2.0 miles from the project area; the noise level at these distances should be between 64 and 70 dB and should not affect these nests. As such, the proposed action is not likely to adversely impact bald eagles, gray bats, or osprey. Habitat for southern bog lemming exists in the hardwood forest in the vicinity of the project area. However, no project activities would occur within this forest, and adverse impacts are not expected due to the lemming's mobility, wide range of habitat preferences, and the abundance of suitable habitat in the surrounding area. As no trees would be disturbed in association with the project activities, no impacts to barn owls, northern long-eared bats or Indiana bats would be anticipated. Therefore, impacts to protected terrestrial animal species and their habitats within the proposed project area are not anticipated.

- *Vegetation* – The proposed project actions all occur within already disturbed areas of WBN. No natural areas occur within the proposed project footprint. At most, some grasses or weeds may be present in some areas. The area within the proposed project footprint has been heavily disturbed through previous actions. Therefore, the proposed project actions or the No Action Alternative would have no effect on federal or state-listed plants.
- *Threatened and Endangered Vegetation Species* - No occurrences of federally listed or state-listed plant species are known on or immediately adjacent to the area to be disturbed under the proposed Action Alternative; therefore, no impacts to threatened or endangered plant species are expected.
- *Aquatic Ecology* - Under Alternative B, minor modification of the barge off-load area could include grading and the addition or moving of gravel. Best management practices (BMPs) such as silt fences and hay bales around drain inlet structures would be employed according to TVA, 2004c. A Tennessee Department of Environment and Conservation (TDEC) Aquatic Resource Alteration Permit (ARAP) would be required for modifications of the barge off-load area. The conditions of the permit would be protective of aquatic ecology. The WBN SWPPP would be updated to address the construction of the concrete building and laydown yard. If 1 acre or greater of land in a given drainage area were estimated to be disturbed during construction of the OSGSF, a Construction Storm Water Permit would be obtained from the state. The Tennessee River at the barge off-load area would not be dredged since the river would have sufficient depth (i.e., estimated to be 16 feet) at the time of delivery. In addition, any disturbed soil during minor grading activities or installation of gravel at the off-load area would be minimized or prevented from entering the river through utilization of appropriate BMPs. With the use of BMPs to ensure no soil erosion/sediment, concrete, or concrete wash waters enter the river, no impacts to aquatic life would result from construction activities under Alternative B.
- *Threatened and Endangered Aquatic Species* - State- and federally listed species are located in the Tennessee River at the barge off-load area where the RSG would be delivered; however, there would be no in-water work (i.e., dredging) in this area in support of the SGR work. In addition, as described in Section 4.12.2, TVA would

coordinate with River Scheduling to ensure that flows and depths of approximately 16 feet are kept as steady as possible during delivery operations to permit safe unloading of the barges. The two generators placed on each barge would represent less than 50 percent of the capacity of a standard river barge that requires a 9-foot draft. Therefore, no effects to these protected species are expected to occur as a result of barge unloading. With the use of BMPs to ensure no soil erosion/sediment, concrete, or concrete wash waters enter the river, no impacts to protected aquatic animals would result from construction activities under the Action Alternative.

- *Wetlands* - No wetlands are present in the proposed WBN Unit 2 steam generator replacement project area. All of the proposed project areas are in industrially developed areas or locations that had been filled, graded, and/or graveled, and have a very low probability of wetland presence. No undisturbed areas would be affected by the proposed project activities. Therefore, no impacts to wetlands are anticipated.
- *Natural Areas* – the proposed project actions all occur within already disturbed areas of WBN. No natural areas, parks, or recreation activities occur within the proposed project footprint. All activities associated with the proposed project would occur within the proposed project footprint and would not result in impacts outside of the project footprint. Therefore, there would be no impacts to natural areas associated with the proposed project actions or the No Action Alternative.

1.5 Necessary Permits or Licenses

Action Alternative B would require the following:

- If 1 acre or more of land are planned to be disturbed at any given time, a Construction Storm Water Permit from TDEC would be required.
- TVA's Storm Water Pollution Prevention Plan (SWPPP) and/or Integrated Pollution Prevention Plan (IPPP) would be modified to include the new steam generator laydown and other areas affected by the project. TVA would notify the State of Tennessee of the change and coordinate any updates to the site's coverage under the Tennessee Storm Water Multi-Sector General Permit for Industrial Activities as needed.
- TDEC Aquatic Resource Alteration Permit (ARAP) would be required for modifications of the barge off-load area.

CHAPTER 2 - ALTERNATIVES

This chapter presents descriptions of the proposed action and its alternatives, a brief comparison of their environmental effects, and TVA's preferred alternative.

2.1 Description of Alternatives

Two alternatives are discussed and evaluated in this EA: (1) the No Action Alternative (Alternative A) and (2) the Action Alternative, to transport and install four RSGs for Unit 2 at WBN; and provide permanent onsite storage for the removed steam generators (Alternative B).

2.1.1 Alternative A

Under the No Action Alternative, TVA would continue to operate Unit 2 at WBN without replacing the OSGs. This would result in gradual derating (reduction of power generation) of WBN Unit 2 followed by subsequent shutdown of the unit or large expenditures of resources for repair of the degraded steam generator tubes. When the power level could no longer be maintained, additional power would need to be made up to support the Tennessee Valley's power needs. At some point, the economic viability of the unit would be threatened.

2.1.2 Alternative B

Under Alternative B, TVA proposes to accept delivery of the RSGs at WBN in fall 2018 and replace the four Unit 2 steam generators during a scheduled outage between 2018 and 2024. The date of the replacement would be determined based on the findings of inspections conducted during each refueling outage (which occur every 18 months). Before the tubes become 15 percent clogged, TVA would schedule the steam generator replacement to occur during the following outage.

The replacement of the four steam generators would occur in two Phases. Phase I would occur in 2018, when the four RSGs would be delivered by barge to an existing off-load area adjacent to WBN (Figure 2-1). At the off-load area, the RSGs would be loaded onto self-propelled modular transporters and rolled off the barge up existing onsite roads to a new temporary storage building where it would remain until installation. A new building to house the Unit 2 OSGs would be constructed immediately adjacent to the existing Unit 1 OSGSF.

The commencement of Phase II would be determined by the status of the tubes as described above. During Phase II, the existing "Rad Pad" located near the Unit 2 containment building would be demolished and the site would be prepared with grouting. A new concrete pad would be poured after the Replacement Outage. The grouting is necessary to provide support for the large outside lift system (OLS crane) which would be placed on a crane mat. A second medium sized Supplemental Crane would be placed on another crane mat also adjacent to the Unit 2 containment building. The location of the two cranes is shown in Figure 2-2.

After the installation of the cranes and scaffolding, two openings would be made in the Unit 2 reactor containment dome and four openings in the interior concrete shell and steel containment structure using a hydrodemolition process (a high pressure water stream over a multiple day

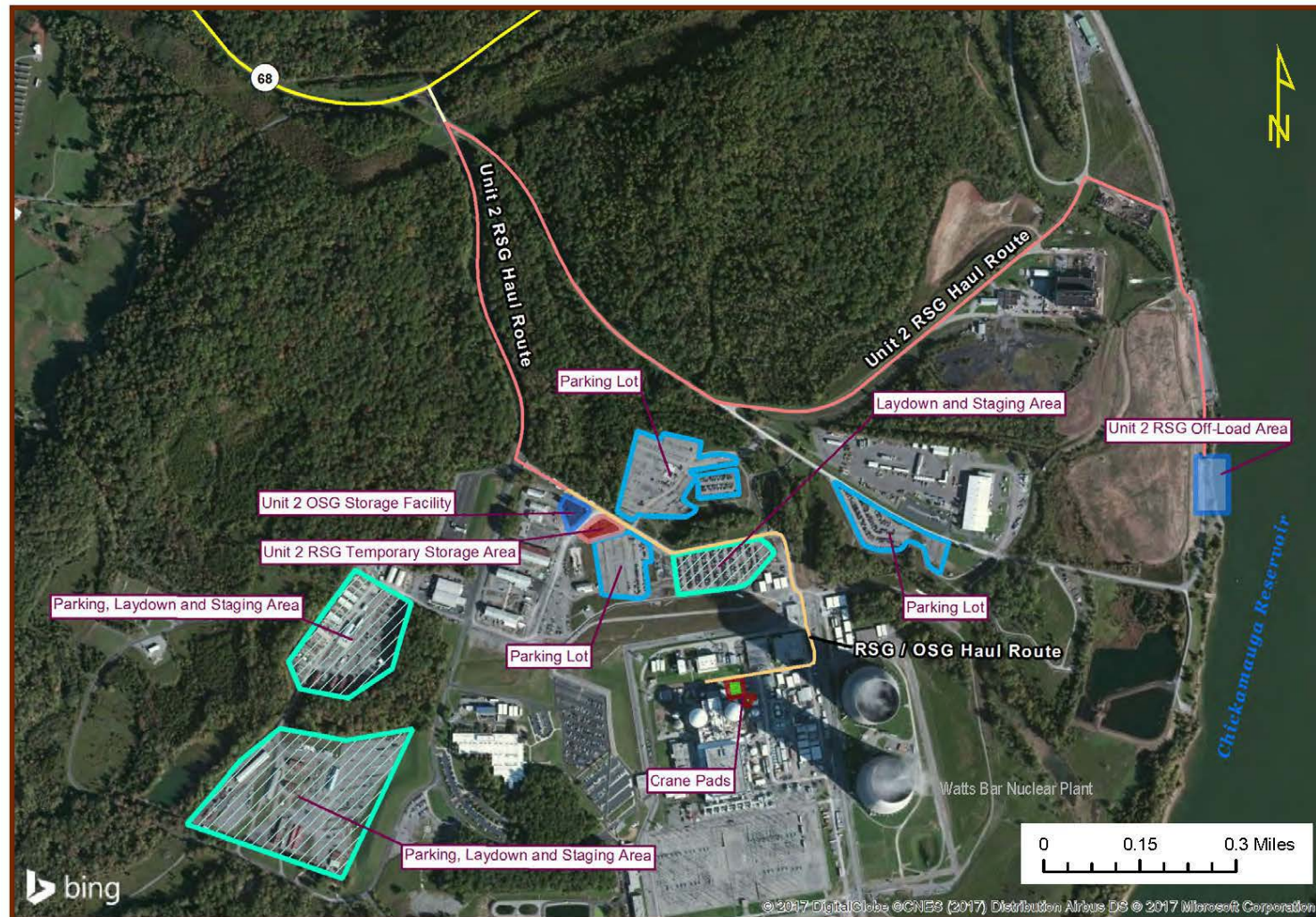


Figure 2-1. Alternative B RSG project areas and haul routes

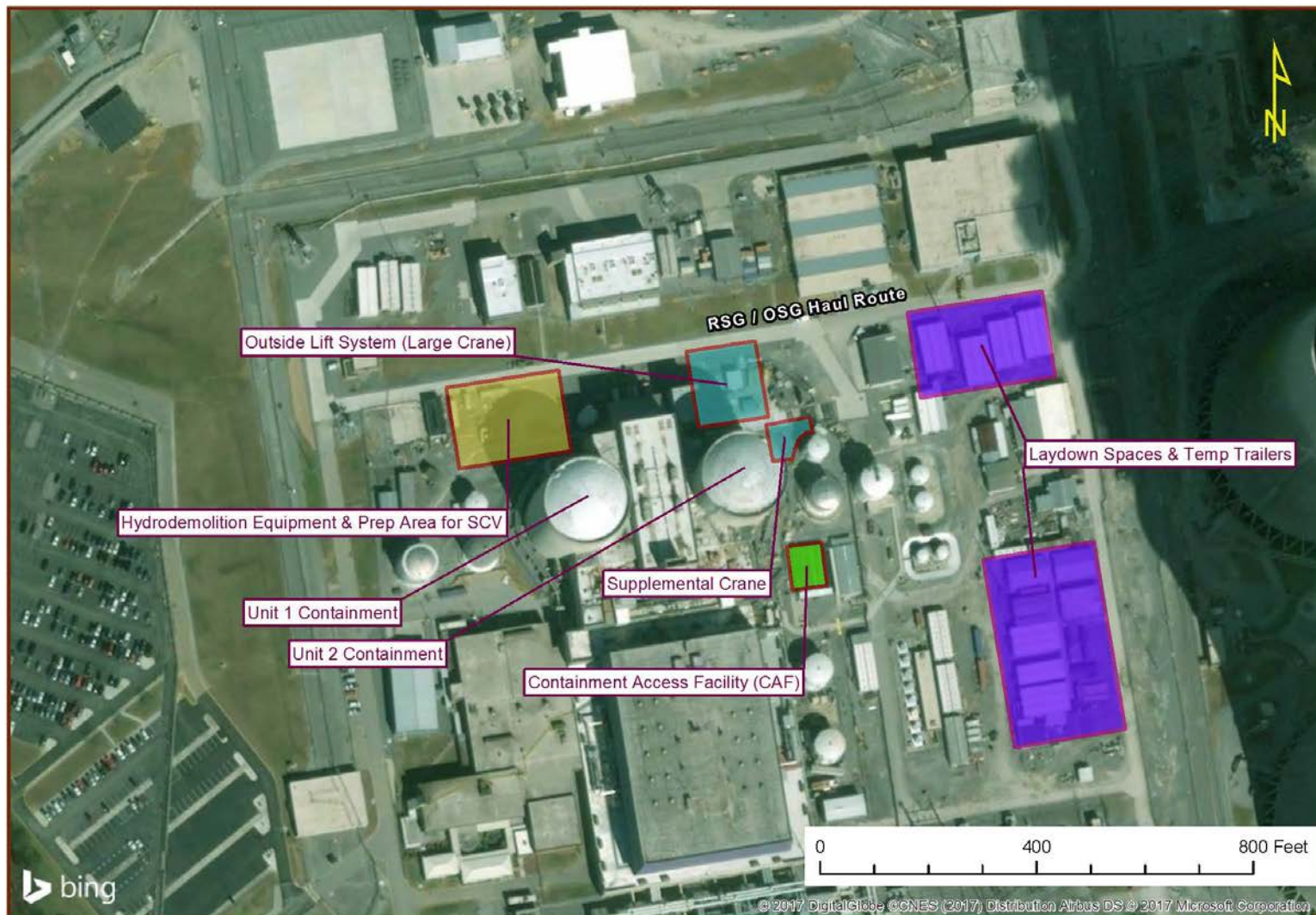


Figure 2-2. Alternative B RSG project areas and haul routes in the vicinity of the containment dome

period), diamond saw, and torch cutting, respectively. Each of the four OSGs would be cut free from existing piping and lifted by crane to a self-propelled modular transporter. The OSGs would be transported on existing roads (Figures 2-1 and 2-2) to the new OSGSF. The RSGs would be transported along the same route to the containment building. The crane would then lift the RSGs into the containment building where they would be connected to the existing piping. The removed portions of the concrete dome would be replaced with new concrete and rebar. The temporary openings in the steel containment structure would be reclosed using the steel previously removed. The temporary openings in the steam generator enclosures would be reclosed using the removed concrete sections and new clamping steel. The old concrete will be free released from the protected area and stored by the OSGSFs. The off-load location, haul routes, and location for the storage building are shown in Figure 2-1.

The construction of the OSGSF would last approximately 7-10 months and would begin no earlier than summer 2018. Relocation and/or new electrical feeds will be required in support of the OSGSF. The electrical work would include relocation of utility poles and hydroexcavation of a trench in the OSGSF vicinity. Installation of the RSGs would occur at the next 18 month refueling cycle after the inspection deemed replacement would be necessary. Hydroexcavation of a trench for electrical feeds to the RSG facility would also be required. Removal of the OSGs, installation of the RSGs, and repairs to the containment building would take approximately 2.5 months during an outage.

2.1.2.1 Steam Generator Replacement Construction Activities

The general construction activities involved would include the following:

Phase I

- Preparation of the barge landing site to receive the barge and roll-off ramp. Preparation may include regrading and movement or addition of gravel and/or excavation of gravel and soil and installation of engineered fill topped by gravel.
- Clearing, grading, and excavation at the temporary RSG storage site. A total of 16 saddle pier support areas would be excavated measuring 15 feet by 10 feet to a depth of 2 feet each.
- Erection of a metal and canvas storage shelter for temporary storage of the RSGs prior to installation.
- Temporary removal of overhead obstructions (electric lines, telephone lines, and directional lighting) on the haul path.
- Delivery of the RSGs and temporary storage on concrete piers.
- Clearing, grading, excavation, and stabilization of the OSGSF site.
- Construction of the new Unit 2 OSGSF.
- Demolition and removal of the existing concrete Rad Pad adjacent to Unit 2 containment and sub-surface improvement (grouting).

Phase II

- Delivery of construction equipment and materials (e.g., trucks, compressors, cranes, pipe, steel plating, concrete) to the laydown areas.
- Grading at the OLS crane site.
- Clearing and grading at the Supplemental Crane site.
- Installation of crane mats for the OLS and Supplemental cranes.
- Erection of the OLS and Supplemental cranes adjacent to the Unit 2 containment building.
- Removal of concrete and steel on the Unit 2 containment building dome and the Steam Generator Enclosures (using hydrodemolition processes, torching, and a diamond saw) for removal of the OSGs.
- Removal of waste concrete and steel.
- Removal of OSGs and associated piping.
- Transport and installation of RSGs and associated piping in Unit 2.
- Replacement of steel and concrete shielding on the Unit 2 containment dome.
- Transport and placement of the OSGs in the new storage facilities.
- Decontamination and disposal of waste concrete, steel, and piping.
- Installation of the replacement Rad Pad.

2.1.2.2 Clearing, Grading, and Excavations

Clearing and grading activities would be required to support the replacement of the steam generators. The primary areas requiring clearing and grading would be:

- Minor modifications to the off-load area (such as onshore grading, additional gravel, or excavation of existing soil and deposition of engineered fill topped by gravel) may be required.
- Foundation excavation for the new OSGSF and concrete piers at the temporary RSG storage area.
- Excavations/removal of the existing concrete Rad Pad north of the Unit 2 containment, grouting, grading, and replacement of the pad for the OLS.
- Clearing and grading for the Supplemental Crane.

2.1.2.3 Replacement Steam Generator Off-Loading, Delivery, and Interim Storage

During Phase I, the four RSGs would be delivered to WBN by barge via the Tennessee River. Under proposed Alternative B, barge deliveries would be expected to occur in fall 2018. Each

barge would be expected to have a dedicated tow. The barges would depart from the Port of New Orleans or the Port of Mobile and travel up the Tennessee-Tombigbee Waterway to the Tennessee River and onto the WBN site off-loading area on the Chickamauga Reservoir. Off-loading would occur south of the existing docking area utilized for the FY 2017 turbine rotor replacement project, as shown on Figure 2-1.

At the off-load area, the barge will pull up to the shore, a steel ramp will be placed connecting the barge to the shore, and the equipment loaded onto self-propelled modular transporters and rolled off. Minor excavation, grading, compaction, and graveling, and expansion of the existing footprint may be required on shore between the ramp and the existing road to provide a stable base, a smooth transition area between the barge and the shore, and room for adequate turning radius. No new boat ramp or dock would be installed and no dredging would be required.

Each RSG would be rolled off the barge to an existing paved road connecting to the WBN Site entrance road (Figure 2-1), turning southeast past warehouses E and F, and delivered to the temporary storage area shown on Figure 2-1. The RSGs would be unloaded and placed on concrete support pedestals inside of canvas and steel tent for temporary storage in anticipation of their installation in Unit 2.

2.1.2.4 Temporary Storage of Equipment and Supplies

Equipment and supplies for the replacement steam generator work would be delivered to the WBN site via trucks. Temporary storage for much of this material would be provided in the SGR temporary laydown/storage area northwest of the north portal. This area is a graveled parking/laydown lot that was recently used for WBN Unit 2 construction (Figure 2-1).

2.1.2.5 Old Steam Generator Storage Facility Construction

During Phase I, a new building, designated as the Unit 2 OSGSF, would be constructed next to the WBN Unit 1 OSGSF and east of warehouses E and F (Figure 2-1), for the storage of the four OSGs removed from Unit 2. The area for the building was originally a parking area during WBN construction and now contains the remnants of a graveled surface and includes a fence and utility pole that would be relocated. The area would be surveyed and graded, and excavations would be made for the building foundation and utilities.

The OSGSF is a stand-alone reinforced concrete structure unconnected to plant structures, systems, and operations. The building would be approximately 150 feet by 43 feet with a height of approximately 27 feet from grade.

2.1.2.6 Electrical Work

Overhead power lines in the vicinity of the planned OSGSF would need to be relocated to not interfere with the OSGSF. The expectation is the three new power poles would be set behind nearby Warehouses “E” and “F” to allow the overhead lines to be rerouted and tie in to and existing power pole near Warehouse “D”.

In order to facilitate the installation of the OSGSF, the underground electrical feeds to Warehouse “E” will need to be relocated. Specifically, a new trench will be hydroexcavated from

the feeder transformer located near Warehouse “C” north along the existing road and then north and west to Warehouse “D” or “E” where it would tie into the existing distribution hardware.

In addition, a new electrical feed will be required for the temporary storage building to house the RSGs. The temporary building will need an electrical power source to facilitate maintenance and pre-replacement activities. This will be accomplished by connecting to an existing transformer at the weld test shop. A portion of the electrical source would run along the ground for a short distance encased in a protective cover. For the remainder, a trench would be hydroexcavated until reaching the RSG building electrical distribution hardware.

2.1.2.7 Erection of Cranes

Two lift cranes (the large OLS and medium Supplemental Crane) would be required outside the Unit 2 containment building to replace the steam generators and lift other large equipment and materials. The anticipated crane foundation areas contain both paved and unpaved developed areas adjacent to Unit 2. Existing above- and underground utilities and possibly a groundwater monitoring well in this area have been evaluated and, if required, will be protected or relocated. Due to poor soil conditions, underground polyurethane foam grouting would be required to accommodate the weight of the OLS crane and its loads. The existing rad pad where the OLS will sit would be demolished and removed. To insert the grouting, a series of holes approximately 8 inches in diameter would be drilled to a depth of about 7 feet at intervals throughout the OLS crane area as determined by a geotechnical engineer. Approximately 900 holes would be drilled. A polyurethane material would be injected through tubes inserted into the drilled holes. Surface monitoring would determine when sufficient soil densification has occurred at which point the injection would cease. The holes would be patched/filled and the surface restored. The OLS would be erected on a crane mat. Following completion of the project and removal of the OLS, the concrete rad pad would be repoured. A separate crane mat would be installed for the Supplemental Crane.

2.1.2.8 Demolition Activities at Unit 2 Containment Dome and Generation of Solid Wastes

TVA would make two openings in the Unit 2 reactor containment dome using a hydrodemolition process. Demolition activities for the Unit 2 containment dome’s two openings 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, which uses a high-pressure water jet to remove concrete while leaving the steel reinforcement bar intact. The hydrodemolition process would create a path through the 2-foot-thick concrete approximately 30 inches wide around the perimeter of the opening.

Each containment dome opening would be approximately 45 feet by 22 feet. There would be approximately 480 cubic feet of removed concrete for the opening, utilizing approximately 900,000 gallons of water. The water and concrete slurry from hydrodemolition would be removed through a high-suction vacuum system. The vacuum system would have a piping connection tied into a vacuum truck located on the ground. The source water for hydrodemolition would be the existing fire protection system for WBN. Water not captured in the

vacuum process would be allowed to drain off the concrete debris within the immediate work area and discharged via the drainage system to the site Yard Holding Pond. This water from the hydrodemolition process would be filtered to remove solids, sampled in accordance with the National Pollutant Discharge Elimination System (NPDES) permit TN0020168, and released through an approved NPDES discharge point. The concrete rubble would be screened for radiation, would be temporarily stored on site in TVA-provided containers, and would be periodically transported off site for disposal in a local landfill. The concrete sections lifted from the dome using the heavy lift crane would be crushed and disposed of at a TVA-specified location.

The Steel Containment Liner will be cut using torches, which do not require a debris containment system.

The Steam Generator Enclosures will be cut using diamond wire. A similar water / slurry debris catch system will be used for these cuts as what would be used for the containment dome.

Each of the steam generators would be cut free from existing piping and then lifted by the large crane through the steel containment and internal structural concrete enclosures that house the steam generators through temporary openings and out the top of the concrete shield building. The OSG would then be loaded onto a crawler and transported to the OSGSF. The RSGs would be lowered into the containment building, reconnected to the existing piping, and the temporary openings would be closed. Creating the temporary openings in the shield building would result in generation of concrete rubble and two concrete slabs for disposal as described above. The steel from the containment vessel would be reused. Prior to welding the RSGs to the existing piping, the piping to be welded would be decontaminated to reduce worker radioactive exposure and dose. This decontamination effort would generate radioactive waste for disposal.

Replacement of the reflective metal insulation on the steam generators would not create much additional waste, as the OSGs would be stored in an engineered onsite facility with the majority of the reflective metal insulation attached to the OSG vessel. The support activities for this work would create some amount of both radioactive and nonradioactive solid waste.

2.2 Comparison of Alternatives

The environmental impacts of the alternatives are summarized in Table 2-1. These summaries are derived from the information and analyses provided in Chapter 3.

Table 2-1. Summary and Comparison of Alternatives by Resource Area

Resource Area	Alternative A	Alternative B
Air Quality	None	Beneficial impact
Climate Change	None	None
Hazardous Materials, Solid and Hazardous Waste	None	Minor and temporary
Occupational Radiation Doses and Radioactive/Mixed Waste	None	Minor

Resource Area	Alternative A	Alternative B
Floodplains and Flood Risk	None	None
Surface Water	None	Minor and Temporary
Navigation/Transportation	None	Minor and Temporary
Land Use and Visual Resources	None	Minor and Temporary
Noise	None	Minor and Temporary
Cultural and Historic Resources	None	None
Socioeconomics and Environmental Justice	None	Minor and Temporary

2.3 Identification of Mitigation Measures

To minimize or reduce the environmental effects of the project, TVA would utilize standard operating procedures, best management practices, and mitigation measures as described below.

Standard Operating Procedures/Best Management Practices include:

- The primary fuel for the equipment and vehicles would be low-sulfur diesel fuel.
- Appropriate BMPs would be implemented to control and reduce fugitive dust emission from SGR construction activities.
- All wastes would be managed in accordance with existing WBN waste management procedures and general BMPs.
- Any radioactive SGR construction wastes would be managed by TVA in accordance with 10 CFR Part 100 limits and WBN's implementing procedures.
- TVA would coordinate with River Scheduling to ensure that Tennessee River flows and would be kept as steady as possible during the delivery operations of the RSGs.
- All excavation would be performed in accordance with digging permits, TVA-TSP-18.804, TVA Safety Manual Form 29205, and appropriate BMPs.
- If 1 acre or more of land were to be disturbed in a given drainage area during construction, a Construction Storm Water Permit would be obtained.
- For excavation and grading within 60-feet of the normal Chickamauga Reservoir high water mark, an ARAP permit would be obtained.
- Storm water runoff from all areas disturbed during the SGR work (i.e., RSG off-loading area, OSGSF areas, temporary construction laydown and parking, etc.) would be protected through the use of erosion and sediment control BMPs as defined in the WBN ECM-4, 4.0 Best Management Practices (TVA 2004c), SPCC Plan ECM-8 (TVA 2004e), and TVA's Corrective Action procedure (NPG-SPP-22.300, Corrective Action Program).

- The source water for hydrodemolition activities for the Unit 2 containment dome would be the existing fire protection system for WBN. This water would be filtered and discharged through Outfall 101. Compliance with the NPDES discharge limitations for this outfall would be maintained.
- Prior to hydrodemolition, TVA personnel would coordinate with TDEC, Water Division, the proper method for sampling, treating, and releasing this process water.
- WBN's Storm Water Pollution Prevention Plan (SWPPP) and/or IPPP would be modified to include the new steam generator laydown and other areas affected by the project. TVA would notify the State of Tennessee of the change and coordinate any updates to the site's coverage under the Tennessee Storm Water Multi-Sector General Permit for Industrial Activities as needed.
- A member of TVA's Navigation staff would assist in communication with the locks and the tows while the RSGs were en route to WBN.
- Hydroexcavation slurry would be transported and placed at the WBN spoils area with geotextile fabric and/or hay bales, silt fences, and straw wattles for filtration.

In addition to the standard operating procedures and best management practices described above, TVA would implement the following non-standard, project specific mitigation measures:

- TVA would implement (as necessary) a public noise awareness program prior to the start of the SGR work.

2.4 Preferred Alternative

TVA's preferred alternative is Alternative B: remove four OSGs from WBN Unit 2, transport and install four RSGs at WBN Unit 2, and provide permanent onsite storage for the OSGs.

CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing environmental conditions at WBN that might be affected if the No Action or Proposed Action is implemented. This chapter also describes the potential environmental effects that could result from implementation of either of these alternatives based on the information available at the time of this analysis.

3.1 Air Quality

3.1.1 Affected Environment

Air quality is an environmental resource value that is considered important to most people. Through the passage of the Clean Air Act in 1970, Congress has mandated the protection and enhancement of our nation's air quality resources. Air emissions from WBN are covered under the Conditionally Exempt Major Source Permit Number 448529.

3.1.2 Environmental Consequences

3.1.2.1 Alternative A

Under the No Action Alternative, the steam generators would not be replaced, and the plant would operate exactly as it operates currently, until such time that degradation of the steam generator tubes required derating of the plant and major repairs on the steam generator tubes. If the power level could no longer be maintained, additional power would need to be made up to support the Tennessee Valley's power needs. No additional impacts to air quality for the No Action Alternative would be anticipated above or beyond those considered among the suite of power generation options available to TVA as evaluated in TVA's Energy Vision 2020 Environmental Impact Statement (TVA 1995).

3.1.2.2 Alternative B

During demolition and replacement activities, there would be additional equipment that would likely result in accumulation of additional dust and debris on the roads and grounds in the vicinity of the OSGSF, the decontamination facility, the Unit 2 reactor building, and the various parking and storage areas. Proposed construction equipment and vehicles that would be used for demolition activities and replacement of steam generators at WBN Unit 2 are shown in Table 3.1-1. The primary fuel for the equipment and vehicles would be low-sulfur diesel fuel. Appropriate Best Management Practices (BMPs) such as water trucks to spray down construction areas would be implemented to control and reduce fugitive dust emission from replacement activities to insignificant levels. In addition, replacing the steam generators to retain nuclear generating capacity would have significantly less air quality impact than replacement generation using various hydrocarbon or fossil fuels. Therefore, replacement of the steam generators would be an overall benefit to air quality based upon current and predicted energy demands.

3.2 Climate Change

3.2.1 Affected Environment

The 2014 National Climate Assessment concluded that global climate is projected to continue to change over this century and beyond. U.S. average temperature has increased by 1.3 degrees Fahrenheit (°F) to 1.9°F since 1895, and most of this increase has occurred since 1970. The most recent decade has been reported as the nation's warmest on record. Temperatures are projected to rise another 2°F to 4°F in most areas of the United States over the next few decades. The amount of warming projected beyond the next few decades is directly linked by many scientists to the cumulative global emissions of heat-trapping greenhouse gases (GHGs) and particles. By the end of this century, a roughly 3°F to 5°F rise is projected under a lower GHG emissions scenario, and a 5°F to 10°F rise is projected for a higher GHG emissions scenario. In both projections emissions are predominantly from fossil fuel combustion (Melillo et al. 2014). There is some uncertainty in these projections.

Similar to the glass in a greenhouse, certain gases in the atmosphere absorb heat that is radiated from the surface of the Earth and that would otherwise have escaped the atmosphere. These gases are primarily carbon dioxide (CO₂), methane, nitrous oxide, perfluorocarbons, sulfur hexafluoride, and hydrofluorocarbons. Increases in the atmospheric concentrations of these gases can cause the Earth to warm by trapping more heat. This is commonly referred to as the “greenhouse effect” and these gases are typically referred to as “greenhouse gases” (GHGs).

GHGs are present in the atmosphere naturally, released by natural sources, or formed from secondary reactions taking place in the atmosphere. In nature, CO₂ is exchanged continually between the atmosphere, plants, and animals through processes of photosynthesis, respiration, and decomposition, and between the atmosphere and oceans through gas exchange. Billions of tons of carbon in the form of CO₂ are annually absorbed by oceans and living biomass (also known as “sinks”) and are annually emitted to the atmosphere through natural and man-made processes (also called “sources”). When in equilibrium, carbon fluxes among these various global reservoirs are roughly balanced.

In the last 200 years, substantial quantities of GHGs have been released into the atmosphere by human activities. These extra emissions are increasing GHG concentrations in the atmosphere, enhancing the natural greenhouse effect, which is considered to be causing or contributing to global warming (Myhre et al. 2013). The most abundant man-made GHG is CO₂. The primary GHG emitted by human activity is CO₂ produced by the combustion of coal and other fossil fuels. Coal- and gas-fired electric power plants and automobiles are major sources of CO₂ in the United States. In 2014, worldwide man-made annual CO₂ emissions were estimated at 36 billion tons, with sources within the United States responsible for 14 percent of this total (Le Quéré et al. 2013). According to the official U.S. Greenhouse Gas Inventory, electric utilities in the United States were estimated to emit 1,900 billion tons, roughly 34 percent of the U.S. total in 2015 (USEPA 2017).

In 2016, fossil-fired generation accounted for 54 percent of TVA's total electric generation, and the non-emitting sources of nuclear, hydro, and other renewables accounted for 46 percent.

Compared to CO₂ emissions from the entire TVA system in 2005 to those in 2016, TVA has reduced its CO₂ emissions by about 34 percent and anticipates achieving a total CO₂ emission reduction of 60 percent by 2020.

3.2.2 Environmental Consequences

3.2.2.1 Alternative A

Under the No Action Alternative, the plant would operate exactly as it operates currently, until such time that degradation of the steam generator tubes required derating of the plant and major repairs of the tubes. If the power level could no longer be maintained, additional power would need to be made up to support the Tennessee Valley's power needs. No additional impacts to climate change associated with greenhouse gas emissions would be anticipated under the No Action Alternative above or beyond those considered among the suite of power generation options available to TVA as evaluated in TVA's Energy Vision 2020 Environmental Impact Statement (TVA 1995).

3.2.2.2 Alternative B

GHG emissions associated with the construction activities relate to the emissions produced by equipment (primarily related to the combustion of gasoline and diesel fuels in vehicles, generators, and earth-moving equipment). Table 3.1-1 presents the anticipated numbers of vehicles required under Alternative B and their anticipated duration of use.

The total amount of GHG emissions associated with the construction would be temporary and minor in comparison to emissions from the surrounding area, and would not adversely affect global GHG levels. Therefore, this alternative would not result in impacts on climate change.

Table 3.1-1. Anticipated Construction Vehicles and Equipment

Equipment/Vehicle Type	Number	Size	Duration of Use (months)
Pick-up Trucks	2	N/A	12
Flat-bed Truck	2	N/A	8-10
Fuel Truck	1	N/A	8
Dump Truck	2	N/A	4
5th-Wheel Tractor	2	N/A	7-9
Lull Forklift	2	5 ton	7-9
Forklift	1	1-1/2 ton	10
Forklift	1	30 ton	10
Crane (rough terrain hydraulic)	1	60 ton	7
Crane	2	20 ton	6
Crane (rough terrain hydraulic)	1	100 ton	10
Crane (Model 3900T)	1	140-foot boom	2
Crane (Model 4100 S-1)	2	160-foot boom	3
Crane (Liebherr)	1	180-foot boom	8
Crane (OLS)	1	340-foot boom	4
Man Lift	2	60 foot	10

Man Lift	1	80 foot	6
Scissor Lift	2	N/A	3
Light Plant	6	N/A	8
Welding Machines	4	N/A	3
Compressor (Model 375)	2	N/A	5
Compressor (Model 1500)	1	N/A	6
Backhoe	1	N/A	10
Hydro-Vac Truck	1	N/A	2
Hydrodemolition Pumps	1	N/A	1
Pier Driller	1	N/A	1

N/A=Not Applicable

3.3 Hazardous Materials and Solid and Hazardous Waste

3.3.1 Affected Environment

Currently, solid and hazardous waste generated at WBN is from plant operation and maintenance activities. WBN is a small quantity generator of hazardous waste. The United States Environmental Protection Agency (USEPA) Generator Identification Number for WBN is TN 2640030035. All waste generated at WBN is managed in accordance with applicable state and federal regulations.

3.3.2 Environmental Consequences

3.3.2.1 Alternative A – No Action

Under the No Action Alternative, the steam generators would not be replaced, and the plant would operate exactly as it operates currently. Therefore, there would be no additional solid and/or hazardous waste generated than is currently generated under the No Action Alternative.

3.3.2.2 Alternative B

Table 3.3-1 represents estimated waste type and quantities for waste that would be generated due to the proposed construction activities associated with the steam generator replacement work. All wastes would be managed in accordance with existing TVA and WBN waste management procedures and general BMPs.

Solid waste from clearing and grading activities (e.g., vegetation, soil, gravel) would be collected and disposed of at TVA-designated areas within the WBN site boundary. Other nonhazardous construction wastes (e.g., wood waste, scrap metal, plastic, paper, glass) would be placed within TVA-provided containers near the work locations and managed by TVA as part of the existing WBN waste management procedures. Concrete rubble and asphalt would be temporarily stored on site in TVA-provided containers and periodically transported off site for disposal in a local landfill.

Hazardous wastes (e.g., used oils, paint supplies, solvents, and degreasers) generated during construction would be placed within suitable containers in TVA-designated hazardous waste

storage areas and managed in accordance with WBN procedures and either transported off site for recycling or disposal in accordance with applicable state and federal regulations.

Through adherence to existing TVA and WBN waste management procedures and general BMPs, the effect of the steam generator replacement project on solid and hazardous waste would be minor and temporary.

Table 3.3-1. Construction Waste Estimates

Location	Scope	Waste Amount (estimated)	Waste Type
Barge Off-load Area	Clearing, grading, and excavations	800 square feet / 0.019 acre	Vegetation, gravel, and soils
Old Steam Generator Storage Facility	Grading and excavation	38,640 cubic feet / 1422 cubic yards / 0.35 acre	Vegetation, gravel, and soils
Replacement Steam Generator Storage Facility	Grading and excavation	4800 cubic feet / 177 cubic yards / 24,200 square feet / 0.56 acre	Vegetation, gravel, and soils
Rad Pad Demolition	Deconstruction of the concrete pad	5,000 cubic feet	Concrete
OLS Crane Grouting	Boring of approximately 900 holes for injection of foam	2250 cubic feet	Soil Slurry
Trailers, Crane Pad, Laydown Areas, Down-Ending, Dome Debris	Grading and excavation	2,500 cubic yards	Vegetation, gravel, soil, and concrete
Dome Cutting	Hydrodemolition	900,000 gallons	Water
		1000 cubic feet	Concrete rubble
		185 tons / 2551 cubic feet each	Shield building roof slabs (2 total)
Steam Generator Cubicles	Concrete saw	Approximately 40, 55 gallon drums	Concrete cuttings

3.4 Occupational Radiation Doses and Radioactive/Mixed Waste

3.4.1 Affected Environment

Radioactive wastes are generated as part of normal plant operations at WBN. These wastes are managed in accordance with Tennessee License for Delivery T-TN014-L04 and are shipped to Barnwell, South Carolina. The volume of radwaste shipped to licensed disposal sites is approximately 151.9 cubic meters annually under South Carolina Permit Number 2765-41-04-X. Actual annual volumes shipped for disposal to Barnwell, South Carolina, equal 360.9 cubic feet of Class A and Class B waste. Class A waste shipped annually to a processor totals 7,280 cubic feet.

There are varieties of compaction and incineration methods used to reduce the volumes of low-level radwaste for disposal. These methods result in an average reduction of dry solid waste greater than a 10 to 1 ratio. Processing of wet waste is accomplished through mobile demineralizers located in the radwaste packaging area. Occupational radiation doses during storage, monitoring, and retrieval of radioactive wastes are a small percentage of the total dose to workers who handle and/or work around radioactive materials each day.

Through procedural controls, WBN has measures in place to minimize the likelihood of mixing radioactive and hazardous wastes. There is currently no mixed waste stored at WBN.

3.4.2 Environmental Consequences

3.4.2.1 Alternative A – No Action

Under the No Action Alternative, the steam generators would not be replaced, and the plant would operate exactly as it operates currently. Therefore, there would be no additional impacts to radiation doses and radioactive/mixed wastes other than what was previously assessed and bounded in the Final Environmental Impact Statement related to the operation of WBN, Units 1 and 2 (NRC 1995).

If the steam generators were not replaced, additional radiation exposures of 31.1 roentgen equivalent to man (rem) per outage would continue to be amassed by workers who perform the required testing, maintenance, and repair to keep the unit operating at its expected power level. The radiation exposure level would increase with time, as the work frequency increased to repair tubes. These impacts are bounded in the Final Environmental Impact Statement related to the operation of WBN, Units 1 and 2; therefore, no additional impacts would be anticipated.

3.4.2.2 Alternative B

The OSG assemblies would be stored onsite in shielded buildings. Potential dose from such storage can be estimated from information gained by previous experience with steam generators (NRC 1996). Each steam generator would contain approximately 300 curie of fixed gamma emitters at the time it would be removed from the containment. In past steam generator replacements, storage buildings that housed the removed steam generators and associated equipment provided sufficient shielding to limit the dose rate to less than 1 mrem/h outside the building. The OSGSF would be over 2,700 feet from the State Route (SR) 68 site boundary, and the estimated additional dose rate at the site boundary from the OSGSF building would be less than 0.00001 mrem/h. An individual that lived at this location for 1 year would receive less than 1 mrem from this source, which 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 2 years of storage because short-lived radionuclides would decay. Thereafter, the dose would decrease by a factor of two every 5 years as the remaining Cobalt 60 decayed. Therefore, the radiation doses to the public from onsite storage of steam generators and other assemblies removed during replacement would be very small and minor.

Estimated waste type and quantities for radioactive waste generated due to the proposed construction/replacement activities are given in Table 3.4-1. Because WBN has measures in

place to minimize the likelihood of mixing radioactive and hazardous wastes, there would be no mixed waste anticipated to be generated by this project.

These construction wastes would be managed by TVA in accordance with 10 CFR Part 100 limits and WBN's implementing procedures. Because this waste would be managed in accordance with all applicable federal and state limits and WBN implementing procedures, the impacts would be minor.

Table 3.4-1. Estimated Radioactive Waste Generated

Waste Type	Quantity (cubic feet)
Insulation	3,120
Scrap Metal	1,209
Welding Stubs	113
Scrap Wood	651
Concrete Rubble	8,505
Total	13,598

3.5 Floodplains and Flood Risk

3.5.1 Affected Environment

As previously stated, WBN is located on the right bank of Chickamauga Reservoir between TRMs 528.0 and 528.6 in Rhea County, Tennessee. The off-load area for this project is located at approximately TRM 528.8. An existing barge loading area is located at about TRM 529.2. The area potentially impacted by this project would extend from about TRMs 528.4 to 529.2. The proposed project area could possibly be flooded from the Tennessee River and local site drainage.

The 100-year floodplain for the Tennessee River would be the area below elevation 697.3 at TRM 528.4 and elevation 697.7 at TRM 529.2. The Tennessee River TVA Flood Risk Profile (FRP) elevation would be 701.1 at TRM 528.4 and 701.5 at TRM 529.2. The FRP is used to control residential and commercial development on TVA land and flood damageable development for TVA projects. At this location on the Tennessee River, the FRP elevations are equal to the 500-year flood elevations.

3.5.2 Environmental Consequences

As a federal agency, TVA adheres to the requirements of EO 11988, Floodplain Management. The objective of EO 11988 is "to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (EO 11988, Floodplain Management). The EO is not intended to prohibit floodplain development in all cases, but rather to create a consistent government policy against such development under most circumstances. The EO requires that agencies avoid the 100-year floodplain unless there

is no practicable alternative. It is necessary to evaluate development in the 100-year floodplain to ensure that the project is consistent with the requirements of EO 11988.

3.5.2.1 Alternative A

Under the No Action Alternative, floodplain areas would not be impacted, and there would be no change in existing conditions.

3.5.2.2 Alternative B

All existing and proposed facilities are, or would be, located outside the limits of the Tennessee River 100- and 500-year floodplains. Improving the off-loading area could involve the removal of existing soil and placement of fill in return. The elevation of the off-load area is not anticipated to change.

A “critical action” (United States Water Resources Council 1978) is any activity for which even a slight chance of flooding would be too great a risk. Based on site topography and the 2008 Rhea County Flood Insurance Rate Map Number 47143C0260D, the proposed OSGSF would be located on ground outside the 100- and 500-year floodplains, which would be consistent with EO 11988 for non-critical and critical activities.

TVA Nuclear personnel evaluate potential facilities and structures for probable maximum precipitation site drainage and Tennessee probable maximum flood elevation as part of complying with the Watts Bar Nuclear Plant operating license. The potential structures and facilities contemplated in this project would be evaluated prior to their construction, and adjustments made to them as needed to comply with site drainage requirements at WBN.

The temporary facilities would be in place for up to 6 years, after which time the area would be returned to preconstruction conditions. By adhering to standard construction BMPs, the project would comply with EO 11988, and there would be no impacts to floodplains.

3.6 Surface Water

3.6.1 Affected Environment

The WBN Reservation is located at the northern end of the Chickamauga Reservoir, TVA’s sixth-largest reservoir. The reservoir is 59 miles long on the Tennessee River and 32 miles long on the Hiwassee River, covering an area of 35,350 acres with a volume of 628,000 acre-feet. At WBN, the reservoir is about 1,100 feet wide, with cross-sectional depths ranging between 18 feet and 26 feet. This plant site is located in Rhea County, Tennessee. The project area drains to streams in the Lower Tennessee River 8-Ditgit HUC (06020001) watershed. This portion of the Tennessee River/Chickamauga Reservoir is listed as Exceptional Tennessee Waters from Goodfield Creek to the Watts Bar Dam. This portion of the Tennessee River is designated for domestic water supply, industrial water supply, fish and aquatic life, recreation, irritation, livestock watering and wildlife and navigation uses.

Precipitation in the general area of the proposed project averages about 57.09 inches per year. The wettest month is July with an average of 5.47 inches of precipitation, and the driest month

is October with 3.19 inches. The average annual air temperature is 57.25°F, ranging from a monthly average of 48°F to 88°F (U.S. Climate Data 2017). Stream flow varies with rainfall and averages about 24.85 inches of runoff per year, i.e., approximately 1.83 cubic feet per second, per square mile of drainage area (USGS 2008).

The federal Clean Water Act requires all states to identify all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards and to establish priorities for the development of limits based on the severity of the pollution and the sensitivity of the established uses of those waters. States are required to submit reports to the USEPA. The term “303(d) list” refers to the list of impaired and threatened streams and water bodies identified by the state. The Yellow Creek is located to the southwest of the plant and is currently listed on Tennessee’s 303(d) list for E. Coli due to pasture grazing (TDEC 2016).

This project entails the replacement of steam generators. During the steam cycle, heat from the WBN Units 1 and 2 turbines is released when the steam passes through a condenser cooled with recirculated water from the Tennessee River. This water is cooled by passing it through natural-draft evaporative cooling towers. Although the system is designed as a closed type, make-up water from the Tennessee River is needed to replace water losses from evaporation, drift, and blowdown. All water withdrawn from and discharged to the Tennessee River for operation of WBN is regulated through the existing NPDES Permit Number TN0020168, and covered in WBN Procedure 0-PI-ENV-3.1: NPDES Plant Effluents.

In 1999, a supplemental condenser cooling water (SCCW) system was added to Watts Bar to feed the cooling tower basins. This system, which draws water from the existing raw water intake and discharge piping originally operated as a part of the Watts Bar Fossil Plant. The SCCW initially delivers the water to the Unit 2 cooling tower basin and from the Unit 2 cooling tower basin this water can be directed to the Unit 1 cooling tower basin and discharged from the WBN’s NPDES Outfall Number 113; water can be directed into the plant; and water can be directly discharged to Outfall 101. This system increases the power production of the WBN Units by drawing cooler water from the Watts Bar Reservoir at the Watts Bar Dam into the plant and reducing the main turbine condenser temperature.

Blowdown from the natural-draft cooling towers is discharged via a multiport diffuser system in the main channel of the Tennessee River at TRM 527.9 in accordance with WBN’s NPDES permit. Make-up water and other raw water supply requirements are taken from an intake channel and pumping station at TRM 528. When there is no flow from the Watts Bar Dam, cooling tower blowdown is routed to the Yard Holding pond. The Yard Holding pond discharges from the diffusers to the Tennessee River at OSN 101. The discharge temperature would vary depending on the cooling tower performance, which is a function of the ambient air temperature, from 41°F in January to 91°F in July.

Storm water discharges from WBN are regulated through the existing Tennessee Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activity, Permit Numbers TNR051343 and TNR051343. In addition, WBN implements the permit and regulatory

requirements for industrial storm water discharges through the site's SWPPP, which includes environmental compliance manual Chapter 4 (ECM-4).

3.6.2 Environmental Consequences

3.6.2.1 Alternative A

No surface water impacts are anticipated under Alternative A, the No Action Alternative, at the Watts Bar site beyond the effects of existing and future activities that are independent of the proposed action.

3.6.2.2 Alternative B

All excavation would be performed using a digging permit, WBN Technical Instruction-215 (TVA 2004d TVA-TSP-18.804). If one acre or greater of land is expected to be disturbed during construction of the OSGSF, a Tennessee General Construction Storm Water Permit would be required. BMPs would be employed according to ECM-4 and in accordance with the Tennessee Erosion and Sediment Control Handbook (TDEC 2012). The current on-site SWPPP would be updated and a project specific SWPPP would be generated to address the construction of the OSG building and laydown yard. Additionally, the WBN's SWPPP and/or IPPP would be modified to include the new steam generator laydown and other areas affected by the project. TVA would notify the State of Tennessee of the change and coordinate any updates to the site's coverage under the Tennessee Storm Water Multi-Sector General Permit for Industrial Activities as needed. Additional protective measures may be required due to the exceptional water designation of the receiving stream(s) in the project vicinity. These extra measures are detailed in the 2016 TDEC construction storm water general permit and may be further addressed should any other permit be required and should be incorporated in the project SWPPP and design plans.

The Tennessee River at the barge off-load area would not be dredged since the river would have sufficient depth (i.e., estimated to be 16 feet) at the time of delivery. In addition, any disturbed soil during minor grading activities or installation of gravel at the off-load area would be minimized or prevented from entering the river through utilization of appropriate BMPs. A TDEC ARAP would be required for work in the 60 foot buffer zone adjacent to exceptional waters. Therefore, only minor impacts to surface waters would be likely to occur as a result of this action.

Surface Runoff - Potential surface water impacts from the replacement of the steam generators would primarily be from wastewater generated as part of the hydrodemolition and hydroexcavation work at and near the Unit 2 containment building and from storm water discharges associated with the construction activities. Prior to hydrodemolition, environmental personnel would coordinate with TDEC Division of Water Resources, as necessary, to determine the proper method for filtering, sampling, treating, and releasing this process water. The source water for both hydrodemolition and hydroexcavation activities would be the existing fire protection system for WBN. This water would be eventually discharged through Outfall 101 after land application and proper BMP treatment. Compliance with the NPDES discharge limitations for this outfall would be maintained.

A series of pumps located adjacent to the Tennessee River at the WBN site provides river water for plant fire protection. The hydrodemolition equipment would tie into an existing fire hydrant that is adjacent to the steam generator replacement work location near Unit 1. The fire hydrant water is chlorinated for biological fouling control. The fire protection water would be pumped through the hydrodemolition equipment and then collected and pumped back through a bag filter to remove suspended solids and other debris. The flow amounts for the blasting are approximately 40 to 50 gallons per minute at 25,000 pounds per square inch. The current estimate for water needs for hydrodemolition is about 75,000 gallons of water per day, for a period of approximately 12 days, for a total of 900,000 gallons of water. This water would be collected through a high-suction vacuum system as mentioned in Section 2.1.2 and in the above paragraph. WBN environmental personnel would coordinate to establish the proper method for sampling, treating, and releasing this construction generated water.

Similar to hydrodemolition work, the proposed source of water for hydroexcavation would be from the existing WBN fire protection system located in the vicinity of the OLS immediately east of Unit 2. Hydroexcavation will be used for the OLS soil improvement process to ensure underground utilities are not damaged when soil is removed for the project. The hydroexcavation process uses a water jet nozzle that produces high pressure (approximately 2,000 pounds per square inch) to remove gravel and soil. The mixed water and spoils would be vacuumed into a large capacity vacuum truck as the hydroexcavating is taking place. Hydroexcavation activities for the OLS soil improvement would occur for approximately 10 weeks using approximately 1,000 gallons of water per day (total yield=10,000 gallons). The assumed recovery rate of the mixed water and spoils slurry to the vacuum truck is 90 percent. Therefore, only approximately 1,000 gallons of water would be treated by BMPs at the OLS location. The resulting slurry captured in the vacuum truck (i.e., 9,000 gallons of water plus spoils) would be transported and placed at a WBN on-site spoils area. The spoils area would be designed and maintained to retain the slurry within a defined area and to prevent surface migration to a receiving stream. The water in the slurry would include BMP treatment prior to discharge. Approximately 2250 cubic feet of soil slurry will be removed for the OLS soil improvement.

Construction activities would result in exposed soils that could cause temporary increases in erosion and sediment runoff if not properly managed. Appropriate design in conjunction with the proper use of BMPs would be needed to minimize erosion and sediment runoff and to minimize the magnitude and duration of the impacts. If 1 acre or more of land were to be disturbed in a given drainage area during construction, a Construction Storm Water Permit would be obtained, prior to the start of earth-disturbing activities. TVA would also prepare a Construction SWPPP that addresses the BMPs to be used to prevent or limit the potential for steam generator replacement work construction activities to impact storm water quality. Discharges from WBN include process water and storm water outfalls, covered by the existing TDEC NPDES Permit (TN0020168), and the Tennessee Storm Water Multi-Sector General Permit for Industrial Activities (TMSP TNR051343). Compliance with the applicable NPDES discharge limits would be maintained for all discharge to surface water. Water runoff resulting from the water/soil/gravel slurry would be captured within the WBN spoils area with BMPs ensuring no runoff from this area impacts waters of the U.S.

Storm water runoff from all areas disturbed during the steam generator replacement work (i.e., RSG off-loading, OSGSF, decontamination building, temporary construction laydown, and parking) would be protected through the use of erosion and sediment control BMPs as defined in TVA 2016 and the project SWPPP. Storm water runoff would continue to be monitored and visually inspected on a routine basis. Therefore, only minor impacts on surface water would result from soil erosion or the siltation of surface drainage.

Additionally, impervious buildings and infrastructure prevent rain from percolating through the soil and result in additional runoff of water and pollutants into storm drains, ditches, and streams. Because this construction would take place in an already industrialized area, the increase in the impervious area would be minimal; however, concentrated storm water flows would need to be properly designed and released to minimize impacts.

Domestic Sewage - Portable toilets would be provided for the construction workforce as needed. These toilets would be pumped out regularly, and the sewage would be transported by tanker truck to a publicly-owned wastewater treatment works that accepts pump out.

Equipment Washing and Dust Control – Equipment washing and dust control discharges would be handled in accordance with BMPs described in the Storm Water Pollution Prevention Plan (SWPPP) for water-only cleaning.

In addition, the steam generator replacement work would be conducted in accordance with the existing WBN Spill Prevention, Control, and Countermeasure (SPCC) Plan and TVA Nuclear Standard Programs and Processes (SPP) 3.1. The plan and procedure describe the BMPs to be used to prevent and/or minimize the release of hazardous substances used on site and the corrective actions to be taken in the event of a release to limit the potential contamination of surface- and groundwaters, respectively.

Development and implementation of BMPs in the SWPPP, IPPP, ECM-4, and SPCC Plan would help prevent and/or minimize the potential for adverse surface water impacts from storm water runoff during execution of the steam generator replacement work. Overall, impacts to surface water resources from storm water runoff, hydrodemolition, or hydroexcavation activities associated with implementation of Alternative B at the WBN site would be, therefore, minor.

3.7 Navigation/Transportation

3.7.1 Affected Environment

WBN is located at the northern end of the Chickamauga Reservoir, TVA's sixth-largest reservoir. The reservoir is 59 miles long on the Tennessee River and 32 miles long on the Hiwassee River, with the navigation channel extending up the Hiwassee approximately 21 miles. Barge transportation on this stretch of the Tennessee River past WBN is significantly less than further downstream. Total tonnage of commodities past WBN ranges from 0.5 - 0.75 million ton annually with salt, non-ferrous ores, and petroleum being the prime commodities transported. Of the 1,500 – 2,000 vessels passing through Watts Bar lock each year (and therefore by WBN), approximately 75 percent are recreation vessels with commercial tows and federal tows comprising the remainder.

3.7.2 Environmental Consequences

3.7.2.1 Alternative A

If the steam generators were not replaced, the barge shipments would not occur, and there would be no impact to commercial navigation under the No Action Alternative. The plant would operate exactly as it operates currently. There would be no additional traffic than is currently at the plant during routine operation and outage activities. Therefore, there would be no impact to transportation for the No Action Alternative.

3.7.2.2 Alternative B

Under the Action Alternative, four RSGs would be shipped from Doosan Heavy Industries in the Republic of South Korea via a seagoing, dedicated vessel through the Panama Canal to the U.S. Port of New Orleans or Mobile Harbor. The RSGs would be transferred from the seagoing vessel to two river barges and would travel up the Tennessee-Tombigbee Waterway to the Tennessee River to WBN. Each barge would be accompanied by a tow or another barge.

Once the RSGs were loaded onto the river barges, they would receive government priority locking at each lock and would not experience any delays throughout the trip. A member of TVA's Navigation staff would assist in communication with the locks and the tows while enroute. There will be a lock closure at Chickamauga Lock beginning February 6, 2018 through April 16, 2018. That is not expected to interfere with the currently anticipated fall 2018 delivery schedule.

The headwaters of Chickamauga Reservoir fluctuate approximately 7.5 feet between normal summer pool elevation 682.5 and winter pool elevation 675. The transport barge would pull up to the shore, approximately 1 mile downstream of Watts Bar Lock and Dam at TRM 529.0, on the right descending bank. The barge off-loading area has been used for various WBN deliveries and has sufficient depth to support the RSG delivery. Navigation staff would coordinate with River Scheduling to ensure that flows would be kept as steady as possible during delivery operations. A steel ramp would be placed connecting the barge to the shore. The RSGs would be rolled off on the ramp onto the shore and then be transported up the existing roadway to WBN.

Overall, through the use of BMPs and standard operating procedures, there would be no impacts to barge transportation as a result of implementation of Alternative B.

The RSG work would require both non-manual and craft construction personnel at the WBN site in addition to the existing operating plant workforce.

Overland deliveries to the WBN site in support of the SGR work would occur primarily in 2018 for construction of the OSGSF. Additional deliveries would occur during the 18 months associated with installation of the RSGs during the designated refueling period. Table 3.7-2 provides the estimated number of deliveries of equipment and materials necessary to support the SGR work including RSG unloading, rental equipment, OSGSF foundation work and construction, concrete deliveries, structural fill, and waste concrete/asphalt to off-site landfill.

Because the additional traffic and deliveries due to the replacement project would be temporary and short term, the road that would be utilized is currently extensively traveled, and the amounts of additional workers would be less than the peak construction workforce for completion of WBN Unit 2 construction, impacts due to transportation would be temporary and minor.

Table 3.7-2. Estimated Types and Number of Deliveries in Support of Steam Generator Replacement Work

Delivery Type	Loads to the Site	Loads off the Site
Equipment and Materials	250	250
Crane	200	200
Concrete	250	0
Structural Fill	200	0
Waste Concrete/Asphalt*	0	50

*Waste concrete/asphalt would be transported for disposal in an offsite landfill. Excess soil, gravel, and vegetation waste would be disposed of at TVA-designated areas on the WBN site and are not expected to require transport offsite.

3.8 Land Use and Visual Resources

3.8.1 Affected Environment

Visual resources are evaluated based on existing landscape character, distances of available views, sensitivity of viewing points, human perceptions of landscape beauty/sense of place (scenic attractiveness), and the degree of visual unity and wholeness of the natural landscape in the course of human alteration (scenic integrity).

The proposed project site is located in rural Rhea County, Tennessee, just south of SR 68 between Spring City and Sweetwater. The topography surrounding the project site is moderately sloping and remains consistent along the valley floor between Walden Ridge and the eastern shore of the Tennessee River. Vegetation is mixed within the valley as the land use transitions from dense forestland along the eastern shore to agricultural lands to sparsely populated residential development to the east and north.

WBN is located on the TVA Watts Bar Reservation, adjacent to the former Watts Bar Fossil Plant site and Watts Bar Hydroelectric Plant, where the existing landscape character is industrial. The 500-kilovolt transmission lines streaming from the power production facilities and the natural-draft cooling towers are dominant elements within the foreground (0 to 0.5 mile from the observer) viewing distance. Shoreline and near shore residents to the north are generally not afforded views of plant structures and operations, as most are within the middleground (0.5 mile to 4 miles from the observer) or background (4 miles and beyond) viewing distances. Recreational river users have prominent views of the cooling towers, transmission structures, and a few of the internal plant facilities as they rise from the western shore of the river near TRM 528. The cooling towers are also prominently visible from SR 68 near WBN dam.

To the interior of the plant site, the landscape character can be separated into two areas, which include the plant operations core area where structures are closely spaced and the landscape is

markedly industrial in character, and the plant operations support area where buildings are more loosely set about the low valley terrain and activity is less pronounced. Within this second landscape characterization, support facilities spread outward and into the woodland fringes.

Views of this portion of the project site are limited and are restricted primarily to employees and visitors to the plant site.

The scenic attractiveness of the proposed project area is minimal, and the scenic integrity is low to very low.

3.8.2 Environmental Consequences

3.8.2.1 Alternative A

Under the No Action Alternative, proposed project elements associated with the replacement of steam generators at WBN would not occur. The existing scenic attractiveness and scenic integrity would not change, and the existing visual resources would not be impacted.

3.8.2.2 Alternative B

Under Alternative B, TVA would replace the steam generators at WBN. This proposed activity would include project elements that would potentially alter the existing landscape character of locations within the plant site. Views of these project elements would be confined, primarily, to the interior of the proposed project site and within the foreground viewing distance.

Recreational river users would have prominent views of operations occurring at the shoreline area such as increases in traffic near the off-load area during times of delivery and unloading and the transportation of replacement generators. Increases in equipment and personnel at the shoreline area would also be discernable to reservoir users but would be brief in duration and would remain in context with the established industrial landscape character.

The replacement activity would require several areas of new construction throughout the plant site in order to facilitate replacement operations. Laydown yards and construction staging/preparation areas would be located where similar activities presently occur. Potential surface preparation and fencing for the security of staging areas would remain in context with the existing landscape character. In addition to construction preparation areas, employee and overflow parking lots would be reclaimed for times of peak activity. Two parking lots would be reclaimed on opposing sides of the proposed RSG haul route, and one construction parking area would be reclaimed to the northeast near TVA's Heavy Equipment Division operations. All of the parking areas have been used previously and would require only minimal, if any, removal of vegetation and stabilization with gravel.

The new Unit 2 OSGSF would be built adjacent to the Unit 1 OSGSF and would be similar in size and design and, thus, would not impact the existing landscape character. Also within the secured plant area, the OLS and Supplemental cranes would be erected to remove and replace the steam generators. The proposed OLS crane would reach as high as 350 feet, with a boom capable of reaching over 400 feet. Once erected, the OLS crane would become a dominant element in the viewshed; however, due to its general features, the OLS crane frame would only

be readily discernable from within the foreground viewing distance. The Supplemental Crane would be less visible and would blend into the industrial setting at WBN.

Most elements of the proposed project would be discernable only to plant visitors and employees. These available views would be in keeping with the existing landscape character, resulting in a minimal impact to visual resources. Those proposed project elements that would be visible to recreational lake users and motorists traveling the eastern shore on River Road would be temporary in duration and would change based on seasonal variations in vegetation along the shoreline. These temporary impacts, including the potential for a noticeable increase in traffic along SR 68, would not impact the existing scenic attractiveness or scenic integrity, which is low.

Aggregately, the removal and replacement of steam generators at WBN would, therefore, result in only minor and temporary impacts to existing visual resources.

3.9 Noise

3.9.1 Affected Environment

Noise is measured in logarithmic units called decibels (dB). Given that the human ear cannot perceive all pitches or frequencies of sound, noise measurements are typically weighted to correspond to the limits of human hearing. This adjusted unit of measure is known as the A-weighted decibel (dBA). A-scale weighting reflects the fact that a human ear hears poorly in the lower octave-bands. It emphasizes the noise levels in the higher frequency bands heard more efficiently by the ear and discounts the lower frequency bands.

The equivalent sound level is the constant sound level that conveys the same sound energy as the actual varying instantaneous sounds over a given period. It averages the fluctuating noise heard over a specific period as if it had been a steady sound. The day-night sound level (L_{dn}) is the 24-hour average noise level with a 10-dBA penalty between 10 p.m. and 7 a.m. to account for the fact that most people are more sensitive to noise while they are sleeping.

There are no federal, state, or local regulations for community noise levels in Rhea County; however, EPA (1973) guidelines recommend that L_{dn} not exceed 55 dBA. The U.S. Department of Housing and Urban Development (HUD) considers an L_{dn} of 65 dBA or less to be compatible with residential areas (HUD 1985).

WBN is situated in a rural area along the Tennessee River approximately 7 miles southeast of Spring City, Tennessee. The nearest sensitive receptors are two homes located approximately 0.9 mile west of WBN Unit 2 on Morrison Lane as well as several homes located along River Road, approximately 0.9 mile southeast of WBN Unit 2. There are also homes along the road to the M&M Dock and numerous homes along Crosby Lane and along Old Dixie Highway; these homes range from within 1 to 2 miles of WBN Units 1 and 2.

At high levels, noise can cause hearing loss, and at moderate levels, noise can interfere with communication, disrupt sleep, and cause stress. Even at relatively low levels, noise can cause annoyance. Noise is measured in decibels (dB), a logarithmic unit, so an increase of 3 dB is just

noticeable and an increase of 10 dB is perceived as a doubling of sound level. Since not all noise frequencies are perceptible to the human ear, A-weighted decibels (dBA), which filter out sound in frequencies above and below human hearing, were used for this assessment.

Ambient noise was measured with a Bruel & Kjaer 2237 Integrating Sound Level Meter on October 22, 2004 in association with the WBN Unit 1 steam generator replacement project. Given the limited number of changes in the area since 2004, these measurements are assumed to adequately represent current noise levels in these areas. Measurements were taken in seven locations:

- (1) On Morrison Lane adjacent to the nearest residence
- (2) At the end of McCustion Cemetery Road where it forks and becomes two private roads
- (3) At the cabins at Watts Bar Resort
- (4) At the end of the road to the M&M Dock
- (5) At the boat ramp at the end of Pinhook Ferry Road
- (6) Along River Road
- (7) At a boat launch just south of Watts Bar Dam

Measurement locations are shown in Figure 3.9-1. The measurement location along River Road is the only one that was dominated by traffic. Noise sources at the other locations included mules, horses, dogs, birds, insects, rustling leaves, and boats. Noise from earthmoving equipment at WBN was audible at locations 3, 5, and 7. Noise levels were measured three times at each location, and each measurement lasted for 5 minutes. L_{eq} is the continuous equivalent sound level or the “average” noise level during the measurement period. While L_{eq} is very valuable for describing continuous noises, it is less useful for intermittent noises such as traffic. L_{eq} smoothes out the discrete high-level events, such as vehicles passing, to the point of eliminating the annoyance factor of the events. MaxP is the maximum peak sound level during the measurement, which is an important descriptor for intermittent noises. The L_{eq} and the MaxP measurements are shown in Table 3.9-1.

Average noise levels in rural areas are typically around 40 dBA during the day, so noise levels at these locations, except along River Road, are fairly typical for rural areas.

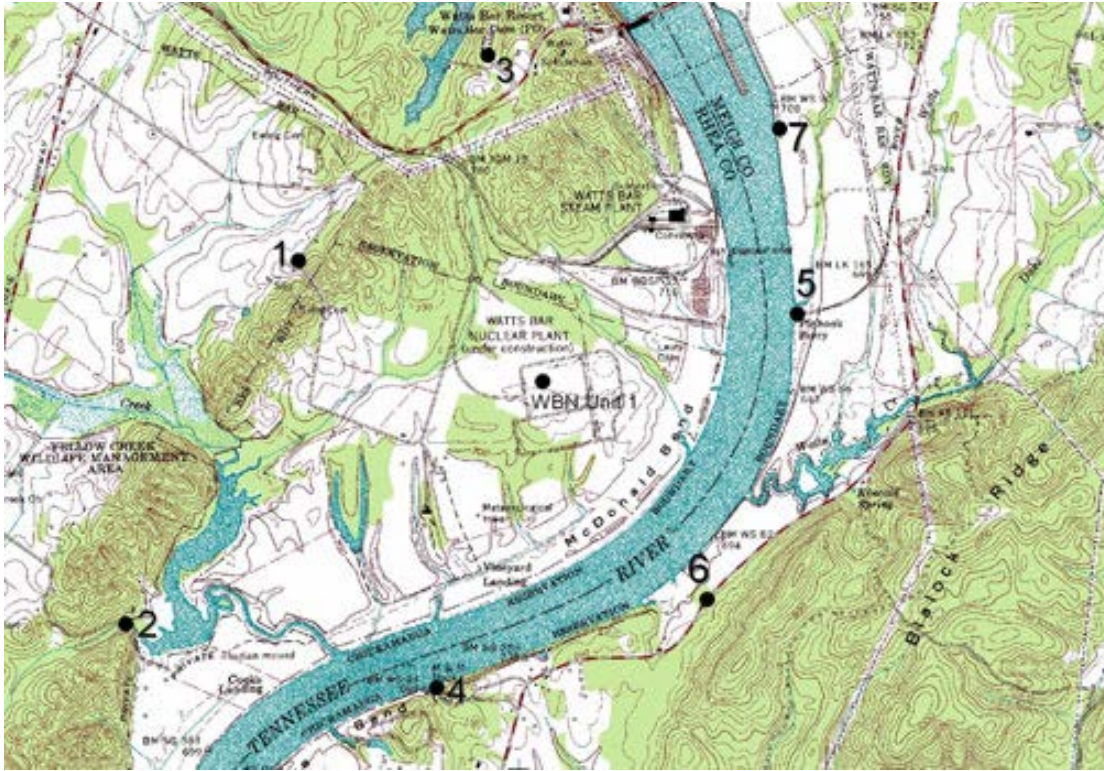


Figure 3-1. Ambient Noise Level Measurement Locations

Table 3.9-1. Ambient Noise Levels

Measurement Location	Average Leq (dBA)	Maximum peak sound level (dBA)	Noise Sources
1. Morrison Lane adjacent to the nearest residence	42.9	86.1	Mules, dog, birds, insects, rustling leaves
2. McCustion Cemetery Road at fork where it becomes private	40.5	83.2	Birds, insects, horses, rustling leaves
3. Cabins at Watts Bar Resort	42.5	90.3	Traffic on SR 68 at WBN
4. At end of road to M&M Dock	46.8	81.1	Boats, birds, insects, rustling leaves
5. At boat ramp on Pinhook Ferry Road	47.5	85.7	Boats at WBN, birds, insects
6. Along River Road	59.6	103.8	Traffic, dogs, birds, insects
7. At boat launch south of Watts Bar Dam	44.1	86.9	Boats, road construction at WBN

3.9.2 Environmental Consequences

3.9.2.1 Alternative A

Under the No Action Alternative, the steam generators would not be replaced, and the plant would operate exactly as it operates currently. Therefore, there would be no additional impacts to noise other than what was previously assessed and bounded in the Final Environmental Statement related to the operation of WBN Units 1 and 2 (NRC 1995).

3.9.2.2 Alternative B

Construction activities for the SGR work would result in noise impacts greater than those associated with normal WBN operation. Typically, noise from construction activities is intermittent and temporary in nature. During replacement of the steam generators, clearing and grading activities and other general construction work would typically occur only during normal work hours (e.g., 7:00 a.m.–5:00 p.m.) on a Monday-to-Friday schedule, although some night-time work is expected.

Table 3.9-2 demonstrates the noise levels of typical construction activities. Noise generated by the hydrodemolition activities is expected to be 110 dBA at 50 feet, which would be about 70 dBA at the nearest residence approximately 0.9 mile away. These levels would exceed the EPA and HUD standards for residential areas.

Table 3.9-2. Noise Levels From Typical Construction Equipment at Various Distances

Equipment	Typical Sound Pressure Level at 50 feet (dBA)	Expected Sound Pressure* Level at		
		1000 feet	2500 feet	5000 feet
Bulldozer (250 to 700 horsepower)	88	62	54	48
Front-end Loader (6 to 15 cubic yards)	88	62	54	48
Truck (200 to 400 horsepower)	86	60	52	46
Grader (13- to 16-foot blade)	85	59	51	45
Backhoe (2 to 5 cubic yards)	84	58	50	44
Portable Generators (50 to 200 kilowatts)	84	58	50	44
Mobile Crane (11 to 20 tons)	83	57	49	43
Concrete Pumps (30 to 150 cubic yards)	81	55	47	41
Tractor (3/4 to 2 cubic yards)	80	54	46	40

* Estimated levels include attenuation due to distance only (geometric spreading). Atmospheric effects (molecular adsorption and excess attenuation) for standard day conditions (59°F, 70 percent relative humidity) would reduce levels by an additional 3, 7, and 11 dBA at 1,000, 2,500, and 5,000 feet, respectively. Source: Barnes et al. 1977.

The noise level at the nearest residence would be typical of a sidewalk with passing automobiles. This would be a substantial increase over the current noise levels in the area. Since typical indoor noise levels are 15 to 20 dBA less than outdoor levels when the doors and windows are closed (Cowan 1994), indoor noise levels at the nearest residence would be

approximately 50 to 55 dBA. This indoor noise level is not likely to interfere with normal speech or telephone conversations (Cowan 1994). While sleep disturbance is more often associated with intermittent or impulsive noises, continuous noise at this level may disrupt sleep for some people. While noise from the hydrodemolition is expected to be quite loud and may cause some temporary impacts at nearby residences. These impacts are expected to be temporary and minor because they would last for no more than 12 days.

Based on the information presented in Table 3.9-2 for typical construction equipment, including the typical attenuation of noise with distance, there are not expected to be any offsite impacts from noise to the local population from non-outage construction activities.

Hydrodemolition and other activities occurring during the outage could pose unacceptable noise impacts to local residents especially during the nighttime hours and on weekends and holidays. As a mitigation measure, TVA would implement (as necessary) a public noise awareness program prior to the start of the steam generator replacement work. The intent of the program would be 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 WBN regarding noise complaints if and when they occur. Actions TVA would implement as part of the program include:

- Notifying key local stakeholders/elected officials of the project actions, schedule, and anticipated noise levels.
- Talking to local civic organizations such as Rotary Clubs, etc. to inform members of the planned project actions, schedule, and anticipated noise levels.
- Posting information on the TVA website/potential media outreach prior to the start of the project.

By implementing a public noise awareness program and because of the temporary nature of the activity, there would not be any long-term impacts from noise associated with the replacement of the steam generators. The short-term impacts would be minor.

Other phases of construction would require the use of cranes, forklifts, man lifts, compressors, backhoes, dump trucks, pier driller, and portable welding machines. This type of equipment would generate noise levels ranging from 81 to 91 dB at 50 feet (USEPA 1971). This type of construction equipment would generate noise levels similar to the earthmoving equipment that is already in use at WBN. Construction noise of 91 dBA at 50 feet would be about 51 dBA at the nearest residence approximately 0.9 mile away. This would likely be audible over background noise levels and would be considered a minor impact.

3.10 Cultural and Historic Resources

3.10.1 Affected Environment

As part of the extensive history of environmental review of constructing and operating WBN, TVA has considered the potential impact on historic and archaeological resources associated with each undertaking. It was determined during the initial environmental review that two

archaeological sites (40RH6 and 40RH7) would be adversely affected by construction of the plant. Based on this finding, TVA proceeded with data recovery of these sites (Calabrese 1976; Schroedl 1978). One historic cemetery (Leuty Cemetery) was located on the property prior to plant construction. Two graves were removed in 1974 and placed in Ewing Cemetery. Subsequent environmental reviews conducted resulted in a "no-effect finding" for archaeological resources. In the 1998 review of the WBN supplemental condenser cooling water system project (TVA 1998a), TVA determined that the Watts Bar Fossil Plant was eligible for listing on the National Register of Historic Places (NRHP). However, it was determined that this property would not be adversely affected by that project. WBF has subsequently been decommissioned and demolished.

Four archaeological sites are located within the WBN property (40RH6, 40RH7, 40RH8, and 40RH64). The first three sites were recorded as part of the Watts Bar Basin survey in 1936. The latter was recorded later during a post-inundation shoreline survey. These sites are considered eligible or potentially eligible for the National Register of Historic Places (NRHP) based on the potential for intact buried archaeological deposits. The entire WBN property has not been subject to systematic archaeological survey and additional archaeological resources may be present on the property undisturbed areas outside the current project's area of potential effects (APE). No archaeological sites have been identified within the APE.

With the exception of the barge off-load area, the entire APE is confined to developed areas and has been extensively disturbed. The project area associated with the barge off-load area was subject to two previous reviews associated with proposed bank stabilization projects no intact deposits were identified during the field reconnaissance. TVA consulted with the Tennessee State Historic Preservation Officer (SHPO) regarding TVA's no effect findings in letters dated November 18, 2013 and November 3, 2014. If the proposed project area were to change, those plans would be reviewed and, if deemed necessary an archaeological survey of the affected area would be conducted, including coordination with the SHPO.

3.10.2 Environmental Consequences

Because the WBN Reservation has been extensively disturbed previously, and because all project actions would occur within this previously disturbed area, no potential exists for historic properties to be affected by implementing either alternative.

The nature of the undertaking is such that it would have no potential to affect historic structures.

3.11 Socioeconomics and Environmental Justice

3.11.1 Affected Environment

As noted earlier, WBN is located in Rhea County, Tennessee. The 2011-2015 5-year estimated population of Rhea County was 32,394 (United States Census Bureau 2015a). The primary labor market area for the plant consists of eight counties: Bledsoe, Cumberland, Knox, Hamilton, Meigs, McMinn, Rhea, and Roane Counties. The 2011-2015 5-year estimated population of this area was 1,013,388. Based on 2011-2015 5-year estimate, the labor force in Rhea County is 25,725; the primary labor market area has a labor force of 822,870 (United

States Census Bureau 2015b). The 5-year estimated unemployment rate in 2011-2015 was 6.1 percent in Rhea County, while the average in the primary labor market area was 5.15 percent (United States Census Bureau 2015b).

The population of Rhea County is 8.7 percent minority, well below both the state of Tennessee, with 25.3 percent, and the nation, with 37.7 percent (United States Census Bureau 2015a). The labor market area has a higher minority population share, 9.6 percent, still well below the state and national levels. The poverty rate in Rhea County is 24.5 percent, somewhat higher than the state average of 17.6 percent and the national average of 15.5 percent. The poverty rate in the eight-county labor market area is 16.7 percent, lower than Rhea County and higher than the state and the nation (United States Census Bureau 2015c).

3.11.2 Environmental Consequences

3.11.2.1 Alternative A

WBN is currently operating Unit 2, and there would be no changes in Unit 2 operations. Therefore, there would be no impacts due to socioeconomics or environmental justice from operation of WBN Unit 2. If the power level could no longer be maintained, additional power would need to be made up to support the Tennessee Valley's power needs. No additional impacts to socioeconomics or environmental justice for the No Action Alternative would be anticipated above or beyond those considered among the suite of power generation options available to TVA as evaluated in TVA's Energy Vision 2020 Environmental Impact Statement (TVA 1995).

3.11.2.2 Alternative B

The proposed action would require both nonmanual and craft construction personnel at the WBN site in addition to the existing operating plant workforce. The number of construction-related personnel would vary over the course of the planned steam generator replacement work with a maximum of about 1000 onsite at the peak of construction. The maximum employment level would represent about 7.11 percent of the current labor force of Rhea County and about 0.20 percent of the labor force in the eight-county primary labor market.

Previous TVA experience at the WBN site and at other construction sites suggests that it is likely that no more than one-third of all workers hired for construction or similar activities would move into the primary labor market area. The remaining workers generally would already reside within the primary labor market area, including locations such as the Chattanooga and Knoxville metropolitan areas, close enough to commute on a temporary basis. Based on this experience, it is anticipated that the maximum number of workers moving into the area would be about 180 to 230 workers, not all resulting from this proposed action. Because of the temporary nature of work and the short duration of the maximum employment level, very few workers who do move in are expected to bring families with them. It is not likely that the increased population in the area due to the steam generator replacement activities would exceed about 260 persons. However, it is possible that the demand for the required skills would make recruiting difficult, resulting in a somewhat larger number of workers moving temporarily into the local area.

Due to the short term of the project, the total impact on annual earnings and income in Rhea County and in the labor market would be minor. The number of personnel brought on site to support this project is within the scope of other TVA nuclear plant refueling outages. Impacts on community services such as medical services, police, and fire protection would also be very minor because of the small size of the workforce relative to existing population, because the workers who do move would likely be dispersed within the labor market area, and because of the short duration of the maximum population increase.

Onsite medical services combined with the medical personnel brought in for construction would accommodate most medical demands.

The minority population around the plant site is relatively small, and poverty rates are slightly higher than those of the broader state and national population. Almost all of the activity associated with the proposed action would occur inside the WBN site, further removing it from the population in the surrounding area. Therefore, no disproportionate adverse impacts to disadvantaged populations would be expected.

3.12 Cumulative Impacts

Cumulative impacts are defined in the Regulations for Implementing the Procedural Provisions of the NEPA at 40 CFR § 1508.7 as follows:

Cumulative impact is the impact on the environment which results 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 can result from individually minor but collectively significant actions taking place over a period of time.

Past actions that have already occurred and present actions are integrated into the existing baseline conditions discussed in the sections above. Projects planned elsewhere in the community are not likely to have a cumulative impact with respect to steam generator replacement given the small scale of the steam generator replacement activities and the distance separating other regional projects from the WBN project area.

3.12.1 Alternative A

TVA has determined that incremental cumulative impacts of the No Action Alternative would be negligible. WBN is currently operating Unit 2, and there would be no changes in Unit 2 operations. If at some time in the future WBN proposed to shut down Unit 2 for any reason, an environmental review that included the effects of shutdown would be conducted at that time.

3.12.2 Alternative B

TVA has determined that incremental cumulative impacts of purchasing, transporting, and installing four RSGs for Unit 2 at WBN and onsite interim storage of the OSGs would be minor. The construction activities are short term and temporary in nature. Disturbed soil would be returned to its original state after the steam generator replacement activities were completed. All

discharges would be short term in nature and would comply with WBN's NPDES discharge permit limitations. All wastes would be managed and disposed of properly. All other impacts would be very minor.

3.13 Unavoidable Adverse Environmental Impacts

This section describes principal unavoidable adverse environmental impacts associated with the replacement of the steam generators, for which mitigation measures are considered either impracticable, do not exist, or cannot entirely eliminate the impact. Specifically, this section considers unavoidable adverse impacts that would occur for the proposed action, Alternative B. Under Alternative B, the construction of the OSGSF, and storage of the OSGs in this facility, would render the small amount of land under the facility permanently unavailable over the duration of storage and likely for some time after decommissioning.

3.14 Relationship of Short-Term Uses and Long-Term Productivity

One of NEPA's basic requirements is to describe "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity." 42 U.S.C. § 4332(2)(C)(iv). TVA's action is to decide whether to replace the WBN Unit 2 steam generators. With respect to this action, short-term is defined as the 20-year period (2015-2035) evaluated in TVA's 2015 IRP (which considers power generation needs), whereas long-term is defined as the period beyond the year 2035.

In the short-term the steam generator replacement would reduce maintenance costs associated with inspection and repair of the OSGs if left in place. Additionally, the replacement would remove the potential reduction in operating efficiency associated with continued operation of the OSGs over time as more tubes become plugged. The replacement would also result in a reduction on the occupational dose to workers at WBN Unit 2. Therefore, the replacement of the steam generators would result in a long-term cost-savings benefit to TVA and its customers, as well as have beneficial impacts on the health of workers at WBN Unit 2. The short-term uses result in increases in long-term efficiency and productivity at WBN.

3.15 Irreversible and Irretrievable Commitments of Resources

This section describes anticipated irreversible and irretrievable commitments of environmental resources associated with both TVA's decision to replace the WBN Unit 2 steam generators. For the purposes of this analysis, the term "irreversible" applies to the commitment of environmental resources (e.g. permanent use of land) that cannot by practical means be reverse to restore the environmental resources to their former state. In contrast, the term "irretrievable" applies to the commitment of material resources that, once used, cannot by practical means be recycled or restored for other uses.

TVA's decision to replace the WBN Unit 2 steam generators would result in the irreversible and irretrievable conversion of the land under the OSGSF. The use of the OSGSF land for other purposes would be irreversibly and irretrievably lost because of the long term storage requirements. Additionally, there would be an irreversible and irretrievable use of resources for the installation of concrete for the replacement Rad Pad, the construction and installation of the

RSGs, and the use of fossil fuels for the transport of the RSGs to the WBN site. Overall, the steam generator replacement would reduce maintenance costs associated with inspection and repair of the OSGs if left in place. Additionally, the replacement would remove the potential reduction in operating efficiency associated with continued operation of the OSGs over time as more tubes become plugged. The replacement would also result in a reduction on the occupational dose to workers at WBN Unit 2. Therefore, the replacement of the steam generators would result in a long-term cost-savings benefit to TVA and its customers, as well as have beneficial impacts on the health of workers at WBN Unit 2.

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CHAPTER 5 - ENVIRONMENTAL ASSESSMENT RECIPIENTS

5.1 Federal Agencies

USACE, Nashville District

5.2 Federally Recognized Tribes

Eastern Band of Cherokee Indians

United Keetowah Band of Cherokee Indians in Oklahoma

Cherokee Nation

Chickasaw Nation

Muscogee (Creek) Nation of Oklahoma

Thlopthlocco Tribal Town

Kialegee Tribal Town

Alabama-Quassarte Tribal Town

Alabama-Coushatta Tribe of Texas

Eastern Shawnee Tribe of Oklahoma

Shawnee Tribe

Absentee Shawnee Tribe of Oklahoma

Seminole Tribe of Florida

Seminole Nation of Oklahoma

Poarch Band of Creek Indians

5.3 State Agencies

Tennessee Department of Environment and Conservation

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