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FINAL ENVIRONMENTAL ASSESSMENT

BROWNS FERRY NUCLEAR PLANT COOLING TOWERS ADDITION AND REPLACEMENTS

Limestone County, Alabama

PREPARED BY:
TENNESSEE VALLEY AUTHORITY

OCTOBER 2010

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The Proposed Decision and Need

Browns Ferry Nuclear Plant (BFN) currently has six mechanical draft cooling towers (MDCT). These existing MDCT can only support 69 percent of the heat rejection needs from the three-unit licensed plant. During the hot summer months, this lack of cooling capacity has caused significant reductions in plant operating power production levels (known as "derates"), resulting in increased operating costs and lost revenue. During the summer of 2010, derates to below 50 percent power were required at BFN for several days in July and about half of August to meet National Pollutant Discharge Elimination System (NPDES) permit requirements involving maximum allowable water temperature. If extended power uprates (EPU) are implemented at BFN in 2014-2015 as anticipated, the ability of the existing cooling towers to reject heat would decrease to between 50 and 60 percent. In order to reduce the duration and frequency of plant derates, which would help keep low power rates in the TVA region, additional and more efficient cooling capacity is needed to increase heat rejection capacity for current operation and for EPU.

TVA proposes to replace four of BFN's six existing MDCTs with larger units and construct one additional 25- to 30-cell linear MDCT on TVA BFN property. Replacement Towers 1, 2, 5 and 6 would be rebuilt at their current locations. The new Cooling Tower 7 would be located on the east side of Shaw Road, approximately where the Western Perimeter Ditch is currently located. The ditch would be relocated to the edge of the wooded area east of the new cooling tower. Shaw Road would be relocated to the east of the new ditch. The property boundary, project area and proposed site changes are shown on Attachments 1 and 2.

Background

BFN is a three-unit General Electric boiling water reactor facility with a capacity of 3,440 megawatts. The plant began commercial operation in 1974 (Unit 1), 1975 (Unit 2), and 1977 (Unit 3). A fire shut down BFN Unit 1 in 1975 for one year. All three units were taken offline in 1985 when TVA temporarily idled its nuclear fleet. TVA restarted Unit 2 in 1991 and Unit 3 in 1995. Following the completion of the *Final Supplemental Environmental Impact Statement for Operating License Renewal of the Browns Ferry Nuclear Plant* (hereinafter referred to as 2002 License Renewal FSEIS), the TVA Board approved the restart of Unit 1 in May 2002 (TVA 2002b). Unit 1 came back on line in May 2007. The operating licenses for Units 1, 2, and 3 were renewed in May 2006, allowing continued operation of the units until 2033, 2034, and 2036 respectively.

The 2002 License Renewal FSEIS (TVA 2002a) described the BFN cooling water system as follows: BFN units are normally cooled by pumping water from Wheeler Reservoir into the turbine generator condensers and discharging it back to the reservoir via large submerged diffuser pipes that are perforated to maximize uniform mixing into the flowstream. This straight-through flow path is known as "open cycle" or open mode" operation. Through various gates,

the cooling water can also be directed through the cooling towers to reduce its temperature as necessary to comply with the plant's NPDES permit. This flow path is known as the "helper mode". The physical capability also exists to recycle the cooling water from the cooling towers directly back to the intake structure without being discharged to the reservoir, known as the "closed mode" of operation. For various operational reasons, BFN has not operated in closed mode, for any unit, since the restart of Unit 2 in 1991.

Six Ecodyne MDCTs were originally built at BFN. Towers 3 and 4 were destroyed by fire in 1996 and 1986. Towers 1, 2, 5, and 6 are the original Ecodyne 16-cell cooling towers with 200 horse power (hp) fans. Tower 3 was replaced in 1996 with a Balcke-Durr 16-cell MDCT, which is approximately 14 feet wider than the original Ecodyne design. Tower 3 also has 200 hp fan motors. Tower 4 was replaced in 2007 with a Marley 16-cell cooling tower to support Unit 1 restart. Tower 4 is also wider and has larger 250 hp fan motors.

The impacts of (1) the license renewal for Units 2 and 3 for an additional 20 years of operation beyond their current operating licenses (2) the restart, license extension, and uprate[1] of BFN Unit 1 (3) construction of an independent spent fuel storage facility were assessed in the 2002 License Renewal FSEIS. Extended power uprate of Units 2 and 3 with up to 120 percent of original licensed thermal power (OLTP) was considered in two TVA environmental assessments (TVA 2001; TVA 2003). In the 2003 EA, TVA concluded that thermal impacts to water quality would be mitigated by using the existing cooling towers and derating BFN as necessary to maintain compliance with the NPDES permit.

Although the 2002 License Renewal FSEIS addressed up to eight cooling towers for the plant, the analysis did not include location of a new tower on the east side of Shaw Road (the proposed location was on the spoil pile). As noted above, Cooling Tower 4 has since been rebuilt as a 16-cell tower, in accord with FSEIS preferred Alternative 2D, Restoration of a Single Linear Mechanical Draft Cooling Tower (TVA 2002b).

The existing cooling towers and associated lift pumps have the capacity to handle approximately 1,650,000 gallons per minute (gpm) out of the total 2,010,000 gpm of condenser circulating water (CCW) flow (based on nine CCW pumps) that could be produced by BFN. In order to increase the amount of condenser heat rejected to the CCW to be transferred to the atmosphere prior to returning to the river, two things must happen. First, additional cooling towers are required to handle the flow capacity deficit of 360,000 gpm (2,010,000 gpm minus 1,650,000 gpm). Second, all new cooling towers must be capable of cooling the CCW to a cold water temperature of 90 degrees Fahrenheit (˚F) or less at the maximum expected wet bulb[2] temperature.

The total BFN intake flow rate reported in the 2002 License Renewal FSEIS was 1,980,000 gpm, or 2,851.2 million gallons per day (TVA 2002). No increases in flow are proposed for the proposed project—intake and discharge volumes would remain the same until EPU. Increases in water use due to EPU were addressed in the TVA 2001 and TVA 2003.

Other Environmental Reviews and Documentation

Several evaluations in the form of environmental reviews have been prepared for actions related to the construction and operation of additional and replacement cooling towers at BFN.

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[1] To uprate is to increasing the maximum power level that a commercial nuclear plant may operate.
[2] Wet bulb temperature is the lowest temperature that can be reached by the evaporation of water only. It is the temperature you feel when your skin is wet and is exposed to moving air.

This EA tiers from the 2002 License Renewal FSEIS and incorporates by reference information from the body of related TVA environmental reviews listed in Table 1 below.

Table 1. Environmental Reviews and Documents Pertinent to the Browns Ferry Cooling Tower Project

Type of Review / Agency	Title	Decision & Findings	Summary/Relevance
Generic EIS/NRC	Generic EIS for License Renewal of Nuclear Plants, Supplement 21 Regarding Browns Ferry Nuclear Plant, Units 1, 2, and 3. Final Report. NUREG 1437.	June 2005	Action was to renew the operating licenses for BFN for an additional 20-year period at OLP or at EPU of 120 percent.
EA/TVA	Browns Ferry Nuclear Plant Extended Power Uprate for Units 2 and 3 EA, August 2003.	FONSI issued 8/7/2003	Based on new technical and economic analyses, TVA's action was to use existing cooling towers and derating to mitigate potential thermal impacts instead of building new cooling towers.
SEIS/TVA	FSEIS for Operating License Renewal of the Browns Ferry Nuclear Plant in Athens, Alabama, March 2002	Record of Decision issued 5/16/2002	Action was to seek extension of NRC licenses for BFN Units 1 through 3 at 120 percent of OLTP for an additional 20 years beyond the original 40-year operating license terms. Mitigation measures for increased thermal loads to surface waters included use of existing cooling towers, construction of a new cooling tower, and derating the plant as necessary.
EA/TVA	Browns Ferry Nuclear Plant Units 2 and 3 Power Uprate Project EA, March 2001.	FONSI issued 3/15/2001	Action was to request an increase in the output of BFN Units 2 and 3 from 105 percent of OLTP to 120 percent.
EA/TVA	Browns Ferry Nuclear Plant Units 2 and 3 Power Uprate Project EA, August 1997.	FONSI issued 8/28/97	Action was to request license amendment from NRC to increase BFN Units 2 and 3 maximum power level to 105 percent of OLTP.
ES[1]/AEC[2]	Browns Ferry Nuclear Plant, Units 1, 2, and 3 Final ES, Volumes 1-3, July 1971.	Record of Decision issued 8/28/1972	Action was to construct and operate BFN.

[1]TVA's early EIS documents were entitled Environmental Statements (ES)
[2]Atomic Energy Commission; now the Nuclear Regulatory Commission (NRC)
BFN = Browns Ferry Nuclear Plant
OLP = Original license power
EPU = Extended power uprates
OLTP = Original license thermal power
FONSI = Finding of no significant Impact
EIS = Environmental impact assessment
SEIS = Supplemental EIS
FSEIS = Final SEIS
EA = Environmental assessment

Permits, Licenses and Approvals

Federal, state and local environmental authorizations could include a construction stormwater permit (Alabama Department of Environmental Management or ADEM), Section 404 and 401 Clean Water Act permits related to moving the ditch and constructing a new road (US Army Corps of Engineers), Executive Order (EO) 11990 Protection of Wetlands, EO 11988 Floodplain Management, and permits for solid and hazardous waste disposal. TVA approval is needed for a new easement to accommodate the relocated portion of Shaw Road, which is owned by Limestone County.

Alternatives and Comparison

Two alternatives are addressed in this EA: No Action Alternative and Action Alternative.

The No Action Alternative

Under the No Action Alternative, TVA would not increase BFN cooling capacity and neither replace the four cooling towers nor construct the proposed new cooling tower.

Action Alternative – Five New Mechanical Draft Cooling Towers (MDCTs)

Under the Action Alternative, Towers 1, 2, 5, and 6 would be replaced with larger (approximately 20-cell) linear MDCTs and one additional 25- to 30-cell linear MDCT would be constructed. The following activities would take place in support of the new and replacement cooling towers (see Attachment 2 for the location of proposed activities):

- Site clearing and grading. Spoil from construction of Tower 7 would be placed in the wooded area east of relocated drainage ditch. This area was previously cleared for use as a spoil pile in the 2002 License Renewal FSEIS (identified as site number 3 in Figure 2.2-7 in TVA 2002).

- Installation of a new pumping station with five new lift pumps on the warm water channel and new supply piping to carry warm water from the new pumping station to Tower 7.

- Construction of a new discharge channel from Tower 7 to the existing cold water channel immediately north of Tower 4.

- Addition of a new gate structure, similar to existing Gate Structure 1, to the cold water channel to increase flow capacity from cold water channel to the conduits leading to the diffusers is being considered.

- Modifications to the existing warm and cold water channels to support new and replacement tower operation.

- Relocation of approximately 2,700 feet of the western perimeter drainage ditch to make room for Tower 7. The new section will be slightly shorter, at approximately 2,500 feet. This ditch is part of the site flood drainage (see the section below on Floodplains and Flood Risk).

- Relocation of a fiber optic cable and two copper telephone lines in the vicinity of the western perimeter ditch.

- Demolition of Towers 1, 2, 5, and 6 and re-grading for construction of replacement towers.

- Addition of approximately 3,200 feet of overhead electric power lines to supply power to Tower 7 and upgrade of electrical systems to support Tower 7 operation including installation of transformers, switchgear and a motor control center.

- Addition of approximately 5,500 feet of 14" underground fire main piping to provide hydrant service to the vicinity of Tower 7. The fire water supply piping will be routed in two directions from the existing loop at Towers 4 and 6 to Tower 7 on the east side of the spoil pile.

- Realignment of Shaw Road to the east of the new tower. The new portion of road would be approximately 1,300 feet longer than the 3,000-foot section being replaced.

- Addition of a 2,900 feet long access road to Tower 7.

- Maintenance and/or improvements to the discharge diffuser, including diffuser pipe clean-out. Material removed from the pipe would be dewatered and placed in approved area on-site.

Construction duration would be approximately three years, with a maximum-sized construction work force of approximately 150. During Fiscal Year (FY) 2011, TVA would complete construction of new Tower 7. The current plan is that two existing towers (Tower 5 and either 1 or 6) would be replaced in FY 2012 and the remaining two towers in FY 2013. It is possible that all four existing towers could be replaced in FY 2012. To meet the aggressive construction schedule for Tower 7, workers are expected to work 10-hour days, six days a week. Approximately 10 project-related truck deliveries per day are expected at the height of construction of Tower 7, with an average of three construction-related trucks per day over the three-year construction period.

During construction of Tower 7 in FY 2011, Shaw Road would be closed and traffic would be rerouted onto Lawngate and Browns Ferry Roads. Improvements to Lawngate Road would be needed to handle the additional traffic including replacement of an existing corrugated metal culvert, resurfacing, and placement of crusher run stone on the shoulders. Additionally, as possible mitigation for the additional traffic on Lawngate Road, a portion of 3-inch waterline running along the rights-of-way east of Mack Road might be replaced with an 8-inch line to allow for installation of fire hydrants. Lawngate Road would be restriped with center and edge lines. A flashing warning light would be installed at the intersection of the Browns Ferry and Nuclear Plant Roads. Also at this intersection, a right turn lane would be added on Browns Ferry Road and an acceleration lane on Nuclear Plant Road. All road improvements would occur on existing county road right-of-way (the current right-of-way is 60 feet from the road centerline). It is expected that Shaw Road would reopen on its new alignment after completion of Tower 7 by summer of 2011. The noise from the new towers would be abated as needed to stay with levels committed to in the 2002 License Renewal FSEIS. Noise monitoring would be conducted periodically to ensure requirements are met. Best management practices would be used in site grading and construction of the cooling towers, ditch, road, and canal and all permit requirements will be met.

<u>Alternatives Not Considered in Detail</u>

TVA initially analyzed several other approaches to gaining additional cooling capacity at BFN. Some were dismissed because they required removal of the existing spoil pile. Purchase of an existing cooling tower for use at BFN was dismissed due to inadequate size and compatibility issues. A natural draft cooling tower (NDCT) was considered too expensive and would have

taken too long to build. All of the following alternatives include replacement of existing Towers 1, 2, 5, and 6 with larger MDCTs. Most of these other approaches would have resulted in environmental impacts similar to or greater than the action proposed here.

- Add one 434-foot diameter NDCT in the spoil pile area. This alternative was dismissed as having the highest cost, high pump power requirements and the longest schedule (three years). It would require a new pumping station with traveling screens, widening of the cold water channel, and removal of the spoil pile.

- Add two round MDCTs in the spoil pile area. This alternative was dismissed due to high cost and the need to remove the spoil pile. It would require a new pumping station with traveling screens and widening of the cold water channel.

- Add two linear MDCTs on the cold water channel dike. This alternative was ruled out due to high pumping power, high maintenance, security concerns and because it would only support Unit 3.

- Only replace cooling Towers 1, 2, 5 and 6 with larger MDCT units. This alternative was the least expensive and all modifications would have stayed within the existing cooling tower area. However, it was impossible to make any tower capacity improvement by the summer of 2011 since this option required all 12 cooling tower lift pumps and Towers 1, 2, 5, & 6 to be replaced and a longer lead time is required to obtain this equipment.

- Purchase from Evaptech/Progress Energy a Round Mechanical Draft Cooling Tower (RMDCT) and construct one additional rectilinear MDCT in the same vicinity. The RMDCT would be a 320 ft diameter 16-cell counter flow MDCT with a non-clogging fill. The smaller MDCT would be a 7-cell counter flow MDCT. This was ruled out because the RMDCT alone would have been too small to meet TVA's requirements, thus requiring construction of a second new tower. It would also have required modifications.

- Relocate the existing spoil pile and construct the RMDCT purchased from Evaptech/Progress Energy in the vicinity of the spoil pile, construct an additional 7-cell counter flow MDCT in the spoil pile area. This was dismissed for the same reasons as stated above with regard to the inadequate size of the RMDCT, and because it would require the removal of the spoil pile.

The 2002 License Renewal FSEIS considered two action alternatives. FSEIS Alternative 2 included four cooling tower options (A through D). Additional cooling towers were considered, but only at the spoil pile location. Preferred Alternative 2D, restoration of a single linear MDCT (Tower 4), was completed in 2007.

<u>Comparison of Alternatives</u>

Under the No Action Alternative, TVA would continue to operate BFN using the existing cooling tower system. No construction impacts would occur. TVA would continue to operate the system so as to meet NPDES permit limits, including derating the plant during the summer as necessary. This would not meet TVA's identified need.

Under the **Action Alternative**, there would be both construction and operational effects. Temporary impacts from construction and operation of additional cooling tower capacity were assessed in the 2002 License Renewal FSEIS. The analysis of the Action Alternative focuses on effects that would be different from those assessed in 2002. With regard to **construction,**

no or small impacts to historic and archaeological resources, floodplains and flood risk, noise, visual resources, endangered and threatened species, and wetlands are expected. There would be temporary, small to moderate adverse effects on transportation during the construction of Tower 7 due to the approximately 3-mile detour of traffic onto Lawngate and Browns Ferry Roads. These effects would be mitigated by such road improvement activities as including paving, striping, shoulder improvements, and installation of a caution light, turn lane and acceleration lane. During **operation**, no effects are anticipated to historic and archaeological resources, floodplains and flood risk, endangered and threatened species, and wetlands. Impacts to visual resources are expected to be minor and insignificant. Noise reduction measures are being included in the plant design and the effects will be monitored and mitigated as needed. When Shaw Road reopens on the new alignment, anticipated to occur in the summer of 2011, transportation service levels are expected to improve overall. Hydrothermal effects are expected to be beneficial, with a reduction in average diffuser discharge temperature, an increase in waste heat rejection capacity, a decrease in the percent of time derates would be required, and a lower risk for unexpected exceedences.

Based on the analysis done for this EA, TVA concludes that the proposed action would not result in environmental impacts significantly different from those identified in the earlier environmental reviews mentioned above, and these impacts are considered insignificant.

Affected Environment and Evaluation of Impacts

As described above, the 2002 License Renewal FSEIS analyzed the environmental effects of various options for constructing and operating additional cooling capacity at BFN. The environmental effects of replacing Towers 1, 2, 5, and 6 were fully analyzed as were the effects of constructing and operating one or more new cooling towers. The difference between what was proposed in 2002 and the current proposal is the location of a new tower east of the spoil pile adjacent to Shaw Road, construction of a new discharge channel, a pumping station, various pipelines, a gate structure, and overhead power lines, relocation of the Western Perimeter Ditch and Shaw Road to make room for Tower 7, relocation of underground fiber optic cable and telephone lines, and improvements to Lawngate and Browns Ferry Roads.

The focus of this EA is on the differences between the current proposal and the alternatives that were analyzed in the 2002 License Renewal FSEIS, as described above. TVA determined that the following media categories could be affected by the proposed action: water quality (temperature) and aquatic species, historic and archaeological resources, floodplain and flood risk, the noise environment, visual resources, transportation and wetlands. It was determined that the potential for effects to state- or federally listed species were adequately addressed in the 2002 License Renewal FSEIS and do not require updating.

Site Description

BFN is located on an 840-acre tract on the right bank of Wheeler Reservoir at about Tennessee River Mile 294 in Limestone County, Alabama. The site is approximately 10 miles northwest of Decatur, Alabama and 10 miles southwest of Athens, Alabama (Figure 1). The surrounding area is primarily farmland with residential pockets. Three county roads provide access to the plant: Browns Ferry Road, Shaw Road and Nuclear Plant Road. The closest residences are in the Paradise Shores community, located immediately to the north of the TVA property boundary The site, which was extensively disturbed during BFN construction, includes the three-unit nuclear plant, six cooling towers and related cooling water channels, numerous support buildings including a training center, roads, and open grassy areas. Located to the east of Towers 4, 5 and 6, the spoil pile which was created during plant construction, is now a wooded

hill. A portion of the area east of Shaw Road and the area surrounding the training center is also wooded. The locations of these features are shown on Attachments 1 and 2.

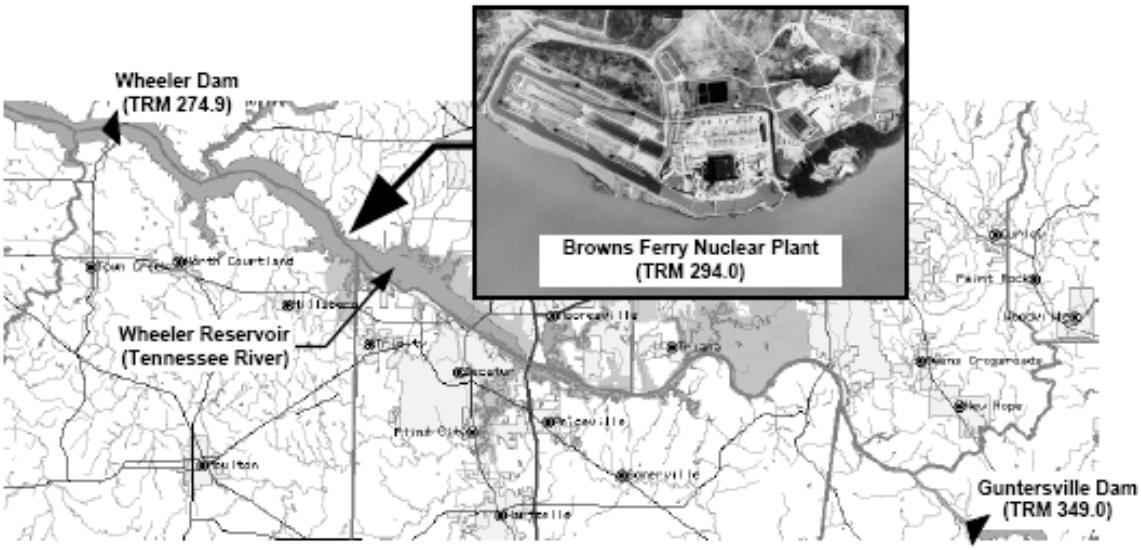

Figure 1. Location of Browns Ferry Nuclear Plant

Little has changed at or near the plant site since preparation of the 2002 License Renewal FSEIS. The proposed cooling tower construction activities and realignment of Shaw Road would occur entirely on previously disturbed TVA property. Improvements to Shaw and Browns Ferry Road would occur on the existing county road rights-of-way.

Impacts Evaluated

Hydrothermal Effects on Water Quality and Aquatic Species

The 2002 License Renewal FSEIS examined the hydrothermal effects on water quality associated with several alternative cooling tower configurations. Results of the FSEIS analyses concluded that as long as TVA complied with the thermal limits in the plant NPDES permit, none of the cooling tower alternatives were likely to have any significant adverse impacts on Wheeler Reservoir. Maintaining compliance with regulatory requirements included not only appropriate operation of the cooling towers, but also implementation of unit derates. In terms of cooling capacity and potential water quality impacts, some of the cooling tower alternatives from the 2002 License Renewal FSEIS are very close to the Action Alternative of this environmental assessment. To augment and to confirm this information, new analyses were performed for the Action Alternative to update the potential hydrothermal effects based on more recently observed meteorology and river hydrology.

For the proposed Action Alternative, evaluations for hydrothermal effects were updated by examining the potential change in the amount of waste heat from plant condensers that is dissipated in the Tennessee River and the corresponding change in temperature of the plant diffuser effluent. These changes were estimated using a hydrothermal model that simulates the combined operation of the plant and the river. A detailed description of the model is given in a report on hydrothermal modeling of BFN with three units at EPU (TVA 2005). The waste heat from the plant is released in Wheeler Reservoir through diffuser pipes situated on the bottom of

the main channel of the Tennessee River. In essence, the model approximates the flow and temperature of the water issuing from the diffuser pipes based on: the flow and temperature of the water entering the plant intake, the performance characteristics of the nuclear units, the performance characteristics of the cooling towers, and the local meteorology. Based on the flow and temperature of the ambient water in the river, the model also approximates the mixing of the waste heat from the diffusers and estimates how the plant must operate to maintain compliance with the thermal limits in the NPDES permit. The model also provides an estimate of the magnitude of plant derates if needed to prevent a thermal permit violation. A summary of the current NPDES temperature limits is given in Table 2.

Table 2. NPDES River Temperature Limits for Browns Ferry Nuclear Plant

Parameter	Period	NPDES Limit
Downstream River Temperature	Rolling 24-hour average	90°F
Downstream River Temperature	Rolling 1-hour average	93°F
River Temperature Rise	Rolling 24-hour average	10 °F

Notes:

1. Temperatures are measured by monitors upstream and downstream of the plant.
2. The limit for the 1-hour average temperature (93°F) applies at any one of the downstream temperature monitors.
3. The downstream 24-hour average temperature may exceed 90°F if the upstream 24-hour average temperature exceeds 90°F; however, in these situations, the downstream 24-hour average temperature may not exceed the upstream 24-hour average temperature.

Inherent uncertainties in the model formulation and input data constrain the ability of the model to predict the magnitude of temperatures, flows, plant derates, and other parameters with absolute certainty. For example, recent experience has found that if a plant derate is required, the units chosen for derating may depend on the condition of reactor fuel, which is not represented in the hydrothermal model. Under these circumstances, the model is best suited for comparing the potential magnitude of changes from one case to another, which minimizes the relevance of the exact operating assumptions of the plant and focuses on impacts stemming from the fundamental differences among the various cases, such as the reactor power levels and cooling tower configurations.

For the analyses summarized herein, current plant conditions (No Action Alternative) were assumed for the base case scenario. This consists of all three nuclear units operating at 105 percent of original license power (OLP) and six MDCT—four of the original Ecodyne cooling towers with 16 cells and 200 hp fans (Towers 1, 2, 5, and 6); one Balcke-Durr cooling tower with 16 cells and 200 hp fans (Tower 3), and one Marley cooling tower with 16 cells and 250 hp fans (Tower 4). Furthermore, all analyses were performed for the year 2010, the worst summer of record in TVA for thermal conditions at BFN. In general, determining thermal levels for summer conditions at BFN are classified based on air temperature and river flow in Chattanooga. For the summer of 2010 (i.e., June-July-August), the mean air temperature in Chattanooga was about 5°F above normal, and the mean natural flow of the Tennessee River at Chickamauga Dam was about 30 percent below normal.

Summer conditions challenge plant operation whenever the capacity of the existing cooling towers is insufficient to meet the rolling 24-hour average temperature limit of 90.0°F, as measured at the downstream end of the diffuser mixing zone. The current strategy (No Action Alternative) for maintaining compliance with the limit is to first to place one or more units on cooling towers, thereby dissipating a portion of the condenser waste heat to the atmosphere before discharging the flow to the river. If this is insufficient, plant generation is then reduced

(i.e., derated) to further reduce the amount of waste heat discharged to the river. With this strategy, and under the extreme conditions of summer 2010, the actual average discharge temperature of the plant effluent issuing from the BFN diffusers for June-July-August is estimated to be about 95.5°F. The corresponding amount of waste heat dissipated in the river is estimated to be about 19.0×10^{12} British thermal units (BTU). During the summer of 2010, the cooling towers were utilized to the extent possible, in consideration of the actual operating conditions of the cooling towers and other plant cooling equipment. Beyond the cooling tower operation, unit derates totaling about 1,230 gigawatt hours were required to maintain compliance with the NPDES temperature limits in 2010. The NPDES temperature criteria were unexpectedly exceeded on one occasion for a brief period of time.

Adding a seventh cooling tower and replacing the remaining Ecodyne cooling towers with new, larger cooling towers would allow treatment of the full volume of the CCW flow. As emphasized in the project background, the current cooling towers include a flow capacity deficit of about 360,000 gpm. This would be eliminated by Tower 7. The overall cooling capacity would be further increased by using a design wet bulb temperature for both the new and replacement cooling towers of 82°F, rather than 78°F-80°F as for the existing towers.

The hydrothermal effects of the new tower (NT) and replacement towers (RTs) were evaluated by running the hydrothermal model for the cases summarized in Table 3. A total of eight cases were examined—four at the current power level of the units, 105 percent OLP (Cases A-105 through D-105), and four at the future EPU, 120 percent OLP (Cases A-120 through D-120). Case A-105 represents current plant conditions (No Action) and is considered the base case. The shaded cells in Table 3 emphasize the changes in the cooling tower configuration among the various cases. The “B” cases include the existing cooling towers plus one additional new tower, Tower 7. Under the Action Alternative, the additional tower will be a linear MDCT between 25 and 30 cells and treat between 360,000 gpm and 410,000 gpm of condenser flow. To bound the potential range of impacts, the new tower in the analyses summarized herein is assumed to provide treatment at the low end of this range, 25 cells and 360,000 gpm. For the “C” cases, in addition to providing Tower 7, two of the existing Ecodyne towers are assumed to be replaced with new, larger MDCTs. The Action Alternative specifies the replacement towers as having approximately 20 cells. Again, to bound impacts, the analyses herein assume the replacement towers include only 19 cells and treat the same volume of water as the existing towers, 275,000 gpm. Although the analyses for the “C” cases assume Tower 5 and Tower 6 are chosen for replacement, the results would be roughly the same no matter which two of the existing Ecodyne towers are selected for replacement. For the “D” cases, in addition to providing Tower 7, all four of the existing Ecodyne towers are assumed to be replaced with new, larger MDCTs, again with 19 cells and treating 275,000 gpm of condenser flow.

Table 3. NPDES River Temperature Limits for Browns Ferry Nuclear Plant

Case	Units [1]			Cooling Towers [2]						
	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
A-105	105	105	105	ED16	ED16	BD16	MA16	ED16	ED16	None
B-105	105	105	105	ED16	ED16	BD16	MA16	ED16	ED16	NT25
C-105	105	105	105	ED16	ED16	BD16	MA16	RT19	RT19	NT25
D-105	105	105	105	RT19	RT19	BD16	MA16	RT19	RT19	NT25
A-120	120	120	120	ED16	ED16	BD16	MA16	ED16	ED16	None
B-120	120	120	120	ED16	ED16	BD16	MA16	ED16	ED16	NT25
C-120	120	120	120	ED16	ED16	BD16	MA16	RT19	RT19	NT25
D-120	120	120	120	RT19	RT19	BD16	MA16	RT19	RT19	NT25

Notes: (1) Percent of unit original license power.
(2) ED=Ecodyne tower, BD=Balcke-Durr tower, MA=Marley tower
NT=new tower, RT=replacement tower
16=16 cells, 19=19 cells, 25=25 cells.

Results from the hydrothermal model simulations for the summer of 2010 are summarized in Table 4 (June-July-August). The results are presented in terms of the approximate expected change from base case conditions (Case A-105, i.e., No Action Alternative) for three parameters—the average temperature of the plant diffuser discharge, the amount of waste heat dissipation in the Tennessee River, and the amount of derate energy loss required to maintain compliance with the NPDES limits. The following observations are noted.

Operation of the Plant at 105 Percent OLP

- Progressively adding cooling tower capacity is expected to reduce the average summer temperature of the plant diffuser discharge. The model results suggest that adding Tower 7 alone would reduce the summer 2010 average diffuser discharge temperature by about 1°F (Case B-105), whereas adding Tower 7 and replacing Towers 1, 2, 5, and 6 would reduce the summer 2010 average diffuser discharge temperature by about 2°F (Case D-105).

- Progressively adding cooling tower capacity, and thereby providing greater heat dissipation to the atmosphere, is expected to reduce the amount of waste heat dissipation in Wheeler Reservoir. The model results suggest that adding Tower 7 alone would reduce the amount of summer 2010 waste heat released to the reservoir by about 9 percent, (Case B-105), whereas adding Tower 7 and replacing Towers 1, 2, 5, and 6 would reduce the amount of summer 2010 waste heat released to the reservoir by about 17 percent (Case D-105).

- Progressively adding cooling tower capacity is expected to reduce the amount of derate required to maintain the NPDES temperature limits. The model results suggest that adding Tower 7 alone would reduce the amount of summer 2010 derate by about 70 percent, (Case B-105), whereas adding Tower 7 and replacing Towers 1, 2, 5, and 6 would reduce the amount of summer 2010 derate by almost 100 percent (Case D-105).

Operation of the Plant at 120 Percent OLP

- In the absence of making any changes to the existing cooling tower system, and compared to the existing power level of the units (Case A-105), the model results suggest that uprating the units to 120 percent OLP (Case A-120) would: increase the summer 2010 average diffuser discharge temperature by about 0.6°F, increase the amount of summer 2010 waste heat released to the reservoir by about 6 percent, and increase the amount of summer 2010 derate by about 33 percent.

- Compared to existing plant conditions, the model results suggest that adding Tower 7 alone at 120 percent OLP would reduce the summer 2010 average diffuser discharge temperature by about 0.5°F (Case B-120), whereas adding Tower 7 and replacing Towers 1, 2, 5, and 6 again would reduce the summer 2010 average diffuser discharge temperature by about 2°F (Case D-120).

- Compared to existing plant conditions, the model results suggest that adding Tower 7 alone at 120 percent OLP would reduce the amount of summer 2010 waste heat released to the reservoir by about 5 percent, (Case B-120), whereas adding Tower 7 and replacing Towers 1, 2, 5, and 6 again would reduce the amount of summer 2010 waste heat released to the reservoir by about 17 percent (Case D-120).

- Compared to existing plant conditions, the model results suggest that adding Tower 7 alone at 120 percent OLP would reduce the amount of summer 2010 derate by about 50 percent, (Case B-120), whereas adding Tower 7 and replacing Towers 1, 2, 5, and 6 would reduce the amount of summer 2010 derate by almost 100 percent (Case D-120).

Note that for the "D" cases, the predicted impacts at 120 percent OLP are the same as those at 105 percent OPL (i.e., Case D-120 vs. Case D-105). This may seem counterintuitive, due to the fact that a larger amount of waste heat is produced at the higher power level. This is offset, however, because the hydrothermal model brings cooling towers into service and implements derates only when they are needed. Compared to Case D-105, the cooling tower use for Case D-120 was over 10 percent greater. That is, although a larger amount of waste heat is produced by the units, a larger proportional amount of waste heat also is rejected to the atmosphere.

Because TVA would operate BFN in compliance with the NPDES permit the No Action Alternative is not expected to have significant adverse hydrothermal effects in Wheeler Reservoir. However, to stay in compliance, plant derates would be expected to continue at a level commensurate with the base case described above.

Overall, the results of the model simulations suggest that by adding cooling tower capacity, the Action Alternative will have no significant adverse direct, indirect or cumulative hydrothermal effects in Wheeler Reservoir, at least for conditions not exceeding those of 2010. The NPDES permit limits were maintained for all of the cases shown in Table 4 by appropriate cooling tower operation and/or unit derates. In this context, aquatic life in Wheeler Reservoir would be protected by the Action Alternative. This is supported by observations in August 2010, when TVA biologists investigated reservoir conditions in the vicinity of the plant to assess the level of heat-related aquatic stress. Water quality profiles and benthos samples were collected both upstream and downstream of BFN and no significant adverse impacts due to the plant thermal discharge were found. That is, for the No Action alternative, and as suggested by the FSEIS of 2002, the operation of the cooling towers in combination with appropriate unit derates is protective of aquatic species, albeit at a greater cost to TVA and at greater risk of sustaining

unexpected NPDES temperature exceedences. By adding cooling tower capacity, again in combination with appropriate unit derates, the Action Alternative also would be protective of aquatic species.

In practice, there will always be the chance of an unexpected exceedence of an NPDES temperature limit like that experienced in 2010, even with full implementation of the Action Alternative. The simulations summarized herein assume that the new and replacement cooling towers, as well as the plant condensers and other relevant plant equipment, are maintained in good operating condition. Any lag in maintenance that reduces the performance of the plant components below these assumptions could result in a degradation of the results in Table 4 (i.e., higher diffuser discharge temperatures, larger amounts of waste heat dissipated in Wheeler Reservoir, more cooling tower operation, and more unit derates). Any reduction in performance could also increase the chance of an unexpected exceedence of an NPDES temperature limit.

As mentioned above under “Background”, BFN was originally designed with the capability of operating in closed mode. However, closed mode has not been used since the restart of Unit 2. The proposed new and replacement cooling towers would have cooling capabilities in excess of those originally purchased and TVA is investigating what other modification would be required to operate the plant in closed mode, should it be required by new regulations. It is unlikely that closed mode operation would be possible until the new and replacement towers of the Action Alternative are fully completed. It is emphasized that the results for the Action Alternative include only cooling tower operation in helper mode. If the cooling tower configuration of the Action Alternative is used to operate the plant in closed mode, wherein almost all of the condenser flow is routed back to the intake (and if all plant issues are resolved that currently prevent closed mode operation), such would likely further reduce the amount of waste heat dissipated in the receiving waterbody, thereby also having no significant adverse hydrothermal effects in Wheeler Reservoir. In closed mode operation, the temperature of any condenser water entering Wheeler Reservoir likely would be higher (i.e., blowdown), but the volume of this flow would be significantly less. Generation by the plant also may be less, not necessarily due to NPDES temperature limits, but due to impacts of closed mode operation on the performance of the units (e.g., higher temperature of condenser cooling water). Should TVA be required or chooses to operate BFN in closed mode, the thermal effects of such operation would be reexamined.

Table 4. Hydrothermal Model Results for Browns Ferry Nuclear Plant for June-July-August, 2010

Case	Percent OLP [1]	Cooling Towers [2]							Approx Change from Base Case June-July-August, 2010		
		No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	Avg. Temp of Diffuser Discharge (Change, °F)	Waste Heat Dissipation in River (% Change)	Derate Energy Loss (% Change)
A-105	105	ED16	ED16	BD16	MA16	ED16	ED16	None	Base case	Base case	Base case
B-105	105	ED16	ED16	BD16	MA16	ED16	ED16	NT25	-1.0	-9%	-71%
C-105	105	ED16	ED16	BD16	MA16	RT19	RT19	NT25	-1.7	-15%	-98%
D-105	105	RT19	RT19	BD16	MA16	RT19	RT19	NT25	-1.9	-17%	-100%
A-120	120	ED16	ED16	BD16	MA16	ED16	ED16	None	0.6	6%	33%
B-120	120	ED16	ED16	BD16	MA16	ED16	ED16	NT25	-0.5	-5%	-48%
C-120	120	ED16	ED16	BD16	MA16	RT19	RT19	NT25	-1.5	-14%	-96%
D-120	120	RT19	RT19	BD16	MA16	RT19	RT19	NT25	-1.9	-17%	-100%

Notes: [1] Percent of unit original license power.
[2] ED=Ecodyne tower, BD=Balcke-Durr tower, MA=Marley tower
NT=new tower, RT=replacement tower
16=16 cells, 19=19 cells, 25=25 cells.

Historic and Archaeological Resources
TVA considers the area of potential effect (APE) for the undertaking to be the footprint where ground disturbance would take place shown on Attachment 1. The majority of the BFN reservation has been previously disturbed by construction of the power plant and associated infrastructure. The majority of the land not disturbed by construction of BFN was surveyed in 2001 (Gage 2001) as part of the 2002 License Renewal FSEIS. The survey identified one historic property. Site 1LI535 is an Early to Middle Woodland period occupation that is considered potentially eligible for the National Register of Historic Places (NRHP). The Cox cemetery is also located within the BFN reservation.

Historic and cultural resources, including archaeological resources, are protected under various federal laws, including: the Archaeological Resources Protection Act, the Native American Graves Protection and Repatriation Act, and the National Historic Preservation Act (NHPA). Section 106 of the NHPA requires federal agencies to consult with the respective State Historic Preservation Officer (SHPO) when proposed federal actions could affect these resources.

There would be no project-related effects to historic or archaeological resources under the **No Action Alternative**. Likewise, no direct, indirect, or cumulative effects to these resources are expected.

Under the **Action Alternative**, the proposed locations of new Tower 7, the four replacement towers and associated infrastructure have been extensively disturbed with the construction of BFN, specifically the construction of the perimeter ditch at the proposed new cooling tower location and the existing towers at the proposed rebuilt tower locations. The proposed undertaking would not be located near site 1LI535 or near the Cox cemetery. The realignment of Shaw Road is located in an area that has been previously surveyed (Gage 2001) and no cultural resources were identified at this location. In addition, TVA has determined that that the onsite electric line supplying power to Cooling Tower 7, a fiber optic cable and two telephone lines, fire main piping, and the possible replacement of a portion of an existing waterline along Lawngate Road are located in areas that have been previously disturbed and do not have the potential to effect archaeological resources. Should there be any improvements to Lawngate Road that would require additional ground disturbance, a cultural resources survey would be conducted. It is TVA's finding that no historic or archaeological resources would be affected by the proposed undertaking.

Pursuant to regulations (36 CFR Part 800) implementing Section 106 of the NHPA, TVA has consulted with the Alabama SHPO regarding TVA's determination that the proposed undertaking would not adversely affect any historic or archaeological resources that are potentially eligible or currently listed in the NRHP (Attachment 3). Pursuant to 36 CFR§§ 800.2 (c)(2)(ii), 800.3 (f)(2), and 800.4 (a)(4)(b), TVA has also consulted with federally recognized Indian tribes regarding historic or archaeological resources within the proposed project's APE that may be of religious and cultural significance to them and eligible for the NRHP (Attachment 4). The Alabama State Historic Preservation Officer concurred by email on October 28, 2010 with TVA's determination of no effects to historic properties. The Chickasaw Nation and Seminole Tribe of Florida also concurred with TVA's findings (Attachment 5).

Floodplains and Flood Risk
The 100-year floodplain for the Tennessee River would be the area below elevation 557.3 ft above mean sea level (msl). The TVA Flood Risk Profile (FRP) elevation on the

Tennessee River would be elevation 557.3 ft msl. The FRP is used to control residential and commercial development on TVA lands. At this location, the FRP elevation is equal to the 500-year flood elevation.

A ditch known as the Western Perimeter Ditch runs through a portion of the project area (Attachment 1). This ditch was constructed by TVA to intercept rainfall runoff from the drainage area north of the plant to prevent flooding of the main plant during a Probable Maximum Precipitation[3] (PMP) event. As stated in Appendix 2.4A of the Browns Ferry Nuclear Plant Final Safety Analysis Report: "The channel is designed with capacity sufficient to carry the maximum possible (probable maximum) flood without flooding the plant" (TVA 2010).

The floodplains and flood risk assessment involves ensuring that facilities would be sited to provide a reasonable level of protection from flooding. In doing this, the requirements of EO 11988 Floodplain Management will be fulfilled. For nonrepetitive actions, EO 11988 states that all proposed facilities must be located outside the limits of the 100-year floodplain unless alternatives are evaluated which either would identify a better option or support and document a determination of "no practicable alternative" to siting within the floodplain. If this determination can be made, adverse floodplain impacts would be minimized during design of the project.

The Western Perimeter Ditch was constructed to prevent flooding of the main plant during a PMP event and the ditch is being relocated. In addition, there would be modifications to the warm and cold water cooling tower channels and installation of a new pump station. Therefore, it will be necessary to evaluate potential impacts from the PMP event over these areas to ensure that it would not flood areas of the main plant. Under the **No Action** Alternative, the proposed cooling towers would not be rebuilt and a new cooling tower and associated facilities would not be constructed. Therefore, the floodplains would not be affected because there would be no physical changes to the current conditions found within the floodplains.

Under the **Action Alternative**, existing Towers 1, 2, 5 and 6 would be rebuilt at their current location, a new intake pumping station would be constructed near existing Tower 5, and a new cooling tower (Tower 7) would be constructed east of Shaw Road within the existing Western Perimeter Ditch. The Western Perimeter Ditch would be relocated, a new discharge channel would be constructed from Cooling Tower 7 to the existing cold water channel, and Shaw Road would be relocated to the northeast. In addition, a culvert under Shaw Road would be replaced, an access road to Cooling Tower 7 would be constructed, a laydown area would be provided for the storage of construction materials and equipment, an electric power line would be constructed to supply power for Cooling Tower 7. Also, an underground fire main piping would be added to supply Tower 7, and a fiber optic cable and two telephone lines would be relocated. Based on site topography and other data sources, none of the proposed activities would involve work within the Tennessee River 100-year floodplain, which would be consistent with Executive Order 11988.

The channel of the Western Perimeter Ditch is currently designed with sufficient capacity to carry the PMP event without flooding the plant, and the cooling tower system currently can pass the PMP event without flooding the main plant. Under the Action Alternative, the relocated portion of the Western Perimeter Ditch would be designed to ensure that a PMP

[3] Probable Maximum Precipitation: The theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage area at a certain time of year.

event would not flood the plant. The relocated portion of the ditch would be designed to provide the same or greater flow carrying capacity compared to the existing channel. Prior to completion of the ditch, and modifications to the cooling tower system, the new designs will be evaluated and revised as necessary to ensure that these areas would convey the PMP event without flooding the main plant. In addition, calculation CDQ004020040239 entitled "PMP BFN Site Drainage Analysis", would be revised to include the updated hydraulic analyses

Noise

The potential for noise impacts from replacement and additional cooling towers was addressed in the 2002 License Renewal FSEIS. Section 3.19.5 described the current noise environment as having changed since the plant was constructed, including growth in adjacent residential populations, an industrial park about 2 miles upstream and across the river, and barge traffic. A 24-hour background noise survey conducted June 2001 in the Paradise Shores and Lakeview Communities found the predominant noise sources were typical of suburban life and included traffic, lawn mowing, home air-conditioning units and children, as well as typical rural night noises. Additionally, a daytime noise survey was conducted in summer 2001 when Towers 2, 3 and 5 (at that time, the towers closest to Paradise Shores) were in operation. Noise from the cooling towers was audible at 1,500 feet in the Paradise Shores area, but not in the Lakeview community. The measured and calculated noise at these residential areas was reported as 42 and 38 A-weighted decibels (dBA), respectively. None of the alternatives showed potential for adverse impacts to Lakeview Communities. Alternative 2C, which was the Enlarged Linear Mechanical Draft Cooling Towers Option, was assessed as potentially resulting in noise impacts to Paradise Shores. The FSEIS stated that use of low noise fans operating at reduced speeds would lower the total predicted noise at Paradise Shores under Alternative C to acceptable noise levels.

EPA's protective noise guideline (EPA 1974) recommends an average annual equivalent sound level day/night (DNL) of 55 dBA to protect the health and well being of the public with an adequate margin of safety. TVA uses the EPA guideline of 55 dBA DNL as a design goal, when feasible, if the nearest receptor is residential. For industrial and commercial areas, TVA uses the equivalent sound level (Leq) of 60 dBA at the property line. In addition, TVA uses the Federal Interagency Committee on Noise (FICON 1992) recommendation that a 3 decibel increase in DNL indicates possible impact and the need for further analysis when the background DNL is 60 dBA or less. During the 5-year period prior to the 2001 noise study, the cooling towers ran an average of 17 days per year for two unit operation. Because the acoustic environment around BFN has changed very little since 2002, this baseline data is still valid for the currently proposed action. There are no federal, state of Alabama, or local municipal noise standards, regulations or ordinances that apply to the action alternatives evaluated in this EA.

Under both the **No Action Alternative** and **Action Alternatives** under consideration in this EA, TVA would meet the above EPA and FICON noise guidelines at residences and exterior plant boundaries. Under the Action Alternative, TVA would work with the selected cooling tower vendor to ensure noise attenuating features, as required, such as low noise fans, lower speed fans, and sound attenuators are included in the cooling tower design. Onsite, TVA would comply with Occupation Safety and Health Administration regulations to protect worker health. Under the Action Alternative, operational noise levels would be verified by a qualified acoustical engineer to ensure that the project's noise level complies with the levels discussed above, and are consistent with previous commitments. Monitoring

is anticipated to be conducted after the completion of each phase of the project (e.g., when new cooling towers become operational). In the event that the resulting levels were found to exceed the criteria, TVA would develop and implement additional acoustical mitigation such as modifications to fans and motors, or the installation of barriers.

Given compliance with applicable guidelines and regulations and the commitment to monitor and mitigate noise effects, no significant direct, indirect or cumulative impacts to the noise environment under the **Action** or the **No Action Alternative** are expected.

Visual Resources

The 2002 License Renewal FSEIS included an analysis of the visual effects of the new and replacement cooling towers that were proposed at that time. The proposed towers would have been architecturally similar to the existing towers. The upper portion of the proposed towers would have been seen by motorists along Browns Ferry and Shaw Roads (identified as County Road 25 in the analysis), adding to the continuous growth of visual discordant structures in the plant area. In addition to the new towers, the analysis considered lowering and reshaping the existing berm or spoil pile, which would have made more of the plant site visible from the road.

Under the current **No Action Alternative**, there would be no change in the visual landscape from the present views, which are bounded by the visual analysis in the FSEIS. Under the **Action Alternative**, one new MDCT (approximately 50 feet high with fan stacks about 64 feet tall and from 900 to 1,000 feet long) would be constructed on the northeast side of the spoil pile. Four existing cooling towers would be replaced with slightly longer and wider units, a coldwater channel would be constructed adjacent to the Western Perimeter Ditch, and a portion of the Western Perimeter Ditch and Shaw Road would be relocated (Attachment 2). The spoil pile would be minimally disturbed around the edges for routing new pipelines and cables, but would not be substantially reshaped.

The construction-related impacts on visual resources assessed in 2002, described as temporary and not significant, bound the potential impacts from the currently proposed Action Alterative. Operational-related impacts, including Tower 7, additional plumes and site lighting would be similar to that described in the FSEIS as insignificant. The primary difference for the proposed action would be in the location of Tower 7, relocation of Shaw Road and lack of major changes to the spoil pile. Proposed Tower 7 would be more visible by motorists than the MDCTs proposed in 2002. However, the area is already visually cluttered with nuclear plant buildings, roads and transmission lines. The **Action Alternative** would result in some changes to the viewscape, but the changes would be similar to what is currently seen. The direct, indirect and cumulative effects would be insignificant.

Transportation

In the 2002 License Renewal FSEIS, effects on transportation from implementation of Alternative 2 (i.e., Unit 1 restart, EPU, dry cask storage and cooling tower-related construction and relicensing) are analyzed. Traffic counts at that time indicated that the level of service (LOS) on Shaw and Nuclear Plant Roads that were rated as LOS C, would show a decrease to LOS D during peak construction, with an estimated construction period of 6 years. Under the LOS concept, quality of service provided by the roadway network is measured as perceived by motorist at the peak hour of traffic. Six LOSs are designated as A through F, with A being the best and D being the minimally acceptable LOS of a roadway. Under Alternative 2 in the 2002 License Renewal FSEIS, traffic was projected to increase

180 percent, with an additional 2,900 vehicles per day. Feeder Highways 72 and 31 were not projected to be impacted by this temporary increase of traffic. Peak traffic in 2002 was assumed at 12 percent of the average daily traffic (ADT) count and truck composition was assumed to be 10 percent of ADT. An average ridership of 1.6 workers per vehicle was assumed. Currently, approximately 1,600 people work at the site on a typical nonoutage day.

The effects of the currently proposed action were considered in this analysis, as Alternative 2 in the 2002 License Renewal FSEIS included construction of replacement and new cooling towers. The primary difference between the current Action Alternative and Alternative 2 with regard to roads is the location of Tower 7 adjacent to Shaw Road, which will necessitate the realignment of Shaw Road and the addition of a short access road for Tower 7. During construction of Tower 7, traffic will be detoured onto Lawngate and Browns Ferry Roads. As described above, a construction workforce of approximately 150 is expected to work 10-hour days, six days per week during the construction period. Approximately eight project-related truck deliveries per day are expected at the height of construction, with an average of two additional trucks per day over the 3-year construction period. During FY 2011 these workers would be in addition to approximately 1,000 workers for the scheduled outage in Fall 2010 and 1,250 in Spring 2011. This number of workers and additional truck traffic are only a small fraction of that assessed in 2002 when LOS on Shaw and Nuclear Plant Roads was predicted to be adequate.

When construction of Tower 7 commences, an approximately 3,000-foot section of Shaw Road would be permanently closed from the culvert at the Western Perimeter Ditch south to the intersection with Nuclear Plant Road and relocated immediately north east of the existing road (shown on Attachment 2 as a blue line). The new section would be approximately 4,300 feet long or approximately 1,300 feet longer than the existing road. During the approximately 7-month Tower 7 construction period, traffic on this section of Shaw Road would be detoured onto Lawngate and Browns Ferry Roads, an additional distance of about 3 miles. TVA would fund improvements needed to bring these two roads up to county standards including repaving, widening, installation of a blinking caution light at the intersection of Browns Ferry and Nuclear Plant Road, addition of a turn lane on Browns Ferry Road and addition of an acceleration lane on Nuclear Plant Road.

In subsequent years, the replacement of Towers 1, 2, 5 and 6 would have minimal effects on traffic over the two following years of construction. Over the 3-year construction period, there would be a small increase in the number of commuter vehicles—approximately 75, based on 1.6 riders per vehicle—and up to approximately 10 additional trucks per day. These workers and trips would be in addition to traffic generated during scheduled outages (approximately 1,000 people in Fall 2010 and 1,250 in Spring 2011).

There would be temporary, small to moderate adverse effects on transportation during the construction of Tower 7 due to the detour. Once the realigned portion of Shaw Road reopens in summer 2011 for the remainder of construction activities, service levels may be slightly improved with the permanent improvements to Lawngate and Browns Ferry Roads and the new portion of Shaw Road in operation. Overall, with the proposed mitigation, direct, indirect and cumulative effects of the proposed action are expected to be insignificant.

Wetlands
Wetland resources and impacts associated with BFN Units 2 and 3 license renewal, restart of Unit 1 and an EPU, including various options for increasing plant cooling capacity, were evaluated in Section 3.12, 4.2.12, and 4.3.12 of the 2002 License Renewal FSEIS. This data, as well as a 2010 field survey, indicates there are no wetlands present within the currently proposed project footprint.

There would be no project-related effects to wetland resources under the No Action Alternative. Similarly, there would also be no impacts to wetlands associated with the Action Alternative. No direct, indirect, or cumulative effects to these resources are expected with either alternative.

Mitigation Measures Considered

- Prior to completion of the Western Perimeter Ditch and modifications to the cooling tower system, the new designs will be evaluated and revised as necessary to ensure that these areas would convey the PMP event without flooding the main plant. In addition, calculation CDQ004020040239 entitled "PMP BFN Site Drainage Analysis" will be revised to include the updated hydraulic analyses.

- Under both the No Action Alternative and Action Alternatives under consideration in this EA, TVA would meet the above EPA and FICON noise guidelines at residences and exterior plant boundaries. Under the Action Alternative, TVA would work with the selected cooling tower vendor to ensure noise attenuating features, as required, such as low noise fans, lower speed fans, and sound attenuators are included in the cooling tower design. Onsite, TVA would comply with Occupation Safety and Health Administration regulations to protect worker health. For the Action Alternative, operational noise would be verified by a qualified acoustical engineer. Noise monitoring would be conducted after the completion of each phase of the project (e.g., when new cooling towers become operational). If resulting levels were found to exceed the criteria, TVA would develop and implement additional acoustical mitigation such as modifications to fans, motors, or installation of barriers.

Preferred Alternative

TVA prefers the Action Alternative of adding additional cooling capacity at BFN in order to increase heat rejection capacity for current operation as well as for EPU, and to reduce the necessity to derate plant operation.

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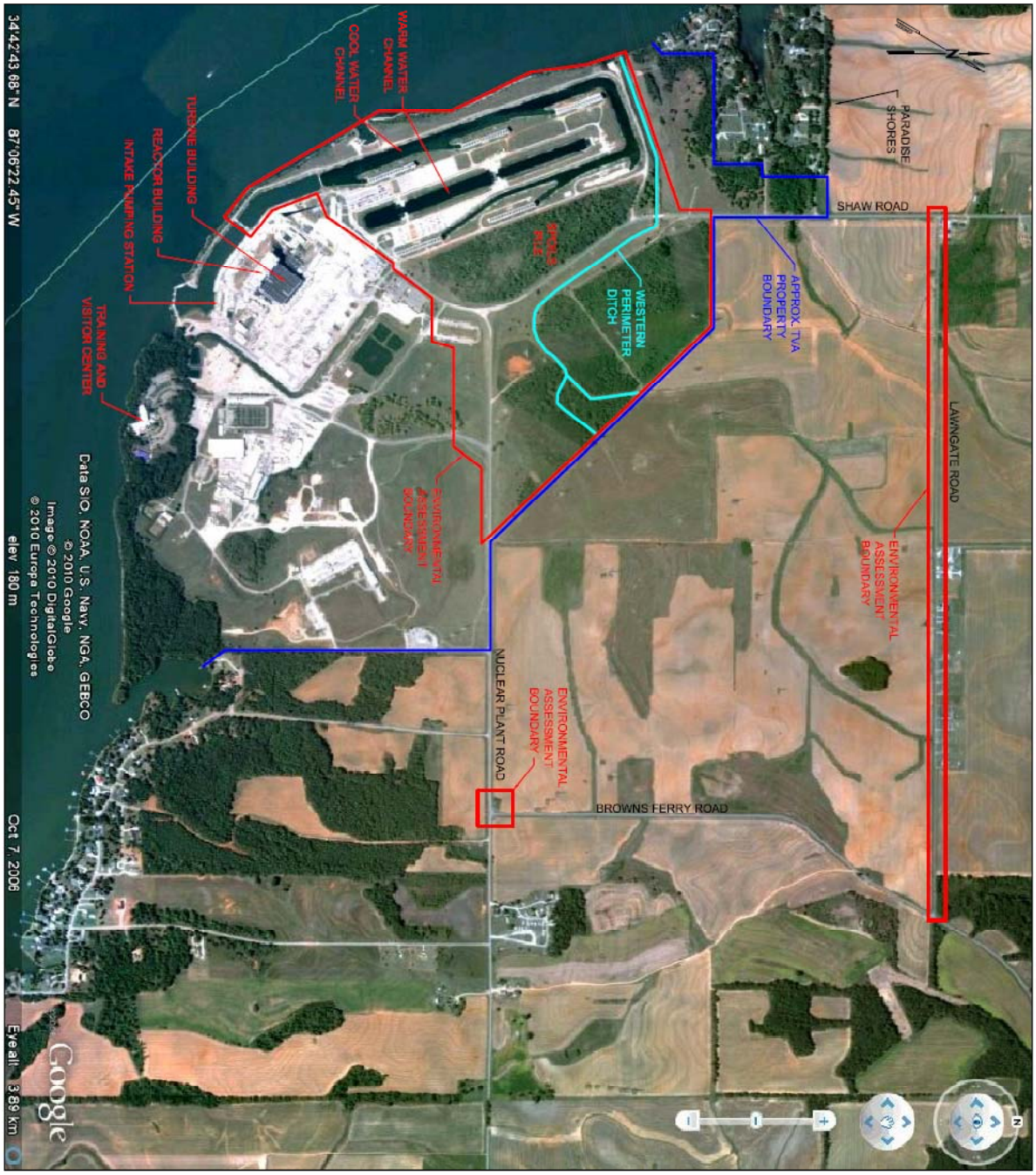
ACRONYMS, ABBREVIATIONS AND SYMBOLS

§	Section
˚F	degrees Fahrenheit
ADEM	Alabama Department of Environmental Management
APE	Area of potential effect
BFN	Browns Ferry Nuclear Plant
CCW	Condenser Circulating Water
CFR	Code of Federal Regulation
dBA	A-weighted Decibel
DNL	sound level day/night
EA	environmental assessments
EO	Executive Order
EPA	U. S. Environmental Protection Agency
EPU	extended power uprates
Leq	equivalent sound level
FICON	Federal Interagency Committee on Noise
FRP	Flood Risk Profile
FSEIS	Final Supplemental Environmental Impact Statement
FY	Fiscal Year
GPM	gallons per minute
HP	horse power
MDCT	mechanical draft cooling tower
NHPA	National Historic Preservation Act
NDCT	natural draft cooling tower
NPDES	National Pollutant Discharge Elimination System
NT	New Tower
OLP	Original License Power
PMP	Probable Maximum Precipitation
RMDCT	Round Mechanical Draft Cooling Tower
RT	Replacement Towers
SHPO	State Historic Preservation Officer
TVA	Tennessee Valley Authority

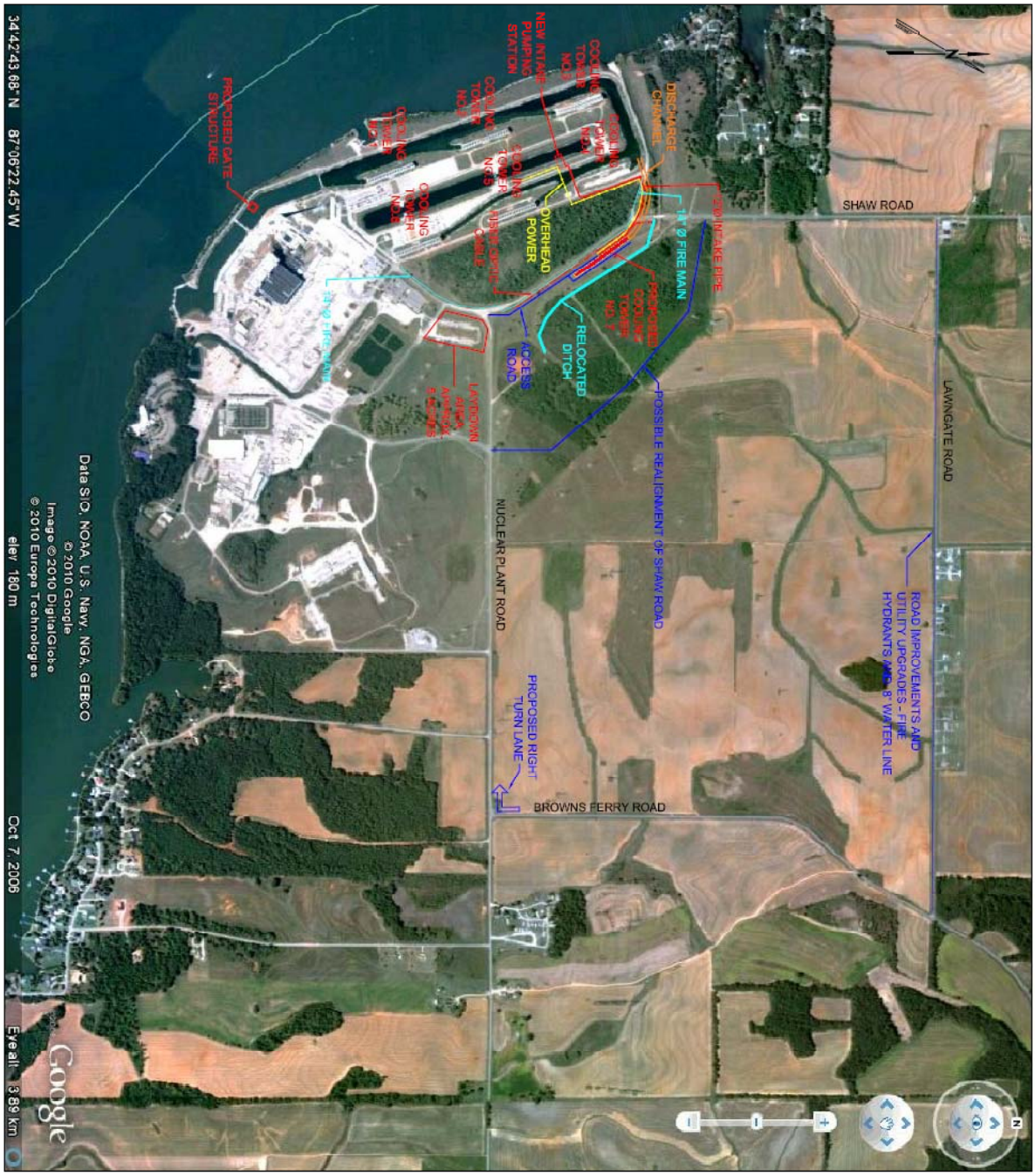
Attachments

Attachment 1 – Action Alternative Project Area and TVA Property Boundary
Attachment 2 – Action Alternative Site Map
Attachment 3 – Letter to Alabama State Historic Preservation Officer
Attachment 4 – Letter to Tribes
Attachment 5 – Letters from Tribes

Attachment 1. Action Alternative Project Area and TVA Property Boundary



Attachment 2. Action Alternative Site Map



Attachment 3. Letter to Alabama State Historic Preservation Officer

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

September 24, 2010

Ms. Stacye Hathorn
Alabama Historical Commission
468 South Perry Street
Montgomery, Alabama 36130-0900

Dear Ms. Hathorn:

BROWNS FERRY NUCLEAR (BFN) POWER PLANT COOLING TOWER ADDITIONS, LIMESTONE COUNTY, ALABAMA

The Tennessee Valley Authority (TVA) proposes to replace four of six existing cooling towers (Towers 1, 2, 5, and 6) with larger units and construct one additional 25–30 cell linear mechanical draft cooling tower site at BFN (Figures 1 and 2). The four existing cooling towers would be demolished and rebuilt within the existing footprint. In 2001, TVA consulted with your office regarding the Environmental Impact Statement (EIS) for the relicensing of Units 1, 2, and 3 and additional cooling towers for BFN (AHC 2001-1439). Your office concurred with TVA that there would be no effect provided that 1LI535 could be avoided. The EIS did not include the currently proposed new cooling tower (Tower 7).

Tower 7 would be located along the east side of Shaw Road at the location of an existing perimeter ditch and includes the installation of a new pumping station, a cold water discharge canal, lift pumps and piping, and two new transformers (Figure 2). A portion of the ditch would be relocated directly northeast of proposed Tower 7 to maintain a perimeter ditch north of the new cooling tower. In addition, the cold water discharge canal is proposed between the north end of the spoil pile and the existing western perimeter ditch, and approximately a five-acre construction staging area is necessary.

TVA considers the archaeological area of potential effect (APE) to be the footprint where ground disturbance would take place (1LI535 is outside of the APE). TVA finds the proposed undertaking would not appreciably add to the existing silhouette of BFN and there would be no visual effect.

The archaeological APE has been extensively disturbed with the construction of BFN, such that no intact archaeological deposits would be present. It is TVA's finding that no cultural resources potentially eligible for the National Register of Historic Places (NRHP) would be affected by the proposed undertaking and no further investigations are recommended. Pursuant to 36 CFR Part 800, we are seeking your concurrence with TVA's findings and recommendations.

Pursuant to 36 CFR Part 800.3(f)(2), TVA is consulting with federally recognized Indian tribes regarding properties within the proposed project's APE that may be of religious and cultural significance and eligible for the NRHP.

If you have any questions or comments, please call me or Richard Yarnell at telephone (865) 632-3463 or by e-mail at wryarnell@tva.gov.

Sincerely,

A. Eric Howard
Federal Preservation Officer
Manager (Acting), Cultural Compliance
WT 11D K

MH:RY:IKS
Enclosures
cc: Cynthia M. Anderson, LP 5D-C
Brenda E. Brickhouse, LP 5U-C
Ruth M. Horton, WT 11D-K
Susan J. Kelly, LP 5U-C
Khurshid K. Mehta, WT 6A-K
EDMS, WT 11D-K

Attachment 4. Letter to Tribes

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

September 24, 2010

To those listed:

BROWNS FERRY NUCLEAR (BFN) POWER PLANT COOLING TOWER ADDITIONS, LIMESTONE COUNTY, ALABAMA

The Tennessee Valley Authority (TVA) proposes to replace four of six existing cooling towers (Towers 1, 2, 5, and 6) with larger units and construct one additional 25–30 cell linear mechanical draft cooling tower site at BFN (Figures 1 and 2). The four existing cooling towers would be demolished and rebuilt within the existing footprint.

The new cooling tower (Tower 7) would be located along the east side of Shaw Road at the location of an existing perimeter ditch and includes the installation of a new pumping station, a cold water discharge canal, lift pumps and piping; and two new transformers (Figure 2). A portion of the ditch would be relocated directly northeast of proposed Tower 7 to maintain a perimeter ditch north of the new cooling tower. In addition, the cold water discharge canal is proposed between the north end of the spoil pile and the existing western perimeter ditch, and an approximate five-acre construction staging area is necessary.

TVA considers the archaeological area of potential effect (APE) to be the footprint where ground disturbance would take place. The majority of the BFN reservation has been previously disturbed by construction of the power plant and associated infrastructure. The majority of the land not disturbed by construction of BFN was surveyed in 2001 as part of the BFN relicensing and expansion Environmental Impact Statement. The survey identified one historic property, Site 1LI535, an Early to Middle Woodland period occupation that is considered potentially eligible for the National Register of Historic Places (NRHP) and is outside of the APE. The APE for the proposed undertaking has been extensively disturbed with the construction of BFN. It is TVA's findings that no cultural resources would be affected by the proposed undertaking.

TVA is consulting with the following federally recognized Indian tribes regarding properties within the proposed project's APE that may be of religious and cultural significance to them and eligible for the NRHP: Cherokee Nation, Eastern Band of Cherokee Indians, United Keetoowah Band of Cherokee Indians in Oklahoma, The Chickasaw Nation, Muscogee (Creek) Nation of Oklahoma, Alabama-Coushatta Tribe of Texas, Alabama-Quassarte Tribal Town, Kialegee Tribal Town, Poarch Band of Creek Indians, Thlopthlocco Tribal Town, Seminole Nation of Oklahoma, Seminole Tribe of Florida, Absentee Shawnee Tribe of Oklahoma, Eastern Shawnee Tribe of Oklahoma, and the Shawnee Tribe.

By this letter, TVA is providing notification of these findings and is seeking your comments regarding this undertaking and any properties that may be of religious and cultural significance and may be eligible for the NRHP pursuant to 36CFR § 800.2 (c)(2)(ii), 800.3 (f)(2), and 800.4 (a)(4)(b).

If you have any questions, please contact me by telephone at (865) 632-6461 or by e-mail at pbezzell@tva.gov. Please respond within 30 days of receipt of this letter, if you have any comments on the proposed undertaking.

Sincerely,

Pat Bernard Ezzell
Tribal Liaison and Corporate Historian
Federal Determinations
WT 11D-K

MH:RY:PBE:IKS
Enclosures
cc: Cynthia M. Anderson, LP 5D-C
Brenda E. Brickhouse, LP 5U-C
Ruth M. Horton, WT 11D-K
Susan J. Kelly, LP 5U-C
Khurshid K. Mehta, WT 6A-K
EDMS, WT 11D-K

THOSE LISTED:

Dr. Richard Allen
Policy Analyst
Cherokee Nation
Post Office Box 948
Tahlequah, Oklahoma 74465

Governor Bill Anoatubby
The Chickasaw Nation
Post Office Box 1548
Ada, Oklahoma 72821-1548

Ms. Augustine Asbury
Cultural Preservation Coordinator
Alabama Quassarte Tribal Town
Post Office Box 187
Wetumka, Oklahoma 74883

Mr. Bryant Celestine
Tribal Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Rd. 56
Livingston, Texas 77351

Mr. Charles Coleman
NAGPRA Representative
Thlopthlocco Tribal Town
Route 1, Box 190-A
Weleetka, Oklahoma 74880

Ms. Natalie Deere
Tribal Historic Preservation Officer
Seminole Nation of Oklahoma
Post Office Box 1498
Wewoka, Oklahoma 74884

Ms. Robin DuShane
Cultural Preservation Director
Eastern Shawnee Tribe of Oklahoma
127 West Oneida
Seneca, Missouri 64865

Mr. Henry Harjo
Environmental Director
Kialegee Tribal Town
Post Office Box 332
Wetumka, Oklahoma 74883

Mr. Tyler Howe
Historic Preservation Specialist
Eastern Band of the Cherokee Indians
Post Office Box 455
Cherokee, North Carolina 28719

cc: Mr. Russ Townsend
Tribal Historic Preservation Officer
Eastern Band of the Cherokee Indians
Post Office Box 455
Cherokee, North Carolina 28719

Mr. Ted Isham
Manager
Cultural Preservation
Muscogee (Creek) Nation
Post Office Box 580
Okmulgee, Oklahoma 74447

Ms. Karen Kaniatobe
Tribal Historic Preservation Officer
Absentee Shawnee Tribe of Oklahoma
2025 S. Gordon Cooper
Shawnee, Oklahoma 74801

Ms. Lisa C. LaRue
Director, Language, History and Culture &
Acting Tribal Historic Preservation Officer
United Keetoowah Band
of Cherokee Indians in Oklahoma
Post Office Box 746
Tahlequah, Oklahoma 74464

Mr. Kirk Perry
Administrator
Division of Policy and Standards
The Chickasaw Nation
Post Office Box 1548
Ada, Oklahoma 72821-1548

Attachment 5. Letters From Tribes

the Chickasaw Nation
Headquarters

Bill Anoatubby, Governor
Jefferson Keel, Lt. Governor

October 4, 2010

Ms. Patricia B. Ezzell
Tribal Liaison and Corporate Historian
Federal Determinations
WT 11D-K
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, TN 37902-1499

Dear Ms. Ezzell:

Thank you for your letter of notification regarding your proposal to replace four of six existing cooling towers with larger units and construct one additional 25-30 cell linear mechanical draft cooling tower site at Browns Ferry Nuclear Power Plant in Limestone County, Alabama. We accept your finding that no cultural resources will be affected by this proposed undertaking.

This area is located within the aboriginal lands of the Chickasaw Nation and is an important area to us. We are unaware of any specific historic properties or traditional cultural, religious and/or sacred sites at this time. However, in the event of inadvertent discoveries, we expect all construction activities to cease and we be notified according to all applicable state and federal laws.

If you have any questions, please contact Ms. Gingy Nail, historic preservation officer at (580) 559-0817, gingy.nail@chickasaw.net or Ms. Julie Ray, historic preservation and repatriation manager at (580) 559-0825, julie.ray@chickasaw.net.

Sincerely,

Jefferson Keel, Lt. Governor
The Chickasaw Nation

jar

Arlington at Mississippi · Post Office Box 1548 · Ada, OK 74821-1548 · 580-436-2603 · www.chickasaw.net

UNITED WE THRIVE

SEMINOLE TRIBE OF FLORIDA
TRIBAL HISTORIC PRESERVATION OFFICE

Pat Bernard Ezzell
Tennessee Valley Authority
400 W. Summit Hill Drive
Knoxville, TN 37902

TRIBAL HISTORIC PRESERVATION OFFICE

SEMINOLE TRIBE OF FLORIDA
AH-TAH-THI-KI MUSEUM

34725 WEST BOUNDARY ROAD
CLEWISTON, FL 33440

PHONE: (863) 983-6549
FAX: (863) 902-1117

TRIBAL OFFICERS

CHAIRMAN
MITCHELL CYPRESS

VICE CHAIRMAN
RICHARD BOWERS JR.

SECRETARY
PRISCILLA D. SAYEN

TREASURER
MICHAEL D. TIGER

THPO#-006967

October 20, 2010

Subject: Browns Ferry Nuclear Power Plant Cooling Tower Additions, Limestone County, Alabama

Dear Ms. Ezzell,

The Seminole Tribe of Florida's Tribal Historic Preservation Office (STOF-THPO) has received the Tennessee Valley Authority's correspondence concerning the aforementioned project. The STOF-THPO has no objection to your findings at this time. However, the STOF-THPO would like to be informed if cultural resources that are potentially ancestral or historically relevant to the Seminole Tribe of Florida are inadvertently discovered during the construction process. We thank you for the opportunity to review the information that has been sent to date regarding this project. Please reference ***THPO-006967*** for any related issues.

We look forward to working with you in the future.

Sincerely,

Direct routine inquiries to:

Willard Steele
Tribal Historic Preservation Officer
Seminole Tribe of Florida

Anne Mullins
Compliance Review Supervisor
annemullins@semtribe.com

JLP:am