

**SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT
TENNESSEE VALLEY AUTHORITY**

**MODIFICATIONS TO FUKUSHIMA RESPONSE STRATEGY
HAMILTON AND RHEA COUNTIES, TENNESSEE AND LIMESTONE
COUNTY, ALABAMA**

Following the March 2011 earthquake and tsunami that struck the Fukushima Dai-ichi electrical power station in Japan, the Nuclear Regulatory Commission directed operators of nuclear power plants, including the Tennessee Valley Authority (TVA), to review their procedures, equipment, and facilities and to develop strategies to improve their ability to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities in the event of a severe accident.

TVA subsequently developed a strategy for addressing these issues at its Browns Ferry (BFN), Sequoyah (SQN), and Watts Bar (WBN) nuclear plants. In addition to evaluating current procedures and existing facilities, TVA's proposed strategy included undertaking several physical actions to increase the reliability and durability of equipment and operating systems at the three plants. Major physical actions included construction of a secure building, known as a Flex Equipment Storage Building or "FESB," at each plant site to house diesel-powered generators and other emergency equipment, and the placement of emergency pumps at various locations on the three plant sites. This equipment is generally referred to as "FLEX" equipment.

On March 15, 2013, TVA issued a final environmental assessment (EA) entitled *Fukushima Response Strategy, Hamilton and Rhea Counties, Tennessee and Limestone County, Alabama* and a finding of no significant impact (FONSI) that documented the potential environmental consequences of implementing the proposed response strategy. Since the issuance of the FONSI, certain modifications to the original proposed action, as well as other actions, have been proposed to improve TVA's capabilities to cope with emergency situations at its nuclear plants. Details of these proposed actions are provided below.

Alternatives

Various options for ensuring the availability of emergency power and providing operational water supplies under emergency conditions were considered and evaluated from engineering and economic standpoints. The most feasible and practicable options are presented below as the Action Alternative.

No Action Alternative

Under the No Action Alternative, TVA would implement its Fukushima Response Strategy as described in the 2013 EA. Specifically, TVA would utilize the existing 7-day plant diesel fuel tanks at each site as the primary fuel supply for diesel-powered emergency equipment. The FESBs at each plant would be constructed at the locations described in the 2013 EA. Additionally, TVA would rely on existing surface water supplies as a source of water during an emergency situation.

Action Alternative

Under the Action Alternative, TVA would amend its Fukushima Response Strategy, as described in the 2013 EA, to include implementing any of the optional actions described below. These actions are presented below by nuclear site.

Browns Ferry Nuclear Plant

- Eliminate the installation of two 3-MW diesel-powered generators in the FESB. As described in the 2013 EA, original plans called for installing two 3-MW capacity generators in the FESB. Current plans call for storing either one or two 1-MW portable diesel-powered generators in the FESB at BFN. These portable generators would not be electrically or mechanically connected to the building. Otherwise, the FESB at BFN would contain FLEX equipment as listed in the 2013 EA. Additionally, depending on future requirements, TVA could opt to construct a second FESB on the BFN plant site to house additional FLEX equipment. The location of a second FESB has not been determined but it would be constructed above the 500-year flood and Probable Maximum Flood¹ (PMF) elevation, at a location that would not have the potential to affect historic properties, including archaeological resources, and in accordance with all applicable requirements.
- Install a staging area to serve as the initial delivery point for equipment arriving onsite during an emergency. The staging area would be known as the Regional Response Center (RRC) Staging Area B. The proposed staging area would likely be located on the eastern side of the BFN plant site at the site of the heavy equipment service area. The proposed site is located above the 500-year flood elevation and the PMF elevation and would not encroach within 250 feet of the relocated Cox Cemetery. The staging area could be several acres in size. However, the paved area of the staging area would have a hard surface, likely concrete or asphalt approximately 1 to 5 acres in size. Appropriate construction storm water permits would be secured for any clearing greater than 1 acre in size. The staging area would likely not be fenced, and no new permanent structures are planned for the area. The site of the proposed staging area at BFN is located outside the Environmental Impact Study Area (EISA) defined in the 2013 EA.
- Validate potential haul paths for onsite transfer of equipment from the staging area and the FESB(s) to various onsite locations. With the exception of a proposed haul route between the FESB and a proposed pump deployment site, all proposed haul paths are located on existing hard-surface roads at the BFN plant site. Establishing this haul route would require the construction of a new road having a gravel or paved surface and a length of approximately 1,200 feet. Otherwise, no new roads would be constructed. However, some road improvements may be required. This validation involves verifying that the routes would be available for use in various emergency conditions, including earthquakes. Thus, seismic testing including soil borings as described on page 12 of the 2013 EA would be required. Bore holes would be approximately 6 to 8 inches in diameter and would extend to bedrock (approximately 40 to 60 feet below ground level). Boring would occur at intervals of approximately 500 to 1,000 feet along the proposed routes. No borings would occur within 100 feet of the Cox Cemetery. Portions of some of the proposed haul paths are located outside the EISA defined in the 2013 EA.

¹ The "Probable Maximum Flood" is defined here as the theoretically largest flood resulting from a combination of the most severe meteorological and hydrologic conditions that could conceivably occur in a given area.

Additionally, establishing the proposed 1,200-foot haul route between the FESB and a pump deployment site would involve the placement of a bridge over the switchyard ditch. This bridge would be approximately 80 feet long and would be a single span and a single lane wide. The bridge would be constructed of metal and would be capable of supporting portable equipment such as emergency pumps and associated tow equipment. The bridge, including the installation of the abutment at each end, would be constructed such that the flow of the switchyard drainage ditch would not be impeded. The switchyard ditch is not considered waters of the United States, and construction of the bridge would not require permits from the U.S. Army Corps of Engineers.

- Establish deployment sites for emergency pumps and other associated emergency equipment. In an emergency situation, portable (i.e., trailer-mounted) pumps would be deployed to predetermined sites. At these sites, a hard-surface (likely concrete) pad would be constructed if the area is not already paved. Appropriate best management practices and best construction practices would be implemented to prevent erosion and sediment movement offsite from areas requiring site preparation. All appropriate permits for constructing the pads and any associated facilities (e.g., ramps, submarine railways² or other devices) to deploy the pumps at the site would be secured prior to their construction. Likewise, the installation of such facilities would be consistent with the requirements of Executive Order 11988 (Floodplain Management). Some of the planned deployment sites are situated outside the EISA considered in the 2013 EA, but all are located within the BFN plant site.

Sequoyah Nuclear Plant

- Eliminate the construction of the FESB at SQN. Rather, the various pieces of FLEX equipment that were proposed for storage in the FESB would be placed in existing onsite buildings and in a new building. Specifically, two 3-MW diesel-powered generators would be installed in the Fifth Diesel Generator Building. Equipment (i.e., two diesel engines) currently located in this building would be removed and used for other purposes onsite or offsite. The floor elevation of the Fifth Diesel Generator Building is above the PMF elevation. Other portable FLEX equipment could be stored in other existing onsite structures such as the former Hypochlorite Building, the Dry Cask Crawler Garage or other appropriate and suitable buildings. Additionally, a covered structure could be constructed between the existing Steam Generator Storage Buildings to house some FLEX equipment. This new structure would be located above the 500-year flood elevation and is within the area of potential effect reviewed for cultural resources as defined in the 2011 Final Supplemental Environmental Impact Statement (FSEIS) entitled *Sequoyah Nuclear Plant Units 1 and 2 License Renewal, Hamilton County, Tennessee*. This new structure would be located beyond the boundaries of the EISA considered in the 2013 EA.
- Include more than one tow vehicle as part of the FLEX emergency equipment. Only one such vehicle was mentioned in the 2013 EA. The number of tow vehicles could vary, but all would be stored in one of the FLEX equipment storage structures described above.
- Install an emergency staging area (i.e., RRC Staging Area B) in the upper parking lot of the SQN Training Center to serve as the initial delivery point for equipment arriving

² A submarine railway is a rail or rack-like structure that extends from the bank into the water that allows equipment to be slid into or out of the water.

onsite in an emergency. This lot is currently paved, and no additional site grading is anticipated. No additional permanent structures are planned at the staging area. The parking lot currently occupies about 1.1 acre. However, as necessary, the staging area could occupy a slightly larger area. The lot is located above the 500-year flood elevation. The proposed location of the staging area would be outside the SQN EISA considered in the 2013 EA.

- Validate the proposed haul roads connecting the staging area to equipment deployment sites. Additionally, haul roads connecting those buildings holding FLEX equipment to the proposed deployment sites would also be validated. As described above, validation would involve drilling multiple bore holes at approximately 500 to 1,000-foot intervals along the proposed routes. With the exception of an approximately 600-foot segment of Igou Ferry Road outside the SQN plant boundary, all proposed haul routes (including an approximately 1,000-foot segment of Igou Ferry Road) are located within the SQN plant boundary. Nevertheless, an approximately 1,600-foot segment of Igou Ferry Road could be subjected to soil boring. If that is the case, the borings would be accomplished in a timely manner, and any damage to the road would be repaired promptly. Although all proposed haul routes would utilize existing hard-surface roads, some road improvements or upgrades to onsite roads may be required. Portions of some haul roads would be located outside the EISA considered in the 2013 EA.
- Establish locations for deploying emergency pumps and associated emergency equipment. Paved pads would be constructed at deployment sites that are not currently located on a hard surface. Appropriate best management practices and best construction practices would be implemented to prevent erosion and movement of sediment from areas requiring site preparation. As necessary, devices, such as ramps, submarine railways or lifts, for deploying equipment could be installed. All necessary permits for installing and operating this equipment would be secured prior to installation. Installation would also be consistent with the requirements of Executive Order 11988 (Floodplain Management). Some of these proposed deployment sites would be situated outside the boundaries of the SQN EISA considered in the 2013 EA; however, all deployment sites would be located on the SQN plant site.
- Construct water storage tanks to provide an emergency water supply. These tanks would have a capacity of approximately 1,000,000 gallons or less. Most likely, there would be two such tanks at the site. These tanks would contain condensate quality water for decay heat removal. The tanks would also supply water as needed for a separate flood mode reactor cooling system make-up system. These water tanks would be located above the 500-year flood elevation, and they would be designed in accordance with all applicable standards. They would be capable of functioning normally in flood events in which the flood elevation is equal to the PMF elevation plus 15 feet. These tanks would provide a 7-day storage capacity. Additionally, multiple groundwater wells could be installed to replenish these water storage tanks and to increase available water supply beyond their storage capacity. Connections would be provided to allow a portable water treatment system to be installed to deliver high-quality water to the storage tanks. These groundwater wells would be drilled to depths of 200 to 500 feet and would have an anticipated average yield of approximately 50 gallons per minute per well. The wells would be equipped with submersible pumps. The location and number of the wells has not been determined; however, they would necessarily be located onsite to reduce the amount of underground piping necessary and to avoid conflict with existing obstacles. The wells would be installed by drillers licensed by the

state of Tennessee and in accordance with all applicable regulations. Water from these wells would be for emergency use, i.e., for filling the storage tanks and for any required periodic flushing of those tanks and associated waterlines.

Watts Bar Nuclear Plant (WBN)

- Include more than one tow vehicle as part of the FLEX equipment to be stored in the FESB at WBN. Only one such vehicle was mentioned in the 2013 EA.
- Install an emergency RRC Staging Area B near the helicopter pad at WBN. This area is located above the 500-year flood elevation and is used as a parking area. Much of the site is currently covered with gravel or paved. The staging area would be paved, likely with concrete. Appropriate best management practices and best construction practices would be implemented to prevent or contain runoff from the site. The paved portion of the staging area would occupy approximately 1 to 5 acres, and no new permanent structures are planned for the site. The site of this proposed staging area is located beyond the boundary of the EISA considered in the 2013 EA.
- Validate proposed haul roads to be used to dispatch emergency equipment to various onsite locations. All proposed haul routes are located within the WBN plant boundary and would use existing hard-surface roads. Some road improvements or upgrades may be required. No core borings are planned at WBN, as data regarding soil conditions are already available. Portions of some of the proposed haul roads are located outside the boundaries of the WBN EISA defined in the 2013 EA.
- Establish emergency equipment deployment sites. Paved pads would be installed at those deployment sites that do not currently have paved surfaces. Some additional paving or gravelling of the access road at one or more deployment sites may be required. A submarine railway equipped with channeled rails or other appropriate equipment for deploying emergency pumps could be installed at one or more sites at WBN. This equipment would involve less than 10 cubic yards of fill in waters of the U.S. and would not require permits from the U.S. Army Corps of Engineers. Some of the proposed deployment sites lie outside the boundary of the EISA considered in the 2013 EA.
- Construct emergency water storage tanks having capacity of approximately 1,000,000 gallons or less at WBN. Most likely, there would be two tanks at the site. These tanks would contain condensate quality water for decay heat removal. The tanks would also supply water as needed for a separate flood mode reactor cooling system make-up system. These water tanks would be located above the 500-year flood elevation, and they would be designed in accordance with all applicable standards. They would be capable of functioning normally in flood events in which the flood elevation is equal to the PMF elevation plus 15 feet. Groundwater wells may be installed to resupply these water storage tanks and to increase available water supply beyond their storage capacity. Connections would be provided to allow a portable water treatment system to be installed to produce high-quality water to the storage tanks. These groundwater wells would be drilled to depths of approximately 200 to 500 feet and would have an anticipated average yield of approximately 50 gallons per minute per well. The wells would be equipped with submersible pumps. The locations and number of the wells has not been determined. However, they would be situated on the WBN site such that the amount of necessary underground piping would be minimized and conflicts with existing

obstacles would be avoided. The wells would be installed by drillers licensed by the state of Tennessee and in accordance with all applicable regulations. Water from these wells would be for emergency use, i.e., for filling the storage tanks and for any required periodic flushing of the tanks and water line connections.

Preferred Alternative

TVA's preferred alternative is the Action Alternative as modified above.

Impacts Assessment

If TVA were to adopt the No Action Alternative, i.e., not undertake any of the proposed modifications to its Fukushima Response Strategy, none of the proposed options described above would be implemented. Consequently, any construction-related environmental effects associated with implementing these options would be avoided, and TVA would implement the Fukushima Response Strategy as described in the 2013 EA. The potential environmental effects of implementing the Fukushima Response Strategy are described in the 2013 EA.

The proposed options described above are consistent with the intent of TVA's Fukushima Response Strategy, as described in the 2013 EA, and implementation of any of them would enhance TVA's ability to cope with emergency conditions at the BFN, SQN, and WBN sites. Some activities, including construction of equipment pads and borings along onsite roads, are not within the EISAs considered in the 2013 EA. However, with the exception of an approximately 1,000-foot segment of Igou Ferry Road adjacent to the SQN plant site, all these actions would occur within the boundaries of the respective plant site. Operations at each site have been the subject of previous environmental reviews as listed in Section 1.3 of the 2013 EA. Construction- and operation-related environmental effects from implementing the proposed modifications are expected to be minor. Appropriate measures (e.g., construction best management practices) would be implemented to reduce the potential for adverse environmental effects during construction, especially from any actions involving soil disturbance. Operation of the proposed facilities would be done in accordance with established procedures and is not expected to cause adverse environmental effects.

The 2013 EA documented findings that implementing the proposed Fukushima Response Strategy would result in no effects to wetlands, endangered and threatened species or cultural resources. Due to their design, implementing those options involving work outside of the respective EISAs described in the 2013 would not result in any effects to wetlands. Because of the similarity and physical proximity of the additional proposed actions to those considered in the 2013 EA, the previous findings of no effects to wetlands and to endangered and threatened species remain valid and relevant.

The 2013 EA also concluded that implementing the Fukushima Response Strategy could affect the following resources, but the potential effects would be minor: air quality and greenhouse gases; solid waste streams; aesthetic qualities; socioeconomic conditions; surface water quality and aquatic life; vegetation and wildlife; and navigation. Implementing the proposed actions described above under the Action Alternative would likewise cause minor effects to these resources.

Implementing the Action Alternative would further reduce the likelihood of release of radioactive materials following a Beyond Design Basis external event and would improve TVA's ability to cope with seismic and flood events, particularly the ability to ensure a reliable source of cooling water to the reactors for an extended period.

Because of the nature of the optional actions described above, additional environmental review of their potential effects on cultural resources, floodplains and flood risk, groundwater, and transportation was conducted. Findings are described below.

Cultural Resources

Soil-disturbing activities proposed at BFN include the establishment of the proposed emergency staging area, core borings, and the construction of an approximately 1,200-foot long road, a bridge over the switchyard ditch, and emergency equipment deployment sites. The proposed core borings at BFN would occur within or on the shoulder of existing hard-surface roads on the plant site in an upland area. No drilling would occur within 100 feet of the relocated Cox Cemetery, and the proposed emergency staging area would be designed such that it would not encroach within 250 feet of the cemetery. All areas where these activities would occur have been disturbed previously by plant construction and prior agricultural activity.

The 2011 SQN FSEIS concluded that no further investigation of cultural resources within the area of potential effect is necessary in connection with the license renewal application and any future undertakings at SQN and that no historic properties would be adversely affected by continued operation of SQN. Those findings remain valid with respect to the above proposed actions at SQN.

Proposed ground disturbance at WBN includes establishing an emergency staging area and emergency equipment deployment sites, including a submarine railway, and the construction of large emergency water tanks. The site of the proposed emergency staging area at WBN has been previously disturbed by plant construction. The proposed equipment deployment site near the intake structure has been subjected to extensive previous disturbance and earth removal associated with the construction of the intake channel. Likewise, the tanks would be constructed on sites that have been previously disturbed by plant construction.

Plant construction at all three nuclear plants involved extensive excavation and ground disturbance and has destroyed archaeological resources in those areas where the proposed actions would occur. Because no intact cultural resources remain in the locations of the proposed actions, and because measures would be taken to avoid affecting the Cox Cemetery, implementing the actions described above has no potential to affect archaeological resources.

As stated in Section 4.6.2 of the 2013 EA, the actions proposed in that document do not have the potential for visual impacts to any architectural resources within a direct line of sight of the EISA at BFN. There are no historic architectural properties at SQN or WBN. Because of the similarities in the optional actions proposed here to those considered in the 2013 EA, the finding in the 2013 EA that there would be no potential effects to historic properties at BFN, SQN, and WBN remains valid.

Floodplains and Flood Risk

With the possible exception of the groundwater wells, the staging areas, and the emergency equipment deployment pads, which would not affect floodplains or their functions, the proposed structures and facilities would be located above the elevation of the 100-year and 500-year flood. Thus, the proposed actions are consistent with the requirements of Executive Order 11988 (Floodplain Management).

Section 2.3 of the 2013 EA stated that the floor elevation of the proposed FLEX equipment storage buildings would be above the controlling PMF elevation. The intent was to ensure that critical equipment (particularly the 3-MW diesel generators) located within these structures

would not be affected by flooding. Because FLEX equipment could be stored in various structures and because not all buildings housing FLEX equipment would contain critical equipment under the options being considered, the requirement that all FESBs be located above the controlling PMF elevation is no longer relevant. Nevertheless, the 3-MW diesel generators at SQN and WBN would be located above the controlling PMF elevation. However, at BFN and SQN, non-critical or portable FLEX equipment could be stored at elevations below the controlling PMF elevation. In an emergency, this equipment could be removed and ready for deployment within an established timeframe (i.e., 27 hours at SQN and 4 days at BFN). Because critical components of the proposed equipment and facilities would be located at elevations above the Beyond Design Basis flood elevation, their availability for operation during and following flood events would be ensured.

The placement and design of the proposed water storage tanks and their associated piping at SQN and WBN would be such that they do not obstruct onsite drainage during or following the Probable Maximum Precipitation³ event.

Groundwater

The proposed groundwater wells at SQN and WBN would be installed by drillers licensed in the State of Tennessee and in accordance with all applicable regulations. Likewise, seismic testing, including the drilling of bore holes to validate haul paths would be done by technicians qualified and licensed by the appropriate state. Appropriate precautions, such as containment of drilling mud, would be implemented to protect local surface waters and groundwater. Thus, any effects to surface waters are expected to be minor, and no adverse effects to local groundwater quality are anticipated from the installation of the proposed groundwater wells. Withdrawal of groundwater would be mainly for emergency use. However, withdrawals for required periodic flushing of the system may be necessary. Nevertheless, overall groundwater withdrawals from the wells would be minor, and no adverse effects to groundwater quantity or its local availability are expected.

The proposed water storage tanks would be constructed with double walls. Thus, any leaks from the internal tank would be contained within the external shell. Therefore, implementing these proposed actions is expected to cause only minor effects to groundwater quality.

Transportation

Equipment and materials associated with the proposed actions would be delivered by truck. No deliveries by barge or by surface transportation requiring special requirements (e.g., road closures) are anticipated. Core borings for haul road validation would occur along or within existing roads on the three plant sites. Because of the localized and temporary nature of the borings, any effects to onsite plant traffic would be minor. A 1,600-foot segment of Igou Ferry Road, a public road, is included as a potential haul route, and this segment could be subjected to boring. Core borings in this segment would be conducted over a short period, and any damage to the road would be repaired promptly. Closure of this segment is not likely to present problems to local traffic, as Sequoyah Access Road would provide a convenient detour. Thus, any effects to local public transportation systems or capabilities from implementing the Action Alternative would be temporary and minor.

³ "Probable Maximum Precipitation" is defined here as the greatest depth (amount) of precipitation, for a given storm duration, that is theoretically possible for a particular area and geographic location.

Cumulative Impacts

Implementing the proposed actions could involve additional onsite construction of buildings and associated facilities and the installation of additional equipment. One or two large water storage tanks and associated underground piping could be constructed at both SQN and WBN. Additional FLEX equipment storage facilities could be constructed at BFN and SQN. This additional construction would result in minor cumulative effects (i.e., beyond those described in the 2013 EA) to local air quality and the production of greenhouse gases, and would result in the generation of additional construction debris. However, these effects would be minor and would be restricted primarily to the construction period. The operation of additional onsite emergency diesel-powered equipment would constitute a minor cumulative effect to air quality and the production of greenhouse gases because these engines would be operated only during emergencies or for required periodic tests to ensure their availability. Because of the industrial character and remoteness of the plant sites, any cumulative degradation of local visual and aesthetic quality due to the presence of additional onsite structures would be negligible. Additional workers may be needed to accomplish the proposed construction; thus, there could be minor local economic benefits due to the increased workforces onsite.

Mitigation

TVA has not identified any measures beyond routine procedures, e.g., implementation of best management practices and construction best management practices, necessary to reduce potential adverse environmental effects. With the exception of the requirement that FLEX equipment storage buildings be constructed such that the floor elevations are above the controlling PMF elevation, the mitigation measures described in Section 2.3 of the 2013 EA will remain in effect.

Conclusion and Findings

Implementing the proposed action options described above would not affect any species federally listed as threatened or endangered. Likewise, no critical habitat for any federally listed species would be affected. Thus, requirements of Section 7 of the Endangered Species Act are satisfied. Implementing the proposed actions does not have the potential to affect historic properties. The proposed modifications are consistent with Executive Order (EO) 11988 (Floodplain Management). The proposed actions are consistent with the requirements of EO 11990 (Protection of Wetlands) because no wetlands would be affected.

TVA has reexamined the 2013 EA and determined that the findings in that document remain relevant and valid. Further, TVA has assessed the potential environmental effects of the specific proposed actions listed above. Based on those findings, TVA has concluded that implementing the proposed modifications to the Fukushima Response Strategy described above would not result in significant adverse impacts to the environment. The proposed actions are not a major federal action significantly affecting the quality of the human environment. Accordingly, an environmental impact statement is not required.



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